SPECIES ACCOUNT: *Aphelocoma coerulescens* (Florida scrub-jay)

Species Taxonomic and Listing Information

Listing Status: Threatened; June 3, 1987; Southeast Region (R4)

Physical Description

The scrub jay is a 12-inch (30-centimeter) crestless jay, totally lacking the white-tipped wing and tail feathers of the common and widespread blue jay (Cvanocitta cristata). The nape, rump, and wings are dark sky-blue; the tail indigo blue; the back and the underparts smoke gray. A necklace of blue feathers separates the white throat from the gray underparts, and a white line over the eye often blends into a whitish forehead. The tail is long and loose in appearance (Sprunt 1954, Woolfenden 1978). Immature Florida scrub jays are much like adults in appearance, but the colors are duller with less blue on the breast, and the top of the head is lighter. The sexes are alike in all plumages (Sprunt 1946). Average weight is 77 g. (USFWS, 2019)

Taxonomy

At the time of listing, the scrub-jay was considered a subspecies (A. c. coerulescens). In 1995, it regained recognition as a full species (Florida scrub-jay, A. coerulescens) from the American Ornithologists Union (AOU 1995) because of genetic, morphological, and behavioral differences from other members of this group: the western scrub-jay (A. californica) and the island scrub-jay (A. insularis) (AOU 1995). The group name is retained for species in this complex; however, it is now hyphenated to “scrub-jay” (AOU 1995).

Historical Range

They formerly were known from Duval, Clay, Gilchrist, and Taylor Counties in the north, to Monroe and Collier Counties in the south (Cox 1984). They were locally distributed on the Florida east coast from the mouth of the St. Johns River south to Rockdale in Dade County. On the west coast they occurred from Piney Point, Taylor County, and Wannee, Gilchrist County, south to Naples in Collier County. In the interior, they were known from Micanopy, Alachua County, south to Inmiokalee, Collier Counties (Sprunt 1954).

Current Range

Today, scrub jays are restricted to scattered and often small, isolated patches of scrub in peninsular Florida (Woolfenden 1978) (Figure 1). They occur in Alachua, Brevard, Charlotte, Citrus, Clay, Collier, Flagler, Glades, Hardee, Hendry, Hernando, Highlands, Hillsborough, Indian River, Lake, Lee, Levy, Manatee, Marion, Martin, Okeechobee, Orange, Osceola, Palm Beach, Pasco, Polk, Putnam, Sarasota, Seminole, St. Lucie, Sumter, and Volusia counties. As of 2015, Florida scrub-jays are considered extirpated from Alachua, Broward, Dade, Duval, Gilchrest, Pinellas and St. Johns counties, and likely from an additional 15 counties, including Collier, Flagler and Palm Beach. Only 9 counties have groups of >30 individuals on public conservation lands. (USFWS, 2019).

Distinct Population Segments Defined

No

Critical Habitat Designated

No;

Life History

Feeding Narrative

Adult: Florida scrub jays are omnivorous, consuming about 60 percent animal matter. Insects, principally orthopterans and lepidopteran larvae, form the bulk of the diet over most of the year. Other insects consumed include: grasshoppers, locusts, crickets, termites, burrower-bugs, squash bugs, leafhoppers, earwigs, bettles, weevils, butterflies, moths, cutworms, bees, wasps, ants, anglewings, and flies. Millipedes, centipedes, spiders, scorpions, ticks, mites, and snails are also eaten. Jays most frequently seek food by hopping along bare sand under scrub oaks, or by jumping from shrub to shrub within the oak foliage, or palmetto fronds, examining leaves and darting after startled animals that attempt to escape. When encountered, a variety of small vertebrates are also taken. Vertebrate prey at the Archbold Biological Station include frogs, toads, lizards, small snakes, small rodents, downy chicks of bobwhite, and eggs and fledglings of small birds. Carrion is also occasionally eaten.Acorns form the principal plant food. In late summer and fall jays spend a considerable part of their day gathering ripening acorns. Many are eaten immediately, but the majority are cached in the sand, husks intact. These are recovered, husked, and eaten throughout the rest of the year. Woolfenden and Fitzpatrick suspect that acorns form a necessary and year-round vegetable staple for Florida scrub jays. Other small nuts, fruits, and seeds are taken occasionally, most notably: hickory nuts, palmetto seeds, tread softly, briars, Smilax, blueberies, gallberries, and rosemary seeds. Weed and grass seeds are rarely, if ever, eaten. Corn, peanuts, sunflower seeds, and many other human-offered foods are readily taken when jays are introduced to them.

Reproduction Narrative

Egg: Incubation lasts 15 to 17 days (Sprunt 1946).

Adult: Florida scrub jays are monogamous and remain mated throughout the year (Sprunt 1946, Woolfenden 1978). They are cooperative breeders. Nonbreeding adults, called “helpers”, often help raise offspring which are not their own. Most helpers are yearling offspring of the resident breeding pair. At the Archbold Biological Station, the breeding season for scrub jays spans about 90 days. Eggs are laid from early March to late June, with the majority laid in late March. One clutch was laid in late February. Scrub jays normally are single brooded, but can lay three, or rarely, four clutches a season. Clutch size varies from two to five eggs, averaging 3.4. Breeding rarely occurs before 2 years of age, and often not until 3 or 4 years (Woolfenden 1978). Females older than 5 years produce over one-half the offspring. Reproductive value peaks at 4 years, but remains high through age 14. Breeder survival is 82 percent annually. Senescence occurs after 15 years.Florida scrub jays nest gregariously, gathering in small, scattered colonies. Myrtle, sand pine, and various oaks (rather than wild olive) are the most commonly used trees for nesting. Breininger (pers. comm. 1988) reported that most scrub jays on Merritt Island nest in oak trees. Both parents gather nest material, construct the nest, incubate, brood, feed, and attend the young. The female does the major part of the incubating, but the male obtains food for her while she is sitting.

Geographic or Habitat Restraints or Barriers

Adult: Occurs only in penisular Florida (see current distribution)

Spatial Arrangements of the Population

Adult: Scattered (see current distribution)

Environmental Specificity

Adult: Narrow

Tolerance Ranges/Thresholds

Adult: Moderate

Site Fidelity

Adult: High (see dispersal/migration narrative)

Dependency on Other Individuals or Species for Habitat

Adult: Oak (predominantly myrtle, sand live, and Chapman)

Habitat Narrative

Adult: The condition, or value, of scrub habitat to Florida scrub-jays is largely dependent on the successional stage of the xeric plant community and its relative size and juxtaposition in the landscape in relation to other xeric plant communities. In general, scrub-jays only persist long-term in early successional scrub communities that are relatively large or in close proximity to other scrub communities. Such scrub habitat occurs only on fine, white, drained sand. This scrub occurs along the coastlines in Florida, and in dunes deposited during the Pleistocene when sea levels were much higher than at present (Laessle 1958, 1968). Scrub comes in a variety of forms. The type most commonly occupied by scrub jays is oak scrub. It consists of a single layer of evergreen shrubs, usually dominated by three species of oak -- myrtle oak, sand live oak, and Chapman oak. Large trees and herbaceous vegetation are lacking in oak scrub, which some authorities refer to as “scrubby flatwoods.” Sand pine scrub and slash pine scrub have shrub layers like that of oak scrub, plus a canopy of either sand pine or slash pine (Pinus elliottii). Scrub jay use of microhabitats show obligatory reliance on oaks. Open sand pine or slash pine scrub has less than 50 percent canopy cover by trees over 3 meters tall. Scrub jays are rarely found in habitats with more than 50 percent canopy cover over 3 meters tall.Thus, high quality or optimal habitat will be in early succession and large or close to adjacent scrub habitat patches. Habitat condition (quality) declines with vegetative height (mid- to late-succession) and degree of fragmentation (distance between habitat patches).Historically, scrub vegetative communities were affected by, and responded to, periodic lightning-generated wildfires (Myers 1985, Robbins and Myers 1989). Wildfires burned scrub communities when adequate fuel loads were present. Natural fire return intervals varied between scrub vegetative communities and probably ranged from 5 to 60 years (Fitzpatrick et al. 1991, Woolfenden and Fitzpatrick 1996). Territory-scale habitat conditions are largely unknown throughout much of the range of the scrub-jay. Optimal Florida Scrub-Jay habitat has greater than 50% of the shrub layer comprised of scrub oaks, a mosaic of oak scrubs that occur in optimal height (1.2-1.7 m, 4-5.5 ft), numerous patches of bare sand or sparse herbaceous vegetation, less than 15% pine canopy cover, and greater than 300 m (984 ft) from a forest edge. Predation is a primary factor influencing the Florida Scrub-Jay’s preference for landscapes dominated by frequently burned scrub. Vegetation that characterizes open (recently burned) scrub is short enough to allow Florida Scrub-Jays to monitor a large area for predators but tall enough to provide refuge and acorns. (USFWS, 2019).

Dispersal/Migration

Motility/Mobility

Adult: Moderate

Migratory vs Non-migratory vs Seasonal Movements

Adult: Non-migratory

Dispersal/Migration Narrative

Adult: Scrub jays are non-migratory and extremely sedentary (Woolfenden 1978).

Population Information and Trends

Population Trends:

Unknown

Species Trends:

Declining

Resiliency:

Nevertheless, these four very highly resilient populations support 73% of known family groups on conservation lands (1,580 out of 2,160). The two remaining populations classified with high resiliency have roughly 50 to 45 family groups each (Avon Park Air Force Range and St. Sebastian River Preserve State Park respectively). There are 16 populations (roughly 25%) with moderate resiliency (10 - 39 family groups), and greater than 65% of the assessed populations (42 out of 65) have low resiliency and currently support fewer than 10 family groups. The total number of family groups on conservation lands, based on the 2009-2010 surveys, represent a > 25% decline in abundance since the 1992-1993 surveys (USFWS, 2019a).

Representation:

Genetically diverse species have a higher evolutionary potential and are better able to adapt to changes in their environment over time. Despite the presumed loss of genetic variability that has occurred since pre-settlement times, the variation that still exist is robust. A significant component of this genetic variation occurs across genetic units, several of which exhibit a high degree of differentiation from one another. Of the 10 genetic units, only 4 genetic units currently have populations with high resiliency and redundancy, which will certainly affect the species' future representation outside of these 4 genetic units (USFWS, 2019a).

Redundancy:

Redundancy refers to the distribution and number of the populations across the landscape (rangewide); redundant, resilient populations reduce the threat of a single catastrophic event threatening the entire species. There are currently 65 Florida Scrub-Jay populations on conservation lands, spanning the entire width and nearly the length of the Florida peninsula, with the highest redundancy in the central inland ridges and the east coastal area (Figure 9). Forty-nine populations (75%) occur in four of the genetic units (A, B, C, and D) with various degrees of connectivity among the populations. Only 7 of the 49 populations in these four genetic units have high population resilience. Eleven populations are categorized as moderate and 31 populations ranked as having low resiliency within these four genetic units. The remaining 16 populations (25%) occurring in the other six genetic units (E, F, G, H, I and K) have low resiliency ranging from one group up to five groups (see Table 5). If the habitat is not well managed with prescribed fire, demographic rates will be lower and local populations will be less resilient. As the population's resiliency declines, inbreeding and loss of genetic diversity are likely to lead to reduced fitness over time, even at population levels considered resilient to demographic and environmental stochasticity. The majority of the local populations are small, highly fragmented, and have poor connectivity. This is exacerbated by the relatively low dispersal distances of Florida Scrub-Jays (USFWS, 2019a).

Population Size:

8,000 New in 2019: Based on a comparison survey conducted in 2009-10 of 198 managed conservation lands to 1992-93 survey results (excluding Ocala National Forest), the population was estimated at 1,253 Florida Scrub-Jay groups (Boughton and Bowman 2011). Surveys indicated a 25% decline on managed conservation lands during the 17-year timeframe. Incorporating private lands (unmanaged and suburban habitats) and assuming an estimated overall population decline between 35-40%, the range- wide population was projected between 2,400-2,600 Florida Scrub-Jay groups (excluding Ocala National Forest). Currently, the population estimates for the entire Ocala National Forest are very crude and are possibly overestimated. Extrapolating data from limited known forest management area population densities to all currently suitable habitat in the forest, the estimate is roughly 1,000 Florida Scrub-Jay groups (pers. com. FFWCC and USFS). (USFWS, 2019).

Population Narrative:

Although a complete survey for this species has not been conducted since 1993, there have been numerous local surveys done. In addition, numerous section 7 consultations and section 10 permit applications confirm that habitat loss is continuing. These indicate a continuing decline is likely. A statewide scrub-jay survey was conducted in 1992-1993, at which time there were an estimated 4,000 pairs of scrub-jays in Florida (Fitzpatrick et al. 1994). Comprehensive rangewide sampling of scrub-jays has been conducted for the last three years by Cornell University. Preliminary results indicate that genetic variation between populations and/or metapopulations of this species may be greater than any other known species of bird in North America (Fitzpatrick 2006). Data are not currently available to assess whether this new information will be informative about genetic variation or trends in genetic variation.

Threats and Stressors

Stressor: Habitat destruction
Exposure:
Response:
Consequence:
Narrative: At the time of listing, it was estimated that 40 percent of occupied scrub habitat had already been destroyed due to land use changes, and the total population of scrub-jays had declined by at least half. Fernald (1989), Fitzpatrick et al. (1991), and Woolfenden and Fitzpatrick (1996a) noted that habitat losses due to agriculture, silviculture, and commercial and residential development continued to play a role in the decline in numbers of scrub-jays throughout their range. More recently, Burns (2006) compared 1989 and 2003 sand pine scrub, xeric oak scrub, and coastal strand land cover classifications, as defined by land cover data sets produced by the FWC. The sand pine scrub and xeric oak scrub land classifications, both potentially suitable scrub-jay habitats, decreased 19 percent from 1989 to 2003, suggesting contemporaneous habitat loss.

In total, 36 permits are currently pending that, if issued, have the potential to result in the loss of about 15,013 acres of scrub-jay habitat. Of this total, one project accounts for 14,928 acres; a habitat conservation plan developed to address take of scrub-jays due to urban development on small parcels in urban landscapes (Service 2006b). Additional future destruction of scrub-jay habitat can be expected in the foreseeable future if human population increases occur as projected.

Stressor: Fire suppression/Habitat degradation
Exposure:
Response:
Consequence:
Narrative: Habitat degradation due to fire suppression may exceed habitat destruction as the single most important limiting factor (Woolfenden and Fitzpatrick 1991, 1996a; Fitzpatrick et al. 1994). Fire is important in the cyclical maintenance of scrub habitat (Nash 1895; Harper 1927; Webber 1935; Davis 1943; Laessle 1968; Abrahamson et al. 1984). Nearly all scrub-jay habitat that is on private property is susceptible to further degradation in the future unless active management is undertaken by landowners. Most scrub habitats become overgrown and unsuitable for scrubjays if not managed (burned) at least every 20 years (Fitzpatrick et al. 1991). Habitat degradation can also be expected on some public lands, even where active management programs are in place. Successful restoration of all scrub-jay habitat on many large parcels will take several years to achieve (Stevens and Knight 2005). Elsewhere, some public land managers do not currently have the resources to implement effective habitat management programs (Howell et al. 2003, Service 2006a).

Stressor: Habitat fragmentation
Exposure:
Response:
Consequence:
Narrative: Habitat fragmentation results from habitat loss and degradation. When habitat is destroyed or becomes unsuitable for scrub-jays, the distance between occupied patches of scrub-jay habitat increases.

Stressor: Predation
Exposure:
Response:
Consequence:
Narrative: Scrub-jays are also vulnerable to predation by feral and free-ranging domestic cats (Fitzpatrick et al. 1991; Bowman and Averill 1993; Bergen 1994; Breininger et al. 1995, 2001; Woolfenden and Fitzpatrick 1996a, 1996b; Breininger 1999; Toland 1999; Christman 2000).

Stressor: Disease
Exposure:
Response:
Consequence:
Narrative: Woolfenden and Fitzpatrick (1996b) noted three episodes of elevated mortality (especially among juveniles) in 26 years at Archbold Biological Station. During the most severe of these presumed epidemics (August 1979 through March 1980), all but one of the juvenile cohort and almost half of the breeding adults died (Woolfenden and Fitzpatrick 1984, 1990). The 1979-

1980 incident coincided with an outbreak of eastern equine encephalitis among domestic birds in central Florida (J. Day pers. comm., cited in Woolfenden and Fitzpatrick 1996b). From the fall of 1997 through the spring of 1998, the continuing population decline of scrub-jays along the Atlantic coast and in central Florida may have been augmented by an epidemic of unknown origin (Breininger 1999).

Stressor: Road mortality
Exposure:
Response:
Consequence:
Narrative: Scrub-jays forage along roadsides and are susceptible to being killed by passing cars. Mumme et al. (2000) indicated that scrub-jay territories found next to a two-lane road experienced adult mortality that was higher than recruitment. Road mortality is a known mortality source but current data are insufficient to assess its impact on overall population viability.

Stressor: Supplemental food
Exposure:
Response:
Consequence:
Narrative: Scrub-jays may persist locally in otherwise marginal or unsuitable areas in or adjacent to urban areas because they can obtain supplemental food from bird feeders (R. Bowman unpublished data, cited in Woolfenden and Fitzpatrick 1996a; Bowman 1998). However, recruitment in these scrub-jay populations appears to be lower than in populations occupying native habitat. Local densities of scrub-jays during nonbreeding seasons are sometimes elevated by supplemental food, even though breeding densities may not be elevated. Therefore, artificial feeding may cause certain areas to act as population sinks.

Stressor: Changes in habitat
Exposure:
Response:
Consequence:
Narrative: Scrub-jays in suburban settings often nest high in tall shrubbery. During March, these nests tend to be susceptible to destruction by seasonal wind storms (R. Bowman and G.E. Woolfenden unpublished data, cited in Woolfenden and Fitzpatrick 1996b; Bowman 1998). In addition, daily ambient temperatures differ between suburban and wildland sites in south central Florida (Aldredge et al. 2005). The higher ambient temperatures in suburban sites decrease the viability of first-laid scrub-jay eggs.

Stressor: Exotic species
Exposure:
Response:
Consequence:
Narrative: The invasion of some scrub habitat within Indian River, St. Lucie, and Martin counties by exotic plants and animals, including Brazilian pepper (Schinus terebinthifolius), cypress pine (Callitris sp.), and Australian pine (Casuarina equisetifolia), has degraded scrub-jay habitat locally. Other human-induced impacts identified by Fernald (1989) include the introduction of domestic dogs (Canis familiaris) and cats, black rats (Rattus rattus), greenhouse frogs (Eleutherodactylus

planirostris), giant toads (Bufo marinus), Cuban tree frogs (Osteopilus septentrionalis), brown anoles (Anolis sagrei), and other exotic animal species. These exotic species may compete with scrub-jays for both space and food, although scrub-jays opportunistically feed on small exotic vertebrates.

Recovery

Reclassification Criteria:
Recovery Priority Number: 8C

Delisting Criteria:
1. The population must be stable or increasing from the current population level at the three existing, large population sites (Ocala National Forest, Merritt Island/Cape Canaveral, and Archbold Biological Station). Each site must have an approved management plan. New in 2019: Populations much exhibit a stable or increasing ternd including natural recruitment and multiple age classes. (USFWS, 2019)

2. There must be documented evidence of scrub-jays recolonizing restored or uninhabited areas throughout their historic range.

3. Establishment of several scrub preserves with sufficient acreage to sustain viable scrub-jay populations.

4. Use of scrub-jay habitat management guidelines by developers when proposing development in scrub habitat.

5. New in 2019: Subpopulations are connected to the extent that genetic diversity can be naturally maintained without translocations. (USFWS, 2019)

6. New in 2019: When in addition to the above criteria, it can be demonstrated that the threats particularly habitat loss and degradation associated with sea level rise, development, and inadequate habitat management are diminished such that sufficient habitat remains for the species to remain viable for the foreseeable future. (USFWS, 2019)

Recovery Actions:

- 1. Habitat Management and Restoration – appropriate fire return intervals, optimal vegetative structure, sufficient sandy openings, increasing connectivity, eliminating dispersal barriers, promoting mosaic within habitat. Priority Level 1. (USFWS, 2019).
- 2. Work with Federal, State, and private organizations to establish protected scrub preserve through acquisition, landowner agreements, or easements. Modified in 2019 to read: Habitat Protection and Acquisition – protect existing public lands, conservation easements on private lands, limited acquisitions to promote connectivity of landscapes, optimum boundaries, eliminate inholdings. Priority Level 1. (USFWS, 2019).
- 3. Population Management – translocations: population augmentations, genetic rescues, maintenance of genetic diversity, re-introductions. Priority Level 1. (USFWS, 2019).
- 4. Population Monitoring – annual post-breeding surveys range-wide, surveys and long-term monitoring in all large population centers and following any restoration/translocation operations. Priority Level 1. (USFWS, 2019).

- 5. Research – population viability analyses, demographic monitoring in response to habitat management, translocation effects on populations, allee effects, genetic studies to investigate degrees of and inbreeding in all populations and its effects on fitness and viability. Priority Level 1. (USFWS, 2019)
- 6. Regulatory – incorporate conservation strategy in conservation measures, mitigation, mitigation banking, safe harbor agreements. Priority Level 2. (USFWS, 2019).
- 7. Incentives – Partners for Fish and Wildlife, Legacy Landowners Program, Working Lands for Wildlife Program. Priority Level 3. (USFWS, 2019)
- 8. Outreach – promote large connected landscapes, facilitate scrub working groups, educate public and increase public support for prescribed fire applications, engage partners and stakeholders in strategic conservation. Priority Level 3. (USFWS, 2019).
- Encourage the State of Florida to revise regulations to establish protection of scrubjay habitat.
- Encourage the State of Florida to develop a scrub-jay management plan.
- Evaluate whether public land management actions in areas where jays exist are achieving stated land management plan objectives and goals beneficial to scrubjays.
- Revise metapopulation viability analysis for the Florida scrub-jay.
- Current scrub-jay distribution and abundance data are needed for the development of a revised metapopulation viability analysis.
- Update the Florida scrub-jay recovery plan to include measurable recovery criteria that are related to reducing and/or eliminating threats.
- Monitoring and research are needed to distinguish among conservation alternatives, and science and management need to be better integrated.
- Provide technical and financial assistance to land managers to ensure scrub-jay habitat is effectively managed on public lands.
- Use Safe Harbor Agreements, Partners for Fish and Wildlife grants, and U.S. Department of Agriculture's Farm Bill programs such as the Wildlife Habitat Incentives, Environmental Quality Incentives, and Farm and Ranchland Protection Programs to encourage private landowners to protect and/or manage scrub-jay habitat.
- Encourage the development of scrub-jay conservation banks on large, privately owned and managed tracts of land with high quality scrub habitat.

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SPECIES ACCOUNT: *Centrocercus minimus* (Gunnison sage-grouse)

Species Taxonomic and Listing Information

Commonly-used Acronym: GUSG

Listing Status: Threatened; 12/22/2014; Mountain-Prairie Region (R6) (USFWS, 2016)

Physical Description

A large bird (grouse). This is a large grouse, dark gray overall, with a long, pointed tail, pale breast, and black belly (Sibley 2003). Males are larger than females; adult total length averages around 22 inches (56 cm) in males, 18 inches (46 cm) in females; body mass is around 2,100 grams in males, 1,100 grams in females (Sibley 2003). (NatureServe, 2015). New in 2019: This is the second largest grouse species in North America. Male GUSG are larger than females, weighing from 1.7–2.4 kg (3.7–5.3 lbs.) and females weigh 0.9–1.3 kg (2.0–2.9 lbs.) (Young et al. 2000, p. 447). GUSG are dark brown in color with black underparts, and coarsely barred brown-white or white-yellow tail feathers. During the non-breeding seasons, males and females appear similar except females are smaller with shorter feathers and the yellow-green eye comb is larger on males (Young et al. 2000, p. 448). Adult males are most conspicuous during the breeding season when they have developed long, thin, black, specialized ornamental contour feathers (filoplumes) on the back of the neck and rounded air sacs that are greenish-yellow within a white upper breast with scale-like feathers (Young et al. 2000, p. 448) (Figure 2). During the breeding season, males use the air sacs to create a popping sound nine times and strut on leks to attract females. Strutting is slower than other species of sage-grouse (Young 1994, p. 15). Juveniles resemble adults of their sex but may be distinguished for up to 17 months by two outermost primaries that are more pointed than adult primaries (Braun and Schroeder 2015, p. 183). GUSG eggs ranges from deep olive-buff and light olive buff color to greenish drab and greenish white with lighter shades of brown or olive green, and are marked with small spots of chocolate brown and brownish olive ovate. Eggs average 54.5 mm in length and 38.0 mm in diameter (Young 1994, p. 37; Young et al. 2015, p. 12). (USFWS, 2019)

Taxonomy

Gunnison sage-grouse are significantly smaller than greater sage-grouse in size of culmen, carpel, and tarsus, and they weigh approximately 1/3 less (Hupp and Braun 1991, Young et al. 2000). The two species also exhibit genetic differences (Kahn et al. 1999, Oyler-McCance et al. 1999). Additionally, Gunnison sage-grouse males have more elaborate head plumes than do greater sage-grouse males, and they have broader white barring on the tail feathers (Young et al. 2000). The two species also differ in male display behavior; for example, the Gunnison sage-grouse display ends with a tail-shaking motion of the raised tail (absent in greater sage-grouse) (Barber 1991; Young et al. 1994, 2000). (NatureServe, 2015)

Historical Range

The historical range is thought to have included southwestern Colorado, northwestern New Mexico, northeastern Arizona, and southeastern Utah (Schroeder et al. 2004). (NatureServe, 2015)

Current Range

The eight GUSG populations in southwestern Colorado and southeastern Utah are: • Gunnison Basin; • Poncha Pass; • Crawford; • Cerro Summit-Cimarron-Sims Mesa; • Piñon Mesa; • San Miguel Basin; • Dove Creek; and • Monticello. These eight small GUSG populations occur in eight counties in Colorado and one county in Utah (Figure 4). The Gunnison Basin population is largest population and has the largest quantity of occupied habitat, covering an estimated 239,641 ha (592,168 ac) (50 FR, p. 69195). Poncha Pass, to the east of the city of Gunnison, is the smallest population and has the least amount occupied habitat, covering 11,234 ha (43.4 mi²). Gunnison Basin supports approximately 85 percent of the breeding birds for the species and 65 percent of the occupied habitat. The remaining 15 percent of the individuals are distributed among the remaining populations, which comprise 35 percent of the overall occupied habitat. Of the eight populations, the San Miguel Basin contains six subpopulations that occupy discreet habitat areas (Figure 4). The eight populations of GUSG occupy six different ecoregions, which are areas delineated by common geology, landforms, soils, vegetation, climate, land use, wildlife, and hydrology (EPA 2018). We summarize these ecoregions to highlight ecological differences between the eight GUSG populations, which influence the resources and demographic factors that we later identify, as species needs and drive current condition. We will reference these ecoregion descriptions when evaluating current condition. The Gunnison Basin population is the only population occurring almost entirely in the Southern Rockies ecoregion, Sagebrush Park. Dominant physiographies in this ecoregion are high intermontane valleys, moderate gradient perennial streams with cobble, gravel, and sandy substrates. Primary vegetation includes Wyoming big sagebrush, mountain big sagebrush, black sagebrush, western wheatgrass, bottlebrush squirreltail, and elk sedge, with areas of bunchgrasses including Arizona fescue and mountain muhly (EPA 2006, 21i.). Soils in the Gunnison Basin primarily fall into the Mollisols order, meaning soils are dark, have relatively high amounts of organic matter, are quite fertile, and characteristically formed under grass in climates that have a moderate to pronounced seasonal moisture deficit (USDA 1999, p. 555). These soils are also generally found between the Aridisols of arid environments and Alfisols of more humid environments (USDA 1999, p. 555). Poncha Pass, to the east of Gunnison Basin, falls almost completely in the Arizona/New Mexico Plateau ecoregion, San Luis Shrublands and Hills, which is on the periphery of mid-elevation forests, and the Southern Rockies. This ecoregion contains low mountains, hills, mesas, and foothills ranging in elevation from 7,900 to 9,100 feet. Common soils here are a mix of Aridisols and Mollisols. Aridisols are soils in which water is not available to mesophytic plants (plants not adapted to dry or wet environments) for long periods (USDA 1999, p. 329). Because of the imbalance between evapotranspiration and precipitation, many Aridisols contain salts (USDA 1999, p. 329). This ecoregion also contains Mollisols soils, as described for the Gunnison Basin. Mean annual precipitation is 10 to 14 inches. Natural vegetation includes shrublands, grasslands, and piñon-juniper woodlands at highest elevations. Species include big sagebrush, rubber rabbitbrush, winterfat, western wheatgrass, green needlegrass, blue grama, and needle-and-thread (EPA 2006, 22a). Three populations (Piñon Mesa, Crawford, and CSCSM) and three subpopulations (Hamilton Mesa, Miramonte Reservoir, and Gurley Reservoir) of the San Miguel population fall in the Colorado Plateau ecoregion of Semiarid Benchlands and Canyonlands. Benches, mesas, cuestas, alluvial fans, hillslopes, cliffs, arches, and canyons characterize this ecoregion, although not all of these features occur in all of these populations (EPA 2006, 20c.). Soil are arid-type soils (Entisols, Aridisols, and Mollisols), often slightly saline and/or calcareous, and mineral soils (NRCS 1999, pp. 421, 555). Natural vegetation includes piñon-juniper woodland, Gambel oak woodland, and sagebrush steppe with black sagebrush, winterfat, Mormon tea, fourwing saltbrush, shadscale, galleta grass, and blue grama (EPA 2006, 20c.). The Dry Creek Basin of the San Miguel population is the westernmost subpopulation of the San Miguel population and primarily falls within the Shale Deserts and Sedimentary Basins ecoregion in the Colorado Plateau (EPA 2006, 20b.). The physiography of Dry Creek Basin is nearly level, with some rolling plains and basins, with benches, low rounded hills, and badlands (EPA 2006, 20b.). The elevation is around 1,940 m (6,365 ft.) above sea level and contains diverse soil groups including Entisols, Aridisols, and Mollisols. Entisol soils occur in areas of recently deposited parent materials or where erosion rates are faster than rates of soil development, such as dunes, steep slopes, and floodplains (USDA 1999, p. 389). Aridisols are too dry for growth of mesophytic (plants adapted to moderate moisture) plants and often accumulate gypsum, salt, and calcium carbonate (USDA 1999, p. 329). Mollisols are more fertile and typically contain more organic matter compared to Aridisols and Entisols. The two eastern-most subpopulations of the San Miguel Basin (Beaver Mesa and Iron Springs) occur in the Southern Rockies ecoregion Sedimentary Mid-Elevation Forests. These subpopulations are near the ecoregion border of Semiarid Benchlands and Canyonlands described previously, so some mixing of physiography, soils, and vegetation is likely. Additionally, there are some small overlaps of the Piñon Mesa, Gunnison Basin and CSCSM occupied ranges onto this ecoregion. Physiography in the Sedimentary Mid-Elevation Forests ecoregion contains low mountain ridges, slops, and outwash fans. There are moderate to high gradient perennial streams with boulder, cobble, and bedrock substrates (EPA 2006, 21f.). Primary soil orders include Alfisols, Entisols, and Mollisols (EPA 2006, 21f.). Alfisols tend to form a belt between the Mollisols if grasslands and other soil types in climates that are more humid. Mollisols are typically more fertile types of soils, occurring in semiarid to moist areas (USDA 1999, pp. 163, 555). Entisols are soils that are essentially unaltered from their parent material (mineral), thus showing no horizons or layers (USDA 1999, p. 389). Natural vegetation in this ecoregion is Ponderosa pine forest, Gambel oak woodland, and aspen forest, with areas of mountain mahogany and two-needle piñon pine. Shrub vegetation includes antelope bitterbrush, fringed sage, serviceberry, and snowberry and understory grasses of Arizona fescue, bluegrass, Junegrass, needlegrasses, mountain muhly, pine dropseed, and mountain brome (EPA 2006, 21f.). The two western-most populations, Monticello (Utah) and Dove Creek (CO), primarily occur in the Colorado Plateau ecoregion, Monticello-Cortez Uplands. This ecoregion is nearly level to rolling plains and basins containing stream terraces, alluvial fans, and low rolling hills and ridges (EPA 2006, 20a.). Elevation in this ecoregion ranges from 6,000 to 7,300 feet. Primary soil types here fall in the orders of Aridisols, Alfisols, and Entisols (EPA 2006, 20a.) and precipitation ranges 10 to 15 in per year. Natural vegetation includes sagebrush steppe and associated grasses, with scattered piñon-juniper woodland. The dominant species include Wyoming big sagebrush, western wheatgrass, and Indian ricegrass (EPA 2006, 20a.). Land use and land cover are primarily dryland cropland with some areas of irrigated cropland, shrubland, and rangeland. (USFWS, 2019)

Distinct Population Segments Defined

No

Critical Habitat Designated

Yes; 11/20/2014.

Legal Description

On November 20, 2014, the U.S. Fish and Wildlife Service (Service), designated critical habitat for the Gunnison sagegrouse (Centrocercus minimus) under the Endangered Species Act (79 FR 69311 - 69363). In total, approximately 1,429,551 acres (ac) (578,515 hectares (ha)) are designated as critical habitat in Delta, Dolores, Gunnison, Hinsdale, Mesa, Montrose, Ouray, Saguache, and San Miguel Counties in Colorado; and in Grand and San Juan Counties in Utah.

Critical Habitat Designation

The critical habitat designation for Centrocercus minimus includes six units totaling approximately 1,429,551 ac (578,515 ha) in Grand and San Juan Counties, Utah, and Delta, Dolores, Gunnison, Hinsdale, Mesa, Montrose, Ouray, Saguache, and San Miguel Counties, Colorado. The units are (1) MonticelloDove Creek, (2) Pinon Mesa, (3) San Miguel Basin, (4) Cerro SummitCimarron-Sims Mesa, (5) Crawford, and (6) Gunnison Basin. The Service considers approximately 55 percent of all critical habitat to be currently occupied and 45 percent to be currently unoccupied by Gunnison sage-grouse.

Unit 1: Monticello-Dove Creek. Unit 1 consists of 343,000 ac (138,807 ha) of Federal, State, and private lands in San Juan County, Utah; and Montrose, San Miguel, and Dolores Counties, Colorado. Approximately 13 percent of the land area within the unit is managed by Federal agencies, 1 percent is owned by the State of Colorado and the State of Utah, and the remaining 86 percent comprises private lands. We consider 33 percent of this unit to be currently occupied by Gunnison sage-grouse, based on mapping developed for the 2005 RCP, as updated (GSRSC 2005, p. 54; CPW 2013e, spatial data). Tables 4 and 5 provide detailed acreage estimates for all critical habitat units. The occupied portion of the Monticello-Dove Creek Unit contains the physical and biological features essential to the conservation of the Gunnison sage-grouse, but these areas are interspersed within lands in agricultural production. Within the occupied portion of this Unit, approximately 23,220 ha (57,377 ac) or 51 percent of the area is currently in agricultural production (USGS 2004, entire). However, a significant portion of the agricultural lands within the Unit are enrolled in the USDA Farm Service Agency’s Conservation Reserve Program (CRP), which is a land conservation program where farmers agree to remove environmentally sensitive lands from agricultural production in exchange for a yearly rental payment. Many CRP lands are used by Gunnison sage-grouse (Lupis et al. 2006, pp. 959–960; Ward 2007, p. 15). Factors potentially affecting the physical and biological features of the Monticello-Dove Creek Unit include, but are not limited to: Habitat loss, degradation, and fragmentation resulting from conversion to agriculture; climate change, drought-related effects; oil and gas production and associated infrastructure; the proliferation of predators of Gunnison sage-grouse; the spread of invasive plant species and associated changes in sagebrush plant community structure and dynamics; and past and present grazing management that degrades or eliminates vegetation structure; all of which can result in the loss, degradation, or fragmentation of sagebrush plant communities. Special management actions that may be needed to address these threats include, but are not limited to: The rangewide prioritization and protection of crucial seasonal habitats from development and agricultural conversion; the control of invasive plant species and restoration of historic plant community structure and dynamics, including altered fire regimes and other natural disturbance factors; and the implementation of grazing regimes that result in proper vegetation structure for Gunnison sage-grouse lifehistory needs in areas used for domestic and wild ungulate grazing and browsing. Limiting the designation of critical habitat in this unit only to currently occupied areas would be inadequate to ensure the conservation of the species. Accordingly, we are designating currently unoccupied areas that we conclude are essential for the conservation of the species. Designated unoccupied habitat comprises approximately 69 percent of the unit, including lands defined in the 2005 RCP as potential habitat or vacant or unknown habitat (GSRSC 2005, p. 54) and other unoccupied areas that met our criteria for critical habitat (see Criteria and Methods Used to Identify and Map Critical Habitat). We acknowledge, however, that portions of these unoccupied lands are locally unsuitable as habitat for Gunnison sage-grouse. For instance, some areas within the critical habitat unit are dominated by pin˜onjuniper communities (Messmer 2013, p. 17). As described earlier, critical habitat was identified on a landscape scale, and includes areas with varying amounts of overall sagebrush cover, plus habitat types that may facilitate bird movements and dispersal. These areas are also located adjacent to occupied habitat or are located immediately between surrounding populations. In addition to contributing to the fulfillment of the landscape scale habitat needs of Gunnison sage-grouse, these areas provide habitat for future population growth and reestablishment of portions of presettlement range, and facilitate movement between other units and within the unit. Some unoccupied habitat areas within this unit consist of lands that recently supported sagebrush-dominant plant communities but are currently in agricultural production or are currently subject to encroachment by coniferous trees or shrubs, most commonly pin˜ onjuniper or mountain shrub plant communities. These areas require management to reestablish or enhance sagebrush communities to support the primary constituent elements of Gunnison sage-grouse nesting or broodrearing habitats. However, in their current state, these areas provide essential habitat for inter-population movements and thus may reduce population isolation and increase genetic exchange among populations.

Unit 2: Pinon Mesa. Unit 2, the Pinon Mesa Unit, consists of 207,792 ac (84,087 ha) of Federal, State, and private lands in Grand County, Utah, and Mesa County, Colorado. Approximately 73 percent of the land area within the unit is managed by Federal agencies, less than 1 percent is owned by the State of Utah, and 27 percent comprises private lands. We consider 14 percent of this unit to be currently occupied by Gunnison sagegrouse, based on mapping developed for the 2005 RCP and subsequently (GSRSC 2005, p. 54; CPW 2013e, spatial data). Tables 4 and 5 provide detailed estimates for all critical habitat units. The occupied portion of the Pin˜ on Mesa Unit contains the physical and biological features essential to the conservation of Gunnison sage-grouse. Factors potentially affecting the physical and biological features of the Pin˜ on Mesa Unit include, but are not limited to: Residential and commercial development including associated landclearing activities for the construction of access roads, utilities, and fences; increased recreational use of roads and trails; the proliferation of predators of Gunnison sage-grouse; climate change, drought-related effects; the spread of invasive plant species and associated changes in sagebrush plant community structure and dynamics; and past and present grazing management that degrades or eliminates vegetation structure; all of which can result in the loss, degradation, or fragmentation of sagebrush plant communities. Special management actions that may be needed to address these threats include, but are not limited to: The rangewide prioritization and protection of crucial seasonal habitats subject to future residential and commercial development and increasing recreational use of roads and trails; the control of invasive plant species and restoration of historical plant community structure and dynamics, including altered fire regimes and other natural disturbance factors; and the implementation of grazing regimes that result in proper vegetation structure for Gunnison sage-grouse life-history needs in areas used for domestic and wild ungulate grazing and browsing. Limiting the designation of critical habitat in this unit only to currently occupied areas would be inadequate to ensure the conservation of the species. Accordingly, we are designating currently unoccupied areas that we conclude are essential for the conservation of the species. Designated unoccupied habitat comprises approximately 86 percent of the unit, including lands defined in the 2005 RCP as potential habitat or vacant or unknown habitat (GSRSC 2005, p. 54) and other unoccupied areas that met our criteria for critical habitat (see Criteria and Methods Used to Identify and Map Critical Habitat). These areas consist of lands with varying amounts of overall sagebrush cover, or have habitat types suitable for movements and dispersal. These areas are also located adjacent to occupied habitat or are located immediately between surrounding populations. In addition to contributing to the fulfillment of the landscape specific habitat needs of Gunnison sagegrouse, these areas provide habitat for future population growth and reestablishment of portions of presettlement range, and facilitate or allow movement between other units and within the unit. Some unoccupied habitat areas within this unit consist of lands that recently supported sagebrushdominant plant communities but are currently in agricultural production or are currently subject to encroachment by coniferous trees or shrubs, most commonly pin˜on-juniper or mountain shrub plant communities. These areas require management to reestablish or enhance sagebrush communities to support the primary constituent elements of Gunnison sage-grouse nesting or brood-rearing habitat. However, in their current state, these areas provide essential habitat for interpopulation movements and thus may reduce population isolation and increase genetic exchange among populations.

Unit 3: San Miguel Basin. Unit 3, the San Miguel Basin Unit, consists of 121,929 ac (49,343 ha) of Federal, State, and private lands in Montrose, San Miguel, and Ouray counties, Colorado. Approximately 41 percent of the land area within the unit is managed by Federal agencies, 12 percent is owned by the State of Colorado, and 47 percent comprises private lands. We consider 67 percent of this unit to be currently occupied by Gunnison sage-grouse, based on mapping developed for the 2005 RCP and subsequently (GSRSC 2005, p. 54; CPW 2013e, spatial data). Tables 4 and 5 provide detailed estimates for all critical habitat units. The occupied portion of the San Miguel Basin Unit contains the physical and biological features essential to the conservation of the Gunnison sage-grouse. Factors potentially affecting the physical and biological features within the San Miguel Basin Unit include, but are not limited to: Residential and commercial development including associated land-clearing activities for the construction of access roads, utilities, and fences; increased recreational use of roads and trails; the proliferation of predators of Gunnison sage-grouse; climate change, droughtrelated effects; the spread of invasive plant species and associated changes in sagebrush plant community structure and dynamics; past and present grazing management that degrades or eliminates vegetation structure; and oil and gas development and associated infrastructure, all of which can result in the loss, degradation, or fragmentation of sagebrush plant communities. Special management actions that may be needed to address these threats include, but are not limited to: The rangewide prioritization and protection of crucial seasonal habitats subject to future residential and commercial development (including oil and gas development) and increasing recreational use of roads and trails; the control of invasive plant species and restoration of historical plant community structure and dynamics, including altered fire regimes and other natural disturbance factors; and the implementation of grazing regimes that result in proper vegetation structure for Gunnison sage-grouse life-history needs in areas used for domestic and wild ungulate grazing and browsing. Limiting the designation of critical habitat in this unit only to currently occupied areas would be inadequate to ensure the conservation of the species. Accordingly, we are designating currently unoccupied areas that we conclude are essential for the conservation of the species. Designated unoccupied habitat comprises approximately 33 percent of the unit including lands defined in the 2005 RCP as potential habitat or vacant or unknown habitat (GSRSC 2005, p. 54) and other unoccupied areas that met our criteria for critical habitat (see Criteria and Methods Used to Identify and Map Critical Habitat). These areas consist of lands with varying amounts of overall sagebrush cover, or have habitat types suitable for movements and dispersal. These areas are also located adjacent to occupied habitat or are located immediately between surrounding populations. In addition to contributing to the fulfillment of the landscape scale habitat needs of Gunnison sage-grouse, these areas provide habitat for future population growth and reestablishment of portions of presettlement range, and facilitate or allow movement between other units and within the unit. Some unoccupied habitat areas within this unit consist of lands that recently supported sagebrush-dominant plant communities but are currently in agricultural production or are currently subject to encroachment by coniferous trees or shrubs, most commonly pin˜ onjuniper or mountain shrub plant communities. These areas require management to reestablish or enhance sagebrush communities to support the primary constituent elements of Gunnison sage-grouse nesting or broodrearing habitat. However, in their current state, these areas provide essential habitat for inter-population movements and thus may reduce population isolation and increase genetic exchange among populations.

Unit 4: Cerro Summit-Cimarron-Sims Mesa. Unit 4, Cerro Summit-Cimarron-Sims Mesa Unit, consists of 52,544 ac (21,264 ha) of Federal, State, and private lands in Montrose, Ouray, and Gunnison Counties, Colorado. Approximately 19 percent of the land area within the unit is managed by Federal agencies, 8 percent is owned by the State of Colorado, and 74 percent comprises private lands. We consider 64 percent of this unit to be currently occupied by Gunnison sage-grouse, based on mapping developed for the 2005 RCP and subsequently (GSRSC 2005, p. 54; CPW 2013e, spatial data). Tables 4 and 5 provide detailed estimates for all critical habitat units. The occupied portion of the Cerro Summit-CimarronSims Mesa Unit contains the physical and biological features essential to the conservation of the Gunnison sagegrouse. Due to the amount of private land within this population, and the small size and scattered nature of the individual populations, we do not consider that having a viable population in this area to be necessary for the conservation of the species. However, we conclude that this population area currently provides a key linkage area between the Gunnison Basin and the Crawford and San Miguel populations. Data indicates that current gene flow between populations is very low (OylerMcCance et al. 2005, p. 635), but if potentially suitable habitat is restored in these population areas, then the Cerro Summit-Cimarron-Sims Mesa population area could provide connectivity for gene flow between these populations. Therefore, we are finalizing critical habitat in this unit primarily for the purpose of facilitating connectivity between Gunnison Basin and the two smaller populations. Factors potentially affecting the physical and biological features of the Cerro Summit-Cimarron-Sims Mesa Unit include, but are not limited to: Residential and commercial development including associated landclearing activities for the construction of access roads, utilities, and fences; increased recreational use of roads and trails; the proliferation of predators of Gunnison sage-grouse; the spread of invasive plant species and associated changes in sagebrush plant community structure and dynamics; climate change, drought-related effects; and past and present grazing management that degrades or eliminates vegetation structure; all of which can result in the loss, degradation, or fragmentation of sagebrush plant communities. Special management actions that may be needed to address these threats include, but are not limited to: The rangewide prioritization and protection of crucial seasonal habitats subject to future residential and commercial development and increasing recreational use of roads and trails; the control of invasive plant species and restoration of historical plant community structure and dynamics, including altered fire regimes and other natural disturbance factors; and the implementation of grazing regimes that result in proper vegetation structure for Gunnison sage-grouse life-history needs in areas used for domestic and wild ungulate grazing and browsing. Limiting the designation of critical habitat in this unit only to currently occupied areas would be inadequate to ensure the conservation of the species. Accordingly, we are designating currently unoccupied areas that we conclude are essential for the conservation of the species. Designated unoccupied habitat comprises approximately 36 percent of the unit including lands defined in the 2005 RCP as potential habitat or vacant or unknown habitat (GSRSC 2005, p. 54) and other unoccupied areas that met our criteria as critical habitat (see Criteria and Methods Used to Identify and Map Critical Habitat). These areas consist of lands with varying amounts of overall sagebrush cover, or have habitat types suitable for movements and dispersal. These areas are also located adjacent to occupied habitat or are located immediately between surrounding populations. In addition to contributing to the fulfillment of the landscape scale habitat needs of Gunnison sage-grouse, these areas provide an important linkage area between populations. Some unoccupied habitat areas within this unit consist of lands that recently supported sagebrush-dominant plant communities but are currently in agricultural production or are currently subject to encroachment by coniferous trees or shrubs, most commonly pin˜ onjuniper or mountain shrub plant communities. These areas require management to reestablish or enhance sagebrush communities to support the primary constituent elements of Gunnison sage-grouse nesting or broodrearing habitat. However, in their current state, these areas provide essential habitat for inter-population movements and thus may reduce population isolation and increase genetic exchange among populations.

Unit 5: Crawford. Unit 5, the Crawford Unit, consists of 83,671 ac (33,860 ha) of Federal and private lands in Delta, Montrose, and Gunnison Counties, Colorado. Approximately 53 percent of the land area within the unit is managed by Federal agencies, and 47 percent comprises private lands. We consider 39 percent of this unit to be currently occupied by Gunnison sage-grouse, based on mapping developed for the 2005 RCP and subsequently (GSRSC 2005, p. 54; CPW 2013e, spatial data). Tables 4 and 5 provide detailed estimates for all critical habitat units. The occupied portion of the Crawford Unit contains the physical and biological features essential to the conservation of the Gunnison sagegrouse. Factors potentially affecting the physical and biological features of the Crawford Unit include, but are not limited to: Residential and commercial development including associated land clearing activities for the construction of access roads, utilities, and fences; increased recreational use of roads and trails; the proliferation of predators of Gunnison sage-grouse; climate change, drought-related effects; the spread of invasive plant species and associated changes in sagebrush plant community structure and dynamics; and past and present grazing management that degrades or eliminates vegetation structure; all of which can result in the loss, degradation, or fragmentation of sagebrush plant communities. Special management actions that may be needed to address these threats include, but are not limited to: The rangewide prioritization and protection of crucial seasonal habitats subject to future residential and commercial development and increasing recreational use of roads and trails; the control of invasive plant species and restoration of historical plant community structure and dynamics, including altered fire regimes and other natural disturbance factors; and the implementation of grazing regimes that result in proper vegetation structure for Gunnison sage-grouse life-history needs in areas used for domestic and wild ungulate grazing and browsing. Limiting the designation of critical habitat in this unit only to currently occupied areas would be inadequate to ensure the conservation of the species. Accordingly, we are designating currently unoccupied areas that we conclude are essential for the conservation of the species. Designated unoccupied habitat comprises approximately 61 percent of the unit including lands defined in the 2005 RCP as potential habitat or vacant or unknown habitat (GSRSC 2005, p. 54) and other unoccupied areas that met our criteria for critical habitat (see Criteria and Methods Used to Identify and Map Critical Habitat). These areas consist of lands with varying amounts of overall sagebrush cover, or have habitat types suitable for movements and dispersal. These areas are also located adjacent to occupied habitat or are located immediately between surrounding populations. In addition to contributing to the fulfillment of the landscape scale habitat needs of Gunnison sage-grouse, these areas provide habitat for future population growth and reestablishment of portions of presettlement range, and facilitate or allow movement between other units and within the unit. Some unoccupied habitat areas within this unit consist of lands that recently supported sagebrush-dominant plant communities but are currently in agricultural production or are currently subject to encroachment by coniferous trees or shrubs, most commonly pin˜ onjuniper or mountain shrub plant communities. These areas require management to reestablish or enhance sagebrush communities to support the primary constituent elements of Gunnison sage-grouse nesting or broodrearing habitat. However, in their current state, these areas provide essential habitat for inter-population movements and thus may reduce population isolation and increase genetic exchange among populations.

Unit 6: Gunnison Basin. Unit 6, the Gunnison Basin Unit, consists of 620,616 ac (251,154 ha) of Federal, State, local government, and private lands in Gunnison, Hinsdale, Montrose, and Saguache Counties, Colorado. Approximately 78 percent of the land area within the unit is managed by Federal agencies, 2 percent is owned by the State of Colorado, less than 0.1 percent is owned by Gunnison County and the City of Gunnison, and 20 percent comprises private lands. We consider 81 percent of this unit to be currently occupied, based on mapping developed for the 2005 RCP and subsequently (GSRSC 2005, p. 54; CPW 2013e, spatial data). Tables 4 and 5 provide detailed estimates for all critical habitat units. The Gunnison Basin contains the largest remaining expanse of sagebrush plant communities within the occupied range of Gunnison sagegrouse. The occupied portion of the Gunnison Basin Unit contains the physical and biological features essential to the conservation of the Gunnison sage-grouse. Factors potentially affecting the physical and biological features of the Gunnison Basin Unit include, but are not limited to: Residential and commercial development including associated land-clearing activities for the construction of access roads, utilities, and fences; increased recreational use of roads and trails; climate change, drought-related effects; the proliferation of predators of Gunnison sage-grouse; the spread of invasive plant species and associated changes in sagebrush plant community structure and dynamics; and past and present grazing management that degrades or eliminates vegetation structure; all of which can result in the loss, degradation, or fragmentation of sagebrush plant communities. Special management actions that may be needed to address these threats include, but are not limited to: The rangewide prioritization and protection of crucial seasonal habitats subject to future residential and commercial development and increasing recreational use of roads and trails; the control of invasive plant species and restoration of historical plant community structure and dynamics, including altered fire regimes and other natural disturbance factors; and the implementation of grazing regimes that result in proper vegetation structure for Gunnison sage-grouse life-history needs in areas used for domestic and wild ungulate grazing and browsing. Limiting the designation of critical habitat in this unit only to currently occupied areas would be inadequate to ensure the conservation of the species. Accordingly, we are designating currently unoccupied areas that we conclude are essential for the conservation of the species. Designated unoccupied habitat comprises approximately 19 percent of the unit including lands defined in the 2005 RCP as potential habitat or vacant or unknown habitat (GSRSC 2005, p. 54; CPW 2013e, spatial data) and other unoccupied areas that met our criteria for critical habitat (see Criteria and Methods Used to Identify and Map Critical Habitat). These areas consist of lands with varying amounts of overall sagebrush cover, or have habitat types suitable for movements and dispersal. These areas are also located adjacent to occupied habitat or are located immediately between surrounding populations. Occupied habitat within the Gunnison Basin population is much larger (592,168 ac (239,600 ha)) than the RCP model's predicted minimum required area. However, extensive sagebrush landscapes capable of supporting a wide array of seasonal habitats and annual migratory patterns for Gunnison sage-grouse are rare across the species' range. The Gunnison Basin population is the largest population, and the population is extremely important for the species' survival. With the satellite populations declining, providing more stability for the Gunnison Basin population through additional expanses of sagebrush landscapes is essential for the conservation of the species. Further, these unoccupied areas of sagebrush expanses also provide potential connectivity to the Crawford and Cerro Summit-Cimarron-Sims Mesa populations to the west. The small piece of unoccupied habitat to the east of the Gunnison Basin provides a link between those birds in occupied habitat to the north and west. Some unoccupied habitat areas within this unit consist of lands that recently supported sagebrush-dominant plant communities but are currently in agricultural production or are currently subject to encroachment by coniferous trees or shrubs, most commonly pin˜ onjuniper or mountain shrub plant communities. These areas require management to reestablish or enhance sagebrush communities to support the primary constituent elements of Gunnison sage-grouse nesting or broodrearing habitat. However, in their current state, these areas provide essential habitat for inter-population movements and thus may reduce population isolation and increase genetic exchange among populations. The maintenance and enhancement of inter-population connectivity is particularly important for the Gunnison Basin because it is the largest population in the species' range and is, therefore, the most likely source of dispersal of Gunnison sage-grouse to other populations.

Primary Constituent Elements/Physical or Biological Features

Within these areas, the primary constituent elements (PCEs) of the physical and biological features essential to the conservation of Gunnison sage-grouse consist of five components:

(i) Landscape Specific Primary Constituent Element. Primary Constituent Element 1—Extensive sagebrush landscapes capable of supporting a population of Gunnison sage-grouse. In general, this includes areas with vegetation composed primarily of sagebrush plant communities (at least 25 percent of the land is dominated by sagebrush cover within a 0.9-mi (1.5-km) radius of any given location), of sufficient size and configuration to encompass all seasonal habitats for a given population of Gunnison sage-grouse, and facilitate movements within and among populations. These areas also occur wholly within the potential historical range of Gunnison sage-grouse.

(ii) Seasonally Specific Primary Constituent Elements. (A) Primary Constituent Element 2—Breeding habitat composed of sagebrush plant communities that, in general, have the structural characteristics within the ranges described in the following table. Habitat structure values are average values over a project area. Breeding habitat includes lek, nesting, and early brood-rearing habitats used typically March 15 through July 15. Early broodrearing habitat may include agricultural fields. B) Primary Constituent Element 3— Summer-late fall habitat composed of sagebrush plant communities that, in general, have the structural characteristics within the ranges described in the following table. Habitat structure values are average values over a project area. Summer-fall habitat includes sagebrush communities having the referenced habitat structure values, as well as agricultural fields and wet meadow or riparian habitat types. Wet meadows and riparian habitats are also included qualitatively under PCE 5 at paragraph (2)(ii)(D) of this entry. (C) Primary Constituent Element 4— Winter habitat composed of sagebrush plant communities that, in general, have sagebrush canopy cover between 30 to 40 percent and sagebrush height of 15.8 to 21.7 in (40 to 55 cm). These habitat structure values are average values over a project area. Winter habitat includes sagebrush areas within currently occupied habitat that are available (i.e., not covered by snow) to Gunnison sagegrouse during average winters. (D) Primary Constituent Element 5— Alternative, mesic habitats used primarily in the summer-late fall season, such as riparian communities, springs, seeps, and mesic meadows.

Special Management Considerations or Protections

Critical habitat for the Gunnison sage-grouse does not include manmade structures (such as buildings, airport runways, roads, and other paved areas) and the land on which they are located existing within the boundaries of designated critical habitat on December 22, 2014.

Special management considerations or protection may be required to address these threats in designated critical habitat. Continued or future management activities that could ameliorate these threats include, but are not limited to: Comprehensive land-use planning and implementation that prevents a net decrease in the extent and quality of Gunnison sage-grouse habitat through the prioritization and protection of habitats and monitoring; protection of lands by fee title acquisition or the establishment of permanent CEs; management of recreational use to minimize direct disturbance and habitat loss; activities to control invasive weed and invasive native plant species; management of domestic and wild ungulate use so that overall habitat meets or exceeds Gunnison sage-grouse structural habitat guidelines; monitoring of predator communities and management as appropriate; coordinated and monitored habitat restoration or improvement projects; and wildfire suppression, particularly in Wyoming big sagebrush communities. In some cases, continuing current land management practices may be appropriate and beneficial for Gunnison sage-grouse.

Life History

Feeding Narrative

Juvenile: Sage-grouse are herbivores and insectivores whose diet consists of almost exclusively sagebrush in winter; during the remainder of the years Gunnison sage-grouse eat sagebrush, forbs, and insects (Wallestad et al. 1975, Schroeder et al. 1999, Young et al. 2000). Insects are important in the diet of chicks during their first three weeks of life; subsequently, forbs and sagebrush increase in importance (see Gunnison Sage-grouse Rangewide Steering Committee 2005). (NatureServe, 2015)

Adult: Sage-grouse are herbivores and insectivores whose diet consists of almost exclusively sagebrush in winter; during the remainder of the years Gunnison sage-grouse eat sagebrush, forbs, and insects (Wallestad et al. 1975, Schroeder et al. 1999, Young et al. 2000). Activity occurs throughout the year, primarily during daylight hours. Mating activity peaks shortly after sunrise but occasionally occurs near sunset or during nights with bright moonlight (Schroeder et al. 1999). During the mating season, sage-grouse forage in morning after breeding activity and in afternoon before roosting or breeding activity (Schroeder et al. 1999). During nesting season, females remain on nests throughout most of the day and night, but they take brief foraging breaks during morning and late afternoon or evening (Girard 1937). In summer, sage-grouse forage in early morning, loaf during midday, and forage again in the afternoon (Nelson 1955). (NatureServe, 2015)

Reproduction Narrative

Adult: The life cycle involves several significant stages, minimally including wintering, lek attendance, nesting, and brood rearing. In Colorado and likely Utah, males display on leks from mid-March through late May, depending on elevation and conditions (Rogers 1964). Females visit leks, mate with one or more males, then depart to begin nesting. Clutch size averages around 6 to 7 eggs (Young 1994, USFWS 2010). Incubation, by the female alone, lasts about 4 weeks. Hatching begins around mid-May and may extend into July; the peak usually is in mid-June (Gunnison Sage-grouse Rangewide Steering Committee 2005). Chicks leave the nest with the female shortly after hatching. Females infrequently renest if they lose their first nest. In greater sage-grouse (Centrocerus urophasianus), yearling males are capable of breeding, but most breeding is done by older males; yearling females often breed but somewhat less frequently than do older females (see Schroeder et al. 1999). Most Gunnison sage-grouse live less than 2 years in the wild. Sage-grouse are strong fliers but tend to travel slowly on foot unless threatened, in which case the grouse tend to hide or fly (less likely to run long distances) (Patterson 1952, Schroeder et al. 1999). (NatureServe, 2015). Males begin to appear and strut on leks beginning in March with peak breeding occurring in April, with exact onsets and peak lek attendance varying 1 to 3 weeks depending on winter severity. Females initiate nests in April, May, and sometimes June if their first nest is lost to depredation early enough in the incubation period, although this appears uncommon in the Gunnison Basin population (Young 1994, pp. 37-44). Nest initiation depends on snow depth and the age of the female. (USFWS, 2019).

Geographic or Habitat Restraints or Barriers

Adult: Unsuitable habitat includes open water as well as other habitats through or over which birds may travel but in which they do not nest or forage much if at all. (NatureServe, 2015)

Environmental Specificity

Adult: Moderate (NatureServe, 2015)

Site Fidelity

Adult: Both male and female sage-grouse exhibit breeding and nesting site fidelity (Connelly et al. 2004, p. 60). Adult males generally return to the same lek to mate throughout their lives (Dunn and Braun 1985, p. 625). Females typically nest in the same area each year (Young 1994, p. 42). If females do not have a successful nest, they may move nest location further (each year) compared to successful females (Connelly et al. 2011, p. 60). Yearling males visit more than one lek in their first breeding season, suggesting an age-related period of establishment (Connelly et al. 2011, p. 60). Of 11 yearling GRSG males in northern Colorado, all visited more than one lek, compared to 3 of 11 adult males visited more than 1 lek (Emmons and Braun 1984, p. 1026). (USFWS, 2019).

Habitat Narrative

Juvenile: During the early summer/brood-rearing season, mesic (wet) areas within or near sagebrush habitats provide important habitats for females and chicks. Juveniles and all other life stages use mesic habitat that provide abundant forbs and invertebrates, especially once those resources are no longer available in the nesting area. Mesic habitats and drainages also provide cover from predators (Young et al. 2015, p. 5). (USFWS, 2019).

Adult: Sage-grouse use a variety of habitats throughout the year, but the primary component necessary is sagebrush (Artemisia spp.), especially big sagebrush (A. tridentata) (Braun 1995). Sagebrush is used for hiding and thermal cover as well as for food in the winter (Hupp and Braun 1989). Leks, used for male displays from mid-March to early June, consist of open areas with good visibility (for predator detection) and acoustics (for transmission of male display sounds). Female nesting sites typically are in relatively tall and dense stands of sagebrush, about 0.2-8.0

kilometers from the leks. Nest sites also have grass and forbs that provide additional hiding cover. Females with young remain in sagebrush uplands if hiding cover is adequate and if food (succulent forbs and insects) is available. As chicks mature and vegetation in the uplands desiccates, females move their broods to wet meadow areas that retain succulent forbs and insects through the summer (Klebenow 1969, Wallestad 1971). Preferred wet meadow areas also contain tall grasses for hiding and sagebrush stands at least 150 meters wide (Dunn and Braun 1986) along the periphery for hiding and foraging.From mid-September into November all individuals use upland areas with 20 percent or greater sagebrush cover and some green forbs. As winter progresses and snow cover is extensive (> 80 percent) and deep (> than 30 centimeters), individuals forage in tall sagebrush (> 41 centimeters) in valleys and lower flat areas (Hupp and Braun 1989) and roost in shorter sagebrush along ridge tops. Roosting and foraging is typically restricted to south- or west- facing slopes where snow is typically shallower and less extensive (Hupp and Braun 1989). Small foraging areas that have 30-40 percent big sagebrush canopy cover also are important. (NatureServe, 2015)

Dispersal/Migration

Motility/Mobility

Adult: High (NatureServe, 2015)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Non-migratory but limited seasonal movements (NatureServe, 2015)

Dispersal

Adult: Moderate (NatureServe, 2015)

Dispersal/Migration Narrative

Adult: This species is basically nonmigratory in some areas, but in other areas it makes limited seasonal movements among different habitats. For example, in San Juan County, Utah, females nested within 3.3 km of lek sites, broods remained within 3.0 km of nest sites, and males stayed within 4.0 km of the nearest lek site (Lupis 2005). Females without broods traveled the farthest, moving up to 7.4 km from the lek on which they were captured (Lupis 2005). In the Gunnison basin, 20 of 25 nests were within 6.4 km of the lek on which the female was captured (Young 1994, Apa 2004, Gunnison Sage-grouse Rangewide Steering Committe 2005). Overall, the vast majority of nests are within 6.4 km of the lek of capture (Gunnison Sage-grouse Rangewide Steering Committee 2005). Longer movements sometimes occur. Movements of up to 24 km have been observed in individual Gunnison sage-grouse in the Gunnison Basin population (Phillips 2010, pers. comm., cited by USFWS 2010). Sage-grouse sometimes move 30 km or more between winter range and nesting areas (see Gunnison Sage-grouse Rangewide Steering Committee 2005). (NatureServe, 2015)

Population Information and Trends

Population Trends:

Long-term trends indicate declines of >80%, whereas short-term trends indicate a relatively stable population (NatureServe, 2015)

Resiliency:

Currently, Dove Creek is the only population in a critical condition (Table 6, Figure 12). Three populations are in low condition (Crawford, Poncha Pass, and Monticello), two populations are in moderate condition (CSCSM and San Miguel), and two populations are in high condition (Gunnison Basin and Piñon Mesa). Five of the populations have habitat in moderate quality, two populations have low habitat quality, and the Gunnison Basin and Piñon Mesa populations have habitat in high condition. Populations in higher resiliency categories are at less risk from potential stochastic events, such as extreme weather events, than populations in lower resiliency At the species level, the eight populations are distributed north to south in southwestern Colorado and east to west in southeastern Utah and southwestern Colorado (redundancy). In general, the eight populations occur in similar habitats, although in six ecoregions with differences between them, such as elevation differences (representation). The eight populations reduce risk associated with potential catastrophic events, such as drought. However, only two of the eight populations are in the high resiliency category. Furthermore, the relatively narrow distribution of the eight populations across the southwestern corner of Colorado and southeastern Utah increases risk from a catastrophe. (USFWS, 2019). Gunnison Basin population is in high condition that has not received additional GUSG individuals through translocations. The high health condition is driven largely by its consistently large population size and sufficient quantity of sagebrush habitat. Piñon Mesa also came out as having high health due to the quality of habitat, and moderate health of the HMC demographic factors. The next two largest populations, San Miguel (moderate condition) and Crawford (low condition), have all fluctuated in HMCs during the same period but have generally increased since 2011 to 2012. These populations also received translocated birds from the Gunnison Basin. Poncha Pass (low condition) had a HMC of zero in 2013, and received 27 translocated birds from Gunnison Basin in 2013 and 2014. CSCSM is in low condition, with consistently low population numbers, yet persists without translocations or other significant population management actions. All the other smaller populations are at higher risk because of their low numbers and poor habitat conditions. (USFWS, 2019). Analysis of microsatellite and mtDNA sequence data has found some evidence of movements among populations, yet substantial genetic structure exists among populations, indicating that gene flow is low and movements among populations are rare (Oyler-McCance et al. 2005, p. 635). For populations of GUSG with low connectivity to other populations, we will continue to see the high levels of genetic differentiation between populations, which, in small populations, ultimately reduces their genetic fitness. The Cerro Summit-Cimarron-Sims Mesa population may provide an important “stepping-stone” that links the larger populations of Gunnison and San Miguel (GSRSC 2005, p. 51). (USFWS, 2019). Therefore, the overall viability of the species is essentially reliant on the resiliency of the Gunnison Basin population. As the only population in a high resiliency condition that has self-sustaining recruitment, the Gunnison Basin population is the best able to withstand stochastic events, so it is critical to the viability of the species. Piñon Mesa is in a high condition as well, although it is at the lower level and reliant on conservation efforts. The remaining populations are currently in moderate, low, or critical condition, so they are at greater risk from stochastic events. Additionally, due to the limited quantity of habitat and low connectivity between populations, this species is reliant on relocation efforts to maintain resiliency. Translocation efforts have been important to ensure that some of the eight populations are resilient currently, and these efforts will likely need to continue in the future to maintain genetic diversity (Zimmerman et al. 2019, p. 8). (USFWS, 2019).

Representation:

The eight populations of GUSG occupy a diversity of environmental conditions, ranging from cold and dry (Gunnison Basin) to warmer and wetter (Piñon Mesa) as well as hot and dry (Dry Creek Basin in San Miguel) and six different ecoregions. The conditions in other populations fall on a gradient between these conditions. Populations also differ in the composition of sagebrush species, topography, and soils Although this seems to indicate the GUSG has some adaptability to ecological variation, the majority (about 85 percent) of the species occurs in Gunnison Basin where temperatures are cooler, there is more precipitation, more sagebrush, and better forb and grass cover. These environmental differences between the populations help spread risk associated with potential catastrophes, such as widespread drought, and help reduce risk associated with novel, environmental change, such as long-term climatic changes. (USFWS, 2019). There is low genetic diversity in GUSG compared to GRSG (Oyler-McCance et al. 2005, p. 630) which is likely influenced by the lack of connectivity between populations. A genetic study of the allelic differences between populations revealed lower levels of genetic diversity in six smaller populations (not including CSCSM) compared to the Gunnison Basin prior to any translocations (Oyler-McCance et al. 2005, p. 635). Collectively, the smaller populations (San Miguel, Monticello-Dove Creek, Piñon Mesa, and Crawford) contain 24 percent of the genetic diversity of the species while representing only about 14 percent of the entire population size. Cerro Summit-Cimarron-Sims Mesa population was not analyzed in this study and Poncha Pass has no unique genomes, following local extirpation and reestablishment of the current population through translocations from Gunnison Basin. (USFWS, 2019). Within the entire range, genetic heterogeneity is highest in the Gunnison Basin population and lowest in Piñon Mesa, which is the most geographically isolated from Gunnison Basin. Low genetic diversity puts an entire population at greater risk from new environmental and demographic stresses (GSRSC 2005, p. 113), such as potential mortality from disease and low hatching success resulting from inbreeding (Stiver et al. 2008, p. 479). Even the largest of the satellite populations, San Miguel, is likely experiencing an inbreeding depression. The population as a whole has moderate HMC growth and HMCs are less than, but near, the target HMC. However, the subpopulations are spread out across the San Miguel Basin and individually, may not be moderately healthy. (USFWS, 2019). In addition to the low resiliency of the satellite populations, connectivity between all populations is limited. Distances between populations ranges from less than 11 km (7 mi) to over 100 km (60 mi). Some telemetered birds made seasonal migrations of 14 km (9 mi), while the majority of birds return to the same breeding and nesting areas each year and stay within a 5 km (3 mi) area (Commons 1997, p. iii). Oyler-McCance et al. (2005, p. 636) identified three possible dispersers (birds moving between populations) based on genetics. Two probable dispersers were individuals moving from San Miguel into Dove Creek/Monticello and Crawford, distances range 30-100 km (18-60 mi) and 60-100 km (37-60 mi) respectively. The other disperser involved movement into Crawford from Curecanti (western edge of Gunnison population) approximately 50 km (31 mi) (Oyler-McCance et al. 2005, p. 636). The long distance between populations reduces the likelihood of GUSG to migrate between them, resulting in decreased genetic diversity and a lower fitness. We have very little evidence of how birds currently move between populations, and it is very unlikely that birds would repopulate an extirpated area on their own due to low population numbers. However, the successful translocations that occurred in 2006-2014, the increase in HMCs following translocations, and successful breeding with the local population indicates translocating is an effective way to supplement populations. With a focused effort on the populations that are most likely to continue to support the demographic and habitat needs of GUSG, translocations are a recovery action that could increase the redundancy of GUSG. We investigate the potential effects of ongoing, additional, and reduced translocations to population resiliency under the Future

Conditions chapter. (USFWS, 2019). Recent genetics work found that birds translocated from the Gunnison Basin to the other populations successfully bred with resident birds (Zimmerman et al. 2019), indicating that translocated birds survived and increased the diversity of the host populations. However, it is unclear if the remaining genetic differences between populations confer some type of adaptive advantage, such as those tailored to population's specific habitat type. It is possible that some of the genetic differences between GUSG satellite populations could represent adaptation to the different environmental conditions found across the current distribution. This would include variation in the dominant sagebrush species and micro-climates. Possible genetic adaptations to local environmental conditions, such as the digestibility of local sagebrush species, needs further investigation (Kohl et al. 2015, p. 432). Many of the genomic differences have also been altered from translocations from Gunnison Basin. Although this means the unique genes of the satellite populations could be lost, it also makes the satellite populations more genetically diverse and more likely to avoid inbreeding depression. (USFWS, 2019).

Redundancy:

GUSG currently has seven populations in southwestern Colorado and one population in Utah (Figure 12, below). The eight populations provide redundancy that reduces risk from catastrophic events. However, the eight populations are distributed relatively narrowly in southwestern Colorado and a small corner of Utah, which put the species at greater risk to catastrophic events than if it were more broadly distributed. Additionally, the Gunnison Basin and Piñon Mesa populations are the only populations in the high resiliency category and Gunnison Basin provides the majority of the adaptive capacity of the species because Piñon Mesa's high health has been reliant on translocated GUSG individuals into the population. (USFWS, 2019).

Population Growth Rate:

Declining (NatureServe, 2015)

Number of Populations:

8 (1 core and 7 satellite) (USFWS, 2024)

Population Size:

~ 4,086 (USFWS, 2024)

Population Narrative:

The current range is thought to be only about 8.5-10 percent of the historical potential habitat area (Schroeder et al. 2004, USFWS 2014). Population size has clearly declined, but degree of decline in population size is not well established (Gunnison Sage-grouse Rangewide Steering Committee 2005). Long-term population trends indicate declines of >80%, whereas short-term trends suggest a relatively stable population. As of 2014, the total population was estimated to be about 4,705 individuals, with about 3,978 of these in the Gunnison Basin, Colorado; the other populations ranged from 10-206 individuals, averaging approximately 100 (USFWS 2014). Gunnison Sage-grouse Rangewide Steering Committee (2005) identified eight extant populations (these are metapopulations, each of which includes gaps in occupied habitat). USFWS (2014) stated that the species currently occurs in seven distinct populations. (NatureServe, 2015). As of 2019, USFWS acknowledges 8 populations within 8 counties in southwestern Colorado and one county in southeastern Utah: Gunnison Basin, Poncha Pass, Crawford, Cerro Summit-Cimarron-Sims Mesa, Pinon Mesa, San Miguel Basin, Dove Creek, Monticello. The Gunnison Basin population is largest population and has the largest quantity of occupied habitat, covering an estimated 239,641 ha (592,168 ac) (50 FR, p. 69195). Poncha Pass, to the east of the city of Gunnison, is the smallest population and has the least amount occupied habitat, covering 11,234 ha (43.4 mi^2). Gunnison Basin supports approximately 85 percent of the breeding birds for the species and 65 percent of the occupied habitat. The remaining 15 percent of the individuals are distributed among the remaining populations, which comprise 35 percent of the overall occupied habitat. Of the eight populations, the San Miguel Basin contains six subpopulations that occupy discreet habitat areas. (USFWS, 2019). As the second largest grouse species in North America, the Gunnison Sage-grouse (GUSG) occurs in eight small, localized populations in central and western Colorado and eastern Utah (Service 2019a, p. 9). GUSG were formerly native to southwestern Colorado, northern New Mexico, southeastern Utah, and northeastern Arizona (Young et al. 2000, p. 446), but are now found exclusively in Colorado and Utah. Seven populations occur in Colorado and one population in Utah. The Gunnison Basin population is the largest and is referred to as the core population, while the remaining seven populations are described as satellite populations. Two satellite populations include further subdivided subpopulations in San Miguel Basin and Cerro Summit-Cimarron-Sims Mesa (CS/C/SM). The remaining satellite populations in Colorado are Piñon Mesa, Crawford, Poncha Pass, and Dove Creek. Across the Utah border is the Monticello satellite population. Changed since the previous review is the full separation of the Dove Creek (CO) and Monticello (UT) satellite populations. They were previously considered together, combining data as the Dove Creek-Monticello population; however, due to very low populations measured by high male counts (HMCs), the lack of movement between the two units, and the differing land management actions between the states of Utah and Colorado, they are no longer combined. (USFWS, 2024)

Threats and Stressors

Stressor: Climate change (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: Climate change has the potential to alter important seasonal habitats and food resources of Gunnison sage-grouse, the distribution and extent of sagebrush, and the occurrence of invasive weeds and associated fire frequencies. Climate change effects, including increased drought, are predicted in all populations (USFWS, 2014).

Stressor: Drought (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: Drought has contributed to substantial declines in all Gunnison sage-grouse populations. Drought likely intensifies other stressors such as predation, invasive plants, and fire. Drought is a substantial threat to Gunnison sage- grouse rangewide, both now and into the future (USFWS, 2014).

Stressor: Habitat destruction or modification (USFWS, 2014)
Exposure:

Response:
Consequence:
Narrative: Habitat loss due to residential and infrastructural development (including roads and powerlines) is a current and future threat to Gunnison sage-grouse range-wide. The collective disturbance from human activities around residences and infrastructure results in habitat decline that negatively impacts Gunnison sage-grouse survival. Other habitat-related threats that are impacting Gunnison sage-grouse include grazing practices inconsistent with local ecological conditions, fences, invasive plants, fire, mineral development, pinion-juniper encroachment, and large-scale water development and irrigation. The cumulative presence of all these features and activities constitutes a threat to Gunnison sage-grouse as they collectively contribute to habitat decline. In particular, the satellite populations are less resilient and more vulnerable to extirpation and environmental pressures including habitat loss and fragmentation. Several issues, such as fire, invasive species, and pinion- juniper encroachment, may not currently have a substantial impact on Gunnison sage-grouse; however, the documented synergy among these three issues results in a high likelihood that they will pose a threat to the species in the future. Invasive plants negatively impact Gunnison sage-grouse primarily by reducing or eliminating native vegetation that sage-grouse require for food and cover, resulting in habitat decline. Climate change will likely alter the range of invasive plants, intensifying the proliferation of invasive plants to the point that they become a threat to the species (USFWS, 2014).

Stressor: Predation and disease (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: Due to the known presence of West Nile virus across the majority of Gunnison sage-grouse range, the high risk of mortality and population-level impacts based on the biology of the species, and the immediacy of those potential impacts, West Nile virus is a future threat to Gunnison sage-grouse rangewide. Predation is a current and future threat to the species, particularly in the satellite populations. Major predators of adult sage-grouse include many species, including golden eagles, red foxes, and bobcats. Juvenile sage-grouse also are killed by many raptors as well as common ravens (Corvus corax), badgers (Taxidea taxus), red foxes, coyotes (Canis latrans), and weasels (Mustela spp.). Nest predators include badgers, weasels, coyotes, common ravens, American crows (Corvus brachyrhyncos), magpies (Pica spp.), and elk (Cervus canadensis). Egg predators are weasels, coyotes, and corvids. Adult male Gunnison and greater sage-grouse are very susceptible to predation while on the lek; predation of adult sage-grouse is low outside the lekking, nesting, and brood- rearing season. Both predation and disease are threats that are likely to increase in the future (USFWS, 2014).

Stressor: Small population size and structure (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: Small population size and structure is a threat to the six satellite populations of Gunnison sage-grouse, both now and into the future. Resiliency, redundancy, and representation in Gunnison sage-grouse are inadequate, or will be inadequate in the future, to ensure the species' long-term viability. Although genetic consequences of low Gunnison sage-grouse population numbers have not been definitively detected to date, the results from Stiver et al. (2008, p. 479) suggest that six of the seven populations may have effective sizes low enough to

induce genetic deterioration, and that all seven could be losing adaptive potential (USFWS, 2014).

Stressor:
Exposure:
Response:
Consequence:
Narrative:

Stressor:
Exposure:
Response:
Consequence:
Narrative:

Stressor:
Exposure:
Response:
Consequence:
Narrative:

Recovery

Reclassification Criteria:
Reclassification criteria are not available.

Recovery Priority Number: 8C

Delisting Criteria:
Delisting criteria are not available.

Recovery Actions:
- Recovery actions are not available.
- Conservation measures are not available.

Conservation Measures and Best Management Practices:
- Warm and Wet In the Warm and Wet scenario, annual temperature increases by 2°F by 2035 and 4°F by 2050. Under this scenario, summer temperatures will last a week longer; annual precipitation will increase by 10 percent by 2035 and 8 percent by 2050 (in terms of soil moisture and stream flows, a 5 percent increase in precipitation is needed to offset the 2°F increase in temperature with its associated higher rate of evapotranspiration). Drought years, such as 2002, will occur every 15th year, similar to today's frequency. However, the intensity and severity of droughts will increase because of higher temperatures. While the water stress from 2°F-temperature increase will be offset by a 10 percent increase in precipitation, ecosystems will change in measurable ways. For example, the ratio of warm season to cool season grasses will change, and we could see declines in western wheatgrass and needle and thread grass, while blue gramma and galleta grass expand. The snowline will shift upwards by 600 ft. In this scenario, heat waves similar to 2002 (5°F above normal) will occur once every decade. The fire risk in this scenario is the lowest of any scenario, but fires will

be present, and intermittent dry conditions may cause severe fire hazards because of high fuel loads. A 2°F increase in temperature will increase the fire frequency up to four times and the annual area burned by six times. In this scenario, there will be greater than normal winter snowpack above 10,000 ft, and spring, summer, and fall precipitation will increase at all elevations. The increase in year-round moisture coupled with a moderate increase in temperature will promote invasive species (more so than any other scenario). Current invasive species present in the southwestern Colorado such as leafy spurge, knapweed, cheatgrass, yellow toadflax will expand into low to montane elevations and new invasive species such as Japanese brome or purple loosestrife will likely move into higher elevations area. Further, invasive species will out-compete the native vegetation, degrading rangelands. Seeps, springs, and other groundwater dependent wetlands will increase or experience very little change. Higher soil moisture will likely eliminate or reduce invasive species in wetlands. There is uncertainty about how more snow could affect winter sage grouse habitat. It is possible some areas could see sagebrush mortality due to higher winter moisture (USFWS, 2019)

- RECOMMENDATIONS FOR FUTURE ACTIONS: • Continue annual lek counts and surveys. • Continue with Recovery Implementation Strategy (RIS) Workshops annually for each GUSG population Working Group. • Continue to implement wet meadow restoration projects and cheatgrass invasive species removal projects (sub-committees) for habitat improvement. • Research the human subsidies provided to common ravens in GUSG populations. If warranted, develop and implement a predator control management plan with partners. • Continue fostering community relationships and outreach. • Continue to secure grant funding for habitat restoration projects and provide funding for Working Group Coordinators. (USFWS, 2024)

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SPECIES ACCOUNT: *Centrocercus urophasianus* (Greater sage-grouse)

Species Taxonomic and Listing Information

Listing Status: Proposed threatened (USFWS, 2013). USFWS 2015 concluded the population was recovering and not in danger of becoming threatened. USFWS, 2019 again proposed the Bi-State DPS be listed as threatened. (USFWS, 2019).

Physical Description

The Greater Sage-Grouse is a large grouse with a chunky, round body, small head, and long tail. Males change shape dramatically when they display, becoming almost spherical as they puff up their chest, droop their wings, and fan their tail into a starburst. Sage-Grouse are mottled gray-brown with a black belly. Males have a black head and throat. The breast has a fluffy white ruff that, during displays, surrounds a pair of inflatable, yellow air sacs. Females have a dusky cheek patch emphasized by white markings behind the eye. (ECOS, 2019). Adults measure approximately 71 cm in length and weigh approximately 3190 g. (NatureServe, 2019)

Current Range

CA, NV;

Critical Habitat Designated

No;

Life History

Food/Nutrient Resources

Food Source

<u>Adult:</u> Sagebrush provide most of the winter diet. At other times of the year sage-grouse feed on sagebrush as well as the leaves, flowers, and buds of associated plants. They also eat insects (e.g., ants, beetles, grasshoppers; Terres 1980). Insects are especially important in the diet of newly hatched broods. In southeastern Oregon, chicks ate primarily forbs and insects at one site, but mostly sagebrush at another site (Drut et al. 1994b). Over the fall, birds shift from consuming large amounts of forbs to eating mostly sagebrush (Wallestad 1975). See Schroeder et al. (1999) for greater detail on diet and food selection. (NatureServe, 2019)

Reproduction Narrative

<u>Adult:</u> This species is a lek breeder; up to 400 males may display in an area 0.8 kilometers long. Clutch size averages around seven to eight but is highly variable; variation may reflect habitat quality and nutritional condition of female (Connelly et al. 2000). Incubation, by the female, lasts 25-27 days. Young are precocial, downy, tended by female, fly when 7-14 days old. Productivity generally is low; reported nest failure 36 percent (Montana) to 76 percent (Oregon) (see Gregg et al. 1993). Renesting rates after nest loss are variable, from less than 10 percent to more than 40 percent (Connelly et al. 2000). Females are sexually mature in 1 year, though some or many yearlings may not nest. Most sage-grouse live 3-6 years or less, but individuals up to 9 years of age have been recorded in the wild (Connelly et al. 2004). (NatureServe, 2019).

Habitat Type

Adult: Sage-grouse are emblematic of the sagebrush steppe of the intermountain West, which is their only habitat. They are widespread across the sagebrush plains but are sensitive to disturbance. In early spring they gather on patches of open ground known as leks, where males display to females. Leks are located in clear areas such as broad ridgetops, grassy swales, dry lakebeds, and sometimes recently burned areas. Adult hens lead their growing chicks to areas with good forage, including irrigated pastures, wet meadows, and alfalfa fields, in addition to sagebrush. (USFWS, 2019)

Site Fidelity

Adult: High (USFWS, 2013)

Habitat Narrative

Adult: Sage-grouse annually exploit numerous habitat types in the sagebrush ecosystem across broad landscapes to successfully complete their life cycle, thus spanning ecological and political boundaries. Populations are slowgrowing due to low reproductive rates (Schroeder et al. 1999 pp. 11, 14; Connelly et al. 2000a, pp. 969–970), and they exhibit natural, cyclical variability in abundance (see ‘‘Current Range/Distribution and Population Estimates/ Annual Lek Counts’’ section of the Species Report (Service 2013a, pp. 17– 29)). (USFWS, 2013).

Dispersal/Migration

Dispersal/Migration Narrative

Adult: Populations can be defined by their migration habit. Populations are either nonmigratory, or undertake a 1-stage migration or two-stage migration. One-stage migrants move between distinct summer and winter ranges, often 15-48 kilometers apart. Two-stage migrants move between breeding habitat, summer range, and winter range, and their annual movements can exceed 80 to 100 kilometers (Connelly 1999b). Fall movements to winter range can span several months, from late August to December (Connelly et al. 1988). Males and females flock separately. In some areas, populations make local elevational migrations between summer and winter habitats. See Schroeder et al. (1999) for more detail on migration habits. (NatureServe, 2019) Median dispersal distance from natal area to breeding area was about 7-9 kilometers in Colorado; probably over half of all yearling grouse attended natal-area lek (Dunn and Braun 1985). Over the year, individuals in migratory populations may cover home ranges that exceed 1,500 square kilometers; size of home ranges vary greatly with migratory habit and season (Connelly et al. 2000). Distances between nest sites and nearest leks average 1.1 to 6.2 kilometers, but females may move more than 20 kilometers from a lek to nest (Connelly et al. 2000). (NatureServe, 2019)

Population Information and Trends

Population Size:

As of 2013: 1833-7416 individuals (USFWS, 2013)

Additional Population-level Information:

Six population management units: Pine Nut PMU, with fewest individuals at approximately 5% of population at 50-331 individuals; Desert Creek-Fales PMU, with 2 somewhat connected populations to other PMUs, at 317-1268 individuals total; Mount Grant PMU, with 1 population at 85-1412 individuals, and some level of connectivity with other PMUs; Bodie PMU, one of 2 core populations with 552-2400 total individuals and some connectivity to other PMUs; South Mono PMU, with 2 populations representing the largest total population of 859-2005 individuals, and largely isolated from the other PMUs; White Mountains PMU with one remote, largely isolated population of unknown size. (USFWS, 2013)

Threats and Stressors

Stressor: Nonnative and Native, invasive plants (USFWS, 2013)
Exposure: Cheat grass, white medusahead rye, pinyon pine, jeffrey pine, juniper (USFWS, 2013)
Response: Alteration of plant community structure and composition, productivity, nutrient cycling, and hydrology (Vitousek 1990, p. 7) (Factor A), and may cause declines in native plant populations through competitive exclusion and niche displacement, among other mechanisms (Mooney and Cleland 2001, p. 5446) (Factor E). They can create long-term changes in ecosystem processes (Factor A), such as fire cycles (see Wildfires and Altered Fire Regime section below, and in the Species Report (Service 2013a, pp. 69–76)) and other disturbance regimes that persist even after an invasive plant is removed (Zouhar et al. 2008, p. 33). (USFWS, 2013)
Consequence: Loss of habitat and food sources (USFWS, 2013)
Narrative: Cheatgrass is considered most invasive in Wyoming sagebrush communities (which is a subspecies of sagebrush that occurs in the Bi-State area), while medusahead rye (Taeniatherum caput-medusae (L.) Nevski) fills a similar niche in more mesic communities with heavier clay soils (Connelly et al. 2004, p. 5–9). Some native tree species are also invading sagebrush habitat and impacting the suitability of the habitat for the various life processes of the Bi-State DPS. Pinyon-juniper woodlands are a native vegetation community dominated by Pinus edulis (pinyon pine) and various Juniperus (juniper) species that can encroach upon, infill, and eventually replace sagebrush habitat (Factors A and E). Some portions of the Bi-State DPS's range are also being adversely affected by Pinus jeffreyi (Jeffrey pine) encroachment. Woodland encroachment is causing significant, measurable habitat loss throughout the range of the Bi-State DPS. (USFWS, 2013)

Stressor: Infrastructure (USFWS, 2013)
Exposure: Roads, power lines, fences, landfills, communication towers. (USFWS, 2013)
Response: Degraded and fragmented habitat, increased predators and invasive plants. (USFWS, 2013)
Consequence: Loss of habitat, collisions, deterrence from use of habitat, direct mortality (USFWS, 2013)
Narrative: Wisdom et al. (2011, p. 463) reported that across the entire range of the greater sagegrouse, the mean distance to highways and transmission lines for extirpated populations was approximately 5 kilometers (km) (3.1 miles (mi)) or less. In the Bi-State area, between 35 and 45 percent of annually occupied leks are within 5 km (3.1 mi) of highways, and between 40 and 50 percent are within this distance to existing transmission lines (Service 2013b, unpublished data). Therefore, the apparent similarity between existing Bi-State conditions and extirpated populations elsewhere suggests that persistence of substantial numbers of leks within the Bi-State DPS will likely be negatively influenced by these anthropogenic features. (USFWS, 2013)

Stressor: Wildfires and altered fire regimes (USFWS, 2013)
Exposure: Increased fuels, reduced precipitation with climate change, increased severity of fires; Reduced number of fires controlling invasive species. (USFWS, 2013)

Response: Habitat loss and fragmentation, isolation of sage-grouse populations; More severe fire events (USFWS, 2013)
Consequence: Loss of habitat and food sources; direct mortality (USFWS, 2013)
Narrative: The historical sagebrush systems likely consisted of extensive sagebrush habitat dotted by small areas of grassland that were maintained by numerous small fires with long interludes between fires, which accounted for little burned area, and that were punctuated by large fire events (Baker 2011, p. 197). In general, fire extensively reduces sagebrush within burned areas, and the most widespread species of sagebrush can take decades to re-establish and much longer to return to pre-burn conditions (Braun 1998, p. 147; Cooper et al. 2007, p. 13; Lesica et al. 2007, p. 264; Baker, 2011, pp. 194–195). (USFWS, 2013) When intervals between wildfire events become unnaturally long in sagebrush communities, woodlands have the ability to expand (allowing seedlings to establish and trees to mature (Miller et al. 2011, p. 167)) when they are adjacent to or are present (in small quantities) within sagebrush habitat. Conifer woodlands have expanded into sagebrush ecosystems throughout the sage-grouse's range over the last century (Miller et al. 2011, p. 162). Alternatively, a shortened fire frequency interval within sagebrush habitat can result in the invasion of nonnative, invasive, annual grasses, such as cheatgrass and medusahead rye; once these nonnatives are established, wildfire frequency within sagebrush ecosystems can increase (Zouhar et al. 2008, p. 41; Miller et al. 2011, p. 167; Balch et al. 2013, p. 178). (USFWS, 2013)

Stressor: Grazing and Rangeland Management (USFWS, 2013)
Exposure:
Response: Decrease in vegetation, soil compaction and erosion, increased nonnative invasive plant species. (USFWS, 2013)
Consequence: Loss of habitat (USFWS, 2013)
Narrative: Livestock management and associated infrastructure (such as water developments and fencing) can degrade important nesting and brood rearing habitat, reduce nesting success, and facilitate the spread of WNv (Factors A, C, and E). However, despite numerous documented negative impacts, some research suggests that under specific conditions, grazing domestic livestock can benefit sage-grouse (Klebenow 1982, p. 121). Other research conducted in Nevada found that cattle grazing can be used to stimulate forbs important as sage-grouse food (Neel 1980, entire; Klebenow 1982, entire; Evans 1986, entire). (USFWS, 2013) Similar to domestic livestock, grazing and management of feral horses have the potential to negatively affect sagegrouse habitats by decreasing grass cover, fragmenting shrub canopies, altering soil characteristics, decreasing plant diversity, and increasing the abundance of invasive cheatgrass (Factor A). Native ungulates (mule deer (Odocoileus hemionus) and pronghorn antelope (Antilocapra americana)) co-exist with sage-grouse in the Bi-State area, but we are not aware of significant impacts from these species on sagegrouse populations or sage-grouse habitat. However, the impacts from different ungulate taxa may have an additive negative influence on sagegrouse habitats (Beever and Aldridge 2011, p. 286). Cattle, horses, mule deer, and pronghorn antelope each use the sagebrush ecosystem somewhat differently, and the combination of multiple ungulate species may produce a different result than a single species. (USFWS, 2013) Overall, impacts from past grazing and rangeland management occur within localized areas throughout the Bi-State DPS's range (i.e., all PMUs, although it is more pronounced in some PMUs than others). These impacts have resulted in ongoing habitat degradation that significantly affect sage-grouse habitat indirectly and cumulatively in the Bi-State area, resulting in an overall reduction in aspects of habitat quality (e.g., fragmentation, lack of understory plants, increased presence of nonnative plant species), especially in the Pine Nut

and Mount Grant PMUs. (USFWS, 2013)

Stressor: Small Population Size and Population Structure (USFWS, 2013)
Exposure:
Response:
Consequence:
Narrative: Sage-grouse have low reproductive rates and high annual survival (Schroeder et al. 1999, pp. 11, 14; Connelly et al. 2000a, pp. 969–970), resulting in a long recovery period due to slower potential or intrinsic population growth rates than is typical of other game birds. Also, as a consequence of their site fidelity to seasonal habitats (Lyon and Anderson 2003, p. 489), measurable population effects may lag behind negative habitat impacts (Wiens and Rotenberry 1985, p. 666). Sage-grouse populations have been described as exhibiting multi-annual fluctuations, meaning that some mechanism or combination of mechanisms is causing populations to fluctuate through time. (USFWS, 2013)

Stressor: Urbanization and Habitat Conversion (USFWS, 2013)
Exposure: Agriculture, urban housing, associated infrastructure (USFWS, 2013)
Response: Loss of habitat, alterred distribution and reduced population size (USFWS, 2013)
Consequence:
Narrative: Sage-grouse display strong site fidelity to traditional seasonal habitats and loss of specific sites (such as mesic meadow or spring habitats that typically occur on potentially developable private lands in the Bi-State area) can have pronounced population impacts (Connelly et al. 2000a, p. 970; Atamian et al. 2010, p. 1533). The influence of land development and habitat conversion on the population dynamics of sage-grouse is greater than a simple measure of spatial extent because of the indirect effects from the associated increases in human activity, as well as the disproportionate importance of some seasonal habitat areas, such as mesic areas for brood-rearing. (USFWS, 2013)

Stressor: Mining (USFWS, 2013)
Exposure:
Response:
Consequence:
Narrative: Surface and subsurface mining for mineral resources (gold, silver, aggregate, and others) results in direct loss of habitat if occurring in sagebrush habitats (Factor A). The direct impact from surface mining is usually greater than it is from subsurface mining, and habitat loss from both types of mining can be exacerbated by the storage of overburden (soil removed to reach subsurface resource) in otherwise undisturbed habitat. Sage-grouse and nests with eggs could be directly affected by crushing or vehicle collision (Factor E). Sage-grouse also could be impacted indirectly from an increase in human presence, land use practices, ground shock, noise, dust, reduced air quality, degradation of water quality and quantity, and changes in vegetation and topography (Moore and Mills 1977, entire; Brown and Clayton 2004, p. 2) (Factor E). Mining operations are currently active in the Mount Grant, Bodie, South Mono, and Pine Nut PMUs, including some occupied habitat areas). (USFWS, 2013)

Stressor: Renewable Energy Development (USFWS, 2013)
Exposure: Geothermal facilities, wind power facilities, solar arrays, power lines, roads. (USFWS, 2013)
Response: Avoidance of potential habitat (USFWS, 2013)

Consequence: Reduced viability, fragmentation, isolation. (USFWS, 2013)
Narrative: Based on the 2013 Federal Register Notice, the Mount Grant PMU and to a lesser degree the Desert Creek-Fales PMU are most likely to be negatively affected by renewable energy development. (USFWS, 2013)

Stressor: Disease (USFWS, 2013)
Exposure:
Response:
Consequence:
Narrative: Sage-grouse are hosts for a variety of parasites and diseases (Factor C) including macroparasitic arthropods, helminths (worms), and microparasites (protozoa, bacteria, viruses, and fungi) (Thorne et al. 1982, p. 338; Connelly et al. 2004, pp. 10–4 to 10–7; Christiansen and Tate 2011, p. 114). Viruses (such as coronavirus and WNv) are serious diseases that are known to cause death in grouse species, potentially influencing population dynamics (Petersen 2004, p. 46) (Factor C). Efficacy and transmission of WNv in sagebrush habitats is primarily regulated by environmental factors including temperature, precipitation, and anthropogenic water sources, such as stock ponds and coal-bed methane ponds that support mosquito vectors (Reisen et al. 2006, p. 309; Walker and Naugle 2011, pp. 131–132). (USFWS, 2013)

Stressor: Predation (USFWS, 2013)
Exposure:
Response:
Consequence:
Narrative: Predation of sage-grouse as a food item is the most commonly identified cause of direct mortality during all life stages (Schroeder et al. 1999, p. 9; Connelly et al. 2000b, p. 228; Casazza et al. 2009, p. 45; Connelly et al. 2011, p. 65) (Factor C). However, sage-grouse have co-evolved with a variety of predators, and their cryptic plumage and behavioral adaptations have allowed them to persist (Schroeder et al. 1999, p. 10; Coates 2008, p. 69; Coates and Delehanty 2008, p. 635; Hagen 2011, p. 96). (USFWS, 2013)

Stressor: Climate (USFWS, 2013)
Exposure: Climate change (hotter and stable to declining levels of precipitation), increased size and severity of fires. (USFWS, 2013)
Response: Increased nest predation, early brood mortality, decreased nest cover, decreased food availability (USFWS, 2013)
Consequence: Reduced fecundity, mortality (USFWS, 2013)
Narrative:

Stressor: Recreation (USFWS, 2013)
Exposure: Fishing, hiking, horseback riding, camping, OHV use, mountain biking (USFWS, 2013)
Response: Reduced wildlife resources (water), increased refuse, disturbance and displacement of wildlife, increased mortality, decreased plant community diversity (USFWS, 2013)
Consequence: Reduced fecundity, mortality (USFWS, 2013)
Narrative:

Recovery

Recovery Actions:

- Limiting infrastructure development and human disturbance in sage-grouse habitat. (USFWS, 2013).
- Removing woodland plant species that encroach upon sagebrush habitats absent sufficient sisturbance to maintain the sagebrush habitat (USFWS, 2013).
- Managing wildfire and invasive species to limit the occurrence of large, high-intensity fire, and fire that facilitates the dominance of invasive species such as cheatgrass (USFWS, 2013).
- Protecting private lands as sagebrush habitat through purchase or conservation easement (USFWS, 2013)
- Managing feral horses in a manner that maintains natural ecosystem functions and avoids facilitating the dominance of cheatgrass (USFWS, 2013)
- Managing and restoring wet meadow and upland habitats to provide important functions for all life stages of sage-grouse (USFWS, 2013)
- Protecting against risks associated with small population size (USFWS, 2013)
- Monitoring and addressing disease and predation threats (USFWS, 2013)
- Conducting research and monitoring actions, and adapting management accordingly (USFWS, 2013).

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SPECIES ACCOUNT: *Charadrius melodus circumcinctus* (Piping Plover - Great Lakes)

Species Taxonomic and Listing Information

Listing Status: Endangered (wintering population: Threatened); 12/11/1985; Midwest Region (R3) (USFWS, 2017a).

Physical Description

Piping plover subspecies are phenotypically indistinguishable (USFWS, 2009). The Great Lakes piping plover, named for its melodic call, is a small North American shorebird, approximately 17 cm (6.7 in) in length (Palmer 1967) that weighs 40-65 g (1.4-2.3 oz) and has a wing span measuring about 38 cm (15 in) (Haig 1992). Light sand-colored upper plumage and white undersides blend in well with the piping plover's principal beach habitats. During the breeding season, the legs and bill are bright orange, and the bill has a black tip. Other distinctive markings include a single black band across the upper breast and a smaller black band across the forehead. In adult females, the breast band is often thin or incomplete, and plumage is frequently duller than in adult males (Wilcox 1959; Haig 1992). During winter, the legs pale, the bill turns black, and darker markings are lost. Chicks have speckled gray, buff, brown, and white down. The coloration of fledged young resembles that of adults in winter. Juveniles acquire adult plumage the spring after they fledge (Prater et al. 1977) (USFWS, 2017b).

Taxonomy

Miller et al. (2009) confirmed separate Atlantic and interior piping plover subspecies (C. m. melodus and C. m. circumcinctus, respectively). This study found that birds from the Great Lakes region were allied with the interior subspecies group and should be taxonomically referred to as C. m. circumcinctus. Very rare (perhaps completely absent) reproductive interchange between the Great Lakes and the Northern Great Plains populations constitutes a marked separation of breeding ranges, albeit insufficient or too recent to result in substantial genetic differences demonstrated by available studies (USFWS, 2009).

Historical Range

Piping plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada. Historically, as many as 492 to 682 breeding pairs may have nested in the Great Lakes region in the late 1800s (Russell 1983). Michigan may have had 215 pairs or more; Ontario and Illinois likely supported the next largest populations (152-162 and 125-130, respectively). Indiana, Ohio, and Wisconsin were estimated to have 100 or fewer breeding pairs each, and Minnesota, New York, and Pennsylvania fewer than 30 each. Piping plovers were extirpated from Great Lakes beaches in Illinois, Indiana, New York, Ohio, Pennsylvania, and Ontario by the late 1970s (Russell 1983). Few piping plovers nested in Wisconsin after the 1970s, and no nests were found in the state between 1983 and 1997 (S. Matteson, Wisconsin Department of Natural Resources, pers. comm. 1998). Similarly, the small number of pairs that nested in Duluth Harbor, Minnesota had abandoned the area by 1986 (B. Eliason, Minnesota Department of Natural Resources, pers. comm. 1999). In 1977, the Great Lakes population was estimated at 31 nesting pairs (Lambert and Ratcliff 1979) but declined to approximately 17 pairs by 1985 (USFWS 1985). When the piping plover was listed as endangered in 1986, the Great Lakes population nested exclusively at a few sites on the northeastern shore of Lake Michigan and southeastern shore of Lake Superior in Michigan, the state with the most remaining habitat (USFWS, 2017b).

Current Range

The wintering ranges of the three breeding populations of the piping plover overlap and extend from Virginia to Florida on the Atlantic Coast and from the Florida Gulf Coast west to Texas and into Mexico, the West Indies, and the Bahamas (Haig 1992). Great Lakes piping plovers winter primarily along the southeast Atlantic Coast and along the eastern Gulf Coast, although some individuals have been reported as far west as Texas and as far south as Mexico and the Bahamas. Along with the general range expansion since listing, breeding location distribution has recently shifted. Between 1986 and 2002, piping plovers routinely nested on several sites in Iosco and Alpena Counties. From 2003-2009, however, few, if any, of these beaches were used for nesting (Stucker et al. 2003; Stucker and Cuthbert 2004; Stucker and Cuthbert 2005; Westbrock et al. 2005; Cuthbert and Roche 2006, 2007b). In addition, traditional sites along the southern shore of Lake Superior such as Crisp Point, have gone unused in recent years. The reduced use of the shorelines of Lakes Huron and Superior, combined with the increasing use of the Lake Michigan shoreline, indicates a shift in distribution toward the Lake Michigan basin (USFWS 2009). In addition, the number of nest sites found in the Lower Peninsula of Michigan over the past few years has decreased, while at the same time increasing along the southern shoreline of the Upper Peninsula and at sites in Wisconsin and, more recently, Canada. There is also increased use of public land by nesting piping plovers. Since 2003, at least 70% of the nests have been located on publicly owned lands. In 2009 for example, nearly 35 % of all nests in the Great Lakes occurred in Michigan's Sleeping Bear Dunes National Lakeshore (Cuthbert and Roche 2009) (USFWS, 2017b). Seventy-five percent of Great Lakes breeders were found along the Atlantic Coast from North Carolina to the Florida Keys (also used by 77% of eastern Canada breeders) (USFWS, 2009).

Distinct Population Segments Defined

No; There are separate breeding populations in the Northern Great Plains and the Great Lakes areas (USFWS, 2009).

Critical Habitat Designated

Yes; 7/10/2001.

Legal Description

On May 19, 2009, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in 18 specific units in Texas under the Endangered Species Act of 1973, as amended (74 FR 23476 - 23600). In total, approximately 139,029 acres (56,263 hectares) fall within the boundaries of the revised critical habitat designation. Other previously designated critical habitat for the wintering piping plover in Texas or elsewhere in the United States remains unaffected.
On October 21, 2008, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in North Carolina under the Endangered Species Act of 1973, as amended (73 FR 62816 - 62841). In total, approximately 2,043 acres (ac) (827 hectares (ha)), in Dare and Hyde Counties, North Carolina, fall within the boundaries of the revised critical habitat designation.
On July 10, 2001, the Fish and Wildlife Service (Service), designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as

critical habitat for the wintering population of the piping plover (Charadrius melodus) (66 FR 36038 - 36143). This includes approximately 2,891.7 kilometers (km) (1,798.3 miles (mi)) of mapped shoreline and approximately 66,881 hectares (ha) (165,211 acres (ac)) of mapped area along the Gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons.
On September 11, 2002, the U.S. Fish and Wildlife Service (Service), designated critical habitat for the northern Great Plains breeding population of the piping plover (Charadrius melodus), pursuant to the Endangered Species Act of 1973, as amended (67 FR 57638 - 57717). The designation includes 19 critical habitat units containing prairie alkali wetlands, inland and reservoir lakes, totaling approximately 183,422 acres (ac) (74,228.4 hectares (ha)) and portions of 4 rivers totaling approximately 1,207.5 river miles (rm) (1,943.3 kilometers (km)) in the States of Minnesota, Montana, Nebraska, North Dakota, and South Dakota.
Critical habitat includes prairie alkali wetlands and surrounding shoreline, including 200 feet (ft) (61 meters (m)) of uplands above the high water mark; river channels and associated sandbars, and islands; reservoirs and their sparsely vegetated shorelines, peninsulas, and islands; and inland lakes and their sparsely vegetated shorelines and peninsulas. Section 7 of the Endangered Species Act requires Federal agencies to ensure that actions they authorize, fund, or carry out are not likely to destroy or adversely modify critical habitat.

Critical Habitat Designation

18 units are designated as revised critical habitat in Texas for the wintering population of the piping plover. The units are divided into 24 areas: (1)Subunit TX–3A: South Padre Island – Gulf of Mexico Shoreline; (2)Subunit TX–3B: South Padre Island –Interior; (3)Subunit TX–3C: North Padre Island – Interior; (4)Subunit TX–3D: North Padre Island – Gulf of Mexico; (5)Subunit TX–3E: Mesquite Rincon; (6)Unit TX–4: Lower Laguna Madre Mainland; (7)Unit TX–7: Newport Pass/Corpus Christi Pass Beach; (8)Unit TX–8: Mustang Island Beach; (9)Unit TX–9: Fish Pass Lagoons; (10)Subunit TX–10A: Shamrock Island; (11)Subunit TX–10B: Mustang Island – Unnamed sand flat; (12)Subunit TX–10C: Mustang Island – Lagoon Complex; (13)Unit TX–14: East Flats; (14)Unit TX–15: North Pass; (15)Unit TX–16: San Jose Beach; (16)Unit TX–18: Cedar Bayou/Vinson Slough; (17)Unit TX–19: Matagorda Island Beach; (18)Unit TX–22: Decros Point; (19)Unit TX–23: West Matagorda Peninsula Beach; (20)Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West; (21)Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East; (22)Unit TX–31: San Bernard NWR Beach; (23)Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers; and (24)Unit TX–33: Bryan Beach and Adjacent Beach.

Unit TX–3: Padre Island Subunit. TX–3A: South Padre Island – Gulf of Mexico Shoreline. This subunit consists of 2,891 ac (1170 ha) in Cameron and Willacy Counties, Texas. It is a beach 30.0 mi (48.2 km) in length on the gulfside of South Padre Island, which is a barrier island. The subunit is located within an area bounded on the south by the southern boundary of Andy Bowie County Park, and on the north by the south jetty of Mansfield Channel, which divides North and South Padre Islands. The jetty itself is outside the boundary of the subunit. The eastern boundary is the estimated MLLW of the Gulf of Mexico, and the western boundary is the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. The vegetated dune and Park Road 100, which runs northsouth along the western side of the dune, separates Subunits TX–3A and 3B. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately one quarter of the subunit is in Federal ownership and managed by the Service’s Laguna Atascosa National Wildlife Refuge (NWR), and approximately 64 percent is in private ownership. The Service does not own the subsurface mineral rights. Ten percent is State land managed by the GLO, and a small portion at the southern end is County park land managed by Andy Bowie County Park. Subunit TX–3A is the southernmost unit of the revised critical habitat for the wintering population of the piping plover. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1), surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greatest magnitude at the southern end of the subunit where housing developments are to the west of the subunit. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3B: South Padre Island –Laguna Madre side. This bayside subunit consists of 44,137 ac (17,862 ha) in Cameron and Willacy Counties, Texas. Its southern boundary extends along the north side of an existing earthen, manmade dike running from the edge of dense dune vegetation to the Laguna Madre along latitude 26° 09’ 19.00’’ N. The dike is not within the boundary of the subunit. The western boundary is the western edge of the intertidal mudflats bordering the eastern shore of the lower Laguna Madre, and the northern boundary is Mansfield Channel. The eastern boundary is dense vegetation of the dunes or, if there is no dense vegetation or dune, the western boundary of Park Road 100. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately 42 percent of the land is federally owned and managed by the Service’s Laguna Atascosa NWR, and approximately 38 percent is Stateowned and managed by the GLO. The remaining 20 percent is in private ownership along the western side of the subunit. The Service does not own the subsurface mineral rights beneath the refuge. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand and mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. These threats, particularly vehicle access, are of greatest magnitude at the southern portion of the subunit where roads are near or adjacent to PCE 1. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3C: North Padre Island – Laguna Madre side. This bayside unit consists of 50,897 ac (20,597 ha) in Kenedy and Kleberg Counties, Texas. It is along and within the Laguna Madre and extends from the western boundary of Padre Island National Seashore (PAIS) to the Gulf Intracoastal Waterway (GIWW). The northern boundary of the subunit is a line extending westward from the PAIS (at latitude 27° 4’ 29.9’’ N), and its southern boundary is a line extending westward from the southern boundary of PAIS along the northern edge of the Mansfield Channel. The eastern boundary of this subunit is the western boundary of PAIS when the PCEs extend as far as PAIS or the eastern edge of the sand flats where the PCEs end. The portion of the western boundary north of longitude/latitude coordinate 26°48’38.2’’N, 97°28’11.6’’W is the eastern edge of the GIWW, and the portion of the western boundary south of the coordinate is the western edge of the intertidal mudflats bordering the eastern shore of the Laguna Madre. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is State-owned and managed by the GLO. A small portion is in private ownership. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time the Service is not aware of any management plans that address this species in this area. Subunit TX–3D: North Padre Island – Gulf of Mexico. This gulfside subunit consists of 270 ac (109 ha) of beach in Kleberg County, Texas. It extends along the gulf shore of North Padre Island from the northern boundary of PAIS northward 6.2 mi (10 km) to the Nueces County line. The southern boundary is the north boundary of the northeast section of the PAIS. The subunit extends eastward to the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Most of the land is owned by the State and managed by the GLO. Approximately one-fifth is in private ownership. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surfcast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greater magnitude at the north end of the subunit, where more roads provide easy access to the PCEs and the subunit is in close proximity to houses. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–3E: North Padre Island – Mesquite Rincon. This triangular bayside subunit of 9,6238 acres (3,894 hectares) lies on the western shore of the lower Laguna Madre in Kenedy County, Texas. The subunit is generally bounded by Rincon de la Soledad on the southwestern side, Mesquite Rincon on the north, and the GIWW and Rincon de San Jose on the east. The southwestern boundary is an irregular line along the PCEs between the latitude/longitude coordinate points: 26° 44′ 10.5′′ N, 97° 28′ 04.5′′ W at the southeastern point of Rincon de San Jose and 26° 50′ 58.1′′ N, 97° 34′ 19.5′′ W. The northern boundary is the line described between the latitude/longitude coordinate points: 26° 51′ 24.2′′ N, 97° 33′ 25.8′′ W and 26° 51′ 24.2′′ N, 97° 27′ 52.7′′ W. The northern portion of the eastern boundary is the western edge of the GIWW south to latitude/longitude coordinate point 26° 48′ 52.7′′ N, 97° 28′ 12.9′′ W. There the subunit curves westward and skirts a small horseshoeshaped inlet in the Laguna Madre to the northeastern point of Rincon de San Jose at latitude/longitude coordinate point 26° 48′ 43.9′′ N, 97° 29′ 4.7′′ W. There it continues south in an irregular line along the edge of the PCEs to the southeastern point of Rincon San Jose. Within that boundary (especially the southeastern portion of the subunit and northwestern-running edge), the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is in private ownership with a small portion that is State-owned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–4: Lower Laguna Madre Mainland. This bayside unit consists of 17,223 ac (6,970 ha) in Cameron and Willacy Counties, Texas, and lies along the western shoreline of the Lower Laguna Madre. The southern boundary is an east-west line at the northern tip of Barclay Island, approximately following latitude 26° 14' 42.2'' N. The northern boundary is an east-west line located near the northern tip of El Sauz Island, approximately 1.2 mi (1.9 km) south of the center of the city of Port Mansfield, Willacy County, Texas, and approximately following latitude 26° 32' 7.8'' N. The eastern boundary of the unit is the eastern edge of the line of dredge spoils that parallel the western side of the GIWW. The western boundary runs from southeast to northwest and is the western edge of sandy beach and mudflat habitat, approximately following the latitude/longitude coordinate points: latitude/longitude coordinate points: 26° 14' 42.45'' N, 97° 19' 32.75'' W; 26° 17' 15.54'' N, 97° 20' 47.31'' W; 26° 20' 10.17'' N, 97° 21' 10.94'' W; 26° 21' 31.54'' N, 97° 22' 48.10'' W; 26° 24' 26.64'' N, 97° 23' 53.27'' W; 26° 26' 8.55'' N, 97° 25' 13.33'' W; and 26° 32' 5.44'' N, 97° 27' 6.91'' W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service has used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately one-third of this unit is within the Service's Laguna Atascosa NWR. Approximately half is Stateowned and managed by the GLO. The remainder is in private ownership. The Service does not own the subsurface mineral rights beneath the surface of the refuge. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand or mud flats above high tide for roosting (PCE 2). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This unit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–7: Newport Pass/Corpus Christi Pass Beach. This unit consists of 294 ac (119 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 5.1-mi (8.2- km) long. The southern boundary is the gulfward extension of Saint Bartholomew Avenue, adjacent to the north end of the seawall. The northern boundary is the edge of the south jetty of the Fish Pass Structure at Mustang Island State Park. The eastern boundary is MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dune. Packery Channel cuts the beach approximately 0.3 mi (0.5 km) north of the south boundary. The seawall, jetty, bollards, and open water of Packery Channel are not within the boundaries of the unit. This unit is in State and private ownership; the State portion is managed by the Mustang Island State Park. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains PCEs in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–8: Mustang Island Beach. This unit consists of 623 ac (252 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 12.5 mi (20.1 km) long. The southern boundary is the edge of the north jetty of the Fish Pass Structure at Mustang Island State Park. The northern boundary is the south side of the Horace Calder Pier in Port Aransas, Texas. The unit is bounded on the east by the MLLW of the Gulf of Mexico, and on the west by the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated. The jetty and pier are not within the boundary of the unit. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is in State and private ownership, with a small municipal park owned and managed by the City of Port Aransas. The State land is managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–9: Fish Pass Lagoons. This bayside unit consists of 168 ac (68 ha) in Nueces County, Texas. This unit encompasses flats facing Corpus Christi Bay that extend 1.0 km (0.6 mi) on either side of Fish Pass. The inland boundary is a line of dense vegetation, and the bayside boundary is the northeast edge of the tidal sand flats that are a PCE. This unit includes all areas of habitat that contain PCEs 1, 2, 5, and 6 within the area described by a polygon with the following latitude/longitude coordinate points: 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W; 27° 41′ 56.97′′ N, 97° 10′ 8.13′′ W; 27° 41′ 24.35′′ N, 97° 10′ 36.89′′ W; 27° 41′ 18.98′′ N, 97° 11′ 16.79′′ W; 27° 41′ 23.51′′ N, 97° 11′ 31.32′′ W and 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W. Within that polygon, six moderate to large polygons from 5 to 64 ac (2 to 25 ha) each and two small polygons less than 1 ac (0.4 ha) each are PCEs and comprise the unit. Most of the unit is owned by the State and managed by the GLO. A few acres are in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and/or mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–10: Shamrock Island and Adjacent Mustang Island Flats. Subunit TX–10A: Shamrock Island. This 12-ac (5-ha) island in Nueces County, Texas, was a peninsula extending off of Mustang Island in Corpus Christi Bay until erosion separated the island from the mainland. Five small polygons of sand flats from 1.1 to 6.8 ac (0.4 to 2.7 ha) comprise the subunit. Most of the land is State-owned and managed by the GLO; the remainder is privately owned. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10B: Mustang Island: Unnamed sand flat. This 2-ac (1-ha) subunit in Nueces County, Texas, is a small, unnamed sand flat near the north edge of the mouth of Wilson’s Cut in Corpus Christi Bay. The subunit is the western half of the island that is sand flats landward (easterly) to the western edge of tidal marsh. It is entirely Stateowned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. The location of the subunit, and the configuration of the polygons of PCEs that comprise this subunit, limit recreational access by vehicles to PCEs 1 and 2. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10C: Mustang Island: Lagoon Complex. This 331-ac (134-ha) subunit in Nueces County, Texas, is an extensive lagoon complex that consists of 11 polygons within a larger polygon that extends 2.2 mi (3.5 km) south of Wilson’s Cut in Corpus Christi Bay. The southern boundary of the larger polygon begins at the western end at latitude/ longitude coordinate point 27° 43’ 2,4’’ N, 97° 10’ 19.4’’ W at the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. It follows the dune line southeast approximately 830 ft (253 m) to a road, then follows the road approximately 945 ft (288 m) to the edge of the tidal sand flat PCE. It follows the southeastern edge of the sand flat northeast to the western edge of a northsouth road, where it follows the edge of the sand flat northward to the south edge of a road that runs east-west parallel to the southwestern edge of Wilson’s Cut. The northern edge of the boundary is the south edge of the road or the northern extent of the sand flat when it does not reach the road. The western boundary follows the PCEs along their eastern edge at Corpus Christi Bay beginning 409 ft (125 m) southwest of the southwestern edge of Wilson’s Cut to the coordinate point at the western edge of the southern boundary. A road transects the larger polygon described above, forming two polygons that exclude the road. The PCEs within the 11 polygons comprise the subunit. Within that boundaries of the 11 polygons, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the polygons that comprise the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundaries can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. The subunit consists of private and Stateowned lands. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to uncontrolled recreational access and beach cleaning and stabilization efforts. Road access to the PCEs is extensive. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–14: East Flats. This bayside unit consists of 591 ac (239 ha) in Nueces County, Texas. It is an irregularly shaped intertidal sand flat south of the Corpus Christi Ship Channel. The north boundary is the northern edge of the sand flat near or adjacent to dredge spoil areas bordering the south side of the Corpus Christi Ship Channel. The northwestern latitude/longitude coordinate is 27° 49′ 54.49′′ N, 97° 6′ 14.28′′ W, and the northeastern latitude/longitude coordinate is 27° 49′ 55.29′′ N, 97° 5′ 12.86′′ W. From there, the sand flat curves southward, and the southeastern edge of it forms a highly irregular line that ends in the southwest portion of the polygon at the eastern edge of a navigation channel from the Corpus Christi Ship Channel to Corpus Christi Bay at latitude/longitude coordinate 51.93′′ N, 97° 5′ 52.58′′ W. The sand flat continues on the western edge of the navigation channel in a northwesterly direction to latitude/longitude coordinate 27° 49′ 22.08′′ N, 97° 6′ 37.04′′ W. It then curves northeasterly and across the cut to the northern edge at the northwest coordinate. On the east, it abuts the City of Port Aransas. There is a small marshland within the sand flat that bisects the sand flat that is not a PCE and is not included in the unit. The unit is mostly in private ownership, with a small portion of State land managed by the GLO. This unit was occupied at the time of listing and is currently occupied. Current ocupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–15: North Pass. This bayside unit consists of 805 ac (326 ha) in Aransas County, Texas. The unit is bounded on the northeast by a line between latitude/longitude coordinates 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W and 27° 54′ 54.53′′ N, 97° 1′ 18.17′′ W, on the northwest and west by the edge of tidal sand flats in Aransas Bay, on the south by a line running east from coordinate 27° 53′ 16.96′′ N, 97° 2′ 22.44′′ W to unit TX–16, and on the southeast by the landward boundary of unit 16. The unit is all areas that contain the PCEs for the species within a larger area described by a polygon with the following sets of latitude/longitude coordinate points: 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W; 27° 53′ 10.68′′ N, 97° 1′ 21.36′′ W; 27° 53′ 16.96′′ N, 97° 2′ 22.44′′ W; 27° 53′ 33.08′′ N, 97° 2′ 33.05′′ W; 27° 54′ 42.68′′ N, 97° 2′ 4.83′′ W; 27° 54′ 47.59′′ N, 97° 1′ 51.73′′ W; 27° 54′ 54.53′′ N, 97° 1′ 18.17′′ W and 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale, so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit is a remnant of a hurricane washover on San Jose Island. Approximately 18 percent is Stateowned and managed by the GLO; the remainder is in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–16: San Jose Beach. This unit consists of 1,378 ac (558 ha) in Aransas County, Texas. It is a gulfside beach unit approximately 19.8 mi (31.9 km) long. The southern boundary is the edge of the north jetty of Aransas Pass. The jetty is not within the boundary of the unit. The south edge of Cedar Bayou Pass is the northern boundary. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. A small section is in Federal ownership and managed by the Service's Matagorda Island NWR. The Service does not own the subsurface mineral rights. Approximately half of the unit is State-owned and managed by the GLO, and nearly as much is in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–18: Cedar Bayou/Vinson Slough. This bayside unit consists of 2,465 ac (998 ha) in Aransas County, Texas. It is a remnant of a hurricane washover area and includes the highly dynamic area of Cedar Bayou, the pass that separates San Jose Island and Matagorda Island. Beginning at the confluence of Vinson Slough and Cedar Bayou, the boundary follows the shore of Spalding Cove to Long Reef, then continues along a line extending 2.5 miles southwest of Long Reef to the shore of San Jose Island, then along the shore of the island to the landward boundary of Unit TX–16. Within that area, the unit consists of numerous polygons of PCEs; areas that are not PCEs within the described area are not within the boundaries of the unit. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. The southern and southeastern boundary of the unit is described by a line with the following sets of latitude/longitude coordinate points: 28° 1′ 21.76′′ N, 96° 57′ 51.24′′ W; 28° 1′ 12.77′′ N, 96° 57′ 31.18′′ W; 28° 2′ 3.07′′ N, 96° 56′ 45.84′′ W; 28° 2′ 15.92′′ N, 96° 56′ 25.10′′ W; 28° 2′ 30.32′′ N, 96° 56′ 11.97′′ W; 28° 3′ 15.62′′ N, 96° 54′ 20.01′′ W; 28° 3′ 58.58′′ N, 96° 53′ 24.65′′ W; 28° 4′ 1.15′′ N, 96° 52′ 14.65′′ W; 28° 3′ 31.74′′ N, 96° 51′ 38.29′′ W and 28° 3’ 17.69’’ N, 96° 51’ 38.47’’ W. The specific northern boundary is described by a line with the following sets of latitude/longitude coordinate points: 28° 5’ 44.24’’ N, 96° 54’ 8.16’’ W; 28° 5’ 13.23’’ N, 96° 52’ 44.85’’ W; 28° 4’ 33.99’’ N, 96° 50’ 46.55’’ W; 28° 4’ 38.92’’ N, 96° 50’ 40.79’’ W and 28° 4’ 22.98’’ N, 96° 50’ 22.94’’ W. The eastern boundary at the northeastern end of the unit is units TX–16 and TX–19 on the gulfside. The western boundary is the western edge of tidal sand flats in Aransas Bay. This area includes a small section of federally owned land managed by the Service’s Matagorda Island NWR and a small section of State-owned land. The remaining area is privately owned. The Service does not own the subsurface mineral rights beneath the NWR. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use. Vehicle use of the unit may be limited somewhat by accessibility. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–19: Matagorda Island Beach. This unit consists of 2,413 ac (976 ha) in Calhoun County, Texas. It is a gulfside beach unit approximately 37.1 mi (59.7 km) long. The southern boundary is the northern edge of Cedar Bayou Pass, and the northern boundary is the southern edge of Pass Cavallo. At Pass Cavallo, the unit curves from the eastern gulfside passing between the south edge of the pass and the north edge of the dunes to a small area on the bayside. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The federally owned land in this unit is managed by the Service’s Matagorda Island NWR, which does not own the subsurface mineral rights. This unit also includes a small section of land in State ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and access by refuge staff and others for sea turtle monitoring efforts. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–22: Decros Point. This unit consists of 544 ac (220 ha) at the Matagorda/Calhoun County line, in Texas. It is a gulfside beach unit approximately 4.8 mi (7.7 km) long that wraps around to the bayside. This unit was originally the southern tip of the Matagorda Peninsula. It was made into an island by the dredging of the Matagorda Ship Channel, the edge of which is the northern boundary of the unit. The unit is horseshoe in shape with the east side along the Gulf of Mexico and the west side along Matagorda Bay; the two are connected at their southern boundary by habitat from the north edge of Pass Cavallo northward to the dune line. Densely vegetated sand dunes run north to south in the center of the horseshoe and are not within the boundary of the critical habitat because they are not a PCE. The eastern boundary is the MLLW of the Gulf of Mexico (see the Methods section for our derivation of MLLW), and the western boundary is the western edge of tidal sand flats on the east side of Matagorda Bay. Within the bayside of the boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 60 percent of the unit is in State ownership managed by the GLO. The remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach (PCE 4) for roosting and sheltering. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Due to a lack of road access, this unit does not receive much recreational vehicle use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–23: West Matagorda Peninsula Beach. This unit consists of 1,808 ac (732 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 23.9 mi (38.5 km) long. The southern boundary is the northern jetty of the Matagorda Ship Channel. The northern boundary is the Old Colorado River channel. The MLLW of the Gulf of Mexico is the eastern boundary, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just under half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West. This unit consists of 905 ac (366 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 14.1 mi (22.8 km) long. The southwestern boundary is the northeastern edge of the Old Colorado River channel. The unit runs along the beach 14 mi (23 km) to the northeastern boundary opposite Eidelbach Flats described by a line between the latitude/longitude coordinate points: 28° 41′ 2.26′′ N, 95° 46′ 29.04′′W and 28° 41′ 6.74′′ N, 95° 46′ 32.46′′ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just over half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East. This gulfside unit consists of 481 ac (194 ha) in Matagorda County, Texas. It extends along the Gulf beach southwest and northeast of Brown Cedar Cut. The cut is not within the boundary of the unit. This unit abuts portions of the southeastern edges of units TX–29 and TX–30, which are on the East Matagorda Bay side. The southwestern boundary is approximately 4 mi (6.5 km) southwest of Brown Cedar Cut at a line described by the following sets of latitude/ longitude coordinate points: 28° 43′ 11.91′′N, 95° 42′ 25.47′′W and 28° 43′ 17.09′′N, 95° 42′ 28.56′′W. The northeastern boundary is approximately 2.8 mi (4.5 km) northeast of Brown Cedar Cut to the point where Texas Farm to Market Road 457 intersects the beach. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat boundaries, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately onethird is in State ownership and managed by the GLO; the remaining two-thirds is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied.

Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–31: San Bernard NWR Beach. This gulfside unit consists of 401 ac (162 ha) in Matagorda and Brazoria Counties, Texas. It is a 6.2-mi (10-km) segment of beach on the Gulf of Mexico near the mouth of the San Bernard River. The northeastern boundary is at the southwestern edge of the mouth of the San Bernard River. The southwestern boundary follows a line described by the following sets of latitude/longitude coordinate points: 28° 47’ 54.39’’ N, 95° 33’ 26.21’’ W, and 28° 47’ 57.69’’ N, 95° 33’ 27.75’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. There is a cut through the beach from the Gulf of Mexico to a lake 3.5 mi (5.6 km) southwest of the San Bernard River, which is not within the unit. Bollards also are not within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 30 percent of this unit is in Federal ownership and managed by the Service’s San Bernard NWR, which does not own the subsurface mineral rights. Approximately 48 percent is Stateowned and managed by the GLO with the remaining area in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The federally owned portion has pedestrian recreational access, but no vehicle access. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers. This gulfside unit consists of 556 ac (225 ha) of shoreline in Brazoria County, Texas. This unit is a 6.1-mi (9.8-km) segment of beach on the Gulf of Mexico between the mouths of the San Bernard and Brazos Rivers. The southwestern boundary is the northeastern edge of the mouth of the San Bernard River. The northeastern boundary is the western edge of the mouth of the Brazos River. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. It is entirely in State ownership and managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–33: Bryan Beach and Adjacent Beach. This unit consists of 211 ac (85 ha) in Brazoria County, Texas. It is gulfside beach approximately 3.5 mi (5.7 km) in length on the Gulf of Mexico near the mouth of the Brazos River. The southwestern boundary is the northeastern edge of the Brazos River. The northeastern boundary is Farm-toMarket Road 1495 (Bryan Beach Rd). The southeastern boundary is the MLLW. The northwestern boundary follows along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is entirely in State ownership and managed by the Texas Department of Parks and Wildlife. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Four units are designated as critical habitat for the wintering population of the piping plover in North Carolina. The four areas designated as critical habitat are: (1) Unit NC–1, Oregon Inlet; (2) Unit NC–2, Cape Hatteras Point; (3) Unit NC–4, Hatteras Inlet; and (4) Unit NC–5, Ocracoke Island.

Unit NC–1: Oregon Inlet. Unit NC–1 is approximately 8.0 km (5.0 mi) long, and consists of about 196 ha (485 ac) of sandy beach and inlet spit habitat on Bodie Island and Pea Island in Dare County, North Carolina. This is the northernmost critical habitat unit within the wintering range of the piping plover. Oregon Inlet is the northernmost inlet in coastal North Carolina, approximately 19.0 km (12.0 mi) southeast of the Town of Manteo, the county seat of Dare County. The unit is bounded by the Atlantic Ocean on the east and Pamlico Sound on the west and includes lands from the mean lower low water (MLLW) on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where the PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit begins at Ramp 4 near the Oregon Inlet Fishing Center on Bodie Island and extends approximately 8.0 km (5.0 mi) south to the intersection of NC Highway 12 and Salt Flats Wildlife Trail (near Mile Marker 30, NC Highway 12), approximately 5.0 km (3.0 mi) from the groin, on Pea Island, and includes Green Island and any emergent sandbars south and west of Oregon Inlet, and the lands owned by the State of North Carolina, specifically islands DR–005–05 and DR–005–06. However, this unit does not include the Oregon Inlet Fishing Center, NC Highway 12, the Bonner Bridge and its associated structures, the terminal groin, the historic Pea Island Life-Saving Station, or any of their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Oregon Inlet has reported consistent use by wintering piping plovers dating from the mid-1960s. As many as 100 piping plovers have been reported from a single day survey during the fall migration (NCWRC unpublished data). Christmas bird counts regularly recorded 20 to 30 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall number of piping plovers reported using the area has declined since the species was listed in 1986 (NCWRC unpublished data), which corresponds to increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Oregon Inlet is one of the first beach access points for off-road vehicles within Cape Hatteras National Seashore when traveling from the developed coastal communities of Nags Head, Kill Devil Hills, Kitty Hawk, and Manteo. As such, the inlet spit is a popular area for off-road vehicle users to congregate. The majority of the Cape Hatteras National Seashore users in this area are off-road vehicle owners and recreational fishermen. In fact, a recent visitor use study of Cape Hatteras National Seashore reported that Oregon Inlet is the second most popular off-road vehicle use area in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby Oregon Inlet Fishing Center. Pea Island National Wildlife Refuge (PINWR) does not allow off-road vehicle use; however, Pea Island regularly receives dredged sediments from the maintenance dredging of Oregon Inlet by the Corps. The disposal of dredged sediments on PINWR has the potential to disturb foraging and roosting plovers and their habitats. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–2: Cape Hatteras Point. Unit NC–2 consists of 262 ha (646 ac) of sandy beach and sand and mud flat habitat in Dare County, North Carolina. Cape Hatteras Point (also known as Cape Point or Hatteras Cove) is located south of the Cape Hatteras Lighthouse. The unit extends south approximately 2.8 mi (4.5 km) from the ocean groin near the old location of the Cape Hatteras Lighthouse to the point of Cape Hatteras, and then extends west 4.7 mi (7.6 km) along Hatteras Cove shoreline (South Beach) to the edge of Ramp 49 near the Frisco Campground. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where PCEs do not occur). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. This unit does not include the ocean groin. Consistent use by wintering piping plover has been reported at Cape Hatteras Point since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Cape Hatteras Point independently from Hatteras Inlet. These single day surveys have recorded as many as 13 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Cape Hatteras Point is located near the Town of Buxton, the largest community on Hatteras Island. For that reason, Cape Hatteras Point is a popular area for ORV use and recreational fishing. A recent visitor use study of the park found that Cape Hatteras Point had the most ORV use within the park (Vogelsong 2003). As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–4: Hatteras Inlet. Unit NC–4 is approximately 8.0 km (5.0 mi) long, and consists of 166 ha (410 ac) of sandy beach and inlet spit habitat on the western end of Hatteras Island and the eastern end of Ocracoke Island in Dare and Hyde Counties, North Carolina. The unit begins at the first beach access point at Ramp 55 at the end of NC Highway 12 near the Graveyard of the Atlantic Museum on the western end of Hatteras Island and continues southwest to the beach access at the ocean-side parking lot near Ramp 59 on the northeastern end of Ocracoke Island. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which itself is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The Hatteras Inlet unit includes all emergent sandbars within Hatteras Inlet including lands owned by the State of North Carolina, specifically Island DR–009–03/04. The unit is adjacent to, but does not include, the Graveyard of the Atlantic Museum, the ferry terminal, the groin on Ocracoke Island, NC Highway 12, or their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Hatteras Inlet has reported consistent use by wintering piping plovers since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Hatteras Inlet independently from Cape Hatteras Point. These single-day surveys have recorded as many as 40 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall numbers of piping plovers reported using the area has declined in the last 10 years (NCWRC unpublished data), corresponding with increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Hatteras Inlet is located near the Village of Hatteras, Dare County, and is the southernmost point of Cape Hatteras National Seashore that can be reached without having to take a ferry. As such, the inlet is a popular off-road vehicle and recreational fishing area. In fact, a recent visitor use study of the park found Hatteras Inlet the fourth most used area by off-road vehicles in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby marinas of Hatteras Village. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–5: Ocracoke Island. This unit consists of 203 ha (502 ac) of sandy beach and mud and sand flat habitat in Hyde County, North Carolina. The unit includes the western portion of Ocracoke Island beginning at the beach access point at the edge of Ramp 72 (South Point Road), extending west approximately 2.1 mi (3.4 km) to Ocracoke Inlet, and then back east on the Pamlico Sound side to a point where stable, densely vegetated dune habitat meets the water. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit includes all emergent sandbars within Ocracoke Inlet. This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. The unit is adjacent to but does not include NC Highway 12, any portion of the maintained South Point Road at Ramp 72, or any of their ancillary facilities. Ocracoke Island had inconsistent recorded use by wintering piping plovers in the early 1980s, and Christmas bird counts recorded only 1 to 6 plovers using the area throughout the early 1990s. However, since the late 1990s when regular and consistent surveys of the area were conducted, as many as 72 piping plovers have been recorded during migration, and 4 to 18 plovers have been regularly recorded during the overwinter period (NCWRC unpublished data). Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). Ocracoke Inlet is located near the Village of Ocracoke, and is the southernmost point of the Cape Hatteras National Seashore. Ocracoke Island is only accessible by ferry. As such, the island is a popular destination for vacationers and locals interested in seclusion. The inlet is also a popular recreational fishing and ORV area. A recent visitor use study of the park reported Ocracoke Inlet was the third most popular ORV use area in the park (Vogelsong 2003). As a result, the primary threat to the wintering piping plover and its habitat within this unit is disturbance to and degradation of foraging and roosting areas by ORVs and by people and their pets. Therefore, sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

The lands designated as critical habitat were divided into 142 critical habitat conservation units that contain areas with the primary constituent elements for the piping plover in the wintering range of the species. These units are found in all eight States where piping plovers winter. See above for revised critical habitat in NC and TX (Units TX– 3, TX–4, TX–7, TX–8, TX–9, TX–10, TX–14, TX–15, TX–16, TX–18, TX–19, TX–22, TX–23, TX–27, TX–28, TX–31, TX–32, and TX–33).

Unit SC–1: Waites Island-North. 75 ha (186 ac) in Horry County. This unit includes the northern tip of Waites Island from the MLLW at Little River Inlet and runs west along the Atlantic Ocean shoreline 2.0 km (1.25 mi) and includes land from the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The unit continues north and west of Little River Inlet stopping at Sheephead Creek, including land from MLLW to dense vegetation line. The majority of the unit is privately owned.

Unit SC–2: Waites Island-South. 58 ha (142 ac) in Horry County.This unit includes the southern tip of Waites Island from the MLLW at Hog Inlet and runs east along the Atlantic Ocean shoreline 0.80 km (0.50 mi) and includes MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It continues north and west of the Hog inlet, stopping at the first major tributary. Critical habitat includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Emerging sandbars within Hog Inlet and adjacent to the tip if eastern Cherry Grove Beach are also included from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur. The majority of this unit is privately owned.

Unit SC–3: Murrells Inlet/Huntington Beach. 135 ha (334 ac) in Georgetown County. The majority of the unit is within Huntington Beach State Park. This unit extends from the southern tip of Garden City Beach, just south of the groins (a rigid structure or structures built out from a shore to protect the shore from erosion or to trap sand) north of Murrells Inlet from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur stopping perpendicular with the southern end of Inlet Point Drive. It includes from MLLW south of Murrells Inlet to the northern edge of North Litchfield Beach approximately 4.5 km (3.0 mi). The unit includes the MLLW from the Atlantic Ocean up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The lagoon at the north end of Huntington Beach State Park is also included.

Unit SC–4: Litchfield. 11 ha (28 ac) in Georgetown County. This unit includes the southern tip of Litchfield Beach beginning 0.50 km (0.30 mi) north of Midway Inlet and stopping at the MLLW at Midway Inlet. It includes from the MLLW on the Atlantic Ocean shoreline across and including land to the MLLW on the back bayside. This unit is mostly privately owned.

Unit SC–5: North Inlet. 99 ha (245 ac) in Georgetown County. The majority of the unit is within Tom Yawley Wildlife Center Heritage Preserve. This unit extends from MLLW to 1.0 km (.62 mi) north of North Inlet on Debidue Beach. It includes shoreline on the Atlantic Ocean from MLLW to the MLLW on the western side of the peninsula. This unit also includes from the MLLW south of North Inlet 1.6 km (1.0 mi). It includes the shoreline on the Atlantic Ocean from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It includes shoreline running south and west of the inlet from the MLLW stopping at the MLLW at the first large tributary (no name).

Unit SC–6: North Santee Bay Inlet. 305 ha (753 ac) in Georgetown County. The majority of the unit is within the Tom Yawley Wildlife Center Heritage Preserve and the Santee-Delta Wildlife Management Area. This unit is at the North Santee Bay inlet and includes lands of South Island, Santee Point, Cedar Island, and all of North Santee Sandbar. This unit includes from MLLW at North Santee Bay Inlet running north along the Atlantic Ocean side of South Island 7.2 km (4.5 mi), stopping 0.60 km (0.4 mi) north of an unnamed inlet. It includes areas from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This unit includes the eastern side of Cedar Island adjacent to the

North Santee Bay Inlet from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of North Santee Sandbar to MLLW is included.

Unit SC–7: Cape Romain. 315 ha (777 ac) in Charleston County.The majority of the unit is within Cape Romain National Wildlife Refuge. This unit includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the southern and southeastern most 1.9 km (1.2 mi) portion of Cape Island, the southernmost portion of Lighthouse Island from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, all of Lighthouse Island South to MLLW, and the southern side of the far eastern tip of Raccoon Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–8: Bull Island. 134 ha (332 ac) in Charleston County. The majority of the unit is within Cape Romain National Wildlife Refuge and land owned by the South Carolina Department of Natural Resources. This unit includes from Schooner Creek on north and south of the river to north of Price’s Inlet on the southern portion of Bull Island along the Atlantic Ocean 1.6 km (1.0 mi) and south of Price’s Inlet on the northeast tip of Capers Island Heritage Preserve 1.4 km (.86 mi) along the Atlantic Ocean. All areas begin at MLLW and extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–9: Stono Inlet. 495 ha (1223 ac) in Charleston County.Most of this unit is privately owned. It includes the eastern end of Kiawah Island (approximately 4.0 km (2.5 mi)) from MLLW on Atlantic Ocean running north to MLLW on first large tributary connecting east of Bass Creek running northeast into Stono River. It includes MLLW up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur along Stono Inlet and River. All of Bird Key-Stono Heritage Preserve and all of Skimmer Flats to MLLW are included. The Golf course and densely vegetated areas are not included.

Unit SC–10: Seabrook Island. 117 ha (290 ac) in Charleston County.This unit runs from just 0.16 km (0.10 mi) north of Captain Sams Inlet to the southwest approximately 3.4 km (2.1 mi) along the Atlantic Ocean shoreline. It includes land areas from the MLLW on the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Most of this unit is privately owned.

Unit SC–11: Deveaux Bank. 130 ha (322 ac) in Charleston County. The entire unit is within Deveaux Bank Heritage Preserve. This unit includes all of Deveaux Island to the MLLW and is State-owned.

Unit SC–12: Otter Island. 68 ha (169 ac) in Colleton County.The majority of the unit is within St. Helena Sound Heritage Preserve. This unit includes the southern portion of Otter Island to the eastern mouth of Otter Creek. It includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The entire unit is State-owned.

Unit SC–13: Harbor Island. 50 ha (122 ac) in Beaufort County. The majority of the unit is State-owned. This unit extends from the northeastern tip of Harbor Island and includes all of Harbor Spit. It begins at the shoreline east of Cedar Reef Drive running south, stopping at the mouth of Johnson Creek. It includes the MLLW on the Atlantic Ocean and St. Helena Sound to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Harber Spit to MLLW is included.

Unit SC–14: Caper's Island. 238 ha (589 ac) in Beaufort County. Most of this unit is privately owned. This unit includes the southern-most 4.5 km (2.8 mi) along the Atlantic Coast shoreline of Little Caper's Island beginning at MLLW on south side of the inlet (un-named). It includes the MLLW on the Atlantic Ocean shoreline to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–15: Hilton Head. 43 ha (106 ac) in Beaufort County. The majority of this unit is State-owned. This unit includes the northeastern tip (Atlantic Ocean side) of Hilton Head Island and all of Joiner Bank. It begins at the shoreline east of northern Planters Row and ends at the shoreline east of Donax Road. It includes the MLLW of Port Royal Sound and the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Joiner Bank to MLLW is included.

Unit GA–1: Tybee Island. 37 ha (91 ac) in Chatham County. The majority of the unit is privately owned. This unit extends along the northern tip of Tybee Island starting from 0.8 km (0.5 mi) northeast from the intersection of Crab Creek and Highway 80 to 0.7 km (0.41 mi) northeast from the intersection of Highway 80 and Horse Pen Creek. The unit includes MLLW on Savannah River and Atlantic Ocean to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit GA–2: Little Tybee Island. 719 ha (1776 ac) in Chatham County. The majority of the unit is within Little Tybee Island State Heritage Preserve. This unit extends just south of the first inlet to Wassaw Sound along the Atlantic Ocean coastline, extending north along the sound 1.7 km (1.1 mi). It includes habitat from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–3: North Wassaw Island. 108 ha (267 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit includes the north-east tip of Wassaw Sound, 1.6 km (1.0 mi) along the inlet side and extending south along the Atlantic Ocean shoreline for 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–4: South Wassaw Island. 61 ha (151 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit extends from the last southern 1.6 km (1.0 mi.) on Atlantic Ocean side, around the southern tip of Wassaw Island, up to mouth of Odingsell River. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–5: Ossabaw Island. 434 ha (1072 ac) in Chatham County. entire unit is within Ossabaw Island State Heritage Preserve. This unit includes the northeastern tip from the mouth of the Bradley River east and 12 km (7.5 mi) south along the Atlantic Ocean shoreline to a point 0.4 km

(0.25 mi) past the south-center inlet. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–6: St. Catherine’s Island Bar. 54 ha (135 ac) in Liberty County. The entire unit is State owned and located east-northeast of St. Catherine’s Island. This unit includes the entire St. Catherine’s Island Bar to MLLW.

Unit GA–7: McQueen’s Inlet. 215 ha (532 ac) in Liberty County. The majority of the unit is private land along the eastern-central coastline on St. Catherine’s Island. This unit extends from McQueen’s Inlet north approximately 3.5 km (2.2 mi) and south approximately 1.8 km (1.1 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–8: St. Catherine’s Island. 60 ha (147 ac) in Liberty County. The majority of the unit is private land on the southern tip of St. Catherine’s Island. This unit starts 1.2 km (0.75 mi) north of Sapelo Sound (along Atlantic Ocean shoreline) and stops inland at Brunsen Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–9: Blackbeard Island. 129 ha (319 ac) in McIntosh County. The entire unit is within the Blackbeard Island National Wildlife Refuge. This unit includes the northeastern portion of the island beginning just east of the mouth of the confluence of McCloy Creek and Blackbeard Creek and continuing east and running south along the Atlantic Ocean shoreline for 1.4 km (.90 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–10: Sapelo Island. 85 ha (210 ac) in McIntosh County. The entire unit is State-owned and within Sapelo Island. The unit extends south of Cabretta Tip approximately 0.2 km (0.13 mi) and north of Cabretta Tip 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–11: Wolf Island. 238 ha (590 ac) in McIntosh County. The majority of the unit is within Wolf Island National Wildlife Refuge and private lands just north of the Refuge. This unit includes the southeastern tip of Queen’s island adjacent to the Doboy Sound and includes the eastern shoreline of Wolf Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–12: Egg Island Bar. 61 ha (151 ac) in McIntosh County. This unit is State owned and includes all of Egg Island Bar to the MLLW.

Unit GA–13: Little St. Simon’s Island. 609 ha (1505 ac) in Glynn County. The majority of the unit is private land on Little St. Simon’s Island. This unit includes the entire eastern coastline along Little St. Simon’s Island. It begins 1.1 km (.70 mi) west of the northeast tip of Little St. Simon’s Island and runs east and then south along the Atlantic Ocean shoreline stopping at the minor tributary (no name) on the southeast tip of Little St. Simon’s Island north of Hampton Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Pelican Spit to MLLW is included when this sand bar is emergent.

Unit GA–14: Sea/St. Simon's Island. 191 ha (471 ac) in Glynn County. The majority of the unit is private land on the south tip of Sea Island and on the east beach of St. Simons Island. This unit extends north of Gould's Inlet (Sea Island) 2.5 km (1.54 mi) starting just south of the groin and extends south of Gould's Inlet (St. Simons Island) 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–15: Jekyll Island. 49 ha (121 ac) in Glynn County. The majority of the unit is within State lands on Jekyll Island. This unit includes the southern region of Jekyll Island beginning at the mouth of Beach Creek, running towards the tip of Jekyll Island and includes the shoreline running north along the Atlantic Ocean shoreline 1.9 km (1.20 mi) from the southern tip of Jekyll Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–16: Cumberland Island. 1454 ha (3591 ac) in Camden County. The majority of the unit is along Cumberland Island Wilderness Area and Cumberland Island National Seashore. This unit includes the majority of the eastern Atlantic Ocean shoreline of Cumberland Island. It begins .50 km (.31 mi) north of the inlet at Long Point, continues south along the Atlantic Ocean shoreline stopping 1.8 km (1.1 mi) west of the southern tip of Cumberland Island National Seashore. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Escambia County. The majority of the unit is within Big Lagoon State Recreation Area. This unit includes the peninsula and emerging sand and mudflats between 0.33 km (0.21 mi) west of the lookout tower along the shoreline and 0.24 km (0.15 mi) east of the lookout tower along the shoreline. Land along the shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All emerging sandbars to MLLW are included.

Unit FL–2: Big Sabine. 182 ha (450 ac) in Escambia County. The majority of the unit is owned by the University of West Florida. This unit includes areas adjacent to Santa Rosa Sound of Big Sabine Point and adjacent embayment between 8.0 km (5.0 mi) and 11.6 (7.2 mi) east of the Bob Sike's Bridge. It begins 0.10 km (.06 mi) north of SR 399 to MLLW on the Santa Rosa Sound.

Unit FL–3: Navarre Beach. 48 ha (118 ac) in Escambia and Santa Rosa Counties. The majority of the unit is owned by Eglin Air Force Base and Santa Rosa Island Authority. This unit includes lands on Santa Rosa Island Sound side, between 0.09 and 0.76 mi east of the eastern end of SR 399 to MLLW on Santa Rosa Sound side.

Unit FL–5: Shell/Crooked Islands. 1789 ha (4419 ac) in Bay County.The majority of the unit is within Tyndall Air Force Base and St. Andrews State Recreation Area. This unit includes all of Shell Island, Crooked Island West, and Crooked Island East from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–6: Upper St. Joe Peninsula. 182 ha (449 ac) in Gulf County.The majority of the unit is within St. Joseph State Park. This unit includes the northern portion of the peninsula from the tip to 8.0 km (5.0 mi) south along the Gulf of Mexico from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–7: Cape San Blas. 158 ha (390 ac) in Gulf County.The entire unit is within Eglin Air Force Base. This unit includes the area known as the Cape between the eastern boundary of Eglin and mile marker 2.1, including the peninsula and all emerging sandbars. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–8: St. Vincent Island. 146 ha (361 ac) in Franklin County.The majority of the unit is within St. Vincent National Wildlife Refuge. This unit includes the western tip of St. Vincent Island that is adjacent to Indian Pass (0.80 km (0.50 mi) east of tip along Indian Pass, and 1.9 km (1.2 mi) from tip southeast along Gulf of Mexico). The unit also includes St. Vincent Point from the inlet at Sheepshead Bayou east 1.6 km (1.0 mi) to include emerging oysters shoals and sand bars and extends south 0.21 km (0.13 mi) of St. Vincent Point. The unit includes the southeastern tip of St. Vincent Island extending north 1.4 km (0.90 mi) and south and west 2.1 km (1.3 mi). The western tip of Little St. George Island 0.80 km (0.50 mi) from West Pass is included (state owned lands). All sections of this unit include land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–9: East St. George Island. 1433 ha (3540 ac) in Franklin County. The majority of the unit is within St. George State Park. This unit begins 5.3 km (3.3 mi) east of the bridge and extends to East Pass. Shell Point, Rattlesnake Cove, Goose Island, East Cove, Gap Point, and Marsh Island are included. This unit includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the Gulf of Mexico, East Pass and St. George Sound.

Unit FL–10: Yent Bayou. 153 ha (378 ac) in Franklin County. The majority of the unit is State owned. This unit is adjacent to the area known as Royal Bluff. It includes the St. George Sound shoreline between 5.9 km (3.7 mi) and 9.5 km (5.9mi) east of SR 65. It includes from MLLW to where densely vegetated habitat or developed structures such as SR 65, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–11: Carabelle Beach. 56 ha (139 ac) in Franklin County. The area within this unit is privately owned. This unit is the peninsula created by Boggy Jordan Bayou. It includes St. George Sound shoreline (south of US 98) 1.6 km (1.0 mi) southwest along US 98 from the Carrabelle River Bridge and extends 1.9 km (1.2 mi) east along the St. George Sound shoreline. It includes from MLLW to where densely vegetated habitat or developed structures such as US 98, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–12: Lanark Reef. 260 ha (643 ac) in Franklin County. The entire unit is State owned. This unit includes the entire island and emerging sandbars to MLLW.

Unit FL–13: Phipps Preserve. 42 ha (104 ac) in Franklin County. This unit includes all of Phipps Preserve (owned by The Nature Conservancy) and any emerging sandbars from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–14: Hagens Cove. 486 ha (1200 ac) in Taylor County. The majority of the unit is within Big Bend Wildlife Management Area. This unit includes all of Hagens Cove and extends from MLLW on north side of Sponge Point to MLLW on south side of Piney Point. The eastern boundary of this unit ends (0.20 mi) west of SR 361. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–15: Anclote Key and North Anclote Bar. 146 ha (360 ac) in Pasco and Pinellas Counties. The majority of the unit is within Anclote Key State Preserve. This unit includes all of North Anclote Bar to the MLLW and the north, south and western sides of Anclote Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–16: Three Rooker Bar Island. 76 ha (188 ac) in Pinellas County. The majority of the unit is within Pinellas County Aquatic Preserve. This unit includes all the islands and emerging sandbars of this complex to MLLW.

Unit FL–17: North Honeymoon Island. 45 ha (112 ac) in Pinellas County. The majority of the unit is within Honeymoon Island State Recreation Area. This unit includes from Pelican Cove north to the far northern tip of Honeymoon Island. It includes the western shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur or the MLLW on the eastern shoreline.

Unit FL–18: South Honeymoon Island. 28 ha (70 ac) in Pinellas County.The majority of the unit is private land. This unit includes the southern end (southern-most 0.32 km (0.20 mi) on western side) of Honeymoon Island and encompasses the far southeastern tip and includes any emerging islands or sandbars to Hurricane Pass. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–19: Caladesi Island. 120 ha (296 ac) in Pinellas County.The majority of the unit is within Caladesi Island State Park. This unit extends from Hurricane Pass to Dunedin Pass on the Gulf of Mexico side. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–20: Shell Key and Mullet Key. 190 ha (470 ac) in Pinellas County. The majority of the unit is within Fort Desoto Park. This unit includes the Shell Key island complex. It also includes the northwest portion of Mullet Key including the western shorelines from Bunces Pass extending south, stopping 1.4 km (.86 mi) north of Ft. Desoto County Park pier. It includes from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–21: Egmont Key. 153 ha (377 ac) Hillsborough County. The majority of the unit is within Egmont Key National Wildlife Refuge. This unit includes the entire island to MLLW.

Unit FL–22: Cayo Costa. 175 ha (432 ac) in Lee County. The majority of the unit, including its northern and southern boundaries, is within Cayo Costa State Park, and nearly all of the remaining area is in the Cayo Costa Florida Conservation and Recreation Lands (CARL) acquisition project. This unit begins at the northern limit of sandy beaches at the northern end of the island, extends through Murdock Point, which at present has a sandbar and lagoon system, and ends at the former entrance to Murdock Bayou. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–23: North Captiva Island. 36 ha (88 ac) in Lee County.The unit is within the Cayo Costa CARL land purchase project. This unit includes the western shoreline extending from 0.80 km (0.50 mi) south of Captiva Pass to approximately Foster Bay. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–25: Bunche Beach. 187 ha (461 ac) in Lee County. This unit is mostly within a CARL Estero Bay acquisition project. Bunche Beach (also spelled Bunch) lies along San Carlos Bay, on the mainland between Sanibel Island and Estero Island (Fort Myers Beach), extending east from the Sanibel Causeway past the end of John Morris Road to a canal serving a residential subdivision. The unit also includes the western tip of Estero Island (Bodwitch Point, also spelled Bowditch Point), including Bowditch Regional Park, operated by Lee County and, on the southwest side of the island facing the Gulf, the beach south nearly to the northwesterly intersection of Estero Boulevard and Carlos Circle. It includes land from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur or, along the developed portion of Estero Island.

Unit FL–26: Estero Island. 86 ha (211 ac) in Lee County. The majority of the unit is privately owned. The unit consists of approximately the southern third of the island’s Gulf-facing shoreline starting near Avenida Pescadora to near Redfish Road. The unit excludes south-facing shoreline at the south end of the island that faces Big Carlos Pass rather than the Gulf. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–27: Marco Island. 245 ha (606 ac) in Collier County. Most of the unit is at the Tigertail Beach County Park. The unit’s northern border is on the north side of Big Marco Pass, including Coconut Island and all emerging sand bars. On the south side of Big Marco Pass, the boundary starts at the north boundary of Tigertail Beach County Park and extends to just south of the fourth condominium tower south of the County Park. The placement of the southern boundary assures that the unit includes all of Sand Dollar Island, the changeable sandbar off Tigertail Beach. The western boundary includes all the sand bars in Big Marco Pass but excludes Hideaway Beach. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–28: Marquesas Keys. 2,937 ha (7,256 ac) in Monroe County. The unit comprises the roughly circular atoll that encloses Mooney Harbor, including Gull Keys and Mooney Harbor Key. The entire unit is within Key West National Wildlife Refuge. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–29: Boca Grande/Woman/ Ballast Keys. 56 ha (138 ac) in Monroe County. These Keys are east of the Marquesas Keys and west of Key West. Boca Grande and Woman Keys are within Key West National Wildlife Refuge. Ballast Key is privately owned. This unit consists only of sandy beaches and flats between the MLLW and to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–30: Bahia Honda/Ohio Keys. 372 ha (918 ac) in Monroe County. This unit comprises Bahia Honda Key (including a small island off its southwest shore), which is almost entirely owned by Bahia Honda State Park, plus Ohio Key, which is privately owned. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–31: Lower Matecumbe Key. 19 ha (48 ac) in Monroe County. Part of the unit is at Anne's Beach park, an Islamorada village park. The remaining parts are at Sunset Drive (Lower Matecumbe Beach) and at Costa Bravo Drive (Port Antiqua Homeowners Beach) on the Florida Bay side of the island. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–32: Sandy Key/Carl Ross Key. 67 ha (165 ac) in Monroe County. This unit consists of two adjoining islands in Florida Bay, roughly south of Flamingo in Everglades National Park. The entire area is owned and managed by the National Park Service. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–33: St. Lucie Inlet. 114 ha (282 ac) in Martin County. The unit includes a small area south of the jetty on the north shore of St. Lucie Inlet, from the jetty west 0.42 km (0.26 mi). While the two sides of the inlet are privately owned, the great majority of the unit is on public land in the Saint Lucie Inlet State Preserve, administered by Jonathan Dickinson State Park. It begins on the sandy shoreline south of Saint Lucie Inlet and extends along the Atlantic Ocean shoreline 2.6 km (1.6 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. The unit does not include sandbars within the inlet.

Unit FL–34: Ponce de Leon Inlet. 68 ha (168 ac) in Volusia County. The majority of the unit is within Smyrna Dunes Park and Lighthouse Point Park. This unit includes shoreline extending from the jetty north of Ponce de Leon Inlet west to the Halifax River and Inlet junction. It includes shoreline south of Ponce de Leon Inlet from the inlet and Halifax River junction, extending east and south along the Atlantic Ocean shoreline 1.2 km (.70 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–35: Nassau Sound-Huguenot. 950 ha (2347 ac) in Duval County. The majority of the unit is within Big Talbot Island State Park, Little Talbot Island State Park, and the Timucuan Ecological and Historical Preserve. This unit includes all emergent shoals and shoreline east of Nassau River bridge and extends to the inlet of the St. John's River. Amelia Island and the northern 2.7 km (1.7 mi) shoreline along Talbot Island are not included. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–36: Tiger Islands. 53 ha (130 ac) in Nassau County. This unit is privately owned. This unit extends from the mouth of Tiger Creek and runs north along Tiger Island 0.8 km (0.5 mi) and south along Little Tiger Island 1.4 km (0.9 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. Emerging sandbars to MLLW are also included.

Unit AL–1: Isle Aux Herbes. 227 ha (561 ac) in Mobile County. This unit includes the entire Isle Aux Herbes island where primary constituent elements occur to MLLW and is Stateowned.

Unit AL–2: Dauphin, Little Dauphin, and Pelican Islands. 880 ha (2,174 ac) in Mobile County. This unit includes all of Dauphin Island where primary constituent elements occur from St. Stephens Street approximately 17.6 km (10.9 mi) west to the western tip of the island to MLLW and all of Little Dauphin and Pelican Islands to MLLW. The area is mostly privately owned but includes State and Federal lands.

Unit AL–3: Fort Morgan. 67 ha (166 ac) in Baldwin County. This area includes Mobile Bay and Gulf of Mexico shorelines within Bon Secour National Wildlife Refuge, Fort Morgan Unit. This unit extends from the west side of the pier on the northwest point of the peninsula, following the shoreline approximately 2.8 km (1.74 mi) southwest around the tip of the peninsula, then east to the terminus of the beach access road and is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The area is State-owned but is leased by the Federal Government.

Unit MS–1: Lakeshore through Bay St. Louis. 41 ha (101 ac) in Hancock County. This unit extends from the north side of Bryan Bayou outlet and includes the shore of the Mississippi Sound following the shoreline northeast approximately 15.0 km (9.3 mi) and ending at the southeast side of the Bay Waveland Yacht Club. The landward boundary of this unit follows the Gulf side of South and North Beach Boulevard and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–2: Henderson Point. 34 ha (84 ac) in Harrison County. This unit extends from 0.2 km (0.12 mi) west of the intersection of 3rd Avenue and Front Street and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Pass Christian Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–3: Pass Christian. 77 ha (190 ac) in Harrison County. This unit extends from the east side of Pass Christian Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 10.5 km (6.5 mi) to the west side of Long Beach Pier and Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–4: Long Beach. 38 ha (94 ac) in Harrison County. This unit extends from the east side of Long Beach Pier and Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Gulfport Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–5: Gulfport. 39 ha (96 ac) in Harrison County. This unit extends from the east side of Gulfport Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.8 km (3.0 mi) to the west side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–6: Mississippi City. 62 ha (153 ac) in Harrison County. This unit extends from the east side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS, and includes the shore of the Mississippi Sound following the shoreline northeast approximately 7.9 km (4.9 mi) to the west side of President Casino. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–10: Ocean Springs West. 11 ha (27 ac) in Jackson County. This unit extends from U.S. 90 and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.9 km (1.2 mi) to the Ocean Springs Harbor inlet. The landward boundary of this unit follows the Bay side of Front Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–11: Ocean Springs East. 7 ha (17 ac) in Jackson County. This unit extends from the east side of Weeks Bayou and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.8 km (1.1 mi) to Halstead Bayou. The landward boundary of this unit follows the Bay side of East Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–12: Deer Island. 194 ha (479 ac) in Harrison County. This unit includes all of Deer Island, where primary constituent elements occur to the MLWW . Deer Island is privately owned.

Unit MS–13: Round Island. 27 ha (67 ac) in Jackson County. This unit includes all of Round Island to the MLWW and is privately owned.

Unit MS–14: Mississippi Barrier Islands. 3,168 ha (7,828 ac) in Harrison and Jackson Counties. This unit includes all of Cat, East and West Ship, Horn, Spoil, and Petit Bois Islands where primary constituent elements occur to MLLW. Cat Island is privately owned, and the remaining islands are part of the Gulf Islands National Seashore.

Unit MS–15: North and South Rigolets. 159 ha (393 ac) in Jackson County, MS, and 12 ha (30 ac) in Mobile County, AL. This unit extends from the southwestern tip of South Rigolets Island and includes the shore of Point Aux Chenes Bay, the Mississippi Sound, and Grand Bay following the shoreline east around the western tip, then north to the south side of South Rigolets Bayou; then from the north side of South Rigolets Bayou (the southeastern corner of North Rigolets Island) north to the northeastern most point of North Rigolets Island. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Approximately 4.4 km (2.7 mi) are in Mississippi and 2.9 km (1.8 mi) are in Alabama. Almost half the Mississippi shoreline length is in the Grand Bay National Wildlife Refuge.

Unit LA–1: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron and Vermilion Parishes. This unit extends from the east side of Sabine Pass (Texas/Louisiana border) and includes the shore of the Gulf of Mexico from the MLLW following the shoreline east 25.7 km (16.0 mi) to the west end of Constance Beach [approximately 2 km (1.2 mi) east of the intersection of Parish Road 528 and the beach]; it extends from the east end of the town of Holly Beach [0.25 km (0.16 mi) east of the intersection of Baritarick Boulevard and the beach] following the shoreline approximately 97 km (60.3 mi) east to the eastern boundary line of Rockefeller Wildlife Refuge [3.4 km (2.1 mi) east of Rollover Bayou]; and it extends from the east side of Freshwater Bayou Canal following the shoreline east for approximately 15 km (9.3 mi) to 1.3 km (0.81 mi) east of where the boundary of Paul J. Rainey Wildlife Sanctuary (National Audubon Society) meets the shoreline. All three sections of this unit include the land from the seaward boundary of MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The shoreline in this unit is both state and privately owned.

Unit LA–2: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA. This unit is located in the eastern portion of the State-owned Atchafalaya Delta Wildlife Management Area (WMA) and includes all exposed land and islands where primary constituent elements occur east and southeast of the main navigation channel of the Atchafalaya River to the MLLW. The islands located south and southeast of the deltaic splay, Donna, T-Pat, and Skimmer Islands and the un-named bird island, are also included in this unit. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–3: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish. This unit includes the entire small island at the northwest tip of Point Au Fer Island to MLLW, then extends from the northwest tip of Point Au Fer Island following the shoreline southeast approximately 7.7 km (4.8 mi) to the point where the un-named oil and gas canal extending southeast from Locust Bayou meets the shoreline [0.8 km (0.5 mi) southeast from Locust Bayou]. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This entire unit is privately owned.

Unit LA–4: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish. This unit includes the State-owned Isles Dernieres chain, including Raccoon, Whiskey, Trinity and East Islands. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–5: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. This unit includes: all of Timbalier Island where primary constituent elements occur to the MLLW, all of Belle Pass West [the ‘‘peninsula’’ extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Unit LA–6: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA. This unit is part of the State-owned Pass a Loutre Wildlife Management Area and includes un-named sand (spoil) islands off South Pass of the Mississippi River near Port Eads. The entire islands to MLLW are included in this unit.

Unit LA–7: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA. This unit includes Breton, Grand Gosier, and Curlew Islands and the Chandeleur Island chain. Those islands are part of the Breton National Wildlife Refuge or are state owned. The entire islands where primary constituent elements occur to MLLW are included in this unit.

Unit TX–1: South Bay and Boca Chica. 2,920 ha (7,217 ac) in Cameron County. The boundaries of the unit are: starting at the Loma Ochoa, following the Brownsville Ship Channel to the northeast out into the Gulf of Mexico to MLLW, then south along a line describing MLLW to the mouth of the Rio Grande, proceeding up the Rio Grande to Loma de Las Vacas, then from that point along a straight line north to Loma Ochoa. The unit does not include densely vegetated habitat within those boundaries. It includes wind tidal flats that are infrequently inundated by seasonal winds, and includes the tidal flats area known as South Bay. Beaches within the unit reach from the mouth of the Rio Grande northward to Brazos Santiago Pass, south of South Padre Island. The southern and western boundaries follow the change in habitat from wind tidal flat, preferred by the piping plover, to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include areas used for roosting by the piping plover. Portions of this unit are owned and managed by the Lower Rio Grande Valley National Wildlife Refuge, the South Bay Coastal Preserve, Boca Chica State Park, and private citizens.

Unit TX–2: Queen Isabella Causeway. 2 ha (6 ac) in Cameron County. The area extends along the Laguna Madre west of the city of South Padre Island. The southern boundary is the Queen Isabella State Fishing Pier, and the northern boundary is at the shoreline due west of the end of Sunny Isles Street. The Queen Isabella causeway bisects this shore but is not included within critical habitat. The eastern boundary is the where developed areas and/or dense vegetation begins, and the western boundary is MLLW. This unit contains lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–5: Upper Laguna Madre. 436 ha (1,076 ac) in Kleberg County. The southern boundary is the northern boundary of PAIS, and the northern boundary is the Kleberg/Nueces County line.

The eastern boundary is the line where dense vegetation begins, and the western boundary is MLLW. This unit includes a series of small flats along the bayside of Padre Island in the Upper Laguna Madre. It includes wind tidal flats and sparsely-vegtated upland areas used for roosting by the piping plover. These boundaries receive heavy use by large numbers of shorebirds, including piping plovers. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, and include upland areas used for roosting by the piping plover.

Unit TX–6: Mollie Beattie Coastal Habitat. 241 ha (596 ac) in Nueces County. This unit will be described as two subunits: (1) Subunit is bounded on the north by Beach Access Road 3, on the east by the inland boundary of critical habitat Unit TX–7, on the south by Zahn road, and on the west by Zahn Road. (2) The subunit is bounded on the north by Corpus Christi Pass, on the east by US 361, on the south by the north side of Packery Channel, and on the west by the Gulf Intercoastal Watersay. Some of the uplands are privately owned and the remaining are owned and managed by the TGLO. This unit includes two hurricane washover passes known as Newport and Corpus Christi Passes, and wind tidal flats that are infrequently inundated by seasonal winds. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover.

Unit TX–11: Blind Oso. 2 ha (5 ac) in Nueces County. This unit is the flats of the Blind Oso, part of Oso Bay, from Hans and Pat Suter Wildlife Refuge (owned and managed by the City of Corpus Christi) northeast to Corpus Christi Bay and then southeast along the edge of Texas A&M University—Corpus Christi. The landward boundaries extend to where densely vegetated habitat, not used by the piping plover, begins, and extends out from the landward boundaries to MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–12: Adjacent to Naval Air Station-Corpus Christi. 2 ha (6 ac) in Nueces County. This unit is along the shore of Oso Bay on flats bordered by Naval Air Station-Corpus Christi and Texas Spur 3 to a point 2.5 km (1.5 mi) south of the bridge between Ward Island and the Naval Air Station. The landward boundary is the line where dense vegetation begins, and the boundary in the Bay is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–13: Sunset Lake. 176 ha (435 ac) in San Patricio County. This unit is triangle shaped, with State Highway 181 as the northwest boundary, and the limits of the City of Portland as the northeast boundary. The shore on Corpus Christi Bay is the third side of the triangle, with the actual boundary being MLLW off this shore. This unit is a large basin with a series of tidal ponds, sand spits and wind tidal flats. This unit is owned and managed by the City of Portland within a system of city parks. Some of the described area falls within the jurisdiction of the TGLO. It includes two city park units referred to as Indian Point and Sunset Lake. Much of the unit is a recent acquisition by the city, and management considerations for the park include the area's importance as a site for wintering and resident shorebirds. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–17: Allyn's Bight. 5 ha (14 ac) in Aransas County. This unit includes shoreline of San Jose Island on Aransas Bay from Allyn's Bight to Blind Pass, the channel between San Jose Island and

Mud Island. The inland boundary is where the line of dense vegetation begins, and the bay-ward boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–20: Ayers Point. 397 ha (982 ac) in Calhoun County. This unit is an unnamed lake on Matagorda Island between Shell Reef Bayou and Big Brundrett Lake, with San Antonio Bay to the north. The unit boundary extends landward from the lake to the line where dense vegetation begins and where the constituent elements no longer occur and includes upland areas used for roosting by the piping plover. This unit includes marsh and flats at Ayers Point on Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–21: Panther Point to Pringle Lake. 863 ha (2,133 ac) in Calhoun County. This unit represents a narrow band of bayside habitats on Matagorda Island from Panther Point to the northeast end of Pringle Lake. The landward boundary is the line indicating where dense vegetation begins, and the bayward boundary is MLLW. The unit is entirely within Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–24: West Matagorda Bay/ Western Peninsula Flats. 756 ha (1,868 ac) in Matagorda County. This unit extends along the bayside of Matagorda Peninsula from 7.5 southwest of Greens Bayou to 2.5 km (1.6 mi) northwest of Greens Bayou. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–25: West Matagorda Bay/ Eastern Peninsula Flats. 232 ha (575 ac) in Matagorda County. This unit follows the bayside of Matagorda Peninsula from Maverick Slough southwest for 5 km (3 mi). The unit begins at Maverick Slough to the northeast and extends 5 km (3 mi) to the southwest, enclosing a series of flats along Matagorda Bay. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–26: Colorado River Diversion Delta. 5 ha (13 ac) in Matagorda County. This unit consists follows the shore of the extreme eastern northeast corner of West Matagorda Bay from Culver Cut to Dog Island Reef. The southeastern tidally emergent portion of Dog Island Reef is included within the unit. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The upland areas includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–29: Brown Cedar Cut. 119 ha (294 ac) in Matagorda County. This unit extends 2 km (1.2 m.) both southwest and northeast of the main channel of Brown Cedar Cut along the bayside of Matagorda Peninsula in East Matagorda Bay, and abuts unit TX–28 to the southeast. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The eastern boundary of TX–29 follows the change in habitat from mud flats preferred by the piping plover, to slightly vegetated dune system adjacent to TX–28. This unit includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–30: Northeast Corner East Matagorda Bay. 120 ha (297 ac) in Matagorda County. This is a unit bounded on the north by the Gulf Intercoastal Waterway, on the east by the northeast limit of Matagorda bay up the line where dense vegetation begins, on the south by the boundary of Unit TX–28, and on the west by MLLW. It is a system of flats associated with tidal channels. This unit includes upland areas used for roosting by the piping plover and lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–34: San Luis Pass. 110 ha (272 ac) near the Brazoria/Galveston County line. This unit extends along the Gulf side of Galveston Island from San Luis Pass to the cite of the former town of Red Fish Cove (USGS 1:24,000 map, San Luis Pass, Texas; 1963, photorevision 1974). The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. Approximately 57 percent of the unit includes flats in the floodtide delta that are State-owned and managed by the TGLO. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–35: Big Reef. 47 ha (117 ac) in Galveston County. This unit consists of beach and sand flats on the north, west, and east shore of Big Reef, down to MLLW. South Jetty is not included. The area is currently managed by the City of Galveston. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–36: Bolivar Flats. 160 ha (395 ac) in Galveston County. This unit extends from the jetties on the southwest end of the Bolivar Peninsula to a point on the Gulf beach 1 km (0.6 mi) north of Beacon Bayou. It includes 5.0 km (3 mi) of Gulf shoreline. The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. The area is leased from TGLO by Houston Audubon Society and managed for its important avian resources. The upland areas are used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–37: Rollover Pass. 6 ha (16 ac) in Galveston County. This unit consists of Rollover Bay on the bayside of Bolivar Peninsula. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. It includes flats on State-owned land managed by the TGLO. This unit captures the intertidal complex of the bay, and is bounded by the towns of Gilchrist to the east and the Gulf beach of the Bolivar Peninsula to the south. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

The critical habitat designation for the northern Great Plains breeding population of Charadrius melodus circumcinctus includes 19 units totaling approximately 183,422 ac (74,228.4 ha) of habitat in Minnesota, Montana, and North Dakota, and approximately 1,207.5 mi (1,943.3 km) of river in Montana, North Dakota, South Dakota, and Nebraska (67 FR 57638 - 57717).

Minnesota: Unit MN–1, Rocky Point, Pine and Curry Island, and Morris Point—This unit includes approximately 235.2 ac (95.1 ha) of unique habitat, including sparsely vegetated windswept islands, peninsulas, and sandy points or spits that interface with Lake of the Woods in Lake of the Woods County. Although this unit is small in size, there have been up to 50 plovers found during the breeding season. Numbers have declined since the mid-1980s and there is a continued need for habitat and predator management. This unit represents the most eastern portion of the northern Great Plains population of breeding piping plovers and may be an important link between the Great Lakes and northern Great Plains breeding populations. It is the only remaining breeding site for piping plovers in Minnesota. Approximately 100.4 ac (40.6 ha) are designated within the 697- ac (282.3-hectare) Rocky Point Wildlife Management Area, which is in public ownership, managed by the Minnesota Department of Natural Resources. Rocky Point is located just east of Arneson on Lake of the Woods. Unit 1 also includes approximately 134.8 ac (54.5 ha) within the Pine and Curry Island Scientific and Natural Area which is in public ownership, managed by the Minnesota Department of Natural Resources. Pine and Curry Island Scientific and Natural Area includes approximately 112.6 ac (45.6 ha) of a sandy barrier island (Pine and Curry Island) and 22.2 ac (8.9 ha) of an adjacent peninsula (Morris Point) located at the mouth of the Rainy River on Lake of the Woods.

Montana: Unit MT–1, Sheridan County—This unit includes approximately 19,222.9 ac (7,779.4 ha) of 20 alkali lakes and wetlands in Sheridan County, located in the extreme northeast corner of Montana. These alkali lakes and wetlands are characterized as follows— shallow, seasonally to permanently flooded; mixosaline to hypersaline chemistry; sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; 200 ft (61 m) of uplands above the wetlands' high water mark including springs and fens, which provide foraging and protective habitat for piping plovers. Sites included in this unit are occupied by piping plovers. This unit requires special management including increasing reproductive success through predator exclusion devices, such as nest cages and electric fences, and reducing vegetation encroachment on nesting beaches through prescribed burning or grazing. Essential breeding habitat is dispersed throughout this unit which represents the largest portion (approximately 66 percent) of the plovers surveyed in Montana. This unit also links similar habitat in Canada and North Dakota. Approximately 5,571 ac (2,254.5 ha) are in private ownership and 13,651.9 ac (5,524.8 ha) are in public ownership. Of the lands in public ownership, 13,356.8 ac (5,405.4 ha) are in Federal ownership and 295.1 ac (119.4 ha) are in State ownership. Federal lands designated include piping plover populations on Medicine Lake National Wildlife Refuge and several Waterfowl Production Areas, both owned and managed by the Service. State lands designated include land owned and managed by the Montana Department of Natural Resources and Conservation. Unit MT–4, Bowdoin National Wildlife Refuge—This unit encompasses approximately 3,294.5 ac (1,333.2 ha) on Bowdoin National Wildlife Refuge with sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand gravel, or shale that interface with these water bodies. The site is located in east-central Phillips County, approximately 170.8 mi (275 km) west of the North Dakota border and 37.3 mi (60 km) south of Canada. This unit represents the western edge of the northern Great Plains breeding population of the piping plover and requires special management including water level and predator management. Bowdoin National Wildlife Refuge is in public ownership (Federal) and managed by the Service. Lake Bowdoin is an off stream facility receiving water from the Milk River.

Nebraska: Unit NE–1, Platte, Loup, and Niobrara Rivers—This unit encompasses approximately 440 mi (707.9 km) of river. The river habitat includes sparsely vegetated channel sandbars, sand and gravel beaches on islands within the high bank for nesting, temporary pools on sandbars and islands, and the interface of sand and river where plovers forage. All three of these rivers are occupied by and provide essential habitat for the piping plover. Niobrara River—The Niobrara River is a tributary of the Missouri River, originating in Wyoming and flowing through the northern part of the Nebraska Sandhills region. The portion of the Niobrara included in as Critical Habitat starts at the bridge south of Norton, Nebraska, and extends downstream 120 mi (193 km) to its confluence with the Missouri River. The Niobrara River is one of the most undeveloped rivers in the northern Great Plains and represents one of the last rivers with largely untouched piping plover habitats. The source of water for this river is largely groundwater discharge which helps to provide a year-round base flow with few flood events which are essential to successful plover nesting. Essential nesting habitat is dispersed throughout this unit and this unit represents about 36 percent of Nebraska's plover population. Five miles of the Niobrara are within the Ponca Tribe reservation boundary. In 1991, Congress designated 76 mi (122.3 km) of the Niobrara River as a ''National Scenic River,'' 50 mi (80.5 km) of which are included in the Critical Habitat designation. The National Scenic River reach ends where Highway 137 crosses the river. The Nature Conservancy owns and manages 9.5 mi (15.3 km) along the Niobrara River that falls within both the National Scenic River reach and the piping plover Critical Habitat. Other ownership and interests are principally private. The primary land use along the Niobrara River is farming (east along the river) and ranching (west along the river). Loup River—The Loup River flows 68 mi (109.4 km) to its confluence with the Platte River near Columbus. Ownership interests within this reach of Critical Habitat are primarily private. Habitat on the Loup River designation is part of the larger Platte River watershed and provides productive habitat for piping plovers. The Loup River is one of the Platte River's principal tributaries. Platte River—The North and Middle Platte Rivers each originate in the Rocky Mountains of Colorado with snow melt, and flow east into Nebraska where they join forming the Platte River near the town of North Platte. The reach included in the piping plover Critical Habitat begins at the Lexington bridge and extends to the Platte's confluence with the Missouri River 252 mi (405.5 km) downstream. About one-fourth of this part of the Platte is already designated as critical habitat for the whooping crane (Grus americana), including a 3-mi wide (4.8-km) northsouth buffer starting at a western boundary south of Lexington east to south of Shelton. Ownership is primarily private, including 28.5 mi (45.9 km) which is managed as conservation land by The Nature Conservancy, Platte River Whooping Crane Habitat Maintenance Trust, Central Nebraska Public Power and Irrigation District, Nebraska Public Power District, and the National Audubon Society's Lillian Annette Rowe Sanctuary. The State of Nebraska owns 8 mi (12.9 km) along the Platte River, which is primarily under the jurisdiction of the Nebraska Game and Parks Commission. Essential nesting habitat is dispersed throughout this unit.

North Dakota: Units 1–10 in North Dakota (described below) include prairie alkali lakes and wetlands. These alkali lakes and wetlands are characterized as follows— shallow; seasonally to permanently flooded; mixosaline to hypersaline chemistry; sandy to gravelly, sparsely vegetated beaches, salt-encrusted mudflats, and/or gravelly salt flats; 200 ft (61 m) of uplands above the wetlands' high water mark, including springs and fens which provide foraging and protective habitat for piping plovers. Sites included in this unit are occupied (determined to have nesting piping plovers in more than 1 year) by piping plovers. This unit requires special management including increasing reproductive success through predator exclusion devices, such as nest cages and electric fences, and reducing vegetation encroachment on nesting beaches through prescribed burning or grazing. These essential breeding habitats in North Dakota can support more than 50 percent of the current known population of the northern Great Plains Piping Plover. The proximity of Units 1–10 to the Missouri River provides an important ecological link that may allow birds extra protection from a severe drought that results in dry wetlands basins. As birds experience drought in these units biologists believe birds move to the river. Conversely, birds may move to these units when Missouri River flows are high. Unit ND–1—This unit encompasses approximately 7,456.9 ac (3,017.7 ha) of 13 alkali lakes and wetlands in Divide and Williams Counties, located in the extreme northwestern corner of North Dakota. Approximately

1,765.2 ac (714.3 ha) are in public ownership and 5,691.7 ac (2,303.4 ha) are in private ownership. Of the lands in public ownership 1,337.9 ac (541.4 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 427.2 ac (172.9 ha) are in State ownership. State lands designated include 3.1 ac (1.2 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 424.1 ac (171.6 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–2—This unit encompasses approximately 20,683.8 ac (8,370.6 ha) of 14 alkali lakes and wetlands in Burke, Renville, and Mountrail Counties, in northwestern North Dakota. Approximately 13,986.5 ac (5,660.2 ha) are in public ownership and 6,697.3 ac (2,710.3 ha) are in private ownership. Of the lands in public ownership, 13,251.8 ac (5,362.9 ha) are in Federal ownership and 734.6 ac (297.3 ha) are in State ownership. Federal lands designated include Lostwood and Upper Souris National Wildlife Refuges and Waterfowl Productions Areas, both owned and managed by the Service. State lands designated include 320.1 ac (129.5 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 414.4 ac (167.7 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–3—This unit encompasses approximately 2,524.5 ac (1,021.6 ha) of 11 alkali lakes and wetlands in Mountrail and Ward Counties in northwestern North Dakota. Approximately 615.9 ac (249.2 ha) are in public ownership and 1,908.5 ac (772.3 ha) are in private ownership. Of the lands in public ownership, 615.7 ac (249.2 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 0.2 ac (0.08 ha) are in State ownership. State lands designated are owned and managed by the North Dakota Game and Fish Department as a Wildlife Management Area. Unit ND–4—This unit encompasses approximately 5,150.7 ac (2,084.4 ha) of eight alkali lakes and wetlands in McLean County in north-central North Dakota. Approximately 1,292.6 ac (523.1 ha) are in public ownership and 3,858 ac (1,561.3 ha) are in private ownership. Of the lands in public ownership, 752.1 ac (304.3 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 540.5 ac (218.7 ha) are in State ownership. State lands designated include 435.5 ac (176.2 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 104.9 ac (42.4 ha) of school lands owned and managed by the North Dakota Land Department. The John E. Williams Preserve, owned and managed by The Nature Conservancy (private), also is included in this unit. Unit ND–5—This unit encompasses approximately 3,925.6 ac (1,588.7 ha) of 10 alkali lakes and wetlands in McHenry and Sheridan Counties in north-central and central North Dakota. Approximately 406.8 ac (164.6 ha) are in public ownership and 3,518.8 ac (1,424 ha) are in private ownership. All public lands are in Federal ownership with 34.4 ac (13.9 ha) owned and managed by the Service as Waterfowl Production Areas and 372.4 ac (150.7 ha) owned by the BOR and managed by the North Dakota Game and Fish Department as a Wildlife Management Area. Unit ND–6—This unit encompasses approximately 6,075.2 ac (2,458.6 ha) of 11 alkali lakes and wetlands in Benson and Pierce Counties, in northeastern North Dakota. Approximately 767.3 ac (310.5 ha) are in public ownership and 5,307.9 ac (2,148 ha) are in private ownership. Of the lands in public ownership, 724.8 ac (293.3 ha) are in Federal ownership and 42.5 ac (17.2 ha) are in State ownership. State lands designated include 20.7 ac (8.4 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 21.7 ac (8.79 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–7—This unit encompasses approximately 30,125.7 ac (12,191.7 ha) of nine alkali lakes and wetlands in Burleigh and Kidder Counties, in southcentral North Dakota. Approximately 20,012.1 ac (8,089.8 ha) are in public ownership and 10,113.5 ac (4,092.9 ha) are in private ownership. Of the lands in public ownership, 18,113.1 ac (7,330.3 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 1,898.9 ac (768.5 ha) are in State ownership. State lands designated include 1,247.9 ac (505 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 650.9 ac (263.4 ha) of school lands owned and managed by the North Dakota Land Department. Federal lands designated include Long Lake National Wildlife Refuge and Waterfowl Production Areas owned and managed by the Service. Unit ND–8—This unit encompasses approximately 4,056.7 ac (1,641.7 ha) of three alkali lakes and wetlands in Stutsman County, in south-central North Dakota. Approximately 3,593.6 ac (1,454.3 ha) are in public ownership and 463.1 ac (187.4 ha) are in private ownership. Of the lands in public ownership, 3,583.8 ac (1,450.3 ha) are in Federal ownership and 9.7 ac (3.9 ha) are in State ownership. Federal lands designated include Chase Lake and Arrowwood National Wildlife Refuges and Waterfowl Production Areas owned and managed by the Service. State lands designated include 7.9 ac (3.2 ha) of school lands owned and managed by the North Dakota Land Department and 1.8 ac (0.7 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department. Unit ND–9—This unit encompasses approximately 2,658 ac (1,075.6 ha) of six alkali lakes and wetlands in Logan and McIntosh Counties in south-central North Dakota. Approximately 732.5 ac (296.4 ha) are in public ownership and 1,925.5 ac (779.2 ha) are in private ownership. Of the lands in public ownership, 497.7 ac (201.4 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 234.7 ac (95 ha) are in State ownership (Wildlife Management Areas managed by the North Dakota Game and Fish Department. Unit ND–10—This unit encompasses approximately 641.6 ac (259.6 ha) of one alkali lake in Eddy County in northeastern North Dakota. Approximately 6.8 ac (2.7 ha) are in public ownership as a Waterfowl Production Area managed by the Service and 634.7 ac (256.8 ha) are in private ownership.

Missouri River Units: Missouri River Units—Missouri River units consist of riverine and reservoir (Fort Peck Lake, Lake Sakakawea and Lake Audubon, Lake Oahe, and Lewis and Clark Lake) reaches. All reservoirs except Lake Audubon are mainstem impoundments, constructed by dams, and regulated by the Corps. Lake Audubon is a sub-impoundment of Lake Sakakawea and is regulated by the BOR through operation of the Snake Creek Pumping Plant. Overall the Missouri River has accounted for up to 31 percent of the northern Great Plains population of piping plovers. All of the units are occupied. Piping plover habitat within reservoir reaches is composed of shorelines, peninsulas, and islands, below the top of the maximum operating pool and is owned by the Federal government. These reservoir habitats include sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, grave, or shale, and their interface with the water. These reservoir reaches provide habitat for about 42 percent of the piping plovers on the Missouri River. Piping plover habitat within riverine reaches consists of inter-channel islands and sandbars including their temporary pools and interface with the river. These habitats are sparsely vegetated and consist of sand and gravel substrates. Riverine reaches provide habitat for about 58 percent of the piping plovers on the Missouri River. Ownership of these sites varies by State. In Montana, islands and sandbars are recognized as owned by the State except along the reservation boundaries of the Assiniboine and Sioux Tribes of Fort Peck. The Assiniboine and Sioux Tribes of Fort Peck own land to the midchannel of the Missouri River adjacent to the Reservation boundary. In North Dakota and South Dakota, islands and sandbars are recognized as owned by the State. Four Tribes along the Missouri River in North Dakota and South Dakota have critical habitat designated within the boundary of their reservation including the Standing Rock Sioux Tribe, and the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Tribes) of the Ft. Berthold Reservation, the Cheyenne River Sioux Tribe, and the Yankton Sioux Tribe. Additionally, these Tribes have land or Tribal trust land on submerged sites or sandbars/ islands within the critical habitat designation of the Missouri River in North and South Dakota. In Nebraska, islands and sandbars are owned by the adjacent landowner including the Santee Sioux Tribe.

Montana: Unit MT–2—This unit encompasses approximately 125.4 mi (201.8 km) from just west of Wolf Point, McCone County, Montana, at RM 1712.0 downstream to the Montana/North Dakota border, Richland County, Montana, and McKenzie County, North Dakota, at RM 1586.6. The Missouri River in this unit flows through reservation land of the Assiniboine and Sioux Tribes of Fort Peck (81.7 mi (131.5 km)), State land, and privately owned land. Unit MT–3, Fort Peck Reservoir—This unit encompasses approximately 77,370 ac (31,311 ha) of Fort Peck Reservoir, located entirely within the Charles M. Russell National Wildlife Refuge which is in Federal ownership, managed by the Service.

North Dakota: Unit ND–11, Missouri River— Approximately 354.6 mi (570.6 km) from the Montana/North Dakota border just west of Williston, McKenzie County, North Dakota, at RM 1586.6 downstream to the North Dakota/South Dakota border in Sioux and Emmons Counties, North Dakota, and Corson and Campbell Counties, South Dakota, at RM 1232.0. Lake Sakakawea, Lake Audubon, and Lake Oahe are included in this unit, along with a free-flowing stretch of the Missouri River from RM 1389 to 1302 (Garrison Reach). The North Dakota Game and Fish Department manages the north half of Audubon Reservoir and the Service manages the south half of Audubon Reservoir. The Missouri River and associated reservoirs in this unit include 6.83 mi (11 km) of shoreline (right and left bank) of trust land and 77 liner rm (123.9 km) within the reservation boundary of the Three Affiliated Tribes of Fort Berthold and 23.22 mi (37.37 km) of shoreline on trust land and 38 linear rm (61.16 km) within the reservation boundary of Standing Rock Sioux Tribe and 20 mi (32.19 km) of shoreline on trust land. A mix of State and privately owned lands also are included in this unit.

South Dakota Unit SD–1 Missouri River— Approximately 159.7 mi (257 km) from the North Dakota/South Dakota border northeast of McLaughlin, Corson County, South Dakota, at RM 1232.0 downstream to RM 1072.3, just north of Oahe Dam (Oahe Reservoir). The Missouri River and associated reservoirs in this unit include 3.22 mi (5.18 km) of shoreline (right bank) on trust land and 41 linear mi (65.98 km) within the reservation boundary of the Standing Rock Sioux and 23.44 mi (37.72 km) of shoreline (right bank) on trust land and 77 linear mi (123.92 km) within the reservation boundary of Cheyenne River Sioux Tribe. A mix of State and privately owned lands also are included in this unit. Unit SD–2, Missouri River— Approximately 127.8 mi (204.4 km) from RM 880.0, at Fort Randall Dam, Bon Homme and Charles Mix Counties, South Dakota, downstream to RM 752.2 near Ponca, Dixon County, Nebraska. One mainstem Missouri River reservoir, Lewis and Clark Lake, and two riverine reaches (Fort Randall and Gavins Point) are included in this unit. In addition to the 127.8 mi (204.4 km) that border South Dakota on the left bank there are approximately 7.8 mi (12.4 km) of river bordering South Dakota on the right bank. All islands and sandbars in South Dakota are in State ownership with the exception of 60.36 mi (97.14 km) of shoreline (left bank) on trust land and 34 linear miles (54.72 km) within the reservation boundary of the Yankton Sioux Tribe. Approximately 120 mi (192 km) (right bank) of river border Nebraska. Sandbars and islands in Nebraska (State line extends to midchannel) belong to the adjacent landowner. Approximately 16 linear mi (25.75 km) (right bank) of river below Ft. Randall Dam are within the boundary of the Santee Sioux Reservation, including 0.05 mi (0.08 km) of shoreline on trust land.

Primary Constituent Elements/Physical or Biological Features

Wintering piping plover’s PCEs are the habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are:

(1) Intertidal sand beaches (including sand flats) or mud flats (between the MLLW and annual high tide) with no, or very sparse, emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.

(2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather.

(3) Surf-cast algae for feeding.

(4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.

(5) Spits, especially sand, running into water used for foraging and roosting.

(6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water.

(7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.

(8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites).

See above.

See above.

The one overriding primary constituent element (biological) required to sustain the northern Great Plains breeding population of piping plovers that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat. Without this biological process the physical component of the primary constituent elements would not be able to develop. These processes develop a mosaic of habitats on the landscape that provide the essential combination of prey, forage, nesting, brooding and chick-rearing areas. The annual, seasonal, daily, and even hourly availability of the habitat patches is dependent on local weather, hydrological conditions and cycles, and geological processes. The biological primary constituent element, i.e., dynamic ecological processes, creates different physical primary constituent elements on the landscape. These physical primary constituent elements exist on different habitat types found in the northern Great Plains, including mixosaline to hypersaline wetlands (Cowardin et al. 1979), rivers, reservoirs, and inland lakes. These habitat types or physical primary constituent elements that sustain the northern Great Plains breeding population of piping plovers are described as follows:

i. On prairie alkali lakes and wetlands, the physical primary constituent elements include—(1) shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; (2) springs and fens along edges of alkali lakes and wetlands; and (3) adjacent uplands 200 ft (61 m) above the high water mark of the alkali lake or wetland.

ii. On rivers the physical primary constituent elements include—sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

iii. On reservoirs the physical primary constituent elements include—sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.

iv. On inland lakes (Lake of the Woods) the physical primary constituent elements include—sparsely vegetated and windswept sandy to gravelly islands, beaches, and peninsulas, and their interface with the water body.

Special Management Considerations or Protections

Activities that may destroy or adversely modify critical habitat are those for which the affected critical habitat would not remain functional to serve its intended conservation role for the species. More specifically, such activities could eliminate or reduce the habitat necessary for foraging by eliminating or reducing the piping plovers' food base; destroying or removing available upland habitats necessary for protection of the birds during storms or other harsh environmental conditions; increasing the amount of vegetation to levels that make foraging or roosting habitats unsuitable; and/or increasing recreational activities to such an extent that the amount of available undisturbed foraging or roosting habitat is reduced, with direct or cumulative adverse effects to individuals and completion of their life cycles. Examples of actions that have effects on wintering piping plover habitats include, but are not limited to: (1) Disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; (2) Predation, especially by falcons, hawks, coyotes, bobcats and feral cats; (3) Beach maintenance (e.g., nourishment (adding sand) and cleaning) and stabilization efforts (e.g., construction of jetties and other hard structures). (4) Oil and other hazardous materials spills and cleanup; (5) Discharge of freshwater from oil and gas activities; (6) Construction of dwellings, roads, marinas, and other structures, and associated activities including staging of materials and equipment; and/or (7) Dredging and dredge spoil placement, and associated activities including staging of equipment and materials.

See above.

See above.

Critical habitat does not include existing developed areas such as mainstem dam structures, buildings, marinas, boat ramps, bank stabilization and breakwater structures, row cropped or plowed agricultural areas, roads and other lands (e.g., high bank bluffs along Missouri River) unlikely to contain primary constituent elements essential for northern Great Plains piping plover conservation.

Life History

Feeding Narrative

Adult: Most foraging is diurnal. Piping plovers utilize numerous areas within breeding and wintering habitats for foraging, including wet sand in the wash zone, intertidal ocean beach, wrack lines, washover passes, mud, sand and algal flats, and shorelines of streams, ephemeral ponds, lagoons, and salt marshes (Powell and Cuthbert 1991; Hoopes et al. 1992; Loegering 1992; Zonick et al. 1998) (USFWS, 2017b).

Reproduction Narrative

Adult: Piping plovers return to their breeding grounds in late April to early May and initiate nesting by mid- to late May (Pike 1985). Courtship behavior includes aerial displays, digging of several nest scrapes, and a ritualized stone-tossing display (Cairns 1977, 1982; Haig 1992). Piping plover nests are shallow scrapes in the sand that are lined with pebbles, shells, and driftwood. Both adults actively defend nest territories and share incubation duties that last 25-31 days (Wilcox 1959; Cairns 1977; Prindiville 1986; Wiens 1986; Haig and Oring 1988). Females lay an egg approximately every other day; clutches are complete at three or four eggs. Eggs hatch from late May to late July at Great Lakes nesting sites (Lambert and Ratcliff 1981; Pike 1985). Precocial chicks usually hatch within one-half to one day of each other and are able to feed themselves within a few hours, following their parents and plucking invertebrates, including insects, spiders, marine worms, crustaceans, and mollusks, from the sand (Haig 1992). Piping plover eggs and young are so well camouflaged that they may go unnoticed. When predators or intruders are near, the young remain motionless while the parents attempt to attract the attention of the intruders to themselves, often by feigning a broken wing or false brooding. Chicks are especially vulnerable to predators after hatching until they are able to fly in 21-30 days. Fledging success in 2009 was 1.79 chicks fledged per pair, while overall fledging success from 1984 to 2009 has averaged 1.49 chicks fledged per pair, not including those chicks fledged from the salvage captive rearing program. Primary constituent elements for both C. m. circumcinctus breeding populations include sparsely vegetated beaches; however, those for the Great Lakes place a much greater emphasis on sandy substrates associated with wide, unforested systems of dunes and inter-dune wetlands (66 FR 22960). Similarly, Wemmer (2000) and Price (2002) found Great Lakes breeding sites to be largely restricted to Great Lakes shoreline areas (USFWS, 2017b).

Site Fidelity

Adult: High (USFWS, 2017b; 2009)

Habitat Narrative

Adult: See reproduction narrative for breeding habitat. The recent ESA status review for piping plovers concluded that inter- and intra-annual fidelity of piping plovers to migration and wintering sites as described in the 1996 Atlantic Coast and 2003 Great Lakes recovery plans was accurate. Great Lakes piping plovers on the breeding grounds exhibit nest site fidelity. In Michigan, adults returned to beaches where they nested previously approximately 65% of the time (Wemmer 2000) (USFWS, 2017b). Piping plovers in the Great Lakes have demonstrated a high degree of fidelity to this ecological setting, with little to no dispersal into breeding ranges of other populations. Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers (USFWS, 2009). On the wintering grounds, piping plovers forage and roost along barrier and mainland beaches, sand, mud, and algal flats, washover passes, salt marshes, and coastal lagoons. Wintering plovers are dependent on a mosaic of habitat patches, and move among these patches depending on local weather and tidal conditions (K. R. Drake 1999). The integrity of the habitat components depends upon daily tidal events and regular sediment transport processes, as well as episodic, high-magnitude storm events; these processes are associated with the formation and movement of barrier islands, inlets, and other coastal landforms (USFWS, 2003).

Dispersal/Migration

Motility/Mobility

Adult: High (USFWS, 2009)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory (USFWS, 2009)

Dispersal

Adult: High (USFWS, 2009)

Dispersal/Migration Narrative

Adult: Piping plovers depart their Great Lakes breeding areas anywhere from mid-July to early September (Pike 1985; Wemmer 2000) (USFWS, 2017b). Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean (USFWS, 2009).

Additional Life History Information

Adult: Migrate to wintering grounds July - September (USFWS, 2017b)

Population Information and Trends

Population Trends:

Increasing (USFWS, 2017b)

Population Size:

71 breeding pairs, 26 non-nesting individuals (USFWS, 2017b)

Minimum Viable Population Size:

150 breeding pairs (USFWS, 2017b)

Resistance to Disease:

Moderate (see threats)

Additional Population-level Information:

First year survival rate ~ 24%, > 1 year survival rate ~ 77% (USFWS, 2017b); population is sensitive to individual survival rates (USFWS, 2009)

Population Narrative:

From 1986 to 2009, the population increased from 12 to 71 breeding pairs and also expanded its breeding distribution within the Great Lakes basin. In 2009, breeding pairs were found in Michigan (59), Wisconsin (4), Illinois (1), and in the Great Lakes area of Ontario, Canada (7). The nest occurrence in Illinois in 2009 was the first nest in the state since 1979. Over the past 20 years, piping plover nests have been found in one county in Illinois, three counties in Wisconsin, 18 counties in Michigan, and in the province of Ontario, Canada. Between 2003 to 2008, an annual average of approximately 26 non-nesting piping plovers were observed, based on limited data from 2003, 2006, 2007, and 2008 (Cuthbert and Roche 2009). Cuthbert and Roche (2007a) determined an average after-hatch year survival rate of 77% and an average hatch year survival rate of approximately 24% (based on data collected from 1993-2005). The current recovery goal is 150 breeding pairs for the Great Lakes population (USFWS, 2017b). The most consistent finding in the various population viability analyses (PVAs) conducted for piping plovers (Ryan et al. 1993, Melvin and Gibbs 1996, Plissner and Haig 2000, Wemmer et al. 2001, Larson et al. 2002, Calvert et al. 2006, Brault 2007) is the sensitivity of extinction risk to even small declines in adult and/or juvenile survival rates (USFWS, 2009).

Threats and Stressors

Stressor: Shoreline development (USFWS, 2017b)
Exposure:
Response:
Consequence:
Narrative: Shoreline development represents the leading cause of piping plover habitat loss in the Great Lakes, and remains a major threat. Over one-quarter of available breeding habitat lies on private lands that are particularly vulnerable to development. Activities, such as homebuilding, shoreline stabilization, and jetty, pier, and rip rap installation, are common examples of coastal changes that occur within the Great Lakes, and these activities continue to threaten piping plover habitat to varying degrees. Loss of habitat due to development pressure also occurs to a limited degree on Federal lands, which currently support approximately 55% of the breeding sites. Disturbance in the form of recreational uses also continues at these sites, although nearly all Federal land management agencies currently participate in the ongoing recovery program and actively support various recovery actions. These include management of current nesting sites, limiting recreational uses, conducting regular outreach activities, and managing habitat conditions (USFWS, 2017b).

Stressor: Disturbance by humans and pets (USFWS, 2017b)
Exposure:
Response:
Consequence:
Narrative: Human activities, such as illegal off-road vehicle usage, unleashed pets, bike riding, bonfires, horseback riding, camping, and beach walking, are known to disturb piping plover nesting habitat and behaviors (Cuthbert and Roche 2008a). Although an arrangement of educational signs, posts, and twine typically enclose a large section of beach around each nest, pedestrians and unleashed pets sometimes ignore this psychological boundary (USFWS, 2017b).

Stressor: Predation (USFWS, 2107b)
Exposure:
Response:

Consequence:
Narrative: Predation remains one of the most significant threats to the Great Lakes population. A number of different species in the Great Lakes prey upon piping plovers. The routine use of predator exclosures (cages which keep larger predators out while allowing the attending adults free access to and from the nest) has reduced egg predation and increased hatching success from 37% to approximately 85%. To date, few observations have been made to suggest predators have “keyed” into exclosures and increased rate of adult predation. As a result, nest exclosures are used at all sites throughout the Great Lakes. Although the use of predator exclosures has reduced egg predation, chicks and adults remain vulnerable to a variety of terrestrial and avian predators (Melvin et al. 1992). In 2003, the NPS and U.S. Department of Agriculture (USDA) Wildlife Services initiated a joint program to control predator populations on North Manitou Island in the Sleeping Bear Dunes National Lakeshore. Increases in the number of pairs nesting on the island reflect the relative success of this program (Stucker et al. 2003; Stucker and Cuthbert 2004; Westbrock et al. 2005; Cuthbert and Roche 2006, 2007b; Cuthbert and Roche 2008b). Finally, merlins (Falco columbarius) are a notable concern to piping plover recovery. Since 2005, merlins are suspected of killing a total of 18 individuals (approximately six per year) (Cuthbert and Roche 2007b). Most of the instances of predation by merlins occurred at sites in the northwestern portion of Michigan’s Lower Peninsula, an area with high densities of nesting plovers (USFWS, 2017b).

Stressor: Disease (USFWS, 2017b)
Exposure:
Response:
Consequence:
Narrative: Although not considered a major threat at the time of listing, two disease-related mortality events have occurred in the Great Lakes population since 2003. In 2004, two young-of-the-year piping plovers were found dead in Benzie County, Michigan. The USGS National Wildlife Health Center (NWHC) determined the cause of death was aspergillosis, a fungal disease of the airway. No further cases of aspergillosis in the Great Lakes have been reported. In 2007, two chicks and two adult piping plovers succumbed to Type E botulism poisoning at Sleeping Bear Dunes National Lakeshore in Benzie and Leelanau Counties in Michigan. Type E botulism is a paralytic, typically fatal disease of birds. Outbreaks have occurred at various times in the Great Lakes basin, with some of the earliest outbreaks documented in Michigan in 1963. Significant outbreaks also occurred in 1976 and 1981 (T. Cooley, Michigan Department of Natural Resources, pers. comm. 2008). The recent outbreak began in 2006, when several thousand waterbirds succumbed to the disease in the northern Lake Michigan area. Although fewer waterbird and shorebird mortalities associated with Type E botulism were reported in 2008 compared to 2007 and 2006, potential disease-related mortality remains a concern for the Great Lakes piping plover population (USFWS, 2017b).

Stressor: Small population size/genetic diversity (USFWS, 2017b)
Exposure:
Response:
Consequence:
Narrative: An analysis of the Great Lakes population in 2003 found up to 29% of adult plovers remained unmated, suggesting a possible Allee effect (Wemmer 2000 in USFWS 2003). On average, from 2003-2008, 18% of adult piping plovers remained unmated (based on limited figures from 2003 and 2006-2008). This decrease may reflect increased nesting densities in areas

of high quality habitat or the overall increase in the population. Other factors, such as uneven sex ratios, may also contribute to this condition. Increased susceptibility to stochastic events also occurs with a small population size. Small populations are less able to recover from losses associated with events such as severe weather, oil spills, and disease outbreaks. The population-level impacts of threats already mentioned, such as human disturbance, increase when there are fewer individuals in the population. The potential for low and/or declining genetic diversity represents another factor often associated with small population size. In 2007, Cuthbert and Roche (2007a) performed a pedigree analysis that suggested a substantial loss of at least 14 of the 17 founder lineages and an over-representation of the remaining three. In addition, they established that the number of observed pairs known to be closely related increased from 1997-2007. Although these are somewhat alarming, Cuthbert and Roche (2007a) also acknowledged that a large percentage of the Great Lakes piping plover pedigree is unknown, and their results should be considered preliminary. Miller et al. (2009) recently conducted a molecular genetic investigation of piping plovers, including mitochondrial DNA sequences and eight nuclear microsatellite loci, based on samples from 23 U.S. states and Canadian provinces. This included an analysis of samples from 17 individuals in the Great Lakes population. They found genetic evidence suggesting that interior birds have experienced genetic bottlenecks and that the Great Lakes region has also experienced a post-bottleneck population expansion. This finding may indicate a population growth following a previous bottleneck event (Miller et al. 2009). Miller et al. (2009) also reported genetic diversity measures for both mitochondrial and microsatellite data for Great Lakes piping plovers. Mitochondrial control region nucleotide diversity and gene diversity were somewhat lower for the Great Lakes population compared with the Atlantic Coast and Northern Great Plains populations in the U.S. and Canada (Miller et al. 2009). The average Great Lakes mitochondrial nucleotide diversity was also below the mean (but still within the range) observed at the same locus in a study of snowy plovers (Charadrius alexandrinus). The lower mitochondrial nucleotide diversity associated with Great Lakes birds may be attributed to historically low (or currently small) population sizes, founder events, or bottlenecks. For microsatellite markers, however, the average number of alleles per locus and heterozygosity in the Great Lakes samples were in the middle of the range observed for all piping plover populations. Although diversity measures observed by Miller et al. (2009) suggest that the current level of genetic diversity may not have a deleterious effect on Great Lakes piping plovers, further investigations are warranted. Furthermore, genetic drift could affect this small population over the long term (USFWS, 2017b).

Stressor: Wind power (USFWS, 2017b)
Exposure:
Response:
Consequence:
Narrative: Wind power has emerged as an alternative energy source in and around the Great Lakes. Wind turbines potentially impact local and migrating populations of birds due to collision-associated mortality. While the exact migration routes of piping plovers are unknown, individual observations along the Great Lakes coastline strongly suggest they use the shoreline as travel corridors. Wind power facilities located along Great Lakes shorelines may pose a risk of injury to piping plovers, particularly during migration (USFWS, 2017b).

Stressor: Climate change (USFWS, 2017b; 2009)
Exposure:
Response:

Consequence:
Narrative: The potential impacts of climate change are increasingly evident in the Great Lakes region. Summer lake water temperatures are increasing, with Lake Superior's average summer surface water temperature increasing by 4.5° F since 1980 (Austin and Colman 2007). Ice forms later and melts earlier throughout the region. According to scenarios used in a national assessment, average temperatures in the Great Lakes region could increase 4° to 8° F by 2100, while precipitation could increase by 25% (Sousounis and Glick 2000). Despite projected increases in precipitation, increased air temperatures and reduced ice cover are expected to result in lake level decreases of 1.5 to as much as 8 feet (Sousounis and Glick 2000). These changes could have significant effects on both aquatic and terrestrial ecosystems. Expected changes due to climate change could have both positive and negative effects on piping plovers and their habitats. Reductions in lake levels could potentially increase the amount of available habitat by increasing the width and length of open beach, areas preferred by Great Lakes piping plovers. Conversely, a longer growing season, coupled with the loss of ice scour, may allow for vegetative encroachment, thus decreasing the amount of habitat available for piping plovers. Increases in regional temperatures may also alter the frequency and intensity of seasonal storms, which can inundate and wash out nests. Such changes could have a particularly significant impact in areas where nest densities are high. Overall, the magnitude of the threats of climate change on piping plover habitat remains unknown (USFWS, 2017b). Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20-70% of current intertidal foraging habitat (Galbraith et al. 2002) (USFWS, 2009).

Stressor: Exotic/invasive vegetation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: A recently identified threat to piping plover habitat, not described in the listing rule or recovery plans, is the spread of coastal invasive plants into suitable piping plover habitat. Like most invasive species, coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. If left uncontrolled, invasive plants cause a habitat shift from open or sparsely vegetated sand to dense vegetation, resulting in the loss or degradation of piping plover roosting habitat, which is especially important during high tides and migration periods. Beach vitex (Vitex rotundifolia) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). Unquantified amounts of crowfoot grass (Dactyloctenium aegyptium) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (Casuarina equisetifolia) changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas. Shorebirds prefer foraging in open areas where they are able to see potential predators, and tall trees provide good perches for avian predators. Australian pines potentially impact shorebirds, including the piping plover, by reducing attractiveness of foraging habitat and/or increasing avian predation (USFWS, 2009).

Stressor: Beach cleaning (USFWS, 2009)

Exposure:
Response:
Consequence:
Narrative: Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Neal et al. 2007) (USFWS, 2009).

Stressor: Inadequacy of existing regulatory mechanisms (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Available regulatory mechanisms include local land use ordinances and state and federal regulations. However, implementation of these mechanisms is often constrained by practical limitations such as lack of staff and funding. Enforcement limitations and/or legal insufficiency of regulations to protect important habitat components result in continued degradation of a significant amount of wintering piping plover coastal habitat, including designated critical habitat units, resulting in a cumulative loss of habitat. At the current time, if the protections of the ESA were removed, existing local, state, and other federal regulatory provisions would provide insufficient protection to nonbreeding piping plover habitats used during migration and winter (USFWS, 2009).

Stressor: Military activities (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: To date, five bases have consulted with the USFWS under section 7 of the ESA, on military activities on beaches and baysides that may affect piping plovers or their habitat. Camp Lejeune in North Carolina consulted formally with USFWS in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with USFWS on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida (USFWS, 2009).

Stressor: Contaminants and pesticides (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The Great Lakes plan states that concentration levels of polychlorinated biphenol (PCB) detected in Michigan piping plover eggs have the potential to cause reproductive harm. Contaminants have the potential to cause direct toxicity to individual birds or negatively impact

their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985, Gilbertson et al. 1991, Hoffman et al. 1996). Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; USFWS 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; A. Amos, University of Texas, pers. comm. 2009). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants. In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon’s Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county’s aerial application of the organophosphate pesticide Fenthion for mosquito control purposes (Williams 2001). Subsequent to a lawsuit being filed against the Environmental Protection Agency (EPA) in 2002, the manufacturer withdrew Fenthion from the market, and EPA declared all uses were to end by November 30, 2004 (American Bird Conservancy 2007, which also states that all other counties in the U.S. now use less toxic chemicals for mosquito control). With one reported plover death from pesticide use, and with the causative pesticide now removed from use, this threat to piping plovers in the U.S. currently appears low. However, it is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico (USFWS, 2009).

Stressor: Storm events (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range. Available information suggests that some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. Significant concerns include disturbance to piping plovers and habitats during cleanup of debris, and post storm acceleration of shoreline stabilization activities, which can cause persistent habitat degradation and loss (USFWS, 2009).

Stressor: Vegetative encroachment (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Several coastal areas traditionally used by piping plovers in the past have gone unused in recent years (Stucker et al. 2003; Stucker and Cuthbert 2004; Westbrock et al. 2005; Cuthbert and Roche 2006, 2007a). These include several sites in northern Michigan, such as Wilderness State Park. As recently as 2001, Wilderness State Park supported over 35% of the entire Great Lakes population. By 2008, the number of breeding pairs at the park was down to one. One possible explanation for this is that increases in vegetation have reduced the overall width of open beach. Piping plovers usually require approximately 30 m of open sandy beach for nesting (Lambert and Ratcliff 1981, Powell and Cuthbert 1992, Allan 1993 in USFWS 2003). In areas lacking natural disturbances (e.g., lake level fluctuations, storms, ice scour), vegetation can cover

beaches and grow nearly to the water's edge, making the area unsuitable for nesting. The percentage of vegetative cover along the shoreline at Wilderness State Park, for example, has increased in the past six years and may have contributed to the reduction of breeding habitat (Stucker and Cuthbert 2005) (USFWS, 2009).

Stressor: Research (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Scientific investigations currently underway are conducted under the authority of permits issued under section 10 of the ESA, and are closely monitored. Current investigations include collection of feather samples for genetic analysis, close observation and monitoring of nest sites, and leg banding. Activities such as banding may result in short-term disturbances during capture, and have the potential for leg injury. Since 2003, a small number of individuals (<5) in the Great Lakes population have been reported with conditions that may have been related to leg bands. It should be noted, however, that some leg injuries may have been due to other causes. In 2004, banding protocols were modified, including a change in leg band position; since that time no observations of band-related injuries have been reported (USFWS, 2009).

Stressor: Agricultural practices (USFWS, 2025)
Exposure:
Response:
Consequence:
Narrative: The impacts from irrigation are the only addition to this section since the 2020 5-Year Review. Consequences of agriculture are not always from input of products into a system but can also be from outputs such as irrigation. Irrigation is prevalent within the Missouri River on the NRMR and its tributaries (NDNR 2022). Irrigation can reduce streamflow used to create and maintain piping plover habitat. Impacts of irrigation are magnified within smaller tributaries such as the Platte River of the SRMR. In 1994, the USFWS determined that flows on the Platte River were projected to no longer be sufficient for protecting threatened and endangered wildlife habitat. As a result, alternatives to the proposed water withdraws were created and water conservation measures were adopted (USFWS, 2025)

Stressor: Commercial sand and gravel mining (USFWS, 2025)
Exposure:
Response:
Consequence:
Narrative: This threat has not significantly changed since the 2020- 5 Year Review. However, additional information has become available. Proactive management at commercial aggregate mines in the SRMR has helped reduce adverse effects on piping plovers and may increase reproductive success. In addition, dredging operations create piping plover habitat by depositing waste sand around central lakes. These benefits are often temporary. Mining sites are disturbance-mediated and require management once the disturbance, usually industrial operations, ceases. Because of the need for perpetual management to maintain suitability, mines do not serve as solutions for long-term recovery (Jorgensen et al. 2021, p. 2), and the closing of current mines and changes to future mining could eventually lead to an overall reduction to plover populations in the SRMR and the entire NGP (USFWS, 2025)

Stressor: Oil and gas development (USFWS, 2025)
Exposure:
Response:
Consequence:
Narrative: Impacts of oil and gas development within the NGP continue at a similar rate to that found in the 2020 5-Year Review. Some impacts to piping plovers result from the drilling process and direct oil spills. Drilling activities produce noise and human activity which may deter piping plovers from nesting (Thomsen 2006). Waste pits from drilling can contain contaminants that may act as piping plover habitat or seep into water associated with habitat (NDDMR 2011). Considering within the last 10 years, producing oil wells have doubled in North Dakota alone (NDOGC 2023), potential threats of oil and gas development should be monitored closely. (USFWS, 2025)

Recovery

Reclassification Criteria:
The population will be considered for reclassification to threatened when the first four criteria are accomplished, and then considered for delisting when all five criteria are met (USFWS, 2009).

Recovery Priority Number: 2C

Delisting Criteria:
1. The population has increased to at least 150 pairs (300 individuals), for at least 5 consecutive years, with at least 100 breeding pairs (200 individuals) in Michigan and 50 breeding pairs (100 individuals) distributed among sites in other Great Lakes states (USFWS, 2017b).

2. Five-year average fecundity is within the range of 1.5-2.0 fledglings per pair, per year, across the breeding distribution, and ten-year population projections indicate the population is stable or continuing to grow above the recovery goal (USFWS, 2017b).

3. Ensure protection and long-term maintenance of essential breeding habitat in the Great Lakes and wintering habitat, sufficient in quantity, quality, and distribution to support the recovery goal of 150 pairs (300 individuals) (USFWS, 2017b).

4. Genetic diversity within the population is deemed adequate for population persistence and can be maintained over the long-term (USFWS, 2017b).

5. Agreements and funding mechanisms are in place for long-term protection and management activities in essential breeding and wintering habitat (USFWS, 2017b).

Recovery Actions:
- Protect the Great Lakes piping plover breeding population and manage breeding habitat to maximize survival and fecundity (USFWS, 2003).
- Protect wintering piping plovers and manage habitat to promote survival and recruitment (USFWS, 2003).
- Identify and protect migration habitat outside of wintering range (USFWS, 2003).
- Conduct scientific research to facilitate recovery efforts (USFWS, 2003).

- Develop and implement public education and outreach (USFWS, 2003).
- Develop partnerships and additional funding mechanisms (USFWS, 2003).
- Develop emergency methods to prevent extirpation (USFWS, 2003).
- Review progress toward recovery and revise recovery tasks as appropriate (USFWS, 2003).
- Develop a comprehensive conservation plan for piping plovers in the U.S. portion of their migration and wintering range. a. Acquire funds to develop a concise, cohesive plan that will address the migration and wintering needs of the three breeding populations. This is most efficiently accomplished by a qualified contractor working in close coordination with USFWS biologists. b. Develop a state-by-state wintering and migration habitat use atlas. i. Quantify amount and distribution of currently existing habitat. ii. Determine the condition of each site, including the type and level of alteration, presence and threat level from invasive species, and whether natural coastal processes are impeded. Compare with historic habitat availability using aerial photography or other records. iii. Determine the temporal abundance and distribution of piping plover activity at sites with suitable habitat. Where appropriate data are currently lacking, conduct multiple surveys by qualified personnel across several migration and wintering seasons. Examples of reports summarizing methods and results of such surveys are available on request to the USFWS. iv. Evaluate likelihood of future actions, including human development and recreational uses, and natural events that could potentially affect habitat quantity and quality at each site. v. Evaluate factors at each site that will affect the response of habitat to accelerating sea-level rise and identify potential actions to minimize its adverse effects. c. Conduct a systematic review of recreational policies and beach management. Identify gaps in management and enforcement of regulatory mechanisms by state. Develop recommendations to improve management and enforcement of piping plover protections where warranted. d. Develop an education/outreach strategy to work with state, county, and municipal governments to develop and implement ordinances and other strategies reducing effects of habitat stabilization, beach cleaning practices, human uses, and pets in beach and bayside habitats. e. Develop an education/outreach strategy to work with private landowners with regard to habitat stabilization, beach-cleaning practices, human uses, and pets (USFWS, 2009).
- Develop, in coordination with land managers, management plans for critical habitat sites or other sites that support or could support nonbreeding piping plovers. This may be accomplished concurrently with development of the atlas described under action 1b above or as a follow-up task. a. Develop and implement a conservation plan tailored to the site’s conditions. A range of management measures may include, as appropriate, leash laws and dog free zones, off-road vehicle management, and symbolic fencing of key habitats during periods of high plover use. b. Develop a recommended piping plover monitoring protocol for each site that includes suggested frequency and intensity of monitoring. c. Monitor the effectiveness of management measures (2.a above) (USFWS, 2009).
- Improve consistency in the approach used, and recommendations generated for, piping plover conservation in ESA section 7 consultations and Coastal Barrier Resources Act review across all USFWS field offices throughout the species’ U.S. coastal migration and wintering range. a. Regularly update USFWS field office staff regarding latest information on piping plovers and habitat use. b. Emphasize importance of maintaining natural coastal processes to perpetuate high quality piping plover migrating and wintering habitat (AC task 2.21). c. Discourage projects that will degrade or interfere with formation or maintenance of high quality piping plover habitat (GL task 2.22, AC task 2.21, NGP task 4.43). d. Encourage project features to minimize adverse effects on piping plovers and their habitat, including

creation and enhancement of habitat in the vicinity of existing stabilization projects. . e. Develop a comprehensive monitoring and management plan template for shoreline stabilization projects on the wintering and migration grounds. f. Consider effects of climate change when determining long-term impacts. Include measures to conserve and enhance the capacity of piping plover habitats to adapt to sea-level rise (USFWS, 2009).

- Develop a website specifically for wintering and migrating piping plover issues (GL task 5.2 and AC tasks 4.1, 4.2). a. Develop a piping plover contact list of all individuals in each state and other countries (Canada, Mexico, Bahamas, etc.). b. Link to other plover websites. c. Upload all pertinent literature, including research and monitoring reports not protected by copyright, to the website. d. Upload summarized section 7 consultations, conservation measures, reasonable and prudent measures, and terms and conditions (USFWS, 2009).
- Focus the non-breeding portion of the International Census on enhancing understanding of piping plover abundance, distribution, and threat levels in seasonally emergent habitat (seagrass beds, oyster reefs, and mud flats) in Texas bays, and in Mexico and the Caribbean. Continue to encourage and improve International Census efforts at priority sites in Texas. b. USFWS regional coordinators for the International Census should establish contacts in Mexico, Bahamas, Cuba, and other appropriate Caribbean countries at least a year in advance of the 2011 International Census. i. Increase efforts to maximize survey coverage. ii. Encourage collection of information describing types and levels of threats at each International Census site in addition to physical and biological attributes of the site. iii. Provide information about color-banded birds and encourage surveyors to look for and report these marked piping plovers (USFWS, 2009).
- To further enhance understanding of spatial partitioning of the breeding populations (as well as the impacts of some threats) on the migration/winter grounds, USFWS should facilitate and encourage all efforts dedicated to (or incorporating) monitoring of color-banded piping plovers. There is urgency associated with this data collection since several large breeding grounds banding studies have recently ended or are slated for completion in the near future, and opportunities to glean information will decline as banded piping plovers die off (USFWS, 2009).
- Further investigate the partitioning of survival within the annual cycle, and determine whether winter habitat quality influences reproductive success and survival (GL task 4.1 and AC task 3.6). Explore opportunities for further comparison of survival rates among breeding populations to inform these issues (USFWS, 2009).
- Continue to refine characterization of optimal winter habitat and understanding of factors affecting piping plover use of different microhabitats (e.g., ocean intertidal zones, wrack, inlet shoreline, soundside flats). Research approaches should recognize that piping plovers may move among relatively nearby habitat patches. Plover habitat use patterns and needs may also vary geographically (across their nonbreeding range) and seasonally. a. Determine how habitat modification or complete loss of a site on migration and wintering grounds affects survival given documented site fidelity. b. Develop design specifications for creating roosting and foraging habitat. c. Quantify the amount and distribution of habitat needed for recovery of each breeding population, giving due consideration to intra- and inter-species competition for use of similar habitats (USFWS, 2009).
- Develop strategies to reduce threats from accelerating sea-level rise. a. Identify human coastal stabilization practices that increase or decrease adverse effects of sea-level rise on coastal piping plover habitats. b. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat as sea-level rises.

c. Evaluate projected effects of sea-level rise on the regional distribution of piping plover habitats over time. Facilitate use of LIDAR (a remote sensing system used to collect topographic data) mapping of coastal elevations, development of models, and timeframe analysis throughout the species wintering and migration range in the U.S. to generate projections regarding areas most likely to be inundated within given time frames (USFWS, 2009).

- Determine the extent that human and pet disturbance limits piping plover abundance and behavioral patterns in the wintering and migration habitats (USFWS, 2009).
- Determine the effect of human and pet disturbance on survival and reproductive fitness (USFWS, 2009).
- Support research to ascertain impacts of predation on wintering/migrating piping plovers, as well as to determine the effectiveness of predator control programs (USFWS, 2009).
- Identify and secure reliable funding for various recovery program partners aimed at continued coordination and management of threats from human disturbance and predation, as described in recovery plan tasks 1.22, 1.34, and 1.36 (USFWS, 2009).
- Continue to build partnerships and increase participation of non-governmental groups and volunteers in conservation efforts (recovery task 6.0) (USFWS, 2009).
- Closely monitor the population for disease outbreaks and prepare response plans to address disease outbreaks, with emphasis on Type E botulism (USFWS, 2009).
- Pursue development of agreements needed to assure long-term protection and management to maintain population targets and productivity (recovery task 1.18). Prototype agreements should be pursued at sites where there is a history of intensive and successful piping plover protection and a high degree of commitment to the piping plover protection program (USFWS, 2009).
- Continue efforts to purchase habitat and increase protection through conservation easements, deed restrictions, and other mechanisms (recovery task 1.362) (USFWS, 2009).
- Conduct further research on the genetic fitness and adequate effective size of the population through molecular genetic and pedigree analysis (recovery task 4.6) (USFWS, 2009).
- Update and refine population viability models to assess and potentially modify recovery goals for the population (recovery task 4.7) (USFWS, 2009).
- Develop strategies to reduce threats from the potential for water level decreases in the Great Lakes associated with climate change. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat (USFWS, 2009).
- Undertake studies addressing merlin foraging ecology and the relationship between merlins and piping plovers breeding areas in the Great Lakes (USFWS, 2009).
- Conduct studies to understand potential effects of wind turbine generators that may be located or proposed for the Great Lakes, nearshore, and within or between nesting or foraging habitats. Information needs include migration routes and altitude, flight patterns associated with breeding adults and post-fledged young of the year foraging at nearby sites that are not contiguous with nesting habitats, and avoidance rates under varying weather conditions (USFWS, 2009).

Conservation Measures and Best Management Practices:

- Recommendations for Great Lakes Population Breeding Range 1. Identify and secure additional sources of reliable funding for recovery partners to ensure continued coordination and management of threats from human disturbance and predation, as described in recovery plan tasks 1.22, 1.34, and 1.36 2. Expand partnership efforts to increase participation of non-governmental organizations, state agencies and volunteers as in recovery plan task 6.0 3. Monitor the population for disease outbreaks, particularly focused on the threat of Type E botulism. Continue to improve response activities when an outbreak occurs. 4. Pursue development of agreements needed to assure long-term protection and management to maintain population targets and productivity (recovery task 1.18). Prototype agreements should be pursued at sites where there is a history of intensive and successful piping plover protection and a high degree of commitment to the piping plover protection program. 5. Continue efforts to purchase habitat and increase protection through conservation easements, deed restrictions, and other mechanisms (recovery task 1.362). 6. Conduct further research on the genetic fitness and adequate effective size of the population through molecular genetic and pedigree analysis (recovery task 4.6) 7. Assess and potentially modify recovery goals for the population (recovery task 4.7). 8. Develop strategies to reduce threats from the potential for water level decreases, or increases associated with climate change. Identify sites most likely to maintain or increase areas of suitable piping plover habitat under different climate change scenarios. 9. Undertake studies addressing merlin and other predator foraging ecology and the relationships between merlins and piping plover breeding areas in the Great Lakes. 10. Continue to pursue opportunities for habitat restoration, particularly at previously occupied breeding locations. Habitat creation projects, similar to the Cat Island effort near Green Bay Wisconsin, should also be considered depending on location and the level of commitment for future management. 11. Conduct studies using geolocators, nanotags or similar technology to learn more about wintering locations and migratory pathways of Great Lakes piping plovers.

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SPECIES ACCOUNT: *Charadrius melodus circumcinctus* (Piping Plover - Northern Great Plains)

Species Taxonomic and Listing Information

Listing Status: Threatened; 12/11/1985; Midwest Region (R3) (USFWS, 2017)

Physical Description

The piping plover is a small [about 16.5 to 17.5 cm (6.5 to 7 inches long); 46 to 64 grams (1.5 to 2 ounces)] migratory shorebird with a short, stout bill, pale underparts and orange legs. During the breeding season, it also has a black band across the forehead, a single black neckband, and the bill is orange with a black tip. The piping plover was named for its melodic high-pitched call from which the scientific name is derived (USFWS 1988b). During the winter, the legs pale, the bill turns black, and the dark bands disappear. Chicks are speckled gray, buff, brown, and white down. Juveniles resemble adults in winter. Juveniles acquire adult plumage the spring after they fledge (Prater et al. 1977) (USFWS, 2015). Piping plover subspecies are phenotypically indistinguishable (USFWS, 2009).

Taxonomy

Miller et al. (2009) confirmed separate Atlantic and interior piping plover subspecies (C. m. melodus and C. m. circumcinctus, respectively). This study found that birds from the Great Lakes region were allied with the interior subspecies group and should be taxonomically referred to as C. m. circumcinctus. Currently available genetic information does not provide evidence that Great Lakes and Northern Great Plains piping plovers are genetically discrete (USFWS, 2009).

Historical Range

The Northern Great Plains population historically bred from Alberta to Ontario, Canada, south to Kansas and Colorado (USFWS, 2001).

Current Range

The breeding population of the Northern Great Plains piping plover extends from Nebraska north along the Missouri River through South Dakota, North Dakota, and eastern Montana, and on alkaline (salty) lakes along the Missouri River Coteau (a large plateau extending north and east of the Missouri River) in North Dakota, Montana, and extending into Canada. The majority of piping plovers from Prairie Canada winter along the south Texas coast, while breeding piping plovers from the U.S. are more widely distributed along the Gulf Coast from Florida to Texas (USFWS, 2015). Northern Great Plains piping plovers currently breed in eight states and three Canadian provinces (Elliott-Smith et al. 2009). Their range extends about 1,000 miles (1,600 km) from north to south and spans more than 800 miles (1,300 km) from west to east. Gratto-Trevor et al. (2009) found that Mississippi, Louisiana, and Texas coasts harbored 71% of observed wintering birds from the U.S. Northern Great Plains. Except at inland sites, piping plover migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from breeding or wintering piping plovers. Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast in winter (Gratto-Trevor et al. 2009). Up to approximately 83% of the plovers in the U.S. Northern Great Plains nest on alkali lakes along the Missouri Coteau from central North Dakota to eastern Montana (Figure NGP10) (Brown and Jorgensen

2008, Peyton and Wilson 2008, USACE in litt. 2008a, USFWS in litt. 2008a) (USFWS, 2009a). Piping plovers winter in coastal areas of the United States from North Carolina to Texas. They also winter along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig 1992) (USFWS, 2001).

Distinct Population Segments Defined

No; There are separate breeding populations in the Northern Great Plains and the Great Lakes areas (USFWS, 2009).

Critical Habitat Designated

Yes; 7/10/2001.

Legal Description

On May 19, 2009, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in 18 specific units in Texas under the Endangered Species Act of 1973, as amended (74 FR 23476 - 23600). In total, approximately 139,029 acres (56,263 hectares) fall within the boundaries of the revised critical habitat designation. Other previously designated critical habitat for the wintering piping plover in Texas or elsewhere in the United States remains unaffected.
On October 21, 2008, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in North Carolina under the Endangered Species Act of 1973, as amended (73 FR 62816 - 62841). In total, approximately 2,043 acres (ac) (827 hectares (ha)), in Dare and Hyde Counties, North Carolina, fall within the boundaries of the revised critical habitat designation.
On July 10, 2001, the Fish and Wildlife Service (Service), designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for the wintering population of the piping plover (Charadrius melodus) (66 FR 36038 - 36143). This includes approximately 2,891.7 kilometers (km) (1,798.3 miles (mi)) of mapped shoreline and approximately 66,881 hectares (ha) (165,211 acres (ac)) of mapped area along the Gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons.
On September 11, 2002, the U.S. Fish and Wildlife Service (Service), designated critical habitat for the northern Great Plains breeding population of the piping plover (Charadrius melodus), pursuant to the Endangered Species Act of 1973, as amended (67 FR 57638 - 57717). The designation includes 19 critical habitat units containing prairie alkali wetlands, inland and reservoir lakes, totaling approximately 183,422 acres (ac) (74,228.4 hectares (ha)) and portions of 4 rivers totaling approximately 1,207.5 river miles (rm) (1,943.3 kilometers (km)) in the States of Minnesota, Montana, Nebraska, North Dakota, and South Dakota.
Critical habitat includes prairie alkali wetlands and surrounding shoreline, including 200 feet (ft) (61 meters (m)) of uplands above the high water mark; river channels and associated sandbars, and islands; reservoirs and their sparsely vegetated shorelines, peninsulas, and islands; and inland lakes and their sparsely vegetated shorelines and peninsulas. Section 7 of the Endangered Species Act requires Federal agencies to ensure that actions they authorize, fund, or carry out are not likely to destroy or adversely modify critical habitat.

Critical Habitat Designation

18 units are designated as revised critical habitat in Texas for the wintering population of the piping plover. The units are divided into 24 areas: (1)Subunit TX–3A: South Padre Island – Gulf of Mexico Shoreline; (2)Subunit TX–3B: South Padre Island –Interior; (3)Subunit TX–3C: North Padre

Island – Interior; (4)Subunit TX–3D: North Padre Island – Gulf of Mexico; (5)Subunit TX–3E: Mesquite Rincon; (6)Unit TX–4: Lower Laguna Madre Mainland; (7)Unit TX–7: Newport Pass/Corpus Christi Pass Beach; (8)Unit TX–8: Mustang Island Beach; (9)Unit TX–9: Fish Pass Lagoons; (10)Subunit TX–10A: Shamrock Island; (11)Subunit TX–10B: Mustang Island – Unnamed sand flat; (12)Subunit TX–10C: Mustang Island – Lagoon Complex; (13)Unit TX–14: East Flats; (14)Unit TX–15: North Pass; (15)Unit TX–16: San Jose Beach; (16)Unit TX–18: Cedar Bayou/Vinson Slough; (17)Unit TX–19: Matagorda Island Beach; (18)Unit TX–22: Decros Point; (19)Unit TX–23: West Matagorda Peninsula Beach; (20)Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West; (21)Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East; (22)Unit TX–31: San Bernard NWR Beach; (23)Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers; and (24)Unit TX–33: Bryan Beach and Adjacent Beach.

Unit TX–3: Padre Island Subunit. TX–3A: South Padre Island – Gulf of Mexico Shoreline. This subunit consists of 2,891 ac (1170 ha) in Cameron and Willacy Counties, Texas. It is a beach 30.0 mi (48.2 km) in length on the gulfside of South Padre Island, which is a barrier island. The subunit is located within an area bounded on the south by the southern boundary of Andy Bowie County Park, and on the north by the south jetty of Mansfield Channel, which divides North and South Padre Islands. The jetty itself is outside the boundary of the subunit. The eastern boundary is the estimated MLLW of the Gulf of Mexico, and the western boundary is the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. The vegetated dune and Park Road 100, which runs northsouth along the western side of the dune, separates Subunits TX–3A and 3B. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately one quarter of the subunit is in Federal ownership and managed by the Service’s Laguna Atascosa National Wildlife Refuge (NWR), and approximately 64 percent is in private ownership. The Service does not own the subsurface mineral rights. Ten percent is State land managed by the GLO, and a small portion at the southern end is County park land managed by Andy Bowie County Park. Subunit TX–3A is the southernmost unit of the revised critical habitat for the wintering population of the piping plover. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1), surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greatest magnitude at the southern end of the subunit where housing developments are to the west of the subunit. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3B: South Padre Island –Laguna Madre side. This bayside subunit consists of 44,137 ac (17,862 ha) in Cameron and Willacy Counties, Texas. Its southern boundary extends along the north side of an existing earthen, manmade dike running from the edge of dense dune vegetation to the Laguna Madre along latitude 26° 09’ 19.00’’ N. The dike is not within the boundary of the subunit. The western boundary is the western edge of the intertidal mudflats bordering the eastern shore of the lower Laguna Madre, and the northern boundary is Mansfield Channel. The eastern boundary is dense vegetation of the dunes or, if there is no dense vegetation or dune, the western boundary of Park Road 100. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately 42 percent of the land is federally owned and managed by the Service’s Laguna Atascosa NWR, and approximately 38 percent is Stateowned and managed by the GLO. The remaining 20 percent is in private ownership along the western side of the subunit. The Service does not own the subsurface mineral rights beneath the refuge. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand and mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. These threats, particularly vehicle access, are of greatest magnitude at the southern portion of the subunit where roads are near or adjacent to PCE 1. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3C: North Padre Island – Laguna Madre side. This bayside unit consists of 50,897 ac (20,597 ha) in Kenedy and Kleberg Counties, Texas. It is along and within the Laguna Madre and extends from the western boundary of Padre Island National Seashore (PAIS) to the Gulf Intracoastal Waterway (GIWW). The northern boundary of the subunit is a line extending westward from the PAIS (at latitude 27° 4’ 29.9’’ N), and its southern boundary is a line extending westward from the southern boundary of PAIS along the northern edge of the Mansfield Channel. The eastern boundary of this subunit is the western boundary of PAIS when the PCEs extend as far as PAIS or the eastern edge of the sand flats where the PCEs end. The portion of the western boundary north of longitude/latitude coordinate 26°48’38.2’’N, 97°28’11.6’’W is the eastern edge of the GIWW, and the portion of the western boundary south of the coordinate is the western edge of the intertidal mudflats bordering the eastern shore of the Laguna Madre. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is State-owned and managed by the GLO. A small portion is in private ownership. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time the Service is not aware of any management plans that address this species in this area. Subunit TX–3D: North Padre Island – Gulf of Mexico. This gulfside subunit consists of 270 ac (109 ha) of beach in Kleberg County, Texas. It extends along the gulf shore of North Padre Island from the northern boundary of PAIS northward 6.2 mi (10 km) to the Nueces County line. The southern boundary is the north boundary of the northeast section of the PAIS. The subunit extends eastward to the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Most of the land is owned by the State and managed by the GLO. Approximately one-fifth is in private ownership. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surfcast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greater magnitude at the north end of the subunit, where more roads provide easy access to the PCEs and the subunit is in close proximity to houses. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–3E: North Padre Island – Mesquite Rincon. This triangular bayside subunit of 9,6238 acres (3,894 hectares) lies on the western shore of the lower Laguna Madre in Kenedy County, Texas. The subunit is generally bounded by Rincon de la Soledad on the southwestern side, Mesquite Rincon on the north, and the GIWW and Rincon de San Jose on the east. The southwestern boundary is an irregular line along the PCEs between the latitude/longitude coordinate points: 26° 44’ 10.5’’ N, 97° 28’ 04.5’’ W at the southeastern point of Rincon de San Jose and 26° 50' 58.1'' N, 97° 34' 19.5'' W. The northern boundary is the line described between the latitude/longitude coordinate points: 26° 51' 24.2'' N, 97° 33' 25.8'' W and 26° 51' 24.2'' N, 97° 27' 52.7'' W. The northern portion of the eastern boundary is the western edge of the GIWW south to latitude/longitude coordinate point 26° 48' 52.7'' N, 97° 28' 12.9'' W. There the subunit curves westward and skirts a small horseshoeshaped inlet in the Laguna Madre to the northeastern point of Rincon de San Jose at latitude/longitude coordinate point 26° 48' 43.9'' N, 97° 29' 4.7'' W. There it continues south in an irregular line along the edge of the PCEs to the southeastern point of Rincon San Jose. Within that boundary (especially the southeastern portion of the subunit and northwestern-running edge), the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is in private ownership with a small portion that is State-owned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–4: Lower Laguna Madre Mainland. This bayside unit consists of 17,223 ac (6,970 ha) in Cameron and Willacy Counties, Texas, and lies along the western shoreline of the Lower Laguna Madre. The southern boundary is an east-west line at the northern tip of Barclay Island, approximately following latitude 26° 14' 42.2'' N. The northern boundary is an east-west line located near the northern tip of El Sauz Island, approximately 1.2 mi (1.9 km) south of the center of the city of Port Mansfield, Willacy County, Texas, and approximately following latitude 26° 32' 7.8'' N. The eastern boundary of the unit is the eastern edge of the line of dredge spoils that parallel the western side of the GIWW. The western boundary runs from southeast to northwest and is the western edge of sandy beach and mudflat habitat, approximately following the latitude/longitude coordinate points: latitude/longitude coordinate points: 26° 14' 42.45'' N, 97° 19' 32.75'' W; 26° 17' 15.54'' N, 97° 20' 47.31'' W; 26° 20' 10.17'' N, 97° 21' 10.94'' W; 26° 21' 31.54'' N, 97° 22' 48.10'' W; 26° 24' 26.64'' N, 97° 23' 53.27'' W; 26° 26' 8.55'' N, 97° 25' 13.33'' W; and 26° 32' 5.44'' N, 97° 27' 6.91'' W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service has used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately one-third of this unit is within the Service's Laguna Atascosa NWR. Approximately half is Stateowned and managed by the GLO. The remainder is in private ownership. The Service does not own the subsurface mineral rights beneath the surface of the refuge. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand or mud flats above high tide for roosting (PCE 2). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This unit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–7: Newport Pass/Corpus Christi Pass Beach. This unit consists of 294 ac (119 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 5.1-mi (8.2- km) long. The southern boundary is the gulfward extension of Saint Bartholomew Avenue, adjacent to the north end of the seawall. The northern boundary is the edge of the south jetty of the Fish Pass Structure at Mustang Island State Park. The eastern boundary is MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dune. Packery Channel cuts the beach approximately 0.3 mi (0.5 km) north of the south boundary. The seawall, jetty, bollards, and open water of Packery Channel are not within the boundaries of the unit. This unit is in State and private ownership; the State portion is managed by the Mustang Island State Park. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains PCEs in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–8: Mustang Island Beach. This unit consists of 623 ac (252 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 12.5 mi (20.1 km) long. The southern boundary is the edge of the north jetty of the Fish Pass Structure at Mustang Island State Park. The northern boundary is the south side of the Horace Calder Pier in Port Aransas, Texas. The unit is bounded on the east by the MLLW of the Gulf of Mexico, and on the west by the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated. The jetty and pier are not within the boundary of the unit. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is in State and private ownership, with a small municipal park owned and managed by the City of Port Aransas. The State land is managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–9: Fish Pass Lagoons. This bayside unit consists of 168 ac (68 ha) in Nueces County, Texas. This unit encompasses flats facing Corpus Christi Bay that extend 1.0 km (0.6 mi) on either side of Fish Pass. The inland boundary is a line of dense vegetation, and the bayside boundary is the northeast edge of the tidal sand flats that are a PCE. This unit includes all areas of habitat that contain PCEs 1, 2, 5, and 6 within the area described by a polygon with the following latitude/longitude coordinate points: 27° 42’ 14.63’’ N, 97° 10’ 44.70’’ W; 27° 41’ 56.97’’ N, 97° 10’ 8.13’’ W; 27° 41’ 24.35’’ N, 97° 10’ 36.89’’ W; 27° 41’ 18.98’’ N, 97° 11’ 16.79’’ W; 27° 41’ 23.51’’ N, 97° 11’ 31.32’’ W and 27° 42’ 14.63’’ N, 97° 10’ 44.70’’ W. Within that polygon, six moderate to large polygons from 5 to 64 ac (2 to 25 ha) each and two small polygons less than 1 ac (0.4 ha) each are PCEs and comprise the unit. Most of the unit is owned by the State and managed by the GLO. A few acres are in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and/or mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–10: Shamrock Island and Adjacent Mustang Island Flats. Subunit TX–10A: Shamrock Island. This 12-ac (5-ha) island in Nueces County, Texas, was a peninsula extending off of Mustang Island in Corpus Christi Bay until erosion separated the island from the mainland. Five small polygons of sand flats from 1.1 to 6.8 ac (0.4 to 2.7 ha) comprise the subunit. Most of the land is State-owned and managed by the GLO; the remainder is privately owned. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10B: Mustang Island: Unnamed sand flat. This 2-ac (1-ha) subunit in Nueces County, Texas, is a small, unnamed sand flat near the north edge of the mouth of Wilson’s Cut in Corpus Christi Bay. The subunit is the western half of the island that is sand flats landward (easterly) to the western edge of tidal marsh. It is entirely Stateowned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. The location of the subunit, and the configuration of the polygons of PCEs that comprise this subunit, limit recreational access by vehicles to PCEs 1 and 2. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10C: Mustang Island: Lagoon Complex. This 331-ac (134-ha) subunit in Nueces County, Texas, is an extensive lagoon complex that consists of 11 polygons within a larger polygon that extends 2.2 mi (3.5 km) south of Wilson’s Cut in Corpus Christi Bay. The southern boundary of the larger polygon begins at the western end at latitude/ longitude coordinate point 27° 43’ 2,4’’ N, 97° 10’ 19.4’’ W at the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. It follows the dune line southeast approximately 830 ft (253 m) to a road, then follows the road approximately 945 ft (288 m) to the edge of the tidal sand flat PCE. It follows the southeastern edge of the sand flat northeast to the western edge of a northsouth road, where it follows the edge of the sand flat northward to the south edge of a road that runs east-west parallel to the southwestern edge of Wilson’s Cut. The northern edge of the boundary is the south edge of the road or the northern extent of the sand flat when it does not reach the road. The western boundary follows the PCEs along their eastern edge at Corpus Christi Bay beginning 409 ft (125 m) southwest of the southwestern edge of Wilson’s Cut to the coordinate point at the western edge of the southern boundary. A road transects the larger polygon described above, forming two polygons that exclude the road. The PCEs within the 11 polygons comprise the subunit. Within that boundaries of the 11 polygons, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the polygons that comprise the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundaries can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. The subunit consists of private and Stateowned lands. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to uncontrolled recreational access and beach cleaning and stabilization efforts. Road access to the PCEs is extensive. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–14: East Flats. This bayside unit consists of 591 ac (239 ha) in Nueces County, Texas. It is an irregularly shaped intertidal sand flat south of the Corpus Christi Ship Channel. The north boundary is the northern edge of the sand flat near or adjacent to dredge spoil areas bordering the south side of the Corpus Christi Ship Channel. The northwestern latitude/longitude coordinate is 27° 49’ 54.49’’ N, 97° 6’ 14.28’’ W, and the northeastern latitude/longitude coordinate is 27° 49’ 55.29’’ N, 97° 5’ 12.86’’ W. From there, the sand flat curves southward, and the southeastern edge of it forms a highly irregular line that ends in the southwest portion of the polygon at the eastern edge of a navigation channel from the Corpus Christi Ship Channel to Corpus Christi Bay at latitude/longitude coordinate 51.93’’ N, 97° 5’ 52.58’’ W. The sand flat continues on the western edge of the navigation channel in a northwesterly direction to latitude/longitude coordinate 27° 49’ 22.08’’ N, 97° 6’ 37.04’’ W. It then curves northeasterly and across the cut to the northern edge at the northwest coordinate. On the east, it abuts the City of Port Aransas. There is a small marshland within the sand flat that bisects the sand flat that is not a PCE and is not included in the unit. The unit is mostly in private ownership, with a small portion of State land managed by the GLO. This unit was occupied at the time of listing and is currently occupied. Current ocupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–15: North Pass. This bayside unit consists of 805 ac (326 ha) in Aransas County, Texas. The unit is bounded on the northeast by a line between latitude/longitude coordinates 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W and 27° 54′ 54.53′′ N, 97° 1′ 18.17′′ W, on the northwest and west by the edge of tidal sand flats in Aransas Bay, on the south by a line running east from coordinate 27° 53′ 16.96′′ N, 97° 2′ 22.44′′ W to unit TX–16, and on the southeast by the landward boundary of unit 16. The unit is all areas that contain the PCEs for the species within a larger area described by a polygon with the following sets of latitude/longitude coordinate points: 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W; 27° 53′ 10.68′′ N, 97° 1′ 21.36′′ W; 27° 53′ 16.96′′ N, 97° 2′ 22.44′′ W; 27° 53′ 33.08′′ N, 97° 2′ 33.05′′ W; 27° 54′ 42.68′′ N, 97° 2′ 4.83′′ W; 27° 54′ 47.59′′ N, 97° 1′ 51.73′′ W; 27° 54′ 54.53′′ N, 97° 1′ 18.17′′ W and 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale, so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit is a remnant of a hurricane washover on San Jose Island. Approximately 18 percent is Stateowned and managed by the GLO; the remainder is in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–16: San Jose Beach. This unit consists of 1,378 ac (558 ha) in Aransas County, Texas. It is a gulfside beach unit approximately 19.8 mi (31.9 km) long. The southern boundary is the edge of the north jetty of Aransas Pass. The jetty is not within the boundary of the unit. The south edge of Cedar Bayou Pass is the northern boundary. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. A small section is in Federal ownership and managed by the Service’s Matagorda Island NWR. The Service does not own the subsurface mineral rights. Approximately half of the unit is State-owned and managed by the GLO, and nearly as much is in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–18: Cedar Bayou/Vinson Slough. This bayside unit consists of 2,465 ac (998 ha) in Aransas County, Texas. It is a remnant of a hurricane washover area and includes the highly dynamic area of Cedar Bayou, the pass that separates San Jose Island and Matagorda Island. Beginning at the confluence of Vinson Slough and Cedar Bayou, the boundary follows the shore of Spalding Cove to Long Reef, then continues along a line extending 2.5 miles southwest of Long Reef to the shore of San Jose Island, then along the shore of the island to the landward boundary of Unit TX–16. Within that area, the unit consists of numerous polygons of PCEs; areas that are not PCEs within the described area are not within the boundaries of the unit. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. The southern and southeastern boundary of the unit is described by a line with the following sets of latitude/longitude coordinate points: 28° 1′ 21.76′′ N, 96° 57′ 51.24′′ W; 28° 1′ 12.77′′ N, 96° 57′ 31.18′′ W; 28° 2′ 3.07′′ N, 96° 56′ 45.84′′ W; 28° 2′ 15.92′′ N, 96° 56′ 25.10′′ W; 28° 2′ 30.32′′ N, 96° 56′ 11.97′′ W; 28° 3′ 15.62′′ N, 96° 54′ 20.01′′ W; 28° 3′ 58.58′′ N, 96° 53′ 24.65′′ W; 28° 4′ 1.15′′ N, 96° 52′ 14.65′′ W; 28° 3′ 31.74′′ N, 96° 51′ 38.29′′ W and 28° 3′ 17.69′′ N, 96° 51′ 38.47′′ W. The specific northern boundary is described by a line with the following sets of latitude/longitude coordinate points: 28° 5′ 44.24′′ N, 96° 54′ 8.16′′ W; 28° 5′ 13.23′′ N, 96° 52′ 44.85′′ W; 28° 4′ 33.99′′ N, 96° 50′ 46.55′′ W; 28° 4′ 38.92′′ N, 96° 50′ 40.79′′ W and 28° 4′ 22.98′′ N, 96° 50′ 22.94′′ W. The eastern boundary at the northeastern end of the unit is units TX–16 and TX–19 on the gulfside. The western boundary is the western edge of tidal sand flats in Aransas Bay. This area includes a small section of federally owned land managed by the Service’s Matagorda Island NWR and a small section of State-owned land. The remaining area is privately owned. The Service does not own the subsurface mineral rights beneath the NWR. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use. Vehicle use of the unit may be limited somewhat by accessibility. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–19: Matagorda Island Beach. This unit consists of 2,413 ac (976 ha) in Calhoun County, Texas. It is a gulfside beach unit approximately 37.1 mi (59.7 km) long. The southern boundary is the northern edge of Cedar Bayou Pass, and the northern boundary is the southern edge of Pass Cavallo. At Pass Cavallo, the unit curves from the eastern gulfside passing between the south edge of the pass and the north edge of the dunes to a small area on the bayside. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The federally owned land in this unit is managed by the Service's Matagorda Island NWR, which does not own the subsurface mineral rights. This unit also includes a small section of land in State ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and access by refuge staff and others for sea turtle monitoring efforts. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–22: Decros Point. This unit consists of 544 ac (220 ha) at the Matagorda/Calhoun County line, in Texas. It is a gulfside beach unit approximately 4.8 mi (7.7 km) long that wraps around to the bayside. This unit was originally the southern tip of the Matagorda Peninsula. It was made into an island by the dredging of the Matagorda Ship Channel, the edge of which is the northern boundary of the unit. The unit is horseshoe in shape with the east side along the Gulf of Mexico and the west side along Matagorda Bay; the two are connected at their southern boundary by habitat from the north edge of Pass Cavallo northward to the dune line. Densely vegetated sand dunes run north to south in the center of the horseshoe and are not within the boundary of the critical habitat because they are not a PCE. The eastern boundary is the MLLW of the Gulf of Mexico (see the Methods section for our derivation of MLLW), and the western boundary is the western edge of tidal sand flats on the east side of Matagorda Bay. Within the bayside of the boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 60 percent of the unit is in State ownership managed by the GLO. The remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach (PCE 4) for roosting and sheltering. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Due to a lack of road access, this unit does not receive much recreational vehicle use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–23: West Matagorda Peninsula Beach. This unit consists of 1,808 ac (732 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 23.9 mi (38.5 km) long. The southern boundary is the northern jetty of the Matagorda Ship Channel. The northern boundary is the Old Colorado River channel. The MLLW of the Gulf of Mexico is the eastern boundary, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just under half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West. This unit consists of 905 ac (366 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 14.1 mi (22.8 km) long. The southwestern boundary is the northeastern edge of the Old Colorado River channel. The unit runs along the beach 14 mi (23 km) to the northeastern boundary opposite Eidelbach Flats described by a line between the latitude/longitude coordinate points: 28° 41’ 2.26’’ N, 95° 46’ 29.04’’W and 28° 41’ 6.74’’ N, 95° 46’ 32.46’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just over half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East. This gulfside unit consists of 481 ac (194 ha) in Matagorda County, Texas. It extends along the Gulf beach southwest and northeast of Brown Cedar Cut. The cut is not within the boundary of the unit. This unit abuts portions of the southeastern edges of units TX–29 and TX–30, which are on the East Matagorda Bay side. The southwestern boundary is approximately 4 mi (6.5 km) southwest of Brown Cedar Cut at a line described by the following sets of latitude/ longitude coordinate points: 28° 43’ 11.91’’N, 95° 42’ 25.47’’W and 28° 43’ 17.09’’N, 95° 42’ 28.56’’W. The northeastern boundary is approximately 2.8 mi (4.5 km) northeast of Brown Cedar Cut to the point where Texas Farm to Market Road 457 intersects the beach. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat boundaries, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately onethird is in State ownership and managed by the GLO; the remaining two-thirds is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–31: San Bernard NWR Beach. This gulfside unit consists of 401 ac (162 ha) in Matagorda and Brazoria Counties, Texas. It is a 6.2-mi (10-km) segment of beach on the Gulf of Mexico near the mouth of the San Bernard River. The northeastern boundary is at the southwestern edge of the mouth of the San Bernard River. The southwestern boundary follows a line described by the following sets of latitude/longitude coordinate points: 28° 47’ 54.39’’ N, 95° 33’ 26.21’’ W, and 28° 47’ 57.69’’ N, 95° 33’ 27.75’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. There is a cut through the beach from the Gulf of Mexico to a lake 3.5 mi (5.6 km) southwest of the San Bernard River, which is not within the unit. Bollards also are not within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 30 percent of this unit is in Federal ownership and managed by the Service's San Bernard NWR, which does not own the subsurface mineral rights. Approximately 48 percent is Stateowned and managed by the GLO with the remaining area in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The federally owned portion has pedestrian recreational access, but no vehicle access. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers. This gulfside unit consists of 556 ac (225 ha) of shoreline in Brazoria County, Texas. This unit is a 6.1-mi (9.8-km) segment of beach on the Gulf of Mexico between the mouths of the San Bernard and Brazos Rivers. The southwestern boundary is the northeastern edge of the mouth of the San Bernard River. The northeastern boundary is the western edge of the mouth of the Brazos River. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. It is entirely in State ownership and managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–33: Bryan Beach and Adjacent Beach. This unit consists of 211 ac (85 ha) in Brazoria County, Texas. It is gulfside beach approximately 3.5 mi (5.7 km) in length on the Gulf of Mexico near the mouth of the Brazos River. The southwestern boundary is the northeastern edge of the Brazos River. The northeastern boundary is Farm-toMarket Road 1495 (Bryan Beach Rd). The southeastern boundary is the MLLW. The northwestern boundary follows along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is entirely in State ownership and managed by the Texas Department of Parks and Wildlife. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Four units are designated as critical habitat for the wintering population of the piping plover in North Carolina. The four areas designated as critical habitat are: (1) Unit NC–1, Oregon Inlet; (2) Unit NC–2, Cape Hatteras Point; (3) Unit NC–4, Hatteras Inlet; and (4) Unit NC–5, Ocracoke Island.

Unit NC–1: Oregon Inlet. Unit NC–1 is approximately 8.0 km (5.0 mi) long, and consists of about 196 ha (485 ac) of sandy beach and inlet spit habitat on Bodie Island and Pea Island in Dare County, North Carolina. This is the northernmost critical habitat unit within the wintering range of the piping plover. Oregon Inlet is the northernmost inlet in coastal North Carolina, approximately 19.0 km (12.0 mi) southeast of the Town of Manteo, the county seat of Dare County. The unit is bounded by the Atlantic Ocean on the east and Pamlico Sound on the west and includes lands from the mean lower low water (MLLW) on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where the PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit begins at Ramp 4 near the Oregon Inlet Fishing Center on Bodie Island and extends approximately 8.0 km (5.0 mi) south to the intersection of NC Highway 12 and Salt Flats Wildlife Trail (near Mile Marker 30, NC Highway 12), approximately 5.0 km (3.0 mi) from the groin, on Pea Island, and includes Green Island and any emergent sandbars south and west of Oregon Inlet, and the lands owned by the State of North Carolina, specifically islands DR–005–05 and DR–005–06. However, this unit does not include the Oregon Inlet Fishing Center, NC Highway 12, the Bonner Bridge and its associated structures, the terminal groin, the historic Pea Island Life-Saving Station, or any of their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Oregon Inlet has reported consistent use by wintering piping plovers dating from the mid-1960s. As many as 100 piping plovers have been reported from a single day survey during the fall migration (NCWRC unpublished data). Christmas bird counts regularly recorded 20 to 30 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall number of piping plovers reported using the area has declined since the species was listed in 1986 (NCWRC unpublished data), which corresponds to increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Oregon Inlet is one of the first beach access points for off-road vehicles within Cape Hatteras National Seashore when traveling from the developed coastal communities of Nags Head, Kill Devil Hills, Kitty Hawk, and Manteo. As such, the inlet spit is a popular area for off-road vehicle users to congregate. The majority of the Cape Hatteras National Seashore users in this area are off-road vehicle owners and recreational fishermen. In fact, a recent visitor use study of Cape Hatteras National Seashore reported that Oregon Inlet is the second most popular off-road vehicle use area in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby Oregon Inlet Fishing Center. Pea Island National Wildlife Refuge (PINWR) does not allow off-road vehicle use; however, Pea Island regularly receives dredged sediments from the maintenance dredging of Oregon Inlet by the Corps. The disposal of dredged sediments on PINWR has the potential to disturb foraging and roosting plovers and their habitats. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–2: Cape Hatteras Point. Unit NC–2 consists of 262 ha (646 ac) of sandy beach and sand and mud flat habitat in Dare County, North Carolina. Cape Hatteras Point (also known as Cape Point or Hatteras Cove) is located south of the Cape Hatteras Lighthouse. The unit extends south approximately 2.8 mi (4.5 km) from the ocean groin near the old location of the Cape Hatteras Lighthouse to the point of Cape Hatteras, and then extends west 4.7 mi (7.6 km) along Hatteras Cove shoreline (South Beach) to the edge of Ramp 49 near the Frisco Campground. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where PCEs do not occur). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. This unit does not include the ocean groin. Consistent use by wintering piping plover has been reported at Cape Hatteras Point since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Cape Hatteras Point independently from Hatteras Inlet. These single day surveys have recorded as many as 13 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Cape Hatteras Point is located near the Town of Buxton, the largest community on Hatteras Island. For that reason, Cape Hatteras Point is a popular area for ORV use and recreational fishing. A recent visitor use study of the park found that Cape Hatteras Point had the most ORV use within the park (Vogelsong 2003). As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–4: Hatteras Inlet. Unit NC–4 is approximately 8.0 km (5.0 mi) long, and consists of 166 ha (410 ac) of sandy beach and inlet spit habitat on the western end of Hatteras Island and the eastern end of Ocracoke Island in Dare and Hyde Counties, North Carolina. The unit begins at the first beach access point at Ramp 55 at the end of NC Highway 12 near the Graveyard of the Atlantic Museum on the western end of Hatteras Island and continues southwest to the beach access at the ocean-side parking lot near Ramp 59 on the northeastern end of Ocracoke Island. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which itself is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The Hatteras Inlet unit includes all emergent sandbars within Hatteras Inlet including lands owned by the State of North Carolina, specifically Island DR–009–03/04. The unit is adjacent to, but does not include, the Graveyard of the Atlantic Museum, the ferry terminal, the groin on Ocracoke Island, NC Highway 12, or their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Hatteras Inlet has reported consistent use by wintering piping plovers since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Hatteras Inlet independently from Cape Hatteras Point. These single-day surveys have recorded as many as 40 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall numbers of piping plovers reported using the area has declined in the last 10 years (NCWRC unpublished data), corresponding with increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Hatteras Inlet is located near the Village of Hatteras, Dare County, and is the southernmost point of Cape Hatteras National Seashore that can be reached without having to take a ferry. As such, the inlet is a popular off-road vehicle and recreational fishing area. In fact, a recent visitor use study of the park found Hatteras Inlet the fourth most used area by off-road vehicles in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby marinas of Hatteras Village. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–5: Ocracoke Island. This unit consists of 203 ha (502 ac) of sandy beach and mud and sand flat habitat in Hyde County, North Carolina. The unit includes the western portion of Ocracoke Island beginning at the beach access point at the edge of Ramp 72 (South Point Road), extending west approximately 2.1 mi (3.4 km) to Ocracoke Inlet, and then back east on the Pamlico Sound side to a point where stable, densely vegetated dune habitat meets the water. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit includes all emergent sandbars within Ocracoke Inlet. This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. The unit is adjacent to but does not include NC Highway 12, any portion of the maintained South Point Road at Ramp 72, or any of their ancillary facilities. Ocracoke Island had inconsistent recorded use by wintering piping plovers in the early 1980s, and Christmas bird counts recorded only 1 to 6 plovers using the area throughout the early 1990s.

However, since the late 1990s when regular and consistent surveys of the area were conducted, as many as 72 piping plovers have been recorded during migration, and 4 to 18 plovers have been regularly recorded during the overwinter period (NCWRC unpublished data). Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). Ocracoke Inlet is located near the Village of Ocracoke, and is the southernmost point of the Cape Hatteras National Seashore. Ocracoke Island is only accessible by ferry. As such, the island is a popular destination for vacationers and locals interested in seclusion. The inlet is also a popular recreational fishing and ORV area. A recent visitor use study of the park reported Ocracoke Inlet was the third most popular ORV use area in the park (Vogelsong 2003). As a result, the primary threat to the wintering piping plover and its habitat within this unit is disturbance to and degradation of foraging and roosting areas by ORVs and by people and their pets. Therefore, sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

The lands designated as critical habitat were divided into 142 critical habitat conservation units that contain areas with the primary constituent elements for the piping plover in the wintering range of the species. These units are found in all eight States where piping plovers winter. See above for revised critical habitat in NC and TX (Units TX– 3, TX–4, TX–7, TX–8, TX–9, TX–10, TX–14, TX–15, TX–16, TX–18, TX–19, TX–22, TX–23, TX–27, TX–28, TX–31, TX–32, and TX–33).

Unit SC–1: Waites Island-North. 75 ha (186 ac) in Horry County. This unit includes the northern tip of Waites Island from the MLLW at Little River Inlet and runs west along the Atlantic Ocean shoreline 2.0 km (1.25 mi) and includes land from the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The unit continues north and west of Little River Inlet stopping at Sheephead Creek, including land from MLLW to dense vegetation line. The majority of the unit is privately owned.

Unit SC–2: Waites Island-South. 58 ha (142 ac) in Horry County.This unit includes the southern tip of Waites Island from the MLLW at Hog Inlet and runs east along the Atlantic Ocean shoreline 0.80 km (0.50 mi) and includes MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It continues north and west of the Hog inlet, stopping at the first major tributary. Critical habitat includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Emerging sandbars within Hog Inlet and adjacent to the tip if eastern Cherry Grove Beach are also included from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur. The majority of this unit is privately owned.

Unit SC–3: Murrells Inlet/Huntington Beach. 135 ha (334 ac) in Georgetown County. The majority of the unit is within Huntington Beach State Park. This unit extends from the southern tip of Garden City Beach, just south of the groins (a rigid structure or structures built out from a shore to protect the shore from erosion or to trap sand) north of Murrells Inlet from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur stopping perpendicular with the southern end of Inlet Point Drive. It includes from MLLW south of Murrells Inlet to the northern edge of North Litchfield Beach approximately 4.5 km (3.0 mi). The unit includes the MLLW from the Atlantic Ocean up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The lagoon at the north end of Huntington Beach State Park is also included.

Unit SC–4: Litchfield. 11 ha (28 ac) in Georgetown County. This unit includes the southern tip of Litchfield Beach beginning 0.50 km (0.30 mi) north of Midway Inlet and stopping at the MLLW at Midway Inlet. It includes from the MLLW on the Atlantic Ocean shoreline across and including land to the MLLW on the back bayside. This unit is mostly privately owned.

Unit SC–5: North Inlet. 99 ha (245 ac) in Georgetown County. The majority of the unit is within Tom Yawley Wildlife Center Heritage Preserve. This unit extends from MLLW to 1.0 km (.62 mi) north of North Inlet on Debidue Beach. It includes shoreline on the Atlantic Ocean from MLLW to the MLLW on the western side of the peninsula. This unit also includes from the MLLW south of North Inlet 1.6 km (1.0 mi). It includes the shoreline on the Atlantic Ocean from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It includes shoreline running south and west of the inlet from the MLLW stopping at the MLLW at the first large tributary (no name).

Unit SC–6: North Santee Bay Inlet. 305 ha (753 ac) in Georgetown County. The majority of the unit is within the Tom Yawley Wildlife Center Heritage Preserve and the Santee-Delta Wildlife Management Area. This unit is at the North Santee Bay inlet and includes lands of South Island, Santee Point, Cedar Island, and all of North Santee Sandbar. This unit includes from MLLW at North Santee Bay Inlet running north along the Atlantic Ocean side of South Island 7.2 km (4.5 mi), stopping 0.60 km (0.4 mi) north of an unnamed inlet. It includes areas from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This unit includes the eastern side of Cedar Island adjacent to the North Santee Bay Inlet from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of North Santee Sandbar to MLLW is included.

Unit SC–7: Cape Romain. 315 ha (777 ac) in Charleston County.The majority of the unit is within Cape Romain National Wildlife Refuge. This unit includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the southern and southeastern most 1.9 km (1.2 mi) portion of Cape Island, the southernmost portion of Lighthouse Island from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, all of Lighthouse Island South to MLLW, and the southern side of the far eastern tip of Raccoon Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–8: Bull Island. 134 ha (332 ac) in Charleston County. The majority of the unit is within Cape Romain National Wildlife Refuge and land owned by the South Carolina Department of Natural Resources. This unit includes from Schooner Creek on north and south of the river to north of Price’s Inlet on the southern portion of Bull Island along the Atlantic Ocean 1.6 km (1.0 mi) and south of Price’s Inlet on the northeast tip of Capers Island Heritage Preserve 1.4 km (.86 mi) along the Atlantic Ocean. All areas begin at MLLW and extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–9: Stono Inlet. 495 ha (1223 ac) in Charleston County.Most of this unit is privately owned. It includes the eastern end of Kiawah Island (approximately 4.0 km (2.5 mi)) from MLLW on Atlantic Ocean running north to MLLW on first large tributary connecting east of Bass Creek running northeast into Stono River. It includes MLLW up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur along Stono Inlet and River. All of Bird Key-Stono Heritage Preserve and all of Skimmer Flats to MLLW are included. The Golf course and densely vegetated areas are not included.

Unit SC–10: Seabrook Island. 117 ha (290 ac) in Charleston County.This unit runs from just 0.16 km (0.10 mi) north of Captain Sams Inlet to the southwest approximately 3.4 km (2.1 mi) along the Atlantic Ocean shoreline. It includes land areas from the MLLW on the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Most of this unit is privately owned.

Unit SC–11: Deveaux Bank. 130 ha (322 ac) in Charleston County. The entire unit is within Deveaux Bank Heritage Preserve. This unit includes all of Deveaux Island to the MLLW and is State-owned.

Unit SC–12: Otter Island. 68 ha (169 ac) in Colleton County.The majority of the unit is within St. Helena Sound Heritage Preserve. This unit includes the southern portion of Otter Island to the eastern mouth of Otter Creek. It includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The entire unit is State-owned.

Unit SC–13: Harbor Island. 50 ha (122 ac) in Beaufort County. The majority of the unit is State-owned. This unit extends from the northeastern tip of Harbor Island and includes all of Harbor Spit. It begins at the shoreline east of Cedar Reef Drive running south, stopping at the mouth of Johnson Creek. It includes the MLLW on the Atlantic Ocean and St. Helena Sound to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Harber Spit to MLLW is included.

Unit SC–14: Caper’s Island. 238 ha (589 ac) in Beaufort County. Most of this unit is privately owned. This unit includes the southern-most 4.5 km (2.8 mi) along the Atlantic Coast shoreline of Little Caper’s Island beginning at MLLW on south side of the inlet (un-named). It includes the MLLW on the Atlantic Ocean shoreline to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–15: Hilton Head. 43 ha (106 ac) in Beaufort County. The majority of this unit is State-owned. This unit includes the northeastern tip (Atlantic Ocean side) of Hilton Head Island and all of Joiner Bank. It begins at the shoreline east of northern Planters Row and ends at the shoreline east of Donax Road. It includes the MLLW of Port Royal Sound and the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Joiner Bank to MLLW is included.

Unit GA–1: Tybee Island. 37 ha (91 ac) in Chatham County. The majority of the unit is privately owned. This unit extends along the northern tip of Tybee Island starting from 0.8 km (0.5 mi) northeast from the intersection of Crab Creek and Highway 80 to 0.7 km (0.41 mi) northeast from the intersection of Highway 80 and Horse Pen Creek. The unit includes MLLW on Savannah River and Atlantic Ocean to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit GA–2: Little Tybee Island. 719 ha (1776 ac) in Chatham County. The majority of the unit is within Little Tybee Island State Heritage Preserve. This unit extends just south of the first inlet to Wassaw Sound along the Atlantic Ocean coastline, extending north along the sound 1.7 km (1.1 mi). It includes habitat from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–3: North Wassaw Island. 108 ha (267 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit includes the north-east tip of Wassaw Sound, 1.6 km (1.0 mi) along the inlet side and extending south along the Atlantic Ocean shoreline for 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–4: South Wassaw Island. 61 ha (151 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit extends from the last southern 1.6 km (1.0 mi.) on Atlantic Ocean side, around the southern tip of Wassaw Island, up to mouth of Odingsell River. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–5: Ossabaw Island. 434 ha (1072 ac) in Chatham County. entire unit is within Ossabaw Island State Heritage Preserve. This unit includes the northeastern tip from the mouth of the Bradley River east and 12 km (7.5 mi) south along the Atlantic Ocean shoreline to a point 0.4 km (0.25 mi) past the south-center inlet. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–6: St. Catherine’s Island Bar. 54 ha (135 ac) in Liberty County. The entire unit is State owned and located east-northeast of St. Catherine’s Island. This unit includes the entire St. Catherine’s Island Bar to MLLW.

Unit GA–7: McQueen’s Inlet. 215 ha (532 ac) in Liberty County. The majority of the unit is private land along the eastern-central coastline on St. Catherine’s Island. This unit extends from McQueen’s Inlet north approximately 3.5 km (2.2 mi) and south approximately 1.8 km (1.1 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–8: St. Catherine’s Island. 60 ha (147 ac) in Liberty County. The majority of the unit is private land on the southern tip of St. Catherine’s Island. This unit starts 1.2 km (0.75 mi) north of Sapelo Sound (along Atlantic Ocean shoreline) and stops inland at Brunsen Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–9: Blackbeard Island. 129 ha (319 ac) in McIntosh County. The entire unit is within the Blackbeard Island National Wildlife Refuge. This unit includes the northeastern portion of the island beginning just east of the mouth of the confluence of McCloy Creek and Blackbeard Creek and continuing east and running south along the Atlantic Ocean shoreline for 1.4 km (.90 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–10: Sapelo Island. 85 ha (210 ac) in McIntosh County. The entire unit is State-owned and within Sapelo Island. The unit extends south of Cabretta Tip approximately 0.2 km (0.13 mi) and north of Cabretta Tip 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–11: Wolf Island. 238 ha (590 ac) in McIntosh County. The majority of the unit is within Wolf Island National Wildlife Refuge and private lands just north of the Refuge. This unit includes the southeastern tip of Queen's island adjacent to the Doboy Sound and includes the eastern shoreline of Wolf Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–12: Egg Island Bar. 61 ha (151 ac) in McIntosh County. This unit is State owned and includes all of Egg Island Bar to the MLLW.

Unit GA–13: Little St. Simon's Island. 609 ha (1505 ac) in Glynn County. The majority of the unit is private land on Little St. Simon's Island. This unit includes the entire eastern coastline along Little St. Simon's Island. It begins 1.1 km (.70 mi) west of the northeast tip of Little St. Simon's Island and runs east and then south along the Atlantic Ocean shoreline stopping at the minor tributary (no name) on the southeast tip of Little St. Simon's Island north of Hampton Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Pelican Spit to MLLW is included when this sand bar is emergent.

Unit GA–14: Sea/St. Simon's Island. 191 ha (471 ac) in Glynn County. The majority of the unit is private land on the south tip of Sea Island and on the east beach of St. Simons Island. This unit extends north of Gould's Inlet (Sea Island) 2.5 km (1.54 mi) starting just south of the groin and extends south of Gould's Inlet (St. Simons Island) 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–15: Jekyll Island. 49 ha (121 ac) in Glynn County. The majority of the unit is within State lands on Jekyll Island. This unit includes the southern region of Jekyll Island beginning at the mouth of Beach Creek, running towards the tip of Jekyll Island and includes the shoreline running north along the Atlantic Ocean shoreline 1.9 km (1.20 mi) from the southern tip of Jekyll Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–16: Cumberland Island. 1454 ha (3591 ac) in Camden County. The majority of the unit is along Cumberland Island Wilderness Area and Cumberland Island National Seashore. This unit includes the majority of the eastern Atlantic Ocean shoreline of Cumberland Island. It begins .50 km (.31 mi) north of the inlet at Long Point, continues south along the Atlantic Ocean shoreline stopping 1.8 km (1.1 mi) west of the southern tip of Cumberland Island National Seashore. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Escambia County. The majority of the unit is within Big Lagoon State Recreation Area. This unit includes the peninsula and emerging sand and mudflats between 0.33 km (0.21 mi) west of the lookout tower along the shoreline and 0.24 km (0.15 mi) east of the lookout tower along the shoreline. Land along the shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All emerging sandbars to MLLW are included.

Unit FL–2: Big Sabine. 182 ha (450 ac) in Escambia County. The majority of the unit is owned by the University of West Florida. This unit includes areas adjacent to Santa Rosa Sound of Big Sabine Point and adjacent embayment between 8.0 km (5.0 mi) and 11.6 (7.2 mi) east of the Bob Sike’s Bridge. It begins 0.10 km (.06 mi) north of SR 399 to MLLW on the Santa Rosa Sound.

Unit FL–3: Navarre Beach. 48 ha (118 ac) in Escambia and Santa Rosa Counties. The majority of the unit is owned by Eglin Air Force Base and Santa Rosa Island Authority. This unit includes lands on Santa Rosa Island Sound side, between 0.09 and 0.76 mi east of the eastern end of SR 399 to MLLW on Santa Rosa Sound side.

Unit FL–5: Shell/Crooked Islands. 1789 ha (4419 ac) in Bay County.The majority of the unit is within Tyndall Air Force Base and St. Andrews State Recreation Area. This unit includes all of Shell Island, Crooked Island West, and Crooked Island East from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–6: Upper St. Joe Peninsula. 182 ha (449 ac) in Gulf County.The majority of the unit is within St. Joseph State Park. This unit includes the northern portion of the peninsula from the tip to 8.0 km (5.0 mi) south along the Gulf of Mexico from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–7: Cape San Blas. 158 ha (390 ac) in Gulf County.The entire unit is within Eglin Air Force Base. This unit includes the area known as the Cape between the eastern boundary of Eglin and mile marker 2.1, including the peninsula and all emerging sandbars. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–8: St. Vincent Island. 146 ha (361 ac) in Franklin County.The majority of the unit is within St. Vincent National Wildlife Refuge. This unit includes the western tip of St. Vincent Island that is adjacent to Indian Pass (0.80 km (0.50 mi) east of tip along Indian Pass, and 1.9 km (1.2 mi) from tip southeast along Gulf of Mexico). The unit also includes St. Vincent Point from the inlet at Sheepshead Bayou east 1.6 km (1.0 mi) to include emerging oysters shoals and sand bars and extends south 0.21 km (0.13 mi) of St. Vincent Point. The unit includes the southeastern tip of St. Vincent Island extending north 1.4 km (0.90 mi) and south and west 2.1 km (1.3 mi). The western tip of Little St. George Island 0.80 km (0.50 mi) from West Pass is included (state owned lands). All sections of this unit include land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–9: East St. George Island. 1433 ha (3540 ac) in Franklin County. The majority of the unit is within St. George State Park. This unit begins 5.3 km (3.3 mi) east of the bridge and extends to East Pass. Shell Point, Rattlesnake Cove, Goose Island, East Cove, Gap Point, and Marsh Island are included. This unit includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the Gulf of Mexico, East Pass and St. George Sound.

Unit FL–10: Yent Bayou. 153 ha (378 ac) in Franklin County. The majority of the unit is State owned. This unit is adjacent to the area known as Royal Bluff. It includes the St. George Sound shoreline between 5.9 km (3.7 mi) and 9.5 km (5.9mi) east of SR 65. It includes from MLLW to where densely vegetated habitat or developed structures such as SR 65, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–11: Carabelle Beach. 56 ha (139 ac) in Franklin County. The area within this unit is privately owned. This unit is the peninsula created by Boggy Jordan Bayou. It includes St. George Sound shoreline (south of US 98) 1.6 km (1.0 mi) southwest along US 98 from the Carrabelle River Bridge and extends 1.9 km (1.2 mi) east along the St. George Sound shoreline. It includes from MLLW to where densely vegetated habitat or developed structures such as US 98, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–12: Lanark Reef. 260 ha (643 ac) in Franklin County. The entire unit is State owned. This unit includes the entire island and emerging sandbars to MLLW.

Unit FL–13: Phipps Preserve. 42 ha (104 ac) in Franklin County. This unit includes all of Phipps Preserve (owned by The Nature Conservancy) and any emerging sandbars from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–14: Hagens Cove. 486 ha (1200 ac) in Taylor County. The majority of the unit is within Big Bend Wildlife Management Area. This unit includes all of Hagens Cove and extends from MLLW on north side of Sponge Point to MLLW on south side of Piney Point. The eastern boundary of this unit ends (0.20 mi) west of SR 361. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–15: Anclote Key and North Anclote Bar. 146 ha (360 ac) in Pasco and Pinellas Counties. The majority of the unit is within Anclote Key State Preserve. This unit includes all of North Anclote Bar to the MLLW and the north, south and western sides of Anclote Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–16: Three Rooker Bar Island. 76 ha (188 ac) in Pinellas County. The majority of the unit is within Pinellas County Aquatic Preserve. This unit includes all the islands and emerging sandbars of this complex to MLLW.

Unit FL–17: North Honeymoon Island. 45 ha (112 ac) in Pinellas County. The majority of the unit is within Honeymoon Island State Recreation Area. This unit includes from Pelican Cove north to the far northern tip of Honeymoon Island. It includes the western shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur or the MLLW on the eastern shoreline.

Unit FL–18: South Honeymoon Island. 28 ha (70 ac) in Pinellas County.The majority of the unit is private land. This unit includes the southern end (southern-most 0.32 km (0.20 mi) on western side) of Honeymoon Island and encompasses the far southeastern tip and includes any emerging islands or sandbars to Hurricane Pass. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–19: Caladesi Island. 120 ha (296 ac) in Pinellas County.The majority of the unit is within Caladesi Island State Park. This unit extends from Hurricane Pass to Dunedin Pass on the Gulf of Mexico side. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–20: Shell Key and Mullet Key. 190 ha (470 ac) in Pinellas County. The majority of the unit is within Fort Desoto Park. This unit includes the Shell Key island complex. It also includes the northwest portion of Mullet Key including the western shorelines from Bunces Pass extending south, stopping 1.4 km (.86 mi) north of Ft. Desoto County Park pier. It includes from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–21: Egmont Key. 153 ha (377 ac) Hillsborough County. The majority of the unit is within Egmont Key National Wildlife Refuge. This unit includes the entire island to MLLW.

Unit FL–22: Cayo Costa. 175 ha (432 ac) in Lee County. The majority of the unit, including its northern and southern boundaries, is within Cayo Costa State Park, and nearly all of the remaining area is in the Cayo Costa Florida Conservation and Recreation Lands (CARL) acquisition project. This unit begins at the northern limit of sandy beaches at the northern end of the island, extends through Murdock Point, which at present has a sandbar and lagoon system, and ends at the former entrance to Murdock Bayou. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–23: North Captiva Island. 36 ha (88 ac) in Lee County.The unit is within the Cayo Costa CARL land purchase project. This unit includes the western shoreline extending from 0.80 km (0.50 mi) south of Captiva Pass to approximately Foster Bay. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–25: Bunche Beach. 187 ha (461 ac) in Lee County. This unit is mostly within a CARL Estero Bay acquisition project. Bunche Beach (also spelled Bunch) lies along San Carlos Bay, on the mainland between Sanibel Island and Estero Island (Fort Myers Beach), extending east from the Sanibel Causeway past the end of John Morris Road to a canal serving a residential subdivision. The unit also includes the western tip of Estero Island (Bodwitch Point, also spelled Bowditch Point), including Bowditch Regional Park, operated by Lee County and, on the southwest side of the island facing the Gulf, the beach south nearly to the northwesterly intersection of Estero Boulevard and Carlos Circle. It includes land from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur or, along the developed portion of Estero Island.

Unit FL–26: Estero Island. 86 ha (211 ac) in Lee County. The majority of the unit is privately owned. The unit consists of approximately the southern third of the island's Gulf-facing shoreline starting near Avenida Pescadora to near Redfish Road. The unit excludes south-facing shoreline at the south end of the island that faces Big Carlos Pass rather than the Gulf. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–27: Marco Island. 245 ha (606 ac) in Collier County. Most of the unit is at the Tigertail Beach County Park. The unit's northern border is on the north side of Big Marco Pass, including Coconut Island and all emerging sand bars. On the south side of Big Marco Pass, the boundary starts at the north boundary of Tigertail Beach County Park and extends to just south of the fourth condominium tower south of the County Park. The placement of the southern boundary assures that the unit includes all of Sand Dollar Island, the changeable sandbar off Tigertail Beach. The western boundary includes all the sand bars in Big Marco Pass but excludes Hideaway Beach. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–28: Marquesas Keys. 2,937 ha (7,256 ac) in Monroe County. The unit comprises the roughly circular atoll that encloses Mooney Harbor, including Gull Keys and Mooney Harbor Key. The entire unit is within Key West National Wildlife Refuge. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–29: Boca Grande/Woman/ Ballast Keys. 56 ha (138 ac) in Monroe County. These Keys are east of the Marquesas Keys and west of Key West. Boca Grande and Woman Keys are within Key West National Wildlife Refuge. Ballast Key is privately owned. This unit consists only of sandy beaches and flats between the MLLW and to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–30: Bahia Honda/Ohio Keys. 372 ha (918 ac) in Monroe County. This unit comprises Bahia Honda Key (including a small island off its southwest shore), which is almost entirely owned by Bahia Honda State Park, plus Ohio Key, which is privately owned. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–31: Lower Matecumbe Key. 19 ha (48 ac) in Monroe County. Part of the unit is at Anne's Beach park, an Islamorada village park. The remaining parts are at Sunset Drive (Lower Matecumbe Beach) and at Costa Bravo Drive (Port Antiqua Homeowners Beach) on the Florida Bay side of the island. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–32: Sandy Key/Carl Ross Key. 67 ha (165 ac) in Monroe County. This unit consists of two adjoining islands in Florida Bay, roughly south of Flamingo in Everglades National Park. The entire area is owned and managed by the National Park Service. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–33: St. Lucie Inlet. 114 ha (282 ac) in Martin County. The unit includes a small area south of the jetty on the north shore of St. Lucie Inlet, from the jetty west 0.42 km (0.26 mi). While the two sides of the inlet are privately owned, the great majority of the unit is on public land in the Saint Lucie Inlet State Preserve, administered by Jonathan Dickinson State Park. It begins on the sandy shoreline south of Saint Lucie Inlet and extends along the Atlantic Ocean shoreline 2.6 km (1.6 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. The unit does not include sandbars within the inlet.

Unit FL–34: Ponce de Leon Inlet. 68 ha (168 ac) in Volusia County. The majority of the unit is within Smyrna Dunes Park and Lighthouse Point Park. This unit includes shoreline extending from the jetty north of Ponce de Leon Inlet west to the Halifax River and Inlet junction. It includes shoreline south of Ponce de Leon Inlet from the inlet and Halifax River junction, extending east and south along the Atlantic Ocean shoreline 1.2 km (.70 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–35: Nassau Sound-Huguenot. 950 ha (2347 ac) in Duval County. The majority of the unit is within Big Talbot Island State Park, Little Talbot Island State Park, and the Timucuan Ecological and Historical Preserve. This unit includes all emergent shoals and shoreline east of Nassau River bridge and extends to the inlet of the St. John's River. Amelia Island and the northern 2.7 km (1.7 mi) shoreline along Talbot Island are not included. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–36: Tiger Islands. 53 ha (130 ac) in Nassau County. This unit is privately owned. This unit extends from the mouth of Tiger Creek and runs north along Tiger Island 0.8 km (0.5 mi) and south along Little Tiger Island 1.4 km (0.9 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. Emerging sandbars to MLLW are also included.

Unit AL–1: Isle Aux Herbes. 227 ha (561 ac) in Mobile County. This unit includes the entire Isle Aux Herbes island where primary constituent elements occur to MLLW and is Stateowned.

Unit AL–2: Dauphin, Little Dauphin, and Pelican Islands. 880 ha (2,174 ac) in Mobile County. This unit includes all of Dauphin Island where primary constituent elements occur from St. Stephens Street approximately 17.6 km (10.9 mi) west to the western tip of the island to MLLW and all of Little Dauphin and Pelican Islands to MLLW. The area is mostly privately owned but includes State and Federal lands.

Unit AL–3: Fort Morgan. 67 ha (166 ac) in Baldwin County. This area includes Mobile Bay and Gulf of Mexico shorelines within Bon Secour National Wildlife Refuge, Fort Morgan Unit. This unit extends from the west side of the pier on the northwest point of the peninsula, following the shoreline approximately 2.8 km (1.74 mi) southwest around the tip of the peninsula, then east to the terminus of the beach access road and is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The area is State-owned but is leased by the Federal Government.

Unit MS–1: Lakeshore through Bay St. Louis. 41 ha (101 ac) in Hancock County. This unit extends from the north side of Bryan Bayou outlet and includes the shore of the Mississippi Sound following the shoreline northeast approximately 15.0 km (9.3 mi) and ending at the southeast side of the Bay Waveland Yacht Club. The landward boundary of this unit follows the Gulf side of South and North Beach Boulevard and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–2: Henderson Point. 34 ha (84 ac) in Harrison County. This unit extends from 0.2 km (0.12 mi) west of the intersection of 3rd Avenue and Front Street and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Pass Christian Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–3: Pass Christian. 77 ha (190 ac) in Harrison County. This unit extends from the east side of Pass Christian Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 10.5 km (6.5 mi) to the west side of Long Beach Pier and Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–4: Long Beach. 38 ha (94 ac) in Harrison County. This unit extends from the east side of Long Beach Pier and Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Gulfport Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–5: Gulfport. 39 ha (96 ac) in Harrison County. This unit extends from the east side of Gulfport Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.8 km (3.0 mi) to the west side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–6: Mississippi City. 62 ha (153 ac) in Harrison County. This unit extends from the east side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS, and includes the shore of the Mississippi Sound following the shoreline northeast approximately 7.9 km (4.9 mi) to the west side of President Casino. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–10: Ocean Springs West. 11 ha (27 ac) in Jackson County. This unit extends from U.S. 90 and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.9 km (1.2 mi) to the Ocean Springs Harbor inlet. The landward boundary of this unit follows the Bay side of Front Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–11: Ocean Springs East. 7 ha (17 ac) in Jackson County. This unit extends from the east side of Weeks Bayou and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.8 km (1.1 mi) to Halstead Bayou. The landward boundary of this unit follows the Bay side of East Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–12: Deer Island. 194 ha (479 ac) in Harrison County. This unit includes all of Deer Island, where primary constituent elements occur to the MLWW . Deer Island is privately owned.

Unit MS–13: Round Island. 27 ha (67 ac) in Jackson County. This unit includes all of Round Island to the MLWW and is privately owned.

Unit MS–14: Mississippi Barrier Islands. 3,168 ha (7,828 ac) in Harrison and Jackson Counties. This unit includes all of Cat, East and West Ship, Horn, Spoil, and Petit Bois Islands where primary constituent elements occur to MLLW. Cat Island is privately owned, and the remaining islands are part of the Gulf Islands National Seashore.

Unit MS–15: North and South Rigolets. 159 ha (393 ac) in Jackson County, MS, and 12 ha (30 ac) in Mobile County, AL. This unit extends from the southwestern tip of South Rigolets Island and includes the shore of Point Aux Chenes Bay, the Mississippi Sound, and Grand Bay following the shoreline east around the western tip, then north to the south side of South Rigolets Bayou; then from the north side of South Rigolets Bayou (the southeastern corner of North Rigolets Island) north to the northeastern most point of North Rigolets Island. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Approximately 4.4 km (2.7 mi) are in Mississippi and 2.9 km (1.8 mi) are in Alabama. Almost half the Mississippi shoreline length is in the Grand Bay National Wildlife Refuge.

Unit LA–1: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron and Vermilion Parishes. This unit extends from the east side of Sabine Pass (Texas/Louisiana border) and includes the shore of the Gulf of Mexico from the MLLW following the shoreline east 25.7 km (16.0 mi) to the west end of Constance Beach [approximately 2 km (1.2 mi) east of the intersection of Parish Road 528 and the beach]; it extends from the east end of the town of Holly Beach [0.25 km (0.16 mi) east of the intersection of Baritarick Boulevard and the beach] following the shoreline approximately 97 km (60.3 mi) east to the eastern boundary line of Rockefeller Wildlife Refuge [3.4 km (2.1 mi) east of Rollover Bayou]; and it extends from the east side of Freshwater Bayou Canal following the shoreline east for approximately 15 km (9.3 mi) to 1.3 km (0.81 mi) east of where the boundary of Paul J. Rainey Wildlife Sanctuary (National Audubon Society) meets the shoreline. All three sections of this unit include the land from the seaward boundary of MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The shoreline in this unit is both state and

privately owned.

Unit LA–2: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA. This unit is located in the eastern portion of the State-owned Atchafalaya Delta Wildlife Management Area (WMA) and includes all exposed land and islands where primary constituent elements occur east and southeast of the main navigation channel of the Atchafalaya River to the MLLW. The islands located south and southeast of the deltaic splay, Donna, T-Pat, and Skimmer Islands and the un-named bird island, are also included in this unit. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–3: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish. This unit includes the entire small island at the northwest tip of Point Au Fer Island to MLLW, then extends from the northwest tip of Point Au Fer Island following the shoreline southeast approximately 7.7 km (4.8 mi) to the point where the un-named oil and gas canal extending southeast from Locust Bayou meets the shoreline [0.8 km (0.5 mi) southeast from Locust Bayou]. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This entire unit is privately owned.

Unit LA–4: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish. This unit includes the State-owned Isles Dernieres chain, including Raccoon, Whiskey, Trinity and East Islands. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–5: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. This unit includes: all of Timbalier Island where primary constituent elements occur to the MLLW, all of Belle Pass West [the ‘‘peninsula’’ extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Unit LA–6: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA. This unit is part of the State-owned Pass a Loutre Wildlife Management Area and includes un-named sand (spoil) islands off South Pass of the Mississippi River near Port Eads. The entire islands to MLLW are included in this unit.

Unit LA–7: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA. This unit includes Breton, Grand Gosier, and Curlew Islands and the Chandeleur Island chain. Those islands are part of the Breton National Wildlife Refuge or are state owned. The entire islands where primary constituent elements occur to MLLW are included in this unit.

Unit TX–1: South Bay and Boca Chica. 2,920 ha (7,217 ac) in Cameron County. The boundaries of the unit are: starting at the Loma Ochoa, following the Brownsville Ship Channel to the northeast out into the Gulf of Mexico to MLLW, then south along a line describing MLLW to the mouth of the Rio Grande, proceeding up the Rio Grande to Loma de Las Vacas, then from that point along a straight line north to Loma Ochoa. The unit does not include densely vegetated habitat within those boundaries. It includes wind tidal flats that are infrequently inundated by seasonal winds, and includes the tidal flats area known as South Bay. Beaches within the unit reach from the mouth of the Rio Grande northward to Brazos Santiago Pass, south of South Padre Island. The southern and western boundaries follow the change in habitat from wind tidal flat, preferred by the piping plover, to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include areas used for roosting by the piping plover. Portions of this unit are owned and managed by the Lower Rio Grande Valley National Wildlife Refuge, the South Bay Coastal Preserve, Boca Chica State Park, and private citizens.

Unit TX–2: Queen Isabella Causeway. 2 ha (6 ac) in Cameron County. The area extends along the Laguna Madre west of the city of South Padre Island. The southern boundary is the Queen Isabella State Fishing Pier, and the northern boundary is at the shoreline due west of the end of Sunny Isles Street. The Queen Isabella causeway bisects this shore but is not included within critical habitat. The eastern boundary is the where developed areas and/or dense vegetation begins, and the western boundary is MLLW. This unit contains lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–5: Upper Laguna Madre. 436 ha (1,076 ac) in Kleberg County. The southern boundary is the northern boundary of PAIS, and the northern boundary is the Kleberg/Nueces County line. The eastern boundary is the line where dense vegetation begins, and the western boundary is MLLW. This unit includes a series of small flats along the bayside of Padre Island in the Upper Laguna Madre. It includes wind tidal flats and sparsely-vegtated upland areas used for roosting by the piping plover. These boundaries receive heavy use by large numbers of shorebirds, including piping plovers. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, and include upland areas used for roosting by the piping plover.

Unit TX–6: Mollie Beattie Coastal Habitat. 241 ha (596 ac) in Nueces County. This unit will be described as two subunits: (1) Subunit is bounded on the north by Beach Access Road 3, on the east by the inland boundary of critical habitat Unit TX–7, on the south by Zahn road, and on the west by Zahn Road. (2) The subunit is bounded on the north by Corpus Christi Pass, on the east by US 361, on the south by the north side of Packery Channel, and on the west by the Gulf Intercoastal Watersay. Some of the uplands are privately owned and the remaining are owned and managed by the TGLO. This unit includes two hurricane washover passes known as Newport and Corpus Christi Passes, and wind tidal flats that are infrequently inundated by seasonal winds. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover.

Unit TX–11: Blind Oso. 2 ha (5 ac) in Nueces County. This unit is the flats of the Blind Oso, part of Oso Bay, from Hans and Pat Suter Wildlife Refuge (owned and managed by the City of Corpus Christi) northeast to Corpus Christi Bay and then southeast along the edge of Texas A&M University—Corpus Christi. The landward boundaries extend to where densely vegetated habitat, not used by the piping plover, begins, and extends out from the landward boundaries to MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–12: Adjacent to Naval Air Station-Corpus Christi. 2 ha (6 ac) in Nueces County. This unit is along the shore of Oso Bay on flats bordered by Naval Air Station-Corpus Christi and Texas Spur 3 to a point 2.5 km (1.5 mi) south of the bridge between Ward Island and the Naval Air Station. The landward boundary is the line where dense vegetation begins, and the boundary in the Bay is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–13: Sunset Lake. 176 ha (435 ac) in San Patricio County. This unit is triangle shaped, with State Highway 181 as the northwest boundary, and the limits of the City of Portland as the northeast boundary. The shore on Corpus Christi Bay is the third side of the triangle, with the actual boundary being MLLW off this shore. This unit is a large basin with a series of tidal ponds, sand spits and wind tidal flats. This unit is owned and managed by the City of Portland within a system of city parks. Some of the described area falls within the jurisdiction of the TGLO. It includes two city park units referred to as Indian Point and Sunset Lake. Much of the unit is a recent acquisition by the city, and management considerations for the park include the area’s importance as a site for wintering and resident shorebirds. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–17: Allyn’s Bight. 5 ha (14 ac) in Aransas County. This unit includes shoreline of San Jose Island on Aransas Bay from Allyn’s Bight to Blind Pass, the channel between San Jose Island and Mud Island. The inland boundary is where the line of dense vegetation begins, and the bay-ward boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–20: Ayers Point. 397 ha (982 ac) in Calhoun County. This unit is an unnamed lake on Matagorda Island between Shell Reef Bayou and Big Brundrett Lake, with San Antonio Bay to the north. The unit boundary extends landward from the lake to the line where dense vegetation begins and where the constituent elements no longer occur and includes upland areas used for roosting by the piping plover. This unit includes marsh and flats at Ayers Point on Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–21: Panther Point to Pringle Lake. 863 ha (2,133 ac) in Calhoun County. This unit represents a narrow band of bayside habitats on Matagorda Island from Panther Point to the northeast end of Pringle Lake. The landward boundary is the line indicating where dense vegetation begins, and the bayward boundary is MLLW. The unit is entirely within Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–24: West Matagorda Bay/ Western Peninsula Flats. 756 ha (1,868 ac) in Matagorda County. This unit extends along the bayside of Matagorda Peninsula from 7.5 southwest of Greens Bayou to 2.5 km (1.6 mi) northwest of Greens Bayou. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–25: West Matagorda Bay/ Eastern Peninsula Flats. 232 ha (575 ac) in Matagorda County. This unit follows the bayside of Matagorda Peninsula from Maverick Slough southwest for 5 km (3 mi). The unit begins at Maverick Slough to the northeast and extends 5 km (3 mi) to the southwest, enclosing a series of flats along Matagorda Bay. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–26: Colorado River Diversion Delta. 5 ha (13 ac) in Matagorda County. This unit consists follows the shore of the extreme eastern northeast corner of West Matagorda Bay from Culver Cut to Dog Island Reef. The southeastern tidally emergent portion of Dog Island Reef is included within the unit. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The upland areas includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–29: Brown Cedar Cut. 119 ha (294 ac) in Matagorda County. This unit extends 2 km (1.2 m.) both southwest and northeast of the main channel of Brown Cedar Cut along the bayside of Matagorda Peninsula in East Matagorda Bay, and abuts unit TX–28 to the southeast. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The eastern boundary of TX–29 follows the change in habitat from mud flats preferred by the piping plover, to slightly vegetated dune system adjacent to TX–28. This unit includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–30: Northeast Corner East Matagorda Bay. 120 ha (297 ac) in Matagorda County. This is a unit bounded on the north by the Gulf Intercoastal Waterway, on the east by the northeast limit of Matagorda bay up the line where dense vegetation begins, on the south by the boundary of Unit TX–28, and on the west by MLLW. It is a system of flats associated with tidal channels. This unit includes upland areas used for roosting by the piping plover and lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–34: San Luis Pass. 110 ha (272 ac) near the Brazoria/Galveston County line. This unit extends along the Gulf side of Galveston Island from San Luis Pass to the cite of the former town of Red Fish Cove (USGS 1:24,000 map, San Luis Pass, Texas; 1963, photorevision 1974). The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. Approximately 57 percent of the unit includes flats in the floodtide delta that are State-owned and managed by the TGLO. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–35: Big Reef. 47 ha (117 ac) in Galveston County. This unit consists of beach and sand flats on the north, west, and east shore of Big Reef, down to MLLW. South Jetty is not included.

The area is currently managed by the City of Galveston. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–36: Bolivar Flats. 160 ha (395 ac) in Galveston County. This unit extends from the jetties on the southwest end of the Bolivar Peninsula to a point on the Gulf beach 1 km (0.6 mi) north of Beacon Bayou. It includes 5.0 km (3 mi) of Gulf shoreline. The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. The area is leased from TGLO by Houston Audubon Society and managed for its important avian resources. The upland areas are used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–37: Rollover Pass. 6 ha (16 ac) in Galveston County. This unit consists of Rollover Bay on the bayside of Bolivar Peninsula. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. It includes flats on State-owned land managed by the TGLO. This unit captures the intertidal complex of the bay, and is bounded by the towns of Gilchrist to the east and the Gulf beach of the Bolivar Peninsula to the south. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

The critical habitat designation for the northern Great Plains breeding population of Charadrius melodus circumcinctus includes 19 units totaling approximately 183,422 ac (74,228.4 ha) of habitat in Minnesota, Montana, and North Dakota, and approximately 1,207.5 mi (1,943.3 km) of river in Montana, North Dakota, South Dakota, and Nebraska (67 FR 57638 - 57717).

Minnesota: Unit MN–1, Rocky Point, Pine and Curry Island, and Morris Point—This unit includes approximately 235.2 ac (95.1 ha) of unique habitat, including sparsely vegetated windswept islands, peninsulas, and sandy points or spits that interface with Lake of the Woods in Lake of the Woods County. Although this unit is small in size, there have been up to 50 plovers found during the breeding season. Numbers have declined since the mid-1980s and there is a continued need for habitat and predator management. This unit represents the most eastern portion of the northern Great Plains population of breeding piping plovers and may be an important link between the Great Lakes and northern Great Plains breeding populations. It is the only remaining breeding site for piping plovers in Minnesota. Approximately 100.4 ac (40.6 ha) are designated within the 697- ac (282.3-hectare) Rocky Point Wildlife Management Area, which is in public ownership, managed by the Minnesota Department of Natural Resources. Rocky Point is located just east of Arneson on Lake of the Woods. Unit 1 also includes approximately 134.8 ac (54.5 ha) within the Pine and Curry Island Scientific and Natural Area which is in public ownership, managed by the Minnesota Department of Natural Resources. Pine and Curry Island Scientific and Natural Area includes approximately 112.6 ac (45.6 ha) of a sandy barrier island (Pine and Curry Island) and 22.2 ac (8.9 ha) of an adjacent peninsula (Morris Point) located at the mouth of the Rainy River on Lake of the Woods.

Montana: Unit MT–1, Sheridan County—This unit includes approximately 19,222.9 ac (7,779.4 ha) of 20 alkali lakes and wetlands in Sheridan County, located in the extreme northeast corner of Montana. These alkali lakes and wetlands are characterized as follows— shallow, seasonally to permanently flooded; mixosaline to hypersaline chemistry; sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; 200 ft (61 m) of uplands above the wetlands' high water mark including springs and fens, which provide foraging and protective habitat for piping plovers. Sites included in this unit are occupied by piping plovers. This unit requires special management including increasing reproductive success through predator exclusion devices, such as nest cages and electric fences, and reducing vegetation encroachment on nesting beaches through prescribed burning or grazing. Essential breeding habitat is dispersed throughout this unit which represents the largest portion (approximately 66 percent) of the plovers surveyed in Montana. This unit also links similar habitat in Canada and North Dakota. Approximately 5,571 ac (2,254.5 ha) are in private ownership and 13,651.9 ac (5,524.8 ha) are in public ownership. Of the lands in public ownership, 13,356.8 ac (5,405.4 ha) are in Federal ownership and 295.1 ac (119.4 ha) are in State ownership. Federal lands designated include piping plover populations on Medicine Lake National Wildlife Refuge and several Waterfowl Production Areas, both owned and managed by the Service. State lands designated include land owned and managed by the Montana Department of Natural Resources and Conservation. Unit MT–4, Bowdoin National Wildlife Refuge—This unit encompasses approximately 3,294.5 ac (1,333.2 ha) on Bowdoin National Wildlife Refuge with sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand gravel, or shale that interface with these water bodies. The site is located in east-central Phillips County, approximately 170.8 mi (275 km) west of the North Dakota border and 37.3 mi (60 km) south of Canada. This unit represents the western edge of the northern Great Plains breeding population of the piping plover and requires special management including water level and predator management. Bowdoin National Wildlife Refuge is in public ownership (Federal) and managed by the Service. Lake Bowdoin is an off stream facility receiving water from the Milk River.

Nebraska: Unit NE–1, Platte, Loup, and Niobrara Rivers—This unit encompasses approximately 440 mi (707.9 km) of river. The river habitat includes sparsely vegetated channel sandbars, sand and gravel beaches on islands within the high bank for nesting, temporary pools on sandbars and islands, and the interface of sand and river where plovers forage. All three of these rivers are occupied by and provide essential habitat for the piping plover. Niobrara River—The Niobrara River is a tributary of the Missouri River, originating in Wyoming and flowing through the northern part of the Nebraska Sandhills region. The portion of the Niobrara included in as Critical Habitat starts at the bridge south of Norton, Nebraska, and extends downstream 120 mi (193 km) to its confluence with the Missouri River. The Niobrara River is one of the most undeveloped rivers in the northern Great Plains and represents one of the last rivers with largely untouched piping plover habitats. The source of water for this river is largely groundwater discharge which helps to provide a year-round base flow with few flood events which are essential to successful plover nesting. Essential nesting habitat is dispersed throughout this unit and this unit represents about 36 percent of Nebraska’s plover population. Five miles of the Niobrara are within the Ponca Tribe reservation boundary. In 1991, Congress designated 76 mi (122.3 km) of the Niobrara River as a ‘‘National Scenic River,’’ 50 mi (80.5 km) of which are included in the Critical Habitat designation. The National Scenic River reach ends where Highway 137 crosses the river. The Nature Conservancy owns and manages 9.5 mi (15.3 km) along the Niobrara River that falls within both the National Scenic River reach and the piping plover Critical Habitat. Other ownership and interests are principally private. The primary land use along the Niobrara River is farming (east along the river) and ranching (west along the river). Loup River—The Loup River flows 68 mi (109.4 km) to its confluence with the Platte River near Columbus. Ownership interests within this reach of Critical Habitat are primarily private. Habitat on the Loup River designation is part of the larger Platte River watershed and provides productive habitat for piping plovers. The Loup River is one of the Platte River’s principal tributaries. Platte River—The North and Middle Platte Rivers each originate in the Rocky Mountains of Colorado with snow melt, and flow east into Nebraska where they join forming the Platte River near the town of North Platte.

The reach included in the piping plover Critical Habitat begins at the Lexington bridge and extends to the Platte's confluence with the Missouri River 252 mi (405.5 km) downstream. About one-fourth of this part of the Platte is already designated as critical habitat for the whooping crane (Grus americana), including a 3-mi wide (4.8-km) northsouth buffer starting at a western boundary south of Lexington east to south of Shelton. Ownership is primarily private, including 28.5 mi (45.9 km) which is managed as conservation land by The Nature Conservancy, Platte River Whooping Crane Habitat Maintenance Trust, Central Nebraska Public Power and Irrigation District, Nebraska Public Power District, and the National Audubon Society's Lillian Annette Rowe Sanctuary. The State of Nebraska owns 8 mi (12.9 km) along the Platte River, which is primarily under the jurisdiction of the Nebraska Game and Parks Commission. Essential nesting habitat is dispersed throughout this unit.

North Dakota: Units 1–10 in North Dakota (described below) include prairie alkali lakes and wetlands. These alkali lakes and wetlands are characterized as follows— shallow; seasonally to permanently flooded; mixosaline to hypersaline chemistry; sandy to gravelly, sparsely vegetated beaches, salt-encrusted mudflats, and/or gravelly salt flats; 200 ft (61 m) of uplands above the wetlands' high water mark, including springs and fens which provide foraging and protective habitat for piping plovers. Sites included in this unit are occupied (determined to have nesting piping plovers in more than 1 year) by piping plovers. This unit requires special management including increasing reproductive success through predator exclusion devices, such as nest cages and electric fences, and reducing vegetation encroachment on nesting beaches through prescribed burning or grazing. These essential breeding habitats in North Dakota can support more than 50 percent of the current known population of the northern Great Plains Piping Plover. The proximity of Units 1–10 to the Missouri River provides an important ecological link that may allow birds extra protection from a severe drought that results in dry wetlands basins. As birds experience drought in these units biologists believe birds move to the river. Conversely, birds may move to these units when Missouri River flows are high. Unit ND–1—This unit encompasses approximately 7,456.9 ac (3,017.7 ha) of 13 alkali lakes and wetlands in Divide and Williams Counties, located in the extreme northwestern corner of North Dakota. Approximately 1,765.2 ac (714.3 ha) are in public ownership and 5,691.7 ac (2,303.4 ha) are in private ownership. Of the lands in public ownership 1,337.9 ac (541.4 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 427.2 ac (172.9 ha) are in State ownership. State lands designated include 3.1 ac (1.2 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 424.1 ac (171.6 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–2—This unit encompasses approximately 20,683.8 ac (8,370.6 ha) of 14 alkali lakes and wetlands in Burke, Renville, and Mountrail Counties, in northwestern North Dakota. Approximately 13,986.5 ac (5,660.2 ha) are in public ownership and 6,697.3 ac (2,710.3 ha) are in private ownership. Of the lands in public ownership, 13,251.8 ac (5,362.9 ha) are in Federal ownership and 734.6 ac (297.3 ha) are in State ownership. Federal lands designated include Lostwood and Upper Souris National Wildlife Refuges and Waterfowl Productions Areas, both owned and managed by the Service. State lands designated include 320.1 ac (129.5 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 414.4 ac (167.7 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–3—This unit encompasses approximately 2,524.5 ac (1,021.6 ha) of 11 alkali lakes and wetlands in Mountrail and Ward Counties in northwestern North Dakota. Approximately 615.9 ac (249.2 ha) are in public ownership and 1,908.5 ac (772.3 ha) are in private ownership. Of the lands in public ownership, 615.7 ac (249.2 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 0.2 ac (0.08 ha) are in State ownership. State lands designated are owned and managed by the North Dakota Game and Fish Department as a Wildlife Management Area. Unit ND–4—This unit encompasses approximately 5,150.7 ac (2,084.4 ha) of eight alkali lakes and wetlands in McLean County in north-central North Dakota. Approximately 1,292.6 ac (523.1 ha) are in public ownership and 3,858 ac (1,561.3 ha) are in private ownership. Of the lands in public ownership, 752.1 ac (304.3 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 540.5 ac (218.7 ha) are in State ownership. State lands designated include 435.5 ac (176.2 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 104.9 ac (42.4 ha) of school lands owned and managed by the North Dakota Land Department. The John E. Williams Preserve, owned and managed by The Nature Conservancy (private), also is included in this unit. Unit ND–5—This unit encompasses approximately 3,925.6 ac (1,588.7 ha) of 10 alkali lakes and wetlands in McHenry and Sheridan Counties in north-central and central North Dakota. Approximately 406.8 ac (164.6 ha) are in public ownership and 3,518.8 ac (1,424 ha) are in private ownership. All public lands are in Federal ownership with 34.4 ac (13.9 ha) owned and managed by the Service as Waterfowl Production Areas and 372.4 ac (150.7 ha) owned by the BOR and managed by the North Dakota Game and Fish Department as a Wildlife Management Area. Unit ND–6—This unit encompasses approximately 6,075.2 ac (2,458.6 ha) of 11 alkali lakes and wetlands in Benson and Pierce Counties, in northeastern North Dakota. Approximately 767.3 ac (310.5 ha) are in public ownership and 5,307.9 ac (2,148 ha) are in private ownership. Of the lands in public ownership, 724.8 ac (293.3 ha) are in Federal ownership and 42.5 ac (17.2 ha) are in State ownership. State lands designated include 20.7 ac (8.4 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 21.7 ac (8.79 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–7—This unit encompasses approximately 30,125.7 ac (12,191.7 ha) of nine alkali lakes and wetlands in Burleigh and Kidder Counties, in southcentral North Dakota. Approximately 20,012.1 ac (8,089.8 ha) are in public ownership and 10,113.5 ac (4,092.9 ha) are in private ownership. Of the lands in public ownership, 18,113.1 ac (7,330.3 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 1,898.9 ac (768.5 ha) are in State ownership. State lands designated include 1,247.9 ac (505 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 650.9 ac (263.4 ha) of school lands owned and managed by the North Dakota Land Department. Federal lands designated include Long Lake National Wildlife Refuge and Waterfowl Production Areas owned and managed by the Service. Unit ND–8—This unit encompasses approximately 4,056.7 ac (1,641.7 ha) of three alkali lakes and wetlands in Stutsman County, in south-central North Dakota. Approximately 3,593.6 ac (1,454.3 ha) are in public ownership and 463.1 ac (187.4 ha) are in private ownership. Of the lands in public ownership, 3,583.8 ac (1,450.3 ha) are in Federal ownership and 9.7 ac (3.9 ha) are in State ownership. Federal lands designated include Chase Lake and Arrowwood National Wildlife Refuges and Waterfowl Production Areas owned and managed by the Service. State lands designated include 7.9 ac (3.2 ha) of school lands owned and managed by the North Dakota Land Department and 1.8 ac (0.7 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department. Unit ND–9—This unit encompasses approximately 2,658 ac (1,075.6 ha) of six alkali lakes and wetlands in Logan and McIntosh Counties in south-central North Dakota. Approximately 732.5 ac (296.4 ha) are in public ownership and 1,925.5 ac (779.2 ha) are in private ownership. Of the lands in public ownership, 497.7 ac (201.4 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 234.7 ac (95 ha) are in State ownership (Wildlife Management Areas managed by the North Dakota Game and Fish Department. Unit ND–10—This unit encompasses approximately 641.6 ac (259.6 ha) of one alkali lake in Eddy County in northeastern North Dakota. Approximately 6.8 ac (2.7 ha) are in public ownership as a Waterfowl Production Area managed by the Service and 634.7 ac (256.8 ha) are in private ownership.

Missouri River Units: Missouri River Units—Missouri River units consist of riverine and reservoir (Fort Peck Lake, Lake Sakakawea and Lake Audubon, Lake Oahe, and Lewis and Clark Lake) reaches. All reservoirs except Lake Audubon are mainstem impoundments, constructed by dams, and regulated by the Corps. Lake Audubon is a sub-impoundment of Lake Sakakawea and is regulated by the BOR through operation of the Snake Creek Pumping Plant. Overall the Missouri River has accounted for up to 31 percent of the northern Great Plains population of piping plovers. All of the units are occupied. Piping plover habitat within reservoir reaches is composed of shorelines, peninsulas, and islands, below the top of the maximum operating pool and is owned by the Federal government. These reservoir habitats include sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, grave, or shale, and their interface with the water. These reservoir reaches provide habitat for about 42 percent of the piping plovers on the Missouri River. Piping plover habitat within riverine reaches consists of inter-channel islands and sandbars including their temporary pools and interface with the river. These habitats are sparsely vegetated and consist of sand and gravel substrates. Riverine reaches provide habitat for about 58 percent of the piping plovers on the Missouri River. Ownership of these sites varies by State. In Montana, islands and sandbars are recognized as owned by the State except along the reservation boundaries of the Assiniboine and Sioux Tribes of Fort Peck. The Assiniboine and Sioux Tribes of Fort Peck own land to the midchannel of the Missouri River adjacent to the Reservation boundary. In North Dakota and South Dakota, islands and sandbars are recognized as owned by the State. Four Tribes along the Missouri River in North Dakota and South Dakota have critical habitat designated within the boundary of their reservation including the Standing Rock Sioux Tribe, and the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Tribes) of the Ft. Berthold Reservation, the Cheyenne River Sioux Tribe, and the Yankton Sioux Tribe. Additionally, these Tribes have land or Tribal trust land on submerged sites or sandbars/ islands within the critical habitat designation of the Missouri River in North and South Dakota. In Nebraska, islands and sandbars are owned by the adjacent landowner including the Santee Sioux Tribe.

Montana: Unit MT–2—This unit encompasses approximately 125.4 mi (201.8 km) from just west of Wolf Point, McCone County, Montana, at RM 1712.0 downstream to the Montana/North Dakota border, Richland County, Montana, and McKenzie County, North Dakota, at RM 1586.6. The Missouri River in this unit flows through reservation land of the Assiniboine and Sioux Tribes of Fort Peck (81.7 mi (131.5 km)), State land, and privately owned land. Unit MT–3, Fort Peck Reservoir—This unit encompasses approximately 77,370 ac (31,311 ha) of Fort Peck Reservoir, located entirely within the Charles M. Russell National Wildlife Refuge which is in Federal ownership, managed by the Service.

North Dakota: Unit ND–11, Missouri River— Approximately 354.6 mi (570.6 km) from the Montana/North Dakota border just west of Williston, McKenzie County, North Dakota, at RM 1586.6 downstream to the North Dakota/South Dakota border in Sioux and Emmons Counties, North Dakota, and Corson and Campbell Counties, South Dakota, at RM 1232.0. Lake Sakakawea, Lake Audubon, and Lake Oahe are included in this unit, along with a free-flowing stretch of the Missouri River from RM 1389 to 1302 (Garrison Reach). The North Dakota Game and Fish Department manages the north half of Audubon Reservoir and the Service manages the south half of Audubon Reservoir. The Missouri River and associated reservoirs in this unit include 6.83

mi (11 km) of shoreline (right and left bank) of trust land and 77 liner rm (123.9 km) within the reservation boundary of the Three Affiliated Tribes of Fort Berthold and 23.22 mi (37.37 km) of shoreline on trust land and 38 linear rm (61.16 km) within the reservation boundary of Standing Rock Sioux Tribe and 20 mi (32.19 km) of shoreline on trust land. A mix of State and privately owned lands also are included in this unit.

South Dakota Unit SD–1 Missouri River— Approximately 159.7 mi (257 km) from the North Dakota/South Dakota border northeast of McLaughlin, Corson County, South Dakota, at RM 1232.0 downstream to RM 1072.3, just north of Oahe Dam (Oahe Reservoir). The Missouri River and associated reservoirs in this unit include 3.22 mi (5.18 km) of shoreline (right bank) on trust land and 41 linear mi (65.98 km) within the reservation boundary of the Standing Rock Sioux and 23.44 mi (37.72 km) of shoreline (right bank) on trust land and 77 linear mi (123.92 km) within the reservation boundary of Cheyenne River Sioux Tribe. A mix of State and privately owned lands also are included in this unit. Unit SD–2, Missouri River— Approximately 127.8 mi (204.4 km) from RM 880.0, at Fort Randall Dam, Bon Homme and Charles Mix Counties, South Dakota, downstream to RM 752.2 near Ponca, Dixon County, Nebraska. One mainstem Missouri River reservoir, Lewis and Clark Lake, and two riverine reaches (Fort Randall and Gavins Point) are included in this unit. In addition to the 127.8 mi (204.4 km) that border South Dakota on the left bank there are approximately 7.8 mi (12.4 km) of river bordering South Dakota on the right bank. All islands and sandbars in South Dakota are in State ownership with the exception of 60.36 mi (97.14 km) of shoreline (left bank) on trust land and 34 linear miles (54.72 km) within the reservation boundary of the Yankton Sioux Tribe. Approximately 120 mi (192 km) (right bank) of river border Nebraska. Sandbars and islands in Nebraska (State line extends to midchannel) belong to the adjacent landowner. Approximately 16 linear mi (25.75 km) (right bank) of river below Ft. Randall Dam are within the boundary of the Santee Sioux Reservation, including 0.05 mi (0.08 km) of shoreline on trust land.

Primary Constituent Elements/Physical or Biological Features

Wintering piping plover's PCEs are the habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are:

(1) Intertidal sand beaches (including sand flats) or mud flats (between the MLLW and annual high tide) with no, or very sparse, emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.

(2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather.

(3) Surf-cast algae for feeding.

(4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.

(5) Spits, especially sand, running into water used for foraging and roosting.

(6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water.

(7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.

(8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites).

See above.

See above.

The one overriding primary constituent element (biological) required to sustain the northern Great Plains breeding population of piping plovers that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat. Without this biological process the physical component of the primary constituent elements would not be able to develop. These processes develop a mosaic of habitats on the landscape that provide the essential combination of prey, forage, nesting, brooding and chick-rearing areas. The annual, seasonal, daily, and even hourly availability of the habitat patches is dependent on local weather, hydrological conditions and cycles, and geological processes. The biological primary constituent element, i.e., dynamic ecological processes, creates different physical primary constituent elements on the landscape. These physical primary constituent elements exist on different habitat types found in the northern Great Plains, including mixosaline to hypersaline wetlands (Cowardin et al. 1979), rivers, reservoirs, and inland lakes. These habitat types or physical primary constituent elements that sustain the northern Great Plains breeding population of piping plovers are described as follows:

i. On prairie alkali lakes and wetlands, the physical primary constituent elements include—(1) shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; (2) springs and fens along edges of alkali lakes and wetlands; and (3) adjacent uplands 200 ft (61 m) above the high water mark of the alkali lake or wetland.

ii. On rivers the physical primary constituent elements include—sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

iii. On reservoirs the physical primary constituent elements include—sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.

iv. On inland lakes (Lake of the Woods) the physical primary constituent elements include—sparsely vegetated and windswept sandy to gravelly islands, beaches, and peninsulas, and their interface with the water body.

Special Management Considerations or Protections

Activities that may destroy or adversely modify critical habitat are those for which the affected critical habitat would not remain functional to serve its intended conservation role for the species. More specifically, such activities could eliminate or reduce the habitat necessary for foraging by eliminating or reducing the piping plovers' food base; destroying or removing available upland habitats necessary for protection of the birds during storms or other harsh environmental conditions; increasing the amount of vegetation to levels that make foraging or roosting habitats unsuitable; and/or increasing recreational activities to such an extent that the amount of available undisturbed foraging or roosting habitat is reduced, with direct or cumulative adverse effects to individuals and completion of their life cycles. Examples of actions that have effects on wintering piping plover habitats include, but are not limited to: (1) Disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; (2) Predation, especially by falcons, hawks, coyotes, bobcats and feral cats; (3) Beach maintenance (e.g., nourishment (adding sand) and cleaning) and stabilization efforts (e.g., construction of jetties and other hard structures). (4) Oil and other hazardous materials spills and cleanup; (5) Discharge of freshwater from oil and gas activities; (6) Construction of dwellings, roads, marinas, and other structures, and associated activities including staging of materials and equipment; and/or (7) Dredging and dredge spoil placement, and associated activities including staging of equipment and materials.

See above.

See above.

Critical habitat does not include existing developed areas such as mainstem dam structures, buildings, marinas, boat ramps, bank stabilization and breakwater structures, row cropped or plowed agricultural areas, roads and other lands (e.g., high bank bluffs along Missouri River) unlikely to contain primary constituent elements essential for northern Great Plains piping plover conservation.

Life History

Feeding Narrative

Juvenile: The chicks learn to feed themselves and eat smaller versions adult food items (Hull 1981). (NatureServe, 2015)

Adult: Piping plovers forage by gleaning invertebrates from the substrate or running and pecking on the substrate with short runs between pecks (Elliott-Smith and Haig 2004). Sandy mud flats, ephemeral pools, seasonally emergent seagrass beds, mud/sand flats with scattered oysters, and overwash fans are considered primary foraging habitats (Nicholls and Baldassarre 1990b; Cohen et al. 2008). Intertidal areas provide key foraging habitats. Zonick (2000) found dietary differences across the range of piping plovers in Texas, with plovers along the northern Texas coast feeding predominantly on polychaetes while those observed further south largely fed on insects and other arthropods. Wrack also contains invertebrate organisms consumed by piping plovers and other shorebirds (USFWS, 2015). As observed in Texas studies, Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. There is some very limited evidence that plover forage on the alkali lakes may be produced on the nearby prairie (Nordstrom 1990) (USFWS, 2009). Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks (Zonick and Ryan 1996, p. 26), which they peck from on top or just beneath the surface of moist or wet sand, mud, or fine shell (USFWS, 2009b).

Reproduction Narrative

Adult: Piping plovers breed on bare sandy or gravelly beaches, sandbars, or islands in several different types of habitat across the broad landscape of the NGP. Piping plovers begin to arrive on the breeding grounds in the first half of April, with courtship, followed by nesting, beginning in mid-to-late April (Catlin and Fraser 2006a; Catlin and Fraser 2007; Felio et al. 2009; Felio et al. 2010a; Felio et al. 2010b; Shaffer et al. 2013). Both adults share incubation duties (Wilcox 1959, Cairns 1982) which last 25 to 28 days (Elliott-Smith and Haig 2004). Hatching begins in late May to early June, generally peaking in June and early July (Catlin 2009). The young leave the nest within hours of hatch and begin to forage almost immediately (Wilcox 1959, Haig 1992). Chicks may be brooded for up to 21 days post-hatch, although the female sometimes deserts the brood after 5 to 10 days (Haig and Oring 1988; Haig 1992; Maxson 2000). Chicks fledge 25 to 35 days after hatching, and are capable of sustained flight soon after fledging (Knetter et al. 2001; Catlin et al. 2013). Piping plovers readily renest if earlier nests fail (Whyte 1985; Haig 1987). They generally only raise one brood a season, although they have been documented to raise two broods on rare occasions (Bottitta et al. 1997). Piping plovers begin to leave the breeding grounds as early as mid-July, with adults leaving first and juveniles last (Elliott-Smith and Haig 2004). Although piping plovers have been documented to live as long as 11 years, the Service estimates that with a 78 to 80 percent adult survival rate, the average lifespan is approximately 5-6 years (USFWS, 2015). In the Northern Great Plains, most piping plovers nest on the unvegetated shorelines of alkali lakes, reservoirs, or river sandbars, as described in the 1988 recovery plan. On occasion, however, they will select non-typical sites for nesting (USFWS, 2009).

Tolerance Ranges/Thresholds

Adult: Low (USFWS, 2009)

Site Fidelity

Adult: High (USFWS, 2009)

Habitat Narrative

Adult: On the wintering grounds, piping plovers forage and roost along barrier and mainland beaches, sand, mud, and algal flats, washover passes, salt marshes, and coastal lagoons. New information confirms inter- and intra-annual fidelity of piping plovers to migration and wintering sites. Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Recent geographic analysis of piping plover distribution on the upper Texas coast noted major concentration areas at the mouths of rivers and washover passes (low, sparsely vegetated barrier island habitats created and maintained by temporary, storm-driven water channels) into major bay systems (Arvin 2008). Piping plovers in the Northern Great Plains population inhabit unvegetated shorelines of alkali lakes, reservoirs, or river sandbars (USFWS, 2009). Wintering plovers are dependent on a mosaic of habitat patches, and move among these patches, depending on local weather and tidal conditions (Drake et al. 2001, pp. 262– 263) (USFWS, 2009b).

Dispersal/Migration

Motility/Mobility

Adult: High (USFWS, 2009)

Migratory vs Non-migratory vs Seasonal Movements

Juvenile: Migratory/spring and summer (NatureServe, 2015)

Adult: Migratory (USFWS, 2009)

Dispersal

Adult: High (USFWS, 2009)

Dispersal/Migration Narrative

Juvenile: The juveniles may remain in wintering areas later but are generally gone by mid- to late August (Cuthbert and Wiens 1982). (NatureServe, 2015)

Adult: Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean (USFWS, 2009). Piping plovers spend three to five months on the breeding grounds annually, and the rest of the year on the wintering or in migration. Piping plovers spend up to 10 months of their annual cycle on their migration and winter grounds, typically from 15 July through 15 May (Elliott-Smith and Haig 2004; Noel et al. 2007; Stucker et al. 2010). Southward migration from the breeding grounds primarily occurs from July to September, with the majority of birds initiating migration by the end of August (USFWS 1996; USFWS 2003). Piping plovers depart the wintering grounds as early as mid-February and as late as mid-May, with peak migration in March (Haig 1992) (USFWS, 2015).

Additional Life History Information

Adult: Migrates to breeding grounds July - September (USFWS, 2015)

Population Information and Trends

Population Trends:

Decline from 1991 through 2001, increase from 2001 through 2006 (USFWS, 2009)

Population Size:

2,959 adults; 1,212 breeding pairs (USFWS, 2009)

Minimum Viable Population Size:

1,300 breeding paris (see recovery criterion 1); 1.24 fledglings/pair (USFWS, 2009)

Additional Population-level Information:

Populations are sensitive to adult and juvenile survival rates (USFWS, 2009)

Population Narrative:

The most consistent finding in the various population viability analyses (PVAs) conducted for piping plovers (Ryan et al. 1993, Melvin and Gibbs 1996, Plissner and Haig 2000, Wemmer et al. 2001, Larson et al. 2002, Calvert et al. 2006, Brault 2007) is the sensitivity of extinction risk to even small declines in adult and/or juvenile survival rates. The International Piping Plover Census, conducted every five years, also estimates the number of piping plover pairs in the Northern Great Plains; the 2006 estimate was 2,959 adults and 1,212 breeding pairs. The most recent model examining population viability suggested that a region-wide fledge ratio of 1.24 would be required for stability (Larson et al. 2002). Plover adult numbers seem to be roughly correlated with the amount of suitable habitat available on the Missouri River system. The International Piping Plover Census numbers indicate that the Northern Great Plains population (including Canada) declined from 1991 through 2001 then increased dramatically from 2001 through 2006 (USFWS, 2009).

Threats and Stressors

Stressor: Sand placement projects (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: In the wake of episodic storm events, managers of lands under public, private, and county ownership often protect coastal structures using emergency storm berms; this is frequently followed by beach nourishment or renourishment activities (nourishment projects are considered “soft” stabilization versus “hard” stabilization such as seawalls). Berm placement and beach nourishment deposit substantial amounts of sand along Gulf of Mexico and Atlantic beaches to protect local property in anticipation of preventing erosion and what otherwise would be considered natural processes of overwash and island migration (Schmitt and Haines 2003). Past and ongoing stabilization projects fundamentally alter the naturally dynamic coastal processes that create and maintain beach strand and bayside habitats, including those habitat components that piping plovers rely upon. Although impacts may vary depending on a range of factors, stabilization projects may directly degrade or destroy piping plover roosting and foraging habitat in several ways. Front beach habitat may be used to construct an artificial berm that is densely planted in grass, which can directly reduce the availability of roosting habitat. Over time, if the beach narrows due to erosion, additional roosting habitat between the berm and the water can be lost. Berms can also prevent or reduce the natural overwash that creates roosting habitats by converting vegetated areas to open sand areas (see summary of studies documenting importance of bay beach habitats for piping plover foraging, section WM 2.2.1.4). The vegetation growth caused by impeding natural overwash can also reduce the maintenance and creation of bayside intertidal feeding habitats. In addition, stabilization projects may indirectly encourage further development of coastal areas and increase the threat of disturbance (see WM 2.2.2.5) (USFWS, 2009).

Stressor: Inlet stabilization/relocation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Many navigable mainland or barrier island tidal inlets along the Atlantic and Gulf of Mexico coasts are stabilized with jetties, groins, or by seawalls and/or adjacent industrial or residential development. Jetties are structures built perpendicular to the shoreline that extend through the entire nearshore zone and past the breaker zone (Hayes and Michel 2008) to prevent or decrease sand deposition in the channel. Inlet stabilization with rock jetties and associated channel dredging for navigation alter the dynamics of longshore sediment transport

and affect the location and movement rate of barrier islands (Camfield and Holmes 1995), typically causing downdrift erosion. Sediment is then dredged and added back to islands which subsequently widen. Once the island becomes stabilized, vegetation encroaches on the bayside habitat, thereby diminishing and eventually destroying its value to piping plovers. Accelerated erosion may compound future habitat loss, depending on the degree of sea-level rise. Unstabilized inlets naturally migrate, re-forming important habitat components, whereas jetties often trap sand and cause significant erosion of the downdrift shoreline. These combined actions affect the availability of piping plover habitat (Cohen et al. 2008). Tidal inlet relocation can cause loss and/or degradation of piping plover habitat; although less permanent than construction of hard structures, effects can persist for years (USFWS, 2009).

Stressor: Sand mining/dredging (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Sand mining, the practice of extracting (dredging) sand from sand bars, shoals, and inlets in the nearshore zone, is a less expensive source of sand than obtaining sand from offshore shoals for beach nourishment. Sand bars and shoals are sand sources that move onshore over time and act as natural breakwaters. Inlet dredging reduces the formation of exposed ebb and flood tidal shoals considered to be primary or optimal piping plover roosting and foraging habitat. Removing these sand sources can alter depth contours and change wave refraction as well as cause localized erosion (Hayes and Michel 2008). Exposed shoals and sandbars are also valuable to piping plovers, as they tend to receive less human recreational use (because they are only accessible by boat) and therefore provide relatively less disturbed habitats for birds. We do not have a good estimate of the amount of sand mining that occurs across the piping plover wintering range, nor do we have a good estimate of the number of inlet dredging projects that occur. This number is likely greater than the number of total jettied inlets shown in Table WM3, since most jettied inlets need maintenance dredging, but non-hardened inlets are often dredged as well (USFWS, 2009).

Stressor: Groins (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Groins (structures made of concrete, rip rap, wood, or metal built perpendicular to the beach in order to trap sand) are typically found on developed beaches with severe erosion. Although groins can be individual structures, they are often clustered along the shoreline. Groins act as barriers to longshore sand transport and cause downdrift erosion, which prevents piping plover habitat creation by limiting sediment deposition and accretion (Hayes and Michel 2008). These structures are found throughout the southeastern Atlantic Coast, and although most were in place prior to the piping plover's 1986 ESA listing, installation of new groins continues to occur (USFWS, 2009).

Stressor: Seawalls and revetments (USFWS, 2009)
Exposure:
Response:
Consequence:

Narrative: Seawalls and revetments are vertical hard structures built parallel to the beach in front of buildings, roads, and other facilities to protect them from erosion. However, these structures often accelerate erosion by causing scouring in front of and downdrift from the structure (Hayes and Michel 2008), which can eliminate intertidal foraging habitat and adjacent roosting habitat. Physical characteristics that determine microhabitats and biological communities can be altered after installation of a seawall or revetment, thereby depleting or changing composition of benthic communities that serve as the prey base for piping plovers. At four California study sites, each comprised of an unarmored segment and a segment seaward of a seawall, Dugan and Hubbard (2006) found that armored segments had narrower intertidal zones, smaller standing crops of macrophyte wrack, and lower shorebird abundance and species richness. Geotubes (long cylindrical bags made of high-strength permeable fabric and filled with sand) are softer alternatives, but act as barriers by preventing overwash. We did not find any sources that summarize the linear extent of seawall, revetment, and geotube installation projects that have occurred across the piping plover's wintering and migration habitat (USFWS, 2009).

Stressor: Exotic/invasive vegetation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Beach vitex (Vitex rotundifolia) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). In 2003, the plant was documented in New Hanover, Pender, and Onslow counties in North Carolina, and at 125 sites in Horry, Georgetown, and Charleston counties in South Carolina. One Chesapeake Bay site in Virginia was eradicated, and another site on Jekyll Island, Georgia, is about 95% controlled (D. Suiter, USFWS, pers. comm. 2009). Beach vitex has been documented from two locations in northwest Florida, but one site disappeared after erosional storm events. The landowner of the other site has indicated an intention to eradicate the plant, but follow through is unknown (R. Farley, PBS&J, Inc., pers. comm. 2009). Task forces formed in North and South Carolina in 2004-05 have made great strides to remove this plant from their coasts. To date, about 200 sites in North Carolina have been treated, with 200 additional sites in need of treatment. Similar efforts are underway in South Carolina. Unquantified amounts of crowfootgrass (Dactyloctenium aegyptium) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (Casuarina equisetifolia) changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas. Shorebirds prefer foraging in open areas where they are able to see potential predators, and tall trees provide good perches for avian predators. Australian pines potentially impact shorebirds, including the piping plover, by reducing attractiveness of foraging habitat and/or increasing avian predation. The propensity of these exotic species to spread, and their tenacity once established, make them a persistent threat, partially countered by increasing landowner awareness and willingness to undertake eradication activities. Piping plover habitat is by nature ephemeral, with fluctuating water levels periodically clearing vegetation, which then grows back over time during dry periods. However, invasive exotics, particularly salt cedar, which is tolerant of flooding, are a growing problem on plover habitat (USACE 2007a). On the Missouri River reservoirs, changing water conditions provide prime habitat for noxious weeds to become established, with up to 200,000 acres of potential

habitat exposed on Lake Oahe alone in dry conditions (USACE 2008c). Salt cedar, leafy spurge (Euphorbia esula), Canada thistle (Cirsium arvense), and absinth wormwood (Artemisia absinthium) have been identified as noxious weeds on Missouri River reservoir shorelines (USACE 2007b). Other invasive species, such as kochia (Kochia scoparia) and clover (Trifolium spp.) can also rapidly take over plover habitat, precluding nesting (USACE 2007a) (USFWS, 2009).

Stressor: Wrack removal and beach cleaning (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999, Smith 2007, Maddock et al. 2009, Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Neal et al. 2007). Tilling beaches to reduce soil compaction, as sometimes required by the USFWS for sea turtle protection after beach nourishment activities, has similar impacts (USFWS, 2009).

Stressor: Disease (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Although researchers increased vigilance following detection of several cases of West Nile virus in breeding Northern Great Plains piping plovers and Type E botulism in the Great Lakes breeding population, the USFWS is not aware of instances of disease in nonbreeding piping plovers. Bird species testing positive for low pathogenic avian influenza consist of Pacific golden-plover (1), bar-tailed godwit (3), dunlin (8), marsh sandpiper (1), red knot (1), sanderling (1), sharp-tailed sandpiper (1), and western sandpiper (1) (Acker, pers. comm. 2009). Based on information available to date, the Service concludes that West Nile virus and avian influenza remain a minor threat to shorebirds, including the piping plover, on their wintering and migration grounds (USFWS, 2009).

Stressor: Predation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The 2003 Great Lakes recovery plan expressed concern about the increase in predators (fox, coyotes, dogs, and cats) that are present year-round on the wintering grounds. The impact of predation on migrating or wintering piping plovers remains largely undocumented. Except for one incident involving a cat in Texas (NY Times 2007), no depredation of piping plovers during winter or migration has been noted, although it would be difficult to document. Avian and mammalian predators are common throughout the species' wintering range. Predatory

birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. The Service considers predator control on their wintering and migration grounds to be a low priority at this time (USFWS, 2009).

Stressor: Recreational disturbance (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Pfister et al. (1992) implicate anthropogenic disturbance as a factor in the longterm decline of migrating shorebirds at staging areas. Disturbance, i.e., human and pet presence that alters bird behavior, disrupts piping plovers as well as other shorebird species. Disturbance can cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995, Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000). Shorebirds are more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than people (Lafferty 2001a, 2001b; Thomas et al. 2002). Dogs off leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds. Off-road vehicles can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast recovery plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993, Goldin 1993). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance would otherwise be very slight. Godfrey et al. (1980 as cited in Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of off-road vehicles negatively correlated with abundance of roosting piping plovers on the ocean beach (USFWS, 2009).

Stressor: Military actions (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Military actions are not listed as threats in either the listing rule or recovery plans. Twelve coastal military bases are located in the Southeast. To date, five bases have consulted with the USFWS under section 7 of the ESA, on military activities on beaches and baysides that may affect piping plovers or their habitat. Camp Lejeune in North Carolina consulted formally

with USFWS in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with USFWS on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt occasional use of motorized equipment on the beaches and associated baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts twice-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to minimize direct disturbance from troop activities (USFWS, 2009).

Stressor: Contaminants (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The various piping plover recovery plans identify contaminants, particularly oil spills, as a threat. The Great Lakes plan also states that concentration levels of polychlorinated biphenol (PCB) detected in Michigan piping plover eggs have the potential to cause reproductive harm. Contaminants have the potential to cause direct toxicity to individual birds or negatively impact their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985, Gilbertson et al. 1991, Hoffman et al. 1996).Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (C. Lee, USFWS, pers. comm. 2009). Federal and state land managers have protective provisions in place to secure and remove the barrels, thus reducing the likelihood of contamination. The extent to which contaminant levels in piping plovers can be attributed to wintering and migratory stopover sites is unknown. Research focused on known winter and migration habitats of the Great Lakes birds may be necessary should any breeding issues arise with regard to PCB levels. Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; USFWS 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; A. Amos, University of Texas, pers. comm. 2009). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants (USFWS, 2009).

Stressor: Pesticides (USFWS, 2009)
Exposure:
Response:

Consequence:
Narrative: Neither the final listing rule nor the recovery plans identified pesticides as a threat to piping plovers on the wintering grounds. In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer chemical manufacturer. With one reported plover death from pesticide use, and with the causative pesticide now removed from use, this threat to piping plovers in the U.S. currently appears low. However, it is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico (USFWS, 2009). Although unknown, given the widespread use of neonicotinoids and the tendency to accumulate in wetlands, persistence in the soil, and potential adverse effects on the quantity and composition of the insect community, neonicotinoids may have a negative effect on the piping plover population, particularly breeding areas in alkaline lakes (USFWS, 2015).

Stressor: Accelerating sea-level rise (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Over the past 100 years, the globally-averaged sea level has risen approximately 10-25 centimeters (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33% of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007, CCSP 2008). Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat that lies immediately seaward of numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the overwashing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments (USFWS, 2009).

Stressor: Storm events (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced overwashand vegetation removal have been noted in portions of the wintering range. The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. Other storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm

and seawall construction. As discussed in more detail in WM 2.2.2.1, such stabilization activities can result in the loss and degradation of feeding and resting habitats. Storms also can cause widespread deposition of debris along beaches. Removal of debris often requires large machinery, which can cause extensive disturbance and adversely affect habitat elements such as wrack. Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity (Emanuel 2005, Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms. In sum, storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range (USFWS, 2009).

Stressor: Inadequacy of existing regulatory mechanisms (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Protections for piping plovers migrating and wintering outside the U.S. include the 2005 designation of 1.5 million acres of the Laguna Madre de Tamaulipas region in Mexico as a Federal Natural Protected Area. Any land-use alterations to piping plover habitats within this area are now subject to review under a federal permitting process that encourages avoidance and minimization of impacts; however, it does not preclude alterations. This is similar to the ESA in allowing some adverse effects to designated critical habitat. Regulatory protections for piping plovers in the Caribbean and Cuba are currently unknown. Enforcement limitations and/or legal insufficiency of regulations to protect important habitat components result in continued degradation of a significant amount of wintering piping plover coastal habitat, including designated critical habitat units, resulting in a cumulative loss of habitat. At the current time, if the protections of the ESA were removed, existing local, state, and other federal regulatory provisions would provide insufficient protection to nonbreeding piping plover habitats used during migration and winter (USFWS, 2009).

Stressor: Reservoirs, channelization of rivers, and modification of river flows (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Prior to colonization, river systems in the Northern Great Plains generally had large rises in the spring as water melted off of the prairie and then the mountains. These spring rises carried sediment down the system, creating sandbar islands as the water slowed and deposited the material. The water levels would then drop throughout the summer, exposing more acres of sandbar as the season progressed (USFWS 2003). After European settlement, attempts were made to make the rivers more predictable and suitable for navigation, and to minimize seasonal flooding. River channels were straightened and channelized, and a number of dams were constructed. These dams greatly reduced sediment inflow into the system, reducing the amount of sand available for sandbar creation (National Research Council 2002). Additionally, the hydrology of the rivers has been drastically altered. On the Missouri river, flows used to generally decline over the summer as tributary flows decreased. Today, they generally increase during the nesting season to provide for downstream needs (USFWS 2003). This means that less sandbar habitat is available over the course of the summer, rather than more, as would have been the case prior to dam construction. By contrast, due to the large number of users on the Platte River, flows are variable and the river often runs dry in the summer, also leading to a reduction in piping plovers on the river (National Research Council 2004). The lack of sufficient suitable

habitat due to modification of river flows continues to be a major threat to the piping plover (USFWS, 2009).

Stressor: Sand and gravel mining (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Mining is ongoing in Nebraska in the lower and central Platte River systems. Mine operators inadvertently create piping plover habitat by depositing waste sand alongside pit lakes. Plovers nest on spoil piles of sparsely or non-vegetated sand and associated lakes at sand and gravel mines. Generally, when production is finished, the mines are turned into housing developments. Some lakes have been constructed for housing developments without first mining the area. As the 1988 plan states, these activities can be problematic because of construction activities in the areas where plovers nest, potentially directly impacting nesting birds or indirectly disturbing nesting or brood rearing activities (Brown and Jorgensen 2008). The 1988 plan also identifies predation as a problem on these mine sites (USFWS, 2009)

Stressor: Oil and gas development (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Oil development on the breeding grounds has increased dramatically since 1988 and remains a threat today. Although USFWS personnel work with oil producers to avoid impacts to plovers, unless a federal permit is required, the USFWS is not necessarily informed about oil activity, and many wells are put in without any input regarding potential impacts on plovers. In North Dakota and Montana, oil production near plover nesting habitat has increased substantially since 1988, and many oil wells are near known plover nesting areas. The impacts from oil development are largely unknown but potentially substantial. Prior to production, seismic surveys are performed over an extensive area to determine the likely location of oil reserves. This requires large equipment that can leave permanent tracks in plover nesting areas, even under frozen conditions in winter. Plover chicks can have difficulty getting out of vehicle tracks, which may contribute to mortality (Eddings 1991, Howard et al. 1993). The extensive road system built to access oil wells may cause direct mortality of adult plovers. Plovers were documented to be hit by cars on a road between Lake Audubon and Lake Sakakawea (a Missouri River reservoir) in North Dakota (USFWS 2004; M. Shriner, Western Area Power Administration, in litt. 2007). Plover mortality has also been documented from powerline strikes (M. Shriner in litt. 2007). Drilling activity is extremely loud and would likely be disruptive to nesting plovers if it is done during the nesting season. Contamination from the reserve pit, either while the well is active or over time after the extraction is complete, may permanently impact piping plover habitat (USFWS, 2009).

Stressor: Wind power (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The number of wind farms in the Northern Great Plains is increasing rapidly (American Wind Energy Association 2008). North Dakota has been identified as the top state in the nation for wind energy potential, and Montana is the fifth highest (American Wind Energy Association

2009). The potential impacts of wind farms on piping plovers are unknown but may be significant. Impacts may occur through direct collision with turbines, or indirectly if plovers avoid previously used areas that now contain wind farms (USFWS, 2009).

Stressor: Intraspecific aggression (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: There is some information suggesting that in situations where density may be leading to insufficient forage for chicks, piping plover adults will attack nonrelated young (D. Catlin in litt. 2009). In the Northern Great Plains, this agonistic behavior is likely related to limited available habitat, as birds are forced to nest in dense concentrations and compete for forage (D. Catlin in litt. 2009). Intraspecific aggression seems to be a symptom of birds nesting too densely resulting in competition for resources. The reduction in suitable nesting habitat due to a number of factors is a major threat to the species, likely limiting reproductive success and thus future recruitment into the population (USFWS, 2009).

Stressor: Power lines (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Overhead power lines have been documented to kill a large number of birds, including plovers (USFWS 2004, M. Shriner in litt. 2007). Overall, power lines are known to kill piping plovers when located between feeding and nesting areas, but it is unknown whether the increasing number of powerlines across the migration routes impacts plovers (USFWS, 2009).

Stressor: Agricultural development (USFWS, 2015)
Exposure:
Response:
Consequence:
Narrative: Alkaline wetlands of the prairie pothole region lie within an agricultural landscape and are subject to siltation, pre-mature filling and other impacts (Gleason and Euliss 1998). Wetlands in agricultural fields receive more sediment from upland areas than wetlands in grassland landscapes. Cultivation of the wetland catchment areas, where surface water runs off to the wetland basin, has greatly altered the dynamics of surface runoff and hydrologic inputs to groundwater. Excessive sediment input can potentially alter the aquatic food web and other basic wetland functions. Retaining grasslands or restoring grassland buffers around plover nesting basins may reduce siltation and other contaminant impacts (USFWS, 2015).

Recovery

Reclassification Criteria:
Not available.

Recovery Priority Number: 2C

Delisting Criteria:

1. Using the most current estimates of region-specific breeding population and population growth (?), the NGP plover population model indicates that the upper 95 percent confidence limit on the probability of a regional population going extinct within the next 50 years is < 0.05. This criterion is satisfied for all four regions (description of the areas is under number '2' below). In addition, the following are met: 1. for every region, population growth is stable or increasing (= 1.0) over a 10-year average, and is projected to remain steady or increasing over the next 50 years, and 2. the population will be distributed so that at least 15 percent of the population is in each of the following regions: a. Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system) b. Northern Rivers (Missouri River system from Fort Peck Lake, Montana to Pierre, South Dakota) c. U.S. Alkaline Lakes d. Prairie Canada (USFWS, 2015).

2. A minimum amount of suitable nesting and foraging habitat is available on a regional basis, as described below. a. 1,630 ha (4,030 ac) in Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system) b. 1,320 ha (3,270 ac) in Northern Rivers (Missouri River system on Fort Peck Lake, Montana to Pierre, South Dakota) c. 1,460 ha (3,600 ac) in the U.S. Alkaline Lakes d. 1,460 ha (3,610 ac) in Prairie Canada. This criterion should be met for a minimum of 12 years prior to initiating delisting (USFWS, 2015).

3. Sufficient habitat is available on the coastal migration and wintering grounds in quantity and quality to support conservation of the species at recovery levels as defined by Criterion 1. This will include designated Critical Habitat, and additional habitat that was not designated but is regularly used by wintering piping plovers. Piping plovers should be spatially distributed in the following locations. a. Western Gulf Coast - from the Galveston Bay area, west-southwest along the coast of Texas and Mexico b. Central Gulf Coast - east-northeast of Galveston Bay through Jefferson County in NW Florida c. Eastern Gulf Coast - Florida's west coast-Taylor County, Florida south to Monroe County d. Atlantic Coast Florida's east coast, including the Florida Keys up through northeastern North Carolina, Caribbean Islands, and the Bahamas Islands (USFWS, 2015).

4. Ensure commitments are in place and functioning as anticipated to provide longterm funding, protection, and conservation management activities in essential breeding and wintering grounds. a. Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system) b. Northern Rivers (Missouri River system from Fort Peck Lake, Montana to Pierre, South Dakota) c. U.S. Alkaline Lakes d. U.S. Wintering Grounds (USFWS, 2015).

Recovery Actions:

- Protect habitat on the breeding grounds to support piping plovers at recovery level goals (USFWS, 2015).
- River system management: Ensure that river management mimics the natural system to the extent possible and furnishes sufficient high-quality nesting habitat to be available at a level to support piping plovers at recovery goals (USFWS, 2015).
- Alkaline Lakes: Identify and reduce threats in landscape ecology of the alkaline lakes basins such that the basins will provide quality self-sustaining habitat (USFWS, 2015).
- Work with commercial aggregate (also known as sand and gravel) mining companies to operate mines to avoid adversely affecting piping plovers during operations (USFWS, 2015).

- Implement steps to reduce unsustainable levels of predation risk over the long- term through ecosystem restoration (USFWS, 2015).
- Protect breeding plovers and their habitats from impacts of energy development (USFWS, 2015).
- Identify and control plant species, with an emphasis on invasives, that may make habitat unsuitable (USFWS, 2015).
- Develop and implement comprehensive plans, reflective of local conditions, to manage and avoid conflicts and to address the social and public relations challenges resulting from restrictions placed on human activities and interests such as recreation, residency, economic development and commerce. Actions should be focused on areas where management actions intended to protect piping plovers may interfere with human activities (USFWS, 2015).
- Coordinate among state, federal, and tribal agencies as well as private landowners to ensure that plover protection is incorporated into development plans on or near plover habitat in order to avert negative impacts to plovers (USFWS, 2015).
- Develop a Conservation Strategy for the long-term management of piping plovers and their habitat, including a post de-listing plan (USFWS, 2015).
- Work internally in the USFWS, and with federal and state agencies on projects so that there are no net negative impacts to plover habitat by assisting with design, implementation, permits, or mitigation measures (USFWS, 2015).
- Ensure that conservation measures designed to offset the adverse effects of human activities, developments and management decisions are monitored for effectiveness (USFWS, 2015).
- Ensure that incidental take that may be authorized pursuant to the ESA is consistent with recovery (USFWS, 2015).
- Continue monitoring efforts on the breeding grounds to track population trends and reproductive success. Monitoring efforts should be coordinated throughout the Northern Great Plains breeding grounds so that overall trends can be tracked across the range (See appendix 3B for a matrix on how this might be done across the range). Input monitoring results into the NGP plover model (see Appendix 2B) to assess progress towards recovery (USFWS, 2015).
- Work with biologists in Canada to identify and find solutions to international problems that may be impacting survival (USFWS, 2015).
- Coordinate between research and monitoring programs across the NGP to determine demographic parameters across time as local and regional conditions change (USFWS, 2015).
- Monitor status of State Wildlife Action Plan revisions and leverage opportunities to provide input on this species (USFWS, 2015).
- Evaluate impacts to the breeding population from projected climate change modeling and analysis (USFWS, 2015).
- Develop a comprehensive conservation plan for piping plovers in the U.S. portion of their migration and wintering range. a. Acquire funds to develop a concise, cohesive plan that will address the migration and wintering needs of the three breeding populations. This is most efficiently accomplished by a qualified contractor working in close coordination with USFWS biologists. b. Develop a state-by-state wintering and migration habitat use atlas (GL tasks 2.12, 2.13, 2.16; AC task 2.1; NGP task 1.13). i. Quantify amount and distribution of currently existing habitat. ii. Determine the condition of each site, including the type and level of

alteration, presence and threat level from invasive species, and whether natural coastal processes are impeded. Compare with historic habitat availability using aerial photography or other records. iii. Determine the temporal abundance and distribution of piping plover activity at sites with suitable habitat. Where appropriate data are currently lacking, conduct multiple surveys by qualified personnel across several migration and wintering seasons. Examples of reports summarizing methods and results of such surveys are available on request to the USFWS. iv. Evaluate likelihood of future actions, including human development and recreational uses, and natural events that could potentially affect habitat quantity and quality at each site. v. Evaluate factors at each site that will affect the response of habitat to accelerating sea-level rise and identify potential actions to minimize its adverse effects. c. Conduct a systematic review of recreational policies and beach management. Identify gaps in management and enforcement of regulatory mechanisms by state. Develop recommendations to improve management and enforcement of piping plover protections where warranted (AC task 2.24). d. Develop an education/outreach strategy to work with state, county, and municipal governments to develop and implement ordinances and other strategies reducing effects of habitat stabilization, beach cleaning practices, human uses, and pets in beach and bayside habitats (GL task 5.2, AC task 2.24, NGP task 5.2). e. Develop an education/outreach strategy to work with private landowners with regard to habitat stabilization, beach-cleaning practices, human uses, and pets (USFWS, 2009).

- Develop, in coordination with land managers, management plans for critical habitat sites or other sites that support or could support nonbreeding piping plovers. This may be accomplished concurrently with development of the atlas described under action 1b above or as a follow-up task (GL tasks 2.14, 2.22; AC tasks 2.13, 2.2; NGP tasks 4.42, 4.43). a. Develop and implement a conservation plan tailored to the site's conditions. A range of management measures may include, as appropriate, leash laws and dogfree zones, off-road vehicle management, and symbolic fencing of key habitats during periods of high plover use. b. Develop a recommended piping plover monitoring protocol for each site that includes suggested frequency and intensity of monitoring. c. Monitor the effectiveness of management measures (2.a above) (USFWS, 2009).
- Improve consistency in the approach used, and recommendations generated for, piping plover conservation in ESA section 7 consultations and Coastal Barrier Resources Act review across all USFWS field offices throughout the species' U.S. coastal migration and wintering range. a. Regularly update USFWS field office staff regarding latest information on piping plovers and habitat use. b. Emphasize importance of maintaining natural coastal processes to perpetuate high quality piping plover migrating and wintering habitat (AC task 2.21). c. Discourage projects that will degrade or interfere with formation or maintenance of high quality piping plover habitat (GL task 2.22, AC task 2.21, NGP task 4.43). d. Encourage project features to minimize adverse effects on piping plovers and their habitat, including creation and enhancement of habitat in the vicinity of existing stabilization projects. . e. Develop a comprehensive monitoring and management plan template for shoreline stabilization projects on the wintering and migration grounds. f. Consider effects of climate change when determining long-term impacts. Include measures to conserve and enhance the capacity of piping plover habitats to adapt to sea-level rise (USFWS, 2009).
- Develop a website specifically for wintering and migrating piping plover issues (GL task 5.2 and AC tasks 4.1, 4.2). a. Develop a piping plover contact list of all individuals in each state and other countries (Canada, Mexico, Bahamas, etc.). b. Link to other plover websites. c. Upload all pertinent literature, including research and monitoring reports not protected by copyright, to the website. d. Upload summarized section 7 consultations, conservation

measures, reasonable and prudent measures, and terms and conditions (USFWS, 2009).

- Focus the non-breeding portion of the International Census on enhancing understanding of piping plover abundance, distribution, and threat levels in seasonally emergent habitat (seagrass beds, oyster reefs, and mud flats) in Texas bays, and in Mexico and the Caribbean (GL task 2.13 and NGP task 1.13). a. Continue to encourage and improve International Census efforts at priority sites in Texas. b. USFWS regional coordinators for the International Census should establish contacts in Mexico, Bahamas, Cuba, and other appropriate Caribbean countries at least a year in advance of the 2011 International Census. i. Increase efforts to maximize survey coverage. ii. Encourage collection of information describing types and levels of threats at each International Census site in addition to physical and biological attributes of the site. iii. Provide information about color-banded birds and encourage surveyors to look for and report these marked piping plovers (USFWS, 2009).
- To further enhance understanding of spatial partitioning of the breeding populations (as well as the impacts of some threats) on the migration/winter grounds, USFWS should facilitate and encourage all efforts dedicated to (or incorporating) monitoring of color-banded piping plovers. There is urgency associated with this data collection since several large breeding grounds banding studies have recently ended or are slated for completion in the near future, and opportunities to glean information will decline as banded piping plovers die off (GL task 2.12, NGP task 1.133) (USFWS, 2009).
- Further investigate the partitioning of survival within the annual cycle, and determine whether winter habitat quality influences reproductive success and survival (GL task 4.1 and AC task 3.6). Explore opportunities for further comparison of survival rates among breeding populations to inform these issues (USFWS, 2009).
- Continue to refine characterization of optimal winter habitat and understanding of factors affecting piping plover use of different microhabitats (e.g., ocean intertidal zones, wrack, inlet shoreline, soundside flats) (GL task 4.4; AC tasks 3.11, 3.12, 3.13; NGP tasks 2.22, 2.23). Research approaches should recognize that piping plovers may move among relatively nearby habitat patches. Plover habitat use patterns and needs may also vary geographically (across their nonbreeding range) and seasonally. a. Determine how habitat modification or complete loss of a site on migration and wintering grounds affects survival given documented site fidelity. b. Develop design specifications for creating roosting and foraging habitat. c. Quantify the amount and distribution of habitat needed for recovery of each breeding population, giving due consideration to intra- and inter-species competition for use of similar habitats (USFWS, 2009).
- Develop strategies to reduce threats from accelerating sea-level rise. a. Identify human coastal stabilization practices that increase or decrease adverse effects of sea-level rise on coastal piping plover habitats. b. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat as sea-level rises. c. Evaluate projected effects of sea-level rise on the regional distribution of piping plover habitats over time. Facilitate use of LIDAR (a remote sensing system used to collect topographic data) mapping of coastal elevations, development of models, and timeframe analysis throughout the species wintering and migration range in the U.S. to generate projections regarding areas most likely to be inundated within given time frames (USFWS, 2009).
- Determine the extent that human and pet disturbance limits piping plover abundance and behavioral patterns in the wintering and migration habitats (GL task 2.14, AC task 3.14, NGP task 3.221) (USFWS, 2009).

- Determine the effect of human and pet disturbance on survival and reproductive fitness (GL task 4.1, AC task 3.14, NGP task 3.221) (USFWS, 2009).
- Support research to ascertain impacts of predation on wintering/migrating piping plovers, as well as to determine the effectiveness of predator control programs (USFWS, 2009).
- A draft and final revised recovery plan (or, alternatively, an interim conservation strategy) for the Northern Great Plains piping plover population should be developed (USFWS, 2009).
- Continue to construct habitat on the Missouri River system while exploring ways that flows could be altered to provide additional habitat for piping plover nesting and brood rearing (USFWS, 2009).
- Actively explore ways that the Missouri River reservoirs and shorelines can be manipulated to provide breeding habitat under a variety of water conditions (USFWS, 2009).
- Ensure habitat availability. Identify how much habitat is needed over time on river systems to provide for a secure Northern Great Plains piping plover population. The Missouri and Platte rivers in particular are highly altered systems, leading to flooding of breeding habitat and suppressed reproduction. To date, sandbar creation efforts on the Missouri River have not kept pace with habitat loss. See recovery plan tasks 4.416 and 4.417 (USFWS, 2009).
- Continue to perform monitoring and recovery actions annually throughout the U.S. Northern Great Plains population (USFWS, 2009).
- Identify and secure consistent funding for management, monitoring, and recovery efforts for the U.S. alkali lakes population (USFWS, 2009).
- Public outreach: a. Increase public outreach and education in areas where there is the potential for human/plover interactions. See recovery plan tasks 5.51 and 5.52. b. Increase law enforcement activities in areas where human disturbance may be impacting reproductive success (USFWS, 2009).
- Habitat protection: a. Continue to work with landowners on the alkali lakes to ensure protection of piping plover alkali lakes and surrounding uplands. Where possible, obtain longterm agreements with landowners to protect these habitats. Increase efforts to remove trees, rockpiles, etc., that may harbor predators. See recovery plan tasks 4.417 and 4.418. b. On the river systems, obtain easements or fee-title on undeveloped land to reduce current and future pressure from human activities on nearby piping plover habitat. Keep as much of the river bank as possible from being stabilized, since this increases flow velocity and thus sandbar erosion rates and encourages development. See recovery plan task 4.416. c. Restrict public use of sandbar and shoreline areas as needed to provide for piping plover nesting and brood-rearing needs (USFWS, 2009).
- Explore the movement of birds within the Northern Great Plains. It has been postulated that if there is not much habitat on the Missouri River system, birds will nest on the alkali lakes and vice versa. Sightings of banded birds have established that birds do move among the Missouri River, Nebraska, and the alkali lakes. There have been some sightings of birds hatched in Saskatchewan that apparently breed on the alkali lakes in Montana. However, it is not known if there are large-scale movements of piping plovers from one habitat type to another, in particular between the alkali lakes in the U.S. and Canada and the Missouri River system. A study of large-scale piping plover movements over time would help to identify where to focus management actions to ensure that there is habitat available in areas where birds may go if habitat in one area is not suitable in a given year (USFWS, 2009).
- Predation control efforts are ongoing on the Missouri River system and the U.S. alkali lakes. However, predation control may not always have the intended effect. For example, caging nests may increase adult mortality if predators learn to key in on cages. Increasing the

number of chicks hatched may not lead to a higher fledging success, since predators may key in on densely occupied areas. Research is needed to determine if predation control is actually improving reproductive success in all areas where it is taking place. See recovery plan tasks 3111 and 3112 (USFWS, 2009).

- The International Census is an extremely useful tool in the Northern Great Plains. Therefore, we recommend continuing the International Census for this population (recovery plan tasks 111 and 112). It may also be worth exploring additional sampling techniques between International Censuses to better track piping plover population trends on the Northern Great Plains. A well-designed sampling approach in which a subset of sites is surveyed more frequently may supplement the International Census by providing information on population trends and bird movements. Therefore, sub-sampling is unlikely to completely replace efforts to periodically survey the entire region. However, a combination of attempting to survey the entire area coupled with more frequent sub-sampling may provide more accurate and timely information about population trends (USFWS, 2009).
- Wind power is rapidly expanding in the Northern Great Plains. Research is needed to assess the threat this poses to piping plovers at breeding sites and in migration corridors. Special focus should be placed on the impact of associated power transmission lines (USFWS, 2009).
- . Oil and gas exploration and production is rapidly expanding throughout Northern Great Plains breeding grounds. Work is needed to determine the short and long-term impacts of oil exploration and production, including short-term impacts such as seismic work or drilling, ongoing impacts of extraction, potential impacts of spills or leakage, and long-term, cumulative changes as more habitat is disturbed for well pads and roads (USFWS, 2009).
- Piping plover adult numbers appear to fluctuate in response to the quantity of water in the river system (see Figure NGP13 in this review). A historical analysis of system storage and flows compared with adults surveyed and reproductive success may help in future river management. See recovery plan tasks 4161 and 4162 (USFWS, 2009).
- There is very limited evidence suggesting that forage on alkali lakes may be generated from nearby prairies. Changes in surrounding habitat may impact plovers in other ways as well. Examining forage on alkali lakes in relation to surrounding land use may help to focus alkali lake management priorities over the long term. See recovery plan task 211 (USFWS, 2009).
- Clarify the piping plover ESA listing to recognize the subspecies Charadrius melodus melodus and C. m. circumcinctus, and, within C. m. circumcinctus, two DPSs (USFWS, 2009).
- The International Piping Plover Census has fostered widespread involvement in survey efforts and provided extensive data. However, as piping plover conservation efforts mature, it may be beneficial to shift the Census effort to address specific questions that are not answered by other ongoing efforts. Given ongoing recovery programs on the breeding grounds, the most important future International Census contribution to ESA recovery implementation and monitoring for all piping plovers is the abundance estimate for the Northern Great Plains breeding population (including Prairie Canada). The highest benefit can be realized by emphasizing completeness and quality control of this portion of the census and by expediting synthesis and reporting, so that managers can make timely use of this information (see recommendation 11 for the Northern Great Plains breeding range). The most valuable potential contribution from future winter censuses is improved understanding of the species’ range in the Caribbean, Mexico, and other areas that may not have been fully covered in the past (e.g., seasonally emergent habitats within bays lying between the mainland and barrier islands in Texas) (USFWS, 2009).

Conservation Measures and Best Management Practices:

- Recommendations for Northern Great Plains Population Breeding Range 1. Design and implement over-arching monitoring framework to track breeding habitat and population performance over time. 2. Create partnerships with conservation organizations and the public where the primary goal is to work together to ameliorate the threat of habitat loss. (USFWS, 2020)

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SPECIES ACCOUNT: *Charadrius melodus circumcinctus* (Piping Plover - Northern Great Plains)

Species Taxonomic and Listing Information

Listing Status: Threatened; 12/11/1985; Midwest Region (R3) (USFWS, 2017)

Physical Description

The piping plover is a small [about 16.5 to 17.5 cm (6.5 to 7 inches long); 46 to 64 grams (1.5 to 2 ounces)] migratory shorebird with a short, stout bill, pale underparts and orange legs. During the breeding season, it also has a black band across the forehead, a single black neckband, and the bill is orange with a black tip. The piping plover was named for its melodic high-pitched call from which the scientific name is derived (USFWS 1988b). During the winter, the legs pale, the bill turns black, and the dark bands disappear. Chicks are speckled gray, buff, brown, and white down. Juveniles resemble adults in winter. Juveniles acquire adult plumage the spring after they fledge (Prater et al. 1977) (USFWS, 2015). Piping plover subspecies are phenotypically indistinguishable (USFWS, 2009).

Taxonomy

Miller et al. (2009) confirmed separate Atlantic and interior piping plover subspecies (C. m. melodus and C. m. circumcinctus, respectively). This study found that birds from the Great Lakes region were allied with the interior subspecies group and should be taxonomically referred to as C. m. circumcinctus. Currently available genetic information does not provide evidence that Great Lakes and Northern Great Plains piping plovers are genetically discrete (USFWS, 2009).

Historical Range

The Northern Great Plains population historically bred from Alberta to Ontario, Canada, south to Kansas and Colorado (USFWS, 2001).

Current Range

The breeding population of the Northern Great Plains piping plover extends from Nebraska north along the Missouri River through South Dakota, North Dakota, and eastern Montana, and on alkaline (salty) lakes along the Missouri River Coteau (a large plateau extending north and east of the Missouri River) in North Dakota, Montana, and extending into Canada. The majority of piping plovers from Prairie Canada winter along the south Texas coast, while breeding piping plovers from the U.S. are more widely distributed along the Gulf Coast from Florida to Texas (USFWS, 2015). Northern Great Plains piping plovers currently breed in eight states and three Canadian provinces (Elliott-Smith et al. 2009). Their range extends about 1,000 miles (1,600 km) from north to south and spans more than 800 miles (1,300 km) from west to east. Gratto-Trevor et al. (2009) found that Mississippi, Louisiana, and Texas coasts harbored 71% of observed wintering birds from the U.S. Northern Great Plains. Except at inland sites, piping plover migration routes and habitats overlap breeding and wintering habitats, and, unless banded, migrants passing through a site usually are indistinguishable from breeding or wintering piping plovers. Northern Great Plains populations were primarily seen farther west and south, especially on the Texas Gulf Coast in winter (Gratto-Trevor et al. 2009). Up to approximately 83% of the plovers in the U.S. Northern Great Plains nest on alkali lakes along the Missouri Coteau from central North Dakota to eastern Montana (Figure NGP10) (Brown and Jorgensen

2008, Peyton and Wilson 2008, USACE in litt. 2008a, USFWS in litt. 2008a) (USFWS, 2009a). Piping plovers winter in coastal areas of the United States from North Carolina to Texas. They also winter along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig 1992) (USFWS, 2001).

Distinct Population Segments Defined

No; There are separate breeding populations in the Northern Great Plains and the Great Lakes areas (USFWS, 2009).

Critical Habitat Designated

Yes; 7/10/2001.

Legal Description

On May 19, 2009, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in 18 specific units in Texas under the Endangered Species Act of 1973, as amended (74 FR 23476 - 23600). In total, approximately 139,029 acres (56,263 hectares) fall within the boundaries of the revised critical habitat designation. Other previously designated critical habitat for the wintering piping plover in Texas or elsewhere in the United States remains unaffected.
On October 21, 2008, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in North Carolina under the Endangered Species Act of 1973, as amended (73 FR 62816 - 62841). In total, approximately 2,043 acres (ac) (827 hectares (ha)), in Dare and Hyde Counties, North Carolina, fall within the boundaries of the revised critical habitat designation.
On July 10, 2001, the Fish and Wildlife Service (Service), designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for the wintering population of the piping plover (Charadrius melodus) (66 FR 36038 - 36143). This includes approximately 2,891.7 kilometers (km) (1,798.3 miles (mi)) of mapped shoreline and approximately 66,881 hectares (ha) (165,211 acres (ac)) of mapped area along the Gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons.
On September 11, 2002, the U.S. Fish and Wildlife Service (Service), designated critical habitat for the northern Great Plains breeding population of the piping plover (Charadrius melodus), pursuant to the Endangered Species Act of 1973, as amended (67 FR 57638 - 57717). The designation includes 19 critical habitat units containing prairie alkali wetlands, inland and reservoir lakes, totaling approximately 183,422 acres (ac) (74,228.4 hectares (ha)) and portions of 4 rivers totaling approximately 1,207.5 river miles (rm) (1,943.3 kilometers (km)) in the States of Minnesota, Montana, Nebraska, North Dakota, and South Dakota.
Critical habitat includes prairie alkali wetlands and surrounding shoreline, including 200 feet (ft) (61 meters (m)) of uplands above the high water mark; river channels and associated sandbars, and islands; reservoirs and their sparsely vegetated shorelines, peninsulas, and islands; and inland lakes and their sparsely vegetated shorelines and peninsulas. Section 7 of the Endangered Species Act requires Federal agencies to ensure that actions they authorize, fund, or carry out are not likely to destroy or adversely modify critical habitat.

Critical Habitat Designation

18 units are designated as revised critical habitat in Texas for the wintering population of the piping plover. The units are divided into 24 areas: (1)Subunit TX–3A: South Padre Island – Gulf of Mexico Shoreline; (2)Subunit TX–3B: South Padre Island –Interior; (3)Subunit TX–3C: North Padre

Island – Interior; (4)Subunit TX–3D: North Padre Island – Gulf of Mexico; (5)Subunit TX–3E: Mesquite Rincon; (6)Unit TX–4: Lower Laguna Madre Mainland; (7)Unit TX–7: Newport Pass/Corpus Christi Pass Beach; (8)Unit TX–8: Mustang Island Beach; (9)Unit TX–9: Fish Pass Lagoons; (10)Subunit TX–10A: Shamrock Island; (11)Subunit TX–10B: Mustang Island – Unnamed sand flat; (12)Subunit TX–10C: Mustang Island – Lagoon Complex; (13)Unit TX–14: East Flats; (14)Unit TX–15: North Pass; (15)Unit TX–16: San Jose Beach; (16)Unit TX–18: Cedar Bayou/Vinson Slough; (17)Unit TX–19: Matagorda Island Beach; (18)Unit TX–22: Decros Point; (19)Unit TX–23: West Matagorda Peninsula Beach; (20)Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West; (21)Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East; (22)Unit TX–31: San Bernard NWR Beach; (23)Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers; and (24)Unit TX–33: Bryan Beach and Adjacent Beach.

Unit TX–3: Padre Island Subunit. TX–3A: South Padre Island – Gulf of Mexico Shoreline. This subunit consists of 2,891 ac (1170 ha) in Cameron and Willacy Counties, Texas. It is a beach 30.0 mi (48.2 km) in length on the gulfside of South Padre Island, which is a barrier island. The subunit is located within an area bounded on the south by the southern boundary of Andy Bowie County Park, and on the north by the south jetty of Mansfield Channel, which divides North and South Padre Islands. The jetty itself is outside the boundary of the subunit. The eastern boundary is the estimated MLLW of the Gulf of Mexico, and the western boundary is the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. The vegetated dune and Park Road 100, which runs northsouth along the western side of the dune, separates Subunits TX–3A and 3B. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately one quarter of the subunit is in Federal ownership and managed by the Service’s Laguna Atascosa National Wildlife Refuge (NWR), and approximately 64 percent is in private ownership. The Service does not own the subsurface mineral rights. Ten percent is State land managed by the GLO, and a small portion at the southern end is County park land managed by Andy Bowie County Park. Subunit TX–3A is the southernmost unit of the revised critical habitat for the wintering population of the piping plover. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1), surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greatest magnitude at the southern end of the subunit where housing developments are to the west of the subunit. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3B: South Padre Island –Laguna Madre side. This bayside subunit consists of 44,137 ac (17,862 ha) in Cameron and Willacy Counties, Texas. Its southern boundary extends along the north side of an existing earthen, manmade dike running from the edge of dense dune vegetation to the Laguna Madre along latitude 26° 09’ 19.00’’ N. The dike is not within the boundary of the subunit. The western boundary is the western edge of the intertidal mudflats bordering the eastern shore of the lower Laguna Madre, and the northern boundary is Mansfield Channel. The eastern boundary is dense vegetation of the dunes or, if there is no dense vegetation or dune, the western boundary of Park Road 100. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately 42 percent of the land is federally owned and managed by the Service’s Laguna Atascosa NWR, and approximately 38 percent is Stateowned and managed by the GLO. The remaining 20 percent is in private ownership along the western side of the subunit. The Service does not own the subsurface mineral rights beneath the refuge. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand and mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. These threats, particularly vehicle access, are of greatest magnitude at the southern portion of the subunit where roads are near or adjacent to PCE 1. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3C: North Padre Island – Laguna Madre side. This bayside unit consists of 50,897 ac (20,597 ha) in Kenedy and Kleberg Counties, Texas. It is along and within the Laguna Madre and extends from the western boundary of Padre Island National Seashore (PAIS) to the Gulf Intracoastal Waterway (GIWW). The northern boundary of the subunit is a line extending westward from the PAIS (at latitude 27° 4’ 29.9’’ N), and its southern boundary is a line extending westward from the southern boundary of PAIS along the northern edge of the Mansfield Channel. The eastern boundary of this subunit is the western boundary of PAIS when the PCEs extend as far as PAIS or the eastern edge of the sand flats where the PCEs end. The portion of the western boundary north of longitude/latitude coordinate 26°48’38.2’’N, 97°28’11.6’’W is the eastern edge of the GIWW, and the portion of the western boundary south of the coordinate is the western edge of the intertidal mudflats bordering the eastern shore of the Laguna Madre. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is State-owned and managed by the GLO. A small portion is in private ownership. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time the Service is not aware of any management plans that address this species in this area. Subunit TX–3D: North Padre Island – Gulf of Mexico. This gulfside subunit consists of 270 ac (109 ha) of beach in Kleberg County, Texas. It extends along the gulf shore of North Padre Island from the northern boundary of PAIS northward 6.2 mi (10 km) to the Nueces County line. The southern boundary is the north boundary of the northeast section of the PAIS. The subunit extends eastward to the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Most of the land is owned by the State and managed by the GLO. Approximately one-fifth is in private ownership. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surfcast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greater magnitude at the north end of the subunit, where more roads provide easy access to the PCEs and the subunit is in close proximity to houses. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–3E: North Padre Island – Mesquite Rincon. This triangular bayside subunit of 9,6238 acres (3,894 hectares) lies on the western shore of the lower Laguna Madre in Kenedy County, Texas. The subunit is generally bounded by Rincon de la Soledad on the southwestern side, Mesquite Rincon on the north, and the GIWW and Rincon de San Jose on the east. The southwestern boundary is an irregular line along the PCEs between the latitude/longitude coordinate points: 26° 44’ 10.5’’ N, 97° 28’ 04.5’’ W at the southeastern point of Rincon de San Jose and 26° 50′ 58.1′′ N, 97° 34′ 19.5′′ W. The northern boundary is the line described between the latitude/longitude coordinate points: 26° 51′ 24.2′′ N, 97° 33′ 25.8′′ W and 26° 51′ 24.2′′ N, 97° 27′ 52.7′′ W. The northern portion of the eastern boundary is the western edge of the GIWW south to latitude/longitude coordinate point 26° 48′ 52.7′′ N, 97° 28′ 12.9′′ W. There the subunit curves westward and skirts a small horseshoeshaped inlet in the Laguna Madre to the northeastern point of Rincon de San Jose at latitude/longitude coordinate point 26° 48′ 43.9′′ N, 97° 29′ 4.7′′ W. There it continues south in an irregular line along the edge of the PCEs to the southeastern point of Rincon San Jose. Within that boundary (especially the southeastern portion of the subunit and northwestern-running edge), the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is in private ownership with a small portion that is State-owned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–4: Lower Laguna Madre Mainland. This bayside unit consists of 17,223 ac (6,970 ha) in Cameron and Willacy Counties, Texas, and lies along the western shoreline of the Lower Laguna Madre. The southern boundary is an east-west line at the northern tip of Barclay Island, approximately following latitude 26° 14′ 42.2′′ N. The northern boundary is an east-west line located near the northern tip of El Sauz Island, approximately 1.2 mi (1.9 km) south of the center of the city of Port Mansfield, Willacy County, Texas, and approximately following latitude 26° 32′ 7.8′′ N. The eastern boundary of the unit is the eastern edge of the line of dredge spoils that parallel the western side of the GIWW. The western boundary runs from southeast to northwest and is the western edge of sandy beach and mudflat habitat, approximately following the latitude/longitude coordinate points: latitude/longitude coordinate points: 26° 14′ 42.45′′ N, 97° 19′ 32.75′′ W; 26° 17′ 15.54′′ N, 97° 20′ 47.31′′ W; 26° 20′ 10.17′′ N, 97° 21′ 10.94′′ W; 26° 21′ 31.54′′ N, 97° 22′ 48.10′′ W; 26° 24′ 26.64′′ N, 97° 23′ 53.27′′ W; 26° 26′ 8.55′′ N, 97° 25′ 13.33′′ W; and 26° 32′ 5.44′′ N, 97° 27′ 6.91′′ W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service has used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately one-third of this unit is within the Service's Laguna Atascosa NWR. Approximately half is Stateowned and managed by the GLO. The remainder is in private ownership. The Service does not own the subsurface mineral rights beneath the surface of the refuge. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand or mud flats above high tide for roosting (PCE 2). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This unit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–7: Newport Pass/Corpus Christi Pass Beach. This unit consists of 294 ac (119 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 5.1-mi (8.2- km) long. The southern boundary is the gulfward extension of Saint Bartholomew Avenue, adjacent to the north end of the seawall. The northern boundary is the edge of the south jetty of the Fish Pass Structure at Mustang Island State Park. The eastern boundary is MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dune. Packery Channel cuts the beach approximately 0.3 mi (0.5 km) north of the south boundary. The seawall, jetty, bollards, and open water of Packery Channel are not within the boundaries of the unit. This unit is in State and private ownership; the State portion is managed by the Mustang Island State Park. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains PCEs in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–8: Mustang Island Beach. This unit consists of 623 ac (252 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 12.5 mi (20.1 km) long. The southern boundary is the edge of the north jetty of the Fish Pass Structure at Mustang Island State Park. The northern boundary is the south side of the Horace Calder Pier in Port Aransas, Texas. The unit is bounded on the east by the MLLW of the Gulf of Mexico, and on the west by the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated. The jetty and pier are not within the boundary of the unit. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is in State and private ownership, with a small municipal park owned and managed by the City of Port Aransas. The State land is managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–9: Fish Pass Lagoons. This bayside unit consists of 168 ac (68 ha) in Nueces County, Texas. This unit encompasses flats facing Corpus Christi Bay that extend 1.0 km (0.6 mi) on either side of Fish Pass. The inland boundary is a line of dense vegetation, and the bayside boundary is the northeast edge of the tidal sand flats that are a PCE. This unit includes all areas of habitat that contain PCEs 1, 2, 5, and 6 within the area described by a polygon with the following latitude/longitude coordinate points: 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W; 27° 41′ 56.97′′ N, 97° 10′ 8.13′′ W; 27° 41′ 24.35′′ N, 97° 10′ 36.89′′ W; 27° 41′ 18.98′′ N, 97° 11′ 16.79′′ W; 27° 41′ 23.51′′ N, 97° 11′ 31.32′′ W and 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W. Within that polygon, six moderate to large polygons from 5 to 64 ac (2 to 25 ha) each and two small polygons less than 1 ac (0.4 ha) each are PCEs and comprise the unit. Most of the unit is owned by the State and managed by the GLO. A few acres are in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and/or mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–10: Shamrock Island and Adjacent Mustang Island Flats. Subunit TX–10A: Shamrock Island. This 12-ac (5-ha) island in Nueces County, Texas, was a peninsula extending off of Mustang Island in Corpus Christi Bay until erosion separated the island from the mainland. Five small polygons of sand flats from 1.1 to 6.8 ac (0.4 to 2.7 ha) comprise the subunit. Most of the land is State-owned and managed by the GLO; the remainder is privately owned. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10B: Mustang Island: Unnamed sand flat. This 2-ac (1-ha) subunit in Nueces County, Texas, is a small, unnamed sand flat near the north edge of the mouth of Wilson’s Cut in Corpus Christi Bay. The subunit is the western half of the island that is sand flats landward (easterly) to the western edge of tidal marsh. It is entirely Stateowned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. The location of the subunit, and the configuration of the polygons of PCEs that comprise this subunit, limit recreational access by vehicles to PCEs 1 and 2. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10C: Mustang Island: Lagoon Complex. This 331-ac (134-ha) subunit in Nueces County, Texas, is an extensive lagoon complex that consists of 11 polygons within a larger polygon that extends 2.2 mi (3.5 km) south of Wilson’s Cut in Corpus Christi Bay. The southern boundary of the larger polygon begins at the western end at latitude/ longitude coordinate point 27° 43’ 2,4’’ N, 97° 10’ 19.4’’ W at the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. It follows the dune line southeast approximately 830 ft (253 m) to a road, then follows the road approximately 945 ft (288 m) to the edge of the tidal sand flat PCE. It follows the southeastern edge of the sand flat northeast to the western edge of a northsouth road, where it follows the edge of the sand flat northward to the south edge of a road that runs east-west parallel to the southwestern edge of Wilson’s Cut. The northern edge of the boundary is the south edge of the road or the northern extent of the sand flat when it does not reach the road. The western boundary follows the PCEs along their eastern edge at Corpus Christi Bay beginning 409 ft (125 m) southwest of the southwestern edge of Wilson’s Cut to the coordinate point at the western edge of the southern boundary. A road transects the larger polygon described above, forming two polygons that exclude the road. The PCEs within the 11 polygons comprise the subunit. Within that boundaries of the 11 polygons, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the polygons that comprise the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundaries can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. The subunit consists of private and Stateowned lands. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to uncontrolled recreational access and beach cleaning and stabilization efforts. Road access to the PCEs is extensive. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–14: East Flats. This bayside unit consists of 591 ac (239 ha) in Nueces County, Texas. It is an irregularly shaped intertidal sand flat south of the Corpus Christi Ship Channel. The north boundary is the northern edge of the sand flat near or adjacent to dredge spoil areas bordering the south side of the Corpus Christi Ship Channel. The northwestern latitude/longitude coordinate is 27° 49’ 54.49’’ N, 97° 6’ 14.28’’ W, and the northeastern latitude/longitude coordinate is 27° 49’ 55.29’’ N, 97° 5’ 12.86’’ W. From there, the sand flat curves southward, and the southeastern edge of it forms a highly irregular line that ends in the southwest portion of the polygon at the eastern edge of a navigation channel from the Corpus Christi Ship Channel to Corpus Christi Bay at latitude/longitude coordinate 51.93’’ N, 97° 5’ 52.58’’ W. The sand flat continues on the western edge of the navigation channel in a northwesterly direction to latitude/longitude coordinate 27° 49’ 22.08’’ N, 97° 6’ 37.04’’ W. It then curves northeasterly and across the cut to the northern edge at the northwest coordinate. On the east, it abuts the City of Port Aransas. There is a small marshland within the sand flat that bisects the sand flat that is not a PCE and is not included in the unit. The unit is mostly in private ownership, with a small portion of State land managed by the GLO. This unit was occupied at the time of listing and is currently occupied. Current ocupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–15: North Pass. This bayside unit consists of 805 ac (326 ha) in Aransas County, Texas. The unit is bounded on the northeast by a line between latitude/longitude coordinates 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W and 27° 54′ 54.53′′ N, 97° 1′ 18.17′′ W, on the northwest and west by the edge of tidal sand flats in Aransas Bay, on the south by a line running east from coordinate 27° 53′ 16.96′′ N, 97° 2′ 22.44′′ W to unit TX–16, and on the southeast by the landward boundary of unit 16. The unit is all areas that contain the PCEs for the species within a larger area described by a polygon with the following sets of latitude/longitude coordinate points: 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W; 27° 53′ 10.68′′ N, 97° 1′ 21.36′′ W; 27° 53′ 16.96′′ N, 97° 2′ 22.44′′ W; 27° 53′ 33.08′′ N, 97° 2′ 33.05′′ W; 27° 54′ 42.68′′ N, 97° 2′ 4.83′′ W; 27° 54′ 47.59′′ N, 97° 1′ 51.73′′ W; 27° 54′ 54.53′′ N, 97° 1′ 18.17′′ W and 27° 54′ 8.70′′ N, 97° 0′ 36.97′′ W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale, so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit is a remnant of a hurricane washover on San Jose Island. Approximately 18 percent is Stateowned and managed by the GLO; the remainder is in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–16: San Jose Beach. This unit consists of 1,378 ac (558 ha) in Aransas County, Texas. It is a gulfside beach unit approximately 19.8 mi (31.9 km) long. The southern boundary is the edge of the north jetty of Aransas Pass. The jetty is not within the boundary of the unit. The south edge of Cedar Bayou Pass is the northern boundary. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. A small section is in Federal ownership and managed by the Service's Matagorda Island NWR. The Service does not own the subsurface mineral rights. Approximately half of the unit is State-owned and managed by the GLO, and nearly as much is in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–18: Cedar Bayou/Vinson Slough. This bayside unit consists of 2,465 ac (998 ha) in Aransas County, Texas. It is a remnant of a hurricane washover area and includes the highly dynamic area of Cedar Bayou, the pass that separates San Jose Island and Matagorda Island. Beginning at the confluence of Vinson Slough and Cedar Bayou, the boundary follows the shore of Spalding Cove to Long Reef, then continues along a line extending 2.5 miles southwest of Long Reef to the shore of San Jose Island, then along the shore of the island to the landward boundary of Unit TX–16. Within that area, the unit consists of numerous polygons of PCEs; areas that are not PCEs within the described area are not within the boundaries of the unit. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. The southern and southeastern boundary of the unit is described by a line with the following sets of latitude/longitude coordinate points: 28° 1’ 21.76’’ N, 96° 57’ 51.24’’ W; 28° 1’ 12.77’’ N, 96° 57’ 31.18’’ W; 28° 2’ 3.07’’ N, 96° 56’ 45.84’’ W; 28° 2’ 15.92’’ N, 96° 56’ 25.10’’ W; 28° 2’ 30.32’’ N, 96° 56’ 11.97’’ W; 28° 3’ 15.62’’ N, 96° 54’ 20.01’’ W; 28° 3’ 58.58’’ N, 96° 53’ 24.65’’ W; 28° 4’ 1.15’’ N, 96° 52’ 14.65’’ W; 28° 3’ 31.74’’ N, 96° 51’ 38.29’’ W and 28° 3’ 17.69’’ N, 96° 51’ 38.47’’ W. The specific northern boundary is described by a line with the following sets of latitude/longitude coordinate points: 28° 5’ 44.24’’ N, 96° 54’ 8.16’’ W; 28° 5’ 13.23’’ N, 96° 52’ 44.85’’ W; 28° 4’ 33.99’’ N, 96° 50’ 46.55’’ W; 28° 4’ 38.92’’ N, 96° 50’ 40.79’’ W and 28° 4’ 22.98’’ N, 96° 50’ 22.94’’ W. The eastern boundary at the northeastern end of the unit is units TX–16 and TX–19 on the gulfside. The western boundary is the western edge of tidal sand flats in Aransas Bay. This area includes a small section of federally owned land managed by the Service’s Matagorda Island NWR and a small section of State-owned land. The remaining area is privately owned. The Service does not own the subsurface mineral rights beneath the NWR. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use. Vehicle use of the unit may be limited somewhat by accessibility. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–19: Matagorda Island Beach. This unit consists of 2,413 ac (976 ha) in Calhoun County, Texas. It is a gulfside beach unit approximately 37.1 mi (59.7 km) long. The southern boundary is the northern edge of Cedar Bayou Pass, and the northern boundary is the southern edge of Pass Cavallo. At Pass Cavallo, the unit curves from the eastern gulfside passing between the south edge of the pass and the north edge of the dunes to a small area on the bayside. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The federally owned land in this unit is managed by the Service's Matagorda Island NWR, which does not own the subsurface mineral rights. This unit also includes a small section of land in State ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and access by refuge staff and others for sea turtle monitoring efforts. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–22: Decros Point. This unit consists of 544 ac (220 ha) at the Matagorda/Calhoun County line, in Texas. It is a gulfside beach unit approximately 4.8 mi (7.7 km) long that wraps around to the bayside. This unit was originally the southern tip of the Matagorda Peninsula. It was made into an island by the dredging of the Matagorda Ship Channel, the edge of which is the northern boundary of the unit. The unit is horseshoe in shape with the east side along the Gulf of Mexico and the west side along Matagorda Bay; the two are connected at their southern boundary by habitat from the north edge of Pass Cavallo northward to the dune line. Densely vegetated sand dunes run north to south in the center of the horseshoe and are not within the boundary of the critical habitat because they are not a PCE. The eastern boundary is the MLLW of the Gulf of Mexico (see the Methods section for our derivation of MLLW), and the western boundary is the western edge of tidal sand flats on the east side of Matagorda Bay. Within the bayside of the boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 60 percent of the unit is in State ownership managed by the GLO. The remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach (PCE 4) for roosting and sheltering. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Due to a lack of road access, this unit does not receive much recreational vehicle use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–23: West Matagorda Peninsula Beach. This unit consists of 1,808 ac (732 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 23.9 mi (38.5 km) long. The southern boundary is the northern jetty of the Matagorda Ship Channel. The northern boundary is the Old Colorado River channel. The MLLW of the Gulf of Mexico is the eastern boundary, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just under half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West. This unit consists of 905 ac (366 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 14.1 mi (22.8 km) long. The southwestern boundary is the northeastern edge of the Old Colorado River channel. The unit runs along the beach 14 mi (23 km) to the northeastern boundary opposite Eidelbach Flats described by a line between the latitude/longitude coordinate points: 28° 41’ 2.26’’ N, 95° 46’ 29.04’’W and 28° 41’ 6.74’’ N, 95° 46’ 32.46’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just over half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East. This gulfside unit consists of 481 ac (194 ha) in Matagorda County, Texas. It extends along the Gulf beach southwest and northeast of Brown Cedar Cut. The cut is not within the boundary of the unit. This unit abuts portions of the southeastern edges of units TX–29 and TX–30, which are on the East Matagorda Bay side. The southwestern boundary is approximately 4 mi (6.5 km) southwest of Brown Cedar Cut at a line described by the following sets of latitude/ longitude coordinate points: 28° 43’ 11.91’’N, 95° 42’ 25.47’’W and 28° 43’ 17.09’’N, 95° 42’ 28.56’’W. The northeastern boundary is approximately 2.8 mi (4.5 km) northeast of Brown Cedar Cut to the point where Texas Farm to Market Road 457 intersects the beach. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat boundaries, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately onethird is in State ownership and managed by the GLO; the remaining two-thirds is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–31: San Bernard NWR Beach. This gulfside unit consists of 401 ac (162 ha) in Matagorda and Brazoria Counties, Texas. It is a 6.2-mi (10-km) segment of beach on the Gulf of Mexico near the mouth of the San Bernard River. The northeastern boundary is at the southwestern edge of the mouth of the San Bernard River. The southwestern boundary follows a line described by the following sets of latitude/longitude coordinate points: 28° 47’ 54.39’’ N, 95° 33’ 26.21’’ W, and 28° 47’ 57.69’’ N, 95° 33’ 27.75’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. There is a cut through the beach from the Gulf of Mexico to a lake 3.5 mi (5.6 km) southwest of the San Bernard River, which is not within the unit. Bollards also are not within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 30 percent of this unit is in Federal ownership and managed by the Service's San Bernard NWR, which does not own the subsurface mineral rights. Approximately 48 percent is Stateowned and managed by the GLO with the remaining area in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The federally owned portion has pedestrian recreational access, but no vehicle access. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers. This gulfside unit consists of 556 ac (225 ha) of shoreline in Brazoria County, Texas. This unit is a 6.1-mi (9.8-km) segment of beach on the Gulf of Mexico between the mouths of the San Bernard and Brazos Rivers. The southwestern boundary is the northeastern edge of the mouth of the San Bernard River. The northeastern boundary is the western edge of the mouth of the Brazos River. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. It is entirely in State ownership and managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–33: Bryan Beach and Adjacent Beach. This unit consists of 211 ac (85 ha) in Brazoria County, Texas. It is gulfside beach approximately 3.5 mi (5.7 km) in length on the Gulf of Mexico near the mouth of the Brazos River. The southwestern boundary is the northeastern edge of the Brazos River. The northeastern boundary is Farm-toMarket Road 1495 (Bryan Beach Rd). The southeastern boundary is the MLLW. The northwestern boundary follows along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is entirely in State ownership and managed by the Texas Department of Parks and Wildlife. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Four units are designated as critical habitat for the wintering population of the piping plover in North Carolina. The four areas designated as critical habitat are: (1) Unit NC–1, Oregon Inlet; (2) Unit NC–2, Cape Hatteras Point; (3) Unit NC–4, Hatteras Inlet; and (4) Unit NC–5, Ocracoke Island.

Unit NC–1: Oregon Inlet. Unit NC–1 is approximately 8.0 km (5.0 mi) long, and consists of about 196 ha (485 ac) of sandy beach and inlet spit habitat on Bodie Island and Pea Island in Dare County, North Carolina. This is the northernmost critical habitat unit within the wintering range of the piping plover. Oregon Inlet is the northernmost inlet in coastal North Carolina, approximately 19.0 km (12.0 mi) southeast of the Town of Manteo, the county seat of Dare County. The unit is bounded by the Atlantic Ocean on the east and Pamlico Sound on the west and includes lands from the mean lower low water (MLLW) on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where the PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit begins at Ramp 4 near the Oregon Inlet Fishing Center on Bodie Island and extends approximately 8.0 km (5.0 mi) south to the intersection of NC Highway 12 and Salt Flats Wildlife Trail (near Mile Marker 30, NC Highway 12), approximately 5.0 km (3.0 mi) from the groin, on Pea Island, and includes Green Island and any emergent sandbars south and west of Oregon Inlet, and the lands owned by the State of North Carolina, specifically islands DR–005–05 and DR–005–06. However, this unit does not include the Oregon Inlet Fishing Center, NC Highway 12, the Bonner Bridge and its associated structures, the terminal groin, the historic Pea Island Life-Saving Station, or any of their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Oregon Inlet has reported consistent use by wintering piping plovers dating from the mid-1960s. As many as 100 piping plovers have been reported from a single day survey during the fall migration (NCWRC unpublished data). Christmas bird counts regularly recorded 20 to 30 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall number of piping plovers reported using the area has declined since the species was listed in 1986 (NCWRC unpublished data), which corresponds to increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Oregon Inlet is one of the first beach access points for off-road vehicles within Cape Hatteras National Seashore when traveling from the developed coastal communities of Nags Head, Kill Devil Hills, Kitty Hawk, and Manteo. As such, the inlet spit is a popular area for off-road vehicle users to congregate. The majority of the Cape Hatteras National Seashore users in this area are off-road vehicle owners and recreational fishermen. In fact, a recent visitor use study of Cape Hatteras National Seashore reported that Oregon Inlet is the second most popular off-road vehicle use area in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby Oregon Inlet Fishing Center. Pea Island National Wildlife Refuge (PINWR) does not allow off-road vehicle use; however, Pea Island regularly receives dredged sediments from the maintenance dredging of Oregon Inlet by the Corps. The disposal of dredged sediments on PINWR has the potential to disturb foraging and roosting plovers and their habitats. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–2: Cape Hatteras Point. Unit NC–2 consists of 262 ha (646 ac) of sandy beach and sand and mud flat habitat in Dare County, North Carolina. Cape Hatteras Point (also known as Cape Point or Hatteras Cove) is located south of the Cape Hatteras Lighthouse. The unit extends south approximately 2.8 mi (4.5 km) from the ocean groin near the old location of the Cape Hatteras Lighthouse to the point of Cape Hatteras, and then extends west 4.7 mi (7.6 km) along Hatteras Cove shoreline (South Beach) to the edge of Ramp 49 near the Frisco Campground. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where PCEs do not occur). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. This unit does not include the ocean groin. Consistent use by wintering piping plover has been reported at Cape Hatteras Point since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Cape Hatteras Point independently from Hatteras Inlet. These single day surveys have recorded as many as 13 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Cape Hatteras Point is located near the Town of Buxton, the largest community on Hatteras Island. For that reason, Cape Hatteras Point is a popular area for ORV use and recreational fishing. A recent visitor use study of the park found that Cape Hatteras Point had the most ORV use within the park (Vogelsong 2003). As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–4: Hatteras Inlet. Unit NC–4 is approximately 8.0 km (5.0 mi) long, and consists of 166 ha (410 ac) of sandy beach and inlet spit habitat on the western end of Hatteras Island and the eastern end of Ocracoke Island in Dare and Hyde Counties, North Carolina. The unit begins at the first beach access point at Ramp 55 at the end of NC Highway 12 near the Graveyard of the Atlantic Museum on the western end of Hatteras Island and continues southwest to the beach access at the ocean-side parking lot near Ramp 59 on the northeastern end of Ocracoke Island. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which itself is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The Hatteras Inlet unit includes all emergent sandbars within Hatteras Inlet including lands owned by the State of North Carolina, specifically Island DR–009–03/04. The unit is adjacent to, but does not include, the Graveyard of the Atlantic Museum, the ferry terminal, the groin on Ocracoke Island, NC Highway 12, or their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Hatteras Inlet has reported consistent use by wintering piping plovers since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Hatteras Inlet independently from Cape Hatteras Point. These single-day surveys have recorded as many as 40 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall numbers of piping plovers reported using the area has declined in the last 10 years (NCWRC unpublished data), corresponding with increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Hatteras Inlet is located near the Village of Hatteras, Dare County, and is the southernmost point of Cape Hatteras National Seashore that can be reached without having to take a ferry. As such, the inlet is a popular off-road vehicle and recreational fishing area. In fact, a recent visitor use study of the park found Hatteras Inlet the fourth most used area by off-road vehicles in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby marinas of Hatteras Village. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–5: Ocracoke Island. This unit consists of 203 ha (502 ac) of sandy beach and mud and sand flat habitat in Hyde County, North Carolina. The unit includes the western portion of Ocracoke Island beginning at the beach access point at the edge of Ramp 72 (South Point Road), extending west approximately 2.1 mi (3.4 km) to Ocracoke Inlet, and then back east on the Pamlico Sound side to a point where stable, densely vegetated dune habitat meets the water. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit includes all emergent sandbars within Ocracoke Inlet. This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. The unit is adjacent to but does not include NC Highway 12, any portion of the maintained South Point Road at Ramp 72, or any of their ancillary facilities. Ocracoke Island had inconsistent recorded use by wintering piping plovers in the early 1980s, and Christmas bird counts recorded only 1 to 6 plovers using the area throughout the early 1990s.

However, since the late 1990s when regular and consistent surveys of the area were conducted, as many as 72 piping plovers have been recorded during migration, and 4 to 18 plovers have been regularly recorded during the overwinter period (NCWRC unpublished data). Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). Ocracoke Inlet is located near the Village of Ocracoke, and is the southernmost point of the Cape Hatteras National Seashore. Ocracoke Island is only accessible by ferry. As such, the island is a popular destination for vacationers and locals interested in seclusion. The inlet is also a popular recreational fishing and ORV area. A recent visitor use study of the park reported Ocracoke Inlet was the third most popular ORV use area in the park (Vogelsong 2003). As a result, the primary threat to the wintering piping plover and its habitat within this unit is disturbance to and degradation of foraging and roosting areas by ORVs and by people and their pets. Therefore, sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

The lands designated as critical habitat were divided into 142 critical habitat conservation units that contain areas with the primary constituent elements for the piping plover in the wintering range of the species. These units are found in all eight States where piping plovers winter. See above for revised critical habitat in NC and TX (Units TX– 3, TX–4, TX–7, TX–8, TX–9, TX–10, TX–14, TX–15, TX–16, TX–18, TX–19, TX–22, TX–23, TX–27, TX–28, TX–31, TX–32, and TX–33).

Unit SC–1: Waites Island-North. 75 ha (186 ac) in Horry County. This unit includes the northern tip of Waites Island from the MLLW at Little River Inlet and runs west along the Atlantic Ocean shoreline 2.0 km (1.25 mi) and includes land from the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The unit continues north and west of Little River Inlet stopping at Sheephead Creek, including land from MLLW to dense vegetation line. The majority of the unit is privately owned.

Unit SC–2: Waites Island-South. 58 ha (142 ac) in Horry County.This unit includes the southern tip of Waites Island from the MLLW at Hog Inlet and runs east along the Atlantic Ocean shoreline 0.80 km (0.50 mi) and includes MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It continues north and west of the Hog inlet, stopping at the first major tributary. Critical habitat includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Emerging sandbars within Hog Inlet and adjacent to the tip if eastern Cherry Grove Beach are also included from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur. The majority of this unit is privately owned.

Unit SC–3: Murrells Inlet/Huntington Beach. 135 ha (334 ac) in Georgetown County. The majority of the unit is within Huntington Beach State Park. This unit extends from the southern tip of Garden City Beach, just south of the groins (a rigid structure or structures built out from a shore to protect the shore from erosion or to trap sand) north of Murrells Inlet from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur stopping perpendicular with the southern end of Inlet Point Drive. It includes from MLLW south of Murrells Inlet to the northern edge of North Litchfield Beach approximately 4.5 km (3.0 mi). The unit includes the MLLW from the Atlantic Ocean up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The lagoon at the north end of Huntington Beach State Park is also included.

Unit SC–4: Litchfield. 11 ha (28 ac) in Georgetown County. This unit includes the southern tip of Litchfield Beach beginning 0.50 km (0.30 mi) north of Midway Inlet and stopping at the MLLW at Midway Inlet. It includes from the MLLW on the Atlantic Ocean shoreline across and including land to the MLLW on the back bayside. This unit is mostly privately owned.

Unit SC–5: North Inlet. 99 ha (245 ac) in Georgetown County. The majority of the unit is within Tom Yawley Wildlife Center Heritage Preserve. This unit extends from MLLW to 1.0 km (.62 mi) north of North Inlet on Debidue Beach. It includes shoreline on the Atlantic Ocean from MLLW to the MLLW on the western side of the peninsula. This unit also includes from the MLLW south of North Inlet 1.6 km (1.0 mi). It includes the shoreline on the Atlantic Ocean from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It includes shoreline running south and west of the inlet from the MLLW stopping at the MLLW at the first large tributary (no name).

Unit SC–6: North Santee Bay Inlet. 305 ha (753 ac) in Georgetown County. The majority of the unit is within the Tom Yawley Wildlife Center Heritage Preserve and the Santee-Delta Wildlife Management Area. This unit is at the North Santee Bay inlet and includes lands of South Island, Santee Point, Cedar Island, and all of North Santee Sandbar. This unit includes from MLLW at North Santee Bay Inlet running north along the Atlantic Ocean side of South Island 7.2 km (4.5 mi), stopping 0.60 km (0.4 mi) north of an unnamed inlet. It includes areas from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This unit includes the eastern side of Cedar Island adjacent to the North Santee Bay Inlet from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of North Santee Sandbar to MLLW is included.

Unit SC–7: Cape Romain. 315 ha (777 ac) in Charleston County.The majority of the unit is within Cape Romain National Wildlife Refuge. This unit includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the southern and southeastern most 1.9 km (1.2 mi) portion of Cape Island, the southernmost portion of Lighthouse Island from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, all of Lighthouse Island South to MLLW, and the southern side of the far eastern tip of Raccoon Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–8: Bull Island. 134 ha (332 ac) in Charleston County. The majority of the unit is within Cape Romain National Wildlife Refuge and land owned by the South Carolina Department of Natural Resources. This unit includes from Schooner Creek on north and south of the river to north of Price’s Inlet on the southern portion of Bull Island along the Atlantic Ocean 1.6 km (1.0 mi) and south of Price’s Inlet on the northeast tip of Capers Island Heritage Preserve 1.4 km (.86 mi) along the Atlantic Ocean. All areas begin at MLLW and extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–9: Stono Inlet. 495 ha (1223 ac) in Charleston County.Most of this unit is privately owned. It includes the eastern end of Kiawah Island (approximately 4.0 km (2.5 mi)) from MLLW on Atlantic Ocean running north to MLLW on first large tributary connecting east of Bass Creek running northeast into Stono River. It includes MLLW up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur along Stono Inlet and River. All of Bird Key-Stono Heritage Preserve and all of Skimmer Flats to MLLW are included. The Golf course and densely vegetated areas are not included.

Unit SC–10: Seabrook Island. 117 ha (290 ac) in Charleston County.This unit runs from just 0.16 km (0.10 mi) north of Captain Sams Inlet to the southwest approximately 3.4 km (2.1 mi) along the Atlantic Ocean shoreline. It includes land areas from the MLLW on the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Most of this unit is privately owned.

Unit SC–11: Deveaux Bank. 130 ha (322 ac) in Charleston County. The entire unit is within Deveaux Bank Heritage Preserve. This unit includes all of Deveaux Island to the MLLW and is State-owned.

Unit SC–12: Otter Island. 68 ha (169 ac) in Colleton County.The majority of the unit is within St. Helena Sound Heritage Preserve. This unit includes the southern portion of Otter Island to the eastern mouth of Otter Creek. It includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The entire unit is State-owned.

Unit SC–13: Harbor Island. 50 ha (122 ac) in Beaufort County. The majority of the unit is State-owned. This unit extends from the northeastern tip of Harbor Island and includes all of Harbor Spit. It begins at the shoreline east of Cedar Reef Drive running south, stopping at the mouth of Johnson Creek. It includes the MLLW on the Atlantic Ocean and St. Helena Sound to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Harber Spit to MLLW is included.

Unit SC–14: Caper’s Island. 238 ha (589 ac) in Beaufort County. Most of this unit is privately owned. This unit includes the southern-most 4.5 km (2.8 mi) along the Atlantic Coast shoreline of Little Caper’s Island beginning at MLLW on south side of the inlet (un-named). It includes the MLLW on the Atlantic Ocean shoreline to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–15: Hilton Head. 43 ha (106 ac) in Beaufort County. The majority of this unit is State-owned. This unit includes the northeastern tip (Atlantic Ocean side) of Hilton Head Island and all of Joiner Bank. It begins at the shoreline east of northern Planters Row and ends at the shoreline east of Donax Road. It includes the MLLW of Port Royal Sound and the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Joiner Bank to MLLW is included.

Unit GA–1: Tybee Island. 37 ha (91 ac) in Chatham County. The majority of the unit is privately owned. This unit extends along the northern tip of Tybee Island starting from 0.8 km (0.5 mi) northeast from the intersection of Crab Creek and Highway 80 to 0.7 km (0.41 mi) northeast from the intersection of Highway 80 and Horse Pen Creek. The unit includes MLLW on Savannah River and Atlantic Ocean to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit GA–2: Little Tybee Island. 719 ha (1776 ac) in Chatham County. The majority of the unit is within Little Tybee Island State Heritage Preserve. This unit extends just south of the first inlet to Wassaw Sound along the Atlantic Ocean coastline, extending north along the sound 1.7 km (1.1 mi). It includes habitat from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–3: North Wassaw Island. 108 ha (267 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit includes the north-east tip of Wassaw Sound, 1.6 km (1.0 mi) along the inlet side and extending south along the Atlantic Ocean shoreline for 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–4: South Wassaw Island. 61 ha (151 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit extends from the last southern 1.6 km (1.0 mi.) on Atlantic Ocean side, around the southern tip of Wassaw Island, up to mouth of Odingsell River. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–5: Ossabaw Island. 434 ha (1072 ac) in Chatham County. entire unit is within Ossabaw Island State Heritage Preserve. This unit includes the northeastern tip from the mouth of the Bradley River east and 12 km (7.5 mi) south along the Atlantic Ocean shoreline to a point 0.4 km (0.25 mi) past the south-center inlet. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–6: St. Catherine's Island Bar. 54 ha (135 ac) in Liberty County. The entire unit is State owned and located east-northeast of St. Catherine's Island. This unit includes the entire St. Catherine's Island Bar to MLLW.

Unit GA–7: McQueen's Inlet. 215 ha (532 ac) in Liberty County. The majority of the unit is private land along the eastern-central coastline on St. Catherine's Island. This unit extends from McQueen's Inlet north approximately 3.5 km (2.2 mi) and south approximately 1.8 km (1.1 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–8: St. Catherine's Island. 60 ha (147 ac) in Liberty County. The majority of the unit is private land on the southern tip of St. Catherine's Island. This unit starts 1.2 km (0.75 mi) north of Sapelo Sound (along Atlantic Ocean shoreline) and stops inland at Brunsen Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–9: Blackbeard Island. 129 ha (319 ac) in McIntosh County. The entire unit is within the Blackbeard Island National Wildlife Refuge. This unit includes the northeastern portion of the island beginning just east of the mouth of the confluence of McCloy Creek and Blackbeard Creek and continuing east and running south along the Atlantic Ocean shoreline for 1.4 km (.90 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–10: Sapelo Island. 85 ha (210 ac) in McIntosh County. The entire unit is State-owned and within Sapelo Island. The unit extends south of Cabretta Tip approximately 0.2 km (0.13 mi) and north of Cabretta Tip 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–11: Wolf Island. 238 ha (590 ac) in McIntosh County. The majority of the unit is within Wolf Island National Wildlife Refuge and private lands just north of the Refuge. This unit includes the southeastern tip of Queen's island adjacent to the Doboy Sound and includes the eastern shoreline of Wolf Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–12: Egg Island Bar. 61 ha (151 ac) in McIntosh County. This unit is State owned and includes all of Egg Island Bar to the MLLW.

Unit GA–13: Little St. Simon's Island. 609 ha (1505 ac) in Glynn County. The majority of the unit is private land on Little St. Simon's Island. This unit includes the entire eastern coastline along Little St. Simon's Island. It begins 1.1 km (.70 mi) west of the northeast tip of Little St. Simon's Island and runs east and then south along the Atlantic Ocean shoreline stopping at the minor tributary (no name) on the southeast tip of Little St. Simon's Island north of Hampton Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Pelican Spit to MLLW is included when this sand bar is emergent.

Unit GA–14: Sea/St. Simon's Island. 191 ha (471 ac) in Glynn County. The majority of the unit is private land on the south tip of Sea Island and on the east beach of St. Simons Island. This unit extends north of Gould's Inlet (Sea Island) 2.5 km (1.54 mi) starting just south of the groin and extends south of Gould's Inlet (St. Simons Island) 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–15: Jekyll Island. 49 ha (121 ac) in Glynn County. The majority of the unit is within State lands on Jekyll Island. This unit includes the southern region of Jekyll Island beginning at the mouth of Beach Creek, running towards the tip of Jekyll Island and includes the shoreline running north along the Atlantic Ocean shoreline 1.9 km (1.20 mi) from the southern tip of Jekyll Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–16: Cumberland Island. 1454 ha (3591 ac) in Camden County. The majority of the unit is along Cumberland Island Wilderness Area and Cumberland Island National Seashore. This unit includes the majority of the eastern Atlantic Ocean shoreline of Cumberland Island. It begins .50 km (.31 mi) north of the inlet at Long Point, continues south along the Atlantic Ocean shoreline stopping 1.8 km (1.1 mi) west of the southern tip of Cumberland Island National Seashore. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Escambia County. The majority of the unit is within Big Lagoon State Recreation Area. This unit includes the peninsula and emerging sand and mudflats between 0.33 km (0.21 mi) west of the lookout tower along the shoreline and 0.24 km (0.15 mi) east of the lookout tower along the shoreline. Land along the shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All emerging sandbars to MLLW are included.

Unit FL–2: Big Sabine. 182 ha (450 ac) in Escambia County. The majority of the unit is owned by the University of West Florida. This unit includes areas adjacent to Santa Rosa Sound of Big Sabine Point and adjacent embayment between 8.0 km (5.0 mi) and 11.6 (7.2 mi) east of the Bob Sike's Bridge. It begins 0.10 km (.06 mi) north of SR 399 to MLLW on the Santa Rosa Sound.

Unit FL–3: Navarre Beach. 48 ha (118 ac) in Escambia and Santa Rosa Counties. The majority of the unit is owned by Eglin Air Force Base and Santa Rosa Island Authority. This unit includes lands on Santa Rosa Island Sound side, between 0.09 and 0.76 mi east of the eastern end of SR 399 to MLLW on Santa Rosa Sound side.

Unit FL–5: Shell/Crooked Islands. 1789 ha (4419 ac) in Bay County.The majority of the unit is within Tyndall Air Force Base and St. Andrews State Recreation Area. This unit includes all of Shell Island, Crooked Island West, and Crooked Island East from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–6: Upper St. Joe Peninsula. 182 ha (449 ac) in Gulf County.The majority of the unit is within St. Joseph State Park. This unit includes the northern portion of the peninsula from the tip to 8.0 km (5.0 mi) south along the Gulf of Mexico from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–7: Cape San Blas. 158 ha (390 ac) in Gulf County.The entire unit is within Eglin Air Force Base. This unit includes the area known as the Cape between the eastern boundary of Eglin and mile marker 2.1, including the peninsula and all emerging sandbars. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–8: St. Vincent Island. 146 ha (361 ac) in Franklin County.The majority of the unit is within St. Vincent National Wildlife Refuge. This unit includes the western tip of St. Vincent Island that is adjacent to Indian Pass (0.80 km (0.50 mi) east of tip along Indian Pass, and 1.9 km (1.2 mi) from tip southeast along Gulf of Mexico). The unit also includes St. Vincent Point from the inlet at Sheepshead Bayou east 1.6 km (1.0 mi) to include emerging oysters shoals and sand bars and extends south 0.21 km (0.13 mi) of St. Vincent Point. The unit includes the southeastern tip of St. Vincent Island extending north 1.4 km (0.90 mi) and south and west 2.1 km (1.3 mi). The western tip of Little St. George Island 0.80 km (0.50 mi) from West Pass is included (state owned lands). All sections of this unit include land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–9: East St. George Island. 1433 ha (3540 ac) in Franklin County. The majority of the unit is within St. George State Park. This unit begins 5.3 km (3.3 mi) east of the bridge and extends to East Pass. Shell Point, Rattlesnake Cove, Goose Island, East Cove, Gap Point, and Marsh Island are included. This unit includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the Gulf of Mexico, East Pass and St. George Sound.

Unit FL–10: Yent Bayou. 153 ha (378 ac) in Franklin County. The majority of the unit is State owned. This unit is adjacent to the area known as Royal Bluff. It includes the St. George Sound shoreline between 5.9 km (3.7 mi) and 9.5 km (5.9mi) east of SR 65. It includes from MLLW to where densely vegetated habitat or developed structures such as SR 65, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–11: Carabelle Beach. 56 ha (139 ac) in Franklin County. The area within this unit is privately owned. This unit is the peninsula created by Boggy Jordan Bayou. It includes St. George Sound shoreline (south of US 98) 1.6 km (1.0 mi) southwest along US 98 from the Carrabelle River Bridge and extends 1.9 km (1.2 mi) east along the St. George Sound shoreline. It includes from MLLW to where densely vegetated habitat or developed structures such as US 98, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–12: Lanark Reef. 260 ha (643 ac) in Franklin County. The entire unit is State owned. This unit includes the entire island and emerging sandbars to MLLW.

Unit FL–13: Phipps Preserve. 42 ha (104 ac) in Franklin County. This unit includes all of Phipps Preserve (owned by The Nature Conservancy) and any emerging sandbars from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–14: Hagens Cove. 486 ha (1200 ac) in Taylor County. The majority of the unit is within Big Bend Wildlife Management Area. This unit includes all of Hagens Cove and extends from MLLW on north side of Sponge Point to MLLW on south side of Piney Point. The eastern boundary of this unit ends (0.20 mi) west of SR 361. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–15: Anclote Key and North Anclote Bar. 146 ha (360 ac) in Pasco and Pinellas Counties. The majority of the unit is within Anclote Key State Preserve. This unit includes all of North Anclote Bar to the MLLW and the north, south and western sides of Anclote Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–16: Three Rooker Bar Island. 76 ha (188 ac) in Pinellas County. The majority of the unit is within Pinellas County Aquatic Preserve. This unit includes all the islands and emerging sandbars of this complex to MLLW.

Unit FL–17: North Honeymoon Island. 45 ha (112 ac) in Pinellas County. The majority of the unit is within Honeymoon Island State Recreation Area. This unit includes from Pelican Cove north to the far northern tip of Honeymoon Island. It includes the western shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur or the MLLW on the eastern shoreline.

Unit FL–18: South Honeymoon Island. 28 ha (70 ac) in Pinellas County.The majority of the unit is private land. This unit includes the southern end (southern-most 0.32 km (0.20 mi) on western side) of Honeymoon Island and encompasses the far southeastern tip and includes any emerging islands or sandbars to Hurricane Pass. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–19: Caladesi Island. 120 ha (296 ac) in Pinellas County.The majority of the unit is within Caladesi Island State Park. This unit extends from Hurricane Pass to Dunedin Pass on the Gulf of Mexico side. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–20: Shell Key and Mullet Key. 190 ha (470 ac) in Pinellas County. The majority of the unit is within Fort Desoto Park. This unit includes the Shell Key island complex. It also includes the northwest portion of Mullet Key including the western shorelines from Bunces Pass extending south, stopping 1.4 km (.86 mi) north of Ft. Desoto County Park pier. It includes from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–21: Egmont Key. 153 ha (377 ac) Hillsborough County. The majority of the unit is within Egmont Key National Wildlife Refuge. This unit includes the entire island to MLLW.

Unit FL–22: Cayo Costa. 175 ha (432 ac) in Lee County. The majority of the unit, including its northern and southern boundaries, is within Cayo Costa State Park, and nearly all of the remaining area is in the Cayo Costa Florida Conservation and Recreation Lands (CARL) acquisition project. This unit begins at the northern limit of sandy beaches at the northern end of the island, extends through Murdock Point, which at present has a sandbar and lagoon system, and ends at the former entrance to Murdock Bayou. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–23: North Captiva Island. 36 ha (88 ac) in Lee County.The unit is within the Cayo Costa CARL land purchase project. This unit includes the western shoreline extending from 0.80 km (0.50 mi) south of Captiva Pass to approximately Foster Bay. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–25: Bunche Beach. 187 ha (461 ac) in Lee County. This unit is mostly within a CARL Estero Bay acquisition project. Bunche Beach (also spelled Bunch) lies along San Carlos Bay, on the mainland between Sanibel Island and Estero Island (Fort Myers Beach), extending east from the Sanibel Causeway past the end of John Morris Road to a canal serving a residential subdivision. The unit also includes the western tip of Estero Island (Bodwitch Point, also spelled Bowditch Point), including Bowditch Regional Park, operated by Lee County and, on the southwest side of the island facing the Gulf, the beach south nearly to the northwesterly intersection of Estero Boulevard and Carlos Circle. It includes land from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur or, along the developed portion of Estero Island.

Unit FL–26: Estero Island. 86 ha (211 ac) in Lee County. The majority of the unit is privately owned. The unit consists of approximately the southern third of the island's Gulf-facing shoreline starting near Avenida Pescadora to near Redfish Road. The unit excludes south-facing shoreline at the south end of the island that faces Big Carlos Pass rather than the Gulf. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–27: Marco Island. 245 ha (606 ac) in Collier County. Most of the unit is at the Tigertail Beach County Park. The unit's northern border is on the north side of Big Marco Pass, including Coconut Island and all emerging sand bars. On the south side of Big Marco Pass, the boundary starts at the north boundary of Tigertail Beach County Park and extends to just south of the fourth condominium tower south of the County Park. The placement of the southern boundary assures that the unit includes all of Sand Dollar Island, the changeable sandbar off Tigertail Beach. The western boundary includes all the sand bars in Big Marco Pass but excludes Hideaway Beach. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–28: Marquesas Keys. 2,937 ha (7,256 ac) in Monroe County. The unit comprises the roughly circular atoll that encloses Mooney Harbor, including Gull Keys and Mooney Harbor Key. The entire unit is within Key West National Wildlife Refuge. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–29: Boca Grande/Woman/ Ballast Keys. 56 ha (138 ac) in Monroe County. These Keys are east of the Marquesas Keys and west of Key West. Boca Grande and Woman Keys are within Key West National Wildlife Refuge. Ballast Key is privately owned. This unit consists only of sandy beaches and flats between the MLLW and to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–30: Bahia Honda/Ohio Keys. 372 ha (918 ac) in Monroe County. This unit comprises Bahia Honda Key (including a small island off its southwest shore), which is almost entirely owned by Bahia Honda State Park, plus Ohio Key, which is privately owned. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–31: Lower Matecumbe Key. 19 ha (48 ac) in Monroe County. Part of the unit is at Anne's Beach park, an Islamorada village park. The remaining parts are at Sunset Drive (Lower Matecumbe Beach) and at Costa Bravo Drive (Port Antiqua Homeowners Beach) on the Florida Bay side of the island. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–32: Sandy Key/Carl Ross Key. 67 ha (165 ac) in Monroe County. This unit consists of two adjoining islands in Florida Bay, roughly south of Flamingo in Everglades National Park. The entire area is owned and managed by the National Park Service. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–33: St. Lucie Inlet. 114 ha (282 ac) in Martin County. The unit includes a small area south of the jetty on the north shore of St. Lucie Inlet, from the jetty west 0.42 km (0.26 mi). While the two sides of the inlet are privately owned, the great majority of the unit is on public land in the Saint Lucie Inlet State Preserve, administered by Jonathan Dickinson State Park. It begins on the sandy shoreline south of Saint Lucie Inlet and extends along the Atlantic Ocean shoreline 2.6 km (1.6 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. The unit does not include sandbars within the inlet.

Unit FL–34: Ponce de Leon Inlet. 68 ha (168 ac) in Volusia County. The majority of the unit is within Smyrna Dunes Park and Lighthouse Point Park. This unit includes shoreline extending from the jetty north of Ponce de Leon Inlet west to the Halifax River and Inlet junction. It includes shoreline south of Ponce de Leon Inlet from the inlet and Halifax River junction, extending east and south along the Atlantic Ocean shoreline 1.2 km (.70 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–35: Nassau Sound-Huguenot. 950 ha (2347 ac) in Duval County. The majority of the unit is within Big Talbot Island State Park, Little Talbot Island State Park, and the Timucuan Ecological and Historical Preserve. This unit includes all emergent shoals and shoreline east of Nassau River bridge and extends to the inlet of the St. John’s River. Amelia Island and the northern 2.7 km (1.7 mi) shoreline along Talbot Island are not included. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–36: Tiger Islands. 53 ha (130 ac) in Nassau County. This unit is privately owned. This unit extends from the mouth of Tiger Creek and runs north along Tiger Island 0.8 km (0.5 mi) and south along Little Tiger Island 1.4 km (0.9 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. Emerging sandbars to MLLW are also included.

Unit AL–1: Isle Aux Herbes. 227 ha (561 ac) in Mobile County. This unit includes the entire Isle Aux Herbes island where primary constituent elements occur to MLLW and is Stateowned.

Unit AL–2: Dauphin, Little Dauphin, and Pelican Islands. 880 ha (2,174 ac) in Mobile County. This unit includes all of Dauphin Island where primary constituent elements occur from St. Stephens Street approximately 17.6 km (10.9 mi) west to the western tip of the island to MLLW and all of Little Dauphin and Pelican Islands to MLLW. The area is mostly privately owned but includes State and Federal lands.

Unit AL–3: Fort Morgan. 67 ha (166 ac) in Baldwin County. This area includes Mobile Bay and Gulf of Mexico shorelines within Bon Secour National Wildlife Refuge, Fort Morgan Unit. This unit extends from the west side of the pier on the northwest point of the peninsula, following the shoreline approximately 2.8 km (1.74 mi) southwest around the tip of the peninsula, then east to the terminus of the beach access road and is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The area is State-owned but is leased by the Federal Government.

Unit MS–1: Lakeshore through Bay St. Louis. 41 ha (101 ac) in Hancock County. This unit extends from the north side of Bryan Bayou outlet and includes the shore of the Mississippi Sound following the shoreline northeast approximately 15.0 km (9.3 mi) and ending at the southeast side of the Bay Waveland Yacht Club. The landward boundary of this unit follows the Gulf side of South and North Beach Boulevard and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–2: Henderson Point. 34 ha (84 ac) in Harrison County. This unit extends from 0.2 km (0.12 mi) west of the intersection of 3rd Avenue and Front Street and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Pass Christian Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–3: Pass Christian. 77 ha (190 ac) in Harrison County. This unit extends from the east side of Pass Christian Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 10.5 km (6.5 mi) to the west side of Long Beach Pier and Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–4: Long Beach. 38 ha (94 ac) in Harrison County. This unit extends from the east side of Long Beach Pier and Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Gulfport Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–5: Gulfport. 39 ha (96 ac) in Harrison County. This unit extends from the east side of Gulfport Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.8 km (3.0 mi) to the west side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–6: Mississippi City. 62 ha (153 ac) in Harrison County. This unit extends from the east side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS, and includes the shore of the Mississippi Sound following the shoreline northeast approximately 7.9 km (4.9 mi) to the west side of President Casino. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–10: Ocean Springs West. 11 ha (27 ac) in Jackson County. This unit extends from U.S. 90 and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.9 km (1.2 mi) to the Ocean Springs Harbor inlet. The landward boundary of this unit follows the Bay side of Front Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–11: Ocean Springs East. 7 ha (17 ac) in Jackson County. This unit extends from the east side of Weeks Bayou and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.8 km (1.1 mi) to Halstead Bayou. The landward boundary of this unit follows the Bay side of East Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–12: Deer Island. 194 ha (479 ac) in Harrison County. This unit includes all of Deer Island, where primary constituent elements occur to the MLWW . Deer Island is privately owned.

Unit MS–13: Round Island. 27 ha (67 ac) in Jackson County. This unit includes all of Round Island to the MLWW and is privately owned.

Unit MS–14: Mississippi Barrier Islands. 3,168 ha (7,828 ac) in Harrison and Jackson Counties. This unit includes all of Cat, East and West Ship, Horn, Spoil, and Petit Bois Islands where primary constituent elements occur to MLLW. Cat Island is privately owned, and the remaining islands are part of the Gulf Islands National Seashore.

Unit MS–15: North and South Rigolets. 159 ha (393 ac) in Jackson County, MS, and 12 ha (30 ac) in Mobile County, AL. This unit extends from the southwestern tip of South Rigolets Island and includes the shore of Point Aux Chenes Bay, the Mississippi Sound, and Grand Bay following the shoreline east around the western tip, then north to the south side of South Rigolets Bayou; then from the north side of South Rigolets Bayou (the southeastern corner of North Rigolets Island) north to the northeastern most point of North Rigolets Island. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Approximately 4.4 km (2.7 mi) are in Mississippi and 2.9 km (1.8 mi) are in Alabama. Almost half the Mississippi shoreline length is in the Grand Bay National Wildlife Refuge.

Unit LA–1: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron and Vermilion Parishes. This unit extends from the east side of Sabine Pass (Texas/Louisiana border) and includes the shore of the Gulf of Mexico from the MLLW following the shoreline east 25.7 km (16.0 mi) to the west end of Constance Beach [approximately 2 km (1.2 mi) east of the intersection of Parish Road 528 and the beach]; it extends from the east end of the town of Holly Beach [0.25 km (0.16 mi) east of the intersection of Baritarick Boulevard and the beach] following the shoreline approximately 97 km (60.3 mi) east to the eastern boundary line of Rockefeller Wildlife Refuge [3.4 km (2.1 mi) east of Rollover Bayou]; and it extends from the east side of Freshwater Bayou Canal following the shoreline east for approximately 15 km (9.3 mi) to 1.3 km (0.81 mi) east of where the boundary of Paul J. Rainey Wildlife Sanctuary (National Audubon Society) meets the shoreline. All three sections of this unit include the land from the seaward boundary of MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The shoreline in this unit is both state and

privately owned.

Unit LA–2: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA. This unit is located in the eastern portion of the State-owned Atchafalaya Delta Wildlife Management Area (WMA) and includes all exposed land and islands where primary constituent elements occur east and southeast of the main navigation channel of the Atchafalaya River to the MLLW. The islands located south and southeast of the deltaic splay, Donna, T-Pat, and Skimmer Islands and the un-named bird island, are also included in this unit. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–3: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish. This unit includes the entire small island at the northwest tip of Point Au Fer Island to MLLW, then extends from the northwest tip of Point Au Fer Island following the shoreline southeast approximately 7.7 km (4.8 mi) to the point where the un-named oil and gas canal extending southeast from Locust Bayou meets the shoreline [0.8 km (0.5 mi) southeast from Locust Bayou]. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This entire unit is privately owned.

Unit LA–4: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish. This unit includes the State-owned Isles Dernieres chain, including Raccoon, Whiskey, Trinity and East Islands. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–5: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. This unit includes: all of Timbalier Island where primary constituent elements occur to the MLLW, all of Belle Pass West [the ‘‘peninsula’’ extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Unit LA–6: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA. This unit is part of the State-owned Pass a Loutre Wildlife Management Area and includes un-named sand (spoil) islands off South Pass of the Mississippi River near Port Eads. The entire islands to MLLW are included in this unit.

Unit LA–7: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA. This unit includes Breton, Grand Gosier, and Curlew Islands and the Chandeleur Island chain. Those islands are part of the Breton National Wildlife Refuge or are state owned. The entire islands where primary constituent elements occur to MLLW are included in this unit.

Unit TX–1: South Bay and Boca Chica. 2,920 ha (7,217 ac) in Cameron County. The boundaries of the unit are: starting at the Loma Ochoa, following the Brownsville Ship Channel to the northeast out into the Gulf of Mexico to MLLW, then south along a line describing MLLW to the mouth of the Rio Grande, proceeding up the Rio Grande to Loma de Las Vacas, then from that point along a straight line north to Loma Ochoa. The unit does not include densely vegetated habitat within those boundaries. It includes wind tidal flats that are infrequently inundated by seasonal winds, and includes the tidal flats area known as South Bay. Beaches within the unit reach from the mouth of the Rio Grande northward to Brazos Santiago Pass, south of South Padre Island. The southern and western boundaries follow the change in habitat from wind tidal flat, preferred by the piping plover, to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include areas used for roosting by the piping plover. Portions of this unit are owned and managed by the Lower Rio Grande Valley National Wildlife Refuge, the South Bay Coastal Preserve, Boca Chica State Park, and private citizens.

Unit TX–2: Queen Isabella Causeway. 2 ha (6 ac) in Cameron County. The area extends along the Laguna Madre west of the city of South Padre Island. The southern boundary is the Queen Isabella State Fishing Pier, and the northern boundary is at the shoreline due west of the end of Sunny Isles Street. The Queen Isabella causeway bisects this shore but is not included within critical habitat. The eastern boundary is the where developed areas and/or dense vegetation begins, and the western boundary is MLLW. This unit contains lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–5: Upper Laguna Madre. 436 ha (1,076 ac) in Kleberg County. The southern boundary is the northern boundary of PAIS, and the northern boundary is the Kleberg/Nueces County line. The eastern boundary is the line where dense vegetation begins, and the western boundary is MLLW. This unit includes a series of small flats along the bayside of Padre Island in the Upper Laguna Madre. It includes wind tidal flats and sparsely-vegtated upland areas used for roosting by the piping plover. These boundaries receive heavy use by large numbers of shorebirds, including piping plovers. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, and include upland areas used for roosting by the piping plover.

Unit TX–6: Mollie Beattie Coastal Habitat. 241 ha (596 ac) in Nueces County. This unit will be described as two subunits: (1) Subunit is bounded on the north by Beach Access Road 3, on the east by the inland boundary of critical habitat Unit TX–7, on the south by Zahn road, and on the west by Zahn Road. (2) The subunit is bounded on the north by Corpus Christi Pass, on the east by US 361, on the south by the north side of Packery Channel, and on the west by the Gulf Intercoastal Watersay. Some of the uplands are privately owned and the remaining are owned and managed by the TGLO. This unit includes two hurricane washover passes known as Newport and Corpus Christi Passes, and wind tidal flats that are infrequently inundated by seasonal winds. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover.

Unit TX–11: Blind Oso. 2 ha (5 ac) in Nueces County. This unit is the flats of the Blind Oso, part of Oso Bay, from Hans and Pat Suter Wildlife Refuge (owned and managed by the City of Corpus Christi) northeast to Corpus Christi Bay and then southeast along the edge of Texas A&M University—Corpus Christi. The landward boundaries extend to where densely vegetated habitat, not used by the piping plover, begins, and extends out from the landward boundaries to MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–12: Adjacent to Naval Air Station-Corpus Christi. 2 ha (6 ac) in Nueces County. This unit is along the shore of Oso Bay on flats bordered by Naval Air Station-Corpus Christi and Texas Spur 3 to a point 2.5 km (1.5 mi) south of the bridge between Ward Island and the Naval Air Station. The landward boundary is the line where dense vegetation begins, and the boundary in the Bay is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–13: Sunset Lake. 176 ha (435 ac) in San Patricio County. This unit is triangle shaped, with State Highway 181 as the northwest boundary, and the limits of the City of Portland as the northeast boundary. The shore on Corpus Christi Bay is the third side of the triangle, with the actual boundary being MLLW off this shore. This unit is a large basin with a series of tidal ponds, sand spits and wind tidal flats. This unit is owned and managed by the City of Portland within a system of city parks. Some of the described area falls within the jurisdiction of the TGLO. It includes two city park units referred to as Indian Point and Sunset Lake. Much of the unit is a recent acquisition by the city, and management considerations for the park include the area’s importance as a site for wintering and resident shorebirds. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–17: Allyn’s Bight. 5 ha (14 ac) in Aransas County. This unit includes shoreline of San Jose Island on Aransas Bay from Allyn’s Bight to Blind Pass, the channel between San Jose Island and Mud Island. The inland boundary is where the line of dense vegetation begins, and the bay-ward boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–20: Ayers Point. 397 ha (982 ac) in Calhoun County. This unit is an unnamed lake on Matagorda Island between Shell Reef Bayou and Big Brundrett Lake, with San Antonio Bay to the north. The unit boundary extends landward from the lake to the line where dense vegetation begins and where the constituent elements no longer occur and includes upland areas used for roosting by the piping plover. This unit includes marsh and flats at Ayers Point on Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–21: Panther Point to Pringle Lake. 863 ha (2,133 ac) in Calhoun County. This unit represents a narrow band of bayside habitats on Matagorda Island from Panther Point to the northeast end of Pringle Lake. The landward boundary is the line indicating where dense vegetation begins, and the bayward boundary is MLLW. The unit is entirely within Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–24: West Matagorda Bay/ Western Peninsula Flats. 756 ha (1,868 ac) in Matagorda County. This unit extends along the bayside of Matagorda Peninsula from 7.5 southwest of Greens Bayou to 2.5 km (1.6 mi) northwest of Greens Bayou. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–25: West Matagorda Bay/ Eastern Peninsula Flats. 232 ha (575 ac) in Matagorda County. This unit follows the bayside of Matagorda Peninsula from Maverick Slough southwest for 5 km (3 mi). The unit begins at Maverick Slough to the northeast and extends 5 km (3 mi) to the southwest, enclosing a series of flats along Matagorda Bay. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–26: Colorado River Diversion Delta. 5 ha (13 ac) in Matagorda County. This unit consists follows the shore of the extreme eastern northeast corner of West Matagorda Bay from Culver Cut to Dog Island Reef. The southeastern tidally emergent portion of Dog Island Reef is included within the unit. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The upland areas includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–29: Brown Cedar Cut. 119 ha (294 ac) in Matagorda County. This unit extends 2 km (1.2 m.) both southwest and northeast of the main channel of Brown Cedar Cut along the bayside of Matagorda Peninsula in East Matagorda Bay, and abuts unit TX–28 to the southeast. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The eastern boundary of TX–29 follows the change in habitat from mud flats preferred by the piping plover, to slightly vegetated dune system adjacent to TX–28. This unit includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–30: Northeast Corner East Matagorda Bay. 120 ha (297 ac) in Matagorda County. This is a unit bounded on the north by the Gulf Intercoastal Waterway, on the east by the northeast limit of Matagorda bay up the line where dense vegetation begins, on the south by the boundary of Unit TX–28, and on the west by MLLW. It is a system of flats associated with tidal channels. This unit includes upland areas used for roosting by the piping plover and lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–34: San Luis Pass. 110 ha (272 ac) near the Brazoria/Galveston County line. This unit extends along the Gulf side of Galveston Island from San Luis Pass to the cite of the former town of Red Fish Cove (USGS 1:24,000 map, San Luis Pass, Texas; 1963, photorevision 1974). The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. Approximately 57 percent of the unit includes flats in the floodtide delta that are State-owned and managed by the TGLO. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–35: Big Reef. 47 ha (117 ac) in Galveston County. This unit consists of beach and sand flats on the north, west, and east shore of Big Reef, down to MLLW. South Jetty is not included.

The area is currently managed by the City of Galveston. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–36: Bolivar Flats. 160 ha (395 ac) in Galveston County. This unit extends from the jetties on the southwest end of the Bolivar Peninsula to a point on the Gulf beach 1 km (0.6 mi) north of Beacon Bayou. It includes 5.0 km (3 mi) of Gulf shoreline. The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. The area is leased from TGLO by Houston Audubon Society and managed for its important avian resources. The upland areas are used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–37: Rollover Pass. 6 ha (16 ac) in Galveston County. This unit consists of Rollover Bay on the bayside of Bolivar Peninsula. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. It includes flats on State-owned land managed by the TGLO. This unit captures the intertidal complex of the bay, and is bounded by the towns of Gilchrist to the east and the Gulf beach of the Bolivar Peninsula to the south. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

The critical habitat designation for the northern Great Plains breeding population of Charadrius melodus circumcinctus includes 19 units totaling approximately 183,422 ac (74,228.4 ha) of habitat in Minnesota, Montana, and North Dakota, and approximately 1,207.5 mi (1,943.3 km) of river in Montana, North Dakota, South Dakota, and Nebraska (67 FR 57638 - 57717).

Minnesota: Unit MN–1, Rocky Point, Pine and Curry Island, and Morris Point—This unit includes approximately 235.2 ac (95.1 ha) of unique habitat, including sparsely vegetated windswept islands, peninsulas, and sandy points or spits that interface with Lake of the Woods in Lake of the Woods County. Although this unit is small in size, there have been up to 50 plovers found during the breeding season. Numbers have declined since the mid-1980s and there is a continued need for habitat and predator management. This unit represents the most eastern portion of the northern Great Plains population of breeding piping plovers and may be an important link between the Great Lakes and northern Great Plains breeding populations. It is the only remaining breeding site for piping plovers in Minnesota. Approximately 100.4 ac (40.6 ha) are designated within the 697- ac (282.3-hectare) Rocky Point Wildlife Management Area, which is in public ownership, managed by the Minnesota Department of Natural Resources. Rocky Point is located just east of Arneson on Lake of the Woods. Unit 1 also includes approximately 134.8 ac (54.5 ha) within the Pine and Curry Island Scientific and Natural Area which is in public ownership, managed by the Minnesota Department of Natural Resources. Pine and Curry Island Scientific and Natural Area includes approximately 112.6 ac (45.6 ha) of a sandy barrier island (Pine and Curry Island) and 22.2 ac (8.9 ha) of an adjacent peninsula (Morris Point) located at the mouth of the Rainy River on Lake of the Woods.

Montana: Unit MT–1, Sheridan County—This unit includes approximately 19,222.9 ac (7,779.4 ha) of 20 alkali lakes and wetlands in Sheridan County, located in the extreme northeast corner of Montana. These alkali lakes and wetlands are characterized as follows— shallow, seasonally to permanently flooded; mixosaline to hypersaline chemistry; sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; 200 ft (61 m) of uplands above the wetlands' high water mark including springs and fens, which provide foraging and protective habitat for piping plovers. Sites included in this unit are occupied by piping plovers. This unit requires special management including increasing reproductive success through predator exclusion devices, such as nest cages and electric fences, and reducing vegetation encroachment on nesting beaches through prescribed burning or grazing. Essential breeding habitat is dispersed throughout this unit which represents the largest portion (approximately 66 percent) of the plovers surveyed in Montana. This unit also links similar habitat in Canada and North Dakota. Approximately 5,571 ac (2,254.5 ha) are in private ownership and 13,651.9 ac (5,524.8 ha) are in public ownership. Of the lands in public ownership, 13,356.8 ac (5,405.4 ha) are in Federal ownership and 295.1 ac (119.4 ha) are in State ownership. Federal lands designated include piping plover populations on Medicine Lake National Wildlife Refuge and several Waterfowl Production Areas, both owned and managed by the Service. State lands designated include land owned and managed by the Montana Department of Natural Resources and Conservation. Unit MT–4, Bowdoin National Wildlife Refuge—This unit encompasses approximately 3,294.5 ac (1,333.2 ha) on Bowdoin National Wildlife Refuge with sparsely vegetated shoreline beaches, peninsulas, and islands composed of sand gravel, or shale that interface with these water bodies. The site is located in east-central Phillips County, approximately 170.8 mi (275 km) west of the North Dakota border and 37.3 mi (60 km) south of Canada. This unit represents the western edge of the northern Great Plains breeding population of the piping plover and requires special management including water level and predator management. Bowdoin National Wildlife Refuge is in public ownership (Federal) and managed by the Service. Lake Bowdoin is an off stream facility receiving water from the Milk River.

Nebraska: Unit NE–1, Platte, Loup, and Niobrara Rivers—This unit encompasses approximately 440 mi (707.9 km) of river. The river habitat includes sparsely vegetated channel sandbars, sand and gravel beaches on islands within the high bank for nesting, temporary pools on sandbars and islands, and the interface of sand and river where plovers forage. All three of these rivers are occupied by and provide essential habitat for the piping plover. Niobrara River—The Niobrara River is a tributary of the Missouri River, originating in Wyoming and flowing through the northern part of the Nebraska Sandhills region. The portion of the Niobrara included in as Critical Habitat starts at the bridge south of Norton, Nebraska, and extends downstream 120 mi (193 km) to its confluence with the Missouri River. The Niobrara River is one of the most undeveloped rivers in the northern Great Plains and represents one of the last rivers with largely untouched piping plover habitats. The source of water for this river is largely groundwater discharge which helps to provide a year-round base flow with few flood events which are essential to successful plover nesting. Essential nesting habitat is dispersed throughout this unit and this unit represents about 36 percent of Nebraska's plover population. Five miles of the Niobrara are within the Ponca Tribe reservation boundary. In 1991, Congress designated 76 mi (122.3 km) of the Niobrara River as a ''National Scenic River,'' 50 mi (80.5 km) of which are included in the Critical Habitat designation. The National Scenic River reach ends where Highway 137 crosses the river. The Nature Conservancy owns and manages 9.5 mi (15.3 km) along the Niobrara River that falls within both the National Scenic River reach and the piping plover Critical Habitat. Other ownership and interests are principally private. The primary land use along the Niobrara River is farming (east along the river) and ranching (west along the river). Loup River—The Loup River flows 68 mi (109.4 km) to its confluence with the Platte River near Columbus. Ownership interests within this reach of Critical Habitat are primarily private. Habitat on the Loup River designation is part of the larger Platte River watershed and provides productive habitat for piping plovers. The Loup River is one of the Platte River's principal tributaries. Platte River—The North and Middle Platte Rivers each originate in the Rocky Mountains of Colorado with snow melt, and flow east into Nebraska where they join forming the Platte River near the town of North Platte.

The reach included in the piping plover Critical Habitat begins at the Lexington bridge and extends to the Platte's confluence with the Missouri River 252 mi (405.5 km) downstream. About one-fourth of this part of the Platte is already designated as critical habitat for the whooping crane (Grus americana), including a 3-mi wide (4.8-km) northsouth buffer starting at a western boundary south of Lexington east to south of Shelton. Ownership is primarily private, including 28.5 mi (45.9 km) which is managed as conservation land by The Nature Conservancy, Platte River Whooping Crane Habitat Maintenance Trust, Central Nebraska Public Power and Irrigation District, Nebraska Public Power District, and the National Audubon Society's Lillian Annette Rowe Sanctuary. The State of Nebraska owns 8 mi (12.9 km) along the Platte River, which is primarily under the jurisdiction of the Nebraska Game and Parks Commission. Essential nesting habitat is dispersed throughout this unit.

North Dakota: Units 1–10 in North Dakota (described below) include prairie alkali lakes and wetlands. These alkali lakes and wetlands are characterized as follows— shallow; seasonally to permanently flooded; mixosaline to hypersaline chemistry; sandy to gravelly, sparsely vegetated beaches, salt-encrusted mudflats, and/or gravelly salt flats; 200 ft (61 m) of uplands above the wetlands' high water mark, including springs and fens which provide foraging and protective habitat for piping plovers. Sites included in this unit are occupied (determined to have nesting piping plovers in more than 1 year) by piping plovers. This unit requires special management including increasing reproductive success through predator exclusion devices, such as nest cages and electric fences, and reducing vegetation encroachment on nesting beaches through prescribed burning or grazing. These essential breeding habitats in North Dakota can support more than 50 percent of the current known population of the northern Great Plains Piping Plover. The proximity of Units 1–10 to the Missouri River provides an important ecological link that may allow birds extra protection from a severe drought that results in dry wetlands basins. As birds experience drought in these units biologists believe birds move to the river. Conversely, birds may move to these units when Missouri River flows are high. Unit ND–1—This unit encompasses approximately 7,456.9 ac (3,017.7 ha) of 13 alkali lakes and wetlands in Divide and Williams Counties, located in the extreme northwestern corner of North Dakota. Approximately 1,765.2 ac (714.3 ha) are in public ownership and 5,691.7 ac (2,303.4 ha) are in private ownership. Of the lands in public ownership 1,337.9 ac (541.4 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 427.2 ac (172.9 ha) are in State ownership. State lands designated include 3.1 ac (1.2 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 424.1 ac (171.6 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–2—This unit encompasses approximately 20,683.8 ac (8,370.6 ha) of 14 alkali lakes and wetlands in Burke, Renville, and Mountrail Counties, in northwestern North Dakota. Approximately 13,986.5 ac (5,660.2 ha) are in public ownership and 6,697.3 ac (2,710.3 ha) are in private ownership. Of the lands in public ownership, 13,251.8 ac (5,362.9 ha) are in Federal ownership and 734.6 ac (297.3 ha) are in State ownership. Federal lands designated include Lostwood and Upper Souris National Wildlife Refuges and Waterfowl Productions Areas, both owned and managed by the Service. State lands designated include 320.1 ac (129.5 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 414.4 ac (167.7 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–3—This unit encompasses approximately 2,524.5 ac (1,021.6 ha) of 11 alkali lakes and wetlands in Mountrail and Ward Counties in northwestern North Dakota. Approximately 615.9 ac (249.2 ha) are in public ownership and 1,908.5 ac (772.3 ha) are in private ownership. Of the lands in public ownership, 615.7 ac (249.2 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 0.2 ac (0.08 ha) are in State ownership. State lands designated are owned and managed by the North Dakota Game and Fish Department as a Wildlife Management Area. Unit ND–4—This unit encompasses approximately 5,150.7 ac (2,084.4 ha) of eight alkali lakes and wetlands in McLean County in north-central North Dakota. Approximately 1,292.6 ac (523.1 ha) are in public ownership and 3,858 ac (1,561.3 ha) are in private ownership. Of the lands in public ownership, 752.1 ac (304.3 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 540.5 ac (218.7 ha) are in State ownership. State lands designated include 435.5 ac (176.2 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 104.9 ac (42.4 ha) of school lands owned and managed by the North Dakota Land Department. The John E. Williams Preserve, owned and managed by The Nature Conservancy (private), also is included in this unit. Unit ND–5—This unit encompasses approximately 3,925.6 ac (1,588.7 ha) of 10 alkali lakes and wetlands in McHenry and Sheridan Counties in north-central and central North Dakota. Approximately 406.8 ac (164.6 ha) are in public ownership and 3,518.8 ac (1,424 ha) are in private ownership. All public lands are in Federal ownership with 34.4 ac (13.9 ha) owned and managed by the Service as Waterfowl Production Areas and 372.4 ac (150.7 ha) owned by the BOR and managed by the North Dakota Game and Fish Department as a Wildlife Management Area. Unit ND–6—This unit encompasses approximately 6,075.2 ac (2,458.6 ha) of 11 alkali lakes and wetlands in Benson and Pierce Counties, in northeastern North Dakota. Approximately 767.3 ac (310.5 ha) are in public ownership and 5,307.9 ac (2,148 ha) are in private ownership. Of the lands in public ownership, 724.8 ac (293.3 ha) are in Federal ownership and 42.5 ac (17.2 ha) are in State ownership. State lands designated include 20.7 ac (8.4 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 21.7 ac (8.79 ha) of school lands owned and managed by the North Dakota Land Department. Unit ND–7—This unit encompasses approximately 30,125.7 ac (12,191.7 ha) of nine alkali lakes and wetlands in Burleigh and Kidder Counties, in southcentral North Dakota. Approximately 20,012.1 ac (8,089.8 ha) are in public ownership and 10,113.5 ac (4,092.9 ha) are in private ownership. Of the lands in public ownership, 18,113.1 ac (7,330.3 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 1,898.9 ac (768.5 ha) are in State ownership. State lands designated include 1,247.9 ac (505 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department and 650.9 ac (263.4 ha) of school lands owned and managed by the North Dakota Land Department. Federal lands designated include Long Lake National Wildlife Refuge and Waterfowl Production Areas owned and managed by the Service. Unit ND–8—This unit encompasses approximately 4,056.7 ac (1,641.7 ha) of three alkali lakes and wetlands in Stutsman County, in south-central North Dakota. Approximately 3,593.6 ac (1,454.3 ha) are in public ownership and 463.1 ac (187.4 ha) are in private ownership. Of the lands in public ownership, 3,583.8 ac (1,450.3 ha) are in Federal ownership and 9.7 ac (3.9 ha) are in State ownership. Federal lands designated include Chase Lake and Arrowwood National Wildlife Refuges and Waterfowl Production Areas owned and managed by the Service. State lands designated include 7.9 ac (3.2 ha) of school lands owned and managed by the North Dakota Land Department and 1.8 ac (0.7 ha) of Wildlife Management Areas owned and managed by the North Dakota Game and Fish Department. Unit ND–9—This unit encompasses approximately 2,658 ac (1,075.6 ha) of six alkali lakes and wetlands in Logan and McIntosh Counties in south-central North Dakota. Approximately 732.5 ac (296.4 ha) are in public ownership and 1,925.5 ac (779.2 ha) are in private ownership. Of the lands in public ownership, 497.7 ac (201.4 ha) are in Federal ownership (Waterfowl Production Areas managed by the Service) and 234.7 ac (95 ha) are in State ownership (Wildlife Management Areas managed by the North Dakota Game and Fish Department. Unit ND–10—This unit encompasses approximately 641.6 ac (259.6 ha) of one alkali lake in Eddy County in northeastern North Dakota. Approximately 6.8 ac (2.7 ha) are in public ownership as a Waterfowl Production Area managed by the Service and 634.7 ac (256.8 ha) are in private ownership.

Missouri River Units: Missouri River Units—Missouri River units consist of riverine and reservoir (Fort Peck Lake, Lake Sakakawea and Lake Audubon, Lake Oahe, and Lewis and Clark Lake) reaches. All reservoirs except Lake Audubon are mainstem impoundments, constructed by dams, and regulated by the Corps. Lake Audubon is a sub-impoundment of Lake Sakakawea and is regulated by the BOR through operation of the Snake Creek Pumping Plant. Overall the Missouri River has accounted for up to 31 percent of the northern Great Plains population of piping plovers. All of the units are occupied. Piping plover habitat within reservoir reaches is composed of shorelines, peninsulas, and islands, below the top of the maximum operating pool and is owned by the Federal government. These reservoir habitats include sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, grave, or shale, and their interface with the water. These reservoir reaches provide habitat for about 42 percent of the piping plovers on the Missouri River. Piping plover habitat within riverine reaches consists of inter-channel islands and sandbars including their temporary pools and interface with the river. These habitats are sparsely vegetated and consist of sand and gravel substrates. Riverine reaches provide habitat for about 58 percent of the piping plovers on the Missouri River. Ownership of these sites varies by State. In Montana, islands and sandbars are recognized as owned by the State except along the reservation boundaries of the Assiniboine and Sioux Tribes of Fort Peck. The Assiniboine and Sioux Tribes of Fort Peck own land to the midchannel of the Missouri River adjacent to the Reservation boundary. In North Dakota and South Dakota, islands and sandbars are recognized as owned by the State. Four Tribes along the Missouri River in North Dakota and South Dakota have critical habitat designated within the boundary of their reservation including the Standing Rock Sioux Tribe, and the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Tribes) of the Ft. Berthold Reservation, the Cheyenne River Sioux Tribe, and the Yankton Sioux Tribe. Additionally, these Tribes have land or Tribal trust land on submerged sites or sandbars/ islands within the critical habitat designation of the Missouri River in North and South Dakota. In Nebraska, islands and sandbars are owned by the adjacent landowner including the Santee Sioux Tribe.

Montana: Unit MT–2—This unit encompasses approximately 125.4 mi (201.8 km) from just west of Wolf Point, McCone County, Montana, at RM 1712.0 downstream to the Montana/North Dakota border, Richland County, Montana, and McKenzie County, North Dakota, at RM 1586.6. The Missouri River in this unit flows through reservation land of the Assiniboine and Sioux Tribes of Fort Peck (81.7 mi (131.5 km)), State land, and privately owned land. Unit MT–3, Fort Peck Reservoir—This unit encompasses approximately 77,370 ac (31,311 ha) of Fort Peck Reservoir, located entirely within the Charles M. Russell National Wildlife Refuge which is in Federal ownership, managed by the Service.

North Dakota: Unit ND–11, Missouri River— Approximately 354.6 mi (570.6 km) from the Montana/North Dakota border just west of Williston, McKenzie County, North Dakota, at RM 1586.6 downstream to the North Dakota/South Dakota border in Sioux and Emmons Counties, North Dakota, and Corson and Campbell Counties, South Dakota, at RM 1232.0. Lake Sakakawea, Lake Audubon, and Lake Oahe are included in this unit, along with a free-flowing stretch of the Missouri River from RM 1389 to 1302 (Garrison Reach). The North Dakota Game and Fish Department manages the north half of Audubon Reservoir and the Service manages the south half of Audubon Reservoir. The Missouri River and associated reservoirs in this unit include 6.83

mi (11 km) of shoreline (right and left bank) of trust land and 77 liner rm (123.9 km) within the reservation boundary of the Three Affiliated Tribes of Fort Berthold and 23.22 mi (37.37 km) of shoreline on trust land and 38 linear rm (61.16 km) within the reservation boundary of Standing Rock Sioux Tribe and 20 mi (32.19 km) of shoreline on trust land. A mix of State and privately owned lands also are included in this unit.

South Dakota Unit SD–1 Missouri River— Approximately 159.7 mi (257 km) from the North Dakota/South Dakota border northeast of McLaughlin, Corson County, South Dakota, at RM 1232.0 downstream to RM 1072.3, just north of Oahe Dam (Oahe Reservoir). The Missouri River and associated reservoirs in this unit include 3.22 mi (5.18 km) of shoreline (right bank) on trust land and 41 linear mi (65.98 km) within the reservation boundary of the Standing Rock Sioux and 23.44 mi (37.72 km) of shoreline (right bank) on trust land and 77 linear mi (123.92 km) within the reservation boundary of Cheyenne River Sioux Tribe. A mix of State and privately owned lands also are included in this unit. Unit SD–2, Missouri River— Approximately 127.8 mi (204.4 km) from RM 880.0, at Fort Randall Dam, Bon Homme and Charles Mix Counties, South Dakota, downstream to RM 752.2 near Ponca, Dixon County, Nebraska. One mainstem Missouri River reservoir, Lewis and Clark Lake, and two riverine reaches (Fort Randall and Gavins Point) are included in this unit. In addition to the 127.8 mi (204.4 km) that border South Dakota on the left bank there are approximately 7.8 mi (12.4 km) of river bordering South Dakota on the right bank. All islands and sandbars in South Dakota are in State ownership with the exception of 60.36 mi (97.14 km) of shoreline (left bank) on trust land and 34 linear miles (54.72 km) within the reservation boundary of the Yankton Sioux Tribe. Approximately 120 mi (192 km) (right bank) of river border Nebraska. Sandbars and islands in Nebraska (State line extends to midchannel) belong to the adjacent landowner. Approximately 16 linear mi (25.75 km) (right bank) of river below Ft. Randall Dam are within the boundary of the Santee Sioux Reservation, including 0.05 mi (0.08 km) of shoreline on trust land.

Primary Constituent Elements/Physical or Biological Features

Wintering piping plover's PCEs are the habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are:

(1) Intertidal sand beaches (including sand flats) or mud flats (between the MLLW and annual high tide) with no, or very sparse, emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.

(2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather.

(3) Surf-cast algae for feeding.

(4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.

(5) Spits, especially sand, running into water used for foraging and roosting.

(6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water.

(7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.

(8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites).

See above.

See above.

The one overriding primary constituent element (biological) required to sustain the northern Great Plains breeding population of piping plovers that must be present at all sites is the dynamic ecological processes that create and maintain piping plover habitat. Without this biological process the physical component of the primary constituent elements would not be able to develop. These processes develop a mosaic of habitats on the landscape that provide the essential combination of prey, forage, nesting, brooding and chick-rearing areas. The annual, seasonal, daily, and even hourly availability of the habitat patches is dependent on local weather, hydrological conditions and cycles, and geological processes. The biological primary constituent element, i.e., dynamic ecological processes, creates different physical primary constituent elements on the landscape. These physical primary constituent elements exist on different habitat types found in the northern Great Plains, including mixosaline to hypersaline wetlands (Cowardin et al. 1979), rivers, reservoirs, and inland lakes. These habitat types or physical primary constituent elements that sustain the northern Great Plains breeding population of piping plovers are described as follows:

i. On prairie alkali lakes and wetlands, the physical primary constituent elements include—(1) shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats; (2) springs and fens along edges of alkali lakes and wetlands; and (3) adjacent uplands 200 ft (61 m) above the high water mark of the alkali lake or wetland.

ii. On rivers the physical primary constituent elements include—sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river.

iii. On reservoirs the physical primary constituent elements include—sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.

iv. On inland lakes (Lake of the Woods) the physical primary constituent elements include—sparsely vegetated and windswept sandy to gravelly islands, beaches, and peninsulas, and their interface with the water body.

Special Management Considerations or Protections

Activities that may destroy or adversely modify critical habitat are those for which the affected critical habitat would not remain functional to serve its intended conservation role for the species. More specifically, such activities could eliminate or reduce the habitat necessary for foraging by eliminating or reducing the piping plovers' food base; destroying or removing available upland habitats necessary for protection of the birds during storms or other harsh environmental conditions; increasing the amount of vegetation to levels that make foraging or roosting habitats unsuitable; and/or increasing recreational activities to such an extent that the amount of available undisturbed foraging or roosting habitat is reduced, with direct or cumulative adverse effects to individuals and completion of their life cycles. Examples of actions that have effects on wintering piping plover habitats include, but are not limited to: (1) Disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; (2) Predation, especially by falcons, hawks, coyotes, bobcats and feral cats; (3) Beach maintenance (e.g., nourishment (adding sand) and cleaning) and stabilization efforts (e.g., construction of jetties and other hard structures). (4) Oil and other hazardous materials spills and cleanup; (5) Discharge of freshwater from oil and gas activities; (6) Construction of dwellings, roads, marinas, and other structures, and associated activities including staging of materials and equipment; and/or (7) Dredging and dredge spoil placement, and associated activities including staging of equipment and materials.

See above.

See above.

Critical habitat does not include existing developed areas such as mainstem dam structures, buildings, marinas, boat ramps, bank stabilization and breakwater structures, row cropped or plowed agricultural areas, roads and other lands (e.g., high bank bluffs along Missouri River) unlikely to contain primary constituent elements essential for northern Great Plains piping plover conservation.

Life History

Feeding Narrative

Juvenile: The chicks learn to feed themselves and eat smaller versions adult food items (Hull 1981). (NatureServe, 2015)

Adult: Piping plovers forage by gleaning invertebrates from the substrate or running and pecking on the substrate with short runs between pecks (Elliott-Smith and Haig 2004). Sandy mud flats, ephemeral pools, seasonally emergent seagrass beds, mud/sand flats with scattered oysters, and overwash fans are considered primary foraging habitats (Nicholls and Baldassarre 1990b; Cohen et al. 2008). Intertidal areas provide key foraging habitats. Zonick (2000) found dietary differences across the range of piping plovers in Texas, with plovers along the northern Texas coast feeding predominantly on polychaetes while those observed further south largely fed on insects and other arthropods. Wrack also contains invertebrate organisms consumed by piping plovers and other shorebirds (USFWS, 2015). As observed in Texas studies, Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. There is some very limited evidence that plover forage on the alkali lakes may be produced on the nearby prairie (Nordstrom 1990) (USFWS, 2009). Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks (Zonick and Ryan 1996, p. 26), which they peck from on top or just beneath the surface of moist or wet sand, mud, or fine shell (USFWS, 2009b).

Reproduction Narrative

Adult: Piping plovers breed on bare sandy or gravelly beaches, sandbars, or islands in several different types of habitat across the broad landscape of the NGP. Piping plovers begin to arrive on the breeding grounds in the first half of April, with courtship, followed by nesting, beginning in mid-to-late April (Catlin and Fraser 2006a; Catlin and Fraser 2007; Felio et al. 2009; Felio et al. 2010a; Felio et al. 2010b; Shaffer et al. 2013). Both adults share incubation duties (Wilcox 1959, Cairns 1982) which last 25 to 28 days (Elliott-Smith and Haig 2004). Hatching begins in late May to early June, generally peaking in June and early July (Catlin 2009). The young leave the nest within hours of hatch and begin to forage almost immediately (Wilcox 1959, Haig 1992). Chicks may be brooded for up to 21 days post-hatch, although the female sometimes deserts the brood after 5 to 10 days (Haig and Oring 1988; Haig 1992; Maxson 2000). Chicks fledge 25 to 35 days after hatching, and are capable of sustained flight soon after fledging (Knetter et al. 2001; Catlin et al. 2013). Piping plovers readily renest if earlier nests fail (Whyte 1985; Haig 1987). They generally only raise one brood a season, although they have been documented to raise two broods on rare occasions (Bottitta et al. 1997). Piping plovers begin to leave the breeding grounds as early as mid-July, with adults leaving first and juveniles last (Elliott-Smith and Haig 2004). Although piping plovers have been documented to live as long as 11 years, the Service estimates that with a 78 to 80 percent adult survival rate, the average lifespan is approximately 5-6 years (USFWS, 2015). In the Northern Great Plains, most piping plovers nest on the unvegetated shorelines of alkali lakes, reservoirs, or river sandbars, as described in the 1988 recovery plan. On occasion, however, they will select non-typical sites for nesting (USFWS, 2009).

Tolerance Ranges/Thresholds

Adult: Low (USFWS, 2009)

Site Fidelity

Adult: High (USFWS, 2009)

Habitat Narrative

Adult: On the wintering grounds, piping plovers forage and roost along barrier and mainland beaches, sand, mud, and algal flats, washover passes, salt marshes, and coastal lagoons. New information confirms inter- and intra-annual fidelity of piping plovers to migration and wintering sites. Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Recent geographic analysis of piping plover distribution on the upper Texas coast noted major concentration areas at the mouths of rivers and washover passes (low, sparsely vegetated barrier island habitats created and maintained by temporary, storm-driven water channels) into major bay systems (Arvin 2008). Piping plovers in the Northern Great Plains population inhabit unvegetated shorelines of alkali lakes, reservoirs, or river sandbars (USFWS, 2009). Wintering plovers are dependent on a mosaic of habitat patches, and move among these patches, depending on local weather and tidal conditions (Drake et al. 2001, pp. 262– 263) (USFWS, 2009b).

Dispersal/Migration

Motility/Mobility

Adult: High (USFWS, 2009)

Migratory vs Non-migratory vs Seasonal Movements

Juvenile: Migratory/spring and summer (NatureServe, 2015)

Adult: Migratory (USFWS, 2009)

Dispersal

Adult: High (USFWS, 2009)

Dispersal/Migration Narrative

Juvenile: The juveniles may remain in wintering areas later but are generally gone by mid- to late August (Cuthbert and Wiens 1982). (NatureServe, 2015)

Adult: Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean (USFWS, 2009). Piping plovers spend three to five months on the breeding grounds annually, and the rest of the year on the wintering or in migration. Piping plovers spend up to 10 months of their annual cycle on their migration and winter grounds, typically from 15 July through 15 May (Elliott-Smith and Haig 2004; Noel et al. 2007; Stucker et al. 2010). Southward migration from the breeding grounds primarily occurs from July to September, with the majority of birds initiating migration by the end of August (USFWS 1996; USFWS 2003). Piping plovers depart the wintering grounds as early as mid-February and as late as mid-May, with peak migration in March (Haig 1992) (USFWS, 2015).

Additional Life History Information

Adult: Migrates to breeding grounds July - September (USFWS, 2015)

Population Information and Trends

Population Trends:

Decline from 1991 through 2001, increase from 2001 through 2006 (USFWS, 2009)

Population Size:

2,959 adults; 1,212 breeding pairs (USFWS, 2009)

Minimum Viable Population Size:

1,300 breeding paris (see recovery criterion 1); 1.24 fledglings/pair (USFWS, 2009)

Additional Population-level Information:

Populations are sensitive to adult and juvenile survival rates (USFWS, 2009)

Population Narrative:

The most consistent finding in the various population viability analyses (PVAs) conducted for piping plovers (Ryan et al. 1993, Melvin and Gibbs 1996, Plissner and Haig 2000, Wemmer et al. 2001, Larson et al. 2002, Calvert et al. 2006, Brault 2007) is the sensitivity of extinction risk to even small declines in adult and/or juvenile survival rates. The International Piping Plover Census, conducted every five years, also estimates the number of piping plover pairs in the Northern Great Plains; the 2006 estimate was 2,959 adults and 1,212 breeding pairs. The most recent model examining population viability suggested that a region-wide fledge ratio of 1.24 would be required for stability (Larson et al. 2002). Plover adult numbers seem to be roughly correlated with the amount of suitable habitat available on the Missouri River system. The International Piping Plover Census numbers indicate that the Northern Great Plains population (including Canada) declined from 1991 through 2001 then increased dramatically from 2001 through 2006 (USFWS, 2009).

Threats and Stressors

Stressor: Sand placement projects (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: In the wake of episodic storm events, managers of lands under public, private, and county ownership often protect coastal structures using emergency storm berms; this is frequently followed by beach nourishment or renourishment activities (nourishment projects are considered “soft” stabilization versus “hard” stabilization such as seawalls). Berm placement and beach nourishment deposit substantial amounts of sand along Gulf of Mexico and Atlantic beaches to protect local property in anticipation of preventing erosion and what otherwise would be considered natural processes of overwash and island migration (Schmitt and Haines 2003). Past and ongoing stabilization projects fundamentally alter the naturally dynamic coastal processes that create and maintain beach strand and bayside habitats, including those habitat components that piping plovers rely upon. Although impacts may vary depending on a range of factors, stabilization projects may directly degrade or destroy piping plover roosting and foraging habitat in several ways. Front beach habitat may be used to construct an artificial berm that is densely planted in grass, which can directly reduce the availability of roosting habitat. Over time, if the beach narrows due to erosion, additional roosting habitat between the berm and the water can be lost. Berms can also prevent or reduce the natural overwash that creates roosting habitats by converting vegetated areas to open sand areas (see summary of studies documenting importance of bay beach habitats for piping plover foraging, section WM 2.2.1.4). The vegetation growth caused by impeding natural overwash can also reduce the maintenance and creation of bayside intertidal feeding habitats. In addition, stabilization projects may indirectly encourage further development of coastal areas and increase the threat of disturbance (see WM 2.2.2.5) (USFWS, 2009).

Stressor: Inlet stabilization/relocation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Many navigable mainland or barrier island tidal inlets along the Atlantic and Gulf of Mexico coasts are stabilized with jetties, groins, or by seawalls and/or adjacent industrial or residential development. Jetties are structures built perpendicular to the shoreline that extend through the entire nearshore zone and past the breaker zone (Hayes and Michel 2008) to prevent or decrease sand deposition in the channel. Inlet stabilization with rock jetties and associated channel dredging for navigation alter the dynamics of longshore sediment transport

and affect the location and movement rate of barrier islands (Camfield and Holmes 1995), typically causing downdrift erosion. Sediment is then dredged and added back to islands which subsequently widen. Once the island becomes stabilized, vegetation encroaches on the bayside habitat, thereby diminishing and eventually destroying its value to piping plovers. Accelerated erosion may compound future habitat loss, depending on the degree of sea-level rise. Unstabilized inlets naturally migrate, re-forming important habitat components, whereas jetties often trap sand and cause significant erosion of the downdrift shoreline. These combined actions affect the availability of piping plover habitat (Cohen et al. 2008). Tidal inlet relocation can cause loss and/or degradation of piping plover habitat; although less permanent than construction of hard structures, effects can persist for years (USFWS, 2009).

Stressor: Sand mining/dredging (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Sand mining, the practice of extracting (dredging) sand from sand bars, shoals, and inlets in the nearshore zone, is a less expensive source of sand than obtaining sand from offshore shoals for beach nourishment. Sand bars and shoals are sand sources that move onshore over time and act as natural breakwaters. Inlet dredging reduces the formation of exposed ebb and flood tidal shoals considered to be primary or optimal piping plover roosting and foraging habitat. Removing these sand sources can alter depth contours and change wave refraction as well as cause localized erosion (Hayes and Michel 2008). Exposed shoals and sandbars are also valuable to piping plovers, as they tend to receive less human recreational use (because they are only accessible by boat) and therefore provide relatively less disturbed habitats for birds. We do not have a good estimate of the amount of sand mining that occurs across the piping plover wintering range, nor do we have a good estimate of the number of inlet dredging projects that occur. This number is likely greater than the number of total jettied inlets shown in Table WM3, since most jettied inlets need maintenance dredging, but non-hardened inlets are often dredged as well (USFWS, 2009).

Stressor: Groins (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Groins (structures made of concrete, rip rap, wood, or metal built perpendicular to the beach in order to trap sand) are typically found on developed beaches with severe erosion. Although groins can be individual structures, they are often clustered along the shoreline. Groins act as barriers to longshore sand transport and cause downdrift erosion, which prevents piping plover habitat creation by limiting sediment deposition and accretion (Hayes and Michel 2008). These structures are found throughout the southeastern Atlantic Coast, and although most were in place prior to the piping plover’s 1986 ESA listing, installation of new groins continues to occur (USFWS, 2009).

Stressor: Seawalls and revetments (USFWS, 2009)
Exposure:
Response:
Consequence:

Narrative: Seawalls and revetments are vertical hard structures built parallel to the beach in front of buildings, roads, and other facilities to protect them from erosion. However, these structures often accelerate erosion by causing scouring in front of and downdrift from the structure (Hayes and Michel 2008), which can eliminate intertidal foraging habitat and adjacent roosting habitat. Physical characteristics that determine microhabitats and biological communities can be altered after installation of a seawall or revetment, thereby depleting or changing composition of benthic communities that serve as the prey base for piping plovers. At four California study sites, each comprised of an unarmored segment and a segment seaward of a seawall, Dugan and Hubbard (2006) found that armored segments had narrower intertidal zones, smaller standing crops of macrophyte wrack, and lower shorebird abundance and species richness. Geotubes (long cylindrical bags made of high-strength permeable fabric and filled with sand) are softer alternatives, but act as barriers by preventing overwash. We did not find any sources that summarize the linear extent of seawall, revetment, and geotube installation projects that have occurred across the piping plover's wintering and migration habitat (USFWS, 2009).

Stressor: Exotic/invasive vegetation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Beach vitex (Vitex rotundifolia) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). In 2003, the plant was documented in New Hanover, Pender, and Onslow counties in North Carolina, and at 125 sites in Horry, Georgetown, and Charleston counties in South Carolina. One Chesapeake Bay site in Virginia was eradicated, and another site on Jekyll Island, Georgia, is about 95% controlled (D. Suiter, USFWS, pers. comm. 2009). Beach vitex has been documented from two locations in northwest Florida, but one site disappeared after erosional storm events. The landowner of the other site has indicated an intention to eradicate the plant, but follow through is unknown (R. Farley, PBS&J, Inc., pers. comm. 2009). Task forces formed in North and South Carolina in 2004-05 have made great strides to remove this plant from their coasts. To date, about 200 sites in North Carolina have been treated, with 200 additional sites in need of treatment. Similar efforts are underway in South Carolina. Unquantified amounts of crowfootgrass (Dactyloctenium aegyptium) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (Casuarina equisetifolia) changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas. Shorebirds prefer foraging in open areas where they are able to see potential predators, and tall trees provide good perches for avian predators. Australian pines potentially impact shorebirds, including the piping plover, by reducing attractiveness of foraging habitat and/or increasing avian predation. The propensity of these exotic species to spread, and their tenacity once established, make them a persistent threat, partially countered by increasing landowner awareness and willingness to undertake eradication activities. Piping plover habitat is by nature ephemeral, with fluctuating water levels periodically clearing vegetation, which then grows back over time during dry periods. However, invasive exotics, particularly salt cedar, which is tolerant of flooding, are a growing problem on plover habitat (USACE 2007a). On the Missouri River reservoirs, changing water conditions provide prime habitat for noxious weeds to become established, with up to 200,000 acres of potential

habitat exposed on Lake Oahe alone in dry conditions (USACE 2008c). Salt cedar, leafy spurge (Euphorbia esula), Canada thistle (Cirsium arvense), and absinth wormwood (Artemisia absinthium) have been identified as noxious weeds on Missouri River reservoir shorelines (USACE 2007b). Other invasive species, such as kochia (Kochia scoparia) and clover (Trifolium spp.) can also rapidly take over plover habitat, precluding nesting (USACE 2007a) (USFWS, 2009).

Stressor: Wrack removal and beach cleaning (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999, Smith 2007, Maddock et al. 2009, Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Neal et al. 2007). Tilling beaches to reduce soil compaction, as sometimes required by the USFWS for sea turtle protection after beach nourishment activities, has similar impacts (USFWS, 2009).

Stressor: Disease (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Although researchers increased vigilance following detection of several cases of West Nile virus in breeding Northern Great Plains piping plovers and Type E botulism in the Great Lakes breeding population, the USFWS is not aware of instances of disease in nonbreeding piping plovers. Bird species testing positive for low pathogenic avian influenza consist of Pacific golden-plover (1), bar-tailed godwit (3), dunlin (8), marsh sandpiper (1), red knot (1), sanderling (1), sharp-tailed sandpiper (1), and western sandpiper (1) (Acker, pers. comm. 2009). Based on information available to date, the Service concludes that West Nile virus and avian influenza remain a minor threat to shorebirds, including the piping plover, on their wintering and migration grounds (USFWS, 2009).

Stressor: Predation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The 2003 Great Lakes recovery plan expressed concern about the increase in predators (fox, coyotes, dogs, and cats) that are present year-round on the wintering grounds. The impact of predation on migrating or wintering piping plovers remains largely undocumented. Except for one incident involving a cat in Texas (NY Times 2007), no depredation of piping plovers during winter or migration has been noted, although it would be difficult to document. Avian and mammalian predators are common throughout the species' wintering range. Predatory

birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. The Service considers predator control on their wintering and migration grounds to be a low priority at this time (USFWS, 2009).

Stressor: Recreational disturbance (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Pfister et al. (1992) implicate anthropogenic disturbance as a factor in the longterm decline of migrating shorebirds at staging areas. Disturbance, i.e., human and pet presence that alters bird behavior, disrupts piping plovers as well as other shorebird species. Disturbance can cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995, Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000). Shorebirds are more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than people (Lafferty 2001a, 2001b; Thomas et al. 2002). Dogs off leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds. Off-road vehicles can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast recovery plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993, Goldin 1993). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance would otherwise be very slight. Godfrey et al. (1980 as cited in Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of off-road vehicles negatively correlated with abundance of roosting piping plovers on the ocean beach (USFWS, 2009).

Stressor: Military actions (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Military actions are not listed as threats in either the listing rule or recovery plans. Twelve coastal military bases are located in the Southeast. To date, five bases have consulted with the USFWS under section 7 of the ESA, on military activities on beaches and baysides that may affect piping plovers or their habitat. Camp Lejeune in North Carolina consulted formally

with USFWS in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with USFWS on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt occasional use of motorized equipment on the beaches and associated baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts twice-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to minimize direct disturbance from troop activities (USFWS, 2009).

Stressor: Contaminants (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The various piping plover recovery plans identify contaminants, particularly oil spills, as a threat. The Great Lakes plan also states that concentration levels of polychlorinated biphenol (PCB) detected in Michigan piping plover eggs have the potential to cause reproductive harm. Contaminants have the potential to cause direct toxicity to individual birds or negatively impact their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985, Gilbertson et al. 1991, Hoffman et al. 1996).Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (C. Lee, USFWS, pers. comm. 2009). Federal and state land managers have protective provisions in place to secure and remove the barrels, thus reducing the likelihood of contamination. The extent to which contaminant levels in piping plovers can be attributed to wintering and migratory stopover sites is unknown. Research focused on known winter and migration habitats of the Great Lakes birds may be necessary should any breeding issues arise with regard to PCB levels. Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; USFWS 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; A. Amos, University of Texas, pers. comm. 2009). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants (USFWS, 2009).

Stressor: Pesticides (USFWS, 2009)
Exposure:
Response:

Consequence:
Narrative: Neither the final listing rule nor the recovery plans identified pesticides as a threat to piping plovers on the wintering grounds. In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer chemical manufacturer. With one reported plover death from pesticide use, and with the causative pesticide now removed from use, this threat to piping plovers in the U.S. currently appears low. However, it is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico (USFWS, 2009). Although unknown, given the widespread use of neonicotinoids and the tendency to accumulate in wetlands, persistence in the soil, and potential adverse effects on the quantity and composition of the insect community, neonicotinoids may have a negative effect on the piping plover population, particularly breeding areas in alkaline lakes (USFWS, 2015).

Stressor: Accelerating sea-level rise (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Over the past 100 years, the globally-averaged sea level has risen approximately 10-25 centimeters (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33% of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007, CCSP 2008). Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat that lies immediately seaward of numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the overwashing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments (USFWS, 2009).

Stressor: Storm events (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced overwashand vegetation removal have been noted in portions of the wintering range. The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. Other storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm

and seawall construction. As discussed in more detail in WM 2.2.2.1, such stabilization activities can result in the loss and degradation of feeding and resting habitats. Storms also can cause widespread deposition of debris along beaches. Removal of debris often requires large machinery, which can cause extensive disturbance and adversely affect habitat elements such as wrack. Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity (Emanuel 2005, Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms. In sum, storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range (USFWS, 2009).

Stressor: Inadequacy of existing regulatory mechanisms (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Protections for piping plovers migrating and wintering outside the U.S. include the 2005 designation of 1.5 million acres of the Laguna Madre de Tamaulipas region in Mexico as a Federal Natural Protected Area. Any land-use alterations to piping plover habitats within this area are now subject to review under a federal permitting process that encourages avoidance and minimization of impacts; however, it does not preclude alterations. This is similar to the ESA in allowing some adverse effects to designated critical habitat. Regulatory protections for piping plovers in the Caribbean and Cuba are currently unknown. Enforcement limitations and/or legal insufficiency of regulations to protect important habitat components result in continued degradation of a significant amount of wintering piping plover coastal habitat, including designated critical habitat units, resulting in a cumulative loss of habitat. At the current time, if the protections of the ESA were removed, existing local, state, and other federal regulatory provisions would provide insufficient protection to nonbreeding piping plover habitats used during migration and winter (USFWS, 2009).

Stressor: Reservoirs, channelization of rivers, and modification of river flows (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Prior to colonization, river systems in the Northern Great Plains generally had large rises in the spring as water melted off of the prairie and then the mountains. These spring rises carried sediment down the system, creating sandbar islands as the water slowed and deposited the material. The water levels would then drop throughout the summer, exposing more acres of sandbar as the season progressed (USFWS 2003). After European settlement, attempts were made to make the rivers more predictable and suitable for navigation, and to minimize seasonal flooding. River channels were straightened and channelized, and a number of dams were constructed. These dams greatly reduced sediment inflow into the system, reducing the amount of sand available for sandbar creation (National Research Council 2002). Additionally, the hydrology of the rivers has been drastically altered. On the Missouri river, flows used to generally decline over the summer as tributary flows decreased. Today, they generally increase during the nesting season to provide for downstream needs (USFWS 2003). This means that less sandbar habitat is available over the course of the summer, rather than more, as would have been the case prior to dam construction. By contrast, due to the large number of users on the Platte River, flows are variable and the river often runs dry in the summer, also leading to a reduction in piping plovers on the river (National Research Council 2004). The lack of sufficient suitable

habitat due to modification of river flows continues to be a major threat to the piping plover (USFWS, 2009).

Stressor: Sand and gravel mining (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Mining is ongoing in Nebraska in the lower and central Platte River systems. Mine operators inadvertently create piping plover habitat by depositing waste sand alongside pit lakes. Plovers nest on spoil piles of sparsely or non-vegetated sand and associated lakes at sand and gravel mines. Generally, when production is finished, the mines are turned into housing developments. Some lakes have been constructed for housing developments without first mining the area. As the 1988 plan states, these activities can be problematic because of construction activities in the areas where plovers nest, potentially directly impacting nesting birds or indirectly disturbing nesting or brood rearing activities (Brown and Jorgensen 2008). The 1988 plan also identifies predation as a problem on these mine sites (USFWS, 2009)

Stressor: Oil and gas development (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Oil development on the breeding grounds has increased dramatically since 1988 and remains a threat today. Although USFWS personnel work with oil producers to avoid impacts to plovers, unless a federal permit is required, the USFWS is not necessarily informed about oil activity, and many wells are put in without any input regarding potential impacts on plovers. In North Dakota and Montana, oil production near plover nesting habitat has increased substantially since 1988, and many oil wells are near known plover nesting areas. The impacts from oil development are largely unknown but potentially substantial. Prior to production, seismic surveys are performed over an extensive area to determine the likely location of oil reserves. This requires large equipment that can leave permanent tracks in plover nesting areas, even under frozen conditions in winter. Plover chicks can have difficulty getting out of vehicle tracks, which may contribute to mortality (Eddings 1991, Howard et al. 1993). The extensive road system built to access oil wells may cause direct mortality of adult plovers. Plovers were documented to be hit by cars on a road between Lake Audubon and Lake Sakakawea (a Missouri River reservoir) in North Dakota (USFWS 2004; M. Shriner, Western Area Power Administration, in litt. 2007). Plover mortality has also been documented from powerline strikes (M. Shriner in litt. 2007). Drilling activity is extremely loud and would likely be disruptive to nesting plovers if it is done during the nesting season. Contamination from the reserve pit, either while the well is active or over time after the extraction is complete, may permanently impact piping plover habitat (USFWS, 2009).

Stressor: Wind power (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The number of wind farms in the Northern Great Plains is increasing rapidly (American Wind Energy Association 2008). North Dakota has been identified as the top state in the nation for wind energy potential, and Montana is the fifth highest (American Wind Energy Association

2009). The potential impacts of wind farms on piping plovers are unknown but may be significant. Impacts may occur through direct collision with turbines, or indirectly if plovers avoid previously used areas that now contain wind farms (USFWS, 2009).

Stressor: Intraspecific aggression (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: There is some information suggesting that in situations where density may be leading to insufficient forage for chicks, piping plover adults will attack nonrelated young (D. Catlin in litt. 2009). In the Northern Great Plains, this agonistic behavior is likely related to limited available habitat, as birds are forced to nest in dense concentrations and compete for forage (D. Catlin in litt. 2009). Intraspecific aggression seems to be a symptom of birds nesting too densely resulting in competition for resources. The reduction in suitable nesting habitat due to a number of factors is a major threat to the species, likely limiting reproductive success and thus future recruitment into the population (USFWS, 2009).

Stressor: Power lines (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Overhead power lines have been documented to kill a large number of birds, including plovers (USFWS 2004, M. Shriner in litt. 2007). Overall, power lines are known to kill piping plovers when located between feeding and nesting areas, but it is unknown whether the increasing number of powerlines across the migration routes impacts plovers (USFWS, 2009).

Stressor: Agricultural development (USFWS, 2015)
Exposure:
Response:
Consequence:
Narrative: Alkaline wetlands of the prairie pothole region lie within an agricultural landscape and are subject to siltation, pre-mature filling and other impacts (Gleason and Euliss 1998). Wetlands in agricultural fields receive more sediment from upland areas than wetlands in grassland landscapes. Cultivation of the wetland catchment areas, where surface water runs off to the wetland basin, has greatly altered the dynamics of surface runoff and hydrologic inputs to groundwater. Excessive sediment input can potentially alter the aquatic food web and other basic wetland functions. Retaining grasslands or restoring grassland buffers around plover nesting basins may reduce siltation and other contaminant impacts (USFWS, 2015).

Recovery

Reclassification Criteria:
Not available.

Recovery Priority Number: 2C

Delisting Criteria:

1. Using the most current estimates of region-specific breeding population and population growth (?), the NGP plover population model indicates that the upper 95 percent confidence limit on the probability of a regional population going extinct within the next 50 years is < 0.05. This criterion is satisfied for all four regions (description of the areas is under number '2' below). In addition, the following are met: 1. for every region, population growth is stable or increasing (= 1.0) over a 10-year average, and is projected to remain steady or increasing over the next 50 years, and 2. the population will be distributed so that at least 15 percent of the population is in each of the following regions: a. Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system) b. Northern Rivers (Missouri River system from Fort Peck Lake, Montana to Pierre, South Dakota) c. U.S. Alkaline Lakes d. Prairie Canada (USFWS, 2015).

2. A minimum amount of suitable nesting and foraging habitat is available on a regional basis, as described below. a. 1,630 ha (4,030 ac) in Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system) b. 1,320 ha (3,270 ac) in Northern Rivers (Missouri River system on Fort Peck Lake, Montana to Pierre, South Dakota) c. 1,460 ha (3,600 ac) in the U.S. Alkaline Lakes d. 1,460 ha (3,610 ac) in Prairie Canada. This criterion should be met for a minimum of 12 years prior to initiating delisting (USFWS, 2015).

3. Sufficient habitat is available on the coastal migration and wintering grounds in quantity and quality to support conservation of the species at recovery levels as defined by Criterion 1. This will include designated Critical Habitat, and additional habitat that was not designated but is regularly used by wintering piping plovers. Piping plovers should be spatially distributed in the following locations. a. Western Gulf Coast - from the Galveston Bay area, west-southwest along the coast of Texas and Mexico b. Central Gulf Coast - east-northeast of Galveston Bay through Jefferson County in NW Florida c. Eastern Gulf Coast - Florida's west coast-Taylor County, Florida south to Monroe County d. Atlantic Coast Florida's east coast, including the Florida Keys up through northeastern North Carolina, Caribbean Islands, and the Bahamas Islands (USFWS, 2015).

4. Ensure commitments are in place and functioning as anticipated to provide longterm funding, protection, and conservation management activities in essential breeding and wintering grounds. a. Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system) b. Northern Rivers (Missouri River system from Fort Peck Lake, Montana to Pierre, South Dakota) c. U.S. Alkaline Lakes d. U.S. Wintering Grounds (USFWS, 2015).

Recovery Actions:

- Protect habitat on the breeding grounds to support piping plovers at recovery level goals (USFWS, 2015).
- River system management: Ensure that river management mimics the natural system to the extent possible and furnishes sufficient high-quality nesting habitat to be available at a level to support piping plovers at recovery goals (USFWS, 2015).
- Alkaline Lakes: Identify and reduce threats in landscape ecology of the alkaline lakes basins such that the basins will provide quality self-sustaining habitat (USFWS, 2015).
- Work with commercial aggregate (also known as sand and gravel) mining companies to operate mines to avoid adversely affecting piping plovers during operations (USFWS, 2015).

- Implement steps to reduce unsustainable levels of predation risk over the long- term through ecosystem restoration (USFWS, 2015).
- Protect breeding plovers and their habitats from impacts of energy development (USFWS, 2015).
- Identify and control plant species, with an emphasis on invasives, that may make habitat unsuitable (USFWS, 2015).
- Develop and implement comprehensive plans, reflective of local conditions, to manage and avoid conflicts and to address the social and public relations challenges resulting from restrictions placed on human activities and interests such as recreation, residency, economic development and commerce. Actions should be focused on areas where management actions intended to protect piping plovers may interfere with human activities (USFWS, 2015).
- Coordinate among state, federal, and tribal agencies as well as private landowners to ensure that plover protection is incorporated into development plans on or near plover habitat in order to avert negative impacts to plovers (USFWS, 2015).
- Develop a Conservation Strategy for the long-term management of piping plovers and their habitat, including a post de-listing plan (USFWS, 2015).
- Work internally in the USFWS, and with federal and state agencies on projects so that there are no net negative impacts to plover habitat by assisting with design, implementation, permits, or mitigation measures (USFWS, 2015).
- Ensure that conservation measures designed to offset the adverse effects of human activities, developments and management decisions are monitored for effectiveness (USFWS, 2015).
- Ensure that incidental take that may be authorized pursuant to the ESA is consistent with recovery (USFWS, 2015).
- Continue monitoring efforts on the breeding grounds to track population trends and reproductive success. Monitoring efforts should be coordinated throughout the Northern Great Plains breeding grounds so that overall trends can be tracked across the range (See appendix 3B for a matrix on how this might be done across the range). Input monitoring results into the NGP plover model (see Appendix 2B) to assess progress towards recovery (USFWS, 2015).
- Work with biologists in Canada to identify and find solutions to international problems that may be impacting survival (USFWS, 2015).
- Coordinate between research and monitoring programs across the NGP to determine demographic parameters across time as local and regional conditions change (USFWS, 2015).
- Monitor status of State Wildlife Action Plan revisions and leverage opportunities to provide input on this species (USFWS, 2015).
- Evaluate impacts to the breeding population from projected climate change modeling and analysis (USFWS, 2015).
- Develop a comprehensive conservation plan for piping plovers in the U.S. portion of their migration and wintering range. a. Acquire funds to develop a concise, cohesive plan that will address the migration and wintering needs of the three breeding populations. This is most efficiently accomplished by a qualified contractor working in close coordination with USFWS biologists. b. Develop a state-by-state wintering and migration habitat use atlas (GL tasks 2.12, 2.13, 2.16; AC task 2.1; NGP task 1.13). i. Quantify amount and distribution of currently existing habitat. ii. Determine the condition of each site, including the type and level of

alteration, presence and threat level from invasive species, and whether natural coastal processes are impeded. Compare with historic habitat availability using aerial photography or other records. iii. Determine the temporal abundance and distribution of piping plover activity at sites with suitable habitat. Where appropriate data are currently lacking, conduct multiple surveys by qualified personnel across several migration and wintering seasons. Examples of reports summarizing methods and results of such surveys are available on request to the USFWS. iv. Evaluate likelihood of future actions, including human development and recreational uses, and natural events that could potentially affect habitat quantity and quality at each site. v. Evaluate factors at each site that will affect the response of habitat to accelerating sea-level rise and identify potential actions to minimize its adverse effects. c. Conduct a systematic review of recreational policies and beach management. Identify gaps in management and enforcement of regulatory mechanisms by state. Develop recommendations to improve management and enforcement of piping plover protections where warranted (AC task 2.24). d. Develop an education/outreach strategy to work with state, county, and municipal governments to develop and implement ordinances and other strategies reducing effects of habitat stabilization, beach cleaning practices, human uses, and pets in beach and bayside habitats (GL task 5.2, AC task 2.24, NGP task 5.2). e. Develop an education/outreach strategy to work with private landowners with regard to habitat stabilization, beach-cleaning practices, human uses, and pets (USFWS, 2009).

- Develop, in coordination with land managers, management plans for critical habitat sites or other sites that support or could support nonbreeding piping plovers. This may be accomplished concurrently with development of the atlas described under action 1b above or as a follow-up task (GL tasks 2.14, 2.22; AC tasks 2.13, 2.2; NGP tasks 4.42, 4.43). a. Develop and implement a conservation plan tailored to the site's conditions. A range of management measures may include, as appropriate, leash laws and dogfree zones, off-road vehicle management, and symbolic fencing of key habitats during periods of high plover use. b. Develop a recommended piping plover monitoring protocol for each site that includes suggested frequency and intensity of monitoring. c. Monitor the effectiveness of management measures (2.a above) (USFWS, 2009).
- Improve consistency in the approach used, and recommendations generated for, piping plover conservation in ESA section 7 consultations and Coastal Barrier Resources Act review across all USFWS field offices throughout the species' U.S. coastal migration and wintering range. a. Regularly update USFWS field office staff regarding latest information on piping plovers and habitat use. b. Emphasize importance of maintaining natural coastal processes to perpetuate high quality piping plover migrating and wintering habitat (AC task 2.21). c. Discourage projects that will degrade or interfere with formation or maintenance of high quality piping plover habitat (GL task 2.22, AC task 2.21, NGP task 4.43). d. Encourage project features to minimize adverse effects on piping plovers and their habitat, including creation and enhancement of habitat in the vicinity of existing stabilization projects. . e. Develop a comprehensive monitoring and management plan template for shoreline stabilization projects on the wintering and migration grounds. f. Consider effects of climate change when determining long-term impacts. Include measures to conserve and enhance the capacity of piping plover habitats to adapt to sea-level rise (USFWS, 2009).
- Develop a website specifically for wintering and migrating piping plover issues (GL task 5.2 and AC tasks 4.1, 4.2). a. Develop a piping plover contact list of all individuals in each state and other countries (Canada, Mexico, Bahamas, etc.). b. Link to other plover websites. c. Upload all pertinent literature, including research and monitoring reports not protected by copyright, to the website. d. Upload summarized section 7 consultations, conservation

measures, reasonable and prudent measures, and terms and conditions (USFWS, 2009).

- Focus the non-breeding portion of the International Census on enhancing understanding of piping plover abundance, distribution, and threat levels in seasonally emergent habitat (seagrass beds, oyster reefs, and mud flats) in Texas bays, and in Mexico and the Caribbean (GL task 2.13 and NGP task 1.13). a. Continue to encourage and improve International Census efforts at priority sites in Texas. b. USFWS regional coordinators for the International Census should establish contacts in Mexico, Bahamas, Cuba, and other appropriate Caribbean countries at least a year in advance of the 2011 International Census. i. Increase efforts to maximize survey coverage. ii. Encourage collection of information describing types and levels of threats at each International Census site in addition to physical and biological attributes of the site. iii. Provide information about color-banded birds and encourage surveyors to look for and report these marked piping plovers (USFWS, 2009).
- To further enhance understanding of spatial partitioning of the breeding populations (as well as the impacts of some threats) on the migration/winter grounds, USFWS should facilitate and encourage all efforts dedicated to (or incorporating) monitoring of color-banded piping plovers. There is urgency associated with this data collection since several large breeding grounds banding studies have recently ended or are slated for completion in the near future, and opportunities to glean information will decline as banded piping plovers die off (GL task 2.12, NGP task 1.133) (USFWS, 2009).
- Further investigate the partitioning of survival within the annual cycle, and determine whether winter habitat quality influences reproductive success and survival (GL task 4.1 and AC task 3.6). Explore opportunities for further comparison of survival rates among breeding populations to inform these issues (USFWS, 2009).
- Continue to refine characterization of optimal winter habitat and understanding of factors affecting piping plover use of different microhabitats (e.g., ocean intertidal zones, wrack, inlet shoreline, soundside flats) (GL task 4.4; AC tasks 3.11, 3.12, 3.13; NGP tasks 2.22, 2.23). Research approaches should recognize that piping plovers may move among relatively nearby habitat patches. Plover habitat use patterns and needs may also vary geographically (across their nonbreeding range) and seasonally. a. Determine how habitat modification or complete loss of a site on migration and wintering grounds affects survival given documented site fidelity. b. Develop design specifications for creating roosting and foraging habitat. c. Quantify the amount and distribution of habitat needed for recovery of each breeding population, giving due consideration to intra- and inter-species competition for use of similar habitats (USFWS, 2009).
- Develop strategies to reduce threats from accelerating sea-level rise. a. Identify human coastal stabilization practices that increase or decrease adverse effects of sea-level rise on coastal piping plover habitats. b. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat as sea-level rises. c. Evaluate projected effects of sea-level rise on the regional distribution of piping plover habitats over time. Facilitate use of LIDAR (a remote sensing system used to collect topographic data) mapping of coastal elevations, development of models, and timeframe analysis throughout the species wintering and migration range in the U.S. to generate projections regarding areas most likely to be inundated within given time frames (USFWS, 2009).
- Determine the extent that human and pet disturbance limits piping plover abundance and behavioral patterns in the wintering and migration habitats (GL task 2.14, AC task 3.14, NGP task 3.221) (USFWS, 2009).

- Determine the effect of human and pet disturbance on survival and reproductive fitness (GL task 4.1, AC task 3.14, NGP task 3.221) (USFWS, 2009).
- Support research to ascertain impacts of predation on wintering/migrating piping plovers, as well as to determine the effectiveness of predator control programs (USFWS, 2009).
- A draft and final revised recovery plan (or, alternatively, an interim conservation strategy) for the Northern Great Plains piping plover population should be developed (USFWS, 2009).
- Continue to construct habitat on the Missouri River system while exploring ways that flows could be altered to provide additional habitat for piping plover nesting and brood rearing (USFWS, 2009).
- Actively explore ways that the Missouri River reservoirs and shorelines can be manipulated to provide breeding habitat under a variety of water conditions (USFWS, 2009).
- Ensure habitat availability. Identify how much habitat is needed over time on river systems to provide for a secure Northern Great Plains piping plover population. The Missouri and Platte rivers in particular are highly altered systems, leading to flooding of breeding habitat and suppressed reproduction. To date, sandbar creation efforts on the Missouri River have not kept pace with habitat loss. See recovery plan tasks 4.416 and 4.417 (USFWS, 2009).
- Continue to perform monitoring and recovery actions annually throughout the U.S. Northern Great Plains population (USFWS, 2009).
- Identify and secure consistent funding for management, monitoring, and recovery efforts for the U.S. alkali lakes population (USFWS, 2009).
- Public outreach: a. Increase public outreach and education in areas where there is the potential for human/plover interactions. See recovery plan tasks 5.51 and 5.52. b. Increase law enforcement activities in areas where human disturbance may be impacting reproductive success (USFWS, 2009).
- Habitat protection: a. Continue to work with landowners on the alkali lakes to ensure protection of piping plover alkali lakes and surrounding uplands. Where possible, obtain longterm agreements with landowners to protect these habitats. Increase efforts to remove trees, rockpiles, etc., that may harbor predators. See recovery plan tasks 4.417 and 4.418. b. On the river systems, obtain easements or fee-title on undeveloped land to reduce current and future pressure from human activities on nearby piping plover habitat. Keep as much of the river bank as possible from being stabilized, since this increases flow velocity and thus sandbar erosion rates and encourages development. See recovery plan task 4.416. c. Restrict public use of sandbar and shoreline areas as needed to provide for piping plover nesting and brood-rearing needs (USFWS, 2009).
- Explore the movement of birds within the Northern Great Plains. It has been postulated that if there is not much habitat on the Missouri River system, birds will nest on the alkali lakes and vice versa. Sightings of banded birds have established that birds do move among the Missouri River, Nebraska, and the alkali lakes. There have been some sightings of birds hatched in Saskatchewan that apparently breed on the alkali lakes in Montana. However, it is not known if there are large-scale movements of piping plovers from one habitat type to another, in particular between the alkali lakes in the U.S. and Canada and the Missouri River system. A study of large-scale piping plover movements over time would help to identify where to focus management actions to ensure that there is habitat available in areas where birds may go if habitat in one area is not suitable in a given year (USFWS, 2009).
- Predation control efforts are ongoing on the Missouri River system and the U.S. alkali lakes. However, predation control may not always have the intended effect. For example, caging nests may increase adult mortality if predators learn to key in on cages. Increasing the

number of chicks hatched may not lead to a higher fledging success, since predators may key in on densely occupied areas. Research is needed to determine if predation control is actually improving reproductive success in all areas where it is taking place. See recovery plan tasks 3111 and 3112 (USFWS, 2009).

- The International Census is an extremely useful tool in the Northern Great Plains. Therefore, we recommend continuing the International Census for this population (recovery plan tasks 111 and 112). It may also be worth exploring additional sampling techniques between International Censuses to better track piping plover population trends on the Northern Great Plains. A well-designed sampling approach in which a subset of sites is surveyed more frequently may supplement the International Census by providing information on population trends and bird movements. Therefore, sub-sampling is unlikely to completely replace efforts to periodically survey the entire region. However, a combination of attempting to survey the entire area coupled with more frequent sub-sampling may provide more accurate and timely information about population trends (USFWS, 2009).
- Wind power is rapidly expanding in the Northern Great Plains. Research is needed to assess the threat this poses to piping plovers at breeding sites and in migration corridors. Special focus should be placed on the impact of associated power transmission lines (USFWS, 2009).
- . Oil and gas exploration and production is rapidly expanding throughout Northern Great Plains breeding grounds. Work is needed to determine the short and long-term impacts of oil exploration and production, including short-term impacts such as seismic work or drilling, ongoing impacts of extraction, potential impacts of spills or leakage, and long-term, cumulative changes as more habitat is disturbed for well pads and roads (USFWS, 2009).
- Piping plover adult numbers appear to fluctuate in response to the quantity of water in the river system (see Figure NGP13 in this review). A historical analysis of system storage and flows compared with adults surveyed and reproductive success may help in future river management. See recovery plan tasks 4161 and 4162 (USFWS, 2009).
- There is very limited evidence suggesting that forage on alkali lakes may be generated from nearby prairies. Changes in surrounding habitat may impact plovers in other ways as well. Examining forage on alkali lakes in relation to surrounding land use may help to focus alkali lake management priorities over the long term. See recovery plan task 211 (USFWS, 2009).
- Clarify the piping plover ESA listing to recognize the subspecies Charadrius melodus melodus and C. m. circumcinctus, and, within C. m. circumcinctus, two DPSs (USFWS, 2009).
- The International Piping Plover Census has fostered widespread involvement in survey efforts and provided extensive data. However, as piping plover conservation efforts mature, it may be beneficial to shift the Census effort to address specific questions that are not answered by other ongoing efforts. Given ongoing recovery programs on the breeding grounds, the most important future International Census contribution to ESA recovery implementation and monitoring for all piping plovers is the abundance estimate for the Northern Great Plains breeding population (including Prairie Canada). The highest benefit can be realized by emphasizing completeness and quality control of this portion of the census and by expediting synthesis and reporting, so that managers can make timely use of this information (see recommendation 11 for the Northern Great Plains breeding range). The most valuable potential contribution from future winter censuses is improved understanding of the species' range in the Caribbean, Mexico, and other areas that may not have been fully covered in the past (e.g., seasonally emergent habitats within bays lying between the mainland and barrier islands in Texas) (USFWS, 2009).

Conservation Measures and Best Management Practices:

- Recommendations for Northern Great Plains Population Breeding Range 1. Design and implement over-arching monitoring framework to track breeding habitat and population performance over time. 2. Create partnerships with conservation organizations and the public where the primary goal is to work together to ameliorate the threat of habitat loss. (USFWS, 2020)

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SPECIES ACCOUNT: *Charadrius melodus melodus* (Piping Plover - Atlantic)

Species Taxonomic and Listing Information

Listing Status: Threatened; 12/11/1985; Northeast Region (R5) (USFWS, 2017)

Physical Description

Piping plover subspecies are phenotypically indistinguishable (USFWS, 2009). The piping plover is a small Nearctic (i.e., North American) shorebird approximately 17 centimeters (7 inches) long with a wingspread of about 38 cm (15 in) (Palmer 1967). Wilcox (1959) found that breeding females were slightly heavier than males (55.6 grams vs. 54.9 g), had slightly shortertail lengths (50.5 millimeters vs. 51.3 mm), but had similar wing lengths. Breeding birds have white underparts, light beige back and crown, white rump, and black upper tail with a white edge. In flight, each wing shows a single, white wing stripe with black highlights at the wrist joints and along the trailing edges. Breeding plumage characteristics are a single black breastband, which is often incomplete, and a blackbar across the forehead. The black breastband and brow bar are generally more pronounced in breeding males than females (Wilcox 1939). The legs and bill are orange in summer, with a black tip on the bill. In winter, the birds lose the blackbands, the legs fade from orange to pale yellow, and the bill becomes mostly black (USFWS, 1996).

Taxonomy

Miller et al. (2009) confirmed separate Atlantic and interior piping plover subspecies (C. m. melodus and C. m. circumcinctus, respectively). This study found that birds from the Great Lakes region were allied with the interior subspecies group and should be taxonomically referred to as C. m. circumcinctus. Very rare (perhaps completely absent) reproductive interchange between the Great Lakes and the Northern Great Plains populations constitutes a marked separation of breeding ranges, albeit insufficient or too recent to result in substantial genetic differences demonstrated by available studies (USFWS, 2009).

Historical Range

See current range/disitrbution.

Current Range

Migrating breeders from eastern Canada have been observed in Massachusetts, New Jersey, New York, and North Carolina (Amirault et al. 2005). Information gaps include the wintering locations of the U.S. Atlantic Coast breeding population. Although there is no exclusive partitioning of the wintering range, piping plovers from the Atlantic Coast (i.e., eastern Canada) and the Great Lakes are most prevalent during migration and winter along the southern Atlantic Coast. Wintering ranges of all three breeding populations overlap on the Gulf Coast of Florida. The latitudinal extent of the breeding population did not change between 1986 and 2006, as piping plovers nested annually from southern North Carolina north to the western coast of Newfoundland. Breeding piping plovers were present each year in all Atlantic Coast states from North Carolina to Maine, except for New Hampshire, where they were reported in 1997 for the first time since ESA listing. One to three pairs were reported nesting in South Carolina in 1986, 1990, 1991, and 1993 (Hecht and Melvin 2009a) (USFWS, 2009). The Atlantic Coastpiping plover(Charadrius melodus) population breeds on coastal beachesfrom Newfoundland to North

Carolina (and occasionally in South Carolina) and winters along the Atlantic Coast from North Carolina south, along the GulfCoast, and in the Caribbean. Piping plovers continue to breed successfully at or near the extremes of their historic range. While the extent of the current range does not appear to be substantially different from the historic range, piping plovers are absent from many former nesting beaches on the Atlantic Coast (Cairns and McLaren 1980, Litwin etal. 1993, CWS 1994, Virginia Department of Game and Inland Fisheries 1994) (USFWS, 1996).

Distinct Population Segments Defined

No

Critical Habitat Designated

Yes; 7/10/2001.

Legal Description

On May 19, 2009, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in 18 specific units in Texas under the Endangered Species Act of 1973, as amended (Act). In total, approximately 139,029 acres (56,263 hectares) fall within the boundaries of the revised critical habitat designation. The revised critical habitat is located in Cameron, Willacy, Kenedy, Kleberg, Nueces, Aransas, Calhoun, Matagorda, and Brazoria Counties, Texas. Other previously designated critical habitat for the wintering piping plover in Texas or elsewhere in the United States remains unaffected.
On October 21, 2008, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in North Carolina under the Endangered Species Act of 1973, as amended (Act) (73 FR 62816 - 62841). In total, approximately 2,043 acres (ac) (827 hectares (ha)), in Dare and Hyde Counties, North Carolina, fall within the boundaries of the revised critical habitat designation.
July 10, 2001, the Fish and Wildlife Service (Service), designate 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for the wintering population of the piping plover (Charadrius melodus). This includes approximately 2,891.7 kilometers (km) (1,798.3 miles (mi)) of mapped shoreline and approximately 66,881 hectares (ha) (165,211 acres (ac)) of mapped area along the Gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons.

Critical Habitat Designation

18 units are designated as revised critical habitat in Texas for the wintering population of the piping plover. The 18 revised critical habitat units are divided into 24 areas: (1)Subunit TX–3A: South Padre Island – Gulf of Mexico Shoreline; (2)Subunit TX–3B: South Padre Island –Interior; (3)Subunit TX–3C: North Padre Island – Interior; (4)Subunit TX–3D: North Padre Island – Gulf of Mexico; (5)Subunit TX–3E: Mesquite Rincon; (6)Unit TX–4: Lower Laguna Madre Mainland; (7)Unit TX–7: Newport Pass/Corpus Christi Pass Beach; (8)Unit TX–8: Mustang Island Beach; (9)Unit TX–9: Fish Pass Lagoons; (10)Subunit TX–10A: Shamrock Island; (11)Subunit TX–10B: Mustang Island – Unnamed sand flat; (12)Subunit TX–10C: Mustang Island – Lagoon Complex; (13)Unit TX–14: East Flats; (14)Unit TX–15: North Pass; (15)Unit TX–16: San Jose Beach; (16)Unit TX–18: Cedar Bayou/Vinson Slough; (17)Unit TX–19: Matagorda Island Beach; (18)Unit TX–22: Decros Point; (19)Unit TX–23: West Matagorda Peninsula Beach; (20)Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West; (21)Unit TX–28: East Matagorda Bay/ Matagorda

Peninsula Beach East; (22)Unit TX–31: San Bernard NWR Beach; (23)Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers; and (24)Unit TX–33: Bryan Beach and Adjacent Beach.

Unit TX–3: Padre Island. Subunit TX–3A: South Padre Island – Gulf of Mexico Shoreline. This subunit consists of 2,891 ac (1170 ha) in Cameron and Willacy Counties, Texas. It is a beach 30.0 mi (48.2 km) in length on the gulfside of South Padre Island, which is a barrier island. The subunit is located within an area bounded on the south by the southern boundary of Andy Bowie County Park, and on the north by the south jetty of Mansfield Channel, which divides North and South Padre Islands. The jetty itself is outside the boundary of the subunit. The eastern boundary is the estimated MLLW of the Gulf of Mexico, and the western boundary is the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. The vegetated dune and Park Road 100, which runs northsouth along the western side of the dune, separates Subunits TX–3A and 3B. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately one quarter of the subunit is in Federal ownership and managed by the Service's Laguna Atascosa National Wildlife Refuge (NWR), and approximately 64 percent is in private ownership. The Service does not own the subsurface mineral rights. Ten percent is State land managed by the GLO, and a small portion at the southern end is County park land managed by Andy Bowie County Park. Subunit TX–3A is the southernmost unit of the revised critical habitat for the wintering population of the piping plover. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1), surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greatest magnitude at the southern end of the subunit where housing developments are to the west of the subunit. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3B: South Padre Island –Laguna Madre side. This bayside subunit consists of 44,137 ac (17,862 ha) in Cameron and Willacy Counties, Texas. Its southern boundary extends along the north side of an existing earthen, manmade dike running from the edge of dense dune vegetation to the Laguna Madre along latitude 26° 09' 19.00'' N. The dike is not within the boundary of the subunit. The western boundary is the western edge of the intertidal mudflats bordering the eastern shore of the lower Laguna Madre, and the northern boundary is Mansfield Channel. The eastern boundary is dense vegetation of the dunes or, if there is no dense vegetation or dune, the western boundary of Park Road 100. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them.

However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately 42 percent of the land is federally owned and managed by the Service's Laguna Atascosa NWR, and approximately 38 percent is Stateowned and managed by the GLO. The remaining 20 percent is in private ownership along the western side of the subunit. The Service does not own the subsurface mineral rights beneath the refuge. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand and mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. These threats, particularly vehicle access, are of greatest magnitude at the southern portion of the subunit where roads are near or adjacent to PCE 1. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, The Service is not aware of any additional management plans that address this species in this area. Subunit TX–3C: North Padre Island – Laguna Madre side. This bayside unit consists of 50,897 ac (20,597 ha) in Kenedy and Kleberg Counties, Texas. It is along and within the Laguna Madre and extends from the western boundary of Padre Island National Seashore (PAIS) to the Gulf Intracoastal Waterway (GIWW). The northern boundary of the subunit is a line extending westward from the PAIS (at latitude 27° 4' 29.9'' N), and its southern boundary is a line extending westward from the southern boundary of PAIS along the northern edge of the Mansfield Channel. The eastern boundary of this subunit is the western boundary of PAIS when the PCEs extend as far as PAIS or the eastern edge of the sand flats where the PCEs end. The portion of the western boundary north of longitude/latitude coordinate 26°48'38.2''N, 97°28'11.6''W is the eastern edge of the GIWW, and the portion of the western boundary south of the coordinate is the western edge of the intertidal mudflats bordering the eastern shore of the Laguna Madre. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that we used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is State-owned and managed by the GLO. A small portion is in private ownership. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5).

This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time the Service is not aware of any management plans that address this species in this area. Subunit TX–3D: North Padre Island – Gulf of Mexico. This gulfside subunit consists of 270 ac (109 ha) of beach in Kleberg County, Texas. It extends along the gulf shore of North Padre Island from the northern boundary of PAIS northward 6.2 mi (10 km) to the Nueces County line. The southern boundary is the north boundary of the northeast section of the PAIS. The subunit extends eastward to the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Most of the land is owned by the State and managed by the GLO. Approximately one-fifth is in private ownership. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surfcast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greater magnitude at the north end of the subunit, where more roads provide easy access to the PCEs and the subunit is in close proximity to houses. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–3E: North Padre Island – Mesquite Rincon. This triangular bayside subunit of 9,6238 acres (3,894 hectares) lies on the western shore of the lower Laguna Madre in Kenedy County, Texas. The subunit is generally bounded by Rincon de la Soledad on the southwestern side, Mesquite Rincon on the north, and the GIWW and Rincon de San Jose on the east. The southwestern boundary is an irregular line along the PCEs between the latitude/longitude coordinate points: 26° 44’ 10.5’’ N, 97° 28’ 04.5’’ W at the southeastern point of Rincon de San Jose and 26° 50’ 58.1’’ N, 97° 34’ 19.5’’ W. The northern boundary is the line described between the latitude/longitude coordinate points: 26° 51’ 24.2’’ N, 97° 33’ 25.8’’ W and 26° 51’ 24.2’’ N, 97° 27’ 52.7’’ W. The northern portion of the eastern boundary is the western edge of the GIWW south to latitude/longitude coordinate point 26° 48’ 52.7’’ N, 97° 28’ 12.9’’ W. There the subunit curves westward and skirts a small horseshoeshaped inlet in the Laguna Madre to the northeastern point of Rincon de San Jose at latitude/longitude coordinate point 26° 48’ 43.9’’ N, 97° 29’ 4.7’’ W. There it continues south in an irregular line along the edge of the PCEs to the southeastern point of Rincon San Jose. Within that boundary (especially the southeastern portion of the subunit and northwestern-running edge), the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that we used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is in private ownership with a small portion that is State-owned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–4: Lower Laguna Madre Mainland. This bayside unit consists of 17,223 ac (6,970 ha) in Cameron and Willacy Counties, Texas, and lies along the western shoreline of the Lower Laguna Madre. The southern boundary is an east-west line at the northern tip of Barclay Island, approximately following latitude 26° 14′ 42.2′′ N. The northern boundary is an east-west line located near the northern tip of El Sauz Island, approximately 1.2 mi (1.9 km) south of the center of the city of Port Mansfield, Willacy County, Texas, and approximately following latitude 26° 32′ 7.8′′ N. The eastern boundary of the unit is the eastern edge of the line of dredge spoils that parallel the western side of the GIWW. The western boundary runs from southeast to northwest and is the western edge of sandy beach and mudflat habitat, approximately following the latitude/longitude coordinate points: latitude/longitude coordinate points: 26° 14′ 42.45′′ N, 97° 19′ 32.75′′ W; 26° 17′ 15.54′′ N, 97° 20′ 47.31′′ W; 26° 20′ 10.17′′ N, 97° 21′ 10.94′′ W; 26° 21′ 31.54′′ N, 97° 22′ 48.10′′ W; 26° 24′ 26.64′′ N, 97° 23′ 53.27′′ W; 26° 26′ 8.55′′ N, 97° 25′ 13.33′′ W; and 26° 32′ 5.44′′ N, 97° 27′ 6.91′′ W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately one-third of this unit is within the Service's Laguna Atascosa NWR. Approximately half is Stateowned and managed by the GLO. The remainder is in private ownership. The Service does not own the subsurface mineral rights beneath the surface of the refuge. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand or mud flats above high tide for roosting (PCE 2). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This unit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–7: Newport Pass/Corpus Christi Pass Beach. This unit consists of 294 ac (119 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 5.1-mi (8.2- km) long. The southern boundary is the gulfward extension of Saint Bartholomew Avenue, adjacent to the north end of the seawall. The northern boundary is the edge of the south jetty of the Fish Pass Structure at Mustang Island State Park. The eastern boundary is MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dune. Packery Channel cuts the beach approximately 0.3 mi (0.5 km) north of the south boundary. The seawall, jetty, bollards, and open water of Packery Channel are not within the boundaries of the unit. This unit is in State and private ownership; the State portion is managed by the Mustang Island State Park. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains PCEs in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–8: Mustang Island Beach. This unit consists of 623 ac (252 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 12.5 mi (20.1 km) long. The southern boundary is the edge of the north jetty of the Fish Pass Structure at Mustang Island State Park. The northern boundary is the south side of the Horace Calder Pier in Port Aransas, Texas. The unit is bounded on the east by the MLLW of the Gulf of Mexico, and on the west by the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated. The jetty and pier are not within the boundary of the unit. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is in State and private ownership, with a small municipal park owned and managed by the City of Port Aransas. The State land is managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–9: Fish Pass Lagoons. This bayside unit consists of 168 ac (68 ha) in Nueces County, Texas. This unit encompasses flats facing Corpus Christi Bay that extend 1.0 km (0.6 mi) on either side of Fish Pass. The inland boundary is a line of dense vegetation, and the bayside boundary is the northeast edge of the tidal sand flats that are a PCE. This unit includes all areas of habitat that contain PCEs 1, 2, 5, and 6 within the area described by a polygon with the following latitude/longitude coordinate points: 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W; 27° 41′ 56.97′′ N, 97° 10′ 8.13′′ W; 27° 41′ 24.35′′ N, 97° 10′ 36.89′′ W; 27° 41′ 18.98′′ N, 97° 11′ 16.79′′ W; 27° 41′ 23.51′′ N, 97° 11′ 31.32′′ W and 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W. Within that polygon, six moderate to large polygons from 5 to 64 ac (2 to 25 ha) each and two small polygons less than 1 ac (0.4 ha) each are PCEs and comprise the unit. Most of the unit is owned by the State and managed by the GLO. A few acres are in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and/or mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–10: Shamrock Island and Adjacent Mustang Island Flats. Subunit TX–10A: Shamrock Island. This 12-ac (5-ha) island in Nueces County, Texas, was a peninsula extending off of Mustang Island in Corpus Christi Bay until erosion separated the island from the mainland. Five small polygons of sand flats from 1.1 to 6.8 ac (0.4 to 2.7 ha) comprise the subunit. Most of the land is State-owned and managed by the GLO; the remainder is privately owned. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10B: Mustang Island: Unnamed sand flat. This 2-ac (1-ha) subunit in Nueces County, Texas, is a small, unnamed sand flat near the north edge of the mouth of Wilson’s Cut in Corpus Christi Bay. The subunit is the western half of the island that is sand flats landward (easterly) to the western edge of tidal marsh. It is entirely Stateowned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. The location of the subunit, and the configuration of the polygons of PCEs that comprise this subunit, limit recreational access by vehicles to PCEs 1 and 2. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10C: Mustang Island: Lagoon Complex. This 331-ac (134-ha) subunit in Nueces County, Texas, is an extensive lagoon complex that consists of 11 polygons within a larger polygon that extends 2.2 mi (3.5 km) south of Wilson’s Cut in Corpus Christi Bay. The southern boundary of the larger polygon begins at the western end at latitude/ longitude coordinate point 27° 43’ 2,4’’ N, 97° 10’ 19.4’’ W at the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. It follows the dune line southeast approximately 830 ft (253 m) to a road, then follows the road approximately 945 ft (288 m) to the edge of the tidal sand flat PCE. It follows the southeastern edge of the sand flat northeast to the western edge of a northsouth road, where it follows the edge of the sand flat northward to the south edge of a road that runs east-west parallel to the southwestern edge of Wilson’s Cut. The northern edge of the boundary is the south edge of the road or the northern extent of the sand flat when it does not reach the road. The western boundary follows the PCEs along their eastern edge at Corpus Christi Bay beginning 409 ft (125 m) southwest of the southwestern edge of Wilson’s Cut to the coordinate point at the western edge of the southern boundary. A road transects the larger polygon described above, forming two polygons that exclude the road. The PCEs within the 11 polygons comprise the subunit. Within that boundaries of the 11 polygons, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the polygons that comprise the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundaries can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. The subunit consists of private and Stateowned lands. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to uncontrolled recreational access and beach cleaning and stabilization efforts. Road access to the PCEs is extensive. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–14: East Flats. This bayside unit consists of 591 ac (239 ha) in Nueces County, Texas. It is an irregularly shaped intertidal sand flat south of the Corpus Christi Ship Channel. The north boundary is the northern edge of the sand flat near or adjacent to dredge spoil areas bordering the south side of the Corpus Christi Ship Channel. The northwestern latitude/longitude coordinate is 27° 49’ 54.49’’ N, 97° 6’ 14.28’’ W, and the northeastern latitude/longitude coordinate is 27° 49’ 55.29’’ N, 97° 5’ 12.86’’ W. From there, the sand flat curves southward, and the southeastern edge of it forms a highly irregular line that ends in the southwest portion of the polygon at the eastern edge of a navigation channel from the Corpus Christi Ship Channel to Corpus Christi Bay at latitude/longitude coordinate 51.93’’ N, 97° 5’ 52.58’’ W. The sand flat continues on the western edge of the navigation channel in a northwesterly direction to latitude/longitude coordinate 27° 49’ 22.08’’ N, 97° 6’ 37.04’’ W. It then curves northeasterly and across the cut to the northern edge at the northwest coordinate. On the east, it abuts the City of Port Aransas. There is a small marshland within the sand flat that bisects the sand flat that is not a PCE and is not included in the unit. The unit is mostly in private ownership, with a small portion of State land managed by the GLO. This unit was occupied at the time of listing and is currently occupied. Current ocupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–15: North Pass. This bayside unit consists of 805 ac (326 ha) in Aransas County, Texas. The unit is bounded on the northeast by a line between latitude/longitude coordinates 27° 54’ 8.70’’ N, 97° 0’ 36.97’’ W and 27° 54’ 54.53’’ N, 97° 1’ 18.17’’ W, on the northwest and west by the edge of tidal sand flats in Aransas Bay, on the south by a line running east from coordinate 27° 53’ 16.96’’ N, 97° 2’ 22.44’’ W to unit TX–16, and on the southeast by the landward boundary of unit 16. The unit is all areas that contain the PCEs for the species within a larger area described by a polygon with the following sets of latitude/longitude coordinate points: 27° 54’ 8.70’’ N, 97° 0’ 36.97’’ W; 27° 53’ 10.68’’ N, 97° 1’ 21.36’’ W; 27° 53’ 16.96’’ N, 97° 2’ 22.44’’ W; 27° 53’ 33.08’’ N, 97° 2’ 33.05’’ W; 27° 54’ 42.68’’ N, 97° 2’ 4.83’’ W; 27° 54’ 47.59’’ N, 97° 1’ 51.73’’ W; 27° 54’ 54.53’’ N, 97° 1’ 18.17’’ W and 27° 54’ 8.70’’ N, 97° 0’ 36.97’’ W. Within that boundary, the

Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale, so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit is a remnant of a hurricane washover on San Jose Island. Approximately 18 percent is Stateowned and managed by the GLO; the remainder is in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–16: San Jose Beach. This unit consists of 1,378 ac (558 ha) in Aransas County, Texas. It is a gulfside beach unit approximately 19.8 mi (31.9 km) long. The southern boundary is the edge of the north jetty of Aransas Pass. The jetty is not within the boundary of the unit. The south edge of Cedar Bayou Pass is the northern boundary. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. A small section is in Federal ownership and managed by the Service’s Matagorda Island NWR. The Service does not own the subsurface mineral rights. Approximately half of the unit is State-owned and managed by the GLO, and nearly as much is in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–18: Cedar Bayou/Vinson Slough. This bayside unit consists of 2,465 ac (998 ha) in Aransas County, Texas. It is a remnant of a hurricane washover area and includes the highly dynamic area of Cedar Bayou, the pass that separates San Jose Island and Matagorda Island. Beginning at the confluence of Vinson Slough and Cedar Bayou, the boundary follows the shore of Spalding Cove to Long Reef, then continues along a line extending 2.5 miles southwest of Long Reef to the shore of San Jose Island, then along the shore of the island to the landward boundary of Unit TX–16. Within that area, the unit consists of numerous polygons of PCEs; areas that are not PCEs within the described area are not within the boundaries of the unit. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. The southern and southeastern boundary of the unit is described by a line with the following sets of latitude/longitude coordinate points: 28° 1′ 21.76′′ N, 96° 57′ 51.24′′ W; 28° 1′ 12.77′′ N, 96° 57′ 31.18′′ W; 28° 2′ 3.07′′ N, 96° 56′ 45.84′′ W; 28° 2′ 15.92′′ N, 96° 56′ 25.10′′ W; 28° 2′ 30.32′′ N, 96° 56′ 11.97′′ W; 28° 3′ 15.62′′ N, 96° 54′ 20.01′′ W; 28° 3′ 58.58′′ N, 96° 53′ 24.65′′ W; 28° 4′ 1.15′′ N, 96° 52′ 14.65′′ W; 28° 3′ 31.74′′ N, 96° 51′ 38.29′′ W and 28° 3′ 17.69′′ N, 96° 51′ 38.47′′ W. The specific northern boundary is described by a line with the following sets of latitude/longitude coordinate points: 28° 5′ 44.24′′ N, 96° 54′ 8.16′′ W; 28° 5′ 13.23′′ N, 96° 52′ 44.85′′ W; 28° 4′ 33.99′′ N, 96° 50′ 46.55′′ W; 28° 4′ 38.92′′ N, 96° 50′ 40.79′′ W and 28° 4′ 22.98′′ N, 96° 50′ 22.94′′ W. The eastern boundary at the northeastern end of the unit is units TX–16 and TX–19 on the gulfside. The western boundary is the western edge of tidal sand flats in Aransas Bay. This area includes a small section of federally owned land managed by the Service’s Matagorda Island NWR and a small section of State-owned land. The remaining area is privately owned. The Service does not own the subsurface mineral rights beneath the NWR. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use. Vehicle use of the unit may be limited somewhat by accessibility. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–19: Matagorda Island Beach. This unit consists of 2,413 ac (976 ha) in Calhoun County, Texas. It is a gulfside beach unit approximately 37.1 mi (59.7 km) long. The southern boundary is the northern edge of Cedar Bayou Pass, and the northern boundary is the southern edge of Pass Cavallo. At Pass Cavallo, the unit curves from the eastern gulfside passing between the south edge of the pass and the north edge of the dunes to a small area on the bayside. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The federally owned land in this unit is managed by the Service’s Matagorda

Island NWR, which does not own the subsurface mineral rights. This unit also includes a small section of land in State ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and access by refuge staff and others for sea turtle monitoring efforts. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–22: Decros Point. This unit consists of 544 ac (220 ha) at the Matagorda/Calhoun County line, in Texas. It is a gulfside beach unit approximately 4.8 mi (7.7 km) long that wraps around to the bayside. This unit was originally the southern tip of the Matagorda Peninsula. It was made into an island by the dredging of the Matagorda Ship Channel, the edge of which is the northern boundary of the unit. The unit is horseshoe in shape with the east side along the Gulf of Mexico and the west side along Matagorda Bay; the two are connected at their southern boundary by habitat from the north edge of Pass Cavallo northward to the dune line. Densely vegetated sand dunes run north to south in the center of the horseshoe and are not within the boundary of the critical habitat because they are not a PCE. The eastern boundary is the MLLW of the Gulf of Mexico and the western boundary is the western edge of tidal sand flats on the east side of Matagorda Bay. Within the bayside of the boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 60 percent of the unit is in State ownership managed by the GLO. The remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach (PCE 4) for roosting and sheltering. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Due to a lack of road access, this unit does not receive much recreational vehicle use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–23: West Matagorda Peninsula Beach. This unit consists of 1,808 ac (732 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 23.9 mi (38.5 km) long. The southern boundary is the northern jetty of the Matagorda Ship Channel. The northern boundary is the Old Colorado River channel. The MLLW of the Gulf of Mexico is the eastern boundary, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just under half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West. This unit consists of 905 ac (366 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 14.1 mi (22.8 km) long. The southwestern boundary is the northeastern edge of the Old Colorado River channel. The unit runs along the beach 14 mi (23 km) to the northeastern boundary opposite Eidelbach Flats described by a line between the latitude/longitude coordinate points: 28° 41’ 2.26’’ N, 95° 46’ 29.04’’W and 28° 41’ 6.74’’ N, 95° 46’ 32.46’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just over half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East. This gulfside unit consists of 481 ac (194 ha) in Matagorda County, Texas. It extends along the Gulf beach southwest and northeast of Brown Cedar Cut. The cut is not within the boundary of the unit. This unit abuts portions of the southeastern edges of units TX–29 and TX–30, which are on the East Matagorda Bay side. The southwestern boundary is approximately 4 mi (6.5 km) southwest of Brown Cedar Cut at a line described by the following sets of latitude/ longitude coordinate points: 28° 43’ 11.91’’N, 95° 42’ 25.47’’W and 28° 43’ 17.09’’N, 95° 42’ 28.56’’W. The northeastern boundary is approximately 2.8 mi (4.5 km) northeast of Brown Cedar Cut to the point where Texas Farm to Market Road 457 intersects the beach. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat boundaries, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately onethird is in State ownership and managed by the GLO; the remaining two-thirds is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–31: San Bernard NWR Beach. This gulfside unit consists of 401 ac (162 ha) in Matagorda and Brazoria Counties, Texas. It is a 6.2-mi (10-km) segment of beach on the Gulf of Mexico near the mouth of the San Bernard River. The northeastern boundary is at the southwestern edge of the mouth of the San Bernard River. The southwestern boundary follows a line described by the following sets of latitude/longitude coordinate points: 28° 47’ 54.39’’ N, 95° 33’ 26.21’’ W, and 28° 47’ 57.69’’ N, 95° 33’ 27.75’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. There is a cut through the beach from the Gulf of Mexico to a lake 3.5 mi (5.6 km) southwest of the San Bernard River, which is not within the unit. Bollards also are not within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 30 percent of this unit is in Federal ownership and managed by the Service’s San Bernard NWR, which does not own the subsurface mineral rights. Approximately 48 percent is Stateowned and managed by the GLO with the remaining area in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The federally owned portion has pedestrian recreational access, but no vehicle access. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers. This gulfside unit consists of 556 ac (225 ha) of shoreline in Brazoria County, Texas. This unit is a 6.1-mi (9.8-km) segment of beach on the Gulf of Mexico between the mouths of the San Bernard and Brazos Rivers. The southwestern boundary is the northeastern edge of the mouth of the San Bernard River. The northeastern boundary is the western edge of the mouth of the Brazos River. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. It is entirely in State ownership and managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–33: Bryan Beach and Adjacent Beach. This unit consists of 211 ac (85 ha) in Brazoria County, Texas. It is gulfside beach approximately 3.5 mi (5.7 km) in length on the Gulf of Mexico near the mouth of the Brazos River. The southwestern boundary is the northeastern edge of the Brazos River. The northeastern boundary is Farm-toMarket Road 1495 (Bryan Beach Rd). The southeastern boundary is the MLLW. The northwestern boundary follows along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is entirely in State ownership and managed by the Texas Department of Parks and Wildlife. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Four units are designated as critical habitat for the wintering population of the piping plover in North Carolina. The four areas designated as critical habitat are: (1) Unit NC–1, Oregon Inlet; (2) Unit NC–2, Cape Hatteras Point; (3) Unit NC–4, Hatteras Inlet; and (4) Unit NC–5, Ocracoke Island.

Unit NC–1: Oregon Inlet. Unit NC–1 is approximately 8.0 km (5.0 mi) long, and consists of about 196 ha (485 ac) of sandy beach and inlet spit habitat on Bodie Island and Pea Island in Dare County, North Carolina. This is the northernmost critical habitat unit within the wintering range of the piping plover. Oregon Inlet is the northernmost inlet in coastal North Carolina, approximately 19.0 km (12.0 mi) southeast of the Town of Manteo, the county seat of Dare County. The unit is bounded by the Atlantic Ocean on the east and Pamlico Sound on the west and includes lands from the mean lower low water (MLLW) on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where the PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit begins at Ramp 4 near the Oregon Inlet Fishing Center on Bodie Island and extends approximately 8.0 km (5.0 mi) south to the intersection of NC Highway 12 and Salt Flats Wildlife Trail (near Mile Marker 30, NC Highway 12), approximately 5.0 km (3.0 mi) from the groin, on Pea Island, and includes Green Island and any emergent sandbars south and west of Oregon Inlet, and the lands owned by the State of North Carolina, specifically islands DR–005–05 and DR–005–06. However, this unit does not include the Oregon Inlet Fishing Center, NC Highway 12, the Bonner Bridge and its associated structures, the terminal groin, the historic Pea Island Life-Saving Station, or any of their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Oregon Inlet has reported consistent use by wintering piping plovers dating from the mid-1960s. As many as 100 piping plovers have been reported from a single day survey during the fall migration (NCWRC unpublished data). Christmas bird counts regularly recorded 20 to 30 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall number of piping plovers reported using the area has declined since the species was listed in 1986 (NCWRC unpublished data), which corresponds to increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Oregon Inlet is one of the first beach access points for off-road vehicles within Cape Hatteras National Seashore when traveling from the developed coastal communities of Nags Head, Kill Devil Hills, Kitty Hawk, and Manteo. As such, the inlet spit is a popular area for off-road vehicle users to congregate. The majority of the Cape Hatteras National Seashore users in this area are off-road vehicle owners and recreational fishermen. In fact, a recent visitor use study of Cape Hatteras National Seashore reported that Oregon Inlet is the second most popular off-road vehicle use area in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby Oregon Inlet Fishing Center. Pea Island National Wildlife Refuge (PINWR) does not allow off-road vehicle use;

however, Pea Island regularly receives dredged sediments from the maintenance dredging of Oregon Inlet by the Corps. The disposal of dredged sediments on PINWR has the potential to disturb foraging and roosting plovers and their habitats. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–2: Cape Hatteras Point. Unit NC–2 consists of 262 ha (646 ac) of sandy beach and sand and mud flat habitat in Dare County, North Carolina. Cape Hatteras Point (also known as Cape Point or Hatteras Cove) is located south of the Cape Hatteras Lighthouse. The unit extends south approximately 2.8 mi (4.5 km) from the ocean groin near the old location of the Cape Hatteras Lighthouse to the point of Cape Hatteras, and then extends west 4.7 mi (7.6 km) along Hatteras Cove shoreline (South Beach) to the edge of Ramp 49 near the Frisco Campground. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where PCEs do not occur). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. This unit does not include the ocean groin. Consistent use by wintering piping plover has been reported at Cape Hatteras Point since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Cape Hatteras Point independently from Hatteras Inlet. These single day surveys have recorded as many as 13 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Cape Hatteras Point is located near the Town of Buxton, the largest community on Hatteras Island. For that reason, Cape Hatteras Point is a popular area for ORV use and recreational fishing. A recent visitor use study of the park found that Cape Hatteras Point had the most ORV use within the park (Vogelsong 2003). As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–4: Hatteras Inlet. Unit NC–4 is approximately 8.0 km (5.0 mi) long, and consists of 166 ha (410 ac) of sandy beach and inlet spit habitat on the western end of Hatteras Island and the eastern end of Ocracoke Island in Dare and Hyde Counties, North Carolina. The unit begins at the first beach access point at Ramp 55 at the end of NC Highway 12 near the Graveyard of the Atlantic Museum on the western end of Hatteras Island and continues southwest to the beach access at the ocean-side parking lot near Ramp 59 on the northeastern end of Ocracoke Island. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which itself is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The Hatteras Inlet unit includes all emergent sandbars within Hatteras Inlet including lands owned by the State of North Carolina, specifically Island DR–009–03/04. The unit is adjacent to, but does not include, the Graveyard of the Atlantic Museum, the ferry terminal, the groin on Ocracoke Island, NC Highway 12, or their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Hatteras Inlet has reported consistent use by wintering piping plovers since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Hatteras Inlet independently from Cape Hatteras Point. These single-day surveys have recorded as many as 40 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall numbers of piping plovers reported using the area has declined in the last 10 years (NCWRC unpublished data), corresponding with increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Hatteras Inlet is located near the Village of Hatteras, Dare County, and is the southernmost point of Cape Hatteras National Seashore that can be reached without having to take a ferry. As such, the inlet is a popular off-road vehicle and recreational fishing area. In fact, a recent visitor use study of the park found Hatteras Inlet the fourth most used area by off-road vehicles in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby marinas of Hatteras Village. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–5: Ocracoke Island. This unit consists of 203 ha (502 ac) of sandy beach and mud and sand flat habitat in Hyde County, North Carolina. The unit includes the western portion of Ocracoke Island beginning at the beach access point at the edge of Ramp 72 (South Point Road), extending west approximately 2.1 mi (3.4 km) to Ocracoke Inlet, and then back east on the Pamlico Sound side to a point where stable, densely vegetated dune habitat meets the water. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit includes all emergent sandbars within Ocracoke Inlet. This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. The unit is adjacent to but does not include NC Highway 12, any portion of the maintained South Point Road at Ramp 72, or any of their ancillary facilities. Ocracoke Island had inconsistent recorded use by wintering piping plovers in the early 1980s, and Christmas bird counts recorded only 1 to 6 plovers using the area throughout the early 1990s. However, since the late 1990s when regular and consistent surveys of the area were conducted, as many as 72 piping plovers have been recorded during migration, and 4 to 18 plovers have been regularly recorded during the overwinter period (NCWRC unpublished data). Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). Ocracoke Inlet is located near the Village of Ocracoke, and is the southernmost point of the Cape Hatteras National Seashore. Ocracoke Island is only accessible by ferry. As such, the island is a popular destination for vacationers and locals interested in seclusion. The inlet is also a popular recreational fishing and ORV area. A recent visitor use study of the park reported Ocracoke Inlet was the third most popular ORV use area in the park (Vogelsong 2003). As a result, the primary threat to the wintering piping plover and its habitat within this unit is disturbance to and degradation of foraging and roosting areas by ORVs and by people and their pets. Therefore, sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Critical habitat was divided into 142 critical habitat conservation units that contain areas with the primary constituent elements for the piping plover in the wintering range of the species. These units are found in all eight States where piping plovers winter. See above for revised critical habitat unit descriptions in NC and TX (Units TX– 3, TX–4, TX–7, TX–8, TX–9, TX–10, TX–14, TX–15, TX–16, TX–18, TX–19, TX–22, TX–23, TX–27, TX–28, TX–31, TX–32, and TX–33).

Unit SC–1: Waites Island-North. 75 ha (186 ac) in Horry County. This unit includes the northern tip of Waites Island from the MLLW at Little River Inlet and runs west along the Atlantic Ocean shoreline 2.0 km (1.25 mi) and includes land from the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The unit continues north and west of Little River Inlet stopping at Sheephead Creek, including land from MLLW to dense vegetation line. The majority of the unit is privately owned.

Unit SC–2: Waites Island-South. 58 ha (142 ac) in Horry County.This unit includes the southern tip of Waites Island from the MLLW at Hog Inlet and runs east along the Atlantic Ocean shoreline 0.80 km (0.50 mi) and includes MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It continues north and west of the Hog inlet, stopping at the first major tributary. Critical habitat includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Emerging sandbars within Hog Inlet and adjacent to the tip if eastern Cherry Grove Beach are also included from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur. The majority of this unit is privately owned.

Unit SC–3: Murrells Inlet/Huntington Beach. 135 ha (334 ac) in Georgetown County. The majority of the unit is within Huntington Beach State Park. This unit extends from the southern tip of Garden City Beach, just south of the groins (a rigid structure or structures built out from a shore to protect the shore from erosion or to trap sand) north of Murrells Inlet from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur stopping perpendicular with the southern end of Inlet Point Drive. It includes from MLLW south of Murrells Inlet to the northern edge of North Litchfield Beach approximately 4.5 km (3.0 mi). The unit includes the MLLW from the Atlantic Ocean up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The lagoon at the north end of Huntington Beach State Park is also included.

Unit SC–4: Litchfield. 11 ha (28 ac) in Georgetown County. This unit includes the southern tip of Litchfield Beach beginning 0.50 km (0.30 mi) north of Midway Inlet and stopping at the MLLW at Midway Inlet. It includes from the MLLW on the Atlantic Ocean shoreline across and including land to the MLLW on the back bayside. This unit is mostly privately owned.

Unit SC–5: North Inlet. 99 ha (245 ac) in Georgetown County. The majority of the unit is within Tom Yawley Wildlife Center Heritage Preserve. This unit extends from MLLW to 1.0 km (.62 mi) north of North Inlet on Debidue Beach. It includes shoreline on the Atlantic Ocean from MLLW to the MLLW on the western side of the peninsula. This unit also includes from the MLLW south of North Inlet 1.6 km (1.0 mi). It includes the shoreline on the Atlantic Ocean from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It includes shoreline running south and west of the inlet from the MLLW stopping at the MLLW at the first large tributary (no name).

Unit SC–6: North Santee Bay Inlet. 305 ha (753 ac) in Georgetown County. The majority of the unit is within the Tom Yawley Wildlife Center Heritage Preserve and the Santee-Delta Wildlife Management Area. This unit is at the North Santee Bay inlet and includes lands of South Island, Santee Point, Cedar Island, and all of North Santee Sandbar. This unit includes from MLLW at North Santee Bay Inlet running north along the Atlantic Ocean side of South Island 7.2 km (4.5 mi), stopping 0.60 km (0.4 mi) north of an unnamed inlet. It includes areas from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This unit includes the eastern side of Cedar Island adjacent to the North Santee Bay Inlet from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of North Santee Sandbar to MLLW is included.

Unit SC–7: Cape Romain. 315 ha (777 ac) in Charleston County.The majority of the unit is within Cape Romain National Wildlife Refuge. This unit includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the southern and southeastern most 1.9 km (1.2 mi) portion of Cape Island, the southernmost portion of Lighthouse Island from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, all of Lighthouse Island South to MLLW, and the southern side of the far eastern tip of Raccoon Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–8: Bull Island. 134 ha (332 ac) in Charleston County. The majority of the unit is within Cape Romain National Wildlife Refuge and land owned by the South Carolina Department of Natural Resources. This unit includes from Schooner Creek on north and south of the river to north of Price’s Inlet on the southern portion of Bull Island along the Atlantic Ocean 1.6 km (1.0 mi) and south of Price’s Inlet on the northeast tip of Capers Island Heritage Preserve 1.4 km (.86 mi) along the Atlantic Ocean. All areas begin at MLLW and extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–9: Stono Inlet. 495 ha (1223 ac) in Charleston County.Most of this unit is privately owned. It includes the eastern end of Kiawah Island (approximately 4.0 km (2.5 mi)) from MLLW on Atlantic Ocean running north to MLLW on first large tributary connecting east of Bass Creek running northeast into Stono River. It includes MLLW up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur along Stono Inlet and River. All of Bird Key-Stono Heritage Preserve and all of Skimmer Flats to MLLW are included. The Golf course and densely vegetated areas are not included.

Unit SC–10: Seabrook Island. 117 ha (290 ac) in Charleston County.This unit runs from just 0.16 km (0.10 mi) north of Captain Sams Inlet to the southwest approximately 3.4 km (2.1 mi) along the Atlantic Ocean shoreline. It includes land areas from the MLLW on the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Most of this unit is privately owned.

Unit SC–11: Deveaux Bank. 130 ha (322 ac) in Charleston County. The entire unit is within Deveaux Bank Heritage Preserve. This unit includes all of Deveaux Island to the MLLW and is State-owned.

Unit SC–12: Otter Island. 68 ha (169 ac) in Colleton County.The majority of the unit is within St. Helena Sound Heritage Preserve. This unit includes the southern portion of Otter Island to the eastern mouth of Otter Creek. It includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The entire unit is State-owned.

Unit SC–13: Harbor Island. 50 ha (122 ac) in Beaufort County. The majority of the unit is State-owned. This unit extends from the northeastern tip of Harbor Island and includes all of Harbor Spit. It begins at the shoreline east of Cedar Reef Drive running south, stopping at the mouth of Johnson Creek. It includes the MLLW on the Atlantic Ocean and St. Helena Sound to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Harber Spit to MLLW is included.

Unit SC–14: Caper's Island. 238 ha (589 ac) in Beaufort County. Most of this unit is privately owned. This unit includes the southern-most 4.5 km (2.8 mi) along the Atlantic Coast shoreline of Little Caper's Island beginning at MLLW on south side of the inlet (un-named). It includes the MLLW on the Atlantic Ocean shoreline to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–15: Hilton Head. 43 ha (106 ac) in Beaufort County. The majority of this unit is State-owned. This unit includes the northeastern tip (Atlantic Ocean side) of Hilton Head Island and all of Joiner Bank. It begins at the shoreline east of northern Planters Row and ends at the shoreline east of Donax Road. It includes the MLLW of Port Royal Sound and the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Joiner Bank to MLLW is included.

Unit GA–1: Tybee Island. 37 ha (91 ac) in Chatham County. The majority of the unit is privately owned. This unit extends along the northern tip of Tybee Island starting from 0.8 km (0.5 mi) northeast from the intersection of Crab Creek and Highway 80 to 0.7 km (0.41 mi) northeast from the intersection of Highway 80 and Horse Pen Creek. The unit includes MLLW on Savannah River and Atlantic Ocean to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit GA–2: Little Tybee Island. 719 ha (1776 ac) in Chatham County. The majority of the unit is within Little Tybee Island State Heritage Preserve. This unit extends just south of the first inlet to Wassaw Sound along the Atlantic Ocean coastline, extending north along the sound 1.7 km (1.1 mi). It includes habitat from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–3: North Wassaw Island. 108 ha (267 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit includes the north-east tip of Wassaw Sound, 1.6 km (1.0 mi) along the inlet side and extending south along the Atlantic Ocean shoreline for 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–4: South Wassaw Island. 61 ha (151 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit extends from the last southern 1.6 km (1.0 mi.) on Atlantic Ocean side, around the southern tip of Wassaw Island, up to mouth of Odingsell River. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–5: Ossabaw Island. 434 ha (1072 ac) in Chatham County. entire unit is within Ossabaw Island State Heritage Preserve. This unit includes the northeastern tip from the mouth of the Bradley River east and 12 km (7.5 mi) south along the Atlantic Ocean shoreline to a point 0.4 km (0.25 mi) past the south-center inlet. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–6: St. Catherine’s Island Bar. 54 ha (135 ac) in Liberty County. The entire unit is State owned and located east-northeast of St. Catherine’s Island. This unit includes the entire St. Catherine’s Island Bar to MLLW.

Unit GA–7: McQueen’s Inlet. 215 ha (532 ac) in Liberty County. The majority of the unit is private land along the eastern-central coastline on St. Catherine’s Island. This unit extends from McQueen’s Inlet north approximately 3.5 km (2.2 mi) and south approximately 1.8 km (1.1 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–8: St. Catherine’s Island. 60 ha (147 ac) in Liberty County. The majority of the unit is private land on the southern tip of St. Catherine’s Island. This unit starts 1.2 km (0.75 mi) north of Sapelo Sound (along Atlantic Ocean shoreline) and stops inland at Brunsen Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–9: Blackbeard Island. 129 ha (319 ac) in McIntosh County. The entire unit is within the Blackbeard Island National Wildlife Refuge. This unit includes the northeastern portion of the island beginning just east of the mouth of the confluence of McCloy Creek and Blackbeard Creek and continuing east and running south along the Atlantic Ocean shoreline for 1.4 km (.90 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–10: Sapelo Island. 85 ha (210 ac) in McIntosh County. The entire unit is State-owned and within Sapelo Island. The unit extends south of Cabretta Tip approximately 0.2 km (0.13 mi) and north of Cabretta Tip 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–11: Wolf Island. 238 ha (590 ac) in McIntosh County. The majority of the unit is within Wolf Island National Wildlife Refuge and private lands just north of the Refuge. This unit includes the southeastern tip of Queen's island adjacent to the Doboy Sound and includes the eastern shoreline of Wolf Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–12: Egg Island Bar. 61 ha (151 ac) in McIntosh County. This unit is State owned and includes all of Egg Island Bar to the MLLW.

Unit GA–13: Little St. Simon's Island. 609 ha (1505 ac) in Glynn County. The majority of the unit is private land on Little St. Simon's Island. This unit includes the entire eastern coastline along Little St. Simon's Island. It begins 1.1 km (.70 mi) west of the northeast tip of Little St. Simon's Island and runs east and then south along the Atlantic Ocean shoreline stopping at the minor tributary (no name) on the southeast tip of Little St. Simon's Island north of Hampton Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Pelican Spit to MLLW is included when this sand bar is emergent.

Unit GA–14: Sea/St. Simon's Island. 191 ha (471 ac) in Glynn County. The majority of the unit is private land on the south tip of Sea Island and on the east beach of St. Simons Island. This unit extends north of Gould's Inlet (Sea Island) 2.5 km (1.54 mi) starting just south of the groin and extends south of Gould's Inlet (St. Simons Island) 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–15: Jekyll Island. 49 ha (121 ac) in Glynn County. The majority of the unit is within State lands on Jekyll Island. This unit includes the southern region of Jekyll Island beginning at the mouth of Beach Creek, running towards the tip of Jekyll Island and includes the shoreline running north along the Atlantic Ocean shoreline 1.9 km (1.20 mi) from the southern tip of Jekyll Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–16: Cumberland Island. 1454 ha (3591 ac) in Camden County. The majority of the unit is along Cumberland Island Wilderness Area and Cumberland Island National Seashore. This unit includes the majority of the eastern Atlantic Ocean shoreline of Cumberland Island. It begins .50 km (.31 mi) north of the inlet at Long Point, continues south along the Atlantic Ocean shoreline stopping 1.8 km (1.1 mi) west of the southern tip of Cumberland Island National Seashore. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–1: Big Lagoon. 8 ha (19 ac) in Escambia County. The majority of the unit is within Big Lagoon State Recreation Area. This unit includes the peninsula and emerging sand and mudflats between 0.33 km (0.21 mi) west of the lookout tower along the shoreline and 0.24 km (0.15 mi) east of the lookout tower along the shoreline. Land along the shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All emerging sandbars to MLLW are included.

Unit FL–2: Big Sabine. 182 ha (450 ac) in Escambia County. The majority of the unit is owned by the University of West Florida. This unit includes areas adjacent to Santa Rosa Sound of Big Sabine Point and adjacent embayment between 8.0 km (5.0 mi) and 11.6 (7.2 mi) east of the Bob Sike's Bridge. It begins 0.10 km (.06 mi) north of SR 399 to MLLW on the Santa Rosa Sound.

Unit FL–3: Navarre Beach. 48 ha (118 ac) in Escambia and Santa Rosa Counties. The majority of the unit is owned by Eglin Air Force Base and Santa Rosa Island Authority. This unit includes lands on Santa Rosa Island Sound side, between 0.09 and 0.76 mi east of the eastern end of SR 399 to MLLW on Santa Rosa Sound side.

Unit FL–5: Shell/Crooked Islands. 1789 ha (4419 ac) in Bay County.The majority of the unit is within Tyndall Air Force Base and St. Andrews State Recreation Area. This unit includes all of Shell Island, Crooked Island West, and Crooked Island East from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–6: Upper St. Joe Peninsula. 182 ha (449 ac) in Gulf County.The majority of the unit is within St. Joseph State Park. This unit includes the northern portion of the peninsula from the tip to 8.0 km (5.0 mi) south along the Gulf of Mexico from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–7: Cape San Blas. 158 ha (390 ac) in Gulf County.The entire unit is within Eglin Air Force Base. This unit includes the area known as the Cape between the eastern boundary of Eglin and mile marker 2.1, including the peninsula and all emerging sandbars. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–8: St. Vincent Island. 146 ha (361 ac) in Franklin County.The majority of the unit is within St. Vincent National Wildlife Refuge. This unit includes the western tip of St. Vincent Island that is adjacent to Indian Pass (0.80 km (0.50 mi) east of tip along Indian Pass, and 1.9 km (1.2 mi) from tip southeast along Gulf of Mexico). The unit also includes St. Vincent Point from the inlet at Sheepshead Bayou east 1.6 km (1.0 mi) to include emerging oysters shoals and sand bars and extends south 0.21 km (0.13 mi) of St. Vincent Point. The unit includes the southeastern tip of St. Vincent Island extending north 1.4 km (0.90 mi) and south and west 2.1 km (1.3 mi). The western tip of Little St. George Island 0.80 km (0.50 mi) from West Pass is included (state owned lands). All sections of this unit include land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–9: East St. George Island. 1433 ha (3540 ac) in Franklin County. The majority of the unit is within St. George State Park. This unit begins 5.3 km (3.3 mi) east of the bridge and extends to East Pass. Shell Point, Rattlesnake Cove, Goose Island, East Cove, Gap Point, and Marsh Island are included. This unit includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the Gulf of Mexico, East Pass and St. George Sound.

Unit FL–10: Yent Bayou. 153 ha (378 ac) in Franklin County. The majority of the unit is State owned. This unit is adjacent to the area known as Royal Bluff. It includes the St. George Sound shoreline between 5.9 km (3.7 mi) and 9.5 km (5.9mi) east of SR 65. It includes from MLLW to where densely vegetated habitat or developed structures such as SR 65, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–11: Carabelle Beach. 56 ha (139 ac) in Franklin County. The area within this unit is privately owned. This unit is the peninsula created by Boggy Jordan Bayou. It includes St. George Sound shoreline (south of US 98) 1.6 km (1.0 mi) southwest along US 98 from the Carrabelle River Bridge and extends 1.9 km (1.2 mi) east along the St. George Sound shoreline. It includes from MLLW to where densely vegetated habitat or developed structures such as US 98, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–12: Lanark Reef. 260 ha (643 ac) in Franklin County. The entire unit is State owned. This unit includes the entire island and emerging sandbars to MLLW.

Unit FL–13: Phipps Preserve. 42 ha (104 ac) in Franklin County. This unit includes all of Phipps Preserve (owned by The Nature Conservancy) and any emerging sandbars from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–14: Hagens Cove. 486 ha (1200 ac) in Taylor County. The majority of the unit is within Big Bend Wildlife Management Area. This unit includes all of Hagens Cove and extends from MLLW on north side of Sponge Point to MLLW on south side of Piney Point. The eastern boundary of this unit ends (0.20 mi) west of SR 361. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–15: Anclote Key and North Anclote Bar. 146 ha (360 ac) in Pasco and Pinellas Counties. The majority of the unit is within Anclote Key State Preserve. This unit includes all of North Anclote Bar to the MLLW and the north, south and western sides of Anclote Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–16: Three Rooker Bar Island. 76 ha (188 ac) in Pinellas County. The majority of the unit is within Pinellas County Aquatic Preserve. This unit includes all the islands and emerging sandbars of this complex to MLLW.

Unit FL–17: North Honeymoon Island. 45 ha (112 ac) in Pinellas County. The majority of the unit is within Honeymoon Island State Recreation Area. This unit includes from Pelican Cove north to the far northern tip of Honeymoon Island. It includes the western shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur or the MLLW on the eastern shoreline.

Unit FL–18: South Honeymoon Island. 28 ha (70 ac) in Pinellas County.The majority of the unit is private land. This unit includes the southern end (southern-most 0.32 km (0.20 mi) on western side) of Honeymoon Island and encompasses the far southeastern tip and includes any emerging islands or sandbars to Hurricane Pass. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–19: Caladesi Island. 120 ha (296 ac) in Pinellas County.The majority of the unit is within Caladesi Island State Park. This unit extends from Hurricane Pass to Dunedin Pass on the Gulf of Mexico side. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–20: Shell Key and Mullet Key. 190 ha (470 ac) in Pinellas County. The majority of the unit is within Fort Desoto Park. This unit includes the Shell Key island complex. It also includes the northwest portion of Mullet Key including the western shorelines from Bunces Pass extending south, stopping 1.4 km (.86 mi) north of Ft. Desoto County Park pier. It includes from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–21: Egmont Key. 153 ha (377 ac) Hillsborough County. The majority of the unit is within Egmont Key National Wildlife Refuge. This unit includes the entire island to MLLW.

Unit FL–22: Cayo Costa. 175 ha (432 ac) in Lee County. The majority of the unit, including its northern and southern boundaries, is within Cayo Costa State Park, and nearly all of the remaining area is in the Cayo Costa Florida Conservation and Recreation Lands (CARL) acquisition project. This unit begins at the northern limit of sandy beaches at the northern end of the island, extends through Murdock Point, which at present has a sandbar and lagoon system, and ends at the former entrance to Murdock Bayou. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–23: North Captiva Island. 36 ha (88 ac) in Lee County.The unit is within the Cayo Costa CARL land purchase project. This unit includes the western shoreline extending from 0.80 km (0.50 mi) south of Captiva Pass to approximately Foster Bay. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–25: Bunche Beach. 187 ha (461 ac) in Lee County. This unit is mostly within a CARL Estero Bay acquisition project. Bunche Beach (also spelled Bunch) lies along San Carlos Bay, on the mainland between Sanibel Island and Estero Island (Fort Myers Beach), extending east from the Sanibel Causeway past the end of John Morris Road to a canal serving a residential subdivision. The unit also includes the western tip of Estero Island (Bodwitch Point, also spelled Bowditch Point), including Bowditch Regional Park, operated by Lee County and, on the southwest side of the island facing the Gulf, the beach south nearly to the northwesterly intersection of Estero Boulevard and Carlos Circle. It includes land from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur or, along the developed portion of Estero Island.

Unit FL–26: Estero Island. 86 ha (211 ac) in Lee County. The majority of the unit is privately owned. The unit consists of approximately the southern third of the island's Gulf-facing shoreline starting near Avenida Pescadora to near Redfish Road. The unit excludes south-facing shoreline at the south end of the island that faces Big Carlos Pass rather than the Gulf. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–27: Marco Island. 245 ha (606 ac) in Collier County. Most of the unit is at the Tigertail Beach County Park. The unit's northern border is on the north side of Big Marco Pass, including Coconut Island and all emerging sand bars. On the south side of Big Marco Pass, the boundary starts at the north boundary of Tigertail Beach County Park and extends to just south of the fourth condominium tower south of the County Park. The placement of the southern boundary assures that the unit includes all of Sand Dollar Island, the changeable sandbar off Tigertail Beach. The western boundary includes all the sand bars in Big Marco Pass but excludes Hideaway Beach. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–28: Marquesas Keys. 2,937 ha (7,256 ac) in Monroe County. The unit comprises the roughly circular atoll that encloses Mooney Harbor, including Gull Keys and Mooney Harbor Key. The entire unit is within Key West National Wildlife Refuge. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–29: Boca Grande/Woman/ Ballast Keys. 56 ha (138 ac) in Monroe County. These Keys are east of the Marquesas Keys and west of Key West. Boca Grande and Woman Keys are within Key West National Wildlife Refuge. Ballast Key is privately owned. This unit consists only of sandy beaches and flats between the MLLW and to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–30: Bahia Honda/Ohio Keys. 372 ha (918 ac) in Monroe County. This unit comprises Bahia Honda Key (including a small island off its southwest shore), which is almost entirely owned by Bahia Honda State Park, plus Ohio Key, which is privately owned. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–31: Lower Matecumbe Key. 19 ha (48 ac) in Monroe County. Part of the unit is at Anne's Beach park, an Islamorada village park. The remaining parts are at Sunset Drive (Lower Matecumbe Beach) and at Costa Bravo Drive (Port Antiqua Homeowners Beach) on the Florida Bay side of the island. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–32: Sandy Key/Carl Ross Key. 67 ha (165 ac) in Monroe County. This unit consists of two adjoining islands in Florida Bay, roughly south of Flamingo in Everglades National Park. The entire area is owned and managed by the National Park Service. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–33: St. Lucie Inlet. 114 ha (282 ac) in Martin County. The unit includes a small area south of the jetty on the north shore of St. Lucie Inlet, from the jetty west 0.42 km (0.26 mi). While the two sides of the inlet are privately owned, the great majority of the unit is on public land in the Saint Lucie Inlet State Preserve, administered by Jonathan Dickinson State Park. It begins on the sandy shoreline south of Saint Lucie Inlet and extends along the Atlantic Ocean shoreline 2.6 km (1.6 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. The unit does not include sandbars within the inlet.

Unit FL–34: Ponce de Leon Inlet. 68 ha (168 ac) in Volusia County. The majority of the unit is within Smyrna Dunes Park and Lighthouse Point Park. This unit includes shoreline extending from the jetty north of Ponce de Leon Inlet west to the Halifax River and Inlet junction. It includes shoreline south of Ponce de Leon Inlet from the inlet and Halifax River junction, extending east and south along the Atlantic Ocean shoreline 1.2 km (.70 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–35: Nassau Sound-Huguenot. 950 ha (2347 ac) in Duval County. The majority of the unit is within Big Talbot Island State Park, Little Talbot Island State Park, and the Timucuan Ecological and Historical Preserve. This unit includes all emergent shoals and shoreline east of Nassau River bridge and extends to the inlet of the St. John’s River. Amelia Island and the northern 2.7 km (1.7 mi) shoreline along Talbot Island are not included. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–36: Tiger Islands. 53 ha (130 ac) in Nassau County. This unit is privately owned. This unit extends from the mouth of Tiger Creek and runs north along Tiger Island 0.8 km (0.5 mi) and south along Little Tiger Island 1.4 km (0.9 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. Emerging sandbars to MLLW are also included.

Unit AL–1: Isle Aux Herbes. 227 ha (561 ac) in Mobile County. This unit includes the entire Isle Aux Herbes island where primary constituent elements occur to MLLW and is State owned.

Unit AL–2: Dauphin, Little Dauphin, and Pelican Islands. 880 ha (2,174 ac) in Mobile County. This unit includes all of Dauphin Island where primary constituent elements occur from St. Stephens Street approximately 17.6 km (10.9 mi) west to the western tip of the island to MLLW and all of Little Dauphin and Pelican Islands to MLLW. The area is mostly privately owned but includes State and Federal lands.

Unit AL–3: Fort Morgan. 67 ha (166 ac) in Baldwin County. This area includes Mobile Bay and Gulf of Mexico shorelines within Bon Secour National Wildlife Refuge, Fort Morgan Unit. This unit extends from the west side of the pier on the northwest point of the peninsula, following the shoreline approximately 2.8 km (1.74 mi) southwest around the tip of the peninsula, then east to the terminus of the beach access road and is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The area is State-owned but is leased by the Federal Government.

Unit MS–1: Lakeshore through Bay St. Louis. 41 ha (101 ac) in Hancock County. This unit extends from the north side of Bryan Bayou outlet and includes the shore of the Mississippi Sound following the shoreline northeast approximately 15.0 km (9.3 mi) and ending at the southeast side of the Bay Waveland Yacht Club. The landward boundary of this unit follows the Gulf side of South and North Beach Boulevard and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–2: Henderson Point. 34 ha (84 ac) in Harrison County. This unit extends from 0.2 km (0.12 mi) west of the intersection of 3rd Avenue and Front Street and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Pass Christian Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–3: Pass Christian. 77 ha (190 ac) in Harrison County. This unit extends from the east side of Pass Christian Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 10.5 km (6.5 mi) to the west side of Long Beach Pier and Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–4: Long Beach. 38 ha (94 ac) in Harrison County. This unit extends from the east side of Long Beach Pier and Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Gulfport Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–5: Gulfport. 39 ha (96 ac) in Harrison County. This unit extends from the east side of Gulfport Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.8 km (3.0 mi) to the west side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–6: Mississippi City. 62 ha (153 ac) in Harrison County. This unit extends from the east side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS, and includes the shore of the Mississippi Sound following the shoreline northeast approximately 7.9 km (4.9 mi) to the west side of President Casino. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–10: Ocean Springs West. 11 ha (27 ac) in Jackson County. This unit extends from U.S. 90 and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.9 km (1.2 mi) to the Ocean Springs Harbor inlet. The landward boundary of this unit follows the Bay side of Front Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–11: Ocean Springs East. 7 ha (17 ac) in Jackson County. This unit extends from the east side of Weeks Bayou and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.8 km (1.1 mi) to Halstead Bayou. The landward boundary of this unit follows the Bay side of East Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is

privately owned.

Unit MS–12: Deer Island. 194 ha (479 ac) in Harrison County. This unit includes all of Deer Island, where primary constituent elements occur to the MLWW . Deer Island is privately owned.

Unit MS–13: Round Island. 27 ha (67 ac) in Jackson County. This unit includes all of Round Island to the MLWW and is privately owned.

Unit MS–14: Mississippi Barrier Islands. 3,168 ha (7,828 ac) in Harrison and Jackson Counties. This unit includes all of Cat, East and West Ship, Horn, Spoil, and Petit Bois Islands where primary constituent elements occur to MLLW. Cat Island is privately owned, and the remaining islands are part of the Gulf Islands National Seashore.

Unit MS–15: North and South Rigolets. 159 ha (393 ac) in Jackson County, MS, and 12 ha (30 ac) in Mobile County, AL. This unit extends from the southwestern tip of South Rigolets Island and includes the shore of Point Aux Chenes Bay, the Mississippi Sound, and Grand Bay following the shoreline east around the western tip, then north to the south side of South Rigolets Bayou; then from the north side of South Rigolets Bayou (the southeastern corner of North Rigolets Island) north to the northeastern most point of North Rigolets Island. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Approximately 4.4 km (2.7 mi) are in Mississippi and 2.9 km (1.8 mi) are in Alabama. Almost half the Mississippi shoreline length is in the Grand Bay National Wildlife Refuge.

Unit LA–1: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron and Vermilion Parishes. This unit extends from the east side of Sabine Pass (Texas/Louisiana border) and includes the shore of the Gulf of Mexico from the MLLW following the shoreline east 25.7 km (16.0 mi) to the west end of Constance Beach [approximately 2 km (1.2 mi) east of the intersection of Parish Road 528 and the beach]; it extends from the east end of the town of Holly Beach [0.25 km (0.16 mi) east of the intersection of Baritarick Boulevard and the beach] following the shoreline approximately 97 km (60.3 mi) east to the eastern boundary line of Rockefeller Wildlife Refuge [3.4 km (2.1 mi) east of Rollover Bayou]; and it extends from the east side of Freshwater Bayou Canal following the shoreline east for approximately 15 km (9.3 mi) to 1.3 km (0.81 mi) east of where the boundary of Paul J. Rainey Wildlife Sanctuary (National Audubon Society) meets the shoreline. All three sections of this unit include the land from the seaward boundary of MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The shoreline in this unit is both state and privately owned.

Unit LA–2: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA. This unit is located in the eastern portion of the State-owned Atchafalaya Delta Wildlife Management Area (WMA) and includes all exposed land and islands where primary constituent elements occur east and southeast of the main navigation channel of the Atchafalaya River to the MLLW. The islands located south and southeast of the deltaic splay, Donna, T-Pat, and Skimmer Islands and the un-named bird island, are also included in this unit. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–3: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish. This unit includes the entire small island at the northwest tip of Point Au Fer Island to MLLW, then extends from the northwest tip of Point Au Fer Island following the shoreline southeast approximately 7.7 km (4.8 mi) to the point where the un-named oil and gas canal extending southeast from Locust Bayou meets the shoreline [0.8 km (0.5 mi) southeast from Locust Bayou]. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This entire unit is privately owned.

Unit LA–4: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish. This unit includes the State-owned Isles Dernieres chain, including Raccoon, Whiskey, Trinity and East Islands. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–5: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. This unit includes: all of Timbalier Island where primary constituent elements occur to the MLLW, all of Belle Pass West [the ‘‘peninsula’’ extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Unit LA–6: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA. This unit is part of the State-owned Pass a Loutre Wildlife Management Area and includes un-named sand (spoil) islands off South Pass of the Mississippi River near Port Eads. The entire islands to MLLW are included in this unit.

Unit LA–7: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA. This unit includes Breton, Grand Gosier, and Curlew Islands and the Chandeleur Island chain. Those islands are part of the Breton National Wildlife Refuge or are state owned. The entire islands where primary constituent elements occur to MLLW are included in this unit.

Unit TX–1: South Bay and Boca Chica. 2,920 ha (7,217 ac) in Cameron County. The boundaries of the unit are: starting at the Loma Ochoa, following the Brownsville Ship Channel to the northeast out into the Gulf of Mexico to MLLW, then south along a line describing MLLW to the mouth of the Rio Grande, proceeding up the Rio Grande to Loma de Las Vacas, then from that point along a straight line north to Loma Ochoa. The unit does not include densely vegetated habitat within those boundaries. It includes wind tidal flats that are infrequently inundated by seasonal winds, and includes the tidal flats area known as South Bay. Beaches within the unit reach from the mouth of the Rio Grande northward to Brazos Santiago Pass, south of South Padre Island. The southern and western boundaries follow the change in habitat from wind tidal flat, preferred by the piping plover, to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include areas used for roosting by the piping plover. Portions of this unit are owned and managed by the Lower Rio Grande Valley National Wildlife Refuge, the South Bay Coastal Preserve, Boca Chica State Park, and private citizens.

Unit TX–2: Queen Isabella Causeway. 2 ha (6 ac) in Cameron County. The area extends along the Laguna Madre west of the city of South Padre Island. The southern boundary is the Queen Isabella State Fishing Pier, and the northern boundary is at the shoreline due west of the end of Sunny Isles Street. The Queen Isabella causeway bisects this shore but is not included within critical habitat. The eastern boundary is the where developed areas and/or dense vegetation begins, and the western boundary is MLLW. This unit contains lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–5: Upper Laguna Madre. 436 ha (1,076 ac) in Kleberg County. The southern boundary is the northern boundary of PAIS, and the northern boundary is the Kleberg/Nueces County line. The eastern boundary is the line where dense vegetation begins, and the western boundary is MLLW. This unit includes a series of small flats along the bayside of Padre Island in the Upper Laguna Madre. It includes wind tidal flats and sparsely-vegtated upland areas used for roosting by the piping plover. These boundaries receive heavy use by large numbers of shorebirds, including piping plovers. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, and include upland areas used for roosting by the piping plover.

Unit TX–6: Mollie Beattie Coastal Habitat. 241 ha (596 ac) in Nueces County. This unit will be described as two subunits: (1) Subunit is bounded on the north by Beach Access Road 3, on the east by the inland boundary of critical habitat Unit TX–7, on the south by Zahn road, and on the west by Zahn Road. (2) The subunit is bounded on the north by Corpus Christi Pass, on the east by US 361, on the south by the north side of Packery Channel, and on the west by the Gulf Intercoastal Watersay. Some of the uplands are privately owned and the remaining are owned and managed by the TGLO. This unit includes two hurricane washover passes known as Newport and Corpus Christi Passes, and wind tidal flats that are infrequently inundated by seasonal winds. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover.

Unit TX–11: Blind Oso. 2 ha (5 ac) in Nueces County. This unit is the flats of the Blind Oso, part of Oso Bay, from Hans and Pat Suter Wildlife Refuge (owned and managed by the City of Corpus Christi) northeast to Corpus Christi Bay and then southeast along the edge of Texas A&M University—Corpus Christi. The landward boundaries extend to where densely vegetated habitat, not used by the piping plover, begins, and extends out from the landward boundaries to MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–12: Adjacent to Naval Air Station-Corpus Christi. 2 ha (6 ac) in Nueces County. This unit is along the shore of Oso Bay on flats bordered by Naval Air Station-Corpus Christi and Texas Spur 3 to a point 2.5 km (1.5 mi) south of the bridge between Ward Island and the Naval Air Station. The landward boundary is the line where dense vegetation begins, and the boundary in the Bay is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–13: Sunset Lake. 176 ha (435 ac) in San Patricio County. This unit is triangle shaped, with State Highway 181 as the northwest boundary, and the limits of the City of Portland as the northeast boundary. The shore on Corpus Christi Bay is the third side of the triangle, with the actual boundary being MLLW off this shore. This unit is a large basin with a series of tidal ponds, sand spits and wind tidal flats. This unit is owned and managed by the City of Portland within a system of city parks. Some of the described area falls within the jurisdiction of the TGLO. It includes two city park units referred to as Indian Point and Sunset Lake. Much of the unit is a recent acquisition by the city, and management considerations for the park include the area’s importance as a site for wintering and resident shorebirds. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–17: Allyn’s Bight. 5 ha (14 ac) in Aransas County. This unit includes shoreline of San Jose Island on Aransas Bay from Allyn’s Bight to Blind Pass, the channel between San Jose Island and Mud Island. The inland boundary is where the line of dense vegetation begins, and the bay-ward boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–20: Ayers Point. 397 ha (982 ac) in Calhoun County. This unit is an unnamed lake on Matagorda Island between Shell Reef Bayou and Big Brundrett Lake, with San Antonio Bay to the north. The unit boundary extends landward from the lake to the line where dense vegetation begins and where the constituent elements no longer occur and includes upland areas used for roosting by the piping plover. This unit includes marsh and flats at Ayers Point on Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–21: Panther Point to Pringle Lake. 863 ha (2,133 ac) in Calhoun County. This unit represents a narrow band of bayside habitats on Matagorda Island from Panther Point to the northeast end of Pringle Lake. The landward boundary is the line indicating where dense vegetation begins, and the bayward boundary is MLLW. The unit is entirely within Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–24: West Matagorda Bay/ Western Peninsula Flats. 756 ha (1,868 ac) in Matagorda County. This unit extends along the bayside of Matagorda Peninsula from 7.5 southwest of Greens Bayou to 2.5 km (1.6 mi) northwest of Greens Bayou. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–25: West Matagorda Bay/ Eastern Peninsula Flats. 232 ha (575 ac) in Matagorda County. This unit follows the bayside of Matagorda Peninsula from Maverick Slough southwest for 5 km (3 mi). The unit begins at Maverick Slough to the northeast and extends 5 km (3 mi) to the southwest, enclosing a series of flats along Matagorda Bay. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–26: Colorado River Diversion Delta. 5 ha (13 ac) in Matagorda County. This unit consists follows the shore of the extreme eastern northeast corner of West Matagorda Bay from Culver Cut to Dog Island Reef. The southeastern tidally emergent portion of Dog Island Reef is included within the unit. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The upland areas includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–29: Brown Cedar Cut. 119 ha (294 ac) in Matagorda County. This unit extends 2 km (1.2 m.) both southwest and northeast of the main channel of Brown Cedar Cut along the bayside of Matagorda Peninsula in East Matagorda Bay, and abuts unit TX–28 to the southeast. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The eastern boundary of TX–29 follows the change in habitat from mud flats preferred by the piping plover, to slightly vegetated dune system adjacent to TX–28. This unit includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–30: Northeast Corner East Matagorda Bay. 120 ha (297 ac) in Matagorda County. This is a unit bounded on the north by the Gulf Intercoastal Waterway, on the east by the northeast limit of Matagorda bay up the line where dense vegetation begins, on the south by the boundary of Unit TX–28, and on the west by MLLW. It is a system of flats associated with tidal channels. This unit includes upland areas used for roosting by the piping plover and lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–34: San Luis Pass. 110 ha (272 ac) near the Brazoria/Galveston County line. This unit extends along the Gulf side of Galveston Island from San Luis Pass to the cite of the former town of Red Fish Cove (USGS 1:24,000 map, San Luis Pass, Texas; 1963, photorevision 1974). The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. Approximately 57 percent of the unit includes flats in the floodtide delta that are State-owned and managed by the TGLO. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–35: Big Reef. 47 ha (117 ac) in Galveston County. This unit consists of beach and sand flats on the north, west, and east shore of Big Reef, down to MLLW. South Jetty is not included. The area is currently managed by the City of Galveston. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–36: Bolivar Flats. 160 ha (395 ac) in Galveston County. This unit extends from the jetties on the southwest end of the Bolivar Peninsula to a point on the Gulf beach 1 km (0.6 mi) north of Beacon Bayou. It includes 5.0 km (3 mi) of Gulf shoreline. The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. The area is leased from TGLO by Houston Audubon Society and managed for its important avian resources. The upland areas are used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–37: Rollover Pass. 6 ha (16 ac) in Galveston County. This unit consists of Rollover Bay on the bayside of Bolivar Peninsula. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. It includes flats on State-owned land managed by the TGLO. This unit captures the intertidal complex of the bay, and is bounded by the towns of Gilchrist to the east and the Gulf beach of the Bolivar Peninsula to the south. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Primary Constituent Elements/Physical or Biological Features

Wintering piping plover's PCEs are the habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are:

(1) Intertidal sand beaches (including sand flats) or mud flats (between the MLLW and annual high tide) with no, or very sparse, emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.

(2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather.

(3) Surf-cast algae for feeding.

(4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.

(5) Spits, especially sand, running into water used for foraging and roosting.

(6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water.

(7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.

(8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites).

See above.
See above.

Special Management Considerations or Protections

Examples of actions that have effects on wintering piping plover habitats include, but are not limited to: (1) Disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; (2) Predation, especially by falcons, hawks, coyotes, bobcats and feral cats; (3) Beach maintenance (e.g., nourishment (adding sand) and cleaning) and stabilization efforts (e.g., construction of jetties and other hard structures). (4) Oil and other hazardous materials spills and cleanup; (5) Discharge of freshwater from oil and gas activities; (6) Construction of dwellings, roads, marinas, and other structures, and associated activities including staging of materials and equipment; and/or (7) Dredging and dredge spoil placement, and associated activities including staging of equipment and materials. As described in more detail in the unit descriptions, the PCEs within each unit may require special management considerations or protection due to threats to the wintering population of the piping plover or its habitat.

Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on the effective date of the rule.

See above.

Life History

Feeding Narrative

<u>Adult:</u> Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. In northwest Florida, however, Smith (2007) reported landform use by foraging piping plovers about equally divided between Gulf (ocean-facing) and bay beaches. Exposed intertidal areas were the dominant foraging substrate in South Carolina (accounting for 94% of observed foraging piping plovers; Maddock et al. 2009) and in northwest Florida (96% of foraging observations; Smith 2007). In southwest Florida, Lott et al. (2009) found approximately 75% of foraging piping plovers on intertidal substrates. Majka and Shaffer (2008) found a preponderance of prey species in the 3.2-5.0 mm size range in fecal samples of piping plovers breeding in Quebec. They also noted high prevalence of one beetle species, Bledius opaculus, which feeds on algae from sand- and mud-flats (USFWS, 2009). Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks (Zonick and Ryan 1996, p. 26), which they peck from on top or just beneath the surface of moist or wet sand, mud, or fine shell (USFWS, 2009b). Feeding activities of both adults and chicks may occur during all hours of the day and night (Burger 1994) and at all stages in the tidal cycle (Goldin 1993b, Hoopes 1993). Territorial and agonistic interactions have been observed with other piping plovers and similar-sized plover species -- semipalmated and snowy plovers (Johnson and Baldassarre 1988, Zonick and Ryan 1993) (USFWS, 1996).

Reproduction Narrative

<u>Adult:</u> Overall productivity for the Atlantic Coast population 1989-2006 was 1.35 chicks fledged per pair (annual range = 1.16-1.54) (USFWS, 2009). Piping plovers nest above the high tide line on coastal beaches, sandllats atthe ends ofsandspits and barrier islands, gently slopingforedunes, blowout areas behind primary dunes, sparsely vegetated dunes, and washover areas cutinto or between dunes. Nests are usually found in areaswith little or no vegetation although, on occasion, piping plovers willnest under stands of American beachgrass (Ammophila breviligulata) or other vegetation (Patterson 1988, Flemming et at. 1990, Maclvor 1990). Piping plovers have been observed as early as February 24 in Virginia (Cross 1991), March 11 in New York (Goldin 1990), March 15 in Massachusetts (Maclvor 1990), and March 28 in Nova Scotia (Mills 1976, cited in Cairns 1977). By early April, males begin to establish territories (Patterson 1988, Maclvor 1990, Cross 1991), which they defend aggressivelyagainst adjacent males by performing “horizontal threat,” ~parallelrun,” and aerial displays, characterized by Caims (1982). Piping plovers are monogamous, but usually shiftmates between years (Wilcox

1959, Haig and Oring 1988c,Maclvor 1990) and, less frequently,between nesting attempts in a given year(Haig and Oring 1 988c, Macivor 1990, Strauss 1990). Plovers are known to breed atone year of age (Maclvor 1990, Strauss 1990, Haig 1992), but the rate at which this occurs is unknown. Eggs may be present on the beach from mid-April to late July. Clutch initiation dates have been recorded as early as April21 in Virginia (Cross 1991), April 15 in New York (C. Brittingham, TheNature Conservancy, pers. comm. 1994), April 20 in Massachusetts (Maclvor 1990), and April 24 in Nova Scotia (Cairns 1977). Nest initiation appears to be slightly later in Quebec, Prince Edward Island, and on the eastern shoreofNew Brunswick,with a peak ofnest initiation in mid-Mayto early June (Morse 1982, Tull 1984, Shaffer and Laporte 1992). Although nests may be initiated as late asJuly 25, fewnests hatch afterJuly 15, and the latest recorded hatch date isJuly 31 in Massachusetts (Maclvor 1990). Piping plovers generally fledge only a single brood perseason, but may renest several times if previous nests are lost or, infrequently, if a brood is lost within several days ofhatching (Wrenn 1991, Goldin I 994a, Rimmer 1994). Clutch size for an initial nest attempt is usually four eggs, one laid every other day. Full-time incubation usually begins with the completion ofthe clutch, averages 27-30 days, and is shared equally by both sexes(Wilcox 1959, Caims 1977, Maclvor 1990). Chicks remain together with one or both parents until they fledge (are able to fly) at 25 to 35 days of age (USFWS, 1996).

Spatial Arrangements of the Population

Adult: Sparsely distributed (USFWS, 2009); winters in small groups or multi-species flocks (USFWS, 1996)

Site Fidelity

Adult: High (USFWS, 2009)

Habitat Narrative

Adult: New information confirms inter- and intra-annual fidelity of piping plovers to migration and wintering sites as described in the 1996 Atlantic Coast recovery plan. Nonbreeding piping plovers in North Carolina primarily used sound (bay or bayshore) beaches and sound islands for foraging and ocean beaches for roosting, preening, and being alert (Cohen et al. 2008). Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Atlantic Coast and Florida studies highlighted the importance of inlets for nonbreeding piping plovers. Almost 90% of observations of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers are sparsely distributed across their Atlantic Coast breeding range. A growing body of evidence reinforces information presented in the 1996 revised recovery plan regarding the importance of wide, flat, sparsely-vegetated barrier beach habitats for recovery of Atlantic Coast piping plovers. Such habitats include abundant moist sediments associated with blowouts, washover areas, spits, unstabilized and recently closed inlets, ephemeral pools,and sparsely vegetated dunes (USFWS, 2009). The habitats used by wintering birds include beaches, mud flats (nearly flat areas made up of mud), sand flats (nearly flat areas made up of sand), algal flats (nearly flat areas with a layer of algae growing on a moist mud or sand substrate), and washover passes (areas where breaks in the sand dunes result in an inlet). Wintering plovers are dependent on a mosaic of habitat patches, and move among these patches, depending on local weather and tidal conditions (Drake et al. 2001, pp. 262– 263) (USFWS, 2009b). Plovers wintering on the Atlantic Coast are generally distributed in small groups; six was the average number of piping plovers per site during Nicholls' 1986-87 survey (Nicholls 1989). Piping plovers also appear to roost in multi-species flocks (Nicholls and Baldassarre 1990b, Zonick and Ryan 1993), but are often found in a tight cluster on the fringes of a flock (J. Nicholls, U.S. Fish and Wildlife Service, pers. obs.) (USFWS, 1996).

Dispersal/Migration

Motility/Mobility

Adult: High (USFWS, 2009)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory (USFWS, 2009)

Dispersal

Adult: High (USFWS, 2009)

Dispersal/Migration Narrative

Adult: In general, distance between stopover locations and duration of stopovers throughout the coastal migration range remain poorly understood. Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean (USFWS, 2009). Northward migration to the breeding grounds occurs during late February, March and early April, and southward migration to the wintering grounds extends from late July, August, and September. Both spring and fall migration routes are believed to follow a narrow strip along the Atlantic Coast (USFWS, 1996).

Additional Life History Information

Adult: Migrates to breeding grounds February - April; migrates to wintering grounds July - September (USFWS, 1996)

Population Information and Trends

Population Trends:

Increasing (USFWS, 2009)

Number of Populations:

4 (inferred from USFWS, 2009)

Population Size:

~1,849 pairs (USFWS, 2009). As of the last census taken in 2011, a preliminary total of 2858 piping plovers were counted during mid-winter counts in VA, NC, SC, GA, FL, AL, MS, LA, TX and Puerto Rico combined. (Table 1, USFWS 2015). 2,593 breeding pairs in 2023 (USFWS, 2025)

Minimum Viable Population Size:

2,000 breeding pairs (See delisting citerion 1)

Resistance to Disease:

High (see threats)

Additional Population-level Information:

Populations are sensitive to individual survival (USFWS, 2009)

Population Narrative:

The most consistent finding in the various population viability analyses (PVAs) conducted for piping plovers (Ryan et al. 1993, Melvin and Gibbs 1996, Plissner and Haig 2000, Wemmer et al. 2001, Larson et al. 2002, Calvert et al. 2006, Brault 2007) is the sensitivity of extinction risk to even small declines in adult and/or juvenile survival rates. Progress towards recovery, attained primarily through intensive protections to increase productivity on the breeding grounds, would be quickly slowed or reversed by even small sustained decreases in survival rates during migration and wintering. The New England recovery unit population has exceeded (or been within three pairs of) its 625-pair abundance goal since 1998, attaining a post-listing high of 711 pairs in 2008. The New York-New Jersey recovery unit reached 586 pairs in 2007, surpassing its 575-pair goal for the first time; in 2008, however, abundance dipped to 554 pairs. The Southern recovery unit, which attained 333 pairs in 2007 and 331 pairs in 2008, has not yet reached its 400-pair goal. Southern recovery unit population growth between 2003 and 2007 is encouraging. The Eastern Canada recovery unit has experienced the lowest population growth (9% net increase between 1989 and 2008), despite higher overall productivity than in the U.S. (see discussion under criterion 3, below). The highest post-listing abundance estimate was 274 pairs in 2002, and the 2008 estimate was 253 pairs, placing this recovery unit furthest from its goal (400 pairs). Average microsatellite heterozygosity and mitochondrial control region nucleotide diversity of Atlantic Coast piping plovers and lack of evidence of recent genetic bottlenecks indicate that current genetic risks are low (Miller et al. 2009). Since its 1986 listing, the Atlantic Coast piping plover population estimate has increased 234%, from approximately 790 pairs to an estimated 1,849 pairs in 2008, and the U.S. portion of the population has almost tripled, from approximately 550 pairs to an estimated 1,596 pairs (USFWS, 2009). Since 2018 (the last estimate that was available for the 2020 5-year review), the total Atlantic Coast piping plover population estimate increased 38 percent, from 1,87813 pairs to 2,593 pairs in 2023. However, overall population growth was tempered by pronounced geographic variability with 68 percent growth in the New England recovery unit between 2018 and 2023, 30 percent in New York-New Jersey, and 4 percent in Eastern Canada. Breeding abundance in the Southern recovery unit decreased 21 percent between 2018 and 2023, (USFWS, 2025)

Threats and Stressors

Stressor: Shoreline development/construction (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The 1985 final rule stated that the number of piping plovers on the Gulf of Mexico coastal wintering grounds may be declining as indicated by preliminary analysis of Christmas Bird Count data. Independent counts of piping plovers on the Alabama coast indicated a decline in numbers between the 1950s and early 1980s. At the time of listing the Texas Parks and Wildlife Department stated that 30% of wintering habitat in Texas had been lost over the previous 20 years. The final rule also stated that in addition to extensive breeding area problems, the loss and modification of wintering habitat was a significant threat to the piping plover. The three recovery plans stated that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The plans further stated that beach maintenance and nourishment, inlet dredging, and artificial structures, such as jetties and groins, can eliminate

wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. Structural development along the shoreline or manipulation of natural inlets upsets the dynamic processes and results in habitat loss or degradation (Melvin et al. 1991). Throughout the range of migrating and wintering piping plovers, inlet and shoreline stabilization, inlet dredging, beach maintenance and nourishment activities, and seawall installations continue to constrain natural coastal processes. Dredging of inlets can affect spit formation adjacent to inlets and directly remove or affect ebb and flood tidal shoal formation. Jetties, which stabilize an island, cause island widening and subsequent growth of vegetation on inlet shores. Seawalls restrict natural island movement and exacerbate erosion. Construction of these projects during months when piping plovers are present also causes disturbance that disrupts the birds' foraging efficiency and hinders their ability to build fat reserves over the winter and in preparation for migration, as well as their recuperation from migratory flights. Continual degradation and loss of habitats used by wintering and migrating shorebirds may cause an increase in intra-specific and interspecific competition for remaining food supplies and roosting habitats (USFWS, 2009). As of 2015, In summary, approximately 40 percent of the sandy beach shoreline in the migration and wintering range is already developed, while 43 percent is largely preserved. This means, however, that the remaining 17 percent of shoreline habitat (that which is currently undeveloped but not preserved) is susceptible to future loss to development and the attendant threats from shoreline stabilization activities. The entire coastline is susceptible to sea level rise. As of 2015, forty-four percent of the tidal inlets within the U.S. wintering range of the piping plover have been or continue to be dredged, primarily for navigational purposes (Table 3). States where more than two-thirds of inlets have been dredged include Alabama (three of four), Mississippi (four of six), North Carolina (16 of 20), and Texas (13 of 18), and 16 of 21 along the Florida Atlantic coast. Dredging can occur on an annual basis or every two to three years, resulting in continual perturbations and modifications to inlet and adjacent shoreline habitat. The volumes of sediment removed can be major, with 2.2 million cubic yards (mcy) (1.7 million cubic meters (mcm)) of sediment removed on average every 1.9 years from the Galveston Bay Entrance (Texas) and 3.6 mcy (2.8 mcm) of sediment removed from Sabine Pass (Texas) on average every 1.4 years (USACE 1992). Rice (2012a) found that the ebb shoal complexes of at least 20 inlets within the wintering range of the piping plover have been mined for beach fill. the removal of sediment from inlet complexes via dredging and sand mining for beach fill has modified nearly half of the tidal inlets within the continental wintering range of the piping plover, leading to habitat loss and degradation. Many of these inlet habitat modifications have become permanent, existing for over 100 years. The expansion of several harbors and ports to accommodate deeper draft ships poses an increasing threat as more sediment is removed from the inlet system, causing larger perturbations and longer recovery times; maintenance dredging conducted annually or every few years may prevent full recovery of the inlet system. Rice found that, as of 2011, an estimated 54 percent of 221 mainland or barrier island tidal inlets in the U.S continental wintering range of the piping plover had been modified by some form of hardened structure, dredging, relocation, mining, or artificial opening or closure (Table 3). On the Atlantic Coast, 43 percent of the inlets have been stabilized with hard structures, whereas 37 percent were stabilized on the Gulf Coast. The Atlantic coast of Florida has 17 stabilized inlets adjacent to each other, extending between the St. John's River in Duval County and Norris Cut in Miami-Dade County, a distance of 341 miles. A shorebird would have to fly nearly 344 miles to find the next unstabilized inlet along this stretch of coast. Although less permanent than construction of hard structures, the effects of inlet relocation can persist for years. For example, December-January surveys documented a continuing decline in wintering plover numbers from 20 birds pre-project (2005-2006) to three birds during the 2009 - 2011 seasons (SCDNR 2011). Subsequent decline in the wintering population on Kiawah is strongly correlated with the decline in polychaete worm densities, suggesting that plovers emigrated to other sites as foraging opportunities in these habitats became less profitable (SCDNR 2011). At least eight inlets in the migration and wintering range have been relocated; a new inlet was cut and the old inlet was closed with fill. In other cases, inlets have been relocated without the old channels being artificially filled The artificial opening and closing of inlets typically creates very different habitats from those found at inlets that open or close naturally (Rice 2012a). Rice (2012a) found that 30 inlets have been artificially created within the migration and wintering range of the piping plover, including 10 of the 21 inlets along the eastern Florida coast (Table 3). These artificially created inlets tend to need hard structures to remain open or stable, with 20 of the 30 (67 percent) of them having hard structures at present. An even higher number of inlets (64) have been artificially closed, the majority in Louisiana (Table 3). One inlet in Texas was closed as part of the Ixtoc oil spill response efforts in 1979. Thirty-two inlets were closed as part of Deepwater Horizon oil spill response efforts in 2010-2011. Of the latter, 29 were in Louisiana, two in Alabama and one in Florida. To date only one of these inlets, West (Little Lagoon) Pass in Gulf Shores, Alabama, has been reopened, and the rest remain closed with no plans to reopen any of those identified by Rice (2012a). Three groins were built in South Carolina between 2006 and 2013, bringing the statewide total to 165 oceanfront groins (SC DHEC 2010; USFWS 2013). Eleven new groins were built in Florida between 2000 and 2009. The Texas coast is armored with nearly 37 miles of seawalls, bulkheads and revetments, the mainland Mississippi coast has over 45 miles of armoring, the Florida Atlantic coast has at least 58 miles, and the Florida Gulf coast over 59 miles (Rice 2012b). Shoreline armoring has modified plover beachfront habitat in all states, but Alabama (4.7 miles), Georgia (10.5 miles) and Louisiana (15.9 miles) have the fewest miles of armored beaches. Lott (2009) found a strong negative correlation between ocean shoreline sand placement projects and the presence of piping and snowy plovers in the Panhandle and southwest Gulf Coast regions of Florida11. (11 Lott (2009) noted that sand placement projects may directly degrade plover habitat, but they may also correlate with high human density, where disturbance is higher.) The beaches along the mainland coast of Mississippi are the most modified by sand placement activities with at least 85 percent affected (Table 4). Of the oceanfront beaches, the Atlantic coast of Florida has had the highest proportion (at least 51 percent) of beaches modified by sand placement activities. Approximately 47 percent of Florida's sandy beach coastline has received sand placement of some type, with many areas receiving fill multiple times from dredge disposal, emergency berms, beach nourishment, dune restoration and other modifications (Rice 2012b). (USFWS, 2015). The quality and quantity of the macroinvertebrate prey base is threatened by shoreline stabilization activities, including the approximately 685 miles of beaches that have received sand placement of various types. The addition of dredged sediment can temporarily affect the benthic fauna of intertidal systems. Invertebrates may be crushed or buried during project construction. Although some benthic species can burrow through a thin layer of additional sediment (38-89 cm for different species), thicker layers (i.e., >1 meter) are likely to smother these sensitive benthic organisms (Greene 2002). Numerous studies of such effects indicate that the recovery of benthic fauna after beach nourishment or sediment placement projects can take anywhere from six months to two years, and possibly longer in extreme cases (Thrush et al. 1996; Peterson et al. 2000; Zajac and Whitlatch 2003; Bishop et al. 2006; Peterson et al. 2006). (USFWS, 2015).

Stressor: Invasive plants (USFWS, 2009)
Exposure:
Response:

Consequence:
Narrative: Like most invasive species, coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. If left uncontrolled, invasive plants cause a habitat shift from open or sparsely vegetated sand to dense vegetation, resulting in the loss or degradation of piping plover roosting habitat, which is especially important during high tides and migration periods. Beach vitex (Vitex rotundifolia) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). Unquantified amounts of crowfootgrass (Dactyloctenium aegyptium) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (Casuarina equisetifolia) changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas (USFWS, 2009).

Stressor: Wrack removal and beach cleaning (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999, Smith 2007, Maddock et al. 2009, Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Neal et al. 2007). Currently, the Florida Department of Environmental Protection's Beaches and Coastal Management Systems section has issued 117 permits for beach raking or cleaning to multiple entities. The Service estimates that 240 of 825 miles (29%) of sandy beach shoreline in Florida are cleaned or raked on various schedules, i.e., daily, weekly, monthly (L. Teich, Florida DEP, pers. comm. 2009). USFWS biologists estimate that South Carolina mechanically cleans approximately 34 of its 187 shoreline miles (18%), and Texas mechanically cleans approximately 20 of its 367 shoreline miles (5.4%). The Service is not aware of what percentage of mechanical cleaning occurs in piping plover critical habitat (USFWS, 2009).

Stressor: Disease (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The Department of the Interior has tested 14,261 shorebirds in the families of Charadriidae and Scolopacidae since 2006. Bird species testing positive for low pathogenic avian influenza consist of Pacific golden-plover (1), bar-tailed godwit (3), dunlin (8), marsh sandpiper (1), red knot (1), sanderling (1), sharp-tailed sandpiper (1), and western sandpiper (1) (Acker, pers. comm. 2009). Other laboratories have ongoing shorebird testing, but results were not

available for this review. Although researchers increased vigilance following detection of several cases of West Nile virus in breeding Northern Great Plains piping plovers and Type E botulism in the Great Lakes breeding population, the USFWS is not aware of instances of disease in nonbreeding piping plovers. Based on information available to date, the Service concludes that West Nile virus and avian influenza remain a minor threat to shorebirds, including the piping plover, on their wintering and migration grounds (USFWS, 2009).

Stressor: Predation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The impact of predation on migrating or wintering piping plovers remains largely undocumented. Avian and mammalian predators are common throughout the species' wintering range. Predatory birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). The 1996 Atlantic Coast recovery plan summarized evidence that human activities affect types, numbers, and activity patterns of some predators, thereby exacerbating natural predation on breeding piping plovers. Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. Recent research and reports indicate that predation poses a continuing (and perhaps intensifying threat) to Atlantic Coast piping plovers. Review of egg losses from natural and artificial nests at Breezy Point, New York, found that gulls, crows, and rats were major predators (Lauro and Tanacredi 2002). Free-roaming domestic and feral cats, particularly those associated with humansubsidized feral cat colonies, appear to be an increasing threat to piping plovers. Predation is a pervasive, persistent, and serious threat to breeding Atlantic Coast piping plovers (USFWS, 2009).

Stressor: Inadequacy of existing regulatory mechanisms (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Most state laws focus on direct protection of the birds but not their habitat. Protections for piping plovers migrating and wintering outside the U.S. include the 2005 designation of 1.5 million acres of the Laguna Madre de Tamaulipas region in Mexico as a Federal Natural Protected Area. Any land-use alterations to piping plover habitats within this area are now subject to review under a federal permitting process that encourages avoidance and minimization of impacts; however, it does not preclude alterations. This is similar to the ESA in allowing some adverse effects to designated critical habitat. Enforcement limitations and/or legal insufficiency of regulations to protect important habitat components result in continued degradation of a significant amount of wintering piping plover coastal habitat, including designated critical habitat units, resulting in a cumulative loss of habitat. At the current time, if the protections of the ESA were removed, existing local, state, and other federal regulatory provisions would provide insufficient protection to nonbreeding piping plover habitats used during migration and winter. Enhanced coordination of project review throughout the migration and wintering range could help to streamline consultations and possibly facilitate further reductions in project impacts to the piping plover and its habitat; however, nonbreeding habitat

degradation continues despite ESA protections. Other threats, such as human disturbance, are currently being managed but not eliminated. Lack of reliable funding to maintain annual implementation of intensive management programs constitutes a serious continuing threat to Atlantic Coast piping plovers (USFWS, 2009).

Stressor: Recreational disturbance (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Disturbance, i.e., human and pet presence that alters bird behavior, disrupts piping plovers as well as other shorebird species. Disturbance can cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995, Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000). Off-road vehicles can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast recovery plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993, Goldin 1993). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance would otherwise be very slight. Godfrey et al. (1980 as cited in Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of off-road vehicles negatively correlated with abundance of roosting piping plovers on the ocean beach. Emerging threats include the increasing popularity of "extreme sports," such as kitebuggies and surf kites (also called "kite boards"), which accidentally land in and near breeding habitat. Disturbance by humans and dogs is a continuing widespread and severe threat to Atlantic Coast piping plovers (USFWS, 2009).

Stressor: Military actions (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: To date, five bases have consulted with the USFWS under section 7 of the ESA, on military activities on beaches and baysides that may affect piping plovers or their habitat. Camp Lejeune in North Carolina consulted formally with USFWS in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with USFWS on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt occasional use of motorized equipment on the beaches and associated

baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts twice-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to minimize direct disturbance from troop activities. A 2001 consultation with the Navy for training exercises on the beach and retraction operations on Peveto Beach, Cameron Parish, Louisiana, concluded informally. Overall, project avoidance and minimization actions currently reduce threats from military activities to wintering and migrating piping plovers to a minimal threat level (USFWS, 2009).

Stressor: Contaminants and pesticides (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The various piping plover recovery plans identify contaminants, particularly oil spills, as a threat. Contaminants have the potential to cause direct toxicity to individual birds or negatively impact their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985, Gilbertson et al. 1991, Hoffman et al. 1996). Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (C. Lee, USFWS, pers. comm. 2009). The extent to which contaminant levels in piping plovers can be attributed to wintering and migratory stopover sites is unknown. Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; USFWS 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; A. Amos, University of Texas, pers. comm. 2009). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants. Chapman (1984) noted shifts in habitat use as piping plovers moved out of spill areas. This behavioral change was believed to be related to the demonstrated decline in benthic infauna (prey items) in the intertidal zone and may have decreased the direct impact to the species. To date, no plover mortality has been attributed to oil contamination outside the breeding grounds, but latent effects would be difficult to prove. Although the risk for impacts from contamination to piping plovers and their habitat is recognized, the safety contingency plans in place alleviate most of these concerns, making contaminants a minor issue at this time. Average concentrations of total polychlorinated biphenyl, dichloro diphenyl dichloroethylene (DDE), and mercury in Atlantic Coast piping plover eggs analyzed since 1990 did not exceed suggested toxicity threshold effect levels, but too few samples were analyzed to adequately characterize contaminant burdens in the population. Although average PCB, DDE, and mercury concentrations were not highly elevated, the maximum reported PCB and mercury concentrations in these composite egg samples were at toxic levels. In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for

mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer chemical manufacturer. Subsequent to a lawsuit being filed against the Environmental Protection Agency (EPA) in 2002, the manufacturer withdrew Fenthion from the market, and EPA declared all uses were to end by November 30, 2004 (American Bird Conservancy 2007, which also states that all other counties in the U.S. now use less toxic chemicals for mosquito control). With one reported plover death from pesticide use, and with the causative pesticide now removed from use, this threat to piping plovers in the U.S. currently appears low. However, it is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico (USFWS, 2009).

Stressor: Sea level rise (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Over the past 100 years, the globally-averaged sea level has risen approximately 10-25 centimeters (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33% of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007, CCSP 2008). Low elevations and proximity to the coast make all nonbreeding coastal piping plover foraging and roosting habitats vulnerable to the effects of rising sea level. Mapping by Titus and Richman (2001) showed that more than 80% of the lowest land along the Atlantic and Gulf coasts was in Louisiana, Florida, Texas, and North Carolina, where 73.5% of all wintering piping plovers were tallied during the 2006 International Piping Plover Census (Elliott-Smith et al. 2009). Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat that lies immediately seaward of numerous structures or roads, especially if those shorelines are also armored with hardened structures. Sea-level rise poses a significant threat to all piping plover populations during the migration and wintering portion of their life cycle (USFWS, 2009).

Stressor: Storm events (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range. Available information suggests that some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. Significant concerns include disturbance to piping plovers and habitats during cleanup of debris, and poststorm acceleration of shoreline stabilization activities, which can cause persistent habitat degradation and loss. Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced overwashand vegetation removal have been noted in portions of the wintering range. The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. Storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm and seawall construction. Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity

(Emanuel 2005, Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms (USFWS, 2009).

Stressor: Banding (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The only utilization-related threat identified post-listing is that of leg injuries associated with banding for scientific studies. Although injuries have been reported in all breeding populations, 78% of 54 injuries (seen 1985-1989) reviewed by Lingle et al. (1999) involved the Atlantic Coast population. Seventeen apparent band-related injuries, ranging from abrasion to foot loss, were observed from 361 recaptures of banded piping plovers in eastern Canada, 1998-2004. All but two of these injuries were related to the use of novel aluminum bands (Amirault et al. 2006). Since 1989, banding of U.S. Atlantic Coast piping plovers has only been authorized in very limited circumstances (i.e., one study involving a relatively small number of birds, and birds released following treatment to remove oil). Threats to Atlantic Coast piping plovers from band-related injuries are fully regulated by the USFWS and CWS and are, therefore, of low concern (USFWS, 2009).

Stressor: Wind turbines (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Five wind turbine generators have been constructed on Sable Island, Nova Scotia, where migrating piping plovers are occasionally reported (D. Amirault-Langlais pers. comm. 2008c). Two wind turbine projects (one with 16 turbines, the other with ten) are also located near piping plover breeding sites on Prince Edward Island. The only proposed wind turbine generator project reviewed by CWS in Atlantic Canada as of March 2009 that raised concerns about piping plovers is on Cape Sable Island, Nova Scotia; this project has not yet proceeded to construction (A. Boyne, CWS, pers. comm. 2009). The major potential threat to piping plovers posed by wind turbine generators is that of collisions. In the off-shore environment, the primary risk occurs during migration, when routes and flight altitudes are largely unknown. While analysis of the best available information indicates that risk from the Cape Wind project is low (USFWS 2008a), the prospect of multiple large wind turbine generator projects along potential migration routes poses greater concern. Risk from wind turbine generators sited nearshore, on nesting beaches, or in the vicinity of intertidal flats landward of barrier islands or spits has not been assessed. Wind turbine generators pose a threat to piping plovers in the foreseeable future, but the magnitude of this threat cannot be assessed without better information about piping plover movements (USFWS, 2009).

Recovery

Reclassification Criteria:
Not available.

Recovery Priority Number: 2C

Delisting Criteria:

2. Verify the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term (USFWS, 2009).

3. Achieve five-year average productivity of 1.5 fledged chicks per pair in each of the four recovery units described in criterion 1. Data to evaluate progress toward this criterion should be obtained from sites that collectively support at least 90% of the recovery unit's population (USFWS, 2009).

4. Institute long-term agreements among cooperating agencies, landowners, and conservation organizations to assure protection and management sufficient to maintain the target populations in each recovery unit and average productivity specified in criteria 1 and 2 (USFWS, 2009).

5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population (USFWS, 2009).

1. Increase and maintain for five years a total of 2,000 breeding pairs, distributed among the four recovery units: Atlantic (eastern) Canada - 400 pairs; New England - 625 pairs; New York-New Jersey - 575 pairs; Southern (DE, MD, VA, NC) - 400 pairs (USFWS, 2009).

(6) Criterion #3 from USFWS, 2015, combined 5-year Review: Sufficient habitat is available on the coastal migration and wintering grounds in quantity and quality to support conservation of the species at recovery levels (as defined by Criterion 1). This will include designated Critical Habitat, and additional habitat that was not designated but is regularly used by wintering piping plovers. Piping plovers should be spatially distributed in the following locations. a. Western Gulf Coast- from the Galveston Bay area, west-southwest along the coast of Texas and Mexico); b. Central Gulf Coast- east-northeast of Galveston Bay through Jefferson County in NW Florida; c. Eastern Gulf Coast- Florida’s west coast-Taylor County, Florida south to Monroe County; d. Atlantic Coast Florida’s east coast, including the Florida Keys up through northeastern North Carolina, Caribbean Islands and the Bahamas Islands. (USFWS, 2015).

(7) Criterion #4 from USFWS, 2015, combined 5-year Review: Ensure commitments are in place and functioning as anticipated to provide long-term funding, protection, and conservation management activities in essential breeding and wintering grounds. a. Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system); b. Northern Rivers (Missouri River system from Fort Peck Lake, Montana to Pierre, South Dakota); c. in U.S. Alkaline Lakes; d. U.S. Wintering Grounds. (USFWS, 2015).

Recovery Actions:

- Monitor and manage wintering and migration areas to maximize survival and recruitment into the breeding population (USFWS, 1996).
- Undertake scientific investigations that will facilitate recovery efforts (USFWS, 1996).
- Develop and implement public information and education programs (USFWS, 1996).
- Review progress towards recovery annually and revise recovery efforts as appropriate (USFWS, 1996).
- Manage breeding piping plovers and habitat to maximize survival and productivity (USFWS, 1996).

- New in 2015: 1W (Wintering Ground Action): Maintain natural coastal processes that perpetuate wintering and coastal migration habitat. 1.1W Protect non-breeding plovers and their habitat from direct and indirect impacts of development.; 1.2W Protect natural processes of inlet formation, migration, and closure.; 1.3W Protect habitat from direct and indirect impacts of shoreline stabilization and sand placement projects.; 1.4W Protect important foraging and roosting habitats.; 1.4.1W Protect and maintain important intertidal habitats including algal flats, sandbars, shoals, and ebb and flow tidal deltas.; 1.4.2W Maintain natural beach habitat and overwash and wrack formation processes.; 1.5W Maintain native vegetation by managing invasive species.; 1.6W Purchase, via easements or fee-title, areas used by plovers for roosting or foraging. (USFWS, 2015).
- New in 2015: 2W. Protect wintering and migrating piping plovers and their habitat from human disturbance.; 2.1W Manage sites to reduce human-caused disturbance to non-breeding plovers. (Impact – High, Scale – Widespread, Timeframe – Long to Short); 2.1.1W Manage pedestrian access to reduce disturbance to non-breeding piping plovers. (Impact – Medium, Scale – Local, Timeframe – Short); 2.1.2W Manage off-road vehicle access to reduce disturbance, mortality, and habitat degradation.; 2.1.3W Implement and enforce pet restrictions in key plover habitat areas.; 2.1.4W Prevent disturbance from other activities.; 2.2W Develop and implement site stewardship plans that address human disturbance and other limiting factors.; 2.3W Develop an effective migration and wintering range outreach strategy and customize it for use in site stewardship plans. (USFWS, 2015).
- New in 2015: 3W. Monitor non-breeding plovers and their habitat. 3.1W Monitor non-breeding piping plovers to assess regional abundance and distribution. 3.2W Monitor non-breeding sites to identify limiting factors and effects of management. 3.3W Provide robust monitoring of piping plover abundance, distribution, survival, and habitat characteristics before and after major projects that have the potential to substantially modify important migration and wintering piping plover habitat. 3.4W Record and promptly report observations of banded piping plovers. 3.5W Develop a state-by-state atlas or other database containing geospatial information on wintering and migrating piping plovers. (USFWS, 2015).
- New in 2015: 4W. Protect non-breeding plovers and their habitats from contamination and degradation from oil or other chemical contaminants. 4.1W Update and refine contaminant exposure response protocols to protect plovers and their habitats. Incorporate updated procedures and protocols into all appropriate federal, state, and local oil and chemical spill contingency plans. 4.2W Develop a rigorous experimental design to evaluate short- and long-term effects of alternative contaminant clean-up techniques on non-breeding plovers and their habitat. 4.3W Identify and remediate any sources of contaminants with potential to adversely affect piping plover survival and reproduction. 4.4W Carry out research projects to determine survival and reproductive success of individually-marked piping plovers that become oiled on the wintering grounds. (USFWS, 2015)
- New in 2015: 5W. Assess predation as a potential limiting factor for piping plovers on wintering and migration sites and take action to address predation as needed. 5.1W Survey for the presence of avian or mammalian predators (especially non-native predators, such as feral cats) on non-breeding plover sites and include appropriate monitoring and management recommendations in site stewardship plans. 5.1.1W Take actions to remove predators from sites used by piping plovers. 5.2W Consider ancillary benefits to non-breeding plovers when developing predator management plans for sites, including national wildlife refuges and state parks. (USFWS, 2015).

- New in 2015: 6W. Improve application of regulatory tools. 6.1W Fully utilize ESA authorities to conserve piping plovers and their habitats. 6.1.1W Maximize avoidance of adverse effects to piping plovers and their habitats through section 7 consultations with federal agencies. 6.1.2W Adopt effective piping plover protections in Habitat Conservation Plans under section 10(a)(1)(B) of the ESA. 6.2W Provide appropriate Coastal Barrier Resources Act determinations. 6.3W Provide exemplary protection for migrating and wintering piping plovers on federal lands. 6.4W Encourage effective use of state and local laws and regulations to enhance conservation of non-breeding piping plovers and their habitat. (USFWS, 2015)
- New in 2015: 7W. Develop mechanisms to provide long-term protection of non-breeding plovers and their habitat. 7.1W Seek long-term agreements with landowners to protect non-breeding plovers and their habitats. 7.2W Acquire important habitat if it becomes available. 7.3W Seek non-regulatory recognition for sites. 7.4W Institutionalize plover site management through long-term planning at the local, state and federal levels. 7.5W Address long-term climate change threats, including accelerating sea level rise. (USFWS, 2015).
- New in 2015: 8W. Conduct scientific investigations to refine knowledge and inform conservation of migrating and wintering piping plovers. 8.1W Evaluate factors in the coastal migration and wintering range that may affect piping plover survival and subsequent fecundity. 8.2W Refine the characterization of optimal winter and migration habitat. 8.3W Determine the effects of shoreline stabilization projects. 8.4W Develop design specifications and monitoring for restoring, creating, and enhancing roosting and foraging habitat. 8.5W Investigate methods to determine the quantity and distribution of wintering and coastal migration habitat needed for long-term conservation of the three populations. 8.6W Determine impacts of human disturbance on non-breeding plovers. 8.7W Evaluate piping plover flight patterns and behaviors to inform risk assessments for wind turbine generators. 8.8W Develop strategies to reduce threats from accelerating sea level rise. 8.9W Investigate the full spectrum of other impacts from climate change on piping plovers in their non-breeding range. 8.10W Ascertain impacts of predation on wintering and migrating piping plovers. (USFWS. 2015).
- New in 2015: 9W. Coordinate, review, and refine recovery efforts. 9.1W Foster communication among recovery partners. 9.2W Facilitate use of new information. 9.3W Support conservation of wintering piping plovers outside the continental U.S. (USFWS, 2015).
- Develop a comprehensive conservation plan for piping plovers in the U.S. portion of their migration and wintering range. a. Acquire funds to develop a concise, cohesive plan that will address the migration and wintering needs of the three breeding populations. This is most efficiently accomplished by a qualified contractor working in close coordination with USFWS biologists. b. Develop a state-by-state wintering and migration habitat use atlas (GL tasks 2.12, 2.13, 2.16; AC task 2.1; NGP task 1.13). i. Quantify amount and distribution of currently existing habitat. ii. Determine the condition of each site, including the type and level of alteration, presence and threat level from invasive species, and whether natural coastal processes are impeded. Compare with historic habitat availability using aerial photography or other records. iii. Determine the temporal abundance and distribution of piping plover activity at sites with suitable habitat. Where appropriate data are currently lacking, conduct multiple surveys by qualified personnel across several migration and wintering seasons. Examples of reports summarizing methods and results of such surveys are available on request to the USFWS. iv. Evaluate likelihood of future actions, including human

development and recreational uses, and natural events that could potentially affect habitat quantity and quality at each site. v. Evaluate factors at each site that will affect the response of habitat to accelerating sea-level rise and identify potential actions to minimize its adverse effects. c. Conduct a systematic review of recreational policies and beach management. Identify gaps in management and enforcement of regulatory mechanisms by state. Develop recommendations to improve management and enforcement of piping plover protections where warranted (AC task 2.24). d. Develop an education/outreach strategy to work with state, county, and municipal governments to develop and implement ordinances and other strategies reducing effects of habitat stabilization, beach cleaning practices, human uses, and pets in beach and bayside habitats (GL task 5.2, AC task 2.24, NGP task 5.2). e. Develop an education/outreach strategy to work with private landowners with regard to habitat stabilization, beach-cleaning practices, human uses, and pets (USFWS, 2009).

- Develop, in coordination with land managers, management plans for critical habitat sites or other sites that support or could support nonbreeding piping plovers. This may be accomplished concurrently with development of the atlas described under action 1b above or as a follow-up task (GL tasks 2.14, 2.22; AC tasks 2.13, 2.2; NGP tasks 4.42, 4.43). a. Develop and implement a conservation plan tailored to the site's conditions. A range of management measures may include, as appropriate, leash laws and dogfree zones, off-road vehicle management, and symbolic fencing of key habitats during periods of high plover use. b. Develop a recommended piping plover monitoring protocol for each site that includes suggested frequency and intensity of monitoring. c. Monitor the effectiveness of management measures (2.a above) (USFWS, 2009).
- Improve consistency in the approach used, and recommendations generated for, piping plover conservation in ESA section 7 consultations and Coastal Barrier Resources Act review across all USFWS field offices throughout the species' U.S. coastal migration and wintering range. a. Regularly update USFWS field office staff regarding latest information on piping plovers and habitat use. b. Emphasize importance of maintaining natural coastal processes to perpetuate high quality piping plover migrating and wintering habitat (AC task 2.21). c. Discourage projects that will degrade or interfere with formation or maintenance of high quality piping plover habitat (GL task 2.22, AC task 2.21, NGP task 4.43). d. Encourage project features to minimize adverse effects on piping plovers and their habitat, including creation and enhancement of habitat in the vicinity of existing stabilization projects. . e. Develop a comprehensive monitoring and management plan template for shoreline stabilization projects on the wintering and migration grounds. f. Consider effects of climate change when determining long-term impacts. Include measures to conserve and enhance the capacity of piping plover habitats to adapt to sea-level rise (USFWS, 2009).
- Develop a website specifically for wintering and migrating piping plover issues (GL task 5.2 and AC tasks 4.1, 4.2). a. Develop a piping plover contact list of all individuals in each state and other countries (Canada, Mexico, Bahamas, etc.). b. Link to other plover websites. c. Upload all pertinent literature, including research and monitoring reports not protected by copyright, to the website. d. Upload summarized section 7 consultations, conservation measures, reasonable and prudent measures, and terms and conditions (USFWS, 2009).
- Focus the non-breeding portion of the International Census on enhancing understanding of piping plover abundance, distribution, and threat levels in seasonally emergent habitat (seagrass beds, oyster reefs, and mud flats) in Texas bays, and in Mexico and the Caribbean (GL task 2.13 and NGP task 1.13). a. Continue to encourage and improve International Census efforts at priority sites in Texas. b. USFWS regional coordinators for the International Census should establish contacts in Mexico, Bahamas, Cuba, and other appropriate

Caribbean countries at least a year in advance of the 2011 International Census. i. Increase efforts to maximize survey coverage. ii. Encourage collection of information describing types and levels of threats at each International Census site in addition to physical and biological attributes of the site. iii. Provide information about color-banded birds and encourage surveyors to look for and report these marked piping plovers (USFWS, 2009).

- To further enhance understanding of spatial partitioning of the breeding populations (as well as the impacts of some threats) on the migration/winter grounds, USFWS should facilitate and encourage all efforts dedicated to (or incorporating) monitoring of color-banded piping plovers. There is urgency associated with this data collection since several large breeding grounds banding studies have recently ended or are slated for completion in the near future, and opportunities to glean information will decline as banded piping plovers die off (GL task 2.12, NGP task 1.133) (USFWS, 2009).
- Further investigate the partitioning of survival within the annual cycle, and determine whether winter habitat quality influences reproductive success and survival (GL task 4.1 and AC task 3.6). Explore opportunities for further comparison of survival rates among breeding populations to inform these issues (USFWS, 2009).
- Continue to refine characterization of optimal winter habitat and understanding of factors affecting piping plover use of different microhabitats (e.g., ocean intertidal zones, wrack, inlet shoreline, soundside flats) (GL task 4.4; AC tasks 3.11, 3.12, 3.13; NGP tasks 2.22, 2.23). Research approaches should recognize that piping plovers may move among relatively nearby habitat patches. Plover habitat use patterns and needs may also vary geographically (across their nonbreeding range) and seasonally. a. Determine how habitat modification or complete loss of a site on migration and wintering grounds affects survival given documented site fidelity. b. Develop design specifications for creating roosting and foraging habitat. c. Quantify the amount and distribution of habitat needed for recovery of each breeding population, giving due consideration to intra- and inter-species competition for use of similar habitats (USFWS, 2009).
- Develop strategies to reduce threats from accelerating sea-level rise. a. Identify human coastal stabilization practices that increase or decrease adverse effects of sea-level rise on coastal piping plover habitats. b. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat as sea-level rises. c. Evaluate projected effects of sea-level rise on the regional distribution of piping plover habitats over time. Facilitate use of LIDAR (a remote sensing system used to collect topographic data) mapping of coastal elevations, development of models, and timeframe analysis throughout the species wintering and migration range in the U.S. to generate projections regarding areas most likely to be inundated within given time frames (USFWS, 2009).
- Determine the extent that human and pet disturbance limits piping plover abundance and behavioral patterns in the wintering and migration habitats (GL task 2.14, AC task 3.14, NGP task 3.221) (USFWS, 2009).
- Determine the effect of human and pet disturbance on survival and reproductive fitness (GL task 4.1, AC task 3.14, NGP task 3.221) (USFWS, 2009).
- Support research to ascertain impacts of predation on wintering/migrating piping plovers, as well as to determine the effectiveness of predator control programs (USFWS, 2009).
- Increase efforts to restore and maintain natural coastal formation processes in the New York-New Jersey recovery unit, where threats from development and artificial shoreline stabilization are highest, and in the Southern recovery unit, where the plover’s habitat

requirements are the most stringent (recovery task 1.2). This action is also critical to reducing adverse effects of accelerating sea-level rise (USFWS, 2009).

- Identify and secure reliable funding to support continuing management of threats from human disturbance and predation, as described in recovery plan tasks 1.1, 1.3, and 1.4 (USFWS, 2009).
- Accelerate development of agreements needed to assure long-term protection and management to maintain population targets and productivity (recovery task 1.6). Prototype agreements should be pursued at sites where there is a history of intensive and successful piping plover protection, a high degree of commitment to the piping plover protection program, and experienced on-site shorebird biologists who can provide expertise to devise and test alternative types of agreements (recovery task 1.62) (USFWS, 2009).
- Develop strategies to reduce threats from accelerating sea-level rise. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat. Identify human coastal stabilization practices that increase or decrease adverse effects of sea-level rise on coastal piping plover habitats (USFWS, 2009).
- Conduct studies to understand potential effects of wind turbine generators that may be located or proposed for the Outer Continental Shelf, nearshore, and within or between nesting and foraging habitats. Information needs include migration routes and altitude; flight patterns associated with breeding adults and post-fledged young of the year foraging at nearby sites that are not contiguous with nesting habitats, and avoidance rates under varying weather conditions (USFWS, 2009).
- Conduct studies, including meta-analyses of local studies, to understand factors that affect latitudinal variation in productivity needed to maintain stationary populations of Atlantic Coast piping plovers (USFWS, 2009).
- Conduct demographic modeling to explore effects of latitudinal variation in productivity, survival rates, and the carrying capacity of habitat on population viability within individual recovery units and the Atlantic Coast population as a whole. Use this information to revise recovery criterion 3 to provide recovery unit specific productivity targets sufficient to assure secure populations (recovery plan task 3.5) (USFWS, 2009).
- Review state laws within the Atlantic Coast piping plover's breeding and wintering range to assess protections that would be afforded if the species were removed from ESA listing (USFWS, 2009).
- Support effective integrated predator management (recovery plan task 1.4) through studies of ecology and foraging behavior of key predators; for example, studies assessing the adequacy of buffers between feral cat colonies and piping plover nesting sites would be useful (USFWS, 2009).
- Clarify the piping plover ESA listing to recognize the subspecies Charadrius melodus melodus and C. m. circumcinctus (USFWS, 2009).
- The International Piping Plover Census has fostered widespread involvement in survey efforts and provided extensive data. However, as piping plover conservation efforts mature, it may be beneficial to shift the Census effort to address specific questions that are not answered by other ongoing efforts. Given ongoing recovery programs on the breeding grounds, the most important future International Census contribution to ESA recovery implementation and monitoring for all piping plovers is the abundance estimate for the Northern Great Plains breeding population (including Prairie Canada). The highest benefit can be realized by emphasizing completeness and quality control of this portion of the census and by expediting synthesis and reporting, so that managers can make timely use of

this information. Trends in abundance of Great Lakes and Atlantic Coast breeding populations (at least for the U.S. portion of their ranges) and progress toward their recovery are most effectively monitored through the annual surveys conducted in accordance with their recovery plans (see sections GL 2.3.2.2 and AC 2.5.2.2). During International Census years, Atlantic and Great Lakes population estimates based on the nine-day U.S. Atlantic Coast window census (see Atlantic Coast recovery task 1.11) and standard Great Lakes survey methods with special emphasis on complete coverage of all suitable habitat can be used to provide a species-wide context. The most valuable potential contribution from future winter censuses is improved understanding of the species' range in the Caribbean, Mexico, and other areas that may not have been fully covered in the past (e.g., seasonally emergent habitats within bays lying between the mainland and barrier islands in Texas). See recommendation 5 for the migration and wintering range. In other portions of the continental U.S., the winter census continues to provide beneficial information in the form of a fairly complete one-time survey coverage of wintering habitats, but it does not provide a true wintering "census." In some areas, participation in wintering census by a broad-based group of cooperators also fosters attention to piping plover conservation needs and collects data that otherwise would not exist. However, constraints associated with single, infrequent, mid-winter counts limits inference from the International Census to the value of particular wintering sites for recovery of the species and to detect trends (USFWS, 2009).

- Regulatory Protections: International Treaties include those established between the US, Canada and Mexico, the Ramsar Convention, the Western Hemisphere/Pan American Convention, Canada/Mexico/U.S. Trilateral Committee for Wildlife and Ecosystem Conservation and Management, The Specially Protected Areas and Wildlife Protocol of the Cartagena Convention (effective in the Caribbean). Federal protections include ESA, the Migratory Bird Treaty Act, the Coastal Barrier Resources Act, Executive Order 11644, Use of Off-Road Vehicles on the Public Lands, and Executive Order 11989, Off-Road Vehicles on Public Lands. Habitats are managed by the USFWS's National Wildlife Refuge System (National Wildlife Refuge System Improvement Act of 1997), the National Park Service (The National Park Service Organic Act), and the Department of Defense (Sikes Act). Most states have their regulations at the state level. Other programs include: The Wildlife Conservation and Restoration Program and State Wildlife Grants (both administered by the USFWS), State parks and wildlife management areas. (USFWS, 2015).
- Non-regulatory conservation programs and organizations include the USFWS inter-regional piping plover team, the Atlantic Coast Joint Venture and its South Atlantic Migratory Bird Initiative (integrates North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, North American Waterbird Conservation Plan, and Partners in Flight), National Audubon Society, the U.S. partner for BirdLife International's Important Bird Area program, Partners in Flight's North American Landbird Conservation Plan (Rich et al. 2004) and Southeast Working Group, The Southeastern Coastal Plains – Caribbean Region Report of the U.S. Shorebird Conservation Plan. (USFWS, 2015).
- New in 2015: BMPs have been described in USFWS 2015 for shoreline stabilization to avoid and minimize adverse environmental impacts, and address dunes, beaches, the nearshore environment (including active littoral or surf zone), offshore environment (including hardbottoms and reefs), inlets, estuarine areas, climate change and rising sea level. (USFWS, 2015).

Conservation Measures and Best Management Practices:

- Recommendations for Atlantic Coast Population Breeding Range 1. Increase efforts to restore and maintain natural coastal habitat formation processes, including overwash and dynamic inlets (recovery task 1.2). This action is critical to near-term availability of sufficient habitat to attain targets for breeding abundance and productivity. It is also key to preserving adaptive capacity of beach habitats in response to current and accelerating rates of sea-level rise. 2. Incorporate protocols for rapid assessment of storm-induced habitat changes into procedures for protecting habitat from degradation during post-storm management of beach habitat and beach recreation. Newly formed habitats should be protected from degradation by activities that directly or indirectly alter topography or accelerate succession of vegetation (recovery tasks 1.22 and 1.23). New and improved habitats should also be appropriately managed to prevent human disturbance that disrupts territory establishment and courtship and causes nest loss and chick mortality (recovery task 1.3). 3. Develop strategies to reduce threats from accelerating sea-level rise. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat. Identify potential changes in coastal management that may decrease adverse effects of sea-level rise on coastal piping plover habitats and locations where they might be implemented. 4. Incorporate new information about effects of disturbance on survival of piping plover chicks into specific beach management practices that will avoid incidental take (recovery task 1.3). 5. Continue and accelerate development and implementation of monitoring and decision support tools to improve and streamline piping plover conservation, including effective and efficient predator management and implementation of activities to prevent disturbance and indirect mortality of piping plovers due to beach recreation and other activities (recovery task 1.1, 1.3, and 1.4). 6. Assess the ability and willingness of state wildlife agencies to assume primary responsibility for protection and management of piping plovers and their habitat sufficient to maintain population targets and productivity. Develop long-term agreements for implementing specific protections that are independent of ESA sections 6 and 9 (recovery task 1.6). 7. Engage Federal agencies, including the NPS, the USACE, the FEMA, the BOEM, and others to ascertain their authorities (independent of ESA section 7) to incorporate conservation of Atlantic Coast piping plovers into activities that they implement, authorize, or fund. Develop long-term commitments for implementing specific protections that are consistent with each agency’s other (non-ESA) regulatory authorities, funding, and personnel resources (recovery task 1.6). 8. Identify and secure reliable funding to support continuing management by landowners and recovery partners of threats from human disturbance and predation, as described in recovery plan tasks 1.1, 1.3, and 1.4. 9. Ascertain whether and to what extent landowners and other partners would be willing to conduct predator management activities if piping plovers are no longer classified as a threatened species under the ESA. Assess effects of foreseeable changes in predator management activities on piping plover abundance and productivity (recovery task 1.6). 10. Implement and refine communications tools and activities to increase public understanding of threats to breeding Atlantic Coast piping plovers and the recovery activities required to address them (recovery task 4). 11. Conduct full life-cycle demographic modeling to elucidate effects of variation in productivity, annual survival rates, dispersal rates, and carrying capacity of habitat on population viability within individual recovery (representative) units and the Atlantic Coast population as a whole. This information may be used (as warranted) to revise recovery criterion 3 to provide recovery unit-specific productivity targets sufficient to secure populations (recovery task 3.5) and facilitate more effective conservation efforts. 12. Increase efforts to understand disturbance and other threats to post-breeding and migrating piping plovers within the Atlantic Coast breeding range, and implement activities to ameliorate them. 13. Continue studies to understand potential effects of wind turbine generators that may be located or proposed for construction within and between nesting and foraging habitats and along migration routes. Continuing information needs include (but are not limited to) weather factors affecting migration altitude, northward migration routes, and avoidance rates under varying light and weather conditions. 14. Support effective integrated predator management (recovery plan task 1.4) through studies of ecology and foraging behavior of key predators and effects of predation management on predator communities. (USFWS, 2020)

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SPECIES ACCOUNT: *Charadrius melodus melodus* (Piping Plover - Atlantic)

Species Taxonomic and Listing Information

Listing Status: Threatened; 12/11/1985; Northeast Region (R5) (USFWS, 2017)

Physical Description

Piping plover subspecies are phenotypically indistinguishable (USFWS, 2009). The piping plover is a small Nearctic (i.e., North American) shorebird approximately 17 centimeters (7 inches) long with a wingspread of about 38 cm (15 in) (Palmer 1967). Wilcox (1959) found that breeding females were slightly heavier than males (55.6 grams vs. 54.9 g), had slightly shortertail lengths (50.5 millimeters vs. 51.3 mm), but had similar wing lengths. Breeding birds have white underparts, light beige back and crown, white rump, and black upper tail with a white edge. In flight, each wing shows a single, white wing stripe with black highlights at the wrist joints and along the trailing edges. Breeding plumage characteristics are a single black breastband, which is often incomplete, and a blackbar across the forehead. The black breastband and brow bar are generally more pronounced in breeding males than females (Wilcox 1939). The legs and bill are orange in summer, with a black tip on the bill. In winter, the birds lose the blackbands, the legs fade from orange to pale yellow, and the bill becomes mostly black (USFWS, 1996).

Taxonomy

Miller et al. (2009) confirmed separate Atlantic and interior piping plover subspecies (C. m. melodus and C. m. circumcinctus, respectively). This study found that birds from the Great Lakes region were allied with the interior subspecies group and should be taxonomically referred to as C. m. circumcinctus. Very rare (perhaps completely absent) reproductive interchange between the Great Lakes and the Northern Great Plains populations constitutes a marked separation of breeding ranges, albeit insufficient or too recent to result in substantial genetic differences demonstrated by available studies (USFWS, 2009).

Historical Range

See current range/disitrbution.

Current Range

Migrating breeders from eastern Canada have been observed in Massachusetts, New Jersey, New York, and North Carolina (Amirault et al. 2005). Information gaps include the wintering locations of the U.S. Atlantic Coast breeding population. Although there is no exclusive partitioning of the wintering range, piping plovers from the Atlantic Coast (i.e., eastern Canada) and the Great Lakes are most prevalent during migration and winter along the southern Atlantic Coast. Wintering ranges of all three breeding populations overlap on the Gulf Coast of Florida. The latitudinal extent of the breeding population did not change between 1986 and 2006, as piping plovers nested annually from southern North Carolina north to the western coast of Newfoundland. Breeding piping plovers were present each year in all Atlantic Coast states from North Carolina to Maine, except for New Hampshire, where they were reported in 1997 for the first time since ESA listing. One to three pairs were reported nesting in South Carolina in 1986, 1990, 1991, and 1993 (Hecht and Melvin 2009a) (USFWS, 2009). The Atlantic Coastpiping plover(Charadrius melodus) population breeds on coastal beachesfrom Newfoundland to North

Carolina (and occasionally in South Carolina) and winters along the Atlantic Coast from North Carolina south, along the GulfCoast, and in the Caribbean. Piping plovers continue to breed successfully at or near the extremes of their historic range. While the extent of the current range does not appear to be substantially different from the historic range, piping plovers are absent from many former nesting beaches on the Atlantic Coast (Cairns and McLaren 1980, Litwin etal. 1993, CWS 1994, Virginia Department of Game and Inland Fisheries 1994) (USFWS, 1996).

Distinct Population Segments Defined

No

Critical Habitat Designated

Yes; 7/10/2001.

Legal Description

On May 19, 2009, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in 18 specific units in Texas under the Endangered Species Act of 1973, as amended (Act). In total, approximately 139,029 acres (56,263 hectares) fall within the boundaries of the revised critical habitat designation. The revised critical habitat is located in Cameron, Willacy, Kenedy, Kleberg, Nueces, Aransas, Calhoun, Matagorda, and Brazoria Counties, Texas. Other previously designated critical habitat for the wintering piping plover in Texas or elsewhere in the United States remains unaffected.

On October 21, 2008, the U.S. Fish and Wildlife Service (Service), designated revised critical habitat for the wintering population of the piping plover (Charadrius melodus) in North Carolina under the Endangered Species Act of 1973, as amended (Act) (73 FR 62816 - 62841). In total, approximately 2,043 acres (ac) (827 hectares (ha)), in Dare and Hyde Counties, North Carolina, fall within the boundaries of the revised critical habitat designation.

July 10, 2001, the Fish and Wildlife Service (Service), designate 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for the wintering population of the piping plover (Charadrius melodus). This includes approximately 2,891.7 kilometers (km) (1,798.3 miles (mi)) of mapped shoreline and approximately 66,881 hectares (ha) (165,211 acres (ac)) of mapped area along the Gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons.

Critical Habitat Designation

18 units are designated as revised critical habitat in Texas for the wintering population of the piping plover. The 18 revised critical habitat units are divided into 24 areas: (1)Subunit TX–3A: South Padre Island – Gulf of Mexico Shoreline; (2)Subunit TX–3B: South Padre Island –Interior; (3)Subunit TX–3C: North Padre Island – Interior; (4)Subunit TX–3D: North Padre Island – Gulf of Mexico; (5)Subunit TX–3E: Mesquite Rincon; (6)Unit TX–4: Lower Laguna Madre Mainland; (7)Unit TX–7: Newport Pass/Corpus Christi Pass Beach; (8)Unit TX–8: Mustang Island Beach; (9)Unit TX–9: Fish Pass Lagoons; (10)Subunit TX–10A: Shamrock Island; (11)Subunit TX–10B: Mustang Island – Unnamed sand flat; (12)Subunit TX–10C: Mustang Island – Lagoon Complex; (13)Unit TX–14: East Flats; (14)Unit TX–15: North Pass; (15)Unit TX–16: San Jose Beach; (16)Unit TX–18: Cedar Bayou/Vinson Slough; (17)Unit TX–19: Matagorda Island Beach; (18)Unit TX–22: Decros Point; (19)Unit TX–23: West Matagorda Peninsula Beach; (20)Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West; (21)Unit TX–28: East Matagorda Bay/ Matagorda

Peninsula Beach East; (22)Unit TX–31: San Bernard NWR Beach; (23)Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers; and (24)Unit TX–33: Bryan Beach and Adjacent Beach.

Unit TX–3: Padre Island. Subunit TX–3A: South Padre Island – Gulf of Mexico Shoreline. This subunit consists of 2,891 ac (1170 ha) in Cameron and Willacy Counties, Texas. It is a beach 30.0 mi (48.2 km) in length on the gulfside of South Padre Island, which is a barrier island. The subunit is located within an area bounded on the south by the southern boundary of Andy Bowie County Park, and on the north by the south jetty of Mansfield Channel, which divides North and South Padre Islands. The jetty itself is outside the boundary of the subunit. The eastern boundary is the estimated MLLW of the Gulf of Mexico, and the western boundary is the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. The vegetated dune and Park Road 100, which runs northsouth along the western side of the dune, separates Subunits TX–3A and 3B. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately one quarter of the subunit is in Federal ownership and managed by the Service’s Laguna Atascosa National Wildlife Refuge (NWR), and approximately 64 percent is in private ownership. The Service does not own the subsurface mineral rights. Ten percent is State land managed by the GLO, and a small portion at the southern end is County park land managed by Andy Bowie County Park. Subunit TX–3A is the southernmost unit of the revised critical habitat for the wintering population of the piping plover. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1), surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greatest magnitude at the southern end of the subunit where housing developments are to the west of the subunit. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area. Subunit TX–3B: South Padre Island –Laguna Madre side. This bayside subunit consists of 44,137 ac (17,862 ha) in Cameron and Willacy Counties, Texas. Its southern boundary extends along the north side of an existing earthen, manmade dike running from the edge of dense dune vegetation to the Laguna Madre along latitude 26° 09’ 19.00’’ N. The dike is not within the boundary of the subunit. The western boundary is the western edge of the intertidal mudflats bordering the eastern shore of the lower Laguna Madre, and the northern boundary is Mansfield Channel. The eastern boundary is dense vegetation of the dunes or, if there is no dense vegetation or dune, the western boundary of Park Road 100. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them.

However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately 42 percent of the land is federally owned and managed by the Service's Laguna Atascosa NWR, and approximately 38 percent is Stateowned and managed by the GLO. The remaining 20 percent is in private ownership along the western side of the subunit. The Service does not own the subsurface mineral rights beneath the refuge. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand and mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. These threats, particularly vehicle access, are of greatest magnitude at the southern portion of the subunit where roads are near or adjacent to PCE 1. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, The Service is not aware of any additional management plans that address this species in this area. Subunit TX–3C: North Padre Island – Laguna Madre side. This bayside unit consists of 50,897 ac (20,597 ha) in Kenedy and Kleberg Counties, Texas. It is along and within the Laguna Madre and extends from the western boundary of Padre Island National Seashore (PAIS) to the Gulf Intracoastal Waterway (GIWW). The northern boundary of the subunit is a line extending westward from the PAIS (at latitude 27° 4’ 29.9’’ N), and its southern boundary is a line extending westward from the southern boundary of PAIS along the northern edge of the Mansfield Channel. The eastern boundary of this subunit is the western boundary of PAIS when the PCEs extend as far as PAIS or the eastern edge of the sand flats where the PCEs end. The portion of the western boundary north of longitude/latitude coordinate 26°48’38.2’’N, 97°28’11.6’’W is the eastern edge of the GIWW, and the portion of the western boundary south of the coordinate is the western edge of the intertidal mudflats bordering the eastern shore of the Laguna Madre. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that we used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is State-owned and managed by the GLO. A small portion is in private ownership. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5).

This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time the Service is not aware of any management plans that address this species in this area. Subunit TX–3D: North Padre Island – Gulf of Mexico. This gulfside subunit consists of 270 ac (109 ha) of beach in Kleberg County, Texas. It extends along the gulf shore of North Padre Island from the northern boundary of PAIS northward 6.2 mi (10 km) to the Nueces County line. The southern boundary is the north boundary of the northeast section of the PAIS. The subunit extends eastward to the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This subunit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Most of the land is owned by the State and managed by the GLO. Approximately one-fifth is in private ownership. It was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this subunit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surfcast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. These threats are of greater magnitude at the north end of the subunit, where more roads provide easy access to the PCEs and the subunit is in close proximity to houses. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–3E: North Padre Island – Mesquite Rincon. This triangular bayside subunit of 9,6238 acres (3,894 hectares) lies on the western shore of the lower Laguna Madre in Kenedy County, Texas. The subunit is generally bounded by Rincon de la Soledad on the southwestern side, Mesquite Rincon on the north, and the GIWW and Rincon de San Jose on the east. The southwestern boundary is an irregular line along the PCEs between the latitude/longitude coordinate points: 26° 44′ 10.5′′ N, 97° 28′ 04.5′′ W at the southeastern point of Rincon de San Jose and 26° 50′ 58.1′′ N, 97° 34′ 19.5′′ W. The northern boundary is the line described between the latitude/longitude coordinate points: 26° 51′ 24.2′′ N, 97° 33′ 25.8′′ W and 26° 51′ 24.2′′ N, 97° 27′ 52.7′′ W. The northern portion of the eastern boundary is the western edge of the GIWW south to latitude/longitude coordinate point 26° 48′ 52.7′′ N, 97° 28′ 12.9′′ W. There the subunit curves westward and skirts a small horseshoeshaped inlet in the Laguna Madre to the northeastern point of Rincon de San Jose at latitude/longitude coordinate point 26° 48′ 43.9′′ N, 97° 29′ 4.7′′ W. There it continues south in an irregular line along the edge of the PCEs to the southeastern point of Rincon San Jose. Within that boundary (especially the southeastern portion of the subunit and northwestern-running edge), the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that we used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. Most of the land is in private ownership with a small portion that is State-owned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the Laguna for foraging and roosting (PCE 5). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This subunit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 7). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–4: Lower Laguna Madre Mainland. This bayside unit consists of 17,223 ac (6,970 ha) in Cameron and Willacy Counties, Texas, and lies along the western shoreline of the Lower Laguna Madre. The southern boundary is an east-west line at the northern tip of Barclay Island, approximately following latitude 26° 14’ 42.2’’ N. The northern boundary is an east-west line located near the northern tip of El Sauz Island, approximately 1.2 mi (1.9 km) south of the center of the city of Port Mansfield, Willacy County, Texas, and approximately following latitude 26° 32’ 7.8’’ N. The eastern boundary of the unit is the eastern edge of the line of dredge spoils that parallel the western side of the GIWW. The western boundary runs from southeast to northwest and is the western edge of sandy beach and mudflat habitat, approximately following the latitude/longitude coordinate points: latitude/longitude coordinate points: 26° 14’ 42.45’’ N, 97° 19’ 32.75’’ W; 26° 17’ 15.54’’ N, 97° 20’ 47.31’’ W; 26° 20’ 10.17’’ N, 97° 21’ 10.94’’ W; 26° 21’ 31.54’’ N, 97° 22’ 48.10’’ W; 26° 24’ 26.64’’ N, 97° 23’ 53.27’’ W; 26° 26’ 8.55’’ N, 97° 25’ 13.33’’ W; and 26° 32’ 5.44’’ N, 97° 27’ 6.91’’ W. Within that boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. Approximately one-third of this unit is within the Service’s Laguna Atascosa NWR. Approximately half is Stateowned and managed by the GLO. The remainder is in private ownership. The Service does not own the subsurface mineral rights beneath the surface of the refuge. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand or mud flats above high tide for roosting (PCE 2). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). This unit also contains sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites) for feeding (PCE 8). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Laguna Atascosa NWR is preparing a Comprehensive Conservation Plan (CCP) that should address the wintering population of the piping plover as well as other listed species; however, a draft CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–7: Newport Pass/Corpus Christi Pass Beach. This unit consists of 294 ac (119 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 5.1-mi (8.2- km) long. The southern boundary is the gulfward extension of Saint Bartholomew Avenue, adjacent to the north end of the seawall. The northern boundary is the edge of the south jetty of the Fish Pass Structure at Mustang Island State Park. The eastern boundary is MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dune. Packery Channel cuts the beach approximately 0.3 mi (0.5 km) north of the south boundary. The seawall, jetty, bollards, and open water of Packery Channel are not within the boundaries of the unit. This unit is in State and private ownership; the State portion is managed by the Mustang Island State Park. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains PCEs in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–8: Mustang Island Beach. This unit consists of 623 ac (252 ha) in Nueces County, Texas. It is a gulfside beach unit approximately 12.5 mi (20.1 km) long. The southern boundary is the edge of the north jetty of the Fish Pass Structure at Mustang Island State Park. The northern boundary is the south side of the Horace Calder Pier in Port Aransas, Texas. The unit is bounded on the east by the MLLW of the Gulf of Mexico, and on the west by the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated. The jetty and pier are not within the boundary of the unit. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is in State and private ownership, with a small municipal park owned and managed by the City of Port Aransas. The State land is managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use. Due to its close proximity to Corpus Christi, this unit receives considerable recreational use and beach cleaning and nourishment. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–9: Fish Pass Lagoons. This bayside unit consists of 168 ac (68 ha) in Nueces County, Texas. This unit encompasses flats facing Corpus Christi Bay that extend 1.0 km (0.6 mi) on either side of Fish Pass. The inland boundary is a line of dense vegetation, and the bayside boundary is the northeast edge of the tidal sand flats that are a PCE. This unit includes all areas of habitat that contain PCEs 1, 2, 5, and 6 within the area described by a polygon with the following latitude/longitude coordinate points: 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W; 27° 41′ 56.97′′ N, 97° 10′ 8.13′′ W; 27° 41′ 24.35′′ N, 97° 10′ 36.89′′ W; 27° 41′ 18.98′′ N, 97° 11′ 16.79′′ W; 27° 41′ 23.51′′ N, 97° 11′ 31.32′′ W and 27° 42′ 14.63′′ N, 97° 10′ 44.70′′ W. Within that polygon, six moderate to large polygons from 5 to 64 ac (2 to 25 ha) each and two small polygons less than 1 ac (0.4 ha) each are PCEs and comprise the unit. Most of the unit is owned by the State and managed by the GLO. A few acres are in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and/or mud flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand, or mud flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–10: Shamrock Island and Adjacent Mustang Island Flats. Subunit TX–10A: Shamrock Island. This 12-ac (5-ha) island in Nueces County, Texas, was a peninsula extending off of Mustang Island in Corpus Christi Bay until erosion separated the island from the mainland. Five small polygons of sand flats from 1.1 to 6.8 ac (0.4 to 2.7 ha) comprise the subunit. Most of the land is State-owned and managed by the GLO; the remainder is privately owned. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10B: Mustang Island: Unnamed sand flat. This 2-ac (1-ha) subunit in Nueces County, Texas, is a small, unnamed sand flat near the north edge of the mouth of Wilson's Cut in Corpus Christi Bay. The subunit is the western half of the island that is sand flats landward (easterly) to the western edge of tidal marsh. It is entirely Stateowned and managed by the GLO. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. The location of the subunit, and the configuration of the polygons of PCEs that comprise this subunit, limit recreational access by vehicles to PCEs 1 and 2. At this time, the Service is not aware of any management plans that address this species in this area. Subunit TX–10C: Mustang Island: Lagoon Complex. This 331-ac (134-ha) subunit in Nueces County, Texas, is an extensive lagoon complex that consists of 11 polygons within a larger polygon that extends 2.2 mi (3.5 km) south of Wilson's Cut in Corpus Christi Bay. The southern boundary of the larger polygon begins at the western end at latitude/ longitude coordinate point 27° 43' 2,4'' N, 97° 10' 19.4'' W at the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. It follows the dune line southeast approximately 830 ft (253 m) to a road, then follows the road approximately 945 ft (288 m) to the edge of the tidal sand flat PCE. It follows the southeastern edge of the sand flat northeast to the western edge of a northsouth road, where it follows the edge of the sand flat northward to the south edge of a road that runs east-west parallel to the southwestern edge of Wilson's Cut. The northern edge of the boundary is the south edge of the road or the northern extent of the sand flat when it does not reach the road. The western boundary follows the PCEs along their eastern edge at Corpus Christi Bay beginning 409 ft (125 m) southwest of the southwestern edge of Wilson's Cut to the coordinate point at the western edge of the southern boundary. A road transects the larger polygon described above, forming two polygons that exclude the road. The PCEs within the 11 polygons comprise the subunit. Within that boundaries of the 11 polygons, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the polygons that comprise the subunit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the subunit boundaries can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. The subunit consists of private and Stateowned lands. This subunit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This subunit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this subunit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to uncontrolled recreational access and beach cleaning and stabilization efforts. Road access to the PCEs is extensive. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–14: East Flats. This bayside unit consists of 591 ac (239 ha) in Nueces County, Texas. It is an irregularly shaped intertidal sand flat south of the Corpus Christi Ship Channel. The north boundary is the northern edge of the sand flat near or adjacent to dredge spoil areas bordering the south side of the Corpus Christi Ship Channel. The northwestern latitude/longitude coordinate is 27° 49’ 54.49’’ N, 97° 6’ 14.28’’ W, and the northeastern latitude/longitude coordinate is 27° 49’ 55.29’’ N, 97° 5’ 12.86’’ W. From there, the sand flat curves southward, and the southeastern edge of it forms a highly irregular line that ends in the southwest portion of the polygon at the eastern edge of a navigation channel from the Corpus Christi Ship Channel to Corpus Christi Bay at latitude/longitude coordinate 51.93’’ N, 97° 5’ 52.58’’ W. The sand flat continues on the western edge of the navigation channel in a northwesterly direction to latitude/longitude coordinate 27° 49’ 22.08’’ N, 97° 6’ 37.04’’ W. It then curves northeasterly and across the cut to the northern edge at the northwest coordinate. On the east, it abuts the City of Port Aransas. There is a small marshland within the sand flat that bisects the sand flat that is not a PCE and is not included in the unit. The unit is mostly in private ownership, with a small portion of State land managed by the GLO. This unit was occupied at the time of listing and is currently occupied. Current ocupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand and mud flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–15: North Pass. This bayside unit consists of 805 ac (326 ha) in Aransas County, Texas. The unit is bounded on the northeast by a line between latitude/longitude coordinates 27° 54’ 8.70’’ N, 97° 0’ 36.97’’ W and 27° 54’ 54.53’’ N, 97° 1’ 18.17’’ W, on the northwest and west by the edge of tidal sand flats in Aransas Bay, on the south by a line running east from coordinate 27° 53’ 16.96’’ N, 97° 2’ 22.44’’ W to unit TX–16, and on the southeast by the landward boundary of unit 16. The unit is all areas that contain the PCEs for the species within a larger area described by a polygon with the following sets of latitude/longitude coordinate points: 27° 54’ 8.70’’ N, 97° 0’ 36.97’’ W; 27° 53’ 10.68’’ N, 97° 1’ 21.36’’ W; 27° 53’ 16.96’’ N, 97° 2’ 22.44’’ W; 27° 53’ 33.08’’ N, 97° 2’ 33.05’’ W; 27° 54’ 42.68’’ N, 97° 2’ 4.83’’ W; 27° 54’ 47.59’’ N, 97° 1’ 51.73’’ W; 27° 54’ 54.53’’ N, 97° 1’ 18.17’’ W and 27° 54’ 8.70’’ N, 97° 0’ 36.97’’ W. Within that boundary, the

Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale, so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit is a remnant of a hurricane washover on San Jose Island. Approximately 18 percent is Stateowned and managed by the GLO; the remainder is in private ownership. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover, including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1) and unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2). This subunit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats of activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–16: San Jose Beach. This unit consists of 1,378 ac (558 ha) in Aransas County, Texas. It is a gulfside beach unit approximately 19.8 mi (31.9 km) long. The southern boundary is the edge of the north jetty of Aransas Pass. The jetty is not within the boundary of the unit. The south edge of Cedar Bayou Pass is the northern boundary. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. A small section is in Federal ownership and managed by the Service’s Matagorda Island NWR. The Service does not own the subsurface mineral rights. Approximately half of the unit is State-owned and managed by the GLO, and nearly as much is in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–18: Cedar Bayou/Vinson Slough. This bayside unit consists of 2,465 ac (998 ha) in Aransas County, Texas. It is a remnant of a hurricane washover area and includes the highly dynamic area of Cedar Bayou, the pass that separates San Jose Island and Matagorda Island. Beginning at the confluence of Vinson Slough and Cedar Bayou, the boundary follows the shore of Spalding Cove to Long Reef, then continues along a line extending 2.5 miles southwest of Long Reef to the shore of San Jose Island, then along the shore of the island to the landward boundary of Unit TX–16. Within that area, the unit consists of numerous polygons of PCEs; areas that are not PCEs within the described area are not within the boundaries of the unit. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http:// criticalhabitat.fws.gov. The southern and southeastern boundary of the unit is described by a line with the following sets of latitude/longitude coordinate points: 28° 1′ 21.76′′ N, 96° 57′ 51.24′′ W; 28° 1′ 12.77′′ N, 96° 57′ 31.18′′ W; 28° 2′ 3.07′′ N, 96° 56′ 45.84′′ W; 28° 2′ 15.92′′ N, 96° 56′ 25.10′′ W; 28° 2′ 30.32′′ N, 96° 56′ 11.97′′ W; 28° 3′ 15.62′′ N, 96° 54′ 20.01′′ W; 28° 3′ 58.58′′ N, 96° 53′ 24.65′′ W; 28° 4′ 1.15′′ N, 96° 52′ 14.65′′ W; 28° 3′ 31.74′′ N, 96° 51′ 38.29′′ W and 28° 3′ 17.69′′ N, 96° 51′ 38.47′′ W. The specific northern boundary is described by a line with the following sets of latitude/longitude coordinate points: 28° 5′ 44.24′′ N, 96° 54′ 8.16′′ W; 28° 5′ 13.23′′ N, 96° 52′ 44.85′′ W; 28° 4′ 33.99′′ N, 96° 50′ 46.55′′ W; 28° 4′ 38.92′′ N, 96° 50′ 40.79′′ W and 28° 4′ 22.98′′ N, 96° 50′ 22.94′′ W. The eastern boundary at the northeastern end of the unit is units TX–16 and TX–19 on the gulfside. The western boundary is the western edge of tidal sand flats in Aransas Bay. This area includes a small section of federally owned land managed by the Service’s Matagorda Island NWR and a small section of State-owned land. The remaining area is privately owned. The Service does not own the subsurface mineral rights beneath the NWR. This unit was occupied at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. This unit contains PCEs in the appropriate spatial arrangement essential to the conservation of the piping plover including intertidal sand flats with no or very sparse emergent vegetation for feeding (PCE 1), unvegetated or sparsely vegetated sand flats above high tide for roosting (PCE 2), and sand spits running into the bay for foraging and roosting (PCE 5). This unit also includes unvegetated washover areas with little or no topographic relief for feeding and roosting (PCE 7). The PCEs in this unit may require special management considerations or protections to ameliorate the threats oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use. Vehicle use of the unit may be limited somewhat by accessibility. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, the CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–19: Matagorda Island Beach. This unit consists of 2,413 ac (976 ha) in Calhoun County, Texas. It is a gulfside beach unit approximately 37.1 mi (59.7 km) long. The southern boundary is the northern edge of Cedar Bayou Pass, and the northern boundary is the southern edge of Pass Cavallo. At Pass Cavallo, the unit curves from the eastern gulfside passing between the south edge of the pass and the north edge of the dunes to a small area on the bayside. The eastern boundary is the MLLW of the Gulf of Mexico, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The federally owned land in this unit is managed by the Service’s Matagorda

Island NWR, which does not own the subsurface mineral rights. This unit also includes a small section of land in State ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and access by refuge staff and others for sea turtle monitoring efforts. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–22: Decros Point. This unit consists of 544 ac (220 ha) at the Matagorda/Calhoun County line, in Texas. It is a gulfside beach unit approximately 4.8 mi (7.7 km) long that wraps around to the bayside. This unit was originally the southern tip of the Matagorda Peninsula. It was made into an island by the dredging of the Matagorda Ship Channel, the edge of which is the northern boundary of the unit. The unit is horseshoe in shape with the east side along the Gulf of Mexico and the west side along Matagorda Bay; the two are connected at their southern boundary by habitat from the north edge of Pass Cavallo northward to the dune line. Densely vegetated sand dunes run north to south in the center of the horseshoe and are not within the boundary of the critical habitat because they are not a PCE. The eastern boundary is the MLLW of the Gulf of Mexico and the western boundary is the western edge of tidal sand flats on the east side of Matagorda Bay. Within the bayside of the boundary, the Service has excluded from critical habitat designation areas that do not contain PCEs. Those areas appear as holes in the unit. The map that is included in this rule is at such a large scale that the holes where critical habitat is not designated do not appear in them. However, the GIS coverages that the Service used to generate the map can be viewed at a finer scale so that the holes where critical habitat is not designated within the unit boundary can be seen. Those GIS coverages can be accessed at http://criticalhabitat.fws.gov. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 60 percent of the unit is in State ownership managed by the GLO. The remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach (PCE 4) for roosting and sheltering. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development activities; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. Due to a lack of road access, this unit does not receive much recreational vehicle use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–23: West Matagorda Peninsula Beach. This unit consists of 1,808 ac (732 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 23.9 mi (38.5 km) long. The southern boundary is the northern jetty of the Matagorda Ship Channel. The northern boundary is the Old Colorado River channel. The MLLW of the Gulf of Mexico is the eastern boundary, and the western boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just under half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–27: East Matagorda Bay/ Matagorda Peninsula Beach West. This unit consists of 905 ac (366 ha) of shoreline in Matagorda County, Texas. It is a gulfside beach unit approximately 14.1 mi (22.8 km) long. The southwestern boundary is the northeastern edge of the Old Colorado River channel. The unit runs along the beach 14 mi (23 km) to the northeastern boundary opposite Eidelbach Flats described by a line between the latitude/longitude coordinate points: 28° 41′ 2.26′′ N, 95° 46′ 29.04′′W and 28° 41′ 6.74′′ N, 95° 46′ 32.46′′ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Just over half of the unit is Stateowned and managed by the GLO; the remainder is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–28: East Matagorda Bay/ Matagorda Peninsula Beach East. This gulfside unit consists of 481 ac (194 ha) in Matagorda County, Texas. It extends along the Gulf beach southwest and northeast of Brown Cedar Cut. The cut is not within the boundary of the unit. This unit abuts portions of the southeastern edges of units TX–29 and TX–30, which are on the East Matagorda Bay side. The southwestern boundary is approximately 4 mi (6.5 km) southwest of Brown Cedar Cut at a line described by the following sets of latitude/ longitude coordinate points: 28° 43’ 11.91’’N, 95° 42’ 25.47’’W and 28° 43’ 17.09’’N, 95° 42’ 28.56’’W. The northeastern boundary is approximately 2.8 mi (4.5 km) northeast of Brown Cedar Cut to the point where Texas Farm to Market Road 457 intersects the beach. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat boundaries, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately onethird is in State ownership and managed by the GLO; the remaining two-thirds is privately owned. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–31: San Bernard NWR Beach. This gulfside unit consists of 401 ac (162 ha) in Matagorda and Brazoria Counties, Texas. It is a 6.2-mi (10-km) segment of beach on the Gulf of Mexico near the mouth of the San Bernard River. The northeastern boundary is at the southwestern edge of the mouth of the San Bernard River. The southwestern boundary follows a line described by the following sets of latitude/longitude coordinate points: 28° 47’ 54.39’’ N, 95° 33’ 26.21’’ W, and 28° 47’ 57.69’’ N, 95° 33’ 27.75’’ W. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. There is a cut through the beach from the Gulf of Mexico to a lake 3.5 mi (5.6 km) southwest of the San Bernard River, which is not within the unit. Bollards also are not within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. Approximately 30 percent of this unit is in Federal ownership and managed by the Service’s San Bernard NWR, which does not own the subsurface mineral rights. Approximately 48 percent is Stateowned and managed by the GLO with the remaining area in private ownership. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of oil and gas exploration and development, including stockpiling materials on sand flats or disposing of dredged material on them, and discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. The federally owned portion has pedestrian recreational access, but no vehicle access. The refuge is preparing a CCP that should address the wintering population of the piping plover as well as other listed species; however, a CCP is not yet available. At this time, the Service is not aware of any additional management plans that address this species in this area.

Unit TX–32: Gulf Beach Between Brazos and San Bernard Rivers. This gulfside unit consists of 556 ac (225 ha) of shoreline in Brazoria County, Texas. This unit is a 6.1-mi (9.8-km) segment of beach on the Gulf of Mexico between the mouths of the San Bernard and Brazos Rivers. The southwestern boundary is the northeastern edge of the mouth of the San Bernard River. The northeastern boundary is the western edge of the mouth of the Brazos River. The southeastern boundary is the MLLW of the Gulf of Mexico. The northwestern boundary runs along the dune line, where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. It is entirely in State ownership and managed by the GLO. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Unit TX–33: Bryan Beach and Adjacent Beach. This unit consists of 211 ac (85 ha) in Brazoria County, Texas. It is gulfside beach approximately 3.5 mi (5.7 km) in length on the Gulf of Mexico near the mouth of the Brazos River. The southwestern boundary is the northeastern edge of the Brazos River. The northeastern boundary is Farm-toMarket Road 1495 (Bryan Beach Rd). The southeastern boundary is the MLLW. The northwestern boundary follows along the dune line where the habitat changes from lightly vegetated, sandy beach to densely vegetated dunes. This unit does not include bollards within the critical habitat designation, although they may be present within the described area because they are too small to be detected with the mapping methodology used. The unit is entirely in State ownership and managed by the Texas Department of Parks and Wildlife. The unit was occupied by piping plovers at the time of listing and is currently occupied. Current occupancy has been confirmed by species experts at least 2 years out of the last 10 years. Habitat in this unit contains features in the appropriate spatial arrangement that are essential to the conservation of the wintering population of the piping plover, including sand flats with little or no emergent vegetation (PCE 1) and surf-cast algae (PCE 3) for feeding, and unvegetated or sparsely vegetated sandy backbeach and washovers (PCEs 4 and 7) for roosting, sheltering, and feeding. The PCEs in this unit may require special management considerations or protections to ameliorate the threats of recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; and increased predation due to recreational use. At this time, the Service is not aware of any management plans that address this species in this area.

Four units are designated as critical habitat for the wintering population of the piping plover in North Carolina. The four areas designated as critical habitat are: (1) Unit NC–1, Oregon Inlet; (2) Unit NC–2, Cape Hatteras Point; (3) Unit NC–4, Hatteras Inlet; and (4) Unit NC–5, Ocracoke Island.

Unit NC–1: Oregon Inlet. Unit NC–1 is approximately 8.0 km (5.0 mi) long, and consists of about 196 ha (485 ac) of sandy beach and inlet spit habitat on Bodie Island and Pea Island in Dare County, North Carolina. This is the northernmost critical habitat unit within the wintering range of the piping plover. Oregon Inlet is the northernmost inlet in coastal North Carolina, approximately 19.0 km (12.0 mi) southeast of the Town of Manteo, the county seat of Dare County. The unit is bounded by the Atlantic Ocean on the east and Pamlico Sound on the west and includes lands from the mean lower low water (MLLW) on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where the PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit begins at Ramp 4 near the Oregon Inlet Fishing Center on Bodie Island and extends approximately 8.0 km (5.0 mi) south to the intersection of NC Highway 12 and Salt Flats Wildlife Trail (near Mile Marker 30, NC Highway 12), approximately 5.0 km (3.0 mi) from the groin, on Pea Island, and includes Green Island and any emergent sandbars south and west of Oregon Inlet, and the lands owned by the State of North Carolina, specifically islands DR–005–05 and DR–005–06. However, this unit does not include the Oregon Inlet Fishing Center, NC Highway 12, the Bonner Bridge and its associated structures, the terminal groin, the historic Pea Island Life-Saving Station, or any of their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Oregon Inlet has reported consistent use by wintering piping plovers dating from the mid-1960s. As many as 100 piping plovers have been reported from a single day survey during the fall migration (NCWRC unpublished data). Christmas bird counts regularly recorded 20 to 30 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall number of piping plovers reported using the area has declined since the species was listed in 1986 (NCWRC unpublished data), which corresponds to increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Oregon Inlet is one of the first beach access points for off-road vehicles within Cape Hatteras National Seashore when traveling from the developed coastal communities of Nags Head, Kill Devil Hills, Kitty Hawk, and Manteo. As such, the inlet spit is a popular area for off-road vehicle users to congregate. The majority of the Cape Hatteras National Seashore users in this area are off-road vehicle owners and recreational fishermen. In fact, a recent visitor use study of Cape Hatteras National Seashore reported that Oregon Inlet is the second most popular off-road vehicle use area in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby Oregon Inlet Fishing Center. Pea Island National Wildlife Refuge (PINWR) does not allow off-road vehicle use;

however, Pea Island regularly receives dredged sediments from the maintenance dredging of Oregon Inlet by the Corps. The disposal of dredged sediments on PINWR has the potential to disturb foraging and roosting plovers and their habitats. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–2: Cape Hatteras Point. Unit NC–2 consists of 262 ha (646 ac) of sandy beach and sand and mud flat habitat in Dare County, North Carolina. Cape Hatteras Point (also known as Cape Point or Hatteras Cove) is located south of the Cape Hatteras Lighthouse. The unit extends south approximately 2.8 mi (4.5 km) from the ocean groin near the old location of the Cape Hatteras Lighthouse to the point of Cape Hatteras, and then extends west 4.7 mi (7.6 km) along Hatteras Cove shoreline (South Beach) to the edge of Ramp 49 near the Frisco Campground. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where PCEs do not occur). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. This unit does not include the ocean groin. Consistent use by wintering piping plover has been reported at Cape Hatteras Point since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Cape Hatteras Point independently from Hatteras Inlet. These single day surveys have recorded as many as 13 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Cape Hatteras Point is located near the Town of Buxton, the largest community on Hatteras Island. For that reason, Cape Hatteras Point is a popular area for ORV use and recreational fishing. A recent visitor use study of the park found that Cape Hatteras Point had the most ORV use within the park (Vogelsong 2003). As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–4: Hatteras Inlet. Unit NC–4 is approximately 8.0 km (5.0 mi) long, and consists of 166 ha (410 ac) of sandy beach and inlet spit habitat on the western end of Hatteras Island and the eastern end of Ocracoke Island in Dare and Hyde Counties, North Carolina. The unit begins at the first beach access point at Ramp 55 at the end of NC Highway 12 near the Graveyard of the Atlantic Museum on the western end of Hatteras Island and continues southwest to the beach access at the ocean-side parking lot near Ramp 59 on the northeastern end of Ocracoke Island. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which itself is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The Hatteras Inlet unit includes all emergent sandbars within Hatteras Inlet including lands owned by the State of North Carolina, specifically Island DR–009–03/04. The unit is adjacent to, but does not include, the Graveyard of the Atlantic Museum, the ferry terminal, the groin on Ocracoke Island, NC Highway 12, or their ancillary facilities (e.g., parking lots, out buildings). This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. Hatteras Inlet has reported consistent use by wintering piping plovers since the early 1980s, but the specific area of use was not consistently recorded in earlier reports. Often piping plovers found at Cape Hatteras Point, Cape Hatteras Cove, and Hatteras Inlet were reported as a collective group. However, more recent surveys report plover use at Hatteras Inlet independently from Cape Hatteras Point. These single-day surveys have recorded as many as 40 piping plovers a day during migration (NCWRC unpublished data). Christmas bird counts regularly recorded 2 to 11 plovers using the area. Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). The overall numbers of piping plovers reported using the area has declined in the last 10 years (NCWRC unpublished data), corresponding with increases in the number of human users (NPS 2005) and off-road vehicles (Davis and Truett 2000). Hatteras Inlet is located near the Village of Hatteras, Dare County, and is the southernmost point of Cape Hatteras National Seashore that can be reached without having to take a ferry. As such, the inlet is a popular off-road vehicle and recreational fishing area. In fact, a recent visitor use study of the park found Hatteras Inlet the fourth most used area by off-road vehicles in the park (Vogelsong 2003). Furthermore, the adjacent islands are easily accessed by boat, which can be launched from the nearby marinas of Hatteras Village. As a result, the sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Unit NC–5: Ocracoke Island. This unit consists of 203 ha (502 ac) of sandy beach and mud and sand flat habitat in Hyde County, North Carolina. The unit includes the western portion of Ocracoke Island beginning at the beach access point at the edge of Ramp 72 (South Point Road), extending west approximately 2.1 mi (3.4 km) to Ocracoke Inlet, and then back east on the Pamlico Sound side to a point where stable, densely vegetated dune habitat meets the water. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. The unit includes all emergent sandbars within Ocracoke Inlet. This unit contains the PCEs essential to the conservation of the species, including a contiguous mix of intertidal beaches and sand or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation, and adjacent areas of unvegetated or sparsely vegetated dune systems and sand or mud flats above annual high tide. The unit is adjacent to but does not include NC Highway 12, any portion of the maintained South Point Road at Ramp 72, or any of their ancillary facilities. Ocracoke Island had inconsistent recorded use by wintering piping plovers in the early 1980s, and Christmas bird counts recorded only 1 to 6 plovers using the area throughout the early 1990s. However, since the late 1990s when regular and consistent surveys of the area were conducted, as many as 72 piping plovers have been recorded during migration, and 4 to 18 plovers have been regularly recorded during the overwinter period (NCWRC unpublished data). Recent surveys have also recorded consistent and repeated use of the area by banded piping plovers from the endangered Great Lakes breeding population (Stucker and Cuthbert 2006). Ocracoke Inlet is located near the Village of Ocracoke, and is the southernmost point of the Cape Hatteras National Seashore. Ocracoke Island is only accessible by ferry. As such, the island is a popular destination for vacationers and locals interested in seclusion. The inlet is also a popular recreational fishing and ORV area. A recent visitor use study of the park reported Ocracoke Inlet was the third most popular ORV use area in the park (Vogelsong 2003). As a result, the primary threat to the wintering piping plover and its habitat within this unit is disturbance to and degradation of foraging and roosting areas by ORVs and by people and their pets. Therefore, sandy beach and mud and sand flat habitats in this unit may require special management considerations or protection.

Critical habitat was divided into 142 critical habitat conservation units that contain areas with the primary constituent elements for the piping plover in the wintering range of the species. These units are found in all eight States where piping plovers winter. See above for revised critical habitat unit descriptions in NC and TX (Units TX– 3, TX–4, TX–7, TX–8, TX–9, TX–10, TX–14, TX–15, TX–16, TX–18, TX–19, TX–22, TX–23, TX–27, TX–28, TX–31, TX–32, and TX–33).

Unit SC–1: Waites Island-North. 75 ha (186 ac) in Horry County. This unit includes the northern tip of Waites Island from the MLLW at Little River Inlet and runs west along the Atlantic Ocean shoreline 2.0 km (1.25 mi) and includes land from the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The unit continues north and west of Little River Inlet stopping at Sheephead Creek, including land from MLLW to dense vegetation line. The majority of the unit is privately owned.

Unit SC–2: Waites Island-South. 58 ha (142 ac) in Horry County.This unit includes the southern tip of Waites Island from the MLLW at Hog Inlet and runs east along the Atlantic Ocean shoreline 0.80 km (0.50 mi) and includes MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It continues north and west of the Hog inlet, stopping at the first major tributary. Critical habitat includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Emerging sandbars within Hog Inlet and adjacent to the tip if eastern Cherry Grove Beach are also included from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur. The majority of this unit is privately owned.

Unit SC–3: Murrells Inlet/Huntington Beach. 135 ha (334 ac) in Georgetown County. The majority of the unit is within Huntington Beach State Park. This unit extends from the southern tip of Garden City Beach, just south of the groins (a rigid structure or structures built out from a shore to protect the shore from erosion or to trap sand) north of Murrells Inlet from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begins and where the constituent elements no longer occur stopping perpendicular with the southern end of Inlet Point Drive. It includes from MLLW south of Murrells Inlet to the northern edge of North Litchfield Beach approximately 4.5 km (3.0 mi). The unit includes the MLLW from the Atlantic Ocean up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The lagoon at the north end of Huntington Beach State Park is also included.

Unit SC–4: Litchfield. 11 ha (28 ac) in Georgetown County. This unit includes the southern tip of Litchfield Beach beginning 0.50 km (0.30 mi) north of Midway Inlet and stopping at the MLLW at Midway Inlet. It includes from the MLLW on the Atlantic Ocean shoreline across and including land to the MLLW on the back bayside. This unit is mostly privately owned.

Unit SC–5: North Inlet. 99 ha (245 ac) in Georgetown County. The majority of the unit is within Tom Yawley Wildlife Center Heritage Preserve. This unit extends from MLLW to 1.0 km (.62 mi) north of North Inlet on Debidue Beach. It includes shoreline on the Atlantic Ocean from MLLW to the MLLW on the western side of the peninsula. This unit also includes from the MLLW south of North Inlet 1.6 km (1.0 mi). It includes the shoreline on the Atlantic Ocean from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. It includes shoreline running south and west of the inlet from the MLLW stopping at the MLLW at the first large tributary (no name).

Unit SC–6: North Santee Bay Inlet. 305 ha (753 ac) in Georgetown County. The majority of the unit is within the Tom Yawley Wildlife Center Heritage Preserve and the Santee-Delta Wildlife Management Area. This unit is at the North Santee Bay inlet and includes lands of South Island, Santee Point, Cedar Island, and all of North Santee Sandbar. This unit includes from MLLW at North Santee Bay Inlet running north along the Atlantic Ocean side of South Island 7.2 km (4.5 mi), stopping 0.60 km (0.4 mi) north of an unnamed inlet. It includes areas from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This unit includes the eastern side of Cedar Island adjacent to the North Santee Bay Inlet from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of North Santee Sandbar to MLLW is included.

Unit SC–7: Cape Romain. 315 ha (777 ac) in Charleston County.The majority of the unit is within Cape Romain National Wildlife Refuge. This unit includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the southern and southeastern most 1.9 km (1.2 mi) portion of Cape Island, the southernmost portion of Lighthouse Island from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, all of Lighthouse Island South to MLLW, and the southern side of the far eastern tip of Raccoon Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–8: Bull Island. 134 ha (332 ac) in Charleston County. The majority of the unit is within Cape Romain National Wildlife Refuge and land owned by the South Carolina Department of Natural Resources. This unit includes from Schooner Creek on north and south of the river to north of Price’s Inlet on the southern portion of Bull Island along the Atlantic Ocean 1.6 km (1.0 mi) and south of Price’s Inlet on the northeast tip of Capers Island Heritage Preserve 1.4 km (.86 mi) along the Atlantic Ocean. All areas begin at MLLW and extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–9: Stono Inlet. 495 ha (1223 ac) in Charleston County.Most of this unit is privately owned. It includes the eastern end of Kiawah Island (approximately 4.0 km (2.5 mi)) from MLLW on Atlantic Ocean running north to MLLW on first large tributary connecting east of Bass Creek running northeast into Stono River. It includes MLLW up to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur along Stono Inlet and River. All of Bird Key-Stono Heritage Preserve and all of Skimmer Flats to MLLW are included. The Golf course and densely vegetated areas are not included.

Unit SC–10: Seabrook Island. 117 ha (290 ac) in Charleston County.This unit runs from just 0.16 km (0.10 mi) north of Captain Sams Inlet to the southwest approximately 3.4 km (2.1 mi) along the Atlantic Ocean shoreline. It includes land areas from the MLLW on the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Most of this unit is privately owned.

Unit SC–11: Deveaux Bank. 130 ha (322 ac) in Charleston County. The entire unit is within Deveaux Bank Heritage Preserve. This unit includes all of Deveaux Island to the MLLW and is State-owned.

Unit SC–12: Otter Island. 68 ha (169 ac) in Colleton County.The majority of the unit is within St. Helena Sound Heritage Preserve. This unit includes the southern portion of Otter Island to the eastern mouth of Otter Creek. It includes the MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The entire unit is State-owned.

Unit SC–13: Harbor Island. 50 ha (122 ac) in Beaufort County. The majority of the unit is State-owned. This unit extends from the northeastern tip of Harbor Island and includes all of Harbor Spit. It begins at the shoreline east of Cedar Reef Drive running south, stopping at the mouth of Johnson Creek. It includes the MLLW on the Atlantic Ocean and St. Helena Sound to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Harber Spit to MLLW is included.

Unit SC–14: Caper's Island. 238 ha (589 ac) in Beaufort County. Most of this unit is privately owned. This unit includes the southern-most 4.5 km (2.8 mi) along the Atlantic Coast shoreline of Little Caper's Island beginning at MLLW on south side of the inlet (un-named). It includes the MLLW on the Atlantic Ocean shoreline to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit SC–15: Hilton Head. 43 ha (106 ac) in Beaufort County. The majority of this unit is State-owned. This unit includes the northeastern tip (Atlantic Ocean side) of Hilton Head Island and all of Joiner Bank. It begins at the shoreline east of northern Planters Row and ends at the shoreline east of Donax Road. It includes the MLLW of Port Royal Sound and the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Joiner Bank to MLLW is included.

Unit GA–1: Tybee Island. 37 ha (91 ac) in Chatham County. The majority of the unit is privately owned. This unit extends along the northern tip of Tybee Island starting from 0.8 km (0.5 mi) northeast from the intersection of Crab Creek and Highway 80 to 0.7 km (0.41 mi) northeast from the intersection of Highway 80 and Horse Pen Creek. The unit includes MLLW on Savannah River and Atlantic Ocean to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit GA–2: Little Tybee Island. 719 ha (1776 ac) in Chatham County. The majority of the unit is within Little Tybee Island State Heritage Preserve. This unit extends just south of the first inlet to Wassaw Sound along the Atlantic Ocean coastline, extending north along the sound 1.7 km (1.1 mi). It includes habitat from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–3: North Wassaw Island. 108 ha (267 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit includes the north-east tip of Wassaw Sound, 1.6 km (1.0 mi) along the inlet side and extending south along the Atlantic Ocean shoreline for 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–4: South Wassaw Island. 61 ha (151 ac) in Chatham County. The entire unit is within Wassaw National Wildlife Refuge. This unit extends from the last southern 1.6 km (1.0 mi.) on Atlantic Ocean side, around the southern tip of Wassaw Island, up to mouth of Odingsell River. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–5: Ossabaw Island. 434 ha (1072 ac) in Chatham County. entire unit is within Ossabaw Island State Heritage Preserve. This unit includes the northeastern tip from the mouth of the Bradley River east and 12 km (7.5 mi) south along the Atlantic Ocean shoreline to a point 0.4 km (0.25 mi) past the south-center inlet. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–6: St. Catherine’s Island Bar. 54 ha (135 ac) in Liberty County. The entire unit is State owned and located east-northeast of St. Catherine’s Island. This unit includes the entire St. Catherine’s Island Bar to MLLW.

Unit GA–7: McQueen’s Inlet. 215 ha (532 ac) in Liberty County. The majority of the unit is private land along the eastern-central coastline on St. Catherine’s Island. This unit extends from McQueen’s Inlet north approximately 3.5 km (2.2 mi) and south approximately 1.8 km (1.1 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–8: St. Catherine’s Island. 60 ha (147 ac) in Liberty County. The majority of the unit is private land on the southern tip of St. Catherine’s Island. This unit starts 1.2 km (0.75 mi) north of Sapelo Sound (along Atlantic Ocean shoreline) and stops inland at Brunsen Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–9: Blackbeard Island. 129 ha (319 ac) in McIntosh County. The entire unit is within the Blackbeard Island National Wildlife Refuge. This unit includes the northeastern portion of the island beginning just east of the mouth of the confluence of McCloy Creek and Blackbeard Creek and continuing east and running south along the Atlantic Ocean shoreline for 1.4 km (.90 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–10: Sapelo Island. 85 ha (210 ac) in McIntosh County. The entire unit is State-owned and within Sapelo Island. The unit extends south of Cabretta Tip approximately 0.2 km (0.13 mi) and north of Cabretta Tip 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–11: Wolf Island. 238 ha (590 ac) in McIntosh County. The majority of the unit is within Wolf Island National Wildlife Refuge and private lands just north of the Refuge. This unit includes the southeastern tip of Queen's island adjacent to the Doboy Sound and includes the eastern shoreline of Wolf Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–12: Egg Island Bar. 61 ha (151 ac) in McIntosh County. This unit is State owned and includes all of Egg Island Bar to the MLLW.

Unit GA–13: Little St. Simon's Island. 609 ha (1505 ac) in Glynn County. The majority of the unit is private land on Little St. Simon's Island. This unit includes the entire eastern coastline along Little St. Simon's Island. It begins 1.1 km (.70 mi) west of the northeast tip of Little St. Simon's Island and runs east and then south along the Atlantic Ocean shoreline stopping at the minor tributary (no name) on the southeast tip of Little St. Simon's Island north of Hampton Creek. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All of Pelican Spit to MLLW is included when this sand bar is emergent.

Unit GA–14: Sea/St. Simon's Island. 191 ha (471 ac) in Glynn County. The majority of the unit is private land on the south tip of Sea Island and on the east beach of St. Simons Island. This unit extends north of Gould's Inlet (Sea Island) 2.5 km (1.54 mi) starting just south of the groin and extends south of Gould's Inlet (St. Simons Island) 1.6 km (1.0 mi). It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–15: Jekyll Island. 49 ha (121 ac) in Glynn County. The majority of the unit is within State lands on Jekyll Island. This unit includes the southern region of Jekyll Island beginning at the mouth of Beach Creek, running towards the tip of Jekyll Island and includes the shoreline running north along the Atlantic Ocean shoreline 1.9 km (1.20 mi) from the southern tip of Jekyll Island. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit GA–16: Cumberland Island. 1454 ha (3591 ac) in Camden County. The majority of the unit is along Cumberland Island Wilderness Area and Cumberland Island National Seashore. This unit includes the majority of the eastern Atlantic Ocean shoreline of Cumberland Island. It begins .50 km (.31 mi) north of the inlet at Long Point, continues south along the Atlantic Ocean shoreline stopping 1.8 km (1.1 mi) west of the southern tip of Cumberland Island National Seashore. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–1: Big Lagoon. 8 ha (19 ac) in Escambia County. The majority of the unit is within Big Lagoon State Recreation Area. This unit includes the peninsula and emerging sand and mudflats between 0.33 km (0.21 mi) west of the lookout tower along the shoreline and 0.24 km (0.15 mi) east of the lookout tower along the shoreline. Land along the shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. All emerging sandbars to MLLW are included.

Unit FL–2: Big Sabine. 182 ha (450 ac) in Escambia County. The majority of the unit is owned by the University of West Florida. This unit includes areas adjacent to Santa Rosa Sound of Big Sabine Point and adjacent embayment between 8.0 km (5.0 mi) and 11.6 (7.2 mi) east of the Bob Sike's Bridge. It begins 0.10 km (.06 mi) north of SR 399 to MLLW on the Santa Rosa Sound.

Unit FL–3: Navarre Beach. 48 ha (118 ac) in Escambia and Santa Rosa Counties. The majority of the unit is owned by Eglin Air Force Base and Santa Rosa Island Authority. This unit includes lands on Santa Rosa Island Sound side, between 0.09 and 0.76 mi east of the eastern end of SR 399 to MLLW on Santa Rosa Sound side.

Unit FL–5: Shell/Crooked Islands. 1789 ha (4419 ac) in Bay County.The majority of the unit is within Tyndall Air Force Base and St. Andrews State Recreation Area. This unit includes all of Shell Island, Crooked Island West, and Crooked Island East from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–6: Upper St. Joe Peninsula. 182 ha (449 ac) in Gulf County.The majority of the unit is within St. Joseph State Park. This unit includes the northern portion of the peninsula from the tip to 8.0 km (5.0 mi) south along the Gulf of Mexico from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–7: Cape San Blas. 158 ha (390 ac) in Gulf County.The entire unit is within Eglin Air Force Base. This unit includes the area known as the Cape between the eastern boundary of Eglin and mile marker 2.1, including the peninsula and all emerging sandbars. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–8: St. Vincent Island. 146 ha (361 ac) in Franklin County.The majority of the unit is within St. Vincent National Wildlife Refuge. This unit includes the western tip of St. Vincent Island that is adjacent to Indian Pass (0.80 km (0.50 mi) east of tip along Indian Pass, and 1.9 km (1.2 mi) from tip southeast along Gulf of Mexico). The unit also includes St. Vincent Point from the inlet at Sheepshead Bayou east 1.6 km (1.0 mi) to include emerging oysters shoals and sand bars and extends south 0.21 km (0.13 mi) of St. Vincent Point. The unit includes the southeastern tip of St. Vincent Island extending north 1.4 km (0.90 mi) and south and west 2.1 km (1.3 mi). The western tip of Little St. George Island 0.80 km (0.50 mi) from West Pass is included (state owned lands). All sections of this unit include land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–9: East St. George Island. 1433 ha (3540 ac) in Franklin County. The majority of the unit is within St. George State Park. This unit begins 5.3 km (3.3 mi) east of the bridge and extends to East Pass. Shell Point, Rattlesnake Cove, Goose Island, East Cove, Gap Point, and Marsh Island are included. This unit includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur on the Gulf of Mexico, East Pass and St. George Sound.

Unit FL–10: Yent Bayou. 153 ha (378 ac) in Franklin County. The majority of the unit is State owned. This unit is adjacent to the area known as Royal Bluff. It includes the St. George Sound shoreline between 5.9 km (3.7 mi) and 9.5 km (5.9mi) east of SR 65. It includes from MLLW to where densely vegetated habitat or developed structures such as SR 65, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–11: Carabelle Beach. 56 ha (139 ac) in Franklin County. The area within this unit is privately owned. This unit is the peninsula created by Boggy Jordan Bayou. It includes St. George Sound shoreline (south of US 98) 1.6 km (1.0 mi) southwest along US 98 from the Carrabelle River Bridge and extends 1.9 km (1.2 mi) east along the St. George Sound shoreline. It includes from MLLW to where densely vegetated habitat or developed structures such as US 98, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–12: Lanark Reef. 260 ha (643 ac) in Franklin County. The entire unit is State owned. This unit includes the entire island and emerging sandbars to MLLW.

Unit FL–13: Phipps Preserve. 42 ha (104 ac) in Franklin County. This unit includes all of Phipps Preserve (owned by The Nature Conservancy) and any emerging sandbars from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–14: Hagens Cove. 486 ha (1200 ac) in Taylor County. The majority of the unit is within Big Bend Wildlife Management Area. This unit includes all of Hagens Cove and extends from MLLW on north side of Sponge Point to MLLW on south side of Piney Point. The eastern boundary of this unit ends (0.20 mi) west of SR 361. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–15: Anclote Key and North Anclote Bar. 146 ha (360 ac) in Pasco and Pinellas Counties. The majority of the unit is within Anclote Key State Preserve. This unit includes all of North Anclote Bar to the MLLW and the north, south and western sides of Anclote Key from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–16: Three Rooker Bar Island. 76 ha (188 ac) in Pinellas County. The majority of the unit is within Pinellas County Aquatic Preserve. This unit includes all the islands and emerging sandbars of this complex to MLLW.

Unit FL–17: North Honeymoon Island. 45 ha (112 ac) in Pinellas County. The majority of the unit is within Honeymoon Island State Recreation Area. This unit includes from Pelican Cove north to the far northern tip of Honeymoon Island. It includes the western shoreline from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur or the MLLW on the eastern shoreline.

Unit FL–18: South Honeymoon Island. 28 ha (70 ac) in Pinellas County.The majority of the unit is private land. This unit includes the southern end (southern-most 0.32 km (0.20 mi) on western side) of Honeymoon Island and encompasses the far southeastern tip and includes any emerging islands or sandbars to Hurricane Pass. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–19: Caladesi Island. 120 ha (296 ac) in Pinellas County.The majority of the unit is within Caladesi Island State Park. This unit extends from Hurricane Pass to Dunedin Pass on the Gulf of Mexico side. It includes from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–20: Shell Key and Mullet Key. 190 ha (470 ac) in Pinellas County. The majority of the unit is within Fort Desoto Park. This unit includes the Shell Key island complex. It also includes the northwest portion of Mullet Key including the western shorelines from Bunces Pass extending south, stopping 1.4 km (.86 mi) north of Ft. Desoto County Park pier. It includes from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–21: Egmont Key. 153 ha (377 ac) Hillsborough County. The majority of the unit is within Egmont Key National Wildlife Refuge. This unit includes the entire island to MLLW.

Unit FL–22: Cayo Costa. 175 ha (432 ac) in Lee County. The majority of the unit, including its northern and southern boundaries, is within Cayo Costa State Park, and nearly all of the remaining area is in the Cayo Costa Florida Conservation and Recreation Lands (CARL) acquisition project. This unit begins at the northern limit of sandy beaches at the northern end of the island, extends through Murdock Point, which at present has a sandbar and lagoon system, and ends at the former entrance to Murdock Bayou. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–23: North Captiva Island. 36 ha (88 ac) in Lee County.The unit is within the Cayo Costa CARL land purchase project. This unit includes the western shoreline extending from 0.80 km (0.50 mi) south of Captiva Pass to approximately Foster Bay. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–25: Bunche Beach. 187 ha (461 ac) in Lee County. This unit is mostly within a CARL Estero Bay acquisition project. Bunche Beach (also spelled Bunch) lies along San Carlos Bay, on the mainland between Sanibel Island and Estero Island (Fort Myers Beach), extending east from the Sanibel Causeway past the end of John Morris Road to a canal serving a residential subdivision. The unit also includes the western tip of Estero Island (Bodwitch Point, also spelled Bowditch Point), including Bowditch Regional Park, operated by Lee County and, on the southwest side of the island facing the Gulf, the beach south nearly to the northwesterly intersection of Estero Boulevard and Carlos Circle. It includes land from MLLW to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur or, along the developed portion of Estero Island.

Unit FL–26: Estero Island. 86 ha (211 ac) in Lee County. The majority of the unit is privately owned. The unit consists of approximately the southern third of the island’s Gulf-facing shoreline starting near Avenida Pescadora to near Redfish Road. The unit excludes south-facing shoreline at the south end of the island that faces Big Carlos Pass rather than the Gulf. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–27: Marco Island. 245 ha (606 ac) in Collier County. Most of the unit is at the Tigertail Beach County Park. The unit's northern border is on the north side of Big Marco Pass, including Coconut Island and all emerging sand bars. On the south side of Big Marco Pass, the boundary starts at the north boundary of Tigertail Beach County Park and extends to just south of the fourth condominium tower south of the County Park. The placement of the southern boundary assures that the unit includes all of Sand Dollar Island, the changeable sandbar off Tigertail Beach. The western boundary includes all the sand bars in Big Marco Pass but excludes Hideaway Beach. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–28: Marquesas Keys. 2,937 ha (7,256 ac) in Monroe County. The unit comprises the roughly circular atoll that encloses Mooney Harbor, including Gull Keys and Mooney Harbor Key. The entire unit is within Key West National Wildlife Refuge. It includes land from MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur.

Unit FL–29: Boca Grande/Woman/ Ballast Keys. 56 ha (138 ac) in Monroe County. These Keys are east of the Marquesas Keys and west of Key West. Boca Grande and Woman Keys are within Key West National Wildlife Refuge. Ballast Key is privately owned. This unit consists only of sandy beaches and flats between the MLLW and to where densely vegetated habitat or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–30: Bahia Honda/Ohio Keys. 372 ha (918 ac) in Monroe County. This unit comprises Bahia Honda Key (including a small island off its southwest shore), which is almost entirely owned by Bahia Honda State Park, plus Ohio Key, which is privately owned. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–31: Lower Matecumbe Key. 19 ha (48 ac) in Monroe County. Part of the unit is at Anne's Beach park, an Islamorada village park. The remaining parts are at Sunset Drive (Lower Matecumbe Beach) and at Costa Bravo Drive (Port Antiqua Homeowners Beach) on the Florida Bay side of the island. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–32: Sandy Key/Carl Ross Key. 67 ha (165 ac) in Monroe County. This unit consists of two adjoining islands in Florida Bay, roughly south of Flamingo in Everglades National Park. The entire area is owned and managed by the National Park Service. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–33: St. Lucie Inlet. 114 ha (282 ac) in Martin County. The unit includes a small area south of the jetty on the north shore of St. Lucie Inlet, from the jetty west 0.42 km (0.26 mi). While the two sides of the inlet are privately owned, the great majority of the unit is on public land in the Saint Lucie Inlet State Preserve, administered by Jonathan Dickinson State Park. It begins on the sandy shoreline south of Saint Lucie Inlet and extends along the Atlantic Ocean shoreline 2.6 km (1.6 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. The unit does not include sandbars within the inlet.

Unit FL–34: Ponce de Leon Inlet. 68 ha (168 ac) in Volusia County. The majority of the unit is within Smyrna Dunes Park and Lighthouse Point Park. This unit includes shoreline extending from the jetty north of Ponce de Leon Inlet west to the Halifax River and Inlet junction. It includes shoreline south of Ponce de Leon Inlet from the inlet and Halifax River junction, extending east and south along the Atlantic Ocean shoreline 1.2 km (.70 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–35: Nassau Sound-Huguenot. 950 ha (2347 ac) in Duval County. The majority of the unit is within Big Talbot Island State Park, Little Talbot Island State Park, and the Timucuan Ecological and Historical Preserve. This unit includes all emergent shoals and shoreline east of Nassau River bridge and extends to the inlet of the St. John’s River. Amelia Island and the northern 2.7 km (1.7 mi) shoreline along Talbot Island are not included. It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur.

Unit FL–36: Tiger Islands. 53 ha (130 ac) in Nassau County. This unit is privately owned. This unit extends from the mouth of Tiger Creek and runs north along Tiger Island 0.8 km (0.5 mi) and south along Little Tiger Island 1.4 km (0.9 mi). It includes land from MLLW to where densely vegetated habitat (including grass or lawns) or developed structures, not used by the piping plover, begin and where the constituent elements no longer occur. Emerging sandbars to MLLW are also included.

Unit AL–1: Isle Aux Herbes. 227 ha (561 ac) in Mobile County. This unit includes the entire Isle Aux Herbes island where primary constituent elements occur to MLLW and is State owned.

Unit AL–2: Dauphin, Little Dauphin, and Pelican Islands. 880 ha (2,174 ac) in Mobile County. This unit includes all of Dauphin Island where primary constituent elements occur from St. Stephens Street approximately 17.6 km (10.9 mi) west to the western tip of the island to MLLW and all of Little Dauphin and Pelican Islands to MLLW. The area is mostly privately owned but includes State and Federal lands.

Unit AL–3: Fort Morgan. 67 ha (166 ac) in Baldwin County. This area includes Mobile Bay and Gulf of Mexico shorelines within Bon Secour National Wildlife Refuge, Fort Morgan Unit. This unit extends from the west side of the pier on the northwest point of the peninsula, following the shoreline approximately 2.8 km (1.74 mi) southwest around the tip of the peninsula, then east to the terminus of the beach access road and is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The area is State-owned but is leased by the Federal Government.

Unit MS–1: Lakeshore through Bay St. Louis. 41 ha (101 ac) in Hancock County. This unit extends from the north side of Bryan Bayou outlet and includes the shore of the Mississippi Sound following the shoreline northeast approximately 15.0 km (9.3 mi) and ending at the southeast side of the Bay Waveland Yacht Club. The landward boundary of this unit follows the Gulf side of South and North Beach Boulevard and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–2: Henderson Point. 34 ha (84 ac) in Harrison County. This unit extends from 0.2 km (0.12 mi) west of the intersection of 3rd Avenue and Front Street and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Pass Christian Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–3: Pass Christian. 77 ha (190 ac) in Harrison County. This unit extends from the east side of Pass Christian Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 10.5 km (6.5 mi) to the west side of Long Beach Pier and Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–4: Long Beach. 38 ha (94 ac) in Harrison County. This unit extends from the east side of Long Beach Pier and Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Gulfport Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–5: Gulfport. 39 ha (96 ac) in Harrison County. This unit extends from the east side of Gulfport Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.8 km (3.0 mi) to the west side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–6: Mississippi City. 62 ha (153 ac) in Harrison County. This unit extends from the east side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS, and includes the shore of the Mississippi Sound following the shoreline northeast approximately 7.9 km (4.9 mi) to the west side of President Casino. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–10: Ocean Springs West. 11 ha (27 ac) in Jackson County. This unit extends from U.S. 90 and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.9 km (1.2 mi) to the Ocean Springs Harbor inlet. The landward boundary of this unit follows the Bay side of Front Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Unit MS–11: Ocean Springs East. 7 ha (17 ac) in Jackson County. This unit extends from the east side of Weeks Bayou and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.8 km (1.1 mi) to Halstead Bayou. The landward boundary of this unit follows the Bay side of East Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is

privately owned.

Unit MS–12: Deer Island. 194 ha (479 ac) in Harrison County. This unit includes all of Deer Island, where primary constituent elements occur to the MLWW . Deer Island is privately owned.

Unit MS–13: Round Island. 27 ha (67 ac) in Jackson County. This unit includes all of Round Island to the MLWW and is privately owned.

Unit MS–14: Mississippi Barrier Islands. 3,168 ha (7,828 ac) in Harrison and Jackson Counties. This unit includes all of Cat, East and West Ship, Horn, Spoil, and Petit Bois Islands where primary constituent elements occur to MLLW. Cat Island is privately owned, and the remaining islands are part of the Gulf Islands National Seashore.

Unit MS–15: North and South Rigolets. 159 ha (393 ac) in Jackson County, MS, and 12 ha (30 ac) in Mobile County, AL. This unit extends from the southwestern tip of South Rigolets Island and includes the shore of Point Aux Chenes Bay, the Mississippi Sound, and Grand Bay following the shoreline east around the western tip, then north to the south side of South Rigolets Bayou; then from the north side of South Rigolets Bayou (the southeastern corner of North Rigolets Island) north to the northeastern most point of North Rigolets Island. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Approximately 4.4 km (2.7 mi) are in Mississippi and 2.9 km (1.8 mi) are in Alabama. Almost half the Mississippi shoreline length is in the Grand Bay National Wildlife Refuge.

Unit LA–1: Texas/Louisiana border to Cheniere au Tigre. 2,650 ha (6,548 ac) in Cameron and Vermilion Parishes. This unit extends from the east side of Sabine Pass (Texas/Louisiana border) and includes the shore of the Gulf of Mexico from the MLLW following the shoreline east 25.7 km (16.0 mi) to the west end of Constance Beach [approximately 2 km (1.2 mi) east of the intersection of Parish Road 528 and the beach]; it extends from the east end of the town of Holly Beach [0.25 km (0.16 mi) east of the intersection of Baritarick Boulevard and the beach] following the shoreline approximately 97 km (60.3 mi) east to the eastern boundary line of Rockefeller Wildlife Refuge [3.4 km (2.1 mi) east of Rollover Bayou]; and it extends from the east side of Freshwater Bayou Canal following the shoreline east for approximately 15 km (9.3 mi) to 1.3 km (0.81 mi) east of where the boundary of Paul J. Rainey Wildlife Sanctuary (National Audubon Society) meets the shoreline. All three sections of this unit include the land from the seaward boundary of MLLW to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The shoreline in this unit is both state and privately owned.

Unit LA–2: Atchafalaya River Delta. 921 ha (2,276 ac) in St. Mary Parish, LA. This unit is located in the eastern portion of the State-owned Atchafalaya Delta Wildlife Management Area (WMA) and includes all exposed land and islands where primary constituent elements occur east and southeast of the main navigation channel of the Atchafalaya River to the MLLW. The islands located south and southeast of the deltaic splay, Donna, T-Pat, and Skimmer Islands and the un-named bird island, are also included in this unit. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–3: Point Au Fer Island. 195 ha (482 ac) in Terrebonne Parish. This unit includes the entire small island at the northwest tip of Point Au Fer Island to MLLW, then extends from the northwest tip of Point Au Fer Island following the shoreline southeast approximately 7.7 km (4.8 mi) to the point where the un-named oil and gas canal extending southeast from Locust Bayou meets the shoreline [0.8 km (0.5 mi) southeast from Locust Bayou]. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. This entire unit is privately owned.

Unit LA–4: Isles Dernieres. 795 ha (1,964 ac) in Terrebonne Parish. This unit includes the State-owned Isles Dernieres chain, including Raccoon, Whiskey, Trinity and East Islands. This unit includes the entire islands where primary constituent elements occur to the MLLW.

Unit LA–5: Timbalier Island to East Grand Terre Island. 2,321 ha (5,735 ac) in Terrebonne, Lafourche, Jefferson, and Plaquemines Parishes. This unit includes: all of Timbalier Island where primary constituent elements occur to the MLLW, all of Belle Pass West [the ‘‘peninsula’’ extending north/northwest approximately 4.8 km (3.0 mi) from the west side of Belle Pass] where primary constituent elements occur to MLLW; the Gulf shoreline extending approximately 11 km (6.8 mi) east from the east side of Belle Pass bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; all of Elmers Island peninsula where primary constituent elements occur to MLLW and the Gulf shoreline from Elmers Island to approximately 0.9 km (0.56 mi) west of Bayou Thunder Von Tranc bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur; the Gulf shoreline of Grand Isle from the Gulf side of the hurricane protection levee to MLLW; and all of East Grand Terre Island where primary constituent elements occur to the MLLW.

Unit LA–6: Mississippi River Delta. 105 ha (259 ac) in Plaquemines Parish, LA. This unit is part of the State-owned Pass a Loutre Wildlife Management Area and includes un-named sand (spoil) islands off South Pass of the Mississippi River near Port Eads. The entire islands to MLLW are included in this unit.

Unit LA–7: Breton Islands and Chandeleur Island Chain. 3,116 ha (7,700 ac) in Plaquemines and St. Bernard Parishes, LA. This unit includes Breton, Grand Gosier, and Curlew Islands and the Chandeleur Island chain. Those islands are part of the Breton National Wildlife Refuge or are state owned. The entire islands where primary constituent elements occur to MLLW are included in this unit.

Unit TX–1: South Bay and Boca Chica. 2,920 ha (7,217 ac) in Cameron County. The boundaries of the unit are: starting at the Loma Ochoa, following the Brownsville Ship Channel to the northeast out into the Gulf of Mexico to MLLW, then south along a line describing MLLW to the mouth of the Rio Grande, proceeding up the Rio Grande to Loma de Las Vacas, then from that point along a straight line north to Loma Ochoa. The unit does not include densely vegetated habitat within those boundaries. It includes wind tidal flats that are infrequently inundated by seasonal winds, and includes the tidal flats area known as South Bay. Beaches within the unit reach from the mouth of the Rio Grande northward to Brazos Santiago Pass, south of South Padre Island. The southern and western boundaries follow the change in habitat from wind tidal flat, preferred by the piping plover, to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include areas used for roosting by the piping plover. Portions of this unit are owned and managed by the Lower Rio Grande Valley National Wildlife Refuge, the South Bay Coastal Preserve, Boca Chica State Park, and private citizens.

Unit TX–2: Queen Isabella Causeway. 2 ha (6 ac) in Cameron County. The area extends along the Laguna Madre west of the city of South Padre Island. The southern boundary is the Queen Isabella State Fishing Pier, and the northern boundary is at the shoreline due west of the end of Sunny Isles Street. The Queen Isabella causeway bisects this shore but is not included within critical habitat. The eastern boundary is the where developed areas and/or dense vegetation begins, and the western boundary is MLLW. This unit contains lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–5: Upper Laguna Madre. 436 ha (1,076 ac) in Kleberg County. The southern boundary is the northern boundary of PAIS, and the northern boundary is the Kleberg/Nueces County line. The eastern boundary is the line where dense vegetation begins, and the western boundary is MLLW. This unit includes a series of small flats along the bayside of Padre Island in the Upper Laguna Madre. It includes wind tidal flats and sparsely-vegtated upland areas used for roosting by the piping plover. These boundaries receive heavy use by large numbers of shorebirds, including piping plovers. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur, and include upland areas used for roosting by the piping plover.

Unit TX–6: Mollie Beattie Coastal Habitat. 241 ha (596 ac) in Nueces County. This unit will be described as two subunits: (1) Subunit is bounded on the north by Beach Access Road 3, on the east by the inland boundary of critical habitat Unit TX–7, on the south by Zahn road, and on the west by Zahn Road. (2) The subunit is bounded on the north by Corpus Christi Pass, on the east by US 361, on the south by the north side of Packery Channel, and on the west by the Gulf Intercoastal Watersay. Some of the uplands are privately owned and the remaining are owned and managed by the TGLO. This unit includes two hurricane washover passes known as Newport and Corpus Christi Passes, and wind tidal flats that are infrequently inundated by seasonal winds. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover.

Unit TX–11: Blind Oso. 2 ha (5 ac) in Nueces County. This unit is the flats of the Blind Oso, part of Oso Bay, from Hans and Pat Suter Wildlife Refuge (owned and managed by the City of Corpus Christi) northeast to Corpus Christi Bay and then southeast along the edge of Texas A&M University—Corpus Christi. The landward boundaries extend to where densely vegetated habitat, not used by the piping plover, begins, and extends out from the landward boundaries to MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–12: Adjacent to Naval Air Station-Corpus Christi. 2 ha (6 ac) in Nueces County. This unit is along the shore of Oso Bay on flats bordered by Naval Air Station-Corpus Christi and Texas Spur 3 to a point 2.5 km (1.5 mi) south of the bridge between Ward Island and the Naval Air Station. The landward boundary is the line where dense vegetation begins, and the boundary in the Bay is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–13: Sunset Lake. 176 ha (435 ac) in San Patricio County. This unit is triangle shaped, with State Highway 181 as the northwest boundary, and the limits of the City of Portland as the northeast boundary. The shore on Corpus Christi Bay is the third side of the triangle, with the actual boundary being MLLW off this shore. This unit is a large basin with a series of tidal ponds, sand spits and wind tidal flats. This unit is owned and managed by the City of Portland within a system of city parks. Some of the described area falls within the jurisdiction of the TGLO. It includes two city park units referred to as Indian Point and Sunset Lake. Much of the unit is a recent acquisition by the city, and management considerations for the park include the area's importance as a site for wintering and resident shorebirds. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–17: Allyn's Bight. 5 ha (14 ac) in Aransas County. This unit includes shoreline of San Jose Island on Aransas Bay from Allyn's Bight to Blind Pass, the channel between San Jose Island and Mud Island. The inland boundary is where the line of dense vegetation begins, and the bay-ward boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–20: Ayers Point. 397 ha (982 ac) in Calhoun County. This unit is an unnamed lake on Matagorda Island between Shell Reef Bayou and Big Brundrett Lake, with San Antonio Bay to the north. The unit boundary extends landward from the lake to the line where dense vegetation begins and where the constituent elements no longer occur and includes upland areas used for roosting by the piping plover. This unit includes marsh and flats at Ayers Point on Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–21: Panther Point to Pringle Lake. 863 ha (2,133 ac) in Calhoun County. This unit represents a narrow band of bayside habitats on Matagorda Island from Panther Point to the northeast end of Pringle Lake. The landward boundary is the line indicating where dense vegetation begins, and the bayward boundary is MLLW. The unit is entirely within Matagorda Island National Wildlife Refuge. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–24: West Matagorda Bay/ Western Peninsula Flats. 756 ha (1,868 ac) in Matagorda County. This unit extends along the bayside of Matagorda Peninsula from 7.5 southwest of Greens Bayou to 2.5 km (1.6 mi) northwest of Greens Bayou. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–25: West Matagorda Bay/ Eastern Peninsula Flats. 232 ha (575 ac) in Matagorda County. This unit follows the bayside of Matagorda Peninsula from Maverick Slough southwest for 5 km (3 mi). The unit begins at Maverick Slough to the northeast and extends 5 km (3 mi) to the southwest, enclosing a series of flats along Matagorda Bay. The upland areas extend to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur and include upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–26: Colorado River Diversion Delta. 5 ha (13 ac) in Matagorda County. This unit consists follows the shore of the extreme eastern northeast corner of West Matagorda Bay from Culver Cut to Dog Island Reef. The southeastern tidally emergent portion of Dog Island Reef is included within the unit. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The upland areas includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–29: Brown Cedar Cut. 119 ha (294 ac) in Matagorda County. This unit extends 2 km (1.2 m.) both southwest and northeast of the main channel of Brown Cedar Cut along the bayside of Matagorda Peninsula in East Matagorda Bay, and abuts unit TX–28 to the southeast. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. The eastern boundary of TX–29 follows the change in habitat from mud flats preferred by the piping plover, to slightly vegetated dune system adjacent to TX–28. This unit includes upland areas used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–30: Northeast Corner East Matagorda Bay. 120 ha (297 ac) in Matagorda County. This is a unit bounded on the north by the Gulf Intercoastal Waterway, on the east by the northeast limit of Matagorda bay up the line where dense vegetation begins, on the south by the boundary of Unit TX–28, and on the west by MLLW. It is a system of flats associated with tidal channels. This unit includes upland areas used for roosting by the piping plover and lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–34: San Luis Pass. 110 ha (272 ac) near the Brazoria/Galveston County line. This unit extends along the Gulf side of Galveston Island from San Luis Pass to the cite of the former town of Red Fish Cove (USGS 1:24,000 map, San Luis Pass, Texas; 1963, photorevision 1974). The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. Approximately 57 percent of the unit includes flats in the floodtide delta that are State-owned and managed by the TGLO. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–35: Big Reef. 47 ha (117 ac) in Galveston County. This unit consists of beach and sand flats on the north, west, and east shore of Big Reef, down to MLLW. South Jetty is not included. The area is currently managed by the City of Galveston. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–36: Bolivar Flats. 160 ha (395 ac) in Galveston County. This unit extends from the jetties on the southwest end of the Bolivar Peninsula to a point on the Gulf beach 1 km (0.6 mi) north of Beacon Bayou. It includes 5.0 km (3 mi) of Gulf shoreline. The landward boundary is the line indicating the beginning of dense vegetation, and the gulfside boundary is MLLW. The area is leased from TGLO by Houston Audubon Society and managed for its important avian resources. The upland areas are used for roosting by the piping plover. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Unit TX–37: Rollover Pass. 6 ha (16 ac) in Galveston County. This unit consists of Rollover Bay on the bayside of Bolivar Peninsula. The landward boundary is the line indicating the beginning of dense vegetation, and the bayside boundary is MLLW. It includes flats on State-owned land managed by the TGLO. This unit captures the intertidal complex of the bay, and is bounded by the towns of Gilchrist to the east and the Gulf beach of the Bolivar Peninsula to the south. This unit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Primary Constituent Elements/Physical or Biological Features

Wintering piping plover’s PCEs are the habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The primary constituent elements are:

(1) Intertidal sand beaches (including sand flats) or mud flats (between the MLLW and annual high tide) with no, or very sparse, emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.

(2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather.

(3) Surf-cast algae for feeding.

(4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.

(5) Spits, especially sand, running into water used for foraging and roosting.

(6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water.

(7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.

(8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites).

See above.
See above.

Special Management Considerations or Protections

Examples of actions that have effects on wintering piping plover habitats include, but are not limited to: (1) Disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; (2) Predation, especially by falcons, hawks, coyotes, bobcats and feral cats; (3) Beach maintenance (e.g., nourishment (adding sand) and cleaning) and stabilization efforts (e.g., construction of jetties and other hard structures). (4) Oil and other hazardous materials spills and cleanup; (5) Discharge of freshwater from oil and gas activities; (6) Construction of dwellings, roads, marinas, and other structures, and associated activities including staging of materials and equipment; and/or (7) Dredging and dredge spoil placement, and associated activities including staging of equipment and materials. As described in more detail in the unit descriptions, the PCEs within each unit may require special management considerations or protection due to threats to the wintering population of the piping plover or its habitat.

Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on the effective date of the rule.

See above.

Life History

Feeding Narrative

Adult: Lott et al. (2009) identified bay beaches (bay shorelines as opposed to ocean-facing beaches) as the most common landform used by foraging piping plovers in southwest Florida. In northwest Florida, however, Smith (2007) reported landform use by foraging piping plovers about equally divided between Gulf (ocean-facing) and bay beaches. Exposed intertidal areas were the dominant foraging substrate in South Carolina (accounting for 94% of observed foraging piping plovers; Maddock et al. 2009) and in northwest Florida (96% of foraging observations; Smith 2007). In southwest Florida, Lott et al. (2009) found approximately 75% of foraging piping plovers on intertidal substrates. Majka and Shaffer (2008) found a preponderance of prey species in the 3.2-5.0 mm size range in fecal samples of piping plovers breeding in Quebec. They also noted high prevalence of one beetle species, Bledius opaculus, which feeds on algae from sand- and mud-flats (USFWS, 2009). Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks (Zonick and Ryan 1996, p. 26), which they peck from on top or just beneath the surface of moist or wet sand, mud, or fine shell (USFWS, 2009b). Feeding activities of both adults and chicks may occur during all hours of the day and night (Burger 1994) and at all stages in the tidal cycle (Goldin 1993b, Hoopes 1993). Territorial and agonistic interactions have been observed with other piping plovers and similar-sized plover species -- semipalmated and snowy plovers (Johnson and Baldassarre 1988, Zonick and Ryan 1993) (USFWS, 1996).

Reproduction Narrative

Adult: Overall productivity for the Atlantic Coast population 1989-2006 was 1.35 chicks fledged per pair (annual range = 1.16-1.54) (USFWS, 2009). Piping plovers nest above the high tide line on coastal beaches, sandllats atthe ends ofsandspits and barrier islands, gently slopingforedunes, blowout areas behind primary dunes, sparsely vegetated dunes, and washover areas cutinto or between dunes. Nests are usually found in areaswith little or no vegetation although, on occasion, piping plovers willnest under stands of American beachgrass (Ammophila breviligulata) or other vegetation (Patterson 1988, Flemming et at. 1990, Maclvor 1990). Piping plovers have been observed as early as February 24 in Virginia (Cross 1991), March 11 in New York (Goldin 1990), March 15 in Massachusetts (Maclvor 1990), and March 28 in Nova Scotia (Mills 1976, cited in Cairns 1977). By early April, males begin to establish territories (Patterson 1988, Maclvor 1990, Cross 1991), which they defend aggressivelyagainst adjacent males by performing “horizontal threat,” ~parallelrun,” and aerial displays, characterized by Caims (1982). Piping plovers are monogamous, but usually shiftmates between years (Wilcox

1959, Haig and Oring 1988c,Maclvor 1990) and, less frequently,between nesting attempts in a given year(Haig and Oring 1 988c, Macivor 1990, Strauss 1990). Plovers are known to breed atone year of age (Maclvor 1990, Strauss 1990, Haig 1992), but the rate at which this occurs is unknown. Eggs may be present on the beach from mid-April to late July. Clutch initiation dates have been recorded as early as April21 in Virginia (Cross 1991), April 15 in New York (C. Brittingham, TheNature Conservancy, pers. comm. 1994), April 20 in Massachusetts (Maclvor 1990), and April 24 in Nova Scotia (Cairns 1977). Nest initiation appears to be slightly later in Quebec, Prince Edward Island, and on the eastern shoreofNew Brunswick,with a peak ofnest initiation in mid-Mayto early June (Morse 1982, Tull 1984, Shaffer and Laporte 1992). Although nests may be initiated as late asJuly 25, fewnests hatch afterJuly 15, and the latest recorded hatch date isJuly 31 in Massachusetts (Maclvor 1990). Piping plovers generally fledge only a single brood perseason, but may renest several times if previous nests are lost or, infrequently, if a brood is lost within several days ofhatching (Wrenn 1991, Goldin I 994a, Rimmer 1994). Clutch size for an initial nest attempt is usually four eggs, one laid every other day. Full-time incubation usually begins with the completion ofthe clutch, averages 27-30 days, and is shared equally by both sexes(Wilcox 1959, Caims 1977, Maclvor 1990). Chicks remain together with one or both parents until they fledge (are able to fly) at 25 to 35 days of age (USFWS, 1996).

Spatial Arrangements of the Population

Adult: Sparsely distributed (USFWS, 2009); winters in small groups or multi-species flocks (USFWS, 1996)

Site Fidelity

Adult: High (USFWS, 2009)

Habitat Narrative

Adult: New information confirms inter- and intra-annual fidelity of piping plovers to migration and wintering sites as described in the 1996 Atlantic Coast recovery plan. Nonbreeding piping plovers in North Carolina primarily used sound (bay or bayshore) beaches and sound islands for foraging and ocean beaches for roosting, preening, and being alert (Cohen et al. 2008). Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. Atlantic Coast and Florida studies highlighted the importance of inlets for nonbreeding piping plovers. Almost 90% of observations of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers are sparsely distributed across their Atlantic Coast breeding range. A growing body of evidence reinforces information presented in the 1996 revised recovery plan regarding the importance of wide, flat, sparsely-vegetated barrier beach habitats for recovery of Atlantic Coast piping plovers. Such habitats include abundant moist sediments associated with blowouts, washover areas, spits, unstabilized and recently closed inlets, ephemeral pools,and sparsely vegetated dunes (USFWS, 2009). The habitats used by wintering birds include beaches, mud flats (nearly flat areas made up of mud), sand flats (nearly flat areas made up of sand), algal flats (nearly flat areas with a layer of algae growing on a moist mud or sand substrate), and washover passes (areas where breaks in the sand dunes result in an inlet). Wintering plovers are dependent on a mosaic of habitat patches, and move among these patches, depending on local weather and tidal conditions (Drake et al. 2001, pp. 262– 263) (USFWS, 2009b). Plovers wintering on the Atlantic Coast are generally distributed in small groups; six was the average number of piping plovers per site during Nicholls' 1986-87 survey (Nicholls 1989). Piping plovers also appear to roost in multi-species flocks (Nicholls and Baldassarre 1990b, Zonick and Ryan 1993), but are often found in a tight cluster on the fringes of a flock (J. Nicholls, U.S. Fish and Wildlife Service, pers. obs.) (USFWS, 1996).

Dispersal/Migration

Motility/Mobility

Adult: High (USFWS, 2009)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory (USFWS, 2009)

Dispersal

Adult: High (USFWS, 2009)

Dispersal/Migration Narrative

Adult: In general, distance between stopover locations and duration of stopovers throughout the coastal migration range remain poorly understood. Piping plovers migrate through and winter in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico and the Caribbean (USFWS, 2009). Northward migration to the breeding grounds occurs during late February, March and early April, and southward migration to the wintering grounds extends from late July, August, and September. Both spring and fall migration routes are believed to follow a narrow strip along the Atlantic Coast (USFWS, 1996).

Additional Life History Information

Adult: Migrates to breeding grounds February - April; migrates to wintering grounds July - September (USFWS, 1996)

Population Information and Trends

Population Trends:

Increasing (USFWS, 2009)

Number of Populations:

4 (inferred from USFWS, 2009)

Population Size:

~1,849 pairs (USFWS, 2009). As of the last census taken in 2011, a preliminary total of 2858 piping plovers were counted during mid-winter counts in VA, NC, SC, GA, FL, AL, MS, LA, TX and Puerto Rico combined. (Table 1, USFWS 2015). 2,593 breeding pairs in 2023 (USFWS, 2025)

Minimum Viable Population Size:

2,000 breeding pairs (See delisting citerion 1)

Resistance to Disease:

High (see threats)

Additional Population-level Information:

Populations are sensitive to individual survival (USFWS, 2009)

Population Narrative:

The most consistent finding in the various population viability analyses (PVAs) conducted for piping plovers (Ryan et al. 1993, Melvin and Gibbs 1996, Plissner and Haig 2000, Wemmer et al. 2001, Larson et al. 2002, Calvert et al. 2006, Brault 2007) is the sensitivity of extinction risk to even small declines in adult and/or juvenile survival rates. Progress towards recovery, attained primarily through intensive protections to increase productivity on the breeding grounds, would be quickly slowed or reversed by even small sustained decreases in survival rates during migration and wintering. The New England recovery unit population has exceeded (or been within three pairs of) its 625-pair abundance goal since 1998, attaining a post-listing high of 711 pairs in 2008. The New York-New Jersey recovery unit reached 586 pairs in 2007, surpassing its 575-pair goal for the first time; in 2008, however, abundance dipped to 554 pairs. The Southern recovery unit, which attained 333 pairs in 2007 and 331 pairs in 2008, has not yet reached its 400-pair goal. Southern recovery unit population growth between 2003 and 2007 is encouraging. The Eastern Canada recovery unit has experienced the lowest population growth (9% net increase between 1989 and 2008), despite higher overall productivity than in the U.S. (see discussion under criterion 3, below). The highest post-listing abundance estimate was 274 pairs in 2002, and the 2008 estimate was 253 pairs, placing this recovery unit furthest from its goal (400 pairs). Average microsatellite heterozygosity and mitochondrial control region nucleotide diversity of Atlantic Coast piping plovers and lack of evidence of recent genetic bottlenecks indicate that current genetic risks are low (Miller et al. 2009). Since its 1986 listing, the Atlantic Coast piping plover population estimate has increased 234%, from approximately 790 pairs to an estimated 1,849 pairs in 2008, and the U.S. portion of the population has almost tripled, from approximately 550 pairs to an estimated 1,596 pairs (USFWS, 2009). Since 2018 (the last estimate that was available for the 2020 5-year review), the total Atlantic Coast piping plover population estimate increased 38 percent, from 1,87813 pairs to 2,593 pairs in 2023. However, overall population growth was tempered by pronounced geographic variability with 68 percent growth in the New England recovery unit between 2018 and 2023, 30 percent in New York-New Jersey, and 4 percent in Eastern Canada. Breeding abundance in the Southern recovery unit decreased 21 percent between 2018 and 2023, (USFWS, 2025)

Threats and Stressors

Stressor: Shoreline development/construction (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The 1985 final rule stated that the number of piping plovers on the Gulf of Mexico coastal wintering grounds may be declining as indicated by preliminary analysis of Christmas Bird Count data. Independent counts of piping plovers on the Alabama coast indicated a decline in numbers between the 1950s and early 1980s. At the time of listing the Texas Parks and Wildlife Department stated that 30% of wintering habitat in Texas had been lost over the previous 20 years. The final rule also stated that in addition to extensive breeding area problems, the loss and modification of wintering habitat was a significant threat to the piping plover. The three recovery plans stated that shoreline development throughout the wintering range poses a threat to all populations of piping plovers. The plans further stated that beach maintenance and nourishment, inlet dredging, and artificial structures, such as jetties and groins, can eliminate

wintering areas and alter sedimentation patterns leading to the loss of nearby habitat. Structural development along the shoreline or manipulation of natural inlets upsets the dynamic processes and results in habitat loss or degradation (Melvin et al. 1991). Throughout the range of migrating and wintering piping plovers, inlet and shoreline stabilization, inlet dredging, beach maintenance and nourishment activities, and seawall installations continue to constrain natural coastal processes. Dredging of inlets can affect spit formation adjacent to inlets and directly remove or affect ebb and flood tidal shoal formation. Jetties, which stabilize an island, cause island widening and subsequent growth of vegetation on inlet shores. Seawalls restrict natural island movement and exacerbate erosion. Construction of these projects during months when piping plovers are present also causes disturbance that disrupts the birds' foraging efficiency and hinders their ability to build fat reserves over the winter and in preparation for migration, as well as their recuperation from migratory flights. Continual degradation and loss of habitats used by wintering and migrating shorebirds may cause an increase in intra-specific and interspecific competition for remaining food supplies and roosting habitats (USFWS, 2009). As of 2015, In summary, approximately 40 percent of the sandy beach shoreline in the migration and wintering range is already developed, while 43 percent is largely preserved. This means, however, that the remaining 17 percent of shoreline habitat (that which is currently undeveloped but not preserved) is susceptible to future loss to development and the attendant threats from shoreline stabilization activities. The entire coastline is susceptible to sea level rise. As of 2015, forty-four percent of the tidal inlets within the U.S. wintering range of the piping plover have been or continue to be dredged, primarily for navigational purposes (Table 3). States where more than two-thirds of inlets have been dredged include Alabama (three of four), Mississippi (four of six), North Carolina (16 of 20), and Texas (13 of 18), and 16 of 21 along the Florida Atlantic coast. Dredging can occur on an annual basis or every two to three years, resulting in continual perturbations and modifications to inlet and adjacent shoreline habitat. The volumes of sediment removed can be major, with 2.2 million cubic yards (mcy) (1.7 million cubic meters (mcm)) of sediment removed on average every 1.9 years from the Galveston Bay Entrance (Texas) and 3.6 mcy (2.8 mcm) of sediment removed from Sabine Pass (Texas) on average every 1.4 years (USACE 1992). Rice (2012a) found that the ebb shoal complexes of at least 20 inlets within the wintering range of the piping plover have been mined for beach fill. the removal of sediment from inlet complexes via dredging and sand mining for beach fill has modified nearly half of the tidal inlets within the continental wintering range of the piping plover, leading to habitat loss and degradation. Many of these inlet habitat modifications have become permanent, existing for over 100 years. The expansion of several harbors and ports to accommodate deeper draft ships poses an increasing threat as more sediment is removed from the inlet system, causing larger perturbations and longer recovery times; maintenance dredging conducted annually or every few years may prevent full recovery of the inlet system. Rice found that, as of 2011, an estimated 54 percent of 221 mainland or barrier island tidal inlets in the U.S continental wintering range of the piping plover had been modified by some form of hardened structure, dredging, relocation, mining, or artificial opening or closure (Table 3). On the Atlantic Coast, 43 percent of the inlets have been stabilized with hard structures, whereas 37 percent were stabilized on the Gulf Coast. The Atlantic coast of Florida has 17 stabilized inlets adjacent to each other, extending between the St. John's River in Duval County and Norris Cut in Miami-Dade County, a distance of 341 miles. A shorebird would have to fly nearly 344 miles to find the next unstabilized inlet along this stretch of coast. Although less permanent than construction of hard structures, the effects of inlet relocation can persist for years. For example, December-January surveys documented a continuing decline in wintering plover numbers from 20 birds pre-project (2005-2006) to three birds during the 2009 - 2011 seasons (SCDNR 2011). Subsequent decline in the wintering population on Kiawah is strongly correlated with the decline in polychaete worm densities, suggesting that plovers emigrated to other sites as foraging opportunities in these habitats became less profitable (SCDNR 2011). At least eight inlets in the migration and wintering range have been relocated; a new inlet was cut and the old inlet was closed with fill. In other cases, inlets have been relocated without the old channels being artificially filled The artificial opening and closing of inlets typically creates very different habitats from those found at inlets that open or close naturally (Rice 2012a). Rice (2012a) found that 30 inlets have been artificially created within the migration and wintering range of the piping plover, including 10 of the 21 inlets along the eastern Florida coast (Table 3). These artificially created inlets tend to need hard structures to remain open or stable, with 20 of the 30 (67 percent) of them having hard structures at present. An even higher number of inlets (64) have been artificially closed, the majority in Louisiana (Table 3). One inlet in Texas was closed as part of the Ixtoc oil spill response efforts in 1979. Thirty-two inlets were closed as part of Deepwater Horizon oil spill response efforts in 2010-2011. Of the latter, 29 were in Louisiana, two in Alabama and one in Florida. To date only one of these inlets, West (Little Lagoon) Pass in Gulf Shores, Alabama, has been reopened, and the rest remain closed with no plans to reopen any of those identified by Rice (2012a). Three groins were built in South Carolina between 2006 and 2013, bringing the statewide total to 165 oceanfront groins (SC DHEC 2010; USFWS 2013). Eleven new groins were built in Florida between 2000 and 2009. The Texas coast is armored with nearly 37 miles of seawalls, bulkheads and revetments, the mainland Mississippi coast has over 45 miles of armoring, the Florida Atlantic coast has at least 58 miles, and the Florida Gulf coast over 59 miles (Rice 2012b). Shoreline armoring has modified plover beachfront habitat in all states, but Alabama (4.7 miles), Georgia (10.5 miles) and Louisiana (15.9 miles) have the fewest miles of armored beaches. Lott (2009) found a strong negative correlation between ocean shoreline sand placement projects and the presence of piping and snowy plovers in the Panhandle and southwest Gulf Coast regions of Florida11. (11 Lott (2009) noted that sand placement projects may directly degrade plover habitat, but they may also correlate with high human density, where disturbance is higher.) The beaches along the mainland coast of Mississippi are the most modified by sand placement activities with at least 85 percent affected (Table 4). Of the oceanfront beaches, the Atlantic coast of Florida has had the highest proportion (at least 51 percent) of beaches modified by sand placement activities. Approximately 47 percent of Florida's sandy beach coastline has received sand placement of some type, with many areas receiving fill multiple times from dredge disposal, emergency berms, beach nourishment, dune restoration and other modifications (Rice 2012b). (USFWS, 2015). The quality and quantity of the macroinvertebrate prey base is threatened by shoreline stabilization activities, including the approximately 685 miles of beaches that have received sand placement of various types. The addition of dredged sediment can temporarily affect the benthic fauna of intertidal systems. Invertebrates may be crushed or buried during project construction. Although some benthic species can burrow through a thin layer of additional sediment (38-89 cm for different species), thicker layers (i.e., >1 meter) are likely to smother these sensitive benthic organisms (Greene 2002). Numerous studies of such effects indicate that the recovery of benthic fauna after beach nourishment or sediment placement projects can take anywhere from six months to two years, and possibly longer in extreme cases (Thrush et al. 1996; Peterson et al. 2000; Zajac and Whitlatch 2003; Bishop et al. 2006; Peterson et al. 2006). (USFWS, 2015).

Stressor: Invasive plants (USFWS, 2009)
Exposure:
Response:

Consequence:
Narrative: Like most invasive species, coastal exotic plants reproduce and spread quickly and exhibit dense growth habits, often outcompeting native plant species. If left uncontrolled, invasive plants cause a habitat shift from open or sparsely vegetated sand to dense vegetation, resulting in the loss or degradation of piping plover roosting habitat, which is especially important during high tides and migration periods. Beach vitex (Vitex rotundifolia) is a woody vine introduced into the southeastern U.S. as a dune stabilization and ornamental plant (Westbrooks and Madsen 2006). It currently occupies a very small percentage of its potential range in the U.S.; however, it is expected to grow well in coastal communities throughout the southeastern U.S. from Virginia to Florida, and west to Texas (Westbrooks and Madsen 2006). Unquantified amounts of crowfootgrass (Dactyloctenium aegyptium) grow invasively along portions of the Florida coastline. It forms thick bunches or mats that may change the vegetative structure of coastal plant communities and alter shorebird habitat. The Australian pine (Casuarina equisetifolia) changes the vegetative structure of the coastal community in south Florida and islands within the Bahamas (USFWS, 2009).

Stressor: Wrack removal and beach cleaning (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Wrack on beaches and baysides provides important foraging and roosting habitat for piping plovers (Drake 1999, Smith 2007, Maddock et al. 2009, Lott et al. 2009) and many other shorebirds on their winter, breeding, and migration grounds. Man-made beach cleaning and raking machines effectively remove seaweed, fish, glass, syringes, plastic, cans, cigarettes, shells, stone, wood, and virtually any unwanted debris (Barber Beach Cleaning Equipment 2009). These efforts remove accumulated wrack, topographic depressions, and sparse vegetation nodes used by roosting and foraging piping plovers. Removal of wrack also eliminates a beach's natural sand-trapping abilities, further destabilizing the beach. In addition, sand adhering to seaweed and trapped in the cracks and crevices of wrack is removed from the beach. Although the amount of sand lost due to single sweeping actions may be small, it adds up considerably over a period of years (Neal et al. 2007). Currently, the Florida Department of Environmental Protection's Beaches and Coastal Management Systems section has issued 117 permits for beach raking or cleaning to multiple entities. The Service estimates that 240 of 825 miles (29%) of sandy beach shoreline in Florida are cleaned or raked on various schedules, i.e., daily, weekly, monthly (L. Teich, Florida DEP, pers. comm. 2009). USFWS biologists estimate that South Carolina mechanically cleans approximately 34 of its 187 shoreline miles (18%), and Texas mechanically cleans approximately 20 of its 367 shoreline miles (5.4%). The Service is not aware of what percentage of mechanical cleaning occurs in piping plover critical habitat (USFWS, 2009).

Stressor: Disease (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The Department of the Interior has tested 14,261 shorebirds in the families of Charadriidae and Scolopacidae since 2006. Bird species testing positive for low pathogenic avian influenza consist of Pacific golden-plover (1), bar-tailed godwit (3), dunlin (8), marsh sandpiper (1), red knot (1), sanderling (1), sharp-tailed sandpiper (1), and western sandpiper (1) (Acker, pers. comm. 2009). Other laboratories have ongoing shorebird testing, but results were not

available for this review. Although researchers increased vigilance following detection of several cases of West Nile virus in breeding Northern Great Plains piping plovers and Type E botulism in the Great Lakes breeding population, the USFWS is not aware of instances of disease in nonbreeding piping plovers. Based on information available to date, the Service concludes that West Nile virus and avian influenza remain a minor threat to shorebirds, including the piping plover, on their wintering and migration grounds (USFWS, 2009).

Stressor: Predation (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The impact of predation on migrating or wintering piping plovers remains largely undocumented. Avian and mammalian predators are common throughout the species' wintering range. Predatory birds are relatively common during fall and spring migration, and it is possible that raptors occasionally take piping plovers (Drake et al. 2001). The 1996 Atlantic Coast recovery plan summarized evidence that human activities affect types, numbers, and activity patterns of some predators, thereby exacerbating natural predation on breeding piping plovers. Regarding predation, the magnitude of this threat to nonbreeding piping plovers remains unknown, but given the pervasive, persistent, and serious impacts of predation on other coastal reliant species, it remains a potential threat. Focused research to confirm impacts as well as to ascertain effectiveness of predator control programs may be warranted, especially in areas frequented by Great Lakes birds during migration and wintering months. Recent research and reports indicate that predation poses a continuing (and perhaps intensifying threat) to Atlantic Coast piping plovers. Review of egg losses from natural and artificial nests at Breezy Point, New York, found that gulls, crows, and rats were major predators (Lauro and Tanacredi 2002). Free-roaming domestic and feral cats, particularly those associated with humansubsidized feral cat colonies, appear to be an increasing threat to piping plovers. Predation is a pervasive, persistent, and serious threat to breeding Atlantic Coast piping plovers (USFWS, 2009).

Stressor: Inadequacy of existing regulatory mechanisms (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Most state laws focus on direct protection of the birds but not their habitat. Protections for piping plovers migrating and wintering outside the U.S. include the 2005 designation of 1.5 million acres of the Laguna Madre de Tamaulipas region in Mexico as a Federal Natural Protected Area. Any land-use alterations to piping plover habitats within this area are now subject to review under a federal permitting process that encourages avoidance and minimization of impacts; however, it does not preclude alterations. This is similar to the ESA in allowing some adverse effects to designated critical habitat. Enforcement limitations and/or legal insufficiency of regulations to protect important habitat components result in continued degradation of a significant amount of wintering piping plover coastal habitat, including designated critical habitat units, resulting in a cumulative loss of habitat. At the current time, if the protections of the ESA were removed, existing local, state, and other federal regulatory provisions would provide insufficient protection to nonbreeding piping plover habitats used during migration and winter. Enhanced coordination of project review throughout the migration and wintering range could help to streamline consultations and possibly facilitate further reductions in project impacts to the piping plover and its habitat; however, nonbreeding habitat

degradation continues despite ESA protections. Other threats, such as human disturbance, are currently being managed but not eliminated. Lack of reliable funding to maintain annual implementation of intensive management programs constitutes a serious continuing threat to Atlantic Coast piping plovers (USFWS, 2009).

Stressor: Recreational disturbance (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Intense human disturbance in shorebird winter habitat can be functionally equivalent to habitat loss if the disturbance prevents birds from using an area (Goss-Custard et al. 1996), which can lead to roost abandonment and local population declines (Burton et al. 1996). Disturbance, i.e., human and pet presence that alters bird behavior, disrupts piping plovers as well as other shorebird species. Disturbance can cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995, Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000). Off-road vehicles can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The 1996 Atlantic Coast recovery plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993, Goldin 1993). The plan also notes that the magnitude of the threat from off-road vehicles is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance would otherwise be very slight. Godfrey et al. (1980 as cited in Lamont et al. 1997) postulated that vehicular traffic along the beach may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of off-road vehicles negatively correlated with abundance of roosting piping plovers on the ocean beach. Emerging threats include the increasing popularity of "extreme sports," such as kitebuggies and surf kites (also called "kite boards"), which accidentally land in and near breeding habitat. Disturbance by humans and dogs is a continuing widespread and severe threat to Atlantic Coast piping plovers (USFWS, 2009).

Stressor: Military actions (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: To date, five bases have consulted with the USFWS under section 7 of the ESA, on military activities on beaches and baysides that may affect piping plovers or their habitat. Camp Lejeune in North Carolina consulted formally with USFWS in 2002 on troop activities, dune stabilization efforts, and recreational use of Onslow Beach. The permit conditions require twice-monthly piping plover surveys and use of buffer zones and work restrictions within buffer zones. Naval Station Mayport in Duval County, Florida, consulted with USFWS on Marine Corps training activities that included beach exercises and use of amphibious assault vehicles. The area of impact was not considered optimal for piping plovers, and the consultation was concluded informally. Similar informal consultations have occurred with Tyndall Air Force Base (Bay County) and Eglin Air Force Base (Okaloosa and Santa Rosa counties) in northwest Florida. Both consultations dealt occasional use of motorized equipment on the beaches and associated

baysides. Tyndall Air Force Base has minimal on-the-ground use, and activities, when conducted, occur on the Gulf of Mexico beach, which is not considered the optimal area for piping plovers within this region. Eglin Air Force Base conducts twice-monthly surveys for piping plovers, and habitats consistently documented with piping plover use are posted with avoidance requirements to minimize direct disturbance from troop activities. A 2001 consultation with the Navy for training exercises on the beach and retraction operations on Peveto Beach, Cameron Parish, Louisiana, concluded informally. Overall, project avoidance and minimization actions currently reduce threats from military activities to wintering and migrating piping plovers to a minimal threat level (USFWS, 2009).

Stressor: Contaminants and pesticides (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The various piping plover recovery plans identify contaminants, particularly oil spills, as a threat. Contaminants have the potential to cause direct toxicity to individual birds or negatively impact their invertebrate prey base (Rattner and Ackerson 2008). Depending on the type and degree of contact, contaminants can have lethal and sub-lethal effects on birds, including behavioral impairment, deformities, and impaired reproduction (Rand and Petrocelli 1985, Gilbertson et al. 1991, Hoffman et al. 1996). Beach-stranded 55-gallon barrels and smaller containers, which may fall from moving cargo ships or offshore rigs and are not uncommon on the Texas coast, contain primarily oil products (gasoline or diesel), as well as other chemicals such as methanol, paint, organochlorine pesticides, and detergents (C. Lee, USFWS, pers. comm. 2009). The extent to which contaminant levels in piping plovers can be attributed to wintering and migratory stopover sites is unknown. Petroleum products are the contaminants of primary concern, as opportunities exist for petroleum to pollute intertidal habitats that provide foraging substrate. Impacts to piping plovers from oil spills have been documented throughout their life cycle (Chapman 1984; USFWS 1996; Burger 1997; Massachusetts Audubon 2003; Amirault-Langlais et al. 2007; A. Amos, University of Texas, pers. comm. 2009). This threat persists due to the high volume of shipping vessels (from which most documented spills have originated) traveling offshore and within connected bays along the Atlantic Coast and the Gulf of Mexico. Additional risks exist for leaks or spills from offshore oil rigs, associated undersea pipelines, and onshore facilities such as petroleum refineries and petrochemical plants. Chapman (1984) noted shifts in habitat use as piping plovers moved out of spill areas. This behavioral change was believed to be related to the demonstrated decline in benthic infauna (prey items) in the intertidal zone and may have decreased the direct impact to the species. To date, no plover mortality has been attributed to oil contamination outside the breeding grounds, but latent effects would be difficult to prove. Although the risk for impacts from contamination to piping plovers and their habitat is recognized, the safety contingency plans in place alleviate most of these concerns, making contaminants a minor issue at this time. Average concentrations of total polychlorinated biphenyl, dichloro diphenyl dichloroethylene (DDE), and mercury in Atlantic Coast piping plover eggs analyzed since 1990 did not exceed suggested toxicity threshold effect levels, but too few samples were analyzed to adequately characterize contaminant burdens in the population. Although average PCB, DDE, and mercury concentrations were not highly elevated, the maximum reported PCB and mercury concentrations in these composite egg samples were at toxic levels. In 2000, mortality of large numbers of wading birds and shorebirds, including one piping plover, at Audubon's Rookery Bay Sanctuary on Marco Island, Florida, occurred following the county's aerial application of the organophosphate pesticide Fenthion for

mosquito control purposes (Williams 2001). Fenthion, a known toxin to birds, was registered for use as an avicide by Bayer chemical manufacturer. Subsequent to a lawsuit being filed against the Environmental Protection Agency (EPA) in 2002, the manufacturer withdrew Fenthion from the market, and EPA declared all uses were to end by November 30, 2004 (American Bird Conservancy 2007, which also states that all other counties in the U.S. now use less toxic chemicals for mosquito control). With one reported plover death from pesticide use, and with the causative pesticide now removed from use, this threat to piping plovers in the U.S. currently appears low. However, it is unknown whether pesticides are a threat for piping plovers wintering in the Bahamas, other Caribbean countries, or Mexico (USFWS, 2009).

Stressor: Sea level rise (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Over the past 100 years, the globally-averaged sea level has risen approximately 10-25 centimeters (Rahmstorf et al. 2007), a rate that is an order of magnitude greater than that seen in the past several thousand years (Douglas et al. 2001 as cited in Hopkinson et al. 2008). The IPCC suggests that by 2080 sea-level rise could convert as much as 33% of the world's coastal wetlands to open water (IPCC 2007). Although rapid changes in sea level are predicted, estimated time frames and resulting water levels vary due to the uncertainty about global temperature projections and the rate of ice sheets melting and slipping into the ocean (IPCC 2007, CCSP 2008). Low elevations and proximity to the coast make all nonbreeding coastal piping plover foraging and roosting habitats vulnerable to the effects of rising sea level. Mapping by Titus and Richman (2001) showed that more than 80% of the lowest land along the Atlantic and Gulf coasts was in Louisiana, Florida, Texas, and North Carolina, where 73.5% of all wintering piping plovers were tallied during the 2006 International Piping Plover Census (Elliott-Smith et al. 2009). Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat that lies immediately seaward of numerous structures or roads, especially if those shorelines are also armored with hardened structures. Sea-level rise poses a significant threat to all piping plover populations during the migration and wintering portion of their life cycle (USFWS, 2009).

Stressor: Storm events (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Storms can create or enhance piping plover habitat while causing localized losses elsewhere in the wintering and migration range. Available information suggests that some birds may have resiliency to storms and move to unaffected areas without harm, while other reports suggest birds may perish from storm events. Significant concerns include disturbance to piping plovers and habitats during cleanup of debris, and poststorm acceleration of shoreline stabilization activities, which can cause persistent habitat degradation and loss. Storms are a component of the natural processes that form coastal habitats used by migrating and wintering piping plovers, and positive effects of storm-induced overwashand vegetation removal have been noted in portions of the wintering range. The adverse effects on piping plovers attributed to storms are sometimes due to a combination of storms and other environmental changes or human use patterns. Storm-induced adverse effects include post-storm acceleration of human activities such as beach nourishment, sand scraping, and berm and seawall construction. Recent climate change studies indicate a trend toward increasing hurricane numbers and intensity

(Emanuel 2005, Webster et al. 2005). When combined with predicted effects of sea-level rise, there may be increased cumulative impacts from future storms (USFWS, 2009).

Stressor: Banding (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: The only utilization-related threat identified post-listing is that of leg injuries associated with banding for scientific studies. Although injuries have been reported in all breeding populations, 78% of 54 injuries (seen 1985-1989) reviewed by Lingle et al. (1999) involved the Atlantic Coast population. Seventeen apparent band-related injuries, ranging from abrasion to foot loss, were observed from 361 recaptures of banded piping plovers in eastern Canada, 1998-2004. All but two of these injuries were related to the use of novel aluminum bands (Amirault et al. 2006). Since 1989, banding of U.S. Atlantic Coast piping plovers has only been authorized in very limited circumstances (i.e., one study involving a relatively small number of birds, and birds released following treatment to remove oil). Threats to Atlantic Coast piping plovers from band-related injuries are fully regulated by the USFWS and CWS and are, therefore, of low concern (USFWS, 2009).

Stressor: Wind turbines (USFWS, 2009)
Exposure:
Response:
Consequence:
Narrative: Five wind turbine generators have been constructed on Sable Island, Nova Scotia, where migrating piping plovers are occasionally reported (D. Amirault-Langlais pers. comm. 2008c). Two wind turbine projects (one with 16 turbines, the other with ten) are also located near piping plover breeding sites on Prince Edward Island. The only proposed wind turbine generator project reviewed by CWS in Atlantic Canada as of March 2009 that raised concerns about piping plovers is on Cape Sable Island, Nova Scotia; this project has not yet proceeded to construction (A. Boyne, CWS, pers. comm. 2009). The major potential threat to piping plovers posed by wind turbine generators is that of collisions. In the off-shore environment, the primary risk occurs during migration, when routes and flight altitudes are largely unknown. While analysis of the best available information indicates that risk from the Cape Wind project is low (USFWS 2008a), the prospect of multiple large wind turbine generator projects along potential migration routes poses greater concern. Risk from wind turbine generators sited nearshore, on nesting beaches, or in the vicinity of intertidal flats landward of barrier islands or spits has not been assessed. Wind turbine generators pose a threat to piping plovers in the foreseeable future, but the magnitude of this threat cannot be assessed without better information about piping plover movements (USFWS, 2009).

Recovery

Reclassification Criteria:
Not available.

Recovery Priority Number: 2C

Delisting Criteria:

2. Verify the adequacy of a 2,000-pair population of piping plovers to maintain heterozygosity and allelic diversity over the long term (USFWS, 2009).

3. Achieve five-year average productivity of 1.5 fledged chicks per pair in each of the four recovery units described in criterion 1. Data to evaluate progress toward this criterion should be obtained from sites that collectively support at least 90% of the recovery unit's population (USFWS, 2009).

4. Institute long-term agreements among cooperating agencies, landowners, and conservation organizations to assure protection and management sufficient to maintain the target populations in each recovery unit and average productivity specified in criteria 1 and 2 (USFWS, 2009).

5. Ensure long-term maintenance of wintering habitat, sufficient in quantity, quality, and distribution to maintain survival rates for a 2,000-pair population (USFWS, 2009).

1. Increase and maintain for five years a total of 2,000 breeding pairs, distributed among the four recovery units: Atlantic (eastern) Canada - 400 pairs; New England - 625 pairs; New York-New Jersey - 575 pairs; Southern (DE, MD, VA, NC) - 400 pairs (USFWS, 2009).

(6) Criterion #3 from USFWS, 2015, combined 5-year Review: Sufficient habitat is available on the coastal migration and wintering grounds in quantity and quality to support conservation of the species at recovery levels (as defined by Criterion 1). This will include designated Critical Habitat, and additional habitat that was not designated but is regularly used by wintering piping plovers. Piping plovers should be spatially distributed in the following locations. a. Western Gulf Coast- from the Galveston Bay area, west-southwest along the coast of Texas and Mexico); b. Central Gulf Coast- east-northeast of Galveston Bay through Jefferson County in NW Florida; c. Eastern Gulf Coast- Florida's west coast-Taylor County, Florida south to Monroe County; d. Atlantic Coast Florida's east coast, including the Florida Keys up through northeastern North Carolina, Caribbean Islands and the Bahamas Islands. (USFWS, 2015).

(7) Criterion #4 from USFWS, 2015, combined 5-year Review: Ensure commitments are in place and functioning as anticipated to provide long-term funding, protection, and conservation management activities in essential breeding and wintering grounds. a. Southern Rivers (Missouri River system from Fort Randall Dam, South Dakota to Ponca, Nebraska, the Niobrara River, the Loup River system and the Platte River system); b. Northern Rivers (Missouri River system from Fort Peck Lake, Montana to Pierre, South Dakota); c. in U.S. Alkaline Lakes; d. U.S. Wintering Grounds. (USFWS, 2015).

Recovery Actions:

- Monitor and manage wintering and migration areas to maximize survival and recruitment into the breeding population (USFWS, 1996).
- Undertake scientific investigations that will facilitate recovery efforts (USFWS, 1996).
- Develop and implement public information and education programs (USFWS, 1996).
- Review progress towards recovery annually and revise recovery efforts as appropriate (USFWS, 1996).
- Manage breeding piping plovers and habitat to maximize survival and productivity (USFWS, 1996).

- New in 2015: 1W (Wintering Ground Action): Maintain natural coastal processes that perpetuate wintering and coastal migration habitat. 1.1W Protect non-breeding plovers and their habitat from direct and indirect impacts of development.; 1.2W Protect natural processes of inlet formation, migration, and closure.; 1.3W Protect habitat from direct and indirect impacts of shoreline stabilization and sand placement projects.; 1.4W Protect important foraging and roosting habitats.; 1.4.1W Protect and maintain important intertidal habitats including algal flats, sandbars, shoals, and ebb and flow tidal deltas.; 1.4.2W Maintain natural beach habitat and overwash and wrack formation processes.; 1.5W Maintain native vegetation by managing invasive species.; 1.6W Purchase, via easements or fee-title, areas used by plovers for roosting or foraging. (USFWS, 2015).
- New in 2015: 2W. Protect wintering and migrating piping plovers and their habitat from human disturbance.; 2.1W Manage sites to reduce human-caused disturbance to non-breeding plovers. (Impact – High, Scale – Widespread, Timeframe – Long to Short); 2.1.1W Manage pedestrian access to reduce disturbance to non-breeding piping plovers. (Impact – Medium, Scale – Local, Timeframe – Short); 2.1.2W Manage off-road vehicle access to reduce disturbance, mortality, and habitat degradation.; 2.1.3W Implement and enforce pet restrictions in key plover habitat areas.; 2.1.4W Prevent disturbance from other activities.; 2.2W Develop and implement site stewardship plans that address human disturbance and other limiting factors.; 2.3W Develop an effective migration and wintering range outreach strategy and customize it for use in site stewardship plans. (USFWS, 2015).
- New in 2015: 3W. Monitor non-breeding plovers and their habitat. 3.1W Monitor non-breeding piping plovers to assess regional abundance and distribution. 3.2W Monitor non-breeding sites to identify limiting factors and effects of management. 3.3W Provide robust monitoring of piping plover abundance, distribution, survival, and habitat characteristics before and after major projects that have the potential to substantially modify important migration and wintering piping plover habitat. 3.4W Record and promptly report observations of banded piping plovers. 3.5W Develop a state-by-state atlas or other database containing geospatial information on wintering and migrating piping plovers. (USFWS, 2015).
- New in 2015: 4W. Protect non-breeding plovers and their habitats from contamination and degradation from oil or other chemical contaminants. 4.1W Update and refine contaminant exposure response protocols to protect plovers and their habitats. Incorporate updated procedures and protocols into all appropriate federal, state, and local oil and chemical spill contingency plans. 4.2W Develop a rigorous experimental design to evaluate short- and long-term effects of alternative contaminant clean-up techniques on non-breeding plovers and their habitat. 4.3W Identify and remediate any sources of contaminants with potential to adversely affect piping plover survival and reproduction. 4.4W Carry out research projects to determine survival and reproductive success of individually-marked piping plovers that become oiled on the wintering grounds. (USFWS, 2015)
- New in 2015: 5W. Assess predation as a potential limiting factor for piping plovers on wintering and migration sites and take action to address predation as needed. 5.1W Survey for the presence of avian or mammalian predators (especially non-native predators, such as feral cats) on non-breeding plover sites and include appropriate monitoring and management recommendations in site stewardship plans. 5.1.1W Take actions to remove predators from sites used by piping plovers. 5.2W Consider ancillary benefits to non-breeding plovers when developing predator management plans for sites, including national wildlife refuges and state parks. (USFWS, 2015).

- New in 2015: 6W. Improve application of regulatory tools. 6.1W Fully utilize ESA authorities to conserve piping plovers and their habitats. 6.1.1W Maximize avoidance of adverse effects to piping plovers and their habitats through section 7 consultations with federal agencies. 6.1.2W Adopt effective piping plover protections in Habitat Conservation Plans under section 10(a)(1)(B) of the ESA. 6.2W Provide appropriate Coastal Barrier Resources Act determinations. 6.3W Provide exemplary protection for migrating and wintering piping plovers on federal lands. 6.4W Encourage effective use of state and local laws and regulations to enhance conservation of non-breeding piping plovers and their habitat. (USFWS, 2015)
- New in 2015: 7W. Develop mechanisms to provide long-term protection of non-breeding plovers and their habitat. 7.1W Seek long-term agreements with landowners to protect non-breeding plovers and their habitats. 7.2W Acquire important habitat if it becomes available. 7.3W Seek non-regulatory recognition for sites. 7.4W Institutionalize plover site management through long-term planning at the local, state and federal levels. 7.5W Address long-term climate change threats, including accelerating sea level rise. (USFWS, 2015).
- New in 2015: 8W. Conduct scientific investigations to refine knowledge and inform conservation of migrating and wintering piping plovers. 8.1W Evaluate factors in the coastal migration and wintering range that may affect piping plover survival and subsequent fecundity. 8.2W Refine the characterization of optimal winter and migration habitat. 8.3W Determine the effects of shoreline stabilization projects. 8.4W Develop design specifications and monitoring for restoring, creating, and enhancing roosting and foraging habitat. 8.5W Investigate methods to determine the quantity and distribution of wintering and coastal migration habitat needed for long-term conservation of the three populations. 8.6W Determine impacts of human disturbance on non-breeding plovers. 8.7W Evaluate piping plover flight patterns and behaviors to inform risk assessments for wind turbine generators. 8.8W Develop strategies to reduce threats from accelerating sea level rise. 8.9W Investigate the full spectrum of other impacts from climate change on piping plovers in their non-breeding range. 8.10W Ascertain impacts of predation on wintering and migrating piping plovers. (USFWS. 2015).
- New in 2015: 9W. Coordinate, review, and refine recovery efforts. 9.1W Foster communication among recovery partners. 9.2W Facilitate use of new information. 9.3W Support conservation of wintering piping plovers outside the continental U.S. (USFWS, 2015).
- Develop a comprehensive conservation plan for piping plovers in the U.S. portion of their migration and wintering range. a. Acquire funds to develop a concise, cohesive plan that will address the migration and wintering needs of the three breeding populations. This is most efficiently accomplished by a qualified contractor working in close coordination with USFWS biologists. b. Develop a state-by-state wintering and migration habitat use atlas (GL tasks 2.12, 2.13, 2.16; AC task 2.1; NGP task 1.13). i. Quantify amount and distribution of currently existing habitat. ii. Determine the condition of each site, including the type and level of alteration, presence and threat level from invasive species, and whether natural coastal processes are impeded. Compare with historic habitat availability using aerial photography or other records. iii. Determine the temporal abundance and distribution of piping plover activity at sites with suitable habitat. Where appropriate data are currently lacking, conduct multiple surveys by qualified personnel across several migration and wintering seasons. Examples of reports summarizing methods and results of such surveys are available on request to the USFWS. iv. Evaluate likelihood of future actions, including human

development and recreational uses, and natural events that could potentially affect habitat quantity and quality at each site. v. Evaluate factors at each site that will affect the response of habitat to accelerating sea-level rise and identify potential actions to minimize its adverse effects. c. Conduct a systematic review of recreational policies and beach management. Identify gaps in management and enforcement of regulatory mechanisms by state. Develop recommendations to improve management and enforcement of piping plover protections where warranted (AC task 2.24). d. Develop an education/outreach strategy to work with state, county, and municipal governments to develop and implement ordinances and other strategies reducing effects of habitat stabilization, beach cleaning practices, human uses, and pets in beach and bayside habitats (GL task 5.2, AC task 2.24, NGP task 5.2). e. Develop an education/outreach strategy to work with private landowners with regard to habitat stabilization, beach-cleaning practices, human uses, and pets (USFWS, 2009).

- Develop, in coordination with land managers, management plans for critical habitat sites or other sites that support or could support nonbreeding piping plovers. This may be accomplished concurrently with development of the atlas described under action 1b above or as a follow-up task (GL tasks 2.14, 2.22; AC tasks 2.13, 2.2; NGP tasks 4.42, 4.43). a. Develop and implement a conservation plan tailored to the site's conditions. A range of management measures may include, as appropriate, leash laws and dogfree zones, off-road vehicle management, and symbolic fencing of key habitats during periods of high plover use. b. Develop a recommended piping plover monitoring protocol for each site that includes suggested frequency and intensity of monitoring. c. Monitor the effectiveness of management measures (2.a above) (USFWS, 2009).
- Improve consistency in the approach used, and recommendations generated for, piping plover conservation in ESA section 7 consultations and Coastal Barrier Resources Act review across all USFWS field offices throughout the species' U.S. coastal migration and wintering range. a. Regularly update USFWS field office staff regarding latest information on piping plovers and habitat use. b. Emphasize importance of maintaining natural coastal processes to perpetuate high quality piping plover migrating and wintering habitat (AC task 2.21). c. Discourage projects that will degrade or interfere with formation or maintenance of high quality piping plover habitat (GL task 2.22, AC task 2.21, NGP task 4.43). d. Encourage project features to minimize adverse effects on piping plovers and their habitat, including creation and enhancement of habitat in the vicinity of existing stabilization projects. . e. Develop a comprehensive monitoring and management plan template for shoreline stabilization projects on the wintering and migration grounds. f. Consider effects of climate change when determining long-term impacts. Include measures to conserve and enhance the capacity of piping plover habitats to adapt to sea-level rise (USFWS, 2009).
- Develop a website specifically for wintering and migrating piping plover issues (GL task 5.2 and AC tasks 4.1, 4.2). a. Develop a piping plover contact list of all individuals in each state and other countries (Canada, Mexico, Bahamas, etc.). b. Link to other plover websites. c. Upload all pertinent literature, including research and monitoring reports not protected by copyright, to the website. d. Upload summarized section 7 consultations, conservation measures, reasonable and prudent measures, and terms and conditions (USFWS, 2009).
- Focus the non-breeding portion of the International Census on enhancing understanding of piping plover abundance, distribution, and threat levels in seasonally emergent habitat (seagrass beds, oyster reefs, and mud flats) in Texas bays, and in Mexico and the Caribbean (GL task 2.13 and NGP task 1.13). a. Continue to encourage and improve International Census efforts at priority sites in Texas. b. USFWS regional coordinators for the International Census should establish contacts in Mexico, Bahamas, Cuba, and other appropriate

Caribbean countries at least a year in advance of the 2011 International Census. i. Increase efforts to maximize survey coverage. ii. Encourage collection of information describing types and levels of threats at each International Census site in addition to physical and biological attributes of the site. iii. Provide information about color-banded birds and encourage surveyors to look for and report these marked piping plovers (USFWS, 2009).

- To further enhance understanding of spatial partitioning of the breeding populations (as well as the impacts of some threats) on the migration/winter grounds, USFWS should facilitate and encourage all efforts dedicated to (or incorporating) monitoring of color-banded piping plovers. There is urgency associated with this data collection since several large breeding grounds banding studies have recently ended or are slated for completion in the near future, and opportunities to glean information will decline as banded piping plovers die off (GL task 2.12, NGP task 1.133) (USFWS, 2009).
- Further investigate the partitioning of survival within the annual cycle, and determine whether winter habitat quality influences reproductive success and survival (GL task 4.1 and AC task 3.6). Explore opportunities for further comparison of survival rates among breeding populations to inform these issues (USFWS, 2009).
- Continue to refine characterization of optimal winter habitat and understanding of factors affecting piping plover use of different microhabitats (e.g., ocean intertidal zones, wrack, inlet shoreline, soundside flats) (GL task 4.4; AC tasks 3.11, 3.12, 3.13; NGP tasks 2.22, 2.23). Research approaches should recognize that piping plovers may move among relatively nearby habitat patches. Plover habitat use patterns and needs may also vary geographically (across their nonbreeding range) and seasonally. a. Determine how habitat modification or complete loss of a site on migration and wintering grounds affects survival given documented site fidelity. b. Develop design specifications for creating roosting and foraging habitat. c. Quantify the amount and distribution of habitat needed for recovery of each breeding population, giving due consideration to intra- and inter-species competition for use of similar habitats (USFWS, 2009).
- Develop strategies to reduce threats from accelerating sea-level rise. a. Identify human coastal stabilization practices that increase or decrease adverse effects of sea-level rise on coastal piping plover habitats. b. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat as sea-level rises. c. Evaluate projected effects of sea-level rise on the regional distribution of piping plover habitats over time. Facilitate use of LIDAR (a remote sensing system used to collect topographic data) mapping of coastal elevations, development of models, and timeframe analysis throughout the species wintering and migration range in the U.S. to generate projections regarding areas most likely to be inundated within given time frames (USFWS, 2009).
- Determine the extent that human and pet disturbance limits piping plover abundance and behavioral patterns in the wintering and migration habitats (GL task 2.14, AC task 3.14, NGP task 3.221) (USFWS, 2009).
- Determine the effect of human and pet disturbance on survival and reproductive fitness (GL task 4.1, AC task 3.14, NGP task 3.221) (USFWS, 2009).
- Support research to ascertain impacts of predation on wintering/migrating piping plovers, as well as to determine the effectiveness of predator control programs (USFWS, 2009).
- Increase efforts to restore and maintain natural coastal formation processes in the New York-New Jersey recovery unit, where threats from development and artificial shoreline stabilization are highest, and in the Southern recovery unit, where the plover's habitat

requirements are the most stringent (recovery task 1.2). This action is also critical to reducing adverse effects of accelerating sea-level rise (USFWS, 2009).
- Identify and secure reliable funding to support continuing management of threats from human disturbance and predation, as described in recovery plan tasks 1.1, 1.3, and 1.4 (USFWS, 2009).
- Accelerate development of agreements needed to assure long-term protection and management to maintain population targets and productivity (recovery task 1.6). Prototype agreements should be pursued at sites where there is a history of intensive and successful piping plover protection, a high degree of commitment to the piping plover protection program, and experienced on-site shorebird biologists who can provide expertise to devise and test alternative types of agreements (recovery task 1.62) (USFWS, 2009).
- Develop strategies to reduce threats from accelerating sea-level rise. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat. Identify human coastal stabilization practices that increase or decrease adverse effects of sea-level rise on coastal piping plover habitats (USFWS, 2009).
- Conduct studies to understand potential effects of wind turbine generators that may be located or proposed for the Outer Continental Shelf, nearshore, and within or between nesting and foraging habitats. Information needs include migration routes and altitude; flight patterns associated with breeding adults and post-fledged young of the year foraging at nearby sites that are not contiguous with nesting habitats, and avoidance rates under varying weather conditions (USFWS, 2009).
- Conduct studies, including meta-analyses of local studies, to understand factors that affect latitudinal variation in productivity needed to maintain stationary populations of Atlantic Coast piping plovers (USFWS, 2009).
- Conduct demographic modeling to explore effects of latitudinal variation in productivity, survival rates, and the carrying capacity of habitat on population viability within individual recovery units and the Atlantic Coast population as a whole. Use this information to revise recovery criterion 3 to provide recovery unit specific productivity targets sufficient to assure secure populations (recovery plan task 3.5) (USFWS, 2009).
- Review state laws within the Atlantic Coast piping plover's breeding and wintering range to assess protections that would be afforded if the species were removed from ESA listing (USFWS, 2009).
- Support effective integrated predator management (recovery plan task 1.4) through studies of ecology and foraging behavior of key predators; for example, studies assessing the adequacy of buffers between feral cat colonies and piping plover nesting sites would be useful (USFWS, 2009).
- Clarify the piping plover ESA listing to recognize the subspecies Charadrius melodus melodus and C. m. circumcinctus (USFWS, 2009).
- The International Piping Plover Census has fostered widespread involvement in survey efforts and provided extensive data. However, as piping plover conservation efforts mature, it may be beneficial to shift the Census effort to address specific questions that are not answered by other ongoing efforts. Given ongoing recovery programs on the breeding grounds, the most important future International Census contribution to ESA recovery implementation and monitoring for all piping plovers is the abundance estimate for the Northern Great Plains breeding population (including Prairie Canada). The highest benefit can be realized by emphasizing completeness and quality control of this portion of the census and by expediting synthesis and reporting, so that managers can make timely use of

this information. Trends in abundance of Great Lakes and Atlantic Coast breeding populations (at least for the U.S. portion of their ranges) and progress toward their recovery are most effectively monitored through the annual surveys conducted in accordance with their recovery plans (see sections GL 2.3.2.2 and AC 2.5.2.2). During International Census years, Atlantic and Great Lakes population estimates based on the nine-day U.S. Atlantic Coast window census (see Atlantic Coast recovery task 1.11) and standard Great Lakes survey methods with special emphasis on complete coverage of all suitable habitat can be used to provide a species-wide context. The most valuable potential contribution from future winter censuses is improved understanding of the species' range in the Caribbean, Mexico, and other areas that may not have been fully covered in the past (e.g., seasonally emergent habitats within bays lying between the mainland and barrier islands in Texas). See recommendation 5 for the migration and wintering range. In other portions of the continental U.S., the winter census continues to provide beneficial information in the form of a fairly complete one-time survey coverage of wintering habitats, but it does not provide a true wintering "census." In some areas, participation in wintering census by a broad-based group of cooperators also fosters attention to piping plover conservation needs and collects data that otherwise would not exist. However, constraints associated with single, infrequent, mid-winter counts limits inference from the International Census to the value of particular wintering sites for recovery of the species and to detect trends (USFWS, 2009).

- Regulatory Protections: International Treaties include those established between the US, Canada and Mexico, the Ramsar Convention, the Western Hemisphere/Pan American Convention, Canada/Mexico/U.S. Trilateral Committee for Wildlife and Ecosystem Conservation and Management, The Specially Protected Areas and Wildlife Protocol of the Cartagena Convention (effective in the Caribbean). Federal protections include ESA, the Migratory Bird Treaty Act, the Coastal Barrier Resources Act, Executive Order 11644, Use of Off-Road Vehicles on the Public Lands, and Executive Order 11989, Off-Road Vehicles on Public Lands. Habitats are managed by the USFWS's National Wildlife Refuge System (National Wildlife Refuge System Improvement Act of 1997), the National Park Service (The National Park Service Organic Act), and the Department of Defense (Sikes Act). Most states have their regulations at the state level. Other programs include: The Wildlife Conservation and Restoration Program and State Wildlife Grants (both administered by the USFWS), State parks and wildlife management areas. (USFWS, 2015).
- Non-regulatory conservation programs and organizations include the USFWS inter-regional piping plover team, the Atlantic Coast Joint Venture and its South Atlantic Migratory Bird Initiative (integrates North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, North American Waterbird Conservation Plan, and Partners in Flight), National Audubon Society, the U.S. partner for BirdLife International's Important Bird Area program, Partners in Flight's North American Landbird Conservation Plan (Rich et al. 2004) and Southeast Working Group, The Southeastern Coastal Plains – Caribbean Region Report of the U.S. Shorebird Conservation Plan. (USFWS, 2015).
- New in 2015: BMPs have been described in USFWS 2015 for shoreline stabilization to avoid and minimize adverse environmental impacts, and address dunes, beaches, the nearshore environment (including active littoral or surf zone), offshore environment (including hardbottoms and reefs), inlets, estuarine areas, climate change and rising sea level. (USFWS, 2015).

Conservation Measures and Best Management Practices:

- Recommendations for Atlantic Coast Population Breeding Range 1. Increase efforts to restore and maintain natural coastal habitat formation processes, including overwash and dynamic inlets (recovery task 1.2). This action is critical to near-term availability of sufficient habitat to attain targets for breeding abundance and productivity. It is also key to preserving adaptive capacity of beach habitats in response to current and accelerating rates of sea-level rise. 2. Incorporate protocols for rapid assessment of storm-induced habitat changes into procedures for protecting habitat from degradation during post-storm management of beach habitat and beach recreation. Newly formed habitats should be protected from degradation by activities that directly or indirectly alter topography or accelerate succession of vegetation (recovery tasks 1.22 and 1.23). New and improved habitats should also be appropriately managed to prevent human disturbance that disrupts territory establishment and courtship and causes nest loss and chick mortality (recovery task 1.3). 3. Develop strategies to reduce threats from accelerating sea-level rise. Identify sites most likely to maintain (or increase) characteristics of suitable piping plover breeding and/or migration habitat. Identify potential changes in coastal management that may decrease adverse effects of sea-level rise on coastal piping plover habitats and locations where they might be implemented. 4. Incorporate new information about effects of disturbance on survival of piping plover chicks into specific beach management practices that will avoid incidental take (recovery task 1.3). 5. Continue and accelerate development and implementation of monitoring and decision support tools to improve and streamline piping plover conservation, including effective and efficient predator management and implementation of activities to prevent disturbance and indirect mortality of piping plovers due to beach recreation and other activities (recovery task 1.1, 1.3, and 1.4). 6. Assess the ability and willingness of state wildlife agencies to assume primary responsibility for protection and management of piping plovers and their habitat sufficient to maintain population targets and productivity. Develop long-term agreements for implementing specific protections that are independent of ESA sections 6 and 9 (recovery task 1.6). 7. Engage Federal agencies, including the NPS, the USACE, the FEMA, the BOEM, and others to ascertain their authorities (independent of ESA section 7) to incorporate conservation of Atlantic Coast piping plovers into activities that they implement, authorize, or fund. Develop long-term commitments for implementing specific protections that are consistent with each agency's other (non-ESA) regulatory authorities, funding, and personnel resources (recovery task 1.6). 8. Identify and secure reliable funding to support continuing management by landowners and recovery partners of threats from human disturbance and predation, as described in recovery plan tasks 1.1, 1.3, and 1.4. 9. Ascertain whether and to what extent landowners and other partners would be willing to conduct predator management activities if piping plovers are no longer classified as a threatened species under the ESA. Assess effects of foreseeable changes in predator management activities on piping plover abundance and productivity (recovery task 1.6). 10. Implement and refine communications tools and activities to increase public understanding of threats to breeding Atlantic Coast piping plovers and the recovery activities required to address them (recovery task 4). 11. Conduct full life-cycle demographic modeling to elucidate effects of variation in productivity, annual survival rates, dispersal rates, and carrying capacity of habitat on population viability within individual recovery (representative) units and the Atlantic Coast population as a whole. This information may be used (as warranted) to revise recovery criterion 3 to provide recovery unit-specific productivity targets sufficient to secure populations (recovery task 3.5) and facilitate more effective conservation efforts. 12. Increase efforts to understand disturbance and other threats to post-breeding and migrating piping plovers within the Atlantic Coast breeding range, and implement activities to ameliorate them. 13. Continue studies to understand potential effects of wind turbine generators that may be located or proposed for construction within and between nesting and foraging habitats and along migration routes. Continuing information needs include (but are not limited to) weather factors affecting migration altitude, northward migration routes, and avoidance rates under varying light and weather conditions. 14. Support effective integrated predator management (recovery plan task 1.4) through studies of ecology and foraging behavior of key predators and effects of predation management on predator communities. (USFWS, 2020)

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SPECIES ACCOUNT: *Coccyzus americanus* (Yellow-billed Cuckoo)

Species Taxonomic and Listing Information

Listing Status: Threatened; 11/03/2014; California/Nevada Region (Region 8)

Physical Description

Adult yellow-billed cuckoos have a fairly stout and slightly down-curved bill; a slender, elongated body with a long-tailed look; and a narrow yellow ring of colored, bare skin around the eye. The plumage is loose and grayishbrown above and white below, with reddish primary flight feathers. The tail feathers are boldly patterned with black and white below. They are a mediumsized bird about 12 inches (in) (30 centimeters (cm)) in length, and about 2 ounces (oz) (60 grams (g)) in weight. The bill is blue-black with yellow on the basal half of the lower mandible. The legs are short and bluish-gray. All cuckoos have a zygodactyl foot with two toes pointing forwards and two toes pointing backwards. Juvenile yellowbilled cuckoos resemble adults, except the tail patterning is less distinct and the lower bill has little or no yellow. Males and females differ slightly and are indistinguishable in the field (Hughes 1999, pp. 2–3).

Taxonomy

Recent research on yellow-billed cuckoo genetics using mitochondrial DNA did not find any fixed genetic differences between eastern and western yellow-billed cuckoos (Farrell 2013, pp. 165–170). The author concluded that the separation into distinct subspecies may be too recent to be expressed in a single mitochondrial gene and recommended future studies using next generation sequencing techniques. Avian geneticist Janice Hughes, Ph.D., a peer reviewer of the proposed listing rule, concluded that close examination of the DNA studies conducted to date on cuckoos infers a deeper genetic divergence between western and eastern cuckoos that with further analysis would likely support division of the yellow-billed cuckoo into two subspecies. She indicated that genetic markers used in all three previously conducted genetics studies evolve too slowly to reveal genetic structure within the species. She recommended that future studies use microsatellite techniques because they would be more informative to a study of DNA at the subspecies level. The existing DNA studies, however, show that western yellow-billed cuckoos have developed unique genetic haplotypes not present in eastern cuckoos and that these are reflected in phenotypic (outwardly visible) divergence that has been observed between eastern and western yellow-billed cuckoos. Please refer to the October 3, 2013, proposed listing rule (78 FR 61624–61645) for a more detailed discussion of information on taxonomy for the species.

Historical Range

Based on historic accounts, the species was widespread and locally common in California and Arizona, locally common in a few river reaches in New Mexico, common very locally in Oregon and Washington, generally local and uncommon in scattered drainages of the arid and semiarid portions of western Colorado, western Wyoming, Idaho, Nevada, and Utah, and probably uncommon and very local in British Columbia. Hughes (1999) summarizes the species' historic range and status in these areas.

Current Range

The yellow-billed cuckoo (Coccyzus americanus) is a member of the avian family Cuculidae and is a Neotropical migrant bird that winters in South America and breeds in North America. Yellow-billed cuckoos spend the winter in South America, east of the Andes, primarily south of the Amazon Basin in southern Brazil, Paraguay, Uruguay, eastern Bolivia, and northern Argentina (Ehrlich et al. 1992, pp. 129–130; American Ornithologists' Union (AOU) 1998, p. 247; Johnson et al. 2008b, pp. 18–29). The breeding range of the entire species formerly included most of North America from southeastern and western Canada (southern Ontario, Quebec, and southwestern British Columbia) south throughout the continental United States to the Greater Antilles and northern Mexico (AOU 1957, pp. 269– 270; AOU 1983, p. 284; AOU 1998, p. 247). Currently, the species no longer breeds in western Canada and the northwestern continental United States (Washington, Oregon, and Montana).

Distinct Population Segments Defined

Yes

Critical Habitat Designated

Yes; 5/21/2021.

Legal Description

We, the U.S. Fish and Wildlife Service (Service), designate critical habitat for the western distinct population segment of the yellow-billed cuckoo (western yellow-billed cuckoo) (Coccyzus americanus) under the Endangered Species Act. In total, approximately 298,845 acres (120,939 hectares) are now being designated as critical habitat in Arizona, California, Colorado, Idaho, New Mexico, Texas, and Utah. This rule extends the Act's protections to critical habitat for this species.(USFWS, 2021)

Critical Habitat Designation

for Arizona, California, Colorado, Idaho, New Mexico, Texas, and Utah, on the maps in this entry. (2) Within these areas, the specific physical or biological features essential to the conservation of western yellowbilled cuckoo consist of three components: (i) Rangewide breeding habitat. Riparian woodlands across the Distinct Population Segment (DPS); Southwestern breeding habitat, primarily in Arizona and New Mexico: Drainages with varying combinations of riparian, xeroriparian, and/or nonriparian trees and large shrubs. This physical or biological feature includes breeding habitat found throughout the DPS range as well as additional breeding habitat characteristics unique to the Southwest. (A) Rangewide breeding habitat (including areas in the Southwest). Rangewide breeding habitat is composed of riparian woodlands within floodplains or in upland areas or terraces often greater than 325 ft (100 m) in width and 200 ac (81 ha) or more in extent with an overstory and understory vegetation component in contiguous or nearly contiguous patches adjacent to intermittent or perennial watercourses. The slope of the watercourses is generally less than 3 percent but may be greater in some instances. Nesting sites within the habitat have an aboveaverage canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats. Rangewide breeding habitat is composed of varying combinations of riparian species including the following nest trees: Cottonwood, willow, ash, sycamore, boxelder, alder, and walnut. (B) Southwestern breeding habitat. Southwestern breeding habitat, found primarily in Arizona and New Mexico, is more variable than rangewide breeding habitat. Southwestern breeding habitat occurs within or along perennial, intermittent, and ephemeral drainages in montane canyons, foothills, desert floodplains, and arroyos. It may include woody side drainages, terraces, and hillsides immediately adjacent to the main drainage bottom. Drainages intersect a variety of habitat types including, but not limited to, desert scrub, desert grassland, and Madrean evergreen woodlands (presence of oak). Southwestern breeding habitat is composed of varying combinations of riparian, xeroriparian, and/or nonriparian tree and large shrub species including, but not limited to, the following nest trees: Cottonwood, willow, mesquite, ash, hackberry, sycamore, walnut, desert willow, soapberry, tamarisk, Russian olive, juniper, acacia, and/or oak. In perennial and intermittent drainages, Southwestern riparian breeding habitat is often narrower, patchier, and/or sparser than rangewide riparian breeding habitat and may contain a greater proportion of xeroriparian trees and large shrub species. Although some cottonwood and willow may be present in Southwestern riparian habitat, xeroriparian species may be more prevalent. Mesquite woodland may be present within the riparian floodplain, flanking the outer edges of wetter riparian habitat, or scattered on the adjacent hillsides. The more arid the drainage, the greater the likelihood that it will be dominated by xeroriparian and nonriparian nest tree species. Arid ephemeral drainages in southeastern Arizona receive summer humidity and rainfall from the North American Monsoon, with a pronounced green-up of grasses and forbs. These arid ephemeral drainages often contain xeroriparian species like hackberry or nonriparian species associated with the adjacent habitat type like oak, mesquite, acacia, mimosa, greythorn, and juniper. In southeastern Arizona mountains, breeding habitat is typically below pine woodlands (~6,000 ft (1,829 m)). (ii) Adequate prey base. Presence of prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies, moth larvae, spiders), lizards, or frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas. (iii) Hydrologic processes. The movement of water and sediment in natural or altered systems that maintains and regenerates breeding habitat. This physical or biological feature includes hydrologic processes found in rangewide breeding habitat as well as additional hydrologic processes unique to the Southwest in southwestern breeding habitat: (A) Rangewide breeding habitat hydrologic processes (including the Southwest). Hydrologic processes (either natural or managed) in river and reservoir systems that encourage sediment movement and deposits and promote riparian tree seedling germination and plant growth, maintenance, health, and vigor (e.g., lower-gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). In some areas where habitat is being restored, such as on terraced slopes above the floodplain, this may include managed irrigated systems that may not naturally flood due to their elevation above the floodplain. (B) Southwestern breeding habitat hydrologic processes. In southwestern breeding habitat, elevated summer humidity and runoff resulting from seasonal water management practices or weather patterns and precipitation (typically from North American Monsoon or other tropical weather events) provide suitable conditions for prey species production and vegetation regeneration and growth. Elevated humidity is especially important in southeastern Arizona, where cuckoos breed in intermittent and ephemeral drainages. (3) Critical habitat does not include humanmade structures (such as buildings, aqueducts, runways, roads, bridges, and other paved or hardened areas as a result of development) and the land on which they are located existing within the legal boundaries of the critical habitat units designated for the species on May 21, 2021. Due to the scale on which the critical habitat boundaries are developed, some areas within these legal boundaries may not contain the physical or biological features and therefore are not considered critical habitat. (4) Data layers defining map units were created on a base of the Natural Resources Conservation Service National Agriculture Imagery Program (NAIP 2011), and critical habitat was then mapped using North American Datum (NAD) 83, Universal Transverse Mercator Zone 10N coordinates. The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at the Service’s Sacramento Fish and Wildlife Office’s internet site at http:// www.fws.gov/sacramento, or on http:// www.regulations.gov at Docket No. FWS–R8–ES–2013–0011. You may obtain field office location information by contacting one of the Service regional offices, the addresses of which are listed at 50 CFR 2.2. (USFWS, 2021)

Primary Constituent Elements/Physical or Biological Features

Physical or Biological Feature 1— Rangewide breeding habitat. Riparian woodlands across the DPS; Southwestern breeding habitat, primarily in Arizona and New Mexico: Drainages with varying combinations of riparian, xeroriparian, and/or nonriparian trees and large shrubs. This physical or biological feature includes breeding habitat found throughout the DPS range as well as additional breeding habitat characteristics unique to the Southwest. a. Rangewide breeding habitat (including areas in the Southwest). Rangewide breeding habitat is composed of riparian woodlands within floodplains or in upland areas or terraces often greater than 325 ft (100 m) in width and 200 ac (81 ha) or more in extent with an overstory and understory vegetation component in contiguous or nearly contiguous patches adjacent to intermittent or perennial watercourses. The slope of the watercourses is generally less than 3 percent but may be greater in some instances. Nesting sites within the habitat have an aboveaverage canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats. Rangewide breeding habitat is composed of varying combinations of riparian species including the following nest trees: Cottonwood, willow, ash, sycamore, boxelder, alder, and walnut. b. Southwestern breeding habitat. Southwestern breeding habitat, found primarily in Arizona and New Mexico, is more variable than rangewide breeding habitat. Southwestern breeding habitat occurs within or along perennial, intermittent, and ephemeral drainages in montane canyons, foothills, desert floodplains, and arroyos. It may include woody side drainages, terraces, and hillsides immediately adjacent to the main drainage bottom. Drainages intersect a variety of habitat types including, but not limited to, desert scrub, desert grassland, and Madrean evergreen woodlands (presence of oak). Southwestern breeding habitat is composed of varying combinations of riparian, xeroriparian, and/or nonriparian tree and large shrub species including, but not limited to, the following nest trees: Cottonwood, willow, mesquite, ash, hackberry, sycamore, walnut, desert willow, soapberry, tamarisk, Russian olive, juniper, acacia, and/or oak. In perennial and intermittent drainages, Southwestern riparian breeding habitat is often narrower, patchier, and/or sparser than rangewide riparian breeding habitat and may contain a greater proportion of xeroriparian trees and large shrub species. Although some cottonwood and willow may be present in Southwestern riparian habitat, xeroriparian species may be more prevalent. Mesquite woodland may be present within the riparian floodplain, flanking the outer edges of wetter riparian habitat, or scattered on the adjacent hillsides. The more arid the drainage, the greater the likelihood that it will be dominated by xeroriparian and nonriparian nest tree species. Arid ephemeral drainages in southeastern Arizona receive summer humidity and rainfall from the North American Monsoon (PBF 3), with a pronounced green-up of grasses and forbs. These arid ephemeral drainages often contain xeroriparian species like hackberry or nonriparian species associated with the adjacent habitat type like oak, mesquite, acacia, mimosa, greythorn, and juniper. In southeastern Arizona mountains, breeding habitat is typically below pine woodlands (~6,000 ft (1,829 m)). Physical or Biological Feature 2— Adequate prey base. Presence of prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies, moth larvae, spiders), lizards, and frogs for adults and young in breeding areas during the nesting season and in postbreeding dispersal areas. Physical or Biological Feature 3— Hydrologic processes. The movement of water and sediment in natural or altered systems that maintains and regenerates breeding habitat. This physical or biological feature includes hydrologic processes found in rangewide breeding habitat as well as additional hydrologic processes unique to the Southwest in southwestern breeding habitat: a. Rangewide breeding habitat hydrologic processes (including the Southwest): Hydrologic processes (either natural or managed) in river and reservoir systems that encourage sediment movement and deposits and promote riparian tree seedling germination and plant growth, maintenance, health, and vigor (e.g., lower-gradient streams and broad floodplains, elevated subsurface groundwater table, and perennial rivers and streams). In some areas where habitat is being restored, such as on terraced slopes above the floodplain, this may include managed irrigated systems that may not naturally flood due to their elevation above the floodplain. b. Southwestern breeding habitat hydrologic processes: In southwestern breeding habitat, elevated summer humidity and runoff resulting from seasonal water management practices or weather patterns and precipitation (typically from North American Monsoon or other tropical weather events) provide suitable conditions for prey species production and vegetation regeneration and growth. Elevated humidity is especially important in southeastern Arizona, where western yellow-billed cuckoos breed in intermittent and ephemeral drainages. Because the western yellow-billed cuckoo exists in noncontiguous areas across a wide geographical and elevational range and its habitat is subject to dynamic events, the areas described below (see Final Critical Habitat Designation) are essential to the conservation of the western yellowbilled cuckoo because they provide opportunities for breeding, allow for connectivity between habitat, assist in dispersal, provide redundancy to protect against catastrophic loss, and provide representation of the varying habitat types used for breeding, thereby helping to sustain the species. The physical or biological features essential to the conservation of the western yellow-billed cuckoo are present in the areas designated, but the specific quality of habitat for nesting, migration, and foraging will vary in condition and location over time due to plant succession and the dynamic environment in which they exist. As a result, the areas that are designated may not contain at any one time all of the physical and biological features that have been identified for the western yellow-billed cuckoo. Based on use of the areas for breeding, we conclude that all of the areas identified contain all or most of the physical or biological features, but in some cases, these features are less prevalent, or their presence is variable over time due to the changing nature of habitat from hydrologic processes. As stated above, all critical habitat units are considered to have been occupied at the time of listing. (USFWS, 2021)

Special Management Considerations or Protections

. The special management considerations include actions to address the main threats to western yellow-billed cuckoo habitat and are grouped into three categories: (1) Threats from alteration of hydrology; (2) threats from floodplain encroachment; and (3) other identified threats. (USFWS, 2021)

Life History

Feeding Narrative

Adult: The yellow-billed cuckoo consumes insects such as cicadas, katydids, caterpillars.

Reproduction Narrative

Adult: Typically a secretive and hard-to detect bird, adult yellow-billed cuckoos have a distinctive ‘‘kowlp’’ call, which is a loud, nonmusical series of notes that slows down and slurs toward the end. Yellow-billed cuckoos advertise for a mate using a series of soft ‘‘cooing’’ notes, which they give at night as well as during daytime. Both members of a pair use a soft knocking call as a contact or warning call near the nest (Hughes 1999, pp. 8–9). Clutch size is usually two or three eggs, and development of the young are very rapid, with a breeding cycle of 17 days from egg-laying to fledging of young. Although yellowbilled cuckoos usually raise their own young, they are facultative brood parasites, occasionally laying eggs in the nests of other yellow-billed cuckoos or of other bird species (Hughes 1997). Nesting peaks later (mid-June through August) than in most co-occurring bird species, and may be triggered by an abundance of thecicadas, katydids, caterpillars, or other large prey which form the bulk of the species' diet (Hamilton and Hamilton 1965; Rosenberg et al. 1982). The species is inconspicuous on its breeding range, except when calling to attract or to contact mates.

Geographic or Habitat Restraints or Barriers

Adult: restricted to nesting in moist river bottoms

Spatial Arrangements of the Population

Adult: clumped according to suitable resources

Environmental Specificity

Adult: generalist

Tolerance Ranges/Thresholds

Adult: unknown

Dependency on Other Individuals or Species for Habitat

Adult: cottonwoods and willows

Habitat Narrative

Adult: Western yellow-billed cuckoos breed in large blocks of riparian habitats (particularly woodlands with cottonwoods and willows), while eastern yellow-billed cuckoos breed in a wider range of habitats, including deciduous woodlands and parks (Ehrlich et al. 1988). Dense understory foliage appears to be an important factor in nest site selection, while cottonwood trees are an important foraging habitat in areas where the species has been studied in California (Laymon et al. 1993). Nesting west of the Continental Divide occurs almost exclusively close to water, and biologists have hypothesized that the species may be restricted to nesting in moist river bottoms in the west because of humidity requirements for successful hatching and rearing of young (Hamilton and Hamilton 1965; Rosenberg et al. 1991).Western yellow-billed cuckoos appear to require large blocks of riparian habitat for nesting. Along the Sacramento River in California, nesting yellow-billed cuckoos occupied home ranges which included 10 hectares (ha) (25 acres (ac)) or more of riparian habitat (Gaines 1974; Laymon et al. 1993). Another study on the same river found riparian patches with yellowbilled cuckoo pairs to average 40 ha (99 ac) (Halterman 1991). Nesting densities ranging from 1 to 15 pairs per 40 ha (99 ac) were estimated in a New Mexico study (Howe 1986), and three plots in Arizona had densities ranging of 8.2, 19.8, and 26.5 pairs per 40 ha (99 ac) (Hughes 1999).

Dispersal/Migration

Motility/Mobility

Adult: high

Migratory vs Non-migratory vs Seasonal Movements

Adult: migratory

Dispersal

Adult: high

Immigration/Emigration

Adult: yes

Dependency on Other Individuals or Species for Dispersal

Adult: not applicable

Dispersal/Migration Narrative

Adult: The breeding range of the yellowbilled cuckoo formerly included most of North America from southern Canada to the Greater Antilles and northern Mexico (AOU 1957, 1998). In recent years, the species' distribution in the west has contracted. The northern limit of breeding in the coastal States is now in Sacramento Valley, California, and the northern limit of breeding in the western interior States is southern Idaho (AOU 1998; Hughes 1999). East of the Continental Divide, the species breeds from southeastern Montana, the Dakotas, Minnesota, southern Ontario, southeastern Quebec and probably southern New Brunswick south to eastern Colorado, Texas, the Gulf coast, northeastern Mexico, the Florida Keys, the Greater Antilles and the northern Lesser Antilles (AOU 1957, 1998). The species overwinters from Columbia and Venezuela, south to northern Argentina (Ehrlich et al. 1992; AOU 1998). The extent to which yellow-billed cuckoos nesting in different regions of North America commingle during migration, or while overwintering, is unknown.Home ranges in the South Fork of the Kern River in California averaged about 17 ha (42 ac) (Laymon et al. 1993).

Population Information and Trends

Population Trends:

Declining

Species Trends:

Declining

Population Growth Rate:

unknown

Number of Populations:

81 occurrences

Population Size:

in between 10000 to 1000000

Minimum Viable Population Size:

unknown

Resistance to Disease:

unknown

Adaptability:

moderate

Population Narrative:

The available data suggest that the yellow-billed cuckoo’s range and population numbers have declined substantially across much of the western United States over the past 50 years. Analysis of population trends is difficult because quantitative data, including historical population estimates, are generally lacking. However, historic and recent data are sufficient to allow an evaluation of changes in the species’ range in the western United States. Rough extrapolations, which use observed densities of yellow-billed cuckoos and historic habitat distribution, indicate that western populations were once substantial (Service 1985). The following discussion is based on information provided by the petition and in our files, and focuses on westernNorth America, the area for which the petition provides information.

Threats and Stressors

Stressor: Habitat Loss From Dams and Alteration of Hydrology Dams
Exposure:
Response:
Consequence:
Narrative: Several researchers and scientific organizations including the Service reviewed the following effects of human modific tion of natural hydrological processes on riparian abitat, including those from dams (Poff et al. 1997, pp. 769–784; Greco 1999, pp. 36–38; National Academy of Sciences (NAS) 2002, pp. 145–150; Service 2002, Appendix I, pp. 1–12). Dams result in an immediate effect of destroying riparian structure and functioning due to habitat displacement from dam construction and by permanent inundation, sometimes flooding miles of upstream riparian areas. This results in the physical loss of riparian vegetation. In the absence of vegetation, the western yellow-billed cuckoo cannot breed, feed, or find shelter. Current and future releases of water downstream from dams at unnatural rates of flow or timing that differ from preconstruction hydrologic circumstances, or at too frequent or too infrequent intervals, may lead to flooding or desiccation beyond the tolerance limits of the native riparian vegetation, thus resulting in loss of habitat of the western yellowbilled cuckoo. Dam construction has been occurring since the settlement of western North America with its peak in the mid-20th century. These include most major western rivers, many of which have a series of dams, and include, but are not limited to, the Sacramento, Kern, San Joaquin, Mojave, Snake, Gila, Salt, Verde, and Rio Grande, including 25 major reservoirs built on the Colorado and Green Rivers alone between the 1930s and 1970s (Richter et al. 1998, p. 332). In northern Mexico, these rivers include the Ri´o Conchos, Yaqui, and Mayo, Ri´o Bambuto, Ri´o Bravo, Tubutama, La Reforma, Cuchujaqui River in Alamos, Aconchi and Baviacora in Ri´o Sonora, and Upper San Pedro River in Sonora (Instituto del Media Ambiente y el Desarrollo Sustentable del Estado de Sonora (IMADES) 2003, p. 4; Kelly and Arias Rojo 2007, pp. 2–3; Cornell et al. 2008, p. 96). There are now dozens of large dams and scores of smaller dams on rivers throughout the range of the western yellow-billed cuckoo. Today, the rate of building new dams has slowed because most of the highest quality dam sites already have dams constructed on them. There were proposals to build two dams on Cottonwood Creek, one of the major tributaries of the Sacramento River (USACE 1982), but it is not clear when or if these dams will be built. A larger current threat is the enlargement (raising of dams or control structures) of existing dams. The enlargement of Terminus Dam on the Tule

River in California by 21 ft (6.5 m) in height was completed in 2004 (Barcouda et al. 2006, p. 12), and proposals to enlarge Shasta Dam on the Sacramento River by up to 18.5 ft (5.7 m) in height and increasing its storage capacity (Reclamation 1999, pp. 3–8; Reclamation 2013, pp. ES 15–22) and Friant Dam on the San Joaquin River by up to 140 ft (43 m) in height are being explored (Reclamation 2003, pp. 3.1– 3.8), and the raising of Lake Isabella on the Kern River by the USACE is in the final stages of implementation (USACE 2012, pp. 1–4). Larger dams with additional storage would likely flood potential western yellow-billed cuckoo habitat upstream and cause additional hydrologic disruption downstream. While the amount of habitat lost within the construction zone of a dam is relatively small, far greater amounts of habitat are destroyed in the areas of inundation and through the ongoing effects of the amount and timing of water releases through the dam operation, which affects both upstream and downstream habitats. Ongoing downstream effects to riparian habitat from dams include changes in sediment transport due to sediment retention behind the dams so that channels below a dam become increasingly ‘‘sediment starved.’’ This situation causes vertical erosion (downcutting), which can lead to loss of river terraces that sustainriparian vegetation (NAS 2002, pp. 145– 150; Poff et al. 2009, pp. 773–774; Poff and Zimmerman 2010, pp. 196–197). Ongoing operations of large dams can also dampen the magnitude of normal high flows, thus preventing cottonwood germination (Howe and Knopf 1991, p. 218), and dewater downstream reaches, causing substantial declines of riparian forests (NAS 2002, pp. 145–150). For example, Groschupf (1987, p. 19) found that almost all cottonwoods and over half of all willow trees were eliminated from one waterway in Arizona that was exposed to repeated large releases of water from a dam. This situation reduced the density of western yellowbilled cuckoos from 13 per 100 ac (40 ha) before the flooding to 3 per 100 ac (40 ha) after the flooding (Groschupf 1987, p. 19). In another example, a study of the San Joaquin River from downstream of the Friant Dam to the Merced River confluence found that, between 1937 and 1993, the area of riparian forest and scrub decreased 28 percent, from 6,787 to 4,914 ac (2,727 to 1,989 ha), and the herbaceous riparian vegetation decreased from 4,076 to 780 ac (1,650 to 316 ha) (Jones and Stokes Associates, Inc. 1998, Chap. 5, pp. 1–2).These losses are most likely attributed to reduced stream flow down the river as a result of water diversions. In the case of the San Joaquin River, efforts are under way for restoring a more natural functioning hydrologic system and to restore riparian habitat (Reclamation 2012, pp. 7–8). Generally, in the absence of ongoing dam operations, where areas are allowed to flood and deposit sediment, the habitat is likely to regenerate naturally. However, because of the way the majority of dams are operated, theability for the stream courses to promote natural regeneration and maintenance of riparian habitat has been greatly diminished. These impacts are happening now and are likely to continue without changes to water release strategies and management. After the completion of the larger dams on the Colorado River system starting in the 1930s, limited pulse flows reached the lower Colorado River in Mexico for nearly 50 years, resulting in the loss of cottonwood–willow forests and the establishment of tamarisk(Glenn et al. 2001, pp. 1175–1186; Nagler et al. 2005, pp. 1843–1844). Local decline of the western yellowbilled cuckoo and other riparian birds has been attributed to that habitat loss and degradation (Hinojosa-Huerta et al. 2008, p. 81). Additionally, along the Rı´o Altar in northern Mexico, completion of the Cuauhte´moc Dam and Reservoir(Presa Cuauhte´moc) in 1950 diverted surface water and contributed to increased vegetation clearing for agriculture, degradation of mature cottonwood forests, and subsequent declines in distribution and abundance of riparian bird species associated with these forests (Flesch 2008, p. 43), including the western yellow-billed cuckoo, which is known to occur there. In addition to past habitat losses, the altered hydrology caused by dams continues to have an ongoing impact on riparian habitat. While alteration of hydrology due to dam construction and other water supply projects has been widely implicated in the loss and degradation of downstream riparian habitat for the western yellow-billed cuckoo (Gaines and Laymon 1984, p. 73; Greco 1999, pp. 36–38; Greco 2012, pp. 8–9), some dams have resulted in temporary habitat expansion for the western yellow-billed cuckoo within the immediate upstream influence of the associated reservoirs. For example, one of the largest concentrations of western yellow-billed cuckoo in New Mexico occurs at the inflow to Elephant Butte Reservoir on the middle Ri´o Grande (Sechrist et al. 2009, p. 1; Ahlers and Moore 2011, pp. 19–20). Western yellow-billed cuckoo numbers increased following several years when water levels receded and riparian vegetation expanded into the exposed area of the reservoir pool. The western yellow-billed cuckoo population there continues to increase, likely as a result of continued drawdown from long-term drought that allows maturation of the riparian forest into suitable breeding habitat (Ahlers and Moore 2011, pp. 19–20). Drought patterns are cyclical, and, when wetter conditions return to the region, Elephant Butte Reservoir likely will be refilled. When this happens, approximately 92 percent of 44 to 87 pairs of

Stressor: Surface and Ground Water Diversion
Exposure:
Response:
Consequence:
Narrative: Water extractions, both from surface water diversions and ground water pumping, can negatively affect riparian vegetation (Poff et al. 1997, pp. 769– 784; Service 2002, Appendix I, pp. 1–8). Water diversions and withdrawals can lower ground water levels in the vicinity of riparian vegetation. Because ground water and surface water are generally connected in floodplains, lowering ground water levels by only about 3 ft (1 m) beneath riparian areas is sometimes sufficient to induce water stress in riparian trees, especially in the western United States (NAS 2002, p. 158). Physiological stress in native vegetation from prolonged lower flows or ground water results in reduced plant growth rate, morphological change, or mortality, and altered species composition dominated by more drought-tolerant vegetation, and conversion to habitat dominated by nonnative species (Poff et al. 1997, p. 776). These effects reduce and degrade habitat for the western yellowbilled cuckoo for foraging, nesting, and cover. The hydrologic regime (stream flow pattern) and supply of (and interaction between) surface and subsurface water is a driving factor in the long-term maintenance, growth, recycling, and regeneration of western yellow-billed cuckoo habitat (Service 2002, p. 16). As streams reach the lowlands, their gradients typically flatten and surrounding terrain opens into broader floodplains (Service 2002, p. 32). In these geographic settings, the streamflow patterns (frequency, magnitude, duration, and timing) will provide the necessary stream-channel conditions (wide configuration, high sediment deposition, periodic inundation, recharged aquifers, lateral channel movement, and elevated ground-water tables throughout the floodplain) that result in the development of riparian habitat suitable for use by western yellow-billed cuckoos (Poff et al. 1997, pp. 770–772; Service 2002, p. 16). Allowing the river to flow over the width of the floodplain, when overbank flooding occurs, is integral to allow deposition of fine moist soils, water, nutrients, and seeds that provide the essential material for plant germination and growth. An abundance and distribution of fine sediments extending farther laterally across the floodplain and deeper underneath the surface retains much more subsurface water, which in turn supplies water for the development of the vegetation that provides western yellow-billed cuckoo habitat and microhabitat conditions (Service 2002, p. 16). The interconnected interaction between ground water and surface water contributes to the quality of the riparian vegetation community (structure and plant species) and will influence the ability of vegetation to germinate, regenerate, and maintain its foliage density, vigor, and species composition (Arizona Department of Water

Resources 1994, pp. 31–32). In many instances, western yellowbilled cuckoo breeding site occur along streams where human impacts are minimized enough to allow more natural processes to create and maintain the habitat. However, there are also breeding sites that are supported by various types of supplemental water including agricultural and urban runoff, treated water outflow, irrigation or diversion ditches, reservoirs, and dam outflows (Service 2002, p. D–15). Although the waters provided to these habitats might be considered ‘‘artificial,’’ they are often important for maintaining the habitat in appropriate condition for breeding western yellowbilled cuckoos within the existing environment.

Stressor: Encroachment of Levees and Flood Control and Bank Stabilization Structures Into the River Channel and Floodplain
Exposure:
Response:
Consequence:
Narrative: Other alterations in river hydrology with ongoing effects on western yellowbilled cuckoo habitat include river channelization, construction of levees, bank stabilization, and placement of any flood control structures that encroach into the river and its floodplain. These actions result in direct loss of habitat from construction and from maintenance activities that remove woody vegetation that has become established on the structures. Furthermore, these structures are effective, by design, at severing the hydrologic connection of the river’s main channel and the river’s immediate floodplain, thereby preventing overbank flooding. By preventing overbank flooding, levees and other similar structures reduce the amount of water available to riparian vegetation in the floodplain, which results in desiccation and eventual loss and degradation of riparian habitat (Vogl 1980, pp. 84–86; NAS 2002, p. 155; Greco 2012, pp. 8–9). Such effects are less destructive, however, for those levees located farther from the stream system, such as those outside the meander belt of a river (Greco 2012, p. 4). As an illustrative example, we provide a brief summary of how river channelization, construction of levees close to the river, and rock riprap armoring along the levees have caused destruction and modification of western yellow-billed cuckoo habitat on the Sacramento River, one of the most substantial historical nesting and foraging habitat areas for the western yellow-billed cuckoo. The Sacramento River is now disconnected from ecological processes that both renew and restore riparian and aquatic habitats (Laymon and Halterman 1987a, pp. 11– 14; Halterman 1991, pp. 1–2; Greco 2008, p. 6; Greco 2012, pp. 8–9). More than one-half of the Sacramento River’s banks within the lowermost 194 mi (312 km) of river have now been rip-rapped by 40 years of bank protection (Service 2000, pp. 26–29). Rock riprap armoring a river reach often changes the river dynamics and leads to channel downcutting and erosion immediately downstream from the riprap. Therefore, riprapping banks leads to the need for more riprapping. Channelizing the river and severing the connection to the floodplain has severely altered the natural disturbance regime that would have allowed riparian habitat to regenerate now and in the future (Poff et al. 1997, pp. 769– 784; Greco 2008, p. 6; Greco 2012, pp. 8–9). The result is that much of the river’s remaining riparian habitat is modified, and now occurs in narrow, disconnected, linear strips (Service 2000, pp. 26–29; Halterman et al. 2001, p. 4) that are not utilized by the western yellow-billed cuckoo for breeding (Gaines 1974, p. 204; Greco 2012, p. 9). With the example of the Sacramento River, nesting western yellow-billed cuckoos no longer occur south of Colusa as the river has been channelized and riprapped from that point into the Sacramento-San Joaquin River Delta. These flood control and bank stabilization structures also keep the riparian habitat from regenerating and maturing. The factors that reduce western yellow-billed cuckoo breeding in these areas are not well-understood, but reductions of breeding population have been attributed

to lack of patches of adequate size for nesting (Greco 2012, pp. 8–9), increased predators, and the species' inability to use highly isolated patches (Halterman 1991, pp. 33–38). The Sacramento River is but one of many rivers within the range of the western yellow-billed cuckoo where these activities have destroyed and modified riparian habitat and where the ramifications of these past actions are continuing to impact the western yellow-billed cuckoo's habitat today. These ongoing impacts will likely continue for decades to come. An additional pervasive threat is the design of open-channel flood control channels with inappropriately smooth roughness coefficients. This creation over-scours the floodplains and requires removal of woody riparian vegetation that regenerates on floodplains, which in turn leads to floodplains with no western yellow-billed cuckoo habitat (Greco 2013, pp. 707–717).

Stressor: Transportation Systems
Exposure:
Response:
Consequence:
Narrative: Similarly, transportation systems have directly and indirectly altered a large number of riparian areas in western North America (NAS 2002, p. 182). Road and rail systems are frequently sited along rivers, and often entail removing riparian vegetation for construction of the roadbed, and modifying local hydrology to reroute surface water and ground water. Bridges or culverts require abutments along the bank to provide roadway support. Because abutments and roadbeds physically constrain the stream, future lateral adjustments by the stream, which can affect floodplain dynamics, are effectively eliminated, which reduces and degrades riparian habitat (NAS 2002, p. 182). Such impacts result in additional destruction and modification of habitat for the western yellow-billed cuckoo. In comparison with construction of dams and altered hydrology, this threat, by itself, is less likely to result in severe impacts to riparian habitat. However, this threat is but one of many that, in combination, results in substantial changes to physical and hydrological properties of a watercourse, which in turn contributes to a substantial curtailment in the habitat of the western yellow-billed cuckoo.

Stressor: Gravel Mining
Exposure:
Response:
Consequence:
Narrative: Other past and ongoing effects to riparian habitat result from gravel mining (Kondolf et al. 2001, pp. 54, 59). Extraction of gravel, primarily for construction products, typically occurs along rivers and adjacent floodplains where gravel deposits are naturally found. Large amounts of gravel removal from the stream and active floodplain result in channel downcutting or incision, which affects groundwater levels, frequency of overbank flows, bank stability, and the extent and character of riparian vegetation of specific stream reaches (Collins and Dunne, 1989, pp. 213–224; Kondolf 1995 pp. 133–136; NAS 2002, p. 179). Some examples of downcutting on streams in California that historically had, but no longer have, populations of western yellow-billed cuckoos, include: Cache Creek, Yolo County (15.0 ft (4.6 m) average and 26.0 ft (8.2 m) maximum downcutting); Merced River, Merced County (5.9 ft (1.8 m) average and 7.8 ft (2.4 m) maximum downcutting); Putah Creek, Yolo County (7.8 ft (2.4 m) average and 15.0 ft (4.6 m) maximum downcutting); Russian River, Sonoma County (11.4 ft (3.5 m) average and 17.9 ft (5.5 m) maximum downcutting); and Santa Clara River, Ventura County (15.6 ft (4.8 m) average and 20.2 ft (6.2 m) maximum downcutting) (Kondolf et al. 2001, p. 50). Furthermore, gravel extraction creates a knickpoint (a sharp change in channel slope) that typically erodes upstream

in a process known as headcutting, which has the potential to propagate upstream for miles on the main river and its tributaries. As headcuts migrate upstream, the incision propagates upstream (Kondolf et al. 2001, p. 49). This process creates ongoing and future impacts to habitat from past as well as current gravel mining operations. Similar to the effects of manmade levees when they disconnect floodplain habitat from the active river channel, artificial channel incision as a result of gravel mining and similar activities reduces overbank flooding. This situation reduces the hydrological connection to the floodplain (Kondolf et al. 2001, p. 56), thereby resulting in subsequent loss and degradation of riparian habitat for the western yellow-billed cuckoo, throughout its range, including Mexico (Cornell et al. 2008, p. 98). The effects of incision and channel erosion are further exacerbated where gravel mining occurs in sediment-starved reaches below dams (Kondolf et al. 2001, p. 10). We expect past and ongoing gravel mining activities, either alone or in combination with other hydrological changes in riparian areas, to continue to modify habitat and further curtail the range of the western yellow-billed cuckoo for decades. In conclusion, dams, channelization, and other manmade features that alter the watercourse hydrology and encroach into the active channel and floodplain are threats to the habitat of the western yellow-billed cuckoo because they, separately or in combination, significantly reduce and degrade nesting and foraging habitats. The natural processes that sustain riparian habitat in these and similar dammed and channelized river systems in the American West and in northwestern Mexico have been altered, resulting in only fragments or remnants of formerly large tracts of native riparian forests that no longer support breeding western yellow-billed cuckoos or support them in fewer numbers. The multiple effects from altered hydrology comprise the most widespread and greatest magnitude of current threats to habitat that supports the western yellow-billed cuckoo. Such processes continue to modify habitat and further curtail the range of the western yellow-billed cuckoo. Moreover, we expect these alterations in the hydrology to continue to affect habitat of the western yellowbilled cuckoo into the future.

Stressor: Habitat Loss and Degradation From Agricultural Activities
Exposure:
Response:
Consequence:
Narrative: Following the effects from alterations in hydrology in severity, conversion of riparian areas for agricultural crops and livestock grazing has been, and continues to be, a major contributor to riparian habitat loss and degradation (NAS 2002, p. 161; Johnson et al. 2007, p. 61). Large areas of cottonwood–willow floodplain vegetation have been converted to agricultural uses, further reducing the extent of habitat available to western yellow-billed cuckoos for breeding (Swift 1984, pp. 225–226; Rosenberg et al. 1991, pp. 18–23). For example, within areas that support the western yellow-billed cuckoo, clearing for agricultural uses occurred extensively in the past. On the floodplains of the Sacramento River (Greco 1999, pp. 2, 107), riparian habitat was reduced from 775,000 ac (314,000 ha) in the 1850s to less than 18,000 ac (7,287 ha) by 1977 (Swift 1984, p. 226). Clearing for agriculture is also extensive along the lower Colorado River (Rosenberg et al. 1991, pp. 18–23), San Pedro River, Gila River (Swift 1984, p. 226), Ri´o Grande, and several river courses in northern Mexico including, but not limited to, the Ri´o Yaqui, Ri´o Mayo, Ri´o Bambuto, Ri´o Tubutama, and Ri´o Sonora (Russell and Monson 1998, p. 11; IMADES 2003, p. 4; Villasen˜ or- Gomez 2006, p. 108). Clearing also occurred along the coasts of Sinaloa and southern Sonora, Mexico, resulting in massive losses of thorn forest to industrial agriculture (Rohwer et al. 2009, p. 19054). Although most riparian and thorn scrub habitat losses largely stem from past agricultural clearing, effects from cultivated agricultural lands are ongoing.

Agricultural lands continue to dominate much of the remaining riparian landscape, particularly along the Sacramento (Greco 1999, pp. 94, 104, 107), parts of the Gila, and lower Colorado Rivers (Johnson et al. 2007, p. 207); along the latter, 65 percent of western yellow-billed cuckoo survey sites are bordered on at least one side by agriculture fields (Johnson et al. 2007, p. 61). Riparian areas are sometimes viewed as a potential source of plant and animal pests, a source of shade that may reduce crop yields, and competition for scarce water resources (NAS 2002, pp. 170–171). For example, in the Salinas Valley in California, a vigorous program is under way to comply with food safety practices that involve the clearing of riparian habitat adjacent to certain types of crops in an effort to eliminate wildlife presence, which has been linked to contamination of crops with a virulent strain of the bacteria Escherichia coli (Beretti and Stuart 2008, pp. 68–69; Gennet et al. 2013, pp. 236–242). While western yellow-billed cuckoos do not currently breed along the Salinas River (Gaines and Laymon 1984, p. 52), if these same rules are applied to farmland along the Gila, Rio Grande, Sacramento, and Colorado Rivers, western yellow-billed cuckoo habitat could be eliminated to meet these food safety concerns. Accidental fire from farm workers operating machinery or burning weeds sporadically escapes into adjacent riparian habitat. Recent fires on western yellow-billed cuckoo and southwestern willow flycatcher conservation properties occurred in 2011, burning 58 ac (24 ha) and 6 ac (2 ha), respectively, within the Fort Thomas Preserve, on parcels owned by the Salt River Project and U.S. Bureau of Reclamation. Both fires were determined to be humancaused, likely from farm workers burning weeds along irrigation drains (SRP 2011, p. 39). Other ongoing effects from cultivated agriculture on the western yellow-billed cuckoo are addressed under Factor E. These include fragmentation of habitat into smaller, more widely disjunct patches; ongoing influence of agriculture on riparian bird community composition; and effects from pesticides, which can negatively impact insect prey populations of the western yellow-billed cuckoo.

Stressor: Habitat Loss and Degradation From Livestock Grazing Activities
Exposure:
Response:
Consequence:
Narrative: Domestic livestock grazing is a traditional agricultural land use practice in the southwestern United States since the first Spanish settlement along the Rio Grande in New Mexico in 1598 (Little 1992, p. 88; Clary and Kruse 2004, p. 239). Livestock grazing continues to be a widespread agricultural use of riparian areas in the western United States and is one of the most common sources of past and ongoing riparian habitat degradation (Carothers 1977, p. 3; Rickard and Cushing 1982, pp. 2–4; Cannon and Knopf 1984, p. 236; Klebenow and Oakleaf 1984, p. 202; Swift 1984, pp. 225–226; Clary and Webster 1989, pp. 1–2; Schultz and Leininger 1990, pp. 298–299; Bock et al. 1993, p. 300). Livestock grazing occurs in western yellow-billed cuckoo habitat along sections of the middle Rio Grande in New Mexico (Lehman and Walker 2001, p. 12), Ri´o Conchos (Cornell et al. 2008, p. 96), Ri´o Bambuto, Tubutama, La Reforma, and Cuchujaqui River in Alamos, Aconchi and Baviacora in Ri´o Sonora, and upper San Pedro River (IMADES 2003, p. 4), and several other rivers in central Sonora, Mexico (Villasen˜ or-Gomez 2006, p. 108). Grazing also occurs extensively along watercourses in a protected reserve on the Ri´o Aros and Ri´o Yaqui in Sonora, Mexico, where the western yellowbilled cuckoo has been documented (O'Brien et al. 2008, p. 8). Grazing intensity in northern Sonora, Mexico, is generally much higher than in adjacent Arizona (Balling 1988, pp. 106–107; Flesch 2008, pp. 44–45), which leads to greater degradation of riparian habitat than in Arizona. The Service (2002, Appendix G, pp. 5–7) and Krueper et al. (2003, p. 608) reviewed the effects of livestock grazing, primarily in southwestern riparian systems. The frequency and intensity of effects vary across the range of

the species, due to variations in grazing practices, climate, hydrology, ecological setting, habitat quality, and other factors (Service 2002, Appendix G, p. 1). However, these effects generally include the removal and trampling of vegetation and compaction of underlying soils, which can inhibit germination and change hydrology (Rea 1983, p. 40; Belsky et al. 1999, pp. 419–431) and promote the dispersal of nonnative plant species. Such effects are most significant when riparian areas have been subject to overuse by livestock (NAS 2002, pp. 24, 168–173). Overuse occurs when grazed vegetation does not recover sufficiently to maintain itself and soils are left bare and vulnerable to erosion. Over time, livestock grazing in riparian habitats, combined with other alterations in streamflow, typically results in reduction of plant species diversity and density and may increase the distribution and density of nonnative tamarisk by eliminating competition from native cottonwood and willow saplings, which are preferred forage for livestock (Krueper et al. 2003, p. 608). Long-term cumulative effects of livestock grazing involve changes in the structure and composition of riparian vegetation (Service 2002, Appendix G, pp. 5–7), which may affect suitability of habitat for western yellow-billed cuckoo breeding and prey population abundance. The western yellow-billed cuckoo nesting habitat is structurally complex with tall trees, a multistoried vegetative understory, low woody vegetation (Halterman 1991, p. 35) andhigher shrub area than sites without western yellow-billed cuckoos (Hammond 2011, p. 48). Livestock grazing alters understory vegetation,reducing height and density or eliminating new growth in riparian areas, and thereby hampering recruitment of woody species that, when mature, provide nest sites. Furthermore, the relatively cool, damp, and shady areas favored by western yellow-billed cuckoos are those favoredby livestock over the surrounding drier uplands. This preference can concentrate the effects of habitat degradation from livestock in western yellow-billed cuckoo habitat (Ames 1977, p. 49; Valentine et al. 1988, p. 111; Johnson 1989, pp. 38–39; Clary and Kruse 2004, pp. 242–243). Removal, reduction, or modification of cattle grazing has resulted in increases in abundance of some riparian bird species. For example, Krueper (1993, pp. 322–323) documented responses of 61 bird species, most of which increased significantly 4 years after removal of livestock grazing in Arizona’s San Pedro River Riparian National Conservation Area. The bird species guilds that increased most dramatically were riparian species, open-cup nesters, Neotropical migrants, and insectivores, all species that share characteristics with the western yellowbilled cuckoo. The western yellowbilled cuckoo numbers in the study increased, although not significantly (p=0.13) (Krueper et al. 2003, p. 612), but their survey methodology was not designed to detect western yellow-billed cuckoos. Recovery of vegetation inresponse to grazing removal in that study was quickest and most pronounced in the lower vegetation layers, the most accessible to grazing cattle. Thus, this situation would allowa greater number of seedlings and saplings of cottonwoods and other nesttrees to attain maturity as suitable nesting sites. In another example, livestock grazingwas terminated along portions of the South Fork Kern River at the Kern River Preserve in the 1980s, and western yellow-billed cuckoos increased in number in the years following livestock removal. Smith (1996, p. 4) contended that termination of grazing at the Kern River Preserve was responsible for the dramatic increase in riparian vegetation, which was concurrent with the increase in western yellow-billed cuckoo numbers. These examples suggest that even severely degraded riparian systems can recover quickly, in at least somecases, after livestock removal (Krueper et al. 2003, p. 615), and that damage to riparian vegetation from grazing is at least partly reversible. They alsoillustrate the extent to which livestock grazing destroys and modifies nesting and foraging habitat of the Western yellow-billed cuckoo. In conclusion, most of the direct loss of habitat from agricultural conversion has occurred in the past, but ongoing agricultural activities, in whole or in combination with other impacts, especially those that result in changes in a watercourse’s hydrology, have resulted in the curtailment of nesting and foraging habitat for the Western yellow-billed cuckoo by restricting or preventing the growth of riparian plants, and such activities present an ongoing threat. Most of the current impacts from agricultural land uses arise from livestock overgrazing in riparian areas. Riparian vegetation can recover relatively quickly from these effects after livestock removal (Smith 1996, p. 4; Krueper et al. 2003, p. 615). However,without proper management to reduce overgrazing, ongoing overgrazing will continue to contribute to habitat modification in the range of the western yellow-billed cuckoo into the future.

Stressor: Habitat Loss and Degradation Due to Conversion to Nonnative Vegetation
Exposure:
Response:
Consequence:
Narrative: Throughout most of its range, habitat for the western yellow-billed cuckoo is threatened by the conversion of native riparian woodlands to riparian vegetation dominated by tamarisk and other nonnative vegetation. The major threat from this habitat conversion is the change from vegetation that supplies the western yellow-billed cuckoos with essential food and adequate thermal cover to vegetation that does not provide these necessary components of habitat for the western yellow-billed cuckoo. The establishment and persistence of tamarisk is often, but not always, aided by altered hydrology, as described above. Altered hydrology is not the cause for establishment and persistence of other types of nonnative vegetation; therefore, we present information on nonnative vegetation in this separate section. Tamarisk is the most widespread nonnative woody plant species found in habitat for the western yellow-billed cuckoo. Glenn and Nagler (2005, pp. 420–423) provide most of the following overview of tamarisk. Tamarisk is present in nearly every southwestern riparian plant community, but varies in dominance from stream to stream. On streams where altered hydrology can no longer support native species, it has replaced native plant communities entirely, but occurs at a low frequency on other streams. Tamarisk was introduced into western North America in the 1800s to serve as ornamental windbreaks, and for erosion control and other purposes. Several species escaped cultivation and have since spread rapidly. The center of tamarisk distribution is currently Arizona, New Mexico, and Utah, and it has spread throughout most of the range of the western yellow-billed cuckoo at least as far north as the Yellowstone River in Montana in the Rockies, and at least as far south as the Yaqui River Valley in Sonora, Mexico. Recent studies in the northwest have located major populations of tamarisk in southwestern Idaho, and eastern Washington and Oregon. Models based on projected climate change predict that this invasive species will become more dominant in this region over the next 100 years (Kerns et al. 2009, pp. 200–215). Tamarisk also occurs west to the Owens, San Joaquin, and Sacramento Rivers in California, although it is still nearly absent from the mainstem Sacramento River in California and suitable habitat west of the Cascades in Oregon and Washington. Tamarisk also occurs as isolated individuals along sections of the Sonora, Moctezuma, and Sahiaripa Rivers in Sonora, Mexico, where the hydrology has been little altered by human modifications (Villasen˜ or-Gomez 2006, pp. 107–108). Its presence is highly variable within sections of the Ri´o Conchos in Chihuahua, Mexico, and becomes dominant in some reaches of that river (Kelly and Arias Rojo 2007, pp. 177–178; Cornell et al. 2008, p. 4). The threshold (in terms of percent tamarisk) for abandonment of a riparian system by western yellow-billed cuckoos is not known. They are not found in areas that are totally dominated by tamarisk with the complete lack of willows or cottonwoods. In California, two nativedominated areas occupied in 1977 by several pairs of western yellow-billed cuckoos had, by 1986, converted to monotypic stands of tamarisk and were found to be uninhabited by western yellow-billed cuckoos. Above Laguna Dam on the Colorado River in 1977, at least three pairs of western yellowbilled cuckoos occupied a 30-ac (12-ha) site that was approximately 20–40

percent willow (Laymon and Halterman 1987a, p. 12). By 1986 no western yellow-billed cuckoos were detected on the site where the dominant vegetation had become tamarisk, with less than 1 percent willow cover. In the vicinity of Picacho State Recreation Area, on the California side of the Colorado River, in 1977, 21 western yellow-billed cuckoos were found in 297 ac (120 ha) of a 230- ft-wide (70-m-wide) willow forest (Gaines and Laymon 1984, p. 72). By 1986, tamarisk and aquatic vegetation dominated this area, and no western yellow-billed cuckoos were found in the 12 ac (5 ha) of scattered willow– cottonwood habitat that remained (Laymon and Halterman 1987a, pp. 12– 13). Human disturbance, such as water diversion, flood control, vegetation clearing, and improper grazing management, often facilitates replacement of native vegetation with tamarisk (Kerpez and Smith 1987, pp. 1–5; Hunter et al. 1988, p. 113; Rosenberg et al. 1991, pp. 18–23). Altered hydrologic regimes (flooding or reduction in water flows from dams) has disrupted natural flooding events that are essential for maintaining native riparian ecosystems (Vogl 1980, pp. 84– 86; Rosenberg et al. 1991, pp. 18–23), and the disruption (usually elimination) of flooding tends to favor tamarisk. In contrast to native cottonwoods, tamarisk does not need flooding to regenerate (Kerpez and Smith 1987, pp. 1–5). Tamarisk is also tolerant of high salt levels, which can be present in river systems as a combined result of water diversions that lower the near-surface ground water and irrigation water runoff that contains high levels of dissolved salts (Kerpez and Smith 1987, pp. 1–5; Busch and Smith 1993, pp. 186–194). This higher tolerance to water stress and salt accumulation is a principlemechanism by which tamarisk has become dominant on some regulated western rivers (Glenn and Nagler 2005, . 439). In addition, tamarisk takes salts from the ground water and exudes them from its leaves, rendering the soil even more unsuitable for germination of native riparian vegetation. This is a significant problem in streams with artificially reduced streamflows where salts accumulate and are not flushed from the system. These factors favor regeneration of tamarisk over native trees and shrubs and are an ongoing threat. Additional areas of native habitat are continuing to be lost to this process. In summary, the persistence and expansion of tamarisk-dominated habitat is the result of multiple forms of ongoing human-related disturbances, which result in degradation of ativedominated riparian habitat, thus reducing its suitability as breeding habitat for the western yellow-billed cuckoo. Other nonnative tree and shrub species have become established within the range of the western yellow-billed cuckoo. In western Colorado and Utah, Russian olive (Elaeagnus angustifolia) has become established and is a dominant tree species in many riparian systems. Giant reed (Arundo donax), common edible fig (Ficus carica), and the Himalayan blackberry (Rubus discolor) are some of the more conspicuous nonnative plants widely established along the Sacramento River, with Himalayan blackberry dominating the understory at some restoration sites (Borders et al. 2006, p. 310). Along the Sacramento River, western yellow-billed cuckoos were far less likely to be detected at sites with an understory dominated by Himalayan blackberry than sites with a predominant native understory. Himalayan blackberry may prevent establishment of native understory species due to its dense growth habit (Hammond 2011, pp. 48– 49). Nesting of the western yellow-billed cuckoo has not been documented in riparian stands dominated by giant reed, common fig, or Himalayan blackberry that lack at least some native canopy trees. In conclusion, because of the absence or near absence of nesting by western yellow-billed cuckoos in nearly monotypic stands of tamarisk and other nonnative vegetation, the available literature suggests that conversion of native or mixed (native and nonnative) riparian woodlands to nearly monotypic stands of tamarisk nd other nonnative vegetation, coupled with the inability of native vegetation to regenerate under altered hydrological conditions, is a significant threat to the western yellowbilled cuckoo now and in the future. Nonnative vegetation, such as tamarisk, occurs across most of the range of the western yellow-billed cuckoo; its establishment can be caused by altered hydrology or other disturbances, which are widespread throughout the range. We expect nonnative vegetation to increasingly modify and curtail habitat for the western yellow-billed cuckoo within a majority of its range in the United States and northern Mexico into the future.

Stressor: Use of Tamarisk by Western Yellow- Billed Cuckoos and the Spread of the Introduced Tamarisk Leaf Beetle Into the Southwest
Exposure:
Response:
Consequence:
Narrative: Western yellow-billed cuckoos use habitat with some tamarisk component for nesting in southern California, Arizona, and western New Mexico, but are not found in monotypic stands of tamarisk. Western yellow-billed cuckoo presence in tamarisk-dominated habitats does not necessarily equate to habitat suitability (Sogge et al. 2008, p. 149; Hammond 2011, p. 50), and additional research is needed to determine productivity, survivorship, physiological condition, and food availability in these habitats. Tamarisk can add to foliar cover that contributes toward reducing temperatures in riparian areas (Paxton et al. 2011, p. 259). Even relatively small decreases in foliar cover may render a site unsuitable for nesting western yellow-billed cuckoos (Paxton et al. 2011, p. 260). Removal of tamarisk in drainages occupied by western yellowbilled cuckoos can have unintended negative consequences if the removal leaves little or no woody vegetation and native riparian vegetation is unable to reestablish. The available literature that pertains to riparian restoration in New Mexico and Arizona (Poff et al. 1997, pp. 769–784; Glenn and Nagler 2005, pp. 439–441; Sogge et al. 2008, pp. 151– 152; Stromberg et al. 2009, pp. 181–182) suggests that restoration of natural hydrological processes, rather than direct removal programs, would be a more effective method for promoting regeneration of native riparian vegetation and diminishing the presence of tamarisk. However, tamarisk removal programs coupled with native riparian plantings can speed up the restoration process assuming that the hydrologic system will support the native vegetation. Tamarisk leaf beetle insects (leaf beetles) (Diorhabda spp.) were released into many locations throughout the southwest to control tamarisk. Leaf beetles are now spreading within the more arid range of the western yellowbilled cuckoo in Nevada, Utah, Arizona, New Mexico, and Texas. Defoliation of tamarisk by the beetles occurs in the summer months when western yellowbilled cuckoos are in the process of nesting. Tamarisk leaf beetles could eventually occur throughout the western United States and northern Mexico (Tracy et al. 2008, pp. 1–3). The future effects of the beetle introductions to the western yellow-billed cuckoo are unknown. If beetles succeed in killing tamarisk, western yellow-billed cuckoo numbers may decline in areas where the hydrology is no longer capable of supporting a native riparian habitat and the numbers may increase in areas where native riparian vegetation is able to become reestablished.

Stressor: Wildfire
Exposure:
Response:
Consequence:
Narrative: Historically, wildfire was uncommon in native riparian woodlands (Busch and Smith 1993, pp. 186–194). However, the lack of scouring floods on regulated and unregulated rivers has resulted in the accumulation of fuel on the floodplain, which increases fire risk and intensity (Stromberg and Chew 2002, pp. 195–219). Water withdrawal, dams, climate change, drought, and human use also contribute toward an increased fuel load and probability of wildfire occurrence. Most fires today are human-caused (Service 2002, p. L–8). In degraded habitat with

tamarisk the threat of fire may be greater. Tamarisk ignites quickly, further increasing the incidence of periodic fires. Exacerbating the immediate loss of native trees from fire, tamarisk recovers more quickly than native trees (Glenn and Nagler 2005, pp. 435–436). Along the Rio Grande River in New Mexico and Texas, wildfire has been documented as destroying, degrading, or setting back successional stages of vegetation development of western yellow-billed cuckoo habitat (Sproul 2000, in litt., p. 3). In summary, the alteration of riparian systems through changes in hydrologic functioning and the introduction of nonnative tamarisk have increased the incidence of wildfire into western yellow-billed cuckoo habitat. These fires further degrade, isolate, or fragment western yellow-billed cuckoo habitat.

Stressor: Environmental Impacts of Cross-Border Foot Traffic in the Southwest
Exposure:
Response:
Consequence:
Narrative: The environmental impact caused by cross border foot traffic has been increasingly occurring in more fragile and remote areas. The number of U.S. Border Patrol apprehensions of border crossers varies annually. Between October 1, 1999, and September 30, 2012, a yearly average of 333,517 border crossers were apprehended by the United States Border Patrol in the Tucson Sector, which does not account for the many others who were not caught (U.S. Border Patrol 2013, p. 1). Impacts associated with border crossings include creation of erosion and watershed degradation, loss of vegetation and wildlife, and humancaused wildfire (Defenders of Wildlife 2006, pp. 1–42). Drainages used by border crossers include the San Pedro River, Santa Cruz River, Cienega Creek, and many remote drainages in the mountain ranges of southeastern Arizona. Human-caused wildland fires have been particularly damaging to areas of riparian habitat in Arizona, especially within 100 mi (161 km) of the United States-Mexico border where border crossers are known to set fires to divert law enforcement agents. Border crossers are also responsible for campfires that can escape and spread as wildfires. At least 2,467 wildfires began along the Arizona border with Mexico from 2006 to 2010 (Government Accounting Office 2011, p. 1). Federal officials have officially investigated only 77 of those fires. Of the fires investigated, 30 were started by border crossers. The resulting environmental impacts include the expansion of nonnative plant species, degraded endangered species habitat, and soil erosion.

Stressor: Climate Change
Exposure:
Response:
Consequence:
Narrative: The available climate change models are predicting altered future environmental conditions across the breeding range of the western yellow-billed cuckoo. In the southwestern United States, northern Mexico, California, Intermountain West, and Pacific Northwest, climate change is generally predicted to result in an overall warmer, drier climate, with periodic episodic precipitation events that, depending on site conditions, are expected to have adverse effects on habitat of the western yellow-billed cuckoo. In rivers that depend on snowmelt, these changes are expected to result in more winter flooding and reduced summer stream flows. The amount of surface ground water available to regenerate and sustain riparian forests is expected to decline overall with persistent drought, favor the spread of tamarisk and other nonnative vegetation, and increase fire frequency. Precipitation events under most climate change scenarios will decrease in frequency and increase in severity. This change may reduce available nesting sites, patch size, and affect prey abundance as a result of lower humidity in riparian areas from

reduced moisture retention, and through periods of prolonged desiccation followed by scouring flood events. In addition, evidence shows that climate change may disrupt the synchrony of nesting western yellow-billed cuckoos and their food supply, causing further population decline and curtailment of its occupied range. Impacts to habitat from climate change exacerbate impacts from impoundments, channelization, and alteration of river flows across the western United States and Mexico, and from conversion of habitat from native to mostly nonnative vegetation. Changing climate is expected to place an added stress on the species and its habitats. While we do not have evidence to suggest that the habitat of the western yellow-billed cuckoo is being substantially affected by climate change at this time, we expect long-term climate trends to have an overall negative effect on the available habitat throughout the breeding range of the western yellow-billed cuckoo. Moreover, a drying trend associated with global climate change may result in more dams, levees, or other activities to ensure fresh water for human consumption, which may result in additional habitat loss from the activities described in the Habitat loss from Dams and Alteration of Hydrology section, above.

Stressor: Disease
Exposure:
Response:
Consequence:
Narrative: Little is known about diseases in the western yellow-billed cuckoo. West Nile virus has recently spread throughout portions of the western United States. It poses a potential threat to many bird species. The U.S. Geological Survey's (USGS) National Wildlife Health Center has identified the yellow-billed cuckoo as a species that is subject to the effects of West Nile virus (USGS–National Wildlife Health Center 2005, p. 2). The Centers for Disease Control's (CDC) Vector-Borne Disease Web site reports that West Nile virus has been documented in a dead yellow-billed cuckoo (CDC 2012); however, it is unknown if this yellow-billed cuckoo was from the western DPS. Although the population of the western yellow-billed cuckoo has been in decline over several decades (see Historical and Current Status section, above), no evidence suggests that it has undergone a precipitous decline coincident with the relatively recent arrival of West Nile virus in western North America. Therefore, we conclude, based on the best available scientific and commercial information, which is limited, that the adverse effects of West Nile virus to the western yellow-billed cuckoo are not significant and do not constitute a threat at this time, nor is there any information to suggest that this situation will change into the future. All bird species, including the yellowbilled cuckoo, are exposed, to some extent, to parasites. Greiner et al. (1975, pp. 1762–1787) found 5 of 16 yellowbilled cuckoos infected with Leucocytozoon, Trypanosoma, and microfilaria blood parasites. No information indicates whether these and other parasites (see Hughes 1999, p. 18, for a brief review) pose any threat to the western yellow-billed cuckoo.

Stressor: Inadequate regulations
Exposure:
Response:
Consequence:
Narrative: Various Federal, State, and international regulatory mechanisms in place provide varying degrees of conservation oversight that may to some degree address the threat of ongoing habitat loss and degradation resulting from altered hydrology, conversion of habitat to nonnative vegetation, climate change, agricultural activities, or exposure to pesticides and effects of small and isolated habitat patches. In California, where the species is listed as endangered,

regulations prohibit unpermitted possession, purchase, sale, or take of listed species. Such prohibition of take does not include the species' habitat, and the western yellow-billed cuckoo continues to decline in California despite its status as a State-listed species. In addition, even though theCalifornia Department of Pesticide Regulations has a program to protect endangered species, the western yellowbilled cuckoo has not been included as a covered species. Because the yellow-billed cuckoo is not a protected or sensitive species in Canada, Mexico, or in a majority of the United States, and a variety of factors influence the species and its habitat, we have determined that the current regulatory regime does not adequately address the majority of impacts to the western yellow-billed cuckoo or its habitat. One of the primary threats with the greatest severity and magnitude of impact to western yellow-billed cuckoo is the loss of habitat as a result of altered hydrologic functioning of streams in the West. Although some protections currently exist for the species and its habitat as a result of existing regulatory mechanisms at the Federal, State, or local level, our evaluation suggests these protections are inadequate to address the threats associated with the species and its habitat.

Stressor: Isolated populations
Exposure:
Response:
Consequence:
Narrative: The potential natural regeneration or restoration of the habitat to reconnect these areas is low due to various reasons. Under the best of circumstances, for riparian habitat (willows, cottonwoods) to mature to the point at which it provides for appropriate food, shelter, and breeding conditions for the western yellow-billed cuckoo may take 3–5 years (Golet et al. 2008, pp. 20–22). However, in areas where conditions are less than optimal, habitat may take several decades to mature to the point where it would be available for use (Strahan 1984, pp. 58–67; Briggs 1995, pp. 63–67; Opperman and Merenlender 2004, pp. 822–834; Trowbridge et al. 2004, pp. 157–164; Morris et al. 2006, pp. 106– 116; Griggs 2009, p. 12). As a result, the western yellow-billed cuckoo now primarily occurs in smaller, more widely separated populations. Compared to large populations, smaller populations are disproportionately affected by natural and manmade factors. These stressors vary in frequency, timing, and magnitude across the species' range. They are related or correlated to each other or act in combination to result in significant impacts to the western yellow-billed cuckoo within all or portions of its range. One of the ramifications of smaller, more isolated habitat patches is that the smaller the patch, the more edge it has in proportion to its area, which increases the percentage of the available habitat exposed to the surrounding land uses (Hunter 1996, pp. 186–187). This is a particularly prevalent characteristic of the western yellow-billed cuckoo's remaining disjunct habitat patches, as many patches are in proximity to agricultural and other human-altered landscapes. For example, such land use currently dominates much of the riparian landscape within many regions, particularly along some reaches of the lower Colorado River, Sacramento River, Snake River, Verde River, Gila River, Santa Cruz River, San Pedro River, and Ri´o Grande; and also in parts of northern Mexico in the vicinity of floodplain farming along the Sonora, Magdalena, and Moctezuma Rivers (Villasen˜ or-Gomez 2006, p. 111).

Stressor: Pesticides
Exposure:
Response:
Consequence:

Narrative: Pesticide use is widespread in agricultural areas in the western yellow-billed cuckoo breeding range in the United States and northern Mexico. Yellow-billed cuckoos have been exposed to the effects of pesticides on their wintering grounds, as evidenced by DDT found in their eggs and eggshell thinning in the United States. Because much of the species' habitat is in proximity to agriculture, the potential exists for direct and indirect effects to a large portion of the species in these areas through altered physiological functioning, prey availability, and, therefore, reproductive success, which ultimately results in lower population abundance and curtailment of the occupied range. While agricultural pesticides can kill prey of the yellow-billed cuckoo, and documentation exists of pesticide exposure in the wild, described above, no known data are available to determine specifically how often agricultural chemicals may be affectingyellow-billed cuckoo prey availability, locations where it may be particularly significant, or the extent to which pesticides may be responsible for population-level effects in the western yellow-billed cuckoo. However, based on the close proximity of agricultural areas to where the western yellow-billed cuckoo breeds, the threat is potentially significant.

Stressor: Collisions With Communication Towers, Wind Turbines, Solar PowerTowers, and Other Tall Structures
Exposure:
Response:
Consequence:
Narrative: Yellow-billed cuckoos are vulnerable to collision with communication towers and other tall structures, particularly during their migration. For example, several hundred yellow-billed cuckoo mortalities were documented at a single television tower in Florida over a 29- year period (Crawford and Stevenson 1984, p. 199; Crawford and Engstrom 2001, p. 383), and at an airport ceilometer in the east (Howell et al. 1954, p. 212). Lesser numbers of yellowbilled cuckoos have been reported as killed at other sites with both television towers and wind turbines in Wisconsin, West Virginia, and northern Texas (Kemper 1996, p. 223; Schechter 2009, p. 1; Bird Watching 2011, p. 1), Although these mortalities were in the eastern segment of the population, with the number of tall towers that have been constructed in recent years in the western United States, the potential exists for collisions with the western yellow-billed cuckoo. Remains of a yellow-billed cuckoo along with 70 other species of birds have been recovered at the Ivanpah solar power tower facility (California) during its first year of operation (Kagan et al. 2014, p. 10). Without further study, we anticipate this to be a minor, but ongoing, effect to individual yellowbilled cuckoos, but in combination with all the other effects to this species mortality from collision would have an additive effect to the threats facing the western yellow-billed cuckoo.

Recovery

Reclassification Criteria:
Not availalble

Recovery Priority Number: 3C

Delisting Criteria:
Not availalble

Recovery Actions:

- Develop a recovery plan.

References

USFWS. 2014. Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus)

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Natureserve

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Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus) Final Rule October 3, 2027

Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus) Final Rule October 3, 2028

Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus) Final Rule October 3, 2029

Determination of Threatened Status for the Western Distinct Population Segment of the Yellow-billed Cuckoo (Coccyzus americanus) Final Rule October 3, 2030

SPECIES ACCOUNT: *Eremophila alpestris strigata* (Streaked Horned lark)

Species Taxonomic and Listing Information

Commonly-used Acronym: SHLA

Listing Status: Threatened; Pacific Region (R1) (USFWS, 2016)

Physical Description

The streaked horned lark (Eremophila alpestris strigata) is endemic to the Pacific Northwest (British Columbia, Washington, and Oregon) (Altman 2011, p. 196) and is a subspecies of the wide-ranging horned lark (Eremophila alpestris sp.). Horned larks are small, ground-dwelling birds, approximately 16 to 20 cm (6 to 8 inches) in length (Beason 1995, p. 2). Adults are pale brown, but shades of brown vary geographically among the subspecies. The male's face has a yellow wash in most subspecies. Adults have a black bib, black whisker marks, black "horns" (feather tufts that can be raised or lowered), and black tail feathers with white margins (Beason 1995, p. 2). Juveniles lack the black face pattern and are varying shades of gray, from almost white to almost black with a silver-speckled back (Beason 1995, p. 2) (USFWS, 2016).

Taxonomy

The horned lark is found throughout the northern hemisphere (Beason 1995, p. 1); it is the only true lark native to North America (Beason 1995, p. 1). Subspecies of horned larks are based primarily on differences in color, body size, and wing length. Molecular analysis has further borne out these morphological distinctions (Drovetski et al. 2005, p. 875). Western populations of horned larks are generally paler and smaller than eastern and northern populations (Beason 1995, p. 3). The streaked horned lark was first described as Otocorys alpestris strigata by Henshaw (1884, pp. 261–264, 267–268). There are four other subspecies of horned larks that occur in Washington and Oregon: pallid horned lark (E. a. alpina), dusky horned lark (E. a. merrilli), Warner horned lark (E. a. lamprochroma), and arctic horned lark (E. a. articola) (Marshall et al. 2003, p. 426; Wahl et al. 2005, p. 268). None of these other subspecies breed within the range of the streaked horned lark, but all four subspecies frequently overwinter in mixed species flocks in the Willamette Valley (Marshall et al. 2003, pp. 425–427). Drovetski et al. (2005, p. 877) evaluated the genetic distinctiveness, conservation status, and level of genetic diversity of the streaked horned lark using the complete mitochondrial ND2 gene. Samples from 32 streaked horned larks in western Washington and 66 horned larks from Alaska, alpine Washington, eastern Washington, eastern Oregon, and California were analyzed. The 30 haplotypes identified from the 98 horned larks formed three clades (taxonomic group of organisms classed together based on homologous features traced to a common ancestor): Pacific Northwest (alpine and eastern Washington, Alaska), Pacific Coast (Puget Sound and Washington coast) and coastal California, and Great Basin (Oregon) (Drovetski et al. 2005, p. 880). Analyses indicate that the streaked horned lark population is well-differentiated and isolated from all other sampled localities, including coastal California, and has "remarkably low genetic diversity" (Drovetski et al. 2005, p. 875). All 32 streaked horned lark individuals shared the same haplotype with no variation between sequences compared. All other localities had multiple haplotypes despite smaller sample sizes (Drovetski et al. 2005, pp. 879–880). The lack of mitochondrial DNA (mtDNA) diversity exhibited by streaked horned larks is consistent with a population bottleneck (Drovetski et al. 2005, p. 881). The streaked horned lark is differentiated and isolated from all other sampled localities, and although it was "…historically a part of a larger Pacific Coast lineage of horned larks, it has been evolving independently for some time and can be considered a distinct evolutionary unit" (Drovetski et al. 2005, p. 880). The streaked horned lark is recognized as a valid subspecies by the Integrated Taxonomic Information System (2012c) (USFWS, 2016).

Historical Range

The streaked horned lark's breeding range historically extended from southern British Columbia, Canada, south through the Puget lowlands and outer coast of Washington, along the lower Columbia River, through the Willamette Valley, the Oregon coast and into the Umpqua and Rogue River Valleys of southwestern Oregon (Altman 2011). The subspecies has been extirpated as a breeding species throughout much of its range, including all of its former range in British Columbia, the San Juan Islands, the northern Puget Trough, the Washington coast north of Grays Harbor County, the Oregon coast, and the Rogue and Umpqua Valleys in southwestern Oregon (Pearson and Altman 2005) (USFWS, 2016).

Current Range

The current range and distribution of the streaked horned lark can be divided into three regions: 1) the south Puget Sound in Washington; 2) the coast (both Oregon and Washington) and lower Columbia River islands (including dredge spoil deposition and industrial sites near the Columbia River in Portland, Oregon); and 3) the Willamette Valley in Oregon (USFWS, 2016). Breeding Range: Streaked horned larks currently breed on seven sites in the south Puget Sound. Four of these sites are on Joint Base Lewis McChord: 13th Division Prairie, Gray Army Airfield, McChord Field, and 91st Division Prairie. The largest population of streaked horned larks currently breeds at the Olympia Regional Airport and a small population nests at the Port of Shelton's Sanderson Field (airport) (Pearson and Altman 2005; Pearson et al. 2008). One additional breeding population has recently been documented at the Tacoma Narrows Airport (Michele Tirhi, WDFW, pers. comm., 2014); however, there is very limited population abundance information available. On the Washington coast, there are four known breeding sites in Grays Harbor and Pacific Counties: Damon Point; Midway Beach; Graveyard Spit; and Leadbetter Point (Pearson and Altman 2005). On the Oregon coast, no documented breeding has occurred, but individuals have been observed during the breeding season in Clatsop County (USFWS 2020). On the lower Columbia River, streaked horned larks breed on several of the sandy islands downstream of Portland, Oregon. Recent surveys have documented breeding streaked horned larks on Rice, Miller Sands Spit, Pillar Rock, Welch, Tenasillahe, Coffeepot, Whites/Browns, Wallace, Crims, and Sandy Islands in Wahkiakum and Cowlitz Counties in Washington, and Columbia and Clatsop Counties in Oregon (Pearson and Altman 2005; Anderson 2013). Larks also breed at the Rivergate Industrial Complex and the Southwest Quad at Portland International Airport; both sites are owned by the Port of Portland, and are former dredge spoil deposition fields (Moore 2011a). In the Willamette Valley, streaked horned larks breed in Benton, Clackamas, Lane, Linn, Marion, Polk, Washington, and Yamhill Counties. Larks are most abundant in the southern part of the Willamette Valley. The largest known population of larks is resident at Corvallis Municipal Airport in Benton County (Moore 2008); other resident populations occur at the Baskett Slough, William L. Finley, and Ankeny units of the Service's Willamette Valley National Wildlife Refuge Complex (Moore 2008) and on Oregon Department of Fish and Wildlife's (ODFW's) E.E. Wilson Wildlife Area (ODFW 2008). Breeding populations also occur at municipal airports in the valley (including McMinnville, Salem, and Eugene) (Moore 2008). Much of the Willamette Valley is private agricultural land, and has not been surveyed for streaked horned larks, except along public road margins. There are numerous other locations on private and municipal lands on which streaked horned larks have been observed in the Willamette Valley, particularly in the southern valley (Linn, Polk, and Benton Counties) (eBird 2013, ebird.org). In 2008, a large population of streaked horned larks colonized a wetland and prairie restoration site on M–DAC Farms, a privately owned parcel in Linn County; as the vegetation at the site matured in the following two years, the site became less suitable for larks, and the population declined (Moore and Kotaich 2010). This is likely a common pattern, as breeding streaked horned larks opportunistically shift sites as habitat becomes available among private agricultural lands in the Willamette Valley (Moore 2008). Winter Range Pearson et al. (2005b) found that most streaked horned larks winter in the Willamette Valley (72%) and on the islands in the lower Columbia River (20%); the rest spend the winter on the Pacific coast (8%) or in the south Puget Sound (1%). In the winter, most of the streaked horned larks that breed in the south Puget Sound migrate south to the Willamette Valley or west to the Washington coast; streaked horned larks that breed on the Washington coast either remain on the coast or migrate south to the Willamette Valley; birds that breed on the lower Columbia River islands remain on the islands or migrate to the Washington coast; and birds that breed in the Willamette Valley remain there over the winter (Pearson et al. 2005). Streaked horned larks spend the winter in large groups of mixed subspecies of horned larks in the Willamette Valley, and in smaller flocks along the lower Columbia River and Washington Coast (Pearson et al. 2005; Pearson and Altman 2005) (USFWS, 2016).

Critical Habitat Designated

Yes; 11/13/2013.

Legal Description

On October 3, 2013, the U.S. Fish and Wildlife Service designated critical habitat for the Taylor's checkerspot butterfly (Euphydryas editha taylori) and streaked horned lark (Eremophila alpestris strigata) under the Endangered Species Act of 1973, as amended (Act). Approximately 4,629 acres (1,873 hectares) in Grays Harbor, Pacific, and Wahkiakum Counties in Washington, and in Clatsop, Columbia, Marion, Polk, and Benton Counties in Oregon, fall within the boundaries of the critical habitat designation for streaked horned lark.

Critical Habitat Designation

The two units designated as critical habitat are: Unit 3— Washington Coast and Columbia River (with 13 subunits), and Unit 4— Willamette Valley (with 3 subunits). The Washington Coast and Columbia River Unit (Unit 3) totals 2,900 ac (1,173 ha) and includes 564 ac (228 ha) of Federal ownership, 2,209 ac (894 ha) of State-owned lands, and 126 ac (51 ha) of private lands. The Willamette Valley Unit (Unit 4) totals 1,729 ac (700 ha) and is entirely composed of Federal lands. A total of 4,629 ac (1,873 ha) of critical habitat is designated for the streaked horned lark rangewide.

Unit 3: Washington Coast and Columbia River—Streaked Horned Lark On the Washington coastal sites, the streaked horned lark occurs on sandy beaches and breeds in the sparsely vegetated, low dune habitats of the upper beach. We are designating four subunits (Subunits 3–A, 3–B, 3–C, and 3–D) and a total of 2,235 ac (904 ha) as critical habitat on the Washington coast. The coastal sites are owned and managed by Federal, State, and private entities. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to reduce human disturbance during the nesting season, and the continued encroachment of invasive, nonnative plants requires special management to restore or retain the open habitat preferred by the streaked horned lark. Subunits 3–A, 3–B, 3–C, and 3–D overlap areas that are designated as critical habitat for the western snowy plover. The snowy plover nesting areas are posted and monitored during the spring and summer to keep recreational beach users away from the nesting areas; these management actions also benefit the streaked horned lark. In the lower Columbia River, we are designating nine island subunits (Subunits 3–E through 3–M) for a total of 665 ac (269 ha). The island subunits are owned by the States of Oregon and Washington. On the Columbia River island sites, only a small portion of each island is designated as critical habitat for the streaked horned lark; most of the areas mapped are used by the Corps for dredge material deposition in its channel maintenance program. Within any deposition site, only a portion is likely to be used by the streaked horned lark in any year, as the area of habitat shifts within the deposition site over time as new materials are deposited and as older deposition sites become too heavily vegetated for use by streaked horned larks. All of the island subunits are small, but are adjacent to open water, which provides the open landscape context needed by streaked horned larks. The main threats to the essential features in the critical habitat subunits designated on the Columbia River islands are invasive vegetation and direct impacts associated with deposition of dredge material onto streaked horned lark nests during the nesting season. In all subunits, the physical or biological features essential to the conservation of each subspecies may require special management considerations or protection to manage, protect, and maintain the PCEs supported by the subunits. For those threats that are common to all subunits, special management considerations or protections may be required to address direct or indirect habitat loss due to the location and timing of dredge material placement to areas that have become unsuitable for streaked horned lark nesting and wintering habitat. Subunit 3–A: Damon Point—(Grays Harbor County, Washington). This critical habitat subunit is about 481 ac (194 ha) in size; of this, 456 ac (185 ha) are owned by the State, and 24 ac (10 ha) are under private ownership. It extends from the Ocean Shores wastewater treatment plant on the western edge through the Oyhut wildlife management unit and Damon Point spit (also called Protection Island). The vast majority of this area (~95 percent) is managed by the State of Washington (WDFW, WDNR, and Washington State Parks). This subunit is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. The site has both the open landscape context and sparse, low-growing vegetation that make up the physical or biological features essential to the conservation of the subspecies. Streaked horned larks currently nest and winter on Damon Point and have also been documented nesting along the beach just west of the treatment plant. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to reduce human disturbance during the nesting season and encroachment by invasive, nonnative plants that render the habitat too dense for use by streaked horned larks. Subunit 3–B: Midway Beach—(Pacific County, Washington). This subunit is about 611 ac (247 ha) in size. The northern edge of the subunit starts at Grayland Beach State Park and extends south to the Warrenton Cannery road. The landward extent is defined by the vegetation and ownership line in the mid-dune area. This site is owned by the State of Washington (Washington State Parks and Recreation Department). This subunit is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. Both open landscape context and the sparse, low-growing vegetation that make up the physical or biological features essential to the conservation of the subspecies are present at the site, and Midway Beach is used by streaked horned larks for both nesting and wintering. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to reduce human disturbance during the nesting season and encroachment by invasive, nonnative plants that render the habitat too dense for use by streaked horned larks. Subunit 3–C: Shoalwater/Graveyard Spit—(Pacific County, Washington). This subunit is about 479 ac (194 ha); of this, 377 ac (152 ha) are owned by the State, and 102 ac (41 ha) are under private ownership. The central portion of the subunit (182 ac; 74 ha) is within the Shoalwater Bay Indian Reservation and has been excluded under section 4(b)(2) (see Exclusions), dividing the subunit into northwest and southeast sections. Streaked horned larks have been documented off and on at this site during the breeding season since 2000. Although the site has been unoccupied for the past couple of years, singing male streaked horned larks were documented at this site during surveys in June 2012; therefore, we consider this site to be currently occupied. As with the other areas along the Washington coast, streaked horned larks use this site for both nesting and wintering. The subunit is a dynamic area and has a constantly changing sand spit that supports the essential features for nesting and wintering habitat. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to reduce human disturbance during the nesting season and encroachment by invasive, nonnative plants that render the habitat too dense for use by streaked horned larks. Subunit 3–D: Leadbetter Point— (Pacific County, Washington). This subunit contains about 665 ac (269 ha) at the northern tip of the Long Beach Peninsula. This subunit is on the Willapa National Wildlife Refuge and the Seashore Conservation Area (managed by Washington State). This site is occupied and provides the physical or biological features essential to the conservation of the subspecies. Most of the streaked horned larks at this site nest within the habitat restoration area and in ponded swales landward of the restoration area that go dry in the summer (Ritchie 2012, pers. comm.). The site has the open landscape context and sparse, low-growing vegetation that make up the physical or biological features essential to the conservation of the subspecies. The Willapa National Wildlife Refuge completed its comprehensive conservation plan in August 2011, and manages habitat at the tip of Leadbetter Spit for the western snowy plover, streaked horned lark, and other native coastal species. These management activities are compatible with streaked horned lark conservation. As with the other coastal sites, Leadbetter is used by streaked horned larks year-round. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–E: Rice Island—(Clatsop County, Oregon, and Wahkiakum County, Washington). This subunit is about 224 ac (91 ha) in size. The island is located at river mile (RM) 21, approximately 7 mi (11 km) upstream of the Astoria-Megler Bridge near the mouth of the Columbia River. Although the island is within the planning boundary of the Julia Butler Hansen National Wildlife Refuge, Rice Island is owned by the Oregon Department of State Lands. A very small portion of the subunit is in Wahkiakum County and on Washington State lands. The Corps uses this site for dredge material disposal as part of its maintenance of the Columbia River shipping channel. This subunit is occupied and provides the features essential to the conservation of the subspecies. Streaked horned larks currently nest and winter on Rice Island. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–F: Miller Sands Spit— (Clatsop County, Oregon). Miller Sands Spit is across the shipping channel from Rice Island at RM 24. The subunit is a sand spit 2 mi (1.2 km) long and about 123 ac (50 ha) in size on the northern shore of the island. The subunit is currently occupied and provides the physical or biological features essential to the conservation of the subspecies for nesting and wintering habitat. The island is owned by the Oregon Department of State Lands, but is also within the planning unit boundary for the Julia Butler Hansen National Wildlife Refuge. The Corps uses this site for dredge material disposal as part of its maintenance of the Columbia River shipping channel. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–G: Pillar Rock/Jim Crow Sands—(Clatsop County, Oregon). This island is located at about RM 27 on the Columbia River. The subunit is about 44 ac (18 ha) in size. Pillar Rock is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. Streaked horned larks nest and winter at the site. The island is owned by the Oregon Department of State Lands and is within the planning unit boundary for the Julia Butler Hansen National Wildlife Refuge. The Corps uses this site for dredge material disposal as part of its maintenance of the Columbia River shipping channel. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–H: Welch Island—(Clatsop County, Oregon). This island is at RM 34 and is owned by the Oregon Department of State Lands. The critical habitat subunit is about 43 ac (18 ha) on the northeastern shore of the island. This site is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. The Corps uses this site for dredge material disposal as part of its maintenance of the Columbia River shipping channel. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–I: Tenasillahe Island— (Columbia County, Oregon). This island is at RM 38; the subunit is on a small unnamed spit at the southern tip of Tenasillahee Island. The subunit is about 23 ac (9 ha) in size. This site is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. The site is owned by the Oregon Department of State Lands. The Corps uses this site for dredge material disposal as part of its maintenance of the Columbia River shipping channel. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–J: Whites/Brown Island— (Wahkiakum County, Washington). Whites/Brown Island is connected to the southern end of Puget Island at RM 46 and is owned by WDFW. The subunit is a small spit at the southern end of Whites/Brown Island and is about 98 ac (39 ha) in size. The site is used by the Corps for dredge material disposal as part of its maintenance of the Columbia River shipping channel. This site is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. Whites/Brown Island supports one of the largest populations of streaked horned larks in the lower Columbia River islands. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–K: Wallace Island— (Columbia County, Oregon). Wallace Island is located across the channel from Whites/Brown Island at RM 47. Streaked horned larks were detected at the site in 2012, which is about 13 ac (5 ha) in size; therefore we consider the subunit presently occupied. The area is owned by the Oregon Department of State Lands. This site is not a dredge material disposal site.

This subunit currently contains the physical or biological features essential to the conservation of the species, but may require special management to maintain the low vegetative structure required by streaked horned larks. Subunit 3–L: Crims Island— (Columbia County, Oregon). This island is located upstream of Wallace Island at RM 57. The subunit is about 60 ac (24 ha) in size. The subunit is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. The area is owned by the Oregon Department of State Lands, but is also within the planning unit boundary for the Julia Butler Hansen National Wildlife Refuge. Crims Island is an approved Corps dredge material disposal site. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 3–M: Sandy Island— (Columbia County, Oregon). This island, at RM 76, is the island farthest upstream that is known to be used by streaked horned lark for nesting. The subunit is about 37 ac (15 ha) in size on the southern end of Sandy Island and is owned by the Oregon Department of State Lands. This subunit is currently occupied and provides the physical or biological features essential to the conservation of the subspecies. The Corps uses this site for dredge material disposal as part of its maintenance of the Columbia River shipping channel. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season.

Unit 4: Willamette Valley—Streaked Horned Lark Unit 4 (Willamette Valley) includes critical habitat subunits for both the Taylor's checkerspot butterfly and streaked horned lark, all in the State of Oregon. We are designating three subunits for the streaked horned lark in the Willamette Valley, all on the Willamette Valley National Wildlife Refuge Complex. The total acreage is 1,729 ac (700 ha). All of the subunits are occupied at the time of listing and contain the physical or biological features essential to the conservation of the subspecies that may require special management considerations or protection. These subunits are managed mainly to provide forage for wintering dusky Canada geese, and this management is compatible with maintaining the essential features for the streaked horned lark. The refuge complex has incorporated management for streaked horned lark into its recently completed comprehensive conservation plan, and streaked horned lark habitat conservation is being implemented in the refuge units. Subunit 4–A: Baskett Slough National Wildlife Refuge—(Polk County, Oregon). There are two parts to this critical habitat subunit, the area of which totals 1,006 ac (407 ha). Subunit 4–A North is 181 ac (73 ha) and is in the North Morgan Reservoir area of the refuge. Subunit 4–A South is 825 ac (334 ha) and is the South Baskett Slough Agricultural area of the refuge; State Route 22 forms the southeast boundary of the south subunit. Both of the subunits are agricultural fields that are heavily grazed by dusky Canada geese in the winter. This subunit is currently occupied and contains the physical or biological features essential to the conservation of the subspecies. Baskett Slough National Wildlife Refuge has large areas of agricultural lands and restored native prairies, which provide the landscape context and vegetation structure required by streaked horned larks. The refuge manages primarily for wintering dusky Canada geese, which also provides suitable management for streaked horned larks. This subunit is consistently used by streaked horned larks in the breeding season. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season.

Subunit 4–B: Ankeny National Wildlife Refuge—(Marion County, Oregon). This site is in the middle of the Ankeny Refuge, in the Field 6 Complex; the northeast boundary of the subunit is formed by the Sydney Ditch. The critical habitat subunit is 264 ac (107 ha). The site is composed of agricultural fields that are heavily grazed by dusky Canada geese in the winter. The subunit is currently occupied and has consistent use by streaked horned larks in the breeding season. This subunit contains all of the physical or biological features essential to the conservation of the subspecies. Ankeny National Wildlife Refuge has both agricultural lands and restored native prairies, which provide the landscape context and vegetation structure required by streaked horned larks. The refuge manages primarily for wintering dusky Canada geese, which also provides suitable management for streaked horned larks. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season. Subunit 4–C: William L. Finley National Wildlife Refuge—(Benton County, Oregon). This critical habitat subunit is on Fields 11 and 12 in the South Finley Agricultural Lands area of the refuge; Bruce Road bisects the subunit, and McFarland Road forms the southern boundary of the site. The subunit is 459 ac (186 ha) in size. This subunit is currently occupied and contains the physical or biological features essential to the conservation of the subspecies. The site is composed of agricultural fields that are heavily grazed by dusky Canada geese in the winter, and it has consistent use by streaked horned larks in the breeding season; streaked horned larks also winter at the refuge. Finley National Wildlife Refuge has large areas of agricultural lands and restored native prairies, which provide the landscape context and vegetation structure required by streaked horned larks. The refuge manages primarily for wintering dusky Canada geese, which also provides suitable management for streaked horned larks. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to maintain the early seral vegetation required by the subspecies and to minimize nest destruction and disturbance during the breeding season.

Primary Constituent Elements/Physical or Biological Features

Critical habitat units are designated for Grays Harbor, Pacific, and Wahkiakum Counties in Washington, and Clatsop, Columbia, Marion, Polk, and Benton Counties in Oregon. Within these areas, the primary constituent elements of the physical or biological features essential to the conservation of the streaked horned lark consist of areas having a minimum of 16 percent bare ground that have sparse, low-stature vegetation composed primarily of grasses and forbs less than 13 inches (33 centimeters) in height found in:

(i) Large (300-acre (120-hectare)), flat (0–5 percent slope) areas within a landscape context that provides visual access to open areas such as open water or fields; or

(ii) Areas smaller than described in paragraph (2)(i) of this entry, but that provide visual access to open areas such as open water or fields.

Special Management Considerations or Protections

Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on November 4, 2013.

All areas designated as critical habitat will require some level of management to address the current and future threats to the streaked horned lark and to maintain or restore the PCEs.

Threats to the physical or biological features that are essential to the conservation of these subspecies and that may warrant special management considerations or protection include, but are not limited to: (1) Loss of habitat from conversion to other uses; (2) control of nonnative, invasive species; (3) development; (4) construction and maintenance of roads and utility corridors; and (5) habitat modifications brought on by succession of vegetation from the lack of disturbance, both small and large scale. These threats also have the potential to affect the PCEs if they are conducted within or adjacent to designated units.

The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to ensure the provision of early seral conditions and landscape context of sufficient quantity and quality for long-term conservation and recovery of the subspecies. Activities such as mowing, burning, grazing, tilling, herbicide treatment, grading, beach nourishment, or placement of dredge material can be used to maintain or restore nesting and wintering habitats. Regular disturbance is necessary to create and maintain suitable habitat, but the timing of management is important. The management actions should be conducted outside of the breeding season to avoid the destruction of nests and young, or if habitat management must be done during the breeding season, it should be done in a way that minimizes destruction of nests or harassment of individuals. Nesting success is highest in locations with restricted public use or entry such as military facilities, airports, islands, wildlife refuges, or sites that are remote or difficult to access.

Life History

Feeding Narrative

Adult: Horned larks forage on the ground in low vegetation or on bare ground (Beason 1995); adults feed on a wide variety of grass and weed seeds, but feed insects to their young (Beason 1995). Larks eat a wide variety of seeds and insects (Beason 1995) and appear to select habitats based on the structure of the vegetation rather than the presence of any specific food plants (Moore 2008) (USFWS, 2016).

Reproduction Narrative

Adult: Horned larks form pairs in the spring (Beason 1995) and establish territories approximately 1.9 acres in size (range 1.5 to 2.5 acres) (Altman 1999). Horned larks create nests in shallow depressions in the ground and line them with soft vegetation (Beason 1995). Female horned larks select the nest site and construct the nest without help from the male (Beason 1995). Streaked horned larks establish their nests in areas of extensive bare ground, and nests are placed adjacent to clumps of bunchgrass (Pearson and Hopey 2004). Studies from Washington sites (the open coast, Puget lowlands and the Columbia River islands) have found strong natal fidelity to nesting sites – that is, streaked horned larks return each year to the place they were born (Pearson et al. 2008). Historically, nesting habitat was found on grasslands, estuaries, and sandy beaches in British Columbia, in dune habitats along the coast of Washington, in western Washington and western Oregon prairies, and on the sandy beaches and spits along the Columbia and Willamette Rivers. Today, the streaked horned lark nests in a broad range of habitats, including native prairies, coastal dunes, fallow and active agricultural fields, wetland mudflats, sparsely-vegetated edges of grass fields, recently planted Christmas tree farms with extensive bare ground, moderately- to heavily-grazed pastures, gravel roads or gravel shoulders of lightly-traveled roads, airports, and dredge deposition sites in the lower Columbia River (Altman 1999; Pearson and Altman 2005; Pearson and Hopey 2005; Moore 2008). Wintering streaked horned larks use habitats that are very similar to breeding habitats (Pearson et al. 2005). The nesting season for streaked horned larks begins in early April and ends mid- to late August (Pearson and Hopey 2004; Moore 2011a). Clutches range from 1 to 5 eggs, with a mean of 3 eggs (Pearson and Hopey 2004). After the first nesting attempt in April, streaked horned larks will often re-nest in late June or early July (Pearson and Hopey 2004). Young streaked horned larks leave the nest by the end of the first week after hatching, and are cared for by the parents until they are about four weeks old when they become independent (Beason 1995). Nest success studies (i.e., the proportion of nests that result in at least one fledged chick) in streaked horned larks report highly variable results. Nest success on the Puget lowlands of Washington is low, with only 28% of nests successfully fledging young (Pearson and Hopey 2004, Pearson and Hopey 2005). According to reports from sites in the Willamette Valley, Oregon, nest success has varied from 23 to 60% depending on the site (Altman 1999; Moore and Kotaich 2010). At one site in Portland, Oregon, Moore (2011) found 100% nest success (USFWS, 2016).

Site Fidelity

Adult: High (USFWS 2020). Studies across the lark's range have found strong natal fidelity to nesting sites, which limits recruitment into new or unpopulated areas; 75 percent of streaked horned larks return each year to the place they were hatched or spent their first breeding season, whereas 25 percent of juvenile birds disperse to a different site (Pearson et al. 2008a, p. 11; Moore 2017a, p. 15; Wolf et al. 2017, p. 31; Wolf et al. 2020, p. 6).

Habitat Narrative

Adult: Habitat used by larks is generally flat with substantial areas of bare ground and sparse low-stature vegetation primarily composed of grasses and forbs (Pearson and Hopey 2005). Suitable habitat is generally 16 to 17% bare ground and may be even more open at sites selected for nesting (Altman 1999; Pearson and Hopey 2005). Historically, nesting habitat was found on grasslands, estuaries, and sandy beaches in British Columbia, in dune habitats along the coast of Washington, in western Washington and western Oregon prairies, and on the sandy beaches and spits along the Columbia and Willamette Rivers. Today, the streaked horned lark nests in a broad range of habitats, including native prairies, coastal dunes, fallow and active agricultural fields, wetland mudflats, sparsely-vegetated edges of grass fields, recently planted Christmas tree farms with extensive bare ground, moderately- to heavily-grazed pastures, gravel roads or gravel shoulders of lightly-traveled roads, airports, and dredge deposition sites in the lower Columbia River (Altman 1999; Pearson and Altman 2005; Pearson and Hopey 2005; Moore 2008). Wintering streaked horned larks use habitats that are very similar to breeding habitats (Pearson et al. 2005) (USFWS, 2016). Vegetation height is generally less than 33cm (13 inches) (Altman 1999; Pearson and Hopey 2005). A key attribute of habitat used by larks is open landscape context. Sites used by larks are generally found in open (i.e., flat, treeless) landscapes of 300 acres or more (Converse et al. 2010). Some patches with the appropriate characteristics (i.e., bare ground, low stature vegetation) may be smaller in size if the adjacent areas provide the required open landscape context; this situation is common in agricultural habitats and on sites next to water. For example, many of the sites used by larks on the islands in the Columbia River are small (less than 100 acres), but are adjacent to open water, which provides the open landscape context needed. Streaked horned lark populations are found at many airports within the range of the subspecies, because airport maintenance requirements provide the desired open landscape context and short vegetation structure. Although streaked horned larks use a wide variety of habitats, populations are vulnerable because the habitats used are often ephemeral or subject to frequent human disturbance. Ephemeral habitats include bare ground in agricultural fields and wetland mudflats; habitats subject to frequent human disturbance include mowed fields at airports, managed road margins, agricultural crop fields, and disposal sites for dredge material (Altman 1999). Foraging Horned larks forage on the ground in low vegetation or on bare ground (Beason 1995); adults feed on a wide variety of grass and weed seeds, but feed insects to their young (Beason 1995). Larks eat a wide variety of seeds and insects (Beason 1995) and appear to select habitats based on the structure of the vegetation rather than the presence of any specific food plants (Moore 2008) (USFWS, 2016).

Dispersal/Migration

Motility/Mobility

Adult: High (USFWS, 2016)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory (USFWS, 2016)

Dispersal

Adult: High (USFWS, 2016)

Dispersal/Migration Narrative

Adult: Pearson et al. (2005b) found that most streaked horned larks winter in the Willamette Valley (72%) and on the islands in the lower Columbia River (20%); the rest spend the winter on the Washington coast (8%) or in the south Puget Sound (1%). In the winter, most of the streaked horned larks that breed in the south Puget Sound migrate south to the Willamette Valley or west to the Washington coast; streaked horned larks that breed on the Washington coast either remain on the coast or migrate south to the Willamette Valley; birds that breed on the lower Columbia River islands remain on the islands or migrate to the Washington coast; and birds that breed in the Willamette Valley remain there over the winter (Pearson et al. 2005). Streaked horned larks spend the winter in large groups of mixed subspecies of horned larks in the Willamette Valley, and in smaller flocks along the lower Columbia River and Washington Coast (Pearson et al. 2005; Pearson and Altman 2005) (USFWS< 2016).

Additional Life History Information

Adult: Available evidence suggests that birds in the Puget lowlands are migrating south for the winter (Pearson and Altman 2005); multiple observations of banded birds throughout the winter in the Willamette Valley, Columbia River and on the Washington Coast suggest that some of these birds are staying in these regions throughout the winter (Pearson and Altman 2005).; Nonmigrant: Y; Local migrant: Y; Distant migrant: N; (NatureServe, 2015)

Population Information and Trends

Population Trends:

Increasing (USFWS, 2016) Despite increases in abundance of local populations, a rangewide population estimate has not been reanalyzed since 2011. Therefore, we are unable to state conclusively that the rangewide population has increased based on survey data of local populations since larks were listed in 2013. (USFWS 2020).

Resiliency:

Resilient populations can withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), severe weather events or other changes to habitat conditions (environmental stochasticity), random fluctuations in genetic variation (genetic drift), or threats caused by anthropogenic activities. Resiliency can be evaluated using metrics such as population demographics (i.e. population size, birth and death rates, nesting success rates), and habitat parameters (i.e. the quality, quantity, and distribution of suitable habitats). To evaluate resiliency for each of the 42 local population units, we developed a condition category matrix to define high, moderate, low, and extirpated condition categories for the demographic and environmental factors influencing resiliency (Table 5). We then used this matrix to systematically evaluate each factor for each of the local population units. To maintain adequate resiliency, local populations of streaked horned larks need large open spaces with suitable habitat structure, and an appropriate disturbance regime sufficient to maintain habitat and support increased numbers of breeding birds. For our evaluation of current condition, we assessed information from peer-reviewed literature, as well as survey data and knowledge of anthropogenic practices. The size and stability of resilient local populations varies among regions, depending on overall abundance, connectivity between sites, the extent and quality of available habitat, and the timing and intensity of disturbance regimes. (USFWS, 2021). South Puget Lowlands: moderate to low resiliency Pacific Coast and Columbia River: low resiliency Willamette Valley: low to moderate resiliency

Representation:

Representation is sufficient genetic and ecological diversity to maintain adaptive capacity in a changing environment. Representation can be assessed as the number or percent of ecological settings across the range over which a species' recovery will occur. Generally, the more representation, or diversity, the species has, the more it can adapt to changes (natural or human-caused) in its environment. The habitat types occupied by local and regional populations of streaked horned larks have been thoroughly documented (Anderson and Pearson 2015, entire). The needs of the streaked horned lark to achieve representation are multiple local populations well distributed across its range in a broad variety of habitat types. Representation is appropriately addressed at the rangewide level. As noted earlier in this document, the streaked horned lark has been extirpated from the northernmost extent of its historical range in the northern Georgia Basin and north Puget Lowlands and from the Rogue and Umpqua Valleys in the south. These losses from the northernmost (i.e., cooler and wetter) and southernmost (i.e., warmer and drier) extremes of the lark's known historical range demonstrate a substantial loss of ecological diversity. Within their current range, larks are found on native prairies; military and civilian airfields; beaches, dunes, and sandy islands; restored native prairies; agricultural areas; and industrial sites. Occupied sites differ markedly within and among regions, which suggest that larks experience a broad range of ecological diversity. (USFWS, 2021) Rangewide: moderate to low representation.

Redundancy:

Redundancy is the ability to withstand catastrophic events, which is directly related to the number, distribution, and connectivity of resilient local populations. The needs of the streaked horned lark to achieve adequate redundancy are multiple resilient populations in each region with the potential for movement among local and regional populations to allow recolonization following major stochastic events. Redundancy is appropriately addressed at the rangewide level. The draft Recovery Plan recommends that resilient local populations are distributed across a combination of lands managed intentionally for long-term lark conservation and lands managed for multipleuse objectives that provide short-term benefits to larks. At minimum, the draft Recovery Plan recommends that 38 sites are managed for long-term conservation: 8 sites in the South Puget Lowlands; 3 sites along the Pacific Coast; 6 sites in the Lower Columbia River; and 21 sites in the Willamette Valley. Currently, the four representational regions support 42 local populations representing species viability. Of the 42 local populations, only 8 are considered highly resilient and only 1 site (Sandy Island) is managed for streaked horned lark conservation. (USFWS, 2021) Rangewide: moderate to low redundancy.

Population Growth Rate:

The breeding range has contracted over time; this subspecies no longer breeds in the northern Puget trough (San Juan Islands and other Puget Sound sites north of Tacoma), southern British Columbia (COSEWIC 2003, Environment Canada 2007), along the Washington Coast north of Grays Harbor, or in the Rogue River Valley (see Pearson and Altman 2005).No historical estimates of population size are available, but this subspecies has apparently suffered a "severe decline" (Beauchesne and Cooper 2002). It is now rare and has been extirpated from much of its range (USFWS 2003). It was originally described as very abundant in the prairies of Puget Sound region (Suckely and Cooper 1860, Dawson and Bowles 1909) and was recorded as breeding "commonly at times" in the San Juan Islands after 1946, but last breeding record there was 1962 (Rogers 2000). In the 1940s, it was was a "very common permanent resident" in the southern Willamette Valley (Gullion 1951). In western Oregon, it was noted as a common breeder in the 1930s, even "particularly abundant" in Polk and Yamhill Counties (Gabrielson and Jewett 1940). However, there may have been confusion between subspecies, and E. a. strigata may never have been that common there (Rogers 2000). The small population in British Columbia declined to extirpation over the last four decades. The last confirmed breeding record was in 1978; and the last summer sighting at Sea Island was in 1987, although a few may have persisted in the central Fraser Valley until the mid-1990s (Campbell et al. 1997, Beauchesne and Cooper 2002).Prairie habitat has declined to less than 1% of its former extent in the Willamette Valley and to less than 3% in the Puget Sound area (Altman 2000, Crawford and Hall 1997). Overall, it has been estimated that less than one percent of the native savanna and grassland remains in the range of the streaked horned lark (Oregon-Washington Partners in Flight 2000). Decline of >90% (NatureServe, 2015)

Number of Populations:

42 (USFWS, 2021) 3 regional populations: South Puget Lowlands - 8 local populations Pacific Coast and Columbia River - 24 local populations Willamette Valley - 10 local populations

Population Size:

1,170 to 1,610 individuals (USFWS, 2021) 1,170 - 1,610 individuals

Minimum Viable Population Size:

5,269 - 6,415 individuals

Population Narrative:

Currently, there are 42 local populations distributed across three distinct representative areas based on ecological uniqueness, each with a mix of high, moderate, and low resiliency. In general, the local populations with low condition have low abundance that has declined since 2013, and populations occur in locations that have less habitat availability and therefore limited capacity to support high numbers of birds. In addition, certain land management activities at these locations, such as construction and development or sand-borrow activities on the Columbia River would not support longterm resiliency even if population abundance stabilized and increased. Use of these sites is opportunistic based on habitat availability, and most of these sites are not anticipated to meaningfully contribute to subspecies viability or support high numbers of birds. (USFWS, 2021) The streaked horned lark has numerous, but mostly small (<10 breeding pairs) local populations that are well distributed across the South Puget Lowlands, Pacific Coast and Lower Columbia River, and the Willamette Valley regions. At the time of listing, local populations of streaked horned larks were smaller and there were fewer known sites compared to the number and size of local populations in 2019. However, it should be noted that monitoring efforts increased after larks were listed in 2013, increasing our knowledge on the status of occupied sites (Tables 1-3). In the South Puget Lowlands, the number of breeding pairs in the regional population increased due to increases in the local populations at the Gray Army and McChord Airfields, and the 91st Division Prairie, Range 76, likely in response to conservation measures implemented as part of section 7 consultations with JBLM. The number of occupied sites along the lower Columbia River has increased since the time of listing due to an increase in the availability of suitable habitat through the strategic placement of dredged materials. While the overall number of occupied sites represent a reduction from its historical range, of the 42 extant populations across the three regions, there are 8 in high condition, 15 in moderate condition, and 19 local populations in low condition that have unstable or declining trends and are at risk of disappearing (Table 12). Three sites that were occupied in years prior to the 2013 listing are currently considered extirpated. In summary, there are 42 local populations distributed across three distinct representative areas based on ecological uniqueness, each with a mix of high, moderate, and low resiliency. In general, the local populations with low condition have low abundance that has declined since 2013, and populations occur in locations that have less habitat availability and therefore limited capacity to support high numbers of birds. In addition, certain land management activities at these locations, such as construction and development or sand-borrow activities on the Columbia River would not support long-term resiliency even if population abundance stabilized and increased. Use of these sites is opportunistic based on habitat availability, and most of these sites are not anticipated to meaningfully contribute to subspecies viability or support high numbers of birds. The South Puget Lowlands region has an overall increasing population trend based on the 2013 to 2019 survey data. The region contains four local populations with high resiliency, one local population with moderate resiliency, and three local populations with low resiliency. Those local populations with low resiliency have small, declining populations and occur in areas where management activities have negative impacts on adult and juvenile birds, which currently limits resiliency. The Pacific Coast and Lower Columbia River region has an overall stable population trend based on survey data from 2013 to 2019. There are two local populations in high condition due to abundance, movement between local populations, beneficial disturbance activities having low adverse effects to breeding birds, and suitable habitat. Nine local populations are in moderate condition due to low abundance and small site size which limits potential resiliency and contribution to regional viability. The remaining 13 local populations have low resiliency due to very low abundance with declining populations occurring in areas where habitat conditions are opportunistically available, such as Martin Bar or Austin Point, but where ongoing management activities do not support long-term, self-sustaining populations. While Leadbetter Point is managed to improve habitat quality for larks and reduce corvid predation, the local population has fluctuated in recent years and is currently considered unstable. While sites along the Pacific Coast have low numbers of breeding pairs, recent detections at previously unoccupied sites suggest the species could recolonize areas with suitable habitat. However, streaked horned larks have not recolonized new sites in the South Puget Lowlands region despite 20 years of prairie restoration and intensive monitoring, suggesting recolonization is site-specific and difficult to predict. Although the current abundance of local populations along the Pacific coast is low compared to other regional populations, it has been low for many years and we see no apparent declining trend in this regional population based on survey data between 2013 and 2019. The Willamette Valley region has an overall increasing population trend for 10 extant populations and supports two local population with high condition, Corvallis Municipal Airport and Baskett Slough NWR. There are five local populations in the Willamette Valley in moderate condition and three local populations in low condition. No breeding pairs were detected at one historical location, Salem Municipal Airport, during surveys from 2013 to 2019 and the site is assumed extirpated. The survey results report in Table 1 represent a small portion of the total number of streaked horned larks in the Willamette Valley due to lack of access on private lands, and there is no information to infer the condition of these populations. While habitat conditions in the Willamette Valley could support increased self-sustaining populations, on-going management activities at airports and agricultural areas have adverse effects on local populations. Combining these management actions with population trends between 2013 and 2019 and very little movement between sites reduces overall resiliency in the region. The draft Recovery Plan for the streaked horned lark (U.S. Fish and Wildlife Service 2019, entire) provides some thoughts on what adequate redundancy and representation for the subspecies entails. The plan recommends that 38 resilient sites be managed for long-term conservation: 8 sites in the South Puget Lowlands; 3 sites along the Pacific Coast and 6 sites in the Lower Columbia River; and 21 sites in the Willamette Valley. The current redundancy of streaked horned lark is characterized by 42 extant local populations across the range of the subspecies; 8 are considered high condition, 15 are ranked moderate, and 19 ranked low. There are at least two local populations ranked high in each regional population, suggesting relative good representation in varying habitats, including prairies, wetlands, coastal dunes, sandy islands, airports and road margins, and agricultural fields. Though the local populations on the Pacific coast add a measure of redundancy to the subspecies, streaked horned larks in the Pacific Coast and Lower Columbia River region use a form of replicated beach habitat on the dredge placement sites, so the exact contribution of the Pacific coast population to ecological and behavioral representation is uncertain. The rangewide distribution of 42 local populations confers some measure of protection against catastrophic events, particularly in the Willamette Valley where relatively large numbers of birds move about in response to changing habitat conditions. Surveys detect low incidence of movement between local populations, and recolonization of restored sites in the South Puget Lowlands region has not occurred. However, recent detections of birds at sites previously unoccupied (i.e., Clatsop Spit) suggest individuals are actively moving between sites, adapting to new areas and potentially recolonizing areas with suitable habitat. Additional local populations in high and moderate condition throughout the range would benefit the overall level of redundancy and representation for the subspecies.

Threats and Stressors

Stressor: Habitat fragmentation, degradation, and loss
Exposure: Vegetation succession; encroachment of woody vegetation or grasses and invasive species; land use changes; crop conversion; and loss of natural disturbance processes.
Response: Loss of habitat.
Consequence: Decreased quantity and quality of suitable habitat to support breeding and wintering streaked horned larks, reduction in population viability.
Narrative: Their habitat is threatened throughout their entire range from loss of natural disturbance regimes, invasion of unsuitable vegetation that alter habitat structure, and incompatible land management practices (USFWS, 2016).

Stressor: Stochastic events (USFWS, 2016)
Exposure:
Response:
Consequence: Extinction
Narrative: Large winter congregations are limited to one region, Oregon's Willamette Valley, which may put larks at risk from stochastic weather events (USFWS, 2016).

Stressor: Recreation
Exposure:
Response: Disturbance to adults; habitat degradation; mortality to eggs, nestlings, and fledglings.
Consequence: Reduced populations, habitat loss.
Narrative: Recreation at coastal sites can cause the degradation of streaked horned lark habitat, as well as disturbance to adults and juveniles, and direct mortality to eggs, nestlings, and fledglings. Activities such as the annual spring razor clam digs, dog walking, beachcombing, offroad vehicle use, camping, fishing, and horseback riding in coastal habitats may directly or indirectly increase predation (primarily by corvids), resulting in nest abandonment and nest failure for streaked horned larks (Pearson and Hopey 2005, pp. 19, 26, 29). Streaked horned larks nest in the same areas as western snowy plovers along the Washington coast, and it is highly likely that recreation has caused nest failures for larks at sites that have documented nest failure for plovers; both species are ground nesters and, therefore, similarly at risk of effects of recreation. During western snowy plover surveys conducted between 2006 and 2010 at coastal sites in Washington, human-caused nest failures were reported in 4 of the 5 years (Pearson et al. 2007, p. 16; Pearson et al. 2008b, p. 17; Pearson et al. 2009a, p. 18; Pearson et al. 2010, p. 16), and one of 16 monitored nests at Midway Beach on the Washington coast was crushed by a horse in 2004 (Pearson and Hopey 2005, pp. 18–19). In 2002, JBLM began restricting recreational activity at the 13th Division Prairie to protect lark nesting sites; JBLM prohibited model airplane flying, dog walking, and vehicle traffic in the area used by streaked horned larks (Pearson and Hopey 2005, p. 29). JBLM continues to restrict recreational activities during the lark breeding season at the 13th Division Prairie, although enforcement, especially on weekends, is intermittent (Wolf et al. 2016, p. 43). In addition, the 2017 programmatic consultation JBLM entered into with the Service (U.S. Fish and Wildlife Service 2017) included recreation. The programmatic consultation has resulted in a marked increase in the breeding population of larks on JBLM from fewer than 100 pairs in 2013 (Wolf and Anderson 2014, p. 12), to over 120 pairs in 2019 (Wolf et al. 2020, p. 6).

Stressor: Aircraft Strikes
Exposure:
Response: Injury or mortality.

Consequence: Reduction in number of breeding adults, and surviving juveniles; population reduction.
Narrative: Individual lark in these local populations near runways are at increased risk of aircraft strikes and collisions. Horned lark strikes are frequently reported at military and civilian airports throughout the country, but because of the bird's small size, few strikes result in significant damage to aircraft (Dolbeer et al. 2011, p. 48; Air Force Safety Center 2012, p. 2). Juvenile males seem to be struck most often, perhaps because they are trying to establish new territories in unoccupied but risky areas on runway margins (Wolf et al. 2017, p. 31). With respect to streaked horned larks in particular, in the 5-year period from 2013 to 2017, McChord Airfield had seven confirmed strikes, and Gray Army Airfield recorded one confirmed streaked horned lark strike (Wolf in litt. 2018). Since January 2017, 16 adults have been killed by strikes on JBLM, including 10 adults and 2 juveniles killed by strikes at McChord Airfield in 2020 (Wolf in litt. 2020). The increased number of strikes in 2020 were a direct result of construction activities that redirected aircraft traffic to the northern half of the runway where lark density is highest and lark abundance was relatively high; this led to a higher than normal mortality rate from aircraft strikes. Aside from the 12 strikes in 2020, JBLM recorded a total of 12 strikes in the seven years between 2013 and 2019, for a rate of 1.7 strikes per year. While aircraft strikes do occur in several local populations at airports throughout the range of the species (particularly in the South Puget Lowlands), the rate appears relatively low and the vegetation management conducted by these airports also maintains replacement habitat that supports breeding pairs (Pearson et al. 2008a, p. 13; Camfield et al. 2011, p. 10; FAA 2020, entire).

Stressor: Aircraft Strikes (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Streaked horned larks are attracted to flat, open habitats around airports throughout their range. The streaked horned lark is also at risk from aircraft strikes and collisions that occur at airports. Death of individual larks caused by aircraft strikes is a threat to small or declining local populations at airports, as the loss of even a single breeding individual can negatively influence the resiliency of local populations. (USFWS, 2021)

Stressor: Land Management Activities and Related Effects
Exposure: Vegetation management activities (i.e. mowing, agricultural practices, etc.); military training activities; and dredged material placement.
Response: Disturbance to adults; habitat degradation; mortality to eggs, nestlings, and fledglings.
Consequence: Reduced populations, habitat loss.
Narrative: Streaked horned larks evolved in a landscape of ephemeral habitat with regular historical disturbance regimes that maintained the large, open spaces with very early seral stage vegetation relied upon by the subspecies. Human activity led to the stabilization of these historical disturbance regimes, as well as the unintentional creation of ''replacement'' habitat for streaked horned larks that mimics their preferred large, open spaces. Replacement habitat occurs in a variety of settings across the range of the subspecies, including agricultural fields, at airports, and on dredge spoil islands. Open habitat is maintained in these areas by way of frequent human disturbance, including burning, mowing, cropping, chemical treatments (herbicide and pesticide application), or placement of dredged materials (Altman 1999, p. 19). Without regular large-scale, human-caused disturbance, the quantity of suitable habitat available to larks would decrease rapidly. These land management activities are key to providing and

maintaining habitat for the streaked horned lark; without replacement habitat, the status of the subspecies would likely be much worse. However, when these same activities are conducted during the most active breeding season (mid-April to mid-June) for streaked horned larks, they have the potential to result in destruction of nests, crushing of eggs or nestlings, or flushing of fledglings or adults (Pearson and Hopey 2005, p. 17; Stinson 2005, p. 72). During the nesting seasons from 2002 to 2004, monitoring at Gray Army Airfield, McChord Airfield, and Olympia Airport in the South Puget Lowlands region documented nest failure at 8 percent of nests due to mowing over nests, forcing young to fledge early (Pearson and Hopey 2005, p. 18). Additionally, though dredge deposits can mimic sandy beach habitat typically used by larks, they have also been documented to destroy breeding sites and active nests (Pearson in litt. 2012a; Pearson et al. 2008a, p. 21; MacLaren 2000, p. 3; Pearson and Altman 2005, p. 10). In the Willamette Valley, some habitats in agricultural areas are consistently maintained and therefore available throughout the year (e.g., on the margins of gravel roads), while other patches of suitable habitat shift as areas such as large fields are mowed, harvested, sprayed, or burned. In 2017, the Willamette Valley NWR entered into a 4-year programmatic consultation with the Service for its farming and pesticide use program (U.S. Fish and Wildlife Service 2016b, entire). This programmatic consultation documents the Refuge program’s commitment to adapting its farming activities to improve the status of the streaked horned lark on the William L. Finley, Ankeny, and Baskett Slough units of the complex. Conservation measures include ensuring that farming activities minimize disturbance to larks, and that pesticides used in agricultural fields have a low risk of adverse effects to larks and their food sources. Airports implement hazardous wildlife management programs that include vegetation management around roads and runways, to discourage the presence of wildlife near the runways and thereby promote human safety for flights. Streaked horned lark are very attracted to the wide-open spaces created by vegetation management, and several airports in the range are now sites for local populations of the subspecies. In the South Puget Lowlands, the streaked horned lark might have been extirpated if not for mowing at airports to maintain large areas of short grass (Stinson 2005, p. 70). Five of the eight streaked horned lark nesting sites in the South Puget Lowlands are located on or adjacent to airports and military airfields (Rogers 2000, p. 37; Pearson and Hopey 2005, p. 15). At least five breeding sites are found at airports in the Willamette Valley, including the largest known local population at Corvallis Municipal Airport (Moore 2008b, pp. 14–17). The Port of Olympia’s Updated Master Plan includes recommendations to minimize impacts to larks at the airport by avoiding mowing during the breeding season; however, mowing still occurs during the breeding season (Port of Olympia/Olympia Regional Airport 2013, pp. 10–11) and the local population at the airport has fluctuated (both increased and decreased) in surveys from 2013 to 2019 (Wolf et al. 2020, p. 16). The overall count in 2019 of 27 breeding pairs was slightly lower that the count in 2013 (30), however, in 2019 there were six more breeding pairs than were counted in 2018. In 2017, the JBLM finalized a programmatic consultation with the Service that covered multiple activities affecting streaked horned lark including mowing (U.S. Fish and Wildlife Service 2017) (although mowing is allowed during the breeding season under emergency circumstances (Wolf et al. 2017, p. 34)). The consultation has resulted in a significant reduction in adverse effects to larks from mowing at military airfields. The breeding population of larks on JBLM increased from fewer than 100 pairs when the streaked horned lark was listed in 2013 (Wolf and Anderson 2014, p. 12), to over 120 pairs in 2019 (Wolf et al. 2020, p. 6). However, there are no conservation measures at several municipal airports in the Puget Lowlands region and none of the airports in the Willamette Valley region to reduce effects to streaked horned larks from operations and maintenance activities, including mowing.

Stressor: Loss of habitat (USFWS, 2020)
Exposure:
Response:
Consequence: Decreased quantity and quality of suitable habitat to support breeding and wintering streaked horned larks, reduction in population viability (USFWS, 2021).
Narrative: Their habitat is threatened throughout their entire range from loss of natural disturbance regimes, invasion of unsuitable vegetation that alter habitat structure, and incompatible land management practices (USFWS, 2016).

Stressor: Stochastic events (USFWS, 2016)
Exposure:
Response:
Consequence: Extinction
Narrative: Large winter congregations are limited to one region, Oregon's Willamette Valley, which may put larks at risk from stochastic weather events (USFWS, 2016).

Stressor: Recreation (USFWS, 2020)
Exposure:
Response: Disturbance to adults; habitat degradation; mortality to eggs, nestlings, and fledglings (USFWS, 2020)
Consequence: Reduced populations, habitat loss.
Narrative: Recreation at coastal sites can cause the degradation of streaked horned lark habitat, as well as disturbance to adults and juveniles, and direct mortality to eggs, nestlings, and fledglings. Activities such as the annual spring razor clam digs, dog walking, beachcombing, offroad vehicle use, camping, fishing, and horseback riding in coastal habitats may directly or indirectly increase predation (primarily by corvids), resulting in nest abandonment and nest failure for streaked horned larks (Pearson and Hopey 2005, pp. 19, 26, 29). Streaked horned larks nest in the same areas as western snowy plovers along the Washington coast, and it is highly likely that recreation has caused nest failures for larks at sites that have documented nest failure for plovers; both species are ground nesters and, therefore, similarly at risk of effects of recreation. During western snowy plover surveys conducted between 2006 and 2010 at coastal sites in Washington, human-caused nest failures were reported in 4 of the 5 years (Pearson et al. 2007, p. 16; Pearson et al. 2008b, p. 17; Pearson et al. 2009a, p. 18; Pearson et al. 2010, p. 16), and one of 16 monitored nests at Midway Beach on the Washington coast was crushed by a horse in 2004 (Pearson and Hopey 2005, pp. 18–19). In 2002, JBLM began restricting recreational activity at the 13th Division Prairie to protect lark nesting sites; JBLM prohibited model airplane flying, dog walking, and vehicle traffic in the area used by streaked horned larks (Pearson and Hopey 2005, p. 29). JBLM continues to restrict recreational activities during the lark breeding season at the 13th Division Prairie, although enforcement, especially on weekends, is intermittent (Wolf et al. 2016, p. 43). In addition, the 2017 programmatic consultation JBLM entered into with the Service (U.S. Fish and Wildlife Service 2017) included recreation. The programmatic consultation has resulted in a marked increase in the breeding population of larks on JBLM from fewer than 100 pairs in 2013 (Wolf and Anderson 2014, p. 12), to over 120 pairs in 2019 (Wolf et al. 2020, p. 6) (USFWS, 2020).

Stressor: Aircraft Strikes (USFWS, 2020)
Exposure:
Response: Injury or mortality (USFWS, 2020)

Consequence: Reduction in number of breeding adults, and surviving juveniles; population reduction. (USFWS, 2020)
Narrative: Individual lark in these local populations near runways are at increased risk of aircraft strikes and collisions. Horned lark strikes are frequently reported at military and civilian airports throughout the country, but because of the bird's small size, few strikes result in significant damage to aircraft (Dolbeer et al. 2011, p. 48; Air Force Safety Center 2012, p. 2). Juvenile males seem to be struck most often, perhaps because they are trying to establish new territories in unoccupied but risky areas on runway margins (Wolf et al. 2017, p. 31). With respect to streaked horned larks in particular, in the 5-year period from 2013 to 2017, McChord Airfield had seven confirmed strikes, and Gray Army Airfield recorded one confirmed streaked horned lark strike (Wolf in litt. 2018). Since January 2017, 16 adults have been killed by strikes on JBLM, including 10 adults and 2 juveniles killed by strikes at McChord Airfield in 2020 (Wolf in litt. 2020). The increased number of strikes in 2020 were a direct result of construction activities that redirected aircraft traffic to the northern half of the runway where lark density is highest and lark abundance was relatively high; this led to a higher than normal mortality rate from aircraft strikes. Aside from the 12 strikes in 2020, JBLM recorded a total of 12 strikes in the seven years between 2013 and 2019, for a rate of 1.7 strikes per year. While aircraft strikes do occur in several local populations at airports throughout the range of the species (particularly in the South Puget Lowlands), the rate appears relatively low and the vegetation management conducted by these airports also maintains replacement habitat that supports breeding pairs (Pearson et al. 2008a, p. 13; Camfield et al. 2011, p. 10; FAA 2020, entire) (USFWS, 2020)

Stressor: Land Management Activities and Related Effects (USFWS, 2020)
Exposure: Vegetation management activities (i.e. mowing, agricultural practices, etc.); military training activities; and dredged material placement (USFWS, 2020)
Response: Disturbance to adults; habitat degradation; mortality to eggs, nestlings, and fledglings (USFWS, 2020)
Consequence: Reduced populations, habitat loss (USFWS, 2020)
Narrative: Streaked horned larks evolved in a landscape of ephemeral habitat with regular historical disturbance regimes that maintained the large, open spaces with very early seral stage vegetation relied upon by the subspecies. Human activity led to the stabilization of these historical disturbance regimes, as well as the unintentional creation of ''replacement'' habitat for streaked horned larks that mimics their preferred large, open spaces. Replacement habitat occurs in a variety of settings across the range of the subspecies, including agricultural fields, at airports, and on dredge spoil islands. Open habitat is maintained in these areas by way of frequent human disturbance, including burning, mowing, cropping, chemical treatments (herbicide and pesticide application), or placement of dredged materials (Altman 1999, p. 19). Without regular large-scale, human-caused disturbance, the quantity of suitable habitat available to larks would decrease rapidly. These land management activities are key to providing and maintaining habitat for the streaked horned lark; without replacement habitat, the status of the subspecies would likely be much worse. However, when these same activities are conducted during the most active breeding season (mid-April to mid-June) for streaked horned larks, they have the potential to result in destruction of nests, crushing of eggs or nestlings, or flushing of fledglings or adults (Pearson and Hopey 2005, p. 17; Stinson 2005, p. 72). During the nesting seasons from 2002 to 2004, monitoring at Gray Army Airfield, McChord Airfield, and Olympia Airport in the South Puget Lowlands region documented nest failure at 8 percent of nests due to mowing over nests, forcing young to fledge early (Pearson and Hopey 2005, p. 18). Additionally, though dredge deposits can mimic sandy beach habitat typically used by larks, they have also

been documented to destroy breeding sites and active nests (Pearson in litt. 2012a; Pearson et al. 2008a, p. 21; MacLaren 2000, p. 3; Pearson and Altman 2005, p. 10). In the Willamette Valley, some habitats in agricultural areas are consistently maintained and therefore available throughout the year (e.g., on the margins of gravel roads), while other patches of suitable habitat shift as areas such as large fields are mowed, harvested, sprayed, or burned. In 2017, the Willamette Valley NWR entered into a 4-year programmatic consultation with the Service for its farming and pesticide use program (U.S. Fish and Wildlife Service 2016b, entire). This programmatic consultation documents the Refuge program's commitment to adapting its farming activities to improve the status of the streaked horned lark on the William L. Finley, Ankeny, and Baskett Slough units of the complex. Conservation measures include ensuring that farming activities minimize disturbance to larks, and that pesticides used in agricultural fields have a low risk of adverse effects to larks and their food sources. Airports implement hazardous wildlife management programs that include vegetation management around roads and runways, to discourage the presence of wildlife near the runways and thereby promote human safety for flights. Streaked horned lark are very attracted to the wide-open spaces created by vegetation management, and several airports in the range are now sites for local populations of the subspecies. In the South Puget Lowlands, the streaked horned lark might have been extirpated if not for mowing at airports to maintain large areas of short grass (Stinson 2005, p. 70). Five of the eight streaked horned lark nesting sites in the South Puget Lowlands are located on or adjacent to airports and military airfields (Rogers 2000, p. 37; Pearson and Hopey 2005, p. 15). At least five breeding sites are found at airports in the Willamette Valley, including the largest known local population at Corvallis Municipal Airport (Moore 2008b, pp. 14–17). The Port of Olympia's Updated Master Plan includes recommendations to minimize impacts to larks at the airport by avoiding mowing during the breeding season; however, mowing still occurs during the breeding season (Port of Olympia/Olympia Regional Airport 2013, pp. 10–11) and the local population at the airport has fluctuated (both increased and decreased) in surveys from 2013 to 2019 (Wolf et al. 2020, p. 16). The overall count in 2019 of 27 breeding pairs was slightly lower that the count in 2013 (30), however, in 2019 there were six more breeding pairs than were counted in 2018. In 2017, the JBLM finalized a programmatic consultation with the Service that covered multiple activities affecting streaked horned lark including mowing (U.S. Fish and Wildlife Service 2017) (although mowing is allowed during the breeding season under emergency circumstances (Wolf et al. 2017, p. 34)). The consultation has resulted in a significant reduction in adverse effects to larks from mowing at military airfields. The breeding population of larks on JBLM increased from fewer than 100 pairs when the streaked horned lark was listed in 2013 (Wolf and Anderson 2014, p. 12), to over 120 pairs in 2019 (Wolf et al. 2020, p. 6). However, there are no conservation measures at several municipal airports in the Puget Lowlands region and none of the airports in the Willamette Valley region to reduce effects to streaked horned larks from operations and maintenance activities, including mowing (USFWS, 2020).

Recovery

Reclassification Criteria:
Recovery Priority Number: 9C

Delisting Criteria:
Three self-sustaining regional populations of streaked horned larks within the south Puget Lowlands, Pacific Coast and lower Columbia River, and Willamette Valley regions that are of sufficient size to ensure long-term population viability; to rangewide population of 5,725

individuals. South Puget Lowland regional population: 700 individuals Pacific Coast and Columbia River regional population: 525 individuals Willamette Valley regional population: 4,500 individuals.

Protection of core sites with permanent or long-term conservation provisions that support appropriate characteristics of lark habitat and managed for conservation of larks.

Recovery Actions:
- Determine population status, trend, and current distribution.
- Conserve and enhance the three regional populations.
- Identify limiting factors and develop solutions for recovery.
- Promote outreach and cooperation with stakeholders and regional agencies.
- Develop and implement a post-delisting monitoring plan.

Conservation Measures and Best Management Practices:
- Since the streaked horned lark was listed in 2013, multiple entities have implemented a series of regulatory and voluntary conservation measures to offset negative impacts to larks and lark habitat, reducing the overall impact of threats and stressors influencing local populations. (USFWS, 2021)
- Development of a Habitat Conservation Plan (HCP) to permit the final phases of development of the Rivergate site was initiated by the Port of Portland in 2017 (Port of Portland 2017, p. 60); earlier phase of development occurred at Rivergate prior to the final listing of the species. As part of the 10(a)(1)(B) permit, the Port mitigated for the loss of habitat by securing a long-term easement on a 32-acre (13 ha) parcel at Sandy Island. Sandy Island is an occupied breeding site on the Columbia River about 30 miles (50 kilometers) north of the Rivergate industrial site and is designated as critical habitat for the streaked horned lark (Port of Portland 2017, p. 4). The HCP was developed to support the permit decision, outlining a 30-year protection and maintenance plan for Sandy Island (Port of Portland 2017, entire). The Port's commitment to manage the site and protect breeding streaked horned larks for the next 30 years helps to offset impacts to the regional population from the loss of available habitat at Rivergate. (USFWS, 2021)
- Conservation measures include the following: 1. Use largest spray booms practical for the job to minimize wheel track passes in treatment unit. Where possible use narrow tires and/or four-wheeled machines rather than floatation tires/three-wheeled machines to further reduce direct ground impacts resulting from treatment(s); 2. Limit ATV access for spot treatment to minimum necessary to facilitate the vegetation management objectives within the proposed project area; 3. Restrict prescribed burns to one-half of the known occupied breeding streaked horned lark habitat; 4. Raise mower decks to highest level to achieve desired biological outcomes and minimize ground level impacts; restrict individual mowing treatments to no more than 50 percent of project sites, while cumulative mowing during nesting season may equal 100 percent of project sites; 5. Stagger heavy equipment site access to allow occupied sites to complete breeding cycle un-impeded; minimize temporal impacts in relation to 120-day nesting period or shift implementation toward the tail end of the nesting season (Jul 15 to Aug 30); 6. Initiate activity at sites farther away from occupied lark habitats, and work toward occupied sites; 7. Avoid known nests by installing temporary fencing to create exclosures within larger grazing areas; 8. Avoid bare or sparsely vegetation areas during operations; 9. Minimize site entry and monitoring during nesting season, prioritizing access in non-streaked horned lark habitat; 10. Pedestrian spot herbicide application can minimize impacts by allowing for targeted treatment of undesirable vegetation while still allowing for concurrent ocular and aural site evaluations for streaked horned lark occupancy (i.e. no ATV

engine noise, wheel tracks, etc.).

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SPECIES ACCOUNT: *Falco femoralis septentrionalis* (northern aplomado falcon)

Species Taxonomic and Listing Information

Listing Status: Endangered (02/25/1986) and experimental population, non-essential (07/26/2006); Southwest Region (Region 2) (USFWS, 2016)

Physical Description

Adults characterized by rufous (rust) underparts, a gray back, a long and banded tail, and a distinctive black and white facial pattern. Aplomado falcons are smaller than peregrine falcons and larger than kestrels. (USFWS, 2016)

Taxonomy

Along with Falco femoralis septentrionalis, two other subspecies have been described: Falco femoralis pichinchae (Chapman) of western South America, and Falco femoralis femoralis (Temminck) in the remaining portions of South and Central America. The subspecies are distinguished by differences in relative dimensions, the degree of completeness of their abdominal bands (“cummerbunds”), and the darkness (or lightness) of their dorsal plumages (Table 1, Blake 1977). Falco femoralis femoralis is only slightly smaller and tends to be darker dorsally but may intergrade with F. f. septentrionalis. The abdominal band of F. f. femoralis is usually complete with only a slight mid—ventral narrowing. Falco femoralls pichinchae is larger, darker, has buffier underparts than F. f. femoralis, and has an abdominal band that is narrow or Incomplete mid—ventrally (Blake 1977). (USFWS, 1990)

Historical Range

Historic breeding range: southeastern Arizona, southern New Mexico, and southern Texas south through Mexico (Tamaulipas, Chiapas, Campeche, Tabasco, Chihuahua, Coahuila, Sinaloa, Jalisco, Guerrero, Veracruz, Yucatan, and San Luis Potosi) to Guatemala (Pacific slope of Central American cordillera). Historic winter range: Sinaloa, Chihuahua, and southern Tamaulipas south to southern Mexico; casual in Guatemala (AOU 1957). (NatureServe, 2015)

Current Range

With the goal of restoring aplomado falcons to their historical range in the United States, a reintroduction program was initiated in 1978 to release captive-bred young into the historical range in south Texas (U.S. Fish and Wildlife Service 1990, Cade et al. 1991). (USFWS, 2014)

Distinct Population Segments Defined

No

Critical Habitat Designated

No;

Life History

Feeding Narrative

Adult: Feeds primarily on birds (up to rock dove size), to a lesser extent on insects (moths, beetles, cicadas, orthopterans); uncommonly on small mammals, lizards, and snakes (Terres 1980, Cade 1982). Pairs often hunt together. Birds comprise most of diet biomass in eastern Mexico, but insects also are commonly consumed. Hunts from perch or air. In eastern Mexico, this species hunted mainly within 1 km of nest site (Hector 1988). Decidedly crepuscular in hunting habits, often catching prey after sunset; not very active in middle of day. (Cade 1982). In eastern Mexico, preyed on birds mainly in the early morning, hawked insects later in the day (see Johnsgard 1990). (NatureServe, 2015)

Reproduction Narrative

Adult: Aplomado falcons do not build their own nests, but use nest sites constructed by large raptors or corvids. The northern aplomado falcon lays eggs from January-June (mainly March-May, peak in April) with a clutch size of 2-3. Both parents (mainly females) incubate eggs for about 31-32 days (Cade 1982, Evans 1982). Young can fly at 4-5 weeks, but may remain in nest area for several weeks more. Pairs remain together throughout the year (Palmer 1988). (USFWS, 2014; NatureServe, 2015)

Habitat Narrative

Adult: Open rangeland and savanna, semiarid grasslands with scattered trees and shrubs; in U.S., was found in coastal prairies along sand ridges, in woodlands along desert streams, and in desert grasslands with scattered mesquite and yucca; has been found in open pine woodland in central Mexico (Matthews and Moseley 1990, Johnsgard 1990). In the Chihuahuan Desert, aplomado falcons prefer broad, open basins and valleys with optimum visibility of the surroundings and relatively few, scattered, tall woody plants providing perch and nest sites (Hector 1981, Montoya et al. 1997, Young et al. 2004). Such settings offer maximum detectability of potential prey and protection against predators. The aplomado falcon does not typically occupy hilly or highly irregular terrain. Encroachment of thick tall grass of brush degrades habitat. Nests in old stick nests of other bird species (e.g., hawks, caracaras, ravens); in sites such as bromeliads in tropics. May sometimes nest on cliff. (USFWS, 2014; NatureServe, 2015)

Dispersal/Migration

Motility/Mobility

Adult: High (NatureServe, 2015)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Non-migratory (NatureServe, 2015)

Dispersal

Adult: Moderate (NatureServe, 2015)

Immigration/Emigration

Adult: Immigrates and emigrates (NatureServe, 2015)

Dispersal/Migration Narrative

Adult: Little is known about the migratory behavior of these falcons. (USFWS, 1990)

Population Information and Trends

Population Trends:

Unknown (USFWS, 2014)

Number of Populations:

3 (USFWS, 2024)

Population Size:

40 - 60 (USFWS, 2014)

Population Narrative:

With the goal of restoring aplomado falcons to their historical range in the United States, a reintroduction program was initiated in 1978 to release captive-bred young into the historical range in south Texas (U.S. Fish and Wildlife Service 1990, Cade et al. 1991). A total of 927 young were reintroduced in south Texas from 1978 to 2013 (Table 1). Established pairs first bred in the wild and produced young in 1995 (Jenny et al. 2004). In recent years, there have been approximately 28 to 29 known pairs in south Texas (Hunt et al 2013; Mutch 2013, 2014). The aplomado falcon population near Brownsville, Texas, currently includes about 19 pairs and extends approximately 55 km (34.18 mi) north from the Mexican border past Laguna Atascosa National Wildlife Refuge (Hunt et al. 2013). (USFWS, 2014). There are three populations of northern aplomado falcons, one in coastal Texas, one in the Chihuahuan Desert of the U.S. and Mexico, and one in the tropical lowlands of Mexico. While breeding populations within the tropics, Chihuahuan Desert, and coastal Texas are hundreds of miles apart, the northern aplomado falcon is wide-ranging, and individuals have been documented to have dispersed up to 230 miles (370 km: A. Macías-Duarte, pers. comm., May 5, 2024). Genetic mixing between populations could occur if they occupied habitat within 230 miles of one another. The populations, however, are approximately 600 km (373 mi; Coastal Texas and Tropical Lowland populations [C. Perez, pers. comm., June 3, 2024]) to 1100 km ([684 mi]; Chihuahuan Desert and Tropical Lowlands populations [Macías-Duarte et al. 2004, p. 1082]) apart between known nesting areas. Therefore, there is no known connectivity or genetic exchange between the Coastal Texas, Chihuahuan Desert, and Tropical Lowland populations. (USFWS, 2024)

Threats and Stressors

Stressor: Habitat changes (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: The overall carrying capacity for aplomado falcons has decreased markedly in the Chihuahuan Desert since the late 1800s (Hunt et al. 2013). The extent of open savanna has diminished as a result of livestock grazing and agriculture, and the abundance of wintering grassland birds important to nesting aplomado falcons has declined similarly (Macías-Duarte et al. 2004, Pool et al. 2012, 2014). Grassland birds are thought to have declined more steeply than any other avian guild in North America (Knopf 1994). A primary source of migrants to the Chihuahuan Desert is the northern prairie grassland, extending northward and westward from South Dakota to Saskatchewan and eastern Alberta. This is a region that has undergone extensive agricultural development with consequent reductions in grassland bird abundance.

This may have resulted in fewer migrant birds, thereby reducing aplomado falcon carrying capacity and productivity, even in areas where habitat conditions appear to be otherwise suitable (Hunt et al. 2013). (USFWS, 2014)

Stressor: Drought/water depletion (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: The Peregrine Fund began releasing captive-bred aplomado falcons in the Chihuahuan desert grasslands of western Texas in spring 2002. Reintroduction sites were chosen according to the suitable habitat criteria described by Young et al. (2004), primarily in yucca savanna similar to occupied habitat in nearby Chihuahua, Mexico (Montoya et al, 1997, Macías-Duarte et al. 2004) (see Figure 6 above). The Chihuahua population is the only known representative of wild, desert-breeding aplomado falcons north of the equator. The 35 pairs present when Montoya began his investigations had dwindled to 25 by 2002 (Macías-Duarte et al 2004), and only 6 could be found in 2011 (Hunt at al. 2013). Factors associated with this decline have been both continuing severe drought conditions and the nearly complete conversion of parts of the study area to irrigated croplands beginning in the mid-2000s (MaciasDuarte et al. 2007). (USFWS, 2014)

Stressor: Climate change (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: Changing climatic conditions are projected to create more extreme and generally drier conditions in the southwestern United States (Gulf South Research Corporation and La Tierra Environmental Consulting 2013). The associated fauna are expected to experience lower productivity, greater stress, and reduced food resources (Parry et al. 2007, Albright et al. 2010, North American Bird Conservation Initiative 2010). This could directly impact aplomado falcons by diminishing the availability of their prey (as discussed below). Increased aridity of grasslands will make them more susceptible to negative impacts from livestock grazing (Gulf South Research Corporation and La Tierra Environmental Consulting 2013). (USFWS, 2014)

Stressor: Prey declines (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: Prey availability is a crucial component of grassland habitat suitability for aplomado falcons, and this may explain some recent distribution findings for the subspecies (Gulf South Research Corporation and La Tierra Environmental Consulting 2013, Hunt et al. 2013). In northern Chihuahua, aplomado falcon productivity and reproductive timing were both associated with avian prey abundances early in the breeding season (Macías-Duarte et al. 2004). Reproductive failure and territory abandonment may occur because of extended periods of low avian prey levels. Avian prey and aplomado falcon productivity in north-central Chihuahua were significantly greater than in an occupied area further east (Macías-Duarte et al. 2004). Researchers suggested that the former site may have been a more important migratory route for birds (Méndez-González 2000, Macías-Duarte et al. 2004). (USFWS, 2014)

Stressor: Peripheral ranges (USFWS, 2014)

Exposure:
Response:
Consequence:
Narrative: In the outer limits of species' ranges, densities often are lower and more variable (Brown et al 1995, Pulliam 1988). Birds may have stronger tendencies to continue southward if conditions are not suitable in the northern extremes of the winter range (Newton 2008, Jonzén et al. 2011, Gulf South Research Corporation and La Tierra Environmental Consulting 2013). The southwestern New Mexico and Sueco, Chihuahua, areas occupied by aplomado falcons are located in broad valleys with deep, productive soils. The associated grasslands offer greater food quality and abundance for wintering birds (Gulf South Research Corporation and La Tierra Environmental Consulting 2013). These features also likely influence the migratory pathways used by grassland birds (Méndez-González 2000, Macías-Duarte et al. 2004). (USFWS, 2014)

Stressor: Pesticides (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: One of the most severe threats to the species is pesticide contamination. Levels of DDE in membranes of 20 clutches of northern aplomado falcon eggs collected in Veracruz (1957—1966) averaged 297 ppm (range 110—530 ppm). Membranes of shell fragments collected in 1977 from 10 nests along a 550—mile transect averaged 296 ppm DDE (range 31—1280 ppm; Kiff et al. 1980). Kiff et al. (1980: 951—952) made the following observations about the pesticide problem. The average decrease (1954—1967) in eggshell thickness (25.4%) is particularly severe and is equivalent to the maximum amount of thinning reported for any population of peregrine falcons (Peakall and Kiff 1979). DDE residue levels found in both bat falcon (Falco rufigularis) and aplomado falcon eggs exceed those associated with 20% thinning in peregrine eggs (Peakall and Kiff 1979). As noted by Peakall et al (1975), thinning of over 20% is likely to result in reproductive failure, primarily from egg breakage. These findings indicate the need for a population—wide survey of the effects of pesticide contamination on aplomado falcons. Experiences with similar pesticide—sensitive species suggest that productivity of falcons in eastern Mexico is threatened by DDT—related reproductive failure. (USFWS, 1990)

Stressor: Wind turbines (USFWS, 2014)
Exposure:
Response:
Consequence:
Narrative: In addition, the relatively recent potential threat posed by wind power operation may also reduce the availability of avian prey for the aplomado falcon by causing mortality from collision with moving blades (Hunt et al. 2013). Between 140,000 and 328,000 (mean = 234,000) birds are killed annually by collisions with monopole turbines in the contiguous United States (Loss et al. 2013). (USFWS, 2014)

Stressor: Shooting (USFWS, 2024)
Exposure:
Response:
Consequence:
Narrative: The frequency and magnitude of the threat posed to a northern aplomado falcon population from shooting and other forms of human persecution is unknown. While

unconfirmed, there has been at least one instance in Cameron County, Texas where circumstantial evidence strongly suggests that northern aplomado falcons had been shot on their artificial nest structure. (USFWS, 2024)

Stressor: Collisions (USFWS< 2024)
Exposure:
Response:
Consequence:
Narrative: Northern aplomado falcons are at risk of direct mortality from colliding with infrastructure or vehicles. An increased matrix of roads and new infrastructure in the Chihuahuan Desert could result in an increase in direct mortality to northern aplomado falcons from collisions with vehicles and infrastructure (Hager 2009, p. 211) especially while pursuing avian prey at high speeds (Keddy-Hector et al. 2020, accessed September 2023). Wind turbines can result in direct mortality to northern aplomado falcon and other raptors, as well as some of its avian prey base (Erickson et al. 2005, pp. 1034-1036). Mortality generally occurs from direct collisions while distracted from surrounding environmental risks while hunting prey. Solar energy development has also had demonstrated impacts on avian populations, including direct mortality from reflected and concentrated solar radiation (Kagan et al. 2014, pp. 1-3). While this may mostly impact avian prey species, an injured bird in or near these structures could lure in a hunting falcon. This could result in a potential collision with the infrastructure while pursuing the injured prey (USFWS, 2024).

Recovery

Reclassification Criteria:
1. A minimum self-sustaining population of 60 breeding pairs has been established in the United States (this goal may be modified after we learn more about suitable habitat within the United States). (USFWS, 2014)

2. Patches of coastal prairie and desert grassland must be maintained in (or restored to) a condition providing optimal habitat for northern aplomado falcons through application of grazing, prescribed fire, and brush control. (USFWS, 2014)

3. Use of pesticides such as DDT and dieldrin must be permanently eliminated within areas inhabited by northern aplomado falcons and their prey. (USFWS, 2014)

4. Aplomado falcons should be reestablished in suitable parts of the southwestern United States. (USFWS, 2014)

Recovery Priority Number: 3

Delisting Criteria:
Delisting criteria are not available.

Recovery Actions:
- Evaluate, monitor, and minimize all threats including pesticides (and other contaminants) to extant populations. (USFWS, 1990)
- Identify, maintain, and improve habitat. (USFWS, 1990)

- Reestablish the northern aplomado falcon in the U.S. and Mexico. (USFWS, 1990)
- Conduct studies of habitat requirements, physiological ecology, and behavior of wild falcons. (USFWS, 1990)
- Enhance public support for this recovery effort through educational programs. (USFWS, 1990)
- Encourage national and international cooperation and coordination in carrying out these objectives. (USFWS, 1990)
- The Aplomado Falcon Recovery Plan should be amended to include the development of delisting criteria. Currently, the recovery plan contains only down-listing criteria. Down-listing criteria should also be re-assessed in light of recent research findings. Both criteria should include recommendations for spatial distribution of aplomado falcon pairs within the historic range. (USFWS, 2014)
- Additional aplomado falcon reintroductions should be considered near Deming, New Mexico, in areas used successfully by nesting aplomado falcons over the past 15 years, and in south coastal Texas, in areas where habitat has recently been restored to suitability for aplomado falcons. (USFWS, 2014)
- The feasibility of supplemental feeding stations should be investigated and considered in areas of limited prey availability for reintroduced aplomado falcons. (USFWS, 2014)
- Artificial nest towers should be installed and maintained in coordination with New Mexico landowners and land managers at sites near Deming, and on the Armendaris Ranch, Bosque del Apache National Wildlife Refuge, Otero Mesa, and Lake Valley. (USFWS, 2014)
- Conservation organizations and agencies should continue to work with similar entities in Mexico to address the sharp decline of the aplomado falcon population in Chihuahua. They should consider acquisition of land or perpetual conservation easements to protect, improve, and maintain suitable aplomado falcon habitat for the Chihuahuan population. In addition, research is needed to further understand the status of aplomado falcons in coastal Mexico. (USFWS, 2014)
- The effects of wind power infrastructure and operation in aplomado falcon habitat should be evaluated and addressed. Also, the potential effects of noise on the aplomado falcon's use of land near the proposed SpaceX project in Texas should be evaluated and addressed. (USFWS, 2014)
- Research should be conducted to evaluate whether great-horned owls are becoming more abundant and widely dispersed across the aplomado falcon's range and to assess methods to address this potential predation threat. (USFWS, 2014)
- The potential threat from mercury in south Texas should continue to be monitored and addressed, if needed. (USFWS, 2014)
- The potential effects of sea-level rise on the aplomado falcon population on Matagorda Island should be evaluated and addressed. Currently, the aplomado falcons on the central Texas coast are restricted to barrier islands. Sea-level rise could reduce the barrier island habitat used by aplomado falcons. It may be unlikely that enough coastal prairie habitat would remain or could be restored to support a population, if the territorial requirements observed to date on Matagorda Island of 2,000 acres/pair are needed. (USFWS, 2014)
- The fate of young aplomado falcons fledged in coastal Texas should be studied by satellite tracking hatch-year birds. (USFWS, 2014)

Conservation Measures and Best Management Practices:

- RECOMMENDATIONS FOR FUTURE ACTIONS Protect habitat along a greater stretch of the Texas coastline to facilitate increased distribution of northern aplomado falcons along the coast and increase the Coastal Texas population's resilience to hurricanes. Implement conservation measures in coastal Texas to protect potential habitat upslope from development, clear it of woodlands, and maintain it with frequent fire or occasional coastal flooding to allow the population to shift upslope buffering effects of rising seas. Implement artificial nest structures to offset competition for or limited natural nests in the Chihuahuan Desert and Coastal Texas populations, where needed. Continue research into genomic differences that will be needed in designing future captive breeding and/or translocation efforts (USFWS, 2024).

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SPECIES ACCOUNT: *Glaucidium brasilianum cactorum* (Cactus ferruginous pygmy-owl)

Species Taxonomic and Listing Information

Listing Status: Threatened

Physical Description

The cactus ferruginous pygmy-owl is a small bird (see Figure 2.1), approximately 17 centimeters (cm) (6.75 inches (in)) long. Generally, male pygmy-owls average 58 grams (g) to 66 g (2.0 to 2.3 ounces (oz)) and females average 70 g to 75 g (2.4 to 2.6 oz) (AGFD 2008b, pers. comm.; Proudfoot and Johnson 2000, p. 16; Johnsgard 1988, p. 159). The pygmy-owl is reddish brown overall, with a cream-colored belly streaked with reddish brown. Color may vary, with some individuals being more grayish brown (Proudfoot and Johnson 2000, pp. 15–16). The crown is lightly streaked, and a pair of dark brown or black spots outlined in white occurs on the nape, suggesting “eyes,” leading to the name “Cuatro Ojos” (four eyes), as it is sometimes called in Mexico (Oberholser 1974, p. 451) (Figure 2.2). The species lacks obvious ear tufts (Santillan, et al. 2008, p. 154), and the eyes are yellow. The tail is relatively long for an owl and is reddish brown in color, with darker brown bars. Males have pale bands between the dark bars on the tail, while females have darker reddish bands between the dark bars (Figure 2.3). Pygmy-owls have relatively large feet and talons (Figure 2.4). (USFWS, 2021)

Taxonomy

The cactus ferruginous pygmy-owl is a small, cavity-nesting owl in the order Strigiformes and the family Strigidae (ITIS 2020, et al. 2017, p. 11; Proudfoot et al. 2020, p.3). Some studies incorporating vocalizations, ecology, and molecular genetics by König (1991) and Heidrich et al. (1995) suggest that the ferruginous pygmy-owl is most closely related to Austral and Peruvian pygmy-owls, which were formerly considered subspecies, in part, of the ferruginous pygmy-owl. Nonetheless, currently there are as many as fifteen subspecies of ferruginous pygmy-owl recognized over the entire range, with the cactus ferruginous pygmy-owl being the northernmost subspecies (Proudfoot et al. 2020). The subspecies cactorum is the subject of this SSA and was originally described in the United States as being common in the lower Rio Grande Valley in southern Texas (Oberholser 1974, p. 452) and along the Salt and Gila Rivers in central Arizona (Fisher 1893, p. 199; Breninger 1898, p. 128; Gilman 1909, p. 148). (USFWS, 2021)

Historical Range

Arizona Historical records for the pygmy-owl in Arizona span at least five counties in southern and south-central Arizona, including Maricopa, Pima, Pinal, Santa Cruz and Yuma Counties (Johnson et al. 2003, p. 394). Historically (i.e., late 1800s and early 1900s), pygmy-owls occupied areas of south-central Arizona – from New River, about 56 km (35 mi) north of Phoenix, south to the United States/Mexico border, west to Agua Caliente near Gila Bend and Cabeza Prieta Tanks, and east to Tucson, and rarely the San Pedro River (Bent 1938; Monson and Phillips 1981; Johnson et al. 2003). Most of the historical (pre-1900) and recent (post-1990) records are from Pima County. Between 1872 and 1971, a total of 56 published records or specimens were recorded for Arizona. Of those, almost half (27) were from Pima County (Johnson et al. 2003, pp. 392–395). Although the pygmy-owl was historically recorded primarily from lowland riparian habitats, all recent records are from upland and xeroriparian (vegetation community in drainages associated with seasonal or intermittent water) Sonoran desertscrub (Abbate et al. 2000, pp. 15–16; FWS 2009b, p. 1; FWS 2011, p. 1). (USFWS, 2021)

Current Range

The pygmy-owl is known to occur historically in all five of the defined analysis units (Figure 4.2). General information related to both the eastern and western populations of the pygmy-owl are available from a few of sources. For example, the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species provides information on the ferruginous pygmy-owl. As a subspecies of the ferruginous pygmy-owl, the distribution of the cactus ferruginous pygmy-owl is much reduced by comparison (Figure 4.3). The range of the cactus ferruginous pygmy-owl accounts for approximately four percent of the overall range of the ferruginous pygmy-owl. The description of the ferruginous pygmy-owl in the IUCN Red List classifies the ferruginous pygmy-owl as a species of Least Concern, based primarily on its large geographic range and overall large population size (BirdLife International 2016, unpaginated). However it is important to keep in mind that the cactus ferruginous pygmy-owl constitutes only about four percent of the overall range of the ferruginous pygmy-owl, so this basis for determination as Least Concern did not consider subspecies and may not apply when looking strictly at the cactorum subspecies. The IUCN does indicate that the population trend is declining, but they do not believe the decline is sufficiently rapid to place it in the Vulnerable category (BirdLife International 2016, unpaginated). They indicate that this decline is based on habitat destruction (BirdLife International 2016, unpaginated). The Birds of the World account of the ferruginous pygmy-owl indicates that there have been few studies of this species and that density estimates are limited. Some data exist on current population densities in Arizona and Texas, but historical accounts of ferruginous pygmy-owl populations generally contain only anecdotal evidence, so the rates of population shrinkages are difficult to calculate. However, this species is considered common throughout most of its range. For example, in Mexico and Central and South America, the ferruginous pygmy-owl is considered a common resident; fairly common to locally common in Panama and Colombia, and fairly common in Costa Rica; and, in some countries, it is the only common pygmy-owl. They also indicate that the ferruginous pygmy-owl occurs in a considerable number of protected areas in most countries throughout its extensive range (Proudfoot et al. 2020, unpaginated). The cactus ferruginous pygmy-owl is the northernmost subspecies of the ferruginous pygmyowl. As such, the pygmy-owls population groups that occur in Arizona and Texas are at the northern periphery of the current geographic extent the species and represent peripheral population groups. Some have suggested that pygmy-owls in Arizona have never been common and experience population fluctuations due the fact that they occur at the northern extent of the range and occupy marginal habitats (Johnson and Carothers 2008, pp. 30 – 31). Indeed, a species' range may be limited by a number of factors including genetics, extent of habitat, climatological tolerances, and competition. While the issue of what is limiting pygmy-owls in the northern extent of their range has been the subject of some debate, it is an accepted principle of conservation biology that disjunct or peripheral populations of species may be genetically impoverished, but they are also likely to be genetically distinct from core populations (Noss 1994, p. 8). This well-documented pattern is the direct consequence of reduced gene flow to isolated or marginal populations. While this may reduce the priority of such areas for conservation or recovery, it can also be important to conservation because disjunct or peripheral populations are likely to have diverged genetically from core populations due to genetic drift, adaptation to local environments, or both (Lesica and Allendorf 1995). If there is a concern about maintaining opportunities for speciation (future biodiversity), then conservation of peripheral and disjunct populations is critical (Noss 1994, p.

8). To reiterate, genetic divergence tends to occur at the periphery of a species' range (Lesica and Allendorf 1995). This genetic divergence enables adaptation of the species as a whole in the face of environmental change. Loss of genetic diversity translates into a loss of fitness (reproductive success) for the species (Meffe and Carroll 1997). The peripheral nature of the Arizona and Texas analysis units increase the potential for those population groups to diverge from populations in in Mexico. The loss of this genetic difference, as peripheral population groups, could be meaningful with regard to genetic divergence within the subspecies. Hence, protection and management of peripheral populations may be important to the survival and evolution of species. Resistance to environmental change and genetic distinction often enables peripheral populations to persist when core populations are extirpated (Channell and Lomolino 2000a, 2000b; Lomolino and Channell 1995). In the face of changing environmental conditions, what constitutes a peripheral population today could be the center of the species' range in the future (Nielsen et al. 2001). Peripheral populations survive more frequently than do core populations when species undergo dramatic reductions in their range (>75%; Channell and Lomolino 2000a). (USFWS, 2021)

Critical Habitat Designated

No;

Life History

Food/Nutrient Resources

Reproductive Strategy

Adult: Oviparous (USFWS, 2021)

Lifespan

Adult: average 3-5 years. 10 yrs in captivity (USFWS, 2021)

Reproduction Narrative

Adult: Pygmy-owls are thought to be monogamous, can breed in their first year, and typically mate for life. Both sexes appear to breed annually. Pair bonds between females and males can begin to form as early as the fall after they fledge, if mates are available. Males begin to make territorial calls the following early spring (i.e., February), about 2-3 months before egg-laying. A short window of calling activity by pygmy-owls does occur in the fall as well. This may be a physiological response to similar day-length periods as spring, or it may be related to dispersal and is the result of established males warning of dispersing males or dispersing hatch-year males trying to establish territories in vacant habitat. Pygmy-owls have been found to be responsive to survey calls in October in Arizona (Flesch 2018, pp. 8 – 9). Nest sites are cavities in trees and columnar cacti (e.g., saguaros) that are excavated by woodpeckers, or form naturally from decay after tree branches break off. Territories normally contain several potential nest and roost cavities from which responding females select a nest. Hence, cavities per acre may be a fundamental criterion for habitat selection. Historically, pygmy-owls in Arizona used cavities in cottonwood, mesquite, and ash trees, and saguaro cacti for nest sites (Millsap and Johnson 1988, pp. 137–138). Current information from Arizona indicates nests are usually located in cavities in saguaro cacti, accounting for all but two of the known nests documented from 1996 to 2020 (n > 50) (Abbate et al. 1996, p. 15; 1999, p. 41; 2000, p. 13; AGFD 2003, pers. comm.). Pygmy-owl nests in Texas were primarily in mesquite and live oak trees (Proudfoot 1996, pp.

36–38), and nests in Sonora, Mexico, were nearly always in columnar cacti (Flesch and Steidl 2002, p. 6). Flesch and Steidl (2010, pp. 1025 – 1028) described several different factors influencing pygmy-owl nest site selection, indicating that pygmy-owls used taller saguaros with more arms and more cavities for nest sites; selected nest cavities will small to moderate cavity openings; and selected cavities of larger volume as indicated by stem swelling around the nest cavity. Recent data collected by Phoenix Zoo collected at nest sites in southern Arizona showed that the vertical diameter of nest cavities ranged from 5.1 – 8.9 cm and horizontal diameter ranged from 5.1 – 8.3 cm (Phoenix Zoo, unpublished data). Pygmy-owls will also use nest boxes for nesting (Proudfoot 1996, p. 67). More specific information on suitable nest cavity selection by pygmy-owls is found below in Section 3.1. Nest selection occurs following courtship, with eggs typically being laid from late March into June. Average clutch size as reported by Johnsgard (1988, p. 162) for the United States and Mexico was 3.3 (range 2 to 5, n = 43). In Texas, Proudfoot and Johnson (2000, p. 11) report an average clutch size of 4.9 (range 3 to 7, n = 58). First eggs hatch generally around mid-May, and fledging occurs from late-May through June. Eggs are white, oval to spherical in shape, and average 28.5 mm in length. The female incubates the eggs for 28 days, and hatching is asynchronous, one hatching every 20-26 hours. The female largely stays in the cavity with the hatchlings for the first week after hatching, while the male provides food. After the first week, both parents provide food. Nestlings fledge between 21 and 30 days after hatching, and depend on their parents for food for up to eight weeks. Data indicate that adults maintain their pair bond following the dispersal of the juveniles (Proudfoot 1996, unpubl. data). One unique issue related to pygmy-owls' breeding behavior in Arizona is the documented occurrence of incestuous pairings. Color band marking to discriminate individual pygmy-owls confirmed a successful pairing of siblings in 1998. These siblings were hatched the previous breeding season (Abbate et al. 1999, p. 53). Incest in raptors is considered rare and its occurrence has been documented in only about 20 cases representing nine species (Carlson et.al. 1998; Stewart et al. 2007, p. 227). Four of the seven species are owls and include: barn owls (Tyto alba), burrowing owl (Athene cunicularia), screech owl (Otus asio) and spotted owls (Strix occidentalis). Similar dispersal direction and relatively short dispersal distances may play a role in the pairing of siblings (Carlson et al. 1998; Stewart et al, 2007, p. 227). The average lifespan for a cactus ferruginous pygmy-owl is probably 3 – 5 years (Proudfoot 2009, pers. comm.; AGFD 2009b, pers. comm.). However, lifespan has been documented to be 7 to 9 years in the wild (Proudfoot 2009, pers. comm.) and 10 years in captivity (AGFD 2009b, pers. comm.). (USFWS, 2021)

Habitat Narrative

Adult: Pygmy-owls are found in a variety of vegetation communities, including Sonoran desertscrub and semidesert grasslands in Arizona and northern Sonora, thornscrub and tropical dry forests in southern Sonora south to Michoacán, Tamaulipan brushland in northeastern Mexico, and live oak forest in Texas. At a finer scale, the pygmy-owl inhabits habitat edges and semi-open areas of thorny scrub and woodlands in association with giant cacti and in scattered patches of woodlands in open landscapes, such as tropical dry forests and riparian communities along ephemeral, intermittent, and perennial drainages (König et al. 1999). It is often found at the edges of riparian and xeroriparian drainages and even habitat edges created by villages, towns, and cities (USFWS, 2024).

Dispersal/Migration

Motility/Mobility

Adult: High (USFWS, 2021)

Dispersal

Adult: High

Dispersal/Migration Narrative

Adult: Fledglings disperse from their natal sites about eight weeks after they fledge. Observations in both Arizona and northern Sonora indicate that initial dispersal movements are often initiated during the full moon phase closest to the eighth week post-fledging (Flesch and Steidl 2007, p. 36). It appears that the dispersal strategy for males differs from females. Males typically disperse shorter distances, setting up a territory in the first available habitat patch they encounter. Females, on the other hand, typically disperse longer distances and disperse until they find an available mate. This can include movements into subsequent breeding seasons. The first dispersal of fledglings in Arizona and Texas was documented as July 24th and August 14th, respectively (Proudfoot and Johnson 2000, p. 10). Dispersal distance ranges from 2.5 to 20.91 km (1.55 to 13.00 mi) in Arizona (Abbate et al. 2000, p. 21) and 16 to 31 km (9.6 to 18.6 mi) in Texas (Proudfoot and Johnson 2000, p. 13). One juvenile female pygmy-owl in Arizona dispersed a total of 260 km (161 mi) between August 2003 and April 2004 (AGFD 2008a, pers. comm.). In Sonora, Mexico, Flesch and Steidl (2007, p. 37) documented dispersal distances ranging from 1.1 to 19.2 km (0.7 to 11.5 mi). Fledglings often travel greater than 1 km (0.6 mi) the first day and have moved up to 1.6 km (1 mi) in a night (Abbate et al. 2000). Dispersal is a key factor in maintaining pygmy-owl numbers and occupancy, especially in areas of the pygmyowl's range that function similar to metapopulations. (USFWS, 2021)

Population Information and Trends

Population Trends:

Unknown

Resiliency:

Overall, only one analysis unit is in high condition. This is a result of high pygmy-owl numbers and reduced effects of climate change. Thus, four out of five analysis units have a reduced resiliency, primarily due to the demographic factors for Arizona (low numbers of pygmy-owls and reduced occupancy) and habitat factors (reduced vegetation intactness, soil moisture, and vegetation health) for the remaining analysis units. The analysis unit in the best current condition is the Western Mexico analysis unit, which is rated as being in high condition (Figure 1). This analysis unit had both a demographic and a habitat factor rated as high. Three analysis units (Northern Sonora, Texas, and Northeastern Mexico) were classified as being in moderate condition (Figure 1). Northern Sonora was primarily classified as being in moderate condition for demographic and habitat factors, while Texas and Northeastern Mexico had high condition in certain factors tempered by other factors classified in low condition. Every analysis unit, except for Western Mexico, had at least one condition factor that rated as low. Figure 1 shows a map of all analysis units depicting their current condition as determined by the analysis above. (USFWS, 2024)

Representation:

We consider the pygmy-owl to currently have representation across its range in the form of genetic diversity (see Section 2.2 of SSA) and ecological diversity (see Sections 2.5 and 3.3 of the

SSA). This primarily occurs as a result of the large geographic area covered by the range of the pygmy-owl, resulting in genetic isolation by distance and its occurrence in a wide variety of habitat types ranging from southern Arizona, through western Mexico, and in northeastern Mexico to southern Texas (Proudfoot et al. 2006a, 2006b; Cobbold et al. 2022b). Vegetation communities where the pygmy-owl is found range from Sonoran desert scrub to thorn scrub and tropical deciduous forests in the west, and oak-mesquite woodlands and riparian communities to Tamaulipan thornscrub and secondary forests in the east. The overall range of the pygmy owl is also characterized by two genetically distinct populations: the eastern and western populations. Within both the eastern and western populations of the pygmy-owl, genetic variation among the various analysis units also occurs (Proudfoot 2006a; Proudfoot 2006b). Representation occurs on two scales. First, at the population scale, representation is needed within both the eastern and western populations of the pygmy-owl. Representation at this scale currently occurs because pygmy-owl population groups are documented throughout both the eastern and western populations. These populations are defined based on geographic separation and genetic differences. The second scale is at the analysis unit scale. Representation within the analysis units contributes to overall representation within the two populations. Representation at the analysis unit scale occurs due to either genetic differences or ecological variation among analysis units. In summary, pygmy-owls occupy a diversity of habitat types throughout the geographic range of the subspecies and maintain substantial genetic diversity. It is possible that representation boundaries could be adjusted in the future after further investigation of the genetic and ecological diversity of the subspecies (USFWS, 2024).

Redundancy:

Given that pygmy-owls occur in all five analysis units, redundancy currently occurs at the range-wide scale for pygmy-owls. Each analysis unit within the geographic range of the subspecies maintains a network of population groups that are connected both within and between analysis units. These population groups have the potential to recolonize areas where other population groups are lost to catastrophic events. As a result, pygmy-owl population groups provide redundancy to withstand catastrophic events were they to occur in any given part of the pygmy-owl's overall range. However, maintaining the redundancy can be affected by reduced numbers of population groups within a given analysis unit, loss of habitat connectivity among population groups or analysis units such that the potential for demographic support (rescue effect) is eliminated or reduced significantly, or resiliency within analysis units declines. Conversely, if land management improves habitat connectivity and conservation actions improve demographic factors, redundancy within and among analysis units will improve. Currently, these types of factors are affecting a number of the analysis units. For example, population groups within the Arizona analysis unit have likely become extirpated based on the lack of detections over multiple consecutive years. Habitat connectivity between the Arizona and Northwest Mexico analysis units, as well as between the Texas and Northeastern Mexico analysis units may be affected by the construction of border walls and associated effects like vegetation clearing, lighting, patrols, and border enforcement activities (Flesch et al. 2010; USFWS 2023, section 7.2). However, limited telemetry data has shown that pygmy-owls are able to cross into Mexico, at least in one area of Arizona (Arizona Game and Fish Department, unpublished data). The redundancy of all analysis units is being reduced through ongoing habitat loss and fragmentation. Despite existing habitat fragmentation, research and monitoring have documented that exchange of individual pygmy-owls between population groups and between some analysis units is still occurring (Arizona/Northern Sonora and Texas/Northeastern Mexico). Maintaining habitat connectivity will be important for preserving this redundancy throughout the subspecies' range. So, while redundancy currently exists across the range of the pygmy-owl, continued redundancy is not certain when considering the factors affecting redundancy within analysis units. (USFWS, 2024)

Number of Populations:

Three (USFWS, 2023)

Additional Population-level Information:

Flesch (2003, entire) sampled 145 landscapes statewide, of which, 95 (65.5%) harbored >l pygmy-owl. Pygmy-owls occurred along 48% of transects at a density of 0.82 ± 0.37 males/100 ha statewide. Relative abundance ranged from 0 to 1.25 males/station and averaged 0.13 ± 0.04 statewide. Density (males/100 ha) was high in Sinaloan Deciduous Forest (2.00 ± 0.82) and Arizona Upland desertscrub (1.47 ± 0.61), moderate in Semidesert Grassland (0.99 ± 0.45), Sinaloan Thornscrub (0.85 ± 0.37), and Plains of Sonora desertscrub (0.56 ± 0.31), and low in Lower Colorado River Valley (0.26 ± 0.13) and Central Gulf Coast (0.08 ± 0.04) desertscrub. Density in the Sonoran Desert was slightly lower than statewide estimates (0.67 ± 0.32). Relative abundance was higher on the Coastal Plain (0.18 ± 0.02 males/station, n = 297) and adjacent foothills and valleys (0.14 ± 0.04, n = 41) than in interior foothills and valleys of the Sierra Madre Occidental (0.003 ± 0.033, 11 = 50) (F2, 285 = 12.26, P < 0.0001). On the Coastal Plain, owls occurred along 52.4% of transects compared to only 2.0% of transects (n = 1 of 50) in the interior (USFWS, 2023). The available information suggests that pygmy-owls currently occupy all five analysis units, although likely at reduced numbers and distribution than occurred historically. However, the status and abundance vary considerably at a smaller scale, such as within an analysis unit, as in the case of Sonora. Flesch's work in Sonora indicates that pygmy-owl abundance and density vary among the northern, central, and southern parts of Sonora, as well as by vegetation communities (Flesch 2003). For example, pygmy-owl densities are similar in valley bottoms and lower bajada areas in Arizona desert scrub communities in norther Sonora as they are in tropical deciduous forests in southern Sonora (95% CI overlap). Pygmy-owl densities are much lower in the vegetation communities in central Sonora (AZGFD 2008, Flesch 2003). Similarly, pygmyowls are more common currently in the oak motte habitats of Texas than they are along the Rio Grande. Additionally, pygmy-owls are more common in the southern, or Mexican, portion of the eastern population than they are in Texas, or northern portion of the eastern population. These specific variations are important to management and conservation of the pygmy-owl and must be considered as we work to recover the pygmy-owl. None of the analysis units or populations have formal population estimates for the pygmy-owl. Therefore, as described in the SSA report, we used a general relative scale of population size when analyzing each analysis unit, but management and conservation actions must also consider the variation within the analysis units (USFWS, 2024).

Population Narrative:

Although there was high temporal variation in abundance, there was little evidence of systematic declines over the 16 years of study. Observed abundance was high initially (55 males in 2000), declined steadily to 2008 (21), increased in 2009-2011 (34-39), decreased somewhat in 2013 and 2014 (28-31), and then increased markedly during the final two years of study to near initial levels (49-51) . The current condition category is a qualitative estimate based on the analysis of the three population and distribution factors and three habitat factors. Based on the total score for each analysis unit, we then rated the resiliency of that analysis unit as High (a score of 22 - 28), Moderate (a score of 15 – 21), or Low (a score of 8 - 14). These ratings are defined by the likelihood of pygmy-owl persistence over the next 30 years. An analysis unit with a high rating has a higher probability of persistence over 30 years than an analysis unit with a moderate or low rating. Conversely, an analysis unit with a high rating has a low (<15 percent) chance of extinction over the next 30 years. An analysis unit in low condition has a 40 – 100 percent chance of extirpation over the next 30 years (USFWS, 2023).

Threats and Stressors

Stressor: Drought and Climate Change
Exposure:
Response:
Consequence:
Narrative: Climate change can influence pygmy-owl habitat conditions and availability, including availability of nesting cavities. Climate change affects vegetation and cover that influence pygmy-owl survival and productivity through prey availability, predator avoidance, and thermoregulation. Climate change and drought also influence habitat loss and fragmentation, including the influences of non-native invasive plants and alteration of historical fire regimes.

Stressor: Urbanization
Exposure:
Response:
Consequence:
Narrative: Increasing human populations result in expanding urban areas. Urbanization causes permanent impacts on the landscape that potentially result in the loss and alteration of pygmy-owl habitat. Residential, commercial, and infrastructure development replace and fragment areas of native vegetation resulting in the loss of available pygmy-owl habitat and habitat connectivity needed to support pygmy-owl dispersal and demographic support (exchange of individuals and rescue effect) of population groups. Increasing human populations require additional water, and increasing water consumption can reduce available surface and ground water needed to support pygmy-owl and pygmy-owl prey habitats. Added human presence on the landscape can potentially lead to increased pygmy-owl mortality through introduced predators, collisions, etc. Appendix 6 of this SSA Report shows analysis done indicating the ongoing loss of pygmy-owl habitat related to urbanization and other human impacts. The following discussion presents the available information related to pygmy-owl habitat impacts associated with urbanization.

Stressor: Invasive Species
Exposure:
Response:
Consequence:
Narrative: The invasion of nonnative vegetation, particularly nonnative grasses, has altered the natural fire regime over the Sonoran Desert ecoregion of the pygmy-owl range, in particular, but invasive species impact native habitats in other pygmy-owl analysis units as well (Esque and Schwalbe 2002, p. 165; Lyons et al. 2013, p. 71; Wied et al. 2020, entire). In areas composed entirely of native species, ground vegetation density is mediated by barren spaces that do not allow fire to carry across the landscape. However, in areas where nonnative species have become established, the fine fuel load is continuous, and fire is capable of spreading quickly and efficiently (Esque and Schwalbe 2002, p. 175; Wied et al. 2020, p. 48). As a result, fire has

become a significant threat to the native vegetation of the Sonoran Desert. Sonoran Desert vegetation is not fire adapted, and many such vegetative communities in Arizona are no longer in a natural or historic state. Esque and Schwalbe (2002, pp. 180–190) discuss the effect of wildfires in the Arizona Upland and Lower Colorado River subdivisions of Sonoran desertscrub, which comprise the primary portions of the pygmy-owl's range within Sonoran desertscrub. Sonoran desertscrub communities and their fire dynamics have been inalterably changed by nonnative grasses and forbs, and in some areas by woody shrubs and trees.

Stressor: Agricultural Production and Wood Harvesting
Exposure:
Response:
Consequence:
Narrative: Agricultural development and wood harvesting can result in substantial impacts to the availability and connectivity of pygmy-owl habitat. Conversion of native vegetation communities to agricultural fields or pastures for grazing has occurred within historical pygmyowl habitat in both the United States and Mexico, and not only removes existing pygmy-owl habitat elements, but also can affect the long-term ability of these areas to return to native vegetation communities once agricultural activities cease. Wood harvesting has a direct effect on the amount of available cover and nest sites for pygmy-owls and is often associated with agricultural development. Wood harvesting also occurs to supply firewood and charcoal, and to provide material for cultural and decorative wood carvings. Appendix 6 of this SSA Report shows analysis done at a large scale indicating the ongoing loss of pygmy-owl habitat related to agricultural and wood harvesting impacts, as well as from other human impacts, throughout the pygmy-owl's range. While we do not have detailed information regarding the impacts of agricultural development and wood harvesting for all areas within the range of the pygmy-owl, the following provides a discussion of the extent of the impacts from these activities for areas for which we do have sufficient information

Stressor: Improper Livestock Grazing
Exposure:
Response:
Consequence:
Narrative: Probably no single land use has had a greater effect on the vegetation of southeastern Arizona or has led to more changes in the landscape than improper livestock grazing and range-management programs (Carothers 1977, p. 4). Undoubtedly, grazing since the 1870s has led to soil erosion, destruction of native plants most palatable to livestock, changes in the regional fire ecology, the spread of both native and alien plants, and changes in the age structure of evergreen woodlands and riparian forests (Bahre 1991, p. 123). Many areas of pygmy-owl habitat have recovered from these historical effects of grazing; however, other areas are slow to recover and may never recover due to the arid nature of the Sonoran Desert.

Stressor: Border Issues
Exposure:
Response:
Consequence:
Narrative: One of the most pressing issues for the U.S.- Mexico border is the impact of illegal human and vehicular traffic through these unique and environmentally sensitive areas. Many of these locations now bear the scars of wildcat trails, abandoned refuse, and trampled vegetation

(Marris 2006, p. 339; Walker and Pavlakovich-Kochi 2003, p. 15). Monitoring activities by the U.S. National Park Service (NPS) estimate that, annually, 300,000 individuals illegally cross through Organ Pipe Cactus National Monument in southwestern Arizona. Video surveillance equipment erected at Coronado National Memorial, in southeastern Arizona, indicates traffic volumes ranging from 100 to 150 immigrants per night (Walker and Pavlakovich-Kochi 2003, p. 15). In the Cabeza Prieta National Wildlife Refuge, located in southwestern Arizona, which has historically supported resident pygmy-owls, there are over 640 km (400 mi) of illegal roads plus another 1,280 km (800 mi) of unauthorized foot trails as a result of illegal border activities (Cohn 2007, p. 96). These activities result in direct impacts to pygmy-owl habitat.

Stressor: Off-highway Vehicle (OHV) Use
Exposure:
Response:
Consequence:
Narrative: The information we have on impacts to the pygmy-owl from OHV use relates primarily to Arizona. Information was not readily available on any potential OHV impacts to pygmy-owls or pygmy-owl habitat in Texas and Mexico.

Recovery

Reclassification Criteria:
Recovery Priority Number: 12C

Conservation Measures and Best Management Practices:

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Additional Threshold Information:

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References

USFWS. 2021. Species status assessment report for Glaucidium brasilianum cactorum (cactus ferruginous pygmy-owl), Version 1.1. United States Fish and Wildlife Service, Tucson, Arizona. 178 pp. + 5 appendices.

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SPECIES ACCOUNT: *Grus americana* (Whooping crane)

Species Taxonomic and Listing Information

Listing Status: Endangered/Experimental Population, Non-Essential; 03/11/1967, 01/22/1993, 06/26/2001, 02/03/2011; Southwest Region (R2), Southeast Region (R4) (USFWS, 2016)

Physical Description

The whooping crane occurs only in North America and is North America's tallest bird, with males approaching 1.5 m (5 ft) when standing erect. The whooping crane adult plumage is snowy white except for black primaries, black or grayish alula (specialized feathers attached to the upper leading end of the wing), sparse black bristly feathers on the carmine crown and malar region (side of the head from the bill to the angle of the jaw), and a dark gray-black wedge-shaped patch on the nape. The common name "whooping crane" probably originated from the loud, single-note vocalization given repeatedly by the birds when they are alarmed. (USFWS, 2016)

Taxonomy

The whooping crane is in the Family Gruidae, Order Gruiformes (Krajewski 1989, Meine and Archibald 1996). The closest taxonomic relatives in continental North America are 5 races of sandhill crane (G. canadensis): the lesser (G. c. canadensis); Canadian (G. c. rowani); greater (G. c. tabida); Florida (G. c. pratensis); and Mississippi (G. c. pulla) (the last also listed as endangered by the USFWS (Meine and Archibald 1996). (USFWS, 2007)

Historical Range

The historical range extended from the Arctic coast of North America south to central Mexico, and from Utah east to New Jersey, South Carolina, Georgia, and Florida; in the 19th and 20th centuries, nesting occurred principally in the region extending from central Canada to the north-central United States (see CWS and USFWS 2007). (NatureServe, 2015)

Current Range

Current distribution includes just three populations: (1) the Aransas-Wood Buffalo National Park Population that nests in Wood Buffalo National Park and adjacent areas in Canada (south-central Mackenzie and adjacent northern Alberta) and winters in coastal marshes in Texas, with significant migration stopovers in southern Saskatchewan, Nebraska, Kansas, and Oklahoma; (2) a reintroduced non-migratory Florida Population that occurs in central Florida; and (3) a reintroduced Eastern Migratory Population that migrates between Wisconsin (Necedah National Wildlife Refuge) and Florida (Chassahowitzka NWR) (CWS and USFWS 2007). (NatureServe, 2015)

Distinct Population Segments Defined

Yes: Entire U.S.A, except where listed as experimental population; Experimental populations: U.S.A. (AL, AR, GA, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, OH, SC, TN, VA, WI, WV); U.S.A. (CO, ID, FL, NM, UT, and the western half of Wyoming); and U.S.A (Southwestern Louisiana) (USFWS, 2016)

Critical Habitat Designated

Yes; 5/16/1978.

Legal Description

On May 15, 1978, the Service determined Critical Habitat for the whooping crane (Grus americana), an Endangered species, in the States of Colorado, Idaho, Kansas, Nebraska, New Mexico, Oklahoma, and Texas (43 FR 20938 - 20942). On August 17, 1978, the Service proposed eight additional areas as critical habitat in Kansas, Montana, Nebraska, North Dakota, and South Dakota (43 FR 36588 - 36590).

Critical Habitat Designation

Critical Habitat for the whooping crane (Grus americana) is determined to include the following areas:

Colorado. Areas of land, water, and airspace with the following components (1) Monte Vista National Wildlife Refuge in Alamosa and Rio Grande Counties; and (2) Alamosa National Wildlife Refuge in Alamosa and Conejos Counties.

Kansas. Areas of land, water, and airspace with the following components: (1) Quivira National Wildlife Refuge in Stafford, Reno, and Rice Counties; and (2) Cheyenne Bottoms State Waterfowl Management Area in Barton County.

Nebraska. An area of land, water, and airspace in Dawson, Buffalo, Hall, Phelps, Kearny, and Adams Counties with the following boundaries: Platte River bottoms—a strip of river bottom with a north-south width 3 miles, a south boundary paralleling Interstate 80, beginning at the junction of U.S. Highway 283 and Interstate 80 near Lexington, and extending eastward along Interstate 80 to the interchange for Shelton and Dehman, Nebr. near the Buffalo-Hall County line.

New Mexico. An area of land. water, and airspace in Socorro County with the follow- ing component: All areas at or below 4,600 feet in elevation within Bosque del Apache National Wildlife Refuge.

Oklahoma. An area of land, water, and airspace in Alfalfa County with the following component: Salt Plains National Wildlife Refuge.

Texas. An area of land, water, and airspace in Aransas, Calhoun, and Refugio Counties with the following boundaries: Beginning at the point where the north boundary of the Aransas National Wildlife Refuge intersects the shore of San Antonio Bay at Webb Point; thence, from this point along a straight line across San Antonio Bay through the westernmost tip of Mosquito Point and inland to a point of intersection with metal surfaced road; thence eastward along a straight line across Espiritu Santo Bay to the intersection of the bay shore and a road at the east end of Pringle Lake on Matagorda Island; thence south along this road to the intersection with the main Matagorda Island road; southwestward along this main road to Cedar Bayou at latitude 28°04'10? N.; thence due west across Cedar Bayou, Vinson Slough, and Isla San Jose to Gulf Intracoastal Waterway platform channel marker No. 25; thence north to the southwest corner of the proclamation boundary, just south of Blackjack Point; thence north along the proclamation boundary into St. Charles Bay to a line drawn as an eastward extension of Twelfth Street on Lamar Peninsula; thence westward along this line to intersection with Palmetto Avenue; thence northward along a straight line to the southwest corner of the Aransas National Wildlife Refuge at Texas State Highway 35 and the north shore of Cavasso Creek; thence northeast on a straight line to the corner of the Aransas National Wildlife Refuge north boundary adjacent to triangulation station "Twin"; thence along the north boundary of said refuge to the starting point at Webb Point.

Primary Constituent Elements/Physical or Biological Features

PCEs not described. All areas designated provide food, water, and other nutritional or physiological needs of the whooping crane. Cranes at Aransas feed primarily on various crustaceans and molluscs found in the tidal flats and marshes. Crayfish, frogs, small fish, and other small animals appear to be the major items taken in wetlands on spring migration. During fall migration whooping cranes seem to feed more extensively in recently harvested grain fields where insects and wasted grains seem to constitute the bulk of their diet. Generally, whooping cranes (as do most other cranes in the world) require an open expanse for nightly roosting. This habit of using sand or gravel bars in rivers and lakes for nightly roosting appears to be one of the major factors in crane habitat selection. Feeding cranes seen in migration are frequently found within short flight distances of reservoirs, lakes, and large rivers that offer bare islands for nightly roosting. Whooping cranes do not readily tolerate disturbances to themselves or their habitat. A human on foot can quickly put a whooping crane to flight at distances over one quarter of a mile. Loss of large expanses of wetlands and shooting were the major factors in causing the massive declines of whooping cranes in the late 1800's. The one common feature uniting the vast majority of confirmed sightings of this crane in migration is the proximity to wetlands that provide undisturbed roosting sites.

Based on the above text, it can be inferred that (i) small aquatic animals, (ii) sand and gravel bars, and (iii) large expanses of undisturbed wetlands are major consitutent elements required by this species.

Special Management Considerations or Protections

Critical habitat excludes existing manmade structures or settlements which are not necessary to the normal needs or survival of the species.

Life History

Feeding Narrative

Adult: Whooping cranes are omnivorous (Walkinshaw 1973), probing the soil subsurface with their bills and taking foods from the soil surface or vegetation. Summer foods include large nymphal or larval forms of insects, frogs, rodents, small birds, minnows, and berries (Allen 1956, Novakowski 1966, Bergeson et al. 2001b). Foods utilized during migration are poorly documented but include frogs, fish, plant tubers, crayfish, insects, and agricultural grains. The largest amount of time is spent feeding in harvested grain fields (Johns et al. 1997). The winter diet consists predominately of animal foods, especially blue crabs (Callinectes sapidus), clams (Tagelus plebius, Ensis minor, Rangia cuneata, Cyrtopleura costada, Phacoides pectinata, Macoma constricta), and the plant wolfberry (Lycium carolinianum) (Allen 1952, Uhler and Locke 1970, Blankinship 1976 and 1987, Hunt and Slack 1987, Chavez-Ramirez 1996). Most foraging occurs in the brackish bays, marshes, and salt flats on the edge of the mainland and on barrier islands. Occasionally, cranes fly to upland sites when attracted by fresh water to drink or by foods such as acorns, snails, crayfish and insects, and then return to the marshes to roost (Hunt 1987, Chavez-Ramirez et al. 1995). Uplands are particularly attractive when partially flooded by rainfall, burned to reduce plant cover or when food is less available in the salt flats and marshes (Bishop and Blankinship 1982). Some whooping cranes use upland sites frequently in most years, but agricultural croplands adjacent to ANWR are rarely visited. (USFWS, 2007)

Reproduction Narrative

Adult: Whooping cranes are a long-lived species. Binkley and Miller (1983) suggested a maximum life span of 22-24 years of age, however at present, 1 wild female died at age 28 and 1 male is currently 28 years old (Tom Stehn, ANWR, pers. comm.). Captive individuals live 35-40 years (Moody 1931, McNulty 1966). Eggs are normally laid in late April to mid-May, and hatching occurs about 1 month later. Pair mates for life. Both sexes, in turn, incubate 2, sometimes 1-3, eggs for 29-31 days. Whooping cranes usually produce clutches of 2 eggs laid 48-60 hours apart. Incubation begins with the first egg laid, resulting in asynchronous hatching of the eggs. Nestlings are precocial. Young are tended by both adults, fledge when no less than 10 weeks old (no earlier than mid-August), remain with parents until following year (dissociate after arrival on breeding grounds). Sexually mature at 4-6 years. Mated pairs and families establish and defend winter territories on coastal marshes in Texas. Breeding territories are very large, averaging 770 ha (Johnsgard 1991). (USFWS, 2007; NatureServe, 2015)

Geographic or Habitat Restraints or Barriers

Adult: A big problem for reintroduced whooping crane flocks may be the lack of large blocks of suitable habitat in which the species seems to prosper. (USFWS, 2007)

Environmental Specificity

Adult: Medium, with some key requirements (NatureServe, 2015)

Site Fidelity

Adult: High (USFWS, 2007)

Habitat Narrative

Adult: Nesting occurs in dense emergent vegetation (sedge, bulrush) in shallow (often slightly alkaline) ponds (Kuyt 1995), freshwater marshes, wet prairies, or along lake margins. Pothole breeding sites in Canada are separated by narrow ridges vegetated by black spruce, tamarack, and willow. The nest is a mound of marsh vegetation rising about 20-50 centimeters above the surrounding water level. Habitat during migration and winter includes marshes, shallow lakes, lagoons, salt flats, grain and stubble fields, and barrier islands (AOU 1983, Matthews and Moseley 1990). Radio-marked migrants roosted primarily in palustrine wetlands, many of which were smaller than 0.5 hectares (Howe 1989). Migration habitat includes mainly sites with good horizontal visibility, water depth of 30 centimeters or less, and minimum wetland size of 0.04 hectares for roosting (Armbruster 1990, which see for further details). A big problem for reintroduced whooping crane flocks may be the lack of large blocks of suitable habitat in which the species seems to prosper. They show considerable fidelity to their breeding territories, and normally nest in the same general vicinity each year. (USFWS, 2007; USFWS, 2012; NatureServe, 2015)

Dispersal/Migration

Motility/Mobility

Adult: High (NatureServe, 2015)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory and non-migratory populations (NatureServe, 2015)

Dispersal

Adult: Medium (NatureServe, 2015)

Dispersal/Migration Narrative

Adult: The whooping crane is a bi-annual migrant, traveling between its summer habitat in central Canada, and its wintering grounds on the Texas coast, across the Great Plains of the U.S. in the spring and fall of each year. The migratory corridor runs in an approximately straight line from the Canadian Prairie Provinces of Alberta and Saskatchewan through the Great Plains states of eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. The complete corridor is approximately 2,400 miles (3,862 km) long by 220 miles (354 km) wide, a zone that encompasses 95% of known sightings of whooping cranes. Autumn migration normally begins in mid-September, with most birds arriving on the Texas wintering grounds between late October and mid-November. Whooping cranes migrate south as singles, pairs, in family groups, or as small flocks of 3 to 5 birds. They are diurnal migrants and stop daily to feed and rest. Local weather conditions influence distance and direction of travel, but whooping cranes generally are capable of reaching the autumn staging grounds in the north central portion of the Saskatchewan agricultural area on the second day of migration, where they remain for 2 – 4 weeks. The remainder of the migration from Saskatchewan to the wintering grounds is usually rapid, probably weather-induced, and may be completed in a week. Whooping cranes occupy winter areas for almost half a year. Although close association with other whooping cranes is tolerated at times on the wintering grounds, pairs and family groups typically occupy and defend relatively discrete territories. As spring approaches, “dancing” behavior (running, leaping and bowing, unison calling, and flying) increases in frequency, and is indicative of pre-migratory restlessness. Spring migration departure dates are normally between March 25 and April 15, with the last birds usually leaving by May 1. (USFWS, 2016)

Population Information and Trends

Population Trends:

Long-term trends suggest declines >90%, whereas short-term trends indicate an increase of >10% (NatureServe, 2015)

Population Growth Rate:

Slowly increasing (NatureServe, 2015)

Number of Populations:

3 (NatureServe, 2015)

Population Size:

338 individuals (NatureServe, 2015)

Minimum Viable Population Size:

Genetic analysis suggests that 90 percent of the genetic material of the species can be sustained for 100 years at a captive flock size of 153 (Jones and Lacy 2003). (USFWS, 2012)

Population Narrative:

Long-term population trends suggest declines >90%, whereas short-term trends indicate an increase of >10%. Historically, population size may have been as high as 10,000 (see CWS and USFWS 2007). A low point came in the mid-1900s when there were fewer than 50 whooping cranes in North America prior to 1968, with an all-time low of 21 as recently as 1954 (CWS and USFWS 2007). With management the total wild population is now a few hundred. Annual growth of the population during the past 65 years has averaged 4.5% per year (CWS and USFWS 2007). The total wild population in February 2006 was estimated at 338. Fewer than 250 are mature in the only self-sustaining population. The captive population contained 135 birds in February, 2006, with annual production from the Calgary Zoo, International Crane Foundation, Patuxent Wildlife Research Center, Species Survival Center, and the San Antonio Zoo. The total population of wild and captive whooping cranes in February, 2006, was 473. Three populations currently exist (see Range Extent comments). Genetic analysis suggests that 90 percent of the genetic material of the species can be sustained for 100 years at a captive flock size of 153 (Jones and Lacy 2003). (USFWS, 2012; NatureServe, 2015)

Threats and Stressors

Stressor: Construction (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: The construction of roads, buildings, power lines, towers and wind turbines have all negatively impacted the species (see section 2.3.2.5). The building of cities and towns directly destroys, as well as fragments, whooping crane migratory habitat. Large metropolitan areas such as Dallas-Ft. Worth make hundreds of square miles unsuitable for crane use, as do smaller towns located throughout the migration corridor. This loss of habitat may exacerbate the normal effects of periodic drought on whooping crane populations that do poorly in all aspects of their life cycle when conditions get drier. The occurrence and severity of drought itself may be made worse by climate change that could dry up wetlands needed by the cranes. The activities of humans continue to be the biggest threat to the species. (USFWS, 2012)

Stressor: Decreases in river flow (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Decreases in river flows have resulted in habitat degradation of riverine migration habitat for the species. Water diversions on major river systems such as the Platte River have degraded migration roost habitat. The reduced flows caused by reservoir construction and water withdrawals from the river are insufficient to scour woody vegetation from the riverbed, allowing trees to become established in the river channel. This has greatly reduced the number of unvegetated sandbars with open visibility used by cranes for roosting. The Platte River channel has also gotten deeper so it is no longer the wide braided river that had once been so attractive to cranes, and wet meadow habitats adjacent to the river have also been reduced. (USFWS, 2012)

Stressor: Population growth/ development (USFWS, 2012)

Exposure:
Response:
Consequence:
Narrative: Population growth on the Texas coast resulting from an increase in development is encroaching on salt marsh habitat used by the wintering whooping cranes. If development continues, it will limit the expansion of the species winter range and very shortly preclude recovery. There are currently five housing canal-lot developers applying for permits on lands which whooping cranes have used. Threats are growing as developers build houses on lands needed for whooping crane survival and expansion, and power lines, cell towers and roads are all increasing. Currently, 60 percent of wintering whooping cranes use the ANWR and Matagorda Island NWRs. With development occurring on private lands as people move to the coast, the potential for future flock expansion may soon be limited unless there is a large effort to protect additional lands. (USFWS, 2012)

Stressor: Reductions in freshwater inflow (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Freshwater inflows starting hundreds of kilometers inland from the Guadalupe and San Antonio rivers flow into whooping crane habitat and critical habitat at and adjacent to ANWR. Inflows are needed to maintain proper salinity gradients, nutrient loadings, and sediments that produce an ecologically healthy and productive estuary (TPWD 1998). Inflows are essential to produce foods used by whooping cranes, especially blue crab populations that do well when inflows are high (Houston Advanced Research Center 2006). A simple inverse relationship exists between blue crab catch rates and mean salinity within an estuary (Longley 1994). Lower salinities in late summer also promote production of Carolina wolfberry that is an important food for whooping cranes in the fall. Inflows also lower salinities in the bays and marshes, providing drinking water for cranes that would otherwise be forced to fly inland for freshwater. Reduced fresh water inflows are reaching the bays and estuaries on and around ANWR due to diversions for agriculture and human use. Developers seek additional water rights from the Guadalupe River that conservationists allege is over-appropriated. Springs coming from the Edwards Aquifer underneath San Antonio are threatened by increased pumping. These springs can make up 80 percent of San Antonio and Guadalupe river flows during periods of drought. Inflows are already reduced over historic levels and at times are insufficient to maintain bay productivity (CWS and USFWS 2007). Due to constructed diversions, by 2040, a decrease of freshwater inflows into the crane's winter range is projected in an average year to cause an 8 percent decline in blue crab populations (Texas Department of Water Resources 1980), but could have a much larger impact in drought years (Norman Johns, NWF, Austin, Texas, pers. comm., 2004). (USFWS, 2012)

Stressor: Reduction in migration stopovers (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Even though they are omnivorous and do feed on agricultural crops during migration, they have not adapted to agricultural production the way sandhill cranes have because most of their life cycle is wetland-dependent. Although many important parts of their range have been protected through public ownership (refuges, parks, and wetland management areas), the cranes

use migration habitat opportunistically and frequently use private lands. The frequent lack of traditional use areas in migration makes management for the species extremely difficult without being able to predict exactly what areas whooping cranes will use. The species must have a multitude of available stopover sites in order to be able to stop at short notice as darkness or wind shifts make conditions unfavorable for migration. Migration habitat is threatened by climate change with predicted reduction in rainfall for much of the corridor. Cranes may also lose habitat with their expected avoidance of areas developed for wind energy. Also, wetland loss is continuing in the migration corridor through conversion of lands for agriculture. (USFWS, 2012)

Stressor: Hunting (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: A major reason for the decline of the species in the 1800s and early 1900s was indiscriminant shooting and egg collection. Allen (1952) recorded 389 whooping cranes known to have died from gunshot or other causes from colonial times to 1948. The majority of documented mortalities (274 cranes) occurred in migration between 1870 and 1930 (Allen 1952). Considering the low reproductive potential of the species, the shooting mortality possibly exceeded annual reproduction by the early 1900s. Prior to the passage of the Migratory Bird Treaty Act in 1918, it was legal to shoot whooping cranes. Through education, whooping cranes at present are only rarely shot (Lewis et al. 1992a). Some of these shootings are strictly acts of vandalism, while most are associated with migratory bird hunting. Whooping cranes of the AWBP occasionally associate with sandhill cranes during migration. Hunting of sandhill cranes and snow geese occurs in and adjacent to areas used by migrating and wintering AWBP whooping cranes. Hunters may misidentify and shoot whooping cranes as these species. Sandhill crane hunting seasons in Canada and the United States in the migration corridor were originally seasonally timed or geographically limited to protect whooping cranes (Buller 1967, Archibald et al. 1976, Thompson and George 1987). Recent expansions of sandhill crane hunting seasons offer an increased potential for overlap with whooping crane migration periods and increased risks to whooping cranes (Konrad 1987). In some instances, large land units have been closed to sandhill crane or waterfowl hunting due to the presence of a flock or flocks of whooping cranes. Quivira NWR in Kansas is closed during most fall migrations whenever whooping cranes stopover (David Hilley, Quivira NWR, pers. comm., 2002). Tundra swan hunts recently initiated in the northern Great Plains (Montana, 1983; North Dakota, 1988; South Dakota, 1990) also present a risk of misidentification and accidental shooting of whooping cranes. (USFWS, 2012)

Stressor: Human disturbances (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: The whooping crane is sensitive to disturbance on the breeding grounds and will not remain near human activity. Some disturbances cause the birds to leave an area; the effects of others may be more subtle. However, the egg transfer and banding programs in WBNP have demonstrated that cranes will tolerate human intrusion for short intervals. Human disturbance occurs from hunters, sport fishermen and commercial crabbers, and birders, and boaters reduce the habitat available to the species, at least on a temporary basis. The growing use of shallow-

water craft including airboats and kayaks has made the crane area accessible even during periods of the lowest tides experienced mid-winter. (USFWS, 2012)

Stressor: Disease (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Little is known about the importance of diseases or parasites as mortality factors for wild whooping cranes. Although wild whooping cranes are presumably susceptible to a variety of infectious and toxicological diseases, evidence of disease-related mortality is infrequently documented. From 1976 to 1989, the USFWS necropsied or examined 25 whooping crane carcasses found dead in the field or removed from the wild because of sickness or debility. Of these, nine were diseased. Seven had avian tuberculosis (Snyder et al. 1997), a subadult crane captured in New Mexico was suffering from avian cholera (Snyder et al. 1987), and an adult died from acute lead poisoning (Brand et al. 1992, Snyder et al. 1992). The high incidence of avian tuberculosis indicates that whooping cranes may be particularly susceptible to that disease. In 2009, an unknown herpes virus was isolated from a juvenile at ANWR. Infectious bursal disease (IBD) has been known to cause mortality in whooping cranes reintroduced in Florida, and sandhill cranes captured in Nebraska in 2009 showed an antibody response to IBD and/or to a herpes virus. Eastern equine encephalitis has also been documented in the Florida flock. Human impacts on the environment and global movements are resulting in emerging disease problems of possible significance to whooping cranes. For example, West Nile virus appeared for the first time in North America in 1999 and spread rapidly. The H5N1 strain of avian influenza that surfaced in Asia in 2005 is an emerging threat to both captive and wild flocks. Aflatoxin and other molds growing on farm crops can be toxic to cranes. In addition, the toxin produced by red tide phytoplankton blooms (Karenia brevis) can be transferred through whooping crane prey items including clams. It has been known to cause bird mortality and could pose a significant threat to whooping cranes that feed heavily on clams in mid-winter. Red tide historically occurred infrequently on the Texas Coast. In recent years, it has occurred nearly annually during late summer and fall, lasting for several months. Red tide has been documented in the whooping crane area in recent years, and there have been occasional severe outbreaks along the Texas coast. In late 2011 through the time of publication, all Texas coastal waters were closed to the commercial and recreational harvesting of oysters, clams and mussels due to the presence of red tide (TPWD, Red Tide Update 2011, online). It is not known what factors are causing the increased number of outbreaks of red tide, but may be related to coastal urbanization causing changes in water quality. Coccidia, an internal parasite, have been found in a whooping crane with an injured wing captured in WBNP and in whooping crane droppings collected on the Texas wintering grounds (Forrester et al. 1978), and are common in cranes in the Florida release population (Spalding et al. 1996). Coccidia have caused deaths of several whooping crane chicks in captivity (Carpenter et al. 1980). The defense of large territories and small brood size ensures low density use of the WBNP natal area, and thereby reduces the likelihood of coccidia oocysts (spores) being ingested in quantities sufficient to cause significant disease. A variety of other parasites have been documented in released whooping cranes in Florida, but none has been proven to cause significant disease (Spalding et al. 1996). (USFWS, 2012)

Stressor: Predation (USFWS, 2012)
Exposure:
Response:

Consequence:
Narrative: Adult whooping cranes generally are not susceptible to predation unless they are weakened by disease or injury, or are flightless during feather molt. However, eggs and chicks are predated (Bergeson et al. 2001a). Potential predators on the nesting grounds include black bear (Ursus americanus), wolverine (Gulo luscus), gray wolf (Canis lupus), red fox (Vulpes fulva), mink (Mustela vison), lynx (Lynx canadensis), and raven (Corvus corax). Black bears and other mammals destroy eggs, and wolves, foxes, and ravens kill chicks (Kuyt 198la, 198lb, Bergeson et al. 2001a). The overall impact of predation on AWBP recruitment remains uncertain, but Boyce et al. (2005) have correlated the 10-year crane population cycle with that of boreal forest predator cycles. Predator control is not considered an appropriate management technique within Canadian National Parks. Whooping cranes are exposed to predators during migration (Lewis et al. 1992b). In the west, two golden eagle attacks on juvenile whooping cranes were documented during migration of reintroduced birds behind an ultralight. In 2002, a bald eagle killed a whooping crane hatchling in Florida. Bobcats (Lynx rufus) and alligators (Alligator mississippiensis) are significant predators of reintroduced whooping cranes in Florida. Bobcat predation appears most severe on individuals that do not show proper roosting behaviors or use habitat with heavy cover. Predation rates are significant in Florida, but appear to be low in wild birds in Texas where more time is spent in coastal wetlands. However, bobcats and coyotes have taken cranes that are sick or injured at ANWR (Hunt et al. 1987). (USFWS, 2012)

Stressor: Climatic factors (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Whooping cranes do not do well faced with drought conditions. Production is reduced dramatically, possibly from increased predation (Kuyt 1981b). Food supplies are diminished, and newly hatched chicks are forced to travel longer distances between wetlands. Habitat becomes more limited in migration as many non-permanent wetlands go dry. Drought affecting the wintering grounds influences availability and abundance of the natural food supply by altering salinity of tidal basins and estuaries (Blankinship 1976). Blue crab and wolfberry populations are reduced, the preferred foods of the whooping crane, and winter mortality increases (Pugesek et al. 2008). The species is also threatened by extreme storm events including blizzards, hail, and lightning. A whooping crane in Florida was struck and killed by lightning in 2009, and 18 captive-raised juveniles were killed in their release pen at Chassahowitzka NWR in Florida by a lightning strike. A late-season hurricane at the ANWR could place cranes at risk due to high wind velocities and flooding; fortunately, the hurricane season ends (November 30) just after most whooping cranes arrive. Any climate change that would increase the intensity of extreme storm events over historical patterns or would cause a general drying of wetland habitat would threaten the species. Global warming and associated climate changes constitute a potential threat to whooping crane recovery. Rising temperatures could increase evaporation and dry up wetlands that whooping cranes use throughout the year. If the warmer temperatures are not counter-balanced by increased precipitation, the species would struggle facing increased drought-like conditions. Warming temperatures that could reduce the number and severity of winter freezes at ANWR could allow black mangrove (Avicennia germinans) to spread its range northward into the crane area, an event that has been occurring over the past decade (T. Stehn, USFWS, pers. comm., 2010). The dense mangrove shrubs would reduce visibility for the cranes and would make much crane habitat unusable. Sea level rise and flooding of coastal wetlands is a major threat. Since whooping cranes mostly only use water

< 20 inches deep, a projected sea level rise that could exceed 39 inches (0.99 m) by the end of the century announced by climate scientists meeting in Copenhagen in March 2009 would make the current whooping crane winter range unusable (Tom Stehn, ANWR, pers. comm., 2010). The realization that glaciers are melting more rapidly and waters are rising faster than originally predicted makes it even more important to carry out a land protection initiative for whooping cranes. Upland areas next to existing marshes need to be purchased based on forecasts of marshland changes. However, bulkheaded developments will prevent new marshes from developing. (USFWS, 2012)

Stressor: Collisions with power and electrical lines (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Collisions with power lines are a substantial cause of whooping crane mortality in migration (Brown et al. 1987, Lewis et al. 1992b). Collisions with both transmission and distribution power lines are responsible for the death or serious injury of at least 45 whooping cranes since 1956 (Stehn and Wassenich 2008). In the 1980s, two of nine radio-marked whooping cranes from AWBP died within the first 18 months of life as a result of power line collisions (Kuyt 1992). Of 27 documented mortalities in the Rocky Mountain reintroduced whooping crane population, almost 2/3 were due to collisions with power lines (40.1 percent) and wire fences (22.2 percent) (Brown et al. 1987). Twenty individuals within the Florida populations and at least four individuals in the migratory Wisconsin population have died hitting power lines. As an additional concern, power lines can cause habitat fragmentation. The Avian Power Line Interaction Committee (APLIC) composed of nine investor-owned electric utilities and the USFWS was established in 1989 to address the issue of whooping crane collisions (Lewis 1997). In 1994, APLIC provided voluntary guidelines to the industry on avoiding power line strikes (APLIC 1994). At present, the USFWS is requesting the development of avian and bat protection plans by participating companies to reduce bird strikes (Manville 2005). Tests of line marking devices, using sandhill cranes as surrogate research species, have identified techniques effective in reducing collisions by up to 61 percent (Morkill 1990; Morkill and Anderson 1991, 1993; Brown and Drewien 1995). Techniques recommended include marking lines in areas frequently used by cranes and avoiding placement of new line corridors around wetlands or other crane use areas. (USFWS, 2012)

Stressor: Renewable resources: wind energy (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Increasing interest in development of renewable energy sources as one part of addressing global climate change, in many regions of the United States, including the range of the whooping crane, has created the need for additional generation and transmission lines to move power to the grid and transport it to the population centers (i.e., areas of demand). Often these sources of renewable energy are located in areas distant from population centers and existing electricity generation sources, and as such have limited transmission infrastructure and limited capacity within the existing infrastructure. Planning for new transmission is ongoing and directed at addressing the transmission bottleneck to further facilitate development of thousands of megawatts of wind energy facilities (i.e., thousands of wind turbines with associated habitat loss and fragmentation). Proposed extreme high voltage transmission lines

(EHV; 345 to 765 kilovolts) could remove transmission capacity bottlenecks that are currently limiting further expansion of wind energy facilities. An estimated 16,000 new wind turbines may be constructed in the U.S. in the next decade, adding to the existing 15,000 turbines (Manville 2005). The development of wind farms in the whooping crane migration corridor has the potential to cause significant mortality. Cranes could be killed directly by wind turbines or from colliding with new power lines associated with wind farm development. Research and management are needed to reduce this new threat. The effects of wind energy development on whooping crane populations have not been investigated, but the effects of similar disturbances such as oil and gas development can serve as a surrogate in many instances and suggest that the effects will not be neutral or beneficial. Like oil and gas development, wind energy development involves loss of habitat due to the installation of roads, turbine pads, substations, maintenance/operation facilities, and generation interconnect lines; these features also serve as sources of habitat fragmentation. It is likely that migrating whooping cranes coming upon wind farms will be less likely to stop due to the presence of the tall turbines since whooping cranes are known to avoid tall structures such as buildings. (USFWS, 2012)

Stressor: Other vertical structures (USFWS, 2012)
Exposure:
Response:
Consequence:
Narrative: Collisions with other objects including fences, aircraft, vehicles and possibly wind turbines and communications towers are a threat to the species. Whooping cranes, particularly in the western population reintroduced at Grays Lake, Idaho were documented either colliding with or getting entangled in fences as they tried to walk through them. Fences crossing wetlands are particularly hazardous as whooping cranes may be coming in to land and simply not see the thin fence wire. Human settlement including roads and buildings has resulted in the fragmentation of whooping crane habitat, particularly in migration. This has reduced the total amount of habitat available to the species. When given a choice, whooping cranes will avoid roads and buildings. Whooping cranes prefer to avoid humans. However, whooping cranes reintroduced in the eastern U.S. that are less wary of people have been documented feeding on roadsides and being killed by vehicle collisions. Guy wires associated with telecommunication towers (radio, television, cellular, and microwave) present another potential collision obstacle to cranes. Although a whooping crane has not yet been documented hitting a tower, particularly worrisome is the use of support guy wires that are thin and thus difficult for whooping cranes to see. Visible markers should be placed on guy wires to reduce the risk of avian collisions. Whooping crane collisions with aircraft rarely occur because of the small number of whooping cranes, but are a growing threat. One whooping crane was killed in June 1982 during a KC-135 tanker takeoff from Minot Air Force Base, North Dakota (Harrison 1983). Feather remains were identified by the Smithsonian Institute. A crane over North Dakota may have been hit by a plane in April 2007; the bird suffered massive internal injuries from collision with a blunt object, but the exact cause of death was never determined. In October 2007, a recently released, naïve DAR bird was struck and killed by a jet aircraft at the Dane County airport in Madison, Wisconsin (WCEP 2007). (USFWS, 2012)

Stressor: Chemical spills (USFWS, 2012)
Exposure:
Response:
Consequence:

Narrative: The release of chemicals at ANWR associated with ship traffic on the Intracoastal Waterway and oil and gas development including platforms and pipelines could cause a disaster, killing a large number of cranes outright or degrading their habitat (Robertson et al. 1993). Many barges carrying toxic chemicals travel the Gulf Intracoastal Waterway (GIWW) daily through the core of whooping crane winter habitat. The U.S. Coast Guard has the lead responsibility for spill response and containment. The USFWS has response plans for the Gulf of Mexico (USFWS 1979) and specifically for Aransas (Robertson et al. 1993). However, it is impossible to provide full protection for the cranes as long as chemicals are transported on the GIWW through the heart of the winter range. When a spill occurs, high winds would greatly reduce the effectiveness of containment booms for products floating on the surface. Gaseous materials leaked could directly kill all cranes downwind. Spills of hazardous chemicals may limit human approach to only those personnel wearing special protective suits and breathing apparatus. An event occurring at night or in bad weather (the most probable times) would slow response. The cranes are exposed to gas and oil development in migration, including waste oil pits and tar sands development in Canada. In the fall of 2006, a crane family group was seen in Nebraska with what appeared to be oil-stained feathers on the lower half of their bodies. It looked like they had walked into an oil waste pit. The huge oil waste pits connected with tar sands oil extraction in Canada located in the migration corridor is another risk to the whooping cranes. There is no evidence that pesticide contamination has ever been a significant threat to whooping cranes. Whooping crane egg and tissue specimens examined for pesticide residues have shown concentrations well below those encountered in most other migratory birds (Robinson et al. 1965, Lamont and Reichel 1970, Anderson and Kreitzer 1971, Lewis et al. 1992b). Eggshell thickness, a measure of contaminant exposure, has been measured in eggs taken from the wild and those in captivity from the 1970s to the present; no evidence of shell thinning has been detected. However, knowledge of potential indirect or sub-lethal effects of pesticides on whooping cranes is inadequate and poorly understood. The baseline contaminant impacts research comes from research on other birds including sandhill cranes, but has never been done on whooping cranes. Whooping cranes on the winter range are exposed to contaminants associated with runoff from agricultural and industrial activities. Nearby Lavaca Bay was closed for multiple years to the harvesting of fish and crabs because of industrial pollution including high levels of mercury (Lewis et al. 1992b). (USFWS, 2012)

Recovery

Reclassification Criteria:
1. Establish and maintain self-sustaining populations of whooping cranes in the wild that are genetically stable and resilient to stochastic environmental events. (USFWS, 2007)

2. Maintain a genetically stable captive population to ensure against extinction of the species. (USFWS, 2007)

Recovery Priority Number: 2C

Delisting Criteria:
Delisting criteria are not available.

Recovery Actions:

- Continue to build the AWBP and protect and manage its habitat to minimize the probability that a catastrophic event will eradicate this population. (USFWS, 2007)
- Attain breeder pair and productivity goals at 4 captive facilities in the United States and 1 in Canada to produce the birds required for reintroductions. Continue research to improve production of captive flocks. (USFWS, 2007)
- Establish 2 additional self-sustaining wild populations. Continue research to identify appropriate reintroduction sites and improve reintroduction techniques. Protect and manage habitat of reintroduced populations. (USFWS, 2007)
- Continue to use genetic information and advances in conservation biology to conserve flock genetics, and determine Ne and revise criteria as warranted. (USFWS, 2007)
- Maintain an outreach program. (USFWS, 2007)
- Determine peak flock size, number of nests, number of fledged chicks, and number of chicks that reach ANWR during each of the next 5 years on aerial surveys. Document spring to fall, and winter mortality. (USFWS, 2012)
- Enhance foraging opportunities on 5,000 acres/year at ANWR by prescribed burns. (USFWS, 2012)
- Obtain additional funding and purchase easements and fee title lands for 40,000 acres of occupied winter habitat, potential habitat and upland buffer in the next 5 years with a 10-year goal of 100,000 acres. (USFWS, 2012)
- Obtain additional funding to restore, enhance and/or maintain 40,000 acres of occupied and potential habitat, including upland buffer, in the next 5 years. Use Cooperative Agreements with non-government organizations and Private Lands Agreements with landowners. (USFWS, 2012)
- Map and characterize the invasion of black mangrove into the crane range at ANWR, coordinate with National Marine Fisheries Service (NMFS), and implement a control program if feasible. (USFWS, 2012)
- Consider expansion of designated Critical Habitat. (USFWS, 2012)
- Minimize and mitigate for impacts to whooping cranes and crane habitat from development projects through ESA, Section 7 consultations, or Section 10 incidental take permits (Habitat Conservation Plans or HCPs). (USFWS, 2012)
- Continue to work to ensure freshwater inflows reach the crane wintering grounds. Assemble data to describe flow levels needed to provide the resources needed for a healthy whooping crane population. (USFWS, 2012)
- Continue education and public relations programs such as community based conservation initiatives, working with news media, doing public presentations, and working with schools. (USFWS, 2012)
- Carry out cooperative tracking project during migration periods. Update annually and post-on-line the GIS corridor database and map. (USFWS, 2012)
- Capture, health check, radio and track 50 whooping cranes. Determine habitat use in migration and detect causes of mortality. (USFWS, 2012)
- Collaborate with the wind industry to write an HCP to minimize and mitigate wind farms impacts. (USFWS, 2012)
- Work with APLIC to write an HCP to minimize and mitigate whooping crane collisions with power lines. (USFWS, 2012)
- Annually carry out the State-Federal contingency plan for protecting cranes in migration. Minimize shooting mortalities related to migratory bird hunting. (USFWS, 2012)

- Maintain and expand to 50 breeder pairs the captive breeding flocks by supporting captive breeding facilities. (USFWS, 2012)
- Complete genomic mapping of the captive flock and compare with genetic material sampled from the AWBP. (USFWS, 2012)
- Initiate research to determine how to get whooping cranes to breed at an earlier age in captivity. (USFWS, 2012)

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SPECIES ACCOUNT: *Grus canadensis pulla* (Mississippi sandhill crane)

Species Taxonomic and Listing Information

Listing Status: Endangered; 06/04/1973; Southeast Region (Region 4) (USFWS, 2016)

Physical Description

Mississippi sandhill cranes resemble great blue herons (Ardea herodias). A major distinguishing characteristic is that cranes are completely gray. Great blue herons usually have white on their heads and dark colored underparts. When standing erect, cranes are about 4 feet tall. Male and female cranes are similar in appearance. All cranes have long necks, and adult cranes possess a bald red forehead. The species vocalizations are loud and clattering. Cranes are also unique in that they require separate nesting, foraging, and roosting habitats (U.S. Fish and Wildlife Service 1991). (USFWS, 2016)

Taxonomy

Six sandhill crane subspecies are currently recognized. Three subspecies, lesser (G. c. canadensis), Canadian (G. c. rowani), and greater (G. c. tabida) sandhill cranes are northern migratory forms that generally nest in northern North America and the Soviet Union and in the winter migrate to the southern United States and in Mexico. In the southeastern United States, migratory sandhill cranes, mainly greater sandhill cranes, are found in the winter from Texas through Florida. In winter, a small number of migratory sandhill cranes inhabit southeastern Mississippi and infrequently they have been observed in the company of Mississippi sandhill cranes. The Florida and Mississippi races are nonmigratory and nest in the souteastern United States. The Cuban sandhill crane, also nonmigratory, nests in Cuba (Johnsgard 1983). (USFWS, 1991)

Historical Range

Small populations formerly occurred in widely scattered areas along the coastal plain of Louisiana, Mississippi, Alabama, and Florida; may have bred in savannas just east of the Pascagoula River in Mississippi in the early 1900s (Matthews and Moseley 1990). (NatureServe, 2015)

Current Range

Currently restricted to an area in southern Jackson County, Mississippi, extending from the Pascagoula River west to the Jackson County line, south to Simmons Bayou, north to latitude about 4 miles north of Vancleave; part of this area is within the Mississippi Sandhill Crane NWR; main winter roost is in the marshes of Bluff Creek, Bayou Castelle, and Paige Bayou (Matthews and Moseley 1990). (NatureServe, 2015)

Distinct Population Segments Defined

No

Critical Habitat Designated

Yes; 8/8/1977.

Legal Description

On August 8, 1977, the Director, U.S. Fish and Wildlife Service determined Critical Habitat for the Mississippi sandhill crane (Grus canadensis pulla) (42 FR 39985 - 39988) pursuant to Section 7 of the Endangered Species Act of 1973. In accordance with Section 7, all Federal agencies will be required to insure that actions authorized, funded, or carried out by them do not adversely affect this Critical Habitat.

Critical Habitat Designation

Mississippi. Areas of land, water, and airspace in Jackson County, with the following components (St. Stephens Base Meridian): T6S 6W Sec. 31: T6S R7W E1/2 of E1/2 Sec. 34, Sec. 35 - 36, S1/2 Sec. 38: T6S R8W Sec. 27, those portions of Sec. 26 - 31 south of Seaman Road, Sec. 32 - 44; T7S R6W N1/2 of N1/2 Sec. 3, Sec. 6; T7S R7W Sec. 2 - 11, Sec. 13 - 16, Sec. 20 - 22, W1/2 Sec. 23, W1/2 of E1/2 Sec. 23, NE1/4 of NE1/4 Sec. 23, N1/2 of N1/2 Sec. 24, that portion of the SW1/4 of SW1/4 Sec. 30 south of the Louisville and Nashville Railroad. W1/2 of W1/2 Sec. 31, W1/2 Sec. 37, that portion of the E1/2 Sec. 37 north of U.S. Inrerstate Highway 10; : T7S R8W Sec. 1 - 3, that portion of Sec. 4 north of U.S. Interstate Highway 10, Sec. 5 - 6, those portions of Sec. 7 - 8 north of U.S. Interstate highway 10, Sec. 10 - 12, W1/2 of W1/2 Sec. 14, Sec. 15, that portion of Sec. 25 south of the Louisville and Nashville Railroad, that portion of the SE1/4 of Sec. 26 south of the Louisville and Nashville Railroad and southeast of Davis Bayou, N1/2 of NE1/4 Sec. 35, Sec. 36.

Primary Constituent Elements/Physical or Biological Features

Primary constituent elements are not described in the 1977 Final Rule (42 FR 39985 - 39988).

Special Management Considerations or Protections

Not available

Life History

Feeding Narrative

Adult: Prey probably includes adult and larval insects, earthworms, crayfish, small reptiles, amphibians, especially frogs, and perhaps small birds and mammals. During the fall, winter, and early spring, most of the cranes feed on small corn and chufa (Cyperus esculentus) fields, pastures, and pecan orchards found within several miles of the nesting range. Picks food items from ground surface or probes into substrate. (USFWS, 1991; NatureServe, 2015)

Reproduction Narrative

Adult: The Mississippi sandhill crane normally nests as far as possible from sources of disturbance. The ideal nesting habitat can be characterized as an open area of grasses and sedges with perennial shallow water. This species defends breeding territory of 36-202 ha during mating (Matthews and Moseley 1990). The age when wild Mississippi sandhill cranes attain sexual maturity is unknown. J. Valentine (pers. comm.) has data that shows some Mississippi cranes first lay eggs between the ages of 3 and 6 years. S. Nesbitt (pers. comm.) said some male Florida cranes become sexually active when 2 years old but females mature a year or so later. Mated cranes defend nesting territories. Incubation begins as soon as the first egg is laid and the average incubation period is about 32 days (Bennett and Bennett 1990). Clutches on the MSCNWR have averaged 1.70 eggs (n = 125). First clutches generally hatch from May 1 through May 20. Sandhill crane sex ratios are generally reported to be 1:1 males and females. Steve Nesbitt (Florida Freshwater Fish and Game Commission, Gainesville, FL, pers. comm.,

1991) reported Florida cranes can attain ages of about 20 years. (USFWS, 1991; NatureServe, 2015)

Environmental Specificity

Adult: Medium, with some key requirements (USFWS, 1991)

Site Fidelity

Adult: Nest site fidelity is high (USFWS, 1991)

Habitat Narrative

Adult: The Mississippi sandhill crane is found in open savannas, swamp edges, young pine plantations, and wetlands along edges of pine forests. Associated trees and shrubs include longleaf pine, slash pine, bald cypress, gallberry, wax myrtle, black gum, sweet bay, and yaupon (Matthews and Moseley 1990). Nesting territories tend to be occupied year after year. The ideal nesting habitat can be characterized as an open area of grasses and sedges with perennial shallow water. The opening is surrounded by trees and shrubs and is large enough for the cranes to see potential predators and allow flight. Areas of water, grasslands, pastures, or open pine forests are often close to the nests. The marshes in the Bluff Creek, Bayou Castelle, and Paige Bayou areas provide the main winter roosts. Marshes have fresh to slightly brackish water and the vegetation is mainly sawgrass and needlerush. Artificial freshwater ponds, on and off the Refuge, are also used as roosting habitats. Other known roosts include savannas, open forests, pastures, and moist clearings in the foraging areas. During the breeding season, paired cranes roost near the nest. (USFWS, 1991; NatureServe, 2015)

Dispersal/Migration

Migratory vs Non-migratory vs Seasonal Movements

Adult: Non-migratory (NatureServe, 2015)

Dispersal/Migration Narrative

Adult: Not available.

Population Information and Trends

Species Trends:

Stable (USFWS, 2019)

Population Growth Rate:

Stable (USFWS, 1991)

Number of Populations:

1 (USFWS, 2019)

Population Size:

current estimate 174 birds: 67 males, 72 females, and 35 cranes of unknown sex (USFWS, 2024)

Population Narrative:

Species status: Stable. Estimates of the only known crane population that occurs on and near the Mississippi Sandhill Crane National Wildlife Refuge (Refuge) are generated annually from monitoring results. The current (March 2019) population estimate on the Refuge was 129 cranes (Hereford and Dedrickson 2019a). The number of chicks fledging on the Refuge has improved somewhat in recent years; however it is the consistent release of captive-bred and reared crane chicks that has provided population stability. An analysis of threats indicates several new post-listing threats have been identified and that the threats present at the time of listing are still present. (USFWS, 2019). Mississippi sandhill cranes are a monogamous long-lived subspecies with low annual reproductive potential and provide extended parent care. As an endemic subspecies, the Mississippi sandhill crane (Grus canadensis pulla) home range is limited to the 19,300 acre (ac) (7,810 ha) Refuge and the immediate surrounding area (Figure 1). The current estimate of the wild Mississippi sandhill crane population is 174 birds: 67 males, 72 females, and 35 cranes of unknown sex (Table 1) (Hereford 2024). This is the highest population estimate of the subspecies observed in the wild since 1993, when an estimate of 135 individuals followed robust releases of captive-reared birds (Gee and Hereford 1995). Currently, the Refuge population has exceeded the carrying capacity identified in the PHVA of 150 cranes, with a range of 130 to 170 birds (CBSG 1992). However, recruitment remains low and annual mortality remains high (Hereford 2024). Subspecies recovery may include expansion to additional areas of suitable habitat within the historical range of the subspecies and the development of a reintroduction strategy to determine the feasibility and means to reestablish a population at Grand Bay (USFWS, 2024)

Threats and Stressors

Stressor: Human activities (NatureServe, 2015)
Exposure:
Response:
Consequence:
Narrative: Wild flock has been slow to increase due to abnormally high mortality of nestlings and first-year birds (End. Sp. Tech. Bull. 18:13). Prior decline was the result of habitat degradation and fragmentation related to conversion of habitat to slash pine plantations; disturbance associated with highways crossing habitat; and commercial and residential development (Matthews and Moseley 1990). Death due to lead poisoning has been reported (Franson and Hereford 1994). Disappears from areas of heavy human use. (NatureServe, 2015)

Stressor: Habitat loss (USFWS, 1991)
Exposure:
Response:
Consequence:
Narrative: As already noted, the human population in southeastern Mississippi, especially along the coast, has increased dramatically. Construction of roads and power lines and commercial and residential development have accompanied the increased human population. In the mid-1950's, timber companies acquired or leased lands for pine tree production. Slash pine was planted on thousands of acres during the 1950's and 1960's. To encourage tree growth in wet situations, savannas were drained and in some areas seedlings were bedded and furrowed. Access roads and fire breaks were constructed. Wild fires were suppressed. The pine plantations formed dense stands that precluded nesting and feeding by cranes. Eight paved roads and highways transect or border the Mississippi sandhill crane's range. The adverse effects have been: (1) direct loss of

lands; (2) noise, vibration, and visual disturbance; (3) pollution; (4) eased public access to the cranes; (5) development along the highway route; and (6) direct mortality. (USFWS, 1991)

Stressor: Direct mortality (USFWS, 1991)
Exposure:
Response:
Consequence:
Narrative: Reports of shootings in the 1960's and 1970's were sporadic, but this mortality probably exceeded recruitment to the population. Between July 1966 and June 1967, three reliable reports of shootings were received and one crane was shot in October 1974. During 1983, two cranes were found shot. These killings exceeded the annual recruitment rate. In 1978, a crane was killed either by a vehicle or an airplane near the end of the Gulf Park Estates Airport. In 1982, a captive-released crane was struck and killed by a car on Interstate Highway 10 and another crane was killed on the Gautier-Vancleave Road. A released crane was found dead on the Refuge in January 1981. Death may have been accidental or caused by an interspecific conflict. A dead crane was found below a power line in 1989. Aside from one or two captive-released cranes known to have been killed by free-running dogs, and predation by a bobcat when the birds were being held in a pen, predation on living adult cranes has not been documented. However, predation is a natural phenomena and dead cranes that have been found may have been killed by predators. Flooding, caused by heavy rainfall, has killed eggs and chicks (Mcllhenny 1938). In April 1980, heavy rainfall may have inundated two nests with eggs. Flash floods regularly occur and nests in low lying areas have been flooded. Hurricanes come ashore along the Mississippi Coast about once every 3 to 5 years. Crane mortality caused by the winds and rains associated with hurricanes has not been documented but loss of birds, eggs, and nests are certainly possible. Conversely, spring and summer droughts are common. Lack of drinking water could cause chick mortality. (USFWS, 1991)

Stressor: Pollution, disease, and parasites (USFWS, 1991)
Exposure:
Response:
Consequence:
Narrative: The area is subjected to the usual pollutants associated with major highways. Until fairly recently, fire ant eradication with Mirex was common. A crane found dead in 1974 contained 0.14 parts per million (ppm) of Mirex in the breast muscle and 0.22 ppm in the brain. Roadsides are often treated with herbicides. Since 1981, eighteen cranes have been necropsied by the National Wildlife Health Research Center (NWHRC, Madison, Wisconsin). Six of these 6irds were diagnosed as having biliary hyperplasia and five of the six with biliary hyperplasia had adenocarcinomas. In four cases, the tumors could have caused death. Similar tumors are very rare among wild birds and tumors have not been documented among the PWRC cranes. The most commonly identified causes of tumors include: (1) infectious agents such as viruses or parasites, (2) xenobiotic or naturally occurring toxins, and (3) genetic predisposition. Although the causative agent has not been established, because both tumors and biliary hyperplasia have been found in each case, a toxin may be indicated (Couvillion et a!., 1991). The susceptibility of the Mississippi sandhill crane to the toxins may be increased by the loss of genetic variability. A captive-released crane, struck by a vehicle, had a nematode infestation in the proventriculus and small intestine. Another released crane that died in 1982 had a severe infestation (probably Cappillaria sp.) of the tongue. The lesions may have prevented the crane from feeding. Another emaciated wild crane died after being found. An unknown type of hepatitis was diagnosed as the

cause of death. (USFWS, 1991)

Stressor: Genetic viability and the captive population (USFWS, 1991)
Exposure:
Response:
Consequence:
Narrative: Poor hatching success and some debilities in captive chicks may have resulted from a lowered level of genetic heterozygosity. In 1988, four of six wild chicks that hatched died within 24 hours after hatching. One other chick pipped the shell but failed to fully hatch. Also, two of 9 chicks that hatched in 1989 died within 24 hours after hatching. Whether the 1988 chick survival problems were caused by an unusual drought, human interference, loss of genetic heterozygosity, or other factors is unknown. Recent information (October 1990) provided by H. Dessauer (Louisiana State University Medical Center, New Orleans, Louisiana) suggests that there has been a loss of heterozygosity in the Mississippi sandhill crane population (Table 9). The genotype of the Mississippi sandhill crane has been studied by blood electrophoresis of 31 proteins (Table 10, G. Gee, unpubl. data, November 1990, Patuxent Wildlife Research Center, Laurel, Maryland). Non-migratory sandhill crane populations along the Gulf Coast have been isolated by human activities. Because of the distances involved, maintenance of genetic diversity by natural intergradation is improbable. In an effort to maintain the remaining genetic variability of Mississippi sandhill cranes, maximum outbreeding techniques are being used with birds in the captive population. Restoring natural intergradation with the Florida and/or Georgia populations is being studied. (USFWS, 1991)

Stressor: Low recruitment (USFWS, 2024)
Exposure:
Response:
Consequence:
Narrative: As a long-lived bird with low productivity (two eggs per nest) and low natural recruitment (approximately 6.7%), recruitment to the Mississippi sandhill crane population has been primarily through population augmentation with captive-bred juveniles. Natural recruitment has continued to increase over the years, and accounts for just under 50% of the current population. Despite increases in natural recruitment, the lack of learned predator-defense behaviors remains the primary factor in the low natural recruitment in the population (see discussion under Factor C). An average annual sandhill crane recruitment rate of 15% is needed to achieve a stable population (Arnold et al. 2016) (USFWS, 2024).

Stressor: Climate Change (USFWS, 2024)
Exposure:
Response:
Consequence:
Narrative: Changing climatic conditions in the Southeast, including increasing drought, timing variations in seasonal precipitation, and heavy rain events (U.S. Environmental Protection Agency 2014; U.S. Global Change Research Program 2017), are expected to influence breeding behavior and impact crane recruitment. Extended droughts can lead to lower annual productivity and recruitment by reducing the quality and quantity of flooded and ponded sites used for nesting, thus increasing accessibility to predators (Hereford and Billodeaux 2010). Alterations in the seasonal timing of precipitation may result in flooded conditions appropriate for nesting occurring outside of the typical crane breeding season. Heavy downpours may flood active nests

and require re-nesting. Although the crane has a prolonged nesting season and can re-nest, climate change may exacerbate the impact of other threats. The number of chicks fledged annually is negatively related to the annual number of extreme heat days (where daily high temperatures are ≥97°F) (Woolley et al. 2022). However, in 2023, despite 23 days categorized as extreme heat days, Mississippi sandhill cranes fledged 13 chicks in a historically long nesting season (February 8–September 22). The number of extreme heat days are expected to increase in the future and the impact of the effects of climate change are expected to increase in the future. As a result of climate change, wildfire severity and limitations on the use of prescribed fire continue to increase (Abatzoglou and Williams 2016; Williams et al. 2019; Burke et al. 2021). The application of prescribed fire is restricted to safe “burn windows”, or ranges of suitable weather and fuel conditions that facilitate manageable fire behavior. Increasing maximum temperatures and alterations in the seasonal timing of precipitation are expected to reduce burn windows, especially in the Southeast. Future climate projections indicate the percentage of suitable days for burning will decrease substantially during the summer months (Kupfer et al. 2020; Jonko et al. 2024). Compared to current conditions, suitable burn days are projected to decrease by 50% throughout the Southeast by 2051–2060 (Jonko et al. 2024). This decrease in projected burn days during the growing season, which accounts for a large percentage of burned area in the region (Nowell et al. 2018), presents a significant challenge to land managers’ ability to achieve ecological objectives (USFWS, 2024).

Recovery

Reclassification Criteria:
Reclassification criteria are not available.

Recovery Priority Number: 6C

Delisting Criteria:
Delisting criteria are not available.

Recovery Actions:

- Maximize the quality and quantity of nesting habitat on and near the Refuge. (USFWS, 1991)
- Increase natural recruitment in the wild population. (USFWS, 1991)
- Increase the genetic viability of the subspecies. (USFWS, 1991)
- Minimize human disturbance, especially to nesting cranes. (USFWS, 1991)
- Stop human predation. (USFWS, 1991)
- Continue to restore, improve, and maintain feeding and roosting habitats. (USFWS, 1991)
- Limit or negate crane contact with potential toxins. (USFWS, 1991)
- 1. Conduct a new PHVA using current data for the Refuge and for potential reintroduction at Grand Bay (USFWS, 2024).
- 2. Assess the genetic relationship of Mississippi sandhill cranes to other North American sandhill cranes and determine if restoring gene flow with other populations of cranes would be beneficial to Mississippi sandhill crane recovery (e.g., Florida sandhill crane) (USFWS, 2024).
- 3. Maximize quality and quantity of habitat on and near the Refuge by continuing to restore, improve, and maintain nesting, feeding, and roosting habitats. Control the spread of invasive plants onto the Refuge (USFWS, 2024).

- 4. Continue the captive propagation program. Determine the number of releases necessary to maintain a stable population and to create new populations elsewhere (USFWS, 2024).
- 5. Continue predator management and antipredator behavior training and possible translocation of cranes with antipredator behavior (USFWS, 2024).
- 6. Introduce Mississippi sandhill cranes onto Grand Bay and look for appropriate prairie/savanna habitat in other parts of Mississippi, Louisiana and Alabama that could potentially support additional Mississippi sandhill crane populations (USFWS, 2024).

Conservation Measures and Best Management Practices:

- RECOMMENDATIONS FOR FUTURE ACTIONS 1. Monitor the Mississippi sandhill crane population. Monitor mortality, survival, nesting, juvenile recruitment, and habitat use including movements and use of roosting, nesting, foraging, and loafing areas. Conduct a new PHVA using up-todate data. 2. Assess the genetic relationship of Mississippi sandhill cranes to other North American sandhill cranes and determine if restoring gene flow with other populations of cranes would be beneficial to Mississippi sandhill crane recovery. 3. Increase natural recruitment in the wild population. Conduct predator management and study habitat variables associated with successful nesting territories. Explore the need and feasibility of using sterilized sandhill cranes from other populations outside Mississippi for cross-fostering Mississippi sandhill chicks at the Refuge in order to increase exposure of chicks to appropriate parenting skills. 4. Maximize the quality and quantity of habitat on and near the Refuge by continuing to restore, improve, and maintain nesting, feeding, and roosting habitats. Control the spread of invasive plants onto the Refuge and limit or negate crane contact with potential toxins. Explore ways to mitigate crane mortality due to increased development outside the refuge and increased density of roads. 5. Continue the captive propagation program. Determine the number of releases necessary to maintain a stable population and to create new populations elsewhere. 6. Introduce Mississippi sandhill cranes onto Grand Bay National Wildlife Refuge and look for appropriate savanna habitat in Louisiana that could potentially support an additional Mississippi sandhill crane population. 7. Implement all other tasks identified in the recovery plan. 8. Revise the recovery plan as appropriate to address new threats and conservation needs. (USFWS, 2019)

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SPECIES ACCOUNT: *Mycteria americana* (Wood stork)

Species Taxonomic and Listing Information

Listing Status: Threatened; February 28, 1984; Southeast region (R4)

Physical Description

The following description is derived from Robertson (1989): The wood stork is a large, long-legged wading bird, with a head to tail length of 85 - 115 cm and a wingspread of 150 - 165 cm. The plumage is white, except for iridescent black primary and secondary wing feathers and a short black tail. On adults, the rough scaly skin of the head and neck is unfeathered and blackish in color, the legs are dark, and the feet are dull pink. The bill color is also blackish. Immature storks, up to the age of about 3 years, differ from adults in that their bills are yellowish or straw colored and there are varying amounts of dusky feathering on the head and neck.

Taxonomy

The wood stork is one of 17 species of true storks (Ciconiidae) occurring worldwide, and is the only stork that regularly occurs in the United States. Throughout its range of the Americas, wood storks are morphometrically indistinguishable, with no apparent differentiation in plumage or size (Coulter et al. 1999).

Historical Range

The wood stork may have formerly bred in all the coastal southeastern states from Texas to South Carolina. Prior to the 1970s, greater than 75 percent of the population nested in colonies in South Florida south of Lake Okeechobee; by the late 1980s, greater than 50 percent nested from central Florida north through South Carolina (Ogden et al. 1987, Harris 1995, Murphy 1995, Service 1997).

Current Range

The wood stork occurs from northern Argentina, eastern Peru and western Ecuador, north to Central America, Mexico, Cuba, Hispaniola, and the southeastern United States. The breeding range of the species extends from the southeastern U.S. south through Mexico and Central America, to Argentina, Brazil, and Uruguay (Bent 1926).

Distinct Population Segments Defined

No, however the original listing of the U.S. breeding population of wood storks likely meets the current standards of the DPS Policy for the following reasons: the population is physically separated from the adjacent population which breeds in southern Mexico, and the loss of the U.S. breeding population would result in a significant gap in the range, as there would no longer be wood storks breeding in the U.S.

Critical Habitat Designated

No;

Life History

Feeding Narrative

Juvenile: Parents feed young by regurgitating whole fish into the bottom of the nest at a rate of 3 to 10 or more feedings per day.

Adult: Wood storks feed almost entirely on fish between 2 and 25 cm in length (Kahl 1964; Ogden et al. 1976; Coulter 1987). Wood storks also occasionally consume crustaceans, amphibians, reptiles, mammals, birds, and arthropods. Storks forage in a wide variety of shallow wetlands, wherever prey concentrations reach high enough densities, in water that is shallow and open enough for the birds to be successful in their hunting efforts (Ogden et al. 1978; Browder 1984; Coulter 1897). Good feeding conditions occur in relatively calm water, where depths are between 5 - 40 cm, and where the water column is uncluttered by dense patches of aquatic vegetation (Coulter and Bryan 1993). The results of one study strongly suggested that storks were foraging at low tide equally both day and night (Bryan 1995). Kahl (1964) calculated that an average wood stork family requires 443 lbs. of fish during a breeding season.

Reproduction Narrative

Egg: Incubation requires about 30 days.

Juvenile: About 9 weeks are required for fledging, but the young return to the nest for an additional 3 to 4 weeks to be fed.

Adult: Females lay a single clutch of eggs per breeding season. A second clutch is sometimes laid if nest failure occurs early in the season (M. Coulter, IWRB/IUCN/BirdLife International, pers. comm.) Two to five eggs are laid. Wood storks are more likely to return to the same nesting site year after year than other wading birds (Frederick and Ogden 1997). They are seasonally monogamous, probably forming a new pair bond every season. Nest initiation varies geographically. The 3-year average productivity rate for all colonies monitored in the Southeast U.S. for 2004-2006 was 1.5 chicks/nest attempt; 2003-2005 was 1.2; and 4-year average for 2003-2006 was 1.5. Typically storks select patches of medium to tall trees as nesting sites, which are located either in standing water (swamps) or on islands surrounded by relatively broad expanses of open water (Palmer 1962, Rodgers et al. 1987, Ogden 1991). Colony sites located in standing water must remain inundated throughout the nesting cycle to protect against predation and nest abandonment. Storks tend to use the same colony sites over many years. There is documented first breeding for 3 and 4 year old birds, but the average age of first breeding is unknown. It is believed that once storks reach sexual maturity they nest on a yearly basis (J. Ogden, SFWMD, pers. comm.) The oldest known bird in the wild was 11 years 8 months (Hancock et al. 1992, p. 284).

Environmental Specificity

Adult: Moderate

Tolerance Ranges/Thresholds

Adult: Moderate

Site Fidelity

Adult: High

Habitat Narrative

Adult: Wood storks are a wetland dependent species. They require a mosaic of wetlands with varying climatological and seasonal conditions. Freshwater emergent wetlands are particularly essential for wood storks (Service 1997). Wood storks use man-made wetlands for foraging and breeding purposes. Man-made wetlands include, but are not limited to, storm water treatment areas and ponds, golf course ponds, borrow pits, reservoirs, roadside ditches, agricultural ditches, drainages, flow-ways, mining and mine reclamation areas, and dredge spoil sites. Wood storks use a variety of freshwater and estuarine wetlands for nesting, feeding, and roosting. Roosting sites include cypress heads and swamps, pine or hardwood islands in marshes, mangrove islands, expansive willow thickets or dry marshes, or on the ground on levees. Roosts may be used for long periods of time, either seasonally or annually. See reproduction narrative for nesting habitat. See feeding narrative for foraging habitat.

Dispersal/Migration

Motility/Mobility

Adult: High

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory

Dispersal

Adult: High

Dispersal/Migration Narrative

Adult: During a satellite tracking study of wood storks in Mississippi and Louisiana, extensive inter- and intra-regional movements from both Southeast U.S. and Mexican/Guatemalan populations of wood storks were documented (Bryan, in press). It is believed that storks nesting in north Florida, Georgia, and South Carolina move south during the winter months.

Population Information and Trends

Population Trends:

Increasing

Population Size:

7,400 - 8,700+

Population Narrative:

Overall population status is improving. Three-year averages calculated from nesting data from 2001 through 2006 indicate that the total nesting population has been consistently above the 6,000 reclassification threshold for nesting pairs, and the averages have ranged from 7,400 to over 8,700. Stangle et al. (1990) employed starch gel electrophoretic techniques to examine genetic variation in Florida wood stork colonies. The study did not indicate significant allosyme differences within or between colonies.

Threats and Stressors

Stressor: Habitat loss and modification

Exposure:
Response:
Consequence:
Narrative: The decline of South Florida's Everglades and Big Cypress ecosystems is well documented (Davis and Ogden 1994). Prior to 1970, a majority (70 percent) of the wood stork population nested south of Lake Okeechobee and declined from 8,500 nesting pairs in the early 1960s to around 500 pairs in the late 1980s and early 1990s (Service 1997). It is generally accepted that the primary cause of this decline was due to the loss of wetland function of these South Florida ecosystems that resulted in reduced prey availability or loss of wetland habitats (Service 1997).

Stressor: Predation
Exposure:
Response:
Consequence:
Narrative: Colonies with adequate water levels under nesting trees or surrounding nesting islands deter raccoon predation. Water level manipulation can facilitate raccoon predation of wood stork nests when water is kept too low. In many cases, colonies have a population of alligators that also deter raccoon predation (Coulter and Bryan 1995). Removal of alligators from a nesting colony site could lead to raccoon predation. Human disturbance may cause adults to leave nests, exposing the eggs and downy nestlings to predators (fish crows), sun and rain. Great horned owls have been documented nesting in and near colonies and they likely impact the colony to some degree. A breeding population of Burmese pythons has been documented in the Florida Everglades. If this snake and/or other species of reptiles become established in the South Florida ecosystem, they could pose a significant threat to nesting wood storks.

Stressor: Natural and man-made factors
Exposure:
Response:
Consequence:
Narrative: Other natural or man-made factors affecting the wood stork's continued existence such as contaminants, harmful algal blooms, electrocution, road kill, invasion of exotic plants and animals, disturbance, and stochastic events, are all documented to effect wood storks, but not to a degree to impede recovery.

Recovery

Reclassification Criteria:
There are 6,000 nesting pairs and annual regional productivity is greater than 1.5 chicks per nest/year (both calculated over a 3-year average).

Recovery Priority Number: 5C

Delisting Criteria:
There are 10,000 nesting pairs calculated over a 5-year period beginning at the time of reclassification and annual regional productivity is greater than 1.5 chicks per nest/year (calculated over a 5-year average).

As a subset of the 10,000 nesting pairs, a minimum of 2,500 pairs must nest successfully in the Everglades and Big Cypress systems in South Florida.

Recovery Actions:

- 1. Protect currently occupied habitat.
- 2. Restore and enhance habitat.
- 3. Conduct applied research necessary to accomplish recovery goals.
- 4. Increase public awareness.
- Prepare proposed rule to reclassify wood storks from endangered to threatened status and expand their known range to include Mississippi and North Carolina. The proposed rule will include a DPS evaluation of the listed entity. The Service believes there is sufficient information presented in the original listing and based upon the current knowledge of the biology to consider the application of the DPS criteria by physical separation of the breeding populations and loss of this population would result in a significant gap in the range.
- Protect wood stork foraging, nesting and roosting habitat. Ensure wetland mitigation procedures consider replacing impacted wood stork foraging wetlands with wood stork foraging wetlands of similar or better quality and quantity. Update Wood Stork Habitat Management Guidelines. Draft white paper on wood stork colony habitat protection under current conservation laws.
- Update and revise the recovery plan for the wood stork to reflect the best available and most up-to-date information on the biology of the species and its habitat. Develop recovery criteria to address the relevant listing factors and current known threats to wood storks.
- Develop a long-term program to monitor productivity at fewer selected (index) colonies within the major regions of the breeding range. Develop a systematic design for aerial surveys.
- Continue to support the development of a demographic model. Establish and refine population parameters and other factors, such as adult survival, variance in vital rates, sampling error, and research-induced biases, to improve the model.
- Conduct genetic studies to find additional micro satellite loci and highly variable nuclear loci to better understand genetic diversity in wood stork populations in the Southeast U.S., Caribbean, Latin America and South America. A multi-year study of large-scale movements of all ages of wood storks is needed to determine the frequency and importance to population mixing. Isotope studies on feathers of 1st and 2nd year birds in the mixing areas of Louisiana, Mississippi and Alabama may indicate the sites and environmental conditions where breeding populations are mixing.
- Develop baseline contaminant information. Develop an understanding of how man-made wetland systems affect wood stork health and develop management strategies for these wetlands to benefit the recovery of the wood stork.

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SPECIES ACCOUNT: *Numenius borealis* (Eskimo curlew)

Species Taxonomic and Listing Information

Listing Status: Endangered; likely extinct; 03/11/1967; Alaska Region (R7) (USFWS, 2016)

Physical Description

A medium-sized shorebird (about 30 cm long) with a slender, slightly downcurved bill; dark crown and rather indistinct pale crownstripe; cinnamon tone above with whole underparts washed cinnamon; heavy v-shaped black marks and barring on breast and flanks; underwings and axillaries bright cinnamon with brown barrings; and legs bluish-grey with reticulated scales posteriorly (USFWs, 2016).

Taxonomy

The Eskimo curlew is a member of the family Scolopacidae (sandpipers) and tribe Numeniini (godwits and curlews). Eight curlew species comprise the genus Numenius, including the Eskimo curlew. Three other Numenius curlews occur in the Western hemisphere: the whimbrel (Numenius phaeopus), the bristle-thighed curlew (Numenius tahitiensis), and the long-billed curlew (Numenius americanus) (USFWS, 2011).

Historical Range

Eskimo curlews historically nested in tundra in the Northwest Territories, presumably in adjacent Nunavut, and possibly in Alaska. After nesting, they moved to Labrador and eastern Canada to fatten on berries before migrating nonstop across the western Atlantic to South America, where they presumably wintered in the Pampas. In spring, Eskimo curlews moved north overland through the prairies of the United States and Canada before returning to the arctic to breed (USFWS, 2011).

Current Range

See historical range/distribution. The last record confirmed by physical evidence is a specimen collected in Barbados in 1963 (USFWS, 2011).

Distinct Population Segments Defined

No

Critical Habitat Designated

No;

Life History

Feeding Narrative

<u>Adult:</u> Adults and immatures are invertivores and frugivores. Recorded foods include grasshoppers and their eggs, crickets, grubs and cutworms, ants, moths, spiders, small snails, earthworms, freshwater insects, seeds and berries (e.g., crowberry, EMPETRUM) (USFWS 1980, Gollop et al. 1986). Picks items from substrate, probes into sand or mud in or near shallow water, or takes prey from water column (Ehrlich et al. 1992) (NatureServe, 2015). The Rocky Mountain grasshopper (Melanoplus spretus; Lockwood and DeBrey 1990), historically was an extremely numerous and irruptive insect and an important food source for migrating curlews

(USFWS, 2011). Added in 2016: The only confirmed breeding areas for Eskimo curlew were identified as “barren grounds” in the Northwest Territories, Canada (Gollop et al. 1986). Primary foods on the breeding grounds were overwintered berries, particularly crowberries (Empetrum nigrum), and insects. Eskimo curlews may have used vegetated and unvegetated intertidal habitats in western and northwestern Alaska (Murdoch 1885, Nelson 1887; cited in Gill et al. 1998). Post-breeding, Eskimo curlews migrated eastward, foraging in heath-shrub habitats, and staged in large numbers along the coast of Labrador where they fed on berries in nearby uplands and invertebrates in intertidal habitats (Gill et al. 1998). Eskimo curlews wintered in the Pampas and possibly intertidal habitats of South America, feeding primarily on insects and presumably other invertebrates. During their northward spring migration through the midwestern United States, Eskimo curlews preferred burned and disturbed prairie habitats and agricultural fields where they fed primarily on grasshopper egg cases and emerging nymphs (Gill et al. 1998). Localized irruptions of the now extinct Rocky Mountain grasshopper may have been a particularly important food resource for Eskimo curlews in these habitats (Gill et al. 1998). (USFWS, 2016).

Reproduction Narrative

Adult: Lays a clutch of 3 - 4 (usually 4) eggs in late May - June or early July. Nests in open arctic tundra, usually in an open site with a wide view (Harrison 1978). Upland grassy tundra or tundra interspersed with scattered trees (Johnson and Herter 1989); tundra marshes and tidal marshes near Arctic Ocean (Matthews and Moseley 1990) (NatureServe, 2015). New in 2016: Nests were simple depressions on bare ground, usually with four eggs. MacFarlane (in Gollop et al. 1986) described the nest as “a mere hole in the earth, lined with a few decayed leaves, and having a thin sprinkling of hay in the midst of them.” Hatching likely occurred in late June and early July. MacFarlane (in Gollop et al. 1986) assumed that only females incubated, although males were noted near nests and broods. Gill et al. (1998) suggest that both parents probably incubated and brooded as in other Numeniini. The time to fledging is unknown. (USFWS, 2016).

Environmental Specificity

Adult: Very narrow (NatureServe, 2015)

Habitat Narrative

Adult: Nonbreeding habitat includes grasslands, pastures, plowed fields, and less frequently, marshes and mudflats (AOU 1983). Favors headlands and hills within a few kilometers of the sea. Roosted on beaches along coast but rarely found near water in midwestern states (Gollop et al. 1986). The environmental specificity is very narrow (specialist or community with key requirements scarce) (NatureServe, 2015).

Dispersal/Migration

Motility/Mobility

Adult: Very high (NatureServe, 2015)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory (NatureServe, 2015)

Dispersal

Adult: Very high (NatureServe, 2015)

Dispersal/Migration Narrative

Adult: Probably began northward migration in late February or March. Arrived in breeding areas beginning in late May in Alaska and Northwest Territories; migrated inland through central prairies of North America (along valleys of the Mississippi, Missouri, and Platte rivers) in spring, arriving in Texas and Louisiana in early March (most likely to be observed in March and April), and migrating through the Great Plains from late March to mid-May; remained in nesting areas until early August; in fall, most migrated eastward from breeding areas and across northern Hudson Bay to Labrador and Newfoundland (most likely present from mid-August to late September), where they fed prior to flight across Atlantic to northern South America (perhaps arriving in October), thence along coast to wintering areas; some birds migrated southward along west shore of Hudson and James bays, then southeastward across Quebec and northeastern states before crossing the Atlantic (Gollop et al. 1986, Johnson and Herter 1989). Storm-blown migrants could appear on the coast of the Canadian Atlantic provinces, New England, or Bermuda from late August to mid-October. Burned over prairies and marshes are particularly attractive during migration (NatureServe, 2015).

Population Information and Trends

Population Trends:

Rare by 1900, last observed in 1987, possibly extinct (NatureServe, 2015)

Species Trends:

Unconfirmed sightings in 2000s - most recent in 2006 (USFWS, 2011)

Population Size:

Zero to 50 individuals (NatureServe, 2015)

Population Narrative:

Declined from a population originally numbering in the hundreds of thousands (Gill et al. 1998). Marked decline began around 1870, began decreasing rapidly in 1880s (Gill et al. 1998); already rare by 1900 and thought to be extinct in 1905. Last specimen taken in Barbados in 1963 (Bond 1965). Now extremely rare or extinct (Gollop et al. 1986, Gill et al. 1998, Morrison et al. 2001). Global population estimated to be less than 50, if the species is still extant (Morrison et al. 2001). Occasional unsubstantiated sightings offer hope that the species is still extant; latest of these was of a bird seen in southwestern Manitoba, May 1996 (Waldon 1966, Gill et al. 1998). Latest records from wintering grounds (again unsubstantiated) were of four birds near Cordoba, Argentina, October 1990 (Michelutti 1991). Four "apparently reliable" sightings in Texas in 1987 (Gollop 1988). Most recent reliable sightings were at three separate locations in 1987: Mormon Island, Nebraska; Lac Rendezvous, Northwest Territories; and North Haven Island, Maine; only single birds were observed. A flock of 23 was observed on Atkinson Island, Texas in 1981. See Johnson and Herter (1989) for account of sightings in 1980s in Beaufort Sea area. See Gollop et al. (1986) for accounts of occurrences in individual states, provinces, and countries. See also Faanes and Senner (1991). Surveys in Argentina and Uruguay in 1992 - 1993 yielded no confirmed sightings, but previously unknown suitable habitat was found (Blanco et al. 1993; Castro et al. 1994, Endangered Species Update 11(3&4):5) (NatureServe, 2015). Virtually no additional information on the species has become available since Gill et al.’s (1998) review, although there were a handful of unconfirmed sightings in the 2000s. Since 1963 there have been only 39 potential sightings, most recently in 2006. However, the Service is unabel to conclude with reasonable certainty that the species is extinct (USFWS, 2011). New in 2016: Recent surveys of the Eskimo Curlew's historic and potential breeding areas (Gollop et al. 1986, J. Rausch, pers. comm. 2008 in COSEWIC 2009), including remote areas of Alaska (e.g., Whitman 2007); fall staging habitat (McCaffery 1991); wintering areas (Blanco et al. 1993); and spring migration stopovers (Eubanks and Collins 1992) have not detected the species. (USFWS, 2016).

Threats and Stressors

Stressor: Habitat loss and modification (NatureServe, 2015).
Exposure:
Response:
Consequence:
Narrative: The spring migration route is through tallgrass and to a lesser extent mixed-grass prairies; only 4 percent of the former ecosystem remains (Samson and Knopf 1994). Fire suppression has further altered remnant prairie ecosystems. Agricultural conversion also apparently caused the demise of what may have been a key prey species during spring migration, the Rocky Mountain grasshopper, Melanoplus spretus (Gill et al. 1998), and probably resulted in declines in other grasshopper species as well (Lockwood and DeBrey 1990, Gill et al. 1998). The recent expansion of diamond exploration activities and establishment of diamond mines within the known breeding range of this species may put additional pressure on any remnant population (Gill et al. 1998) (NatureServe, 2015). Future mining and oil and gas development may occur within Arctic breeding habitat (USFWS, 2011). New in 2016: Conversion of tallgrass prairie and eastern mixed-grass prairie to agriculture in the late 1800s probably contributed to the decline of Eskimo curlews. These habitats were important stopovers for the curlews on their northward spring migration. Remaining prairie ecosystems were also altered by fire suppression, reducing the amount of preferred disturbed prairie habitat available to curlews (Gill et al. 1998). Fire regimes can significantly affect the community structure and productivity of grasshoppers (Meyer et al. 2002, Evans 1984, 1988) in tallgrass prairie ecosystems through effects on plant communities. The limited availability of suitable habitat and key food resources in the Midwestern States during the Eskimo curlews' spring migration may impede potential recovery of the species. (USFWS, 2016)

Stressor: Competition (NatureServe, 2015)
Exposure:
Response:
Consequence:
Narrative: Former breeding range has now apparently been taken over by the slightly larger Whimbrel, which may displace the few remaining individuals (Gollop et al. 1986) (NatureServe, 2015).

Stressor: Specific life history requirements (NatureServe, 2015)
Exposure:
Response:
Consequence:
Narrative: Any recovery has been hampered by this species' former reliance on shifting, patchy, fire-dependent habitats during spring migration, its conservative life history (e.g. long migration with few, but strictly traditional stopover sites), and its highly social behavior (Gill et al. 1998)

(NatureServe, 2015).

Stressor: Climate change (USFWS, 2011)
Exposure:
Response:
Consequence:
Narrative: Global climate change is likely to result in ecosystem level effects on historical Eskimo curlew habitats, particularly in Arctic breeding grounds. For the last several decades, surface air temperatures in the Arctic have warmed at a rate that exceeds the global average and they are projected to continue on that path (IPCC 2007). Although the altered hydrology and temperature regimes associated with climate change is expected to affect the habitats in which Eskimo curlews breed, stage during migration, and winter, the limited information available on their biology makes it difficult to assess the potential vulnerability of the species to these changes (USFWS, 2011).

Stressor: Contaminants (USFWS, 2011)
Exposure:
Response:
Consequence:
Narrative: The role of pesticides in the decline of the Eskimo curlew and their potential as a continued threat to the species is unknown. Gill et al. (1998) indicate that use of strychnine in the late 1800s may have affected curlews in the midwestern United States and suggest the examination of tissue from existing specimens may provide additional information on contaminant levels in Eskimo curlews (USFWS, 2011).

Stressor: Hunting and research (USFWS, 2011)
Exposure:
Response:
Consequence:
Narrative: Intensive market and sport hunting has been identified as a major contributing factor in the decline of the Eskimo curlew in the late 19th century (e.g., Banks 1977, Gill 1986, Gollop et al. 1986, Gill et al. 1998). However, regulatory protection of the Eskimo curlew and other migratory birds has eliminated market hunting as a current threat to the species in North America. Sport hunting of shorebirds still occurs in Barbados where the last Eskimo curlew specimen was shot in 1963 (Hutt 1991 in Blanco and Canevari 1995) and other countries in the Carribean (R. Lanctot, pers. com. 2011); subsistence hunting of shorebirds may still occur in Guyana (Blanco and Canevari 1995). If an extant population of Eskimo curlews is found, efforts by researchers and naturalists to observe, photograph, or otherwise study the species may potentially disturb individual birds. The sensitivity of Eskimo curlews to disturbance is unknown. Such activities could potentially displace curlews from preferred habitat and have unknown physiological and reproductive consequences resulting from altered behavior patterns. Because the population of Eskimo curlews, if extant, is estimated to be in the tens of individuals, investigator disturbance within or near breeding habitat could result in population-level impacts to the species (USFWS, 2011).

Stressor: Storms (USFWS, 2011)
Exposure:
Response:

Consequence:
Narrative: Severe storms during transoceanic migration over the Atlantic in fall, or storms on the wintering grounds are potential threats (Gill et al. 1998). The susceptibility of the species to these storms is unknown (USFWS, 2011).

Recovery

Reclassification Criteria:
Not available - the Service has not developed a recovery plan for Eskimo curlew.

Recovery Priority Number: 5

Delisting Criteria:
Not available - the Service has not developed a recovery plan for Eskimo curlew.

Recovery Actions:
- Not available - the Service has not developed a recovery plan for Eskimo curlew.
- Because the likelihood that the Eskimo curlew remains extant to be extremely low, further conservation or management actions are not recommended at this time. However, efforts to conserve other shorebirds (e.g. Donaldson et al. 2000, Brown et al. 2001) with similar life history characteristics would help to address current threats to the Eskimo curlew and support their recovery if an extant population exists. If the continued existence of the Eskimo curlew is confirmed in the future, development and implementation of a recovery plan would be warranted (USFWS, 2011).

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USFWS 2011. Eskimo Curlew (Numenius borealis) 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska.

SPECIES ACCOUNT: *Picoides borealis* (Red-cockaded woodpecker)

Species Taxonomic and Listing Information

Listing Status: Endangered; October 13, 1970; Southeast region (R4) (USFWS 2006). Down listed from Endangered to Threatened on November 25, 2024.

Physical Description

From USFWS (2003): Red-cockaded woodpeckers are relatively small. Adults measure 20 to 23 cm (8 to 9 in) and weigh roughly 40 to 55 g (1.5 to 1.75 oz; Jackson 1994, Conner et al. 2001). Red-cockaded woodpeckers are black and white with a ladder back and large white cheek patches. These cheek patches distinguish red-cockaded woodpeckers from all others in their range. Red-cockaded woodpeckers are black above with black and white barring on their backs and wings. Their breasts and bellies are white to grayish white with distinctive black spots along the sides of breast changing to bars on the flanks. Central tail feathers are black and outer tail feathers are white with black barring. Adults have black crowns, a narrow white line above the black eye, a heavy black stripe separating the white cheek from a white throat, and white to grayish or buffy nasal tufts. Bills are black, and legs are gray to black. Sexes of adult red-cockaded woodpeckers are extremely similar in plumage and generally indistinguishable in the field. Juveniles may be distinguished from adults in the field by duller plumage, white flecks often present just above the bill on the forehead, and by diffuse black shading in the white cheek patch.

Taxonomy

From USFWS (2003): Red-cockaded woodpeckers are currently recognized as Picoides borealis. The species is endemic to the southeastern United States but other members of the genus are found throughout the Americas. Red-cockaded woodpeckers were first described for science as Picus borealis, “le pic boreal”, by the French businessman and amateur naturalist Vieillot (1807). In 1810, unaware of Vieillot’s description, Alexander Wilson described the species as Picus querulus because of its distinctive vocalizations (Wilson 1810).

Historical Range

P. borealis was once a common bird distributed continuously across the southeastern United States. The species has been extirpated from New Jersey, Missouri, Maryland, Tennessee, and Kentucky (USFWS 2006, 2003).

Current Range

Currently, the species occurs in Alabama, Arkansas, Louisiana, Mississippi, Texas, Florida, Georgia, North Carolina, Oklahoma, Virginia, and South Carolina (USFWS 2006).

Distinct Population Segments Defined

No (USFWS 2006)

Critical Habitat Designated

No;

Life History

Feeding Narrative

Juvenile: From USFWS (2003): The diet of nestlings consists principally of arthropods, and fruits may be given on occasion (Baker 1971a, Harlow and Lennartz 1977, Hanula and Engstrom 2000, Hanula et al. 2000b). Large arthropod prey are commonly fed to nestlings in addition to or instead of ants (Hanula and Franzreb 1995, Hess and James 1998, Hanula and Engstrom 2000, Hanula et al. 2000b). For the first several days after fledging, the young birds are somewhat reluctant to fly, and spend considerable time perched high up in the pines, clinging to the trunk. Parents and helpers sometimes forage some distance away from the young at this time, but return frequently to feed them.

Adult: From USFWS (2003): Over 75 percent of the diet of red-cockaded woodpeckers consists of arthropods, especially ants and roaches, but also beetles, spiders, centipedes, true bugs, crickets, and moths (Beal et al. 1941, Baker 1971a, Harlow and Lennartz 1977, Hanula and Franzreb 1995, Hess and James 1998, Hanula and Engstrom 2000, Hanula et al. 2000b). Ants are particularly common in the diet of adults, comprising over half the stomach contents of adults and sub-adults in the Gulf coast region (Beal et al. 1941) and the Apalachicola National Forest in Florida (Hess and James 1998). Crematogaster ashmeadii was the most prominent of the ant species in the diet of red-cockaded woodpeckers in the Apalachicola, comprising 74 percent of the ant biomass taken (Hess and James 1998). Fruits and seeds make up the small remaining portion of the adult diet. From USFWS (2006): Red cockaded woodpeckers require abundant foraging habitat. Suitable foraging habitat consists of mature pines with an open canopy, low densities of small pines, little or no hardwood or pine midstory, few or no overstory hardwoods, and abundant native bunchgrass and forb groundcovers. Red-cockaded woodpeckers generally capture arthropods on and under the outer bark of live pines and in dead branches of live pines.

Reproduction Narrative

Adult: From USFWS (2003): Red-cockaded woodpeckers are a cooperatively breeding species and highly monogamous. Cavities are a critical resource that red-cockaded woodpeckers excavate in live pines, a task that commonly takes several years to complete. Longleaf pine is a preferred tree species for cavity excavation. Most clutches contain 2 to 4 eggs, although the full range is 1 to 5 eggs. Nest failure rates average about 20 percent. The average number of young fledged from successful nests is about two in northern populations. It is not unusual to see young being fed two months after fledging, and young are occasionally seen begging as late as the subsequent winter (Ligon 1970). The sex ratio among fledglings has been reported as biased toward males in a South Carolina population (Gowaty and Lennartz 1985), biased toward females in a Florida population (Epting and DeLotelle, unpublished) and unbiased (i.e., 1:1) in three North Carolina populations (Walters 1990, unpublished, LaBranche 1992) and another Florida population (Hardesty et al. 1997). A dispersing individual, if it survives, may become a breeder at age one. Individuals may remain helpers for up to eight years, but most become breeders within a few years (Walters et al. 1988a, 1992a). The group produces a single brood (Haig et al. 1993, 1994b), and not all groups attempt nesting in a given year. If the nest fails, the group may renest. Ages 4 to 8 are the peak reproductive years, as productivity is reduced somewhat at ages 9 and beyond in both sexes. Adult survival rates are 70 - 80%. Survival is fairly constant at ages 1 to 10 in males, and 1 to 8 in females.

Geographic or Habitat Restraints or Barriers

Adult: Restricted to mature pine forests (inferred from USFWS 2006, 2003)

Spatial Arrangements of the Population

Adult: Clumped (USFWS 2003)

Environmental Specificity

Adult: Narrow (inferred from USFWS 2006, 2003)

Tolerance Ranges/Thresholds

Adult: Moderate (inferred from USFWS 2003)

Site Fidelity

Adult: High (inferred from USFWS 2003)

Dependency on Other Individuals or Species for Habitat

Adult: Longleaf pine trees (USFWS 2006, 2003)

Habitat Narrative

Adult: From USFWS (2006): This species endemic to open, mature and old growth pine ecosystems. Red-cockaded woodpeckers require open pine woodlands and savannahs with large old pines for nesting and roosting habitat (clusters). Large old pines are required as cavity trees because the cavities are excavated completely within inactive heartwood, so that the cavity interior remains free from resin that can entrap the birds. From USFWS (2003): Because of the cooperative breeding system, red-cockaded woodpecker populations are unusually resistant to environmental and demographic variation, but highly sensitive to the spatial arrangement of habitat. Colonization of unoccupied habitat is an exceedingly slow process under natural conditions, because cavities take long periods of time to excavate and birds do not occupy habitat without cavities. Birds cannot tolerate the hardwood encroachment that results from lack of fire. The species is distributed largely as distinct populations, with large gaps of unoccupied land between them.

Dispersal/Migration

Motility/Mobility

Adult: High (inferred from USFWS 2003)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Non-migratory (inferred from USFWS 2003)

Dispersal

Adult: Low to high (USFWS 2003)

Immigration/Emigration

Adult: May emigrate (USFWS 2003)

Dispersal/Migration Narrative

Adult: From USFWS (2003): P. borealis exhibits limited dispersal characteristic of cooperative breeders (Walters et al. 1988a, Daniels and Walters 2000a; see 2B). Young birds may either disperse in their first year to search for a breeding vacancy, or they may remain on the natal territory and become a helper. When helpers move, it is usually to an adjacent territory, and they rarely disperse across more than two territories. In contrast, individuals of both sexes dispersing in their first year sometimes move long distances, more than 100 km in a few cases (Walters et al. 1988b, Conner et al. 1997c, Ferral et al. 1997). Bradshaw (1995) reported that average year-round home range size for 6 groups in coastal Virginia was 120.2 ha (297 ac); Nesbitt et al. (1983) estimated that summer range for 5 groups in south Florida was 144.5 ha (357 ac); and Engstrom and Sanders (1997) reported that home range size for 7 groups in old growth forest in southwest Georgia was 46.9 ha (116 ac).

Population Information and Trends

Population Trends:

Increasing (USFWS 2006)

Resiliency:

Current Population Resilience Resiliency describes the ability of populations to withstand deterministic and low-level stochastic events (arising from random factors). Highly resilient populations are better able to withstand disturbances such as random fluctuations in birth rates (demographic stochasticity), annual variation in rainfall (environmental stochasticity), or the effects of anthropogenic activities. We measured resiliency at the population level for this assessment, primarily by evaluating the current population size as number of active clusters and secondarily by the associated past growth rate. Populations are located on properties owned by a variety of agencies and private entities including but not limited to the Department of Defense, U.S. Forest Service, state wildlife and natural resource agencies, Department of Energy, state forest service, U.S. Fish and Wildlife Service, and a variety of private landowners. The data used to calculate number of current active clusters and population growth rates came from a variety of sources, and in some cases we had to make some assumptions depending on the data resolution. The breadth of data sources and the corresponding decisions made based on the data resolution are detailed below. Values for current numbers of active clusters were derived from the most recent estimates we were able to obtain. In most cases, these estimates were available from the Service's Annual RCW Property Data Report database and represented the total number of active clusters during the 2016 breeding season. When possible, we obtained updated numbers for the 2017 breeding season from GIS files or other sources. For a few populations, we were not able to obtain population size estimates as recent as 2016, so we used the most current population size we were able to obtain. No current population size estimates are older than the 2013 breeding season. To calculate growth rates for a given demographic population we obtained past time series abundance data for annual number of active clusters for as long as possible, not to precede 1998. We did not seek or use data prior 1998 for several reasons. Abundance and spatial data are not available prior to 1998 for most demographically delineated populations. The best available data for most populations is for 1998 and afterwards concurrent with the implementation of the Service's Annual RCW Property Data Report database. Also, as discussed in previous sections, the management paradigm for RCWs changed dramatically in the late 1990s (e.g. cavity management, recruitment clusters) to sustain and increase populations, and we wanted to capture the results of this new and more effective management. It is important to note that much of our abundance data is limited to a property level. Thus, if a property has multiple current demographic populations, we often lacked a past and spatially explicit time series for those individual demographic populations. In these cases, we calculated a "property level" population growth rate, and applied it to all of the demographic populations occurring on that property. Currently, there are at least 124 demographic populations across the range of the RCW (Table 3). Although we have not categorized overall resilience, we have categorized two important parameters related to population resiliency: current population size and associated population growth rate. Population size categories are as follows: very low (<30 active clusters); low (30-99 active clusters); moderate (100-249 active clusters); high (250-499 active clusters); and very high (>500 active clusters). This categorization is based largely on modeling of the dynamics of idealized RCW populations by Walters et al. (2002b) as validated by Schiegg et al. (2005) and Walters et al. (2011). Walters et al. (2002b) employed a spatially-explicit, individual-based RCW model that incorporated demographic and environmental stochasticity, and thus is appropriate for assessing resilience. In subsequent applications, the demographic effects of inbreeding depression on population size and persistence were added (Daniels et al. 2000, Schiegg et al. 2006) based on empirical RCW data of inbreeding effects. In their analysis, populations were modeled with unlimited, high quality foraging and nesting habitat, with sufficient and well distributed old pines for natural cavity excavation, but were not subject to management techniques designed to stimulate population growth (e.g., recruitment clusters and cavity management). Population growth was limited to pioneering and budding with natural cavity excavation. Population growth, persistence, risks of extirpation and other output of these model simulations provides a template to identify inherent population resilience against results of the relative success or failure of management for this conservation-reliant species. Under these model and simulation conditions, populations of 25 (our very low category) and 50 (low) active clusters always declined in response to spatial aggregation, density of groups, and inbreeding depression. Simulated populations of 250 (high) and 500 (very high) were stable on average regardless of spatial aggregation and density at comparative densities to the spatially delineated demographic SSA populations, although the smaller populations near 250 in this sizeclass could have a declining growth rate slightly less than 1.0. Populations of 100 to 250 groups were stable at high levels of aggregation and density, but declining at lower levels. Thus our moderate category captures the range within which stability was dependent on spatial aggregation and density of groups. We used 30 active clusters rather than 25 as our boundary between the very low and low categories because 30 is a threshold for differences in management in the species' Recovery Plan (USFWS 2003), particularly for RCW translocation management benefits, as well as a threshold for differences in population behavior observed in our global model analysis. When we had at least 5 years of past abundance data we estimated a population growth rate by comparing the initial population size to the final population size and calculating the rate of growth required to produce the observed change in population size. Thus the figures we present are constant growth rates. Based on these rates we categorized populations as decreasing ($\lambda < 1$), increasing ($\lambda > 1.02$) or stable ($\lambda = 1.00\text{-}1.02$). Our primary categorization of current resilience is based on population size. We use population growth rate as a secondary factor to indicate relative resilience of populations within each of the five resilience categories (see below). Of the 124 populations analyzed, we classified the resilience of 3 populations as very high; 3 as high; 10 as moderate; 37 as low; and 71 as very low (Table 3). In any category, management has been essential to restore and sustain foraging habitat with prescribed fire, silviculture and other treatments, and provide sufficient cavities. (USFWS, 2019)

Representation:

Representation provides the ability of a species to adapt to changing environmental conditions. As described in Chapter 3, representation for this species is assessed primarily on life history variation and ecological diversity among ecoregions. This approach is based ecoregions that represented recovery units in the RCW Recovery plan (USFWS 2003). Redundancy describes the ability of a species to withstand catastrophic events. Measured by the number of populations, their resiliency, and their distribution and connectivity, redundancy increases the probability that the species has a margin of safety to withstand or recover from catastrophic events (such as a rare destructive natural event or episode involving many populations). We report redundancy for RCWs as the total number and resilience of demographic populations and their distribution within and among representative units. The historical range of the RCW included the entire historical range of longleaf pine ecosystems, but the RCWs also inhabited open shortleaf, slash, loblolly, and Virginia pine forests, especially in the Ozark-Ouachita Highlands and the southern tip of the Appalachian Highlands (Costa and Walker 1995). Occasional occurrences were noted for New Jersey (Hausman 1928), Pennsylvania (Gentry 1877), Maryland (Meanly 1943), and Ohio (Dawson and Jones 1903). Historic distribution data in Figure 25 consists of county level information based on published sources (Jackson 1971; Hooper et el. 1980; Costa and Walker 1995) and interviews with various RCW experts. County historical records are contemporary data, most from the 1900s, and do not represent pre-settlement conditions when RCWs were more abundant and probably more widely distributed. Based on these data, RCWs no longer occur in 7 ecoregions where their occurrence in suitable woodland likely was on the edge the historic range: Ozarks, Central Mixed Grass Prairies, Interior Low Province, Cross Timbers and Southern Mixed Grass Prairies, North Atlantic Coast, Central Appalachian Forest, and Southern Blue Ridge (Figure 24). RCWs have been extirpated from these ecoregions for some time, and they are not considered relevant to recovery (USFWS 2003). The remaining 13 ecoregions still contain RCWs. (USFWS, 2019)

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Population Growth Rate:
Slow (USFWS 2003)

Population Size:
14, 068 (USFWS 2003)

Minimum Viable Population Size:
250 - 350 breeding groups (USFWS 2003)

Population Narrative:
The status of this species is improving (USFWS 2006). From USFWS (2003): Currently, there are an estimated 14,068 red-cockaded woodpeckers living in 5,627 known active clusters across eleven states. The cooperative breeding system does not allow rapid natural growth of populations. Combining budding and pioneering, growth rates are 0.7 percent, 2.4 percent, and 2.2 percent per year for the North Carolina Sandhills, Croatan National Forest, and Marine Corps Base Camp Lejeune, respectively. Genetic differences between populations are greater than is typical of birds, but equivalent to those in other endangered birds. However, populations do not exhibit unique alleles and some small populations exhibit reduced heterozygosity. Currently, the USFWS estimates the population size necessary to withstand effects of environmental stochasticity is 250 potential breeding groups, although some researchers consider 350 breeding groups the minimum size necessary to produce enough novel variation to offset loss from drift.

Threats and Stressors

Stressor: Habitat loss and modification (USFWS 2003)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2003): Today, longleaf forests have declined to less than 1.2 million ha (3 million ac; Landers et al. 1995), of which roughly 3 percent remains in relatively natural condition (Frost 1993). Little old growth remains, and virtually no longleaf forest has escaped changes in the natural fire regime (Simberloff 1993, Walker 1999). Southern pine forests today are very different from precolonial communities not only in extent, but also in species composition, age, and structure (Ware et al. 1993, Noel et al. 1998). Much of today's forest is young, dense, and dominated by loblolly pine, with a substantial hardwood component and little or no herbaceous groundcover (Ware et al. 1993, Noel et al. 1998). Loss of residual trees in the twentieth century has been a major factor in the decline of woodpecker populations (Costa and Escano 1989, Conner et al. 2001; see 2D). A second major impact of habitat loss on the viability of red-cockaded woodpeckers is the resultant fragmented distribution. Fragmentation and isolation have occurred both among groups within a population and among populations, with serious consequences for red-cockaded woodpeckers.

Stressor: Fire suppression (USFWS 2003)
Exposure:
Response:
Consequence:

Narrative: From USFWS (2003): Natural fire frequency declined as fires were reduced in area because of roads, plowed fields, and other human-made firebreaks (Frost 1993, Ware et al. 1993). Active fire suppression began to be institutionalized in the southeastern United States between 1910 and 1930 (Frost 1993, Ware et al. 1993). Fire suppression has severe and numerous impacts on southern pine ecosystems, including changes in tree species composition and forest structure. Longleaf pine cannot reproduce without access to the mineral soil, and will be replaced under fire suppression by other species of pines and hardwoods. The structure of the forest changes from two layers, a canopy and a diverse groundcover, to a multi-layered midstory and canopy with little or no groundcover. With increasing hardwood midstory, arthropod communities change in species abundance, species composition, and distribution on the substrate (Collins 1998, Provencher et al. 2001a). Red-cockaded woodpeckers are directly and adversely affected by each of these changes.

Stressor: Silviculture (USFWS 2003)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2003): Several silvicultural practices have been detrimental to red-cockaded woodpeckers, including short rotations, clearcutting, and conversion to sub-optimal pine species. Cutting of second-growth longleaf pines began during World War II and continues today. Removal of second-growth longleaf has exceeded growth by over 40 percent, and much of the remaining longleaf is aging without replacement (Landers et al. 1995).

Stressor: Logging (USFWS 2003)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2003): Logging is a potential threat to woodpecker populations on private lands (Cely and Ferral 1995), as harvests of mature pines continues at a high rate. One recent study estimated the current rate of pine cutting on private lands in parts of South Carolina and Georgia at 4.0 percent per year, a rate much higher than those estimated by similar methods for temperate or tropical rainforest (Pinder et al. 1999). One of the most common ways longleaf pine cover is lost is by replacement of other pine species after logging (Outcalt and Sheffield 1996). Widespread conversion of longleaf to plantations of other pine species began in the 1940’s and this process still continues today.

Stressor: Small population size (USFWS 2003)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2003): One identified threat to species viability that stems from habitat loss is the set of risks inherent to critically small populations. Small populations may be extirpated because of random environmental, demographic, genetic, and catastrophic events (Shaffer 1981, 1987). Random environmental events affect an entire population; for example, an exceptionally severe winter that causes high adult mortality. Random demographic events act on individuals within populations; for example, a death due to predation, or a brood consisting of all males. Random genetic events are losses or gains in frequency of any given gene, simply due to chance inheritance. Lastly, catastrophic events, which can affect large as well as small

populations, are similar to environmental events but larger in scale. Any of these processes alone or in concert can cause the extirpation of a small population. Such processes will continue to remain threats until population sizes are sufficient to withstand them (Shaffer 1981, 1987, Crowder et al. 1998, Letcher et al. 1998, Walters et al. 2002b).

Recovery

Reclassification Criteria:
1. The Central Florida Panhandle Primary Core Population in the East Gulf Coastal Plain Recovery Unit is stable or increasing and contains at least 350 potential breeding groups (400 to 500 active clusters) (USFWS 2003).

2. There is at least one stable or increasing population containing at least 250 potential breeding groups (275 to 350 active clusters) in each of the following recovery units: Sandhills, Mid-Atlantic Coastal Plain, South Atlantic Coastal Plain, West Gulf Coastal Plain, Upper West Gulf Coastal Plain, and Upper East Gulf Coastal Plain (USFWS 2003).

3. There is at least one stable or increasing population containing at least 100 potential breeding groups (110 to 140 active clusters) in each of the following recovery units: Mid-Atlantic Coastal Plain, Sandhills, South Atlantic Coastal Plain, and East Gulf Coastal Plain (USFWS 2003).

4. There is at least one stable or increasing population containing at least 70 potential breeding groups (75 to 100 active clusters) in each of four recovery units, Cumberlands/Ridge and Valley, Ouachita Mountains, Piedmont, and Sandhills. In addition, the Northeast North Carolina/Southeast Virginia Essential Support Population is stable or increasing and contains at least 70 potential breeding groups (75 to 100 active clusters) (USFWS 2003).

5. There are at least four populations each containing at least 40 potential breeding groups (45 to 60 active clusters) on state and/or federal lands in the South/Central Florida Recovery Unit (USFWS 2003).

6. There are habitat management plans in place in each of the above populations identifying management actions sufficient to increase the populations to recovery levels, with special emphasis on frequent prescribed burning during the growing season (USFWS 2003).

Recovery Priority Number: 8C

Delisting Criteria:
1. There are 10 populations of red-cockaded woodpeckers that each contain at least 350 PBGs (potential breeding groups) (400 to 500 active clusters), and one population that contains at least 1000 PBGs (1100 to 1400 active clusters), from among 13 designated primary core populations, and each of these 11 populations is not dependent on continuing installation of artificial cavities to remain at or above this population size (USFWS 2003).

2. There are 9 populations of red cockaded woodpeckers that each contain at least 250 potential breeding groups (275 to 350 active clusters), from among 10 designated secondary core populations, and each of these 9 populations is not dependent on continuing installation of artificial nest cavities to remain at or above this population size (USFWS 2003).

3. There are at least 250 potential breeding groups (275 to 350 active clusters) distributed among designated essential support populations in the South/Central Florida Recovery Unit, and six of these populations (including at least two of the following: Avon Park, Big Cypress, and Ocala) exhibit a minimum population size of 40 potential breeding groups that is independent of continuing artificial nest cavity installation (USFWS 2003).

4. The following populations are stable or increasing and each contain at least 100 potential breeding groups (110 to 140 active clusters): (1) Northeast North Carolina/Southeast Virginia Essential Support Population of the Mid-Atlantic Coastal Plain Recovery Unit, (2) Talladega/Shoal Creek Essential Support Population of the Cumberlands/Ridge and Valley Recovery Unit, and (3) North Carolina Sandhills West Essential Support Population of the Sandhills Recovery Unit; and these populations are not dependent on continuing artificial cavity installation to remain at or above this population size (USFWS 2003).

5. For each of the populations meeting the above size criteria, responsible management agencies shall provide (1) a habitat management plan that is adequate to sustain the population and emphasizes frequent prescribed burning, and (2) a plan for continued population monitoring (USFWS 2003).

Recovery Actions:

- 1. Application of frequent fire to both clusters and foraging habitat (USFWS 2003).
- 2. Protection and development of large, mature pines throughout the landscape (USFWS 2003).
- 3. Protection of existing cavities and judicious provisioning of artificial cavities (USFWS 2003).
- 4. Provision of sufficient recruitment clusters in locations chosen to enhance the spatial arrangement of groups (USFWS 2003).
- 5. Restoration of sufficient habitat quality and quantity to support the large populations necessary for recovery (USFWS 2003).
- Population monitoring (USFWS 2003)
- Cavity management (USFWS 2003)
- Predator and cavity kleptoparasite control (USFWS 2003)
- Translocation (USFWS 2003)
- Silviculture (USFWS 2003)
- Prescribed burning (USFWS 2003)
- Habitat restoration (USFWS 2003)
- Ecosystem management (USFWS 2003)

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SPECIES ACCOUNT: *Polyborus plancus audubonii* (Audubon's crested caracara)

Species Taxonomic and Listing Information

Commonly-used Acronym: CRCA (USFWS 2009)

Listing Status: Threatened; July 6, 1987; Southeast Region (R4) (USFWS 2009)

Physical Description

From USFWS (1999): Audubon's crested caracara is a large raptor with a crest, naked face, heavy bill, elongate neck, and unusually long legs. It is about 50 to 64 cm long and has a wingspan of 120 cm. The adult is dark brownish black on the crown, wings, back, and lower abdomen. The lower part of the head, throat, upper abdomen, and under tail coverts are white, sometimes tinged with yellow; the breast and upper back are whitish, heavily barred with black. The tail is white with narrow, dark crossbars and a broad, dark terminal band. Prominent white patches are visible near the tips of the wings in flight. The large, white patches in the primaries and the white tail, broadly tipped with black, are both very conspicuous in flight and can be recognized at a long distance (Bent 1961). Juveniles have a similar color pattern but are brownish and buffy with the breast and upper back streaked instead of barred. Subadults resemble adults but are more brownish in color. Adults have yellow orange facial skin and yellow legs. Facial skin of juveniles is pinkish in color, and the legs are gray (Layne 1978). Full adult plumage is obtained sometime after 2 years of age (J. Morrison, University of Florida, personal communication 1997).

Taxonomy

From USFWS (2009): While listed as Audubon's crested caracara (Polyborus plancus audubonii), taxonomic research has revealed that the Florida population should be recognized as the northern crested caracara (Caracara cheriway) (Dove and Banks 1999; Integrated Taxonomic Information System 2008). Minor variations between populations do not warrant recognition of subspecies within C. cheriway (Dove and Banks 1999). This taxonomic change has been accepted by the scientific community.

Historical Range

From USFWS (2009): Its historic range in Florida generally consisted of St. Johns River marshes in Brevard County and the major prairie ecosystem originally present within Highland, Glades, Polk, Osceola, Okeechobee, Hardee, Desoto, Indian River, St. Lucie, and Martin Counties (Davis 1967; Morrison 2006).

Current Range

From USFWS (2009): Caracara cheriway ranges from northern Brazil, through Central America and Mexico, north to the United States (except Guadalupe Island) (Dove and Banks 1999). The overall current range of CRCA in Florida remains relatively similar to the historical range, with sightings of individuals in other neighboring counties, but the fragmentation and degradation of habitat from land use changes has resulted in patchy suitable areas where CRCA occur in a clustered distribution (Morrison 2006; Root and Barnes 2007). Core CRCA habitat (i.e., a 95 percent kernel of high density area) lies within the Kissimmee Prairie, located northwest of Lake Okeechobee, and includes less than 1000 km2 of suitable habitat (Root and Barnes 2007).

Distinct Population Segments Defined

USFWS (2009): Yes. While the CRCA was listed prior to the 1996 DPS policy, the entity listed was restricted to the Florida population.

Critical Habitat Designated

No;

Life History

Feeding Narrative

Adult: From USFWS (1999): Caracaras are highly opportunistic in their feeding habits, eating carrion and capturing live prey. Their diets include insects and other invertebrates, fish, snakes, turtles, birds, and mammals (Layne 1978). Live prey also include rabbits, skunks, prairie dogs, opossums (Didelphis marsupialis), rats (Rattus spp.), mice, squirrels, frogs, lizards, young alligators (Alligator mississippiensis), crabs, crayfish, fish, young birds, cattle egrets (Bubulcus ibis), beetles, grasshoppers, maggots, and worms (Bent 1961, Layne et al. 1977). Several authors have noted that caracaras may consume unusual items, including turtle and other eggs (Terres 1980, Grossman and Hamlet 1964) as well as coconut meat (Haverschmidt 1947). Caracars are diurnal. These raptors hunt on the wing, from perches, and on the ground (FWS 1989). They will also regularly patrol sections of highway in search of carrion (Palmer 1988).

Reproduction Narrative

Egg: Incubation lasts for about 28 days (USFWS 1999).

Juvenile: Young fledge after 8 weeks (Layne 1978) (USFWS 2009).

Adult: From USFWS (2009): Clutch size averages two eggs (Dickinson and Arnold 1996; Layne 1996; Morrison 1999 [2.23 eggs]). Double-brooding has been documented, but second clutches are generally not as successful as first attempts (Morrison 1996; 1998). Annual survival estimates suggest a lifespan of 8 to 10 years (Morrison 2003), and banding records indicate wild individuals living over 20 years (Morrison 2009). The age at first breeding is approximately 3 years (Morrison 2009). CRCA most frequently nest in cabbage palms within pasture or grassland habitat, but a few nests have been observed in cypress, live oak, pine, and other trees (Bent 1938; Sprunt 1954; Service 1989; Morrison et al. 1997; Morrison 2007). From USFWS (1999): The pair bond is relatively strong, lasting until one mate dies (FWS 1989). Egg laying has been estimated to begin as early as late September based upon evidence of chicks fledging in December (Humphrey and Morrison 1997). The height of the nesting season is in January and February. Nests with eggs have also been found as late as April (Nicholson 1929). In their study, Humphrey and Morrison (1997) suggest that most reproductive activity occurs during the winter dry season, although nesting attempts may occur throughout the year. Caracaras construct new nests each nesting season, often in the same tree as the previous year. Incubation is shared by both sexes.

Spatial Arrangements of the Population

Adult: Clustered (see current range/distribution)

Site Fidelity

Adult: High (see reproduction narrative)

Habitat Narrative

Adult: From USFWS (2009): Primary CRCA habitat in Florida consists of prairies interspersed with marshes and cabbage palm hammocks (Morrison and Humphrey 2001). Current habitat use of CRCA, based on habitat evaluations conducted proximal to nest sites, includes (ranked highest to lowest proportion): improved pasture, dry prairie, freshwater marsh, mixed upland hardwoods, shrub swamp, shrub and brushland, grassland, pinelands, bare soil, urban, other agriculture, citrus, and scrub (Morrison 2006).

Dispersal/Migration

Motility/Mobility

Adult: High (inferred from USFWS 1999)

Migratory vs Non-migratory vs Seasonal Movements

Adult: Non-migratory (USFWS 1999)

Dispersal/Migration Narrative

Adult: From USFWS (1999): Caracaras are resident and nonmigratory. Adult caracaras may be found in their home range year-round. Home ranges may encompass an area of up to 2,389 ha with an average of 1,552 ha.

Population Information and Trends

Population Trends:

Unknown (USFWS 2009)

Population Size:

500 (USFWS 2009)

Population Narrative:

From USFWS (2009): Results from continuing research initiated in 2006 suggest all territories identified in the 1990s remain occupied, but breeding success has not been evaluated. Based on current knowledge of over 150 nest sites within a limited portion of the bird’s range in Florida, over 500 individuals inhabit Florida (Morrison 2009). Information concerning present levels of genetic diversity and variation in CRCA is not available.

Threats and Stressors

Stressor: Habitat loss, fragmentation, and degradation (USFWS (2009)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2009): Conversion of improved pasture to citrus, sugarcane, or residential development would clearly be unsuitable (Humphrey and Morrison 1997; Service 1999; Morrison 2006). Many changes in land use that occur are not associated with any regulatory review, but are detrimental to CRCA. The scope and severity of this threat are high.

This threat also increases the severity of all other threats addressed subsequently. Analyses by Zwick and Carr (2006) indicate that the central Florida region is expected to experience “explosive” growth, with continuous urban development from Ocala to Sebring; virtually all of the natural systems and wildlife corridors in this region will be fragmented, if not replaced, by urban development.

Stressor: Disease (USFWS 2009)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2009): The blood parasite, Haemoproteus tinnunculi, has been found in CRCA (Foster et al. 1998). The effect of this parasite on survival is not known. West Nile virus, St. Louis encephalitis, and Eastern equine encephalitis are also documented in CRCA (Dwyer 2009).

Stressor: Predation (USFWS 2009)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2009): Detailed information regarding predators of CRCA is lacking, but fish crows (Corvus ossifragus) and raccoons (Procyon lotor) are known nest predators (Layne 1996), and fire ants (Solenopsis invicta) have killed young (Dickinson 1995).

Stressor: Road mortality (USFWS 2009)
Exposure:
Response:
Consequence:
Narrative: From USFWS (2009): Road-killed animals are an important source of carrion to CRCA (Layne 1996), but vehicle strikes are a major cause of mortality for fledglings and immature CRCA (Morrison 1996). Fifty-five percent of mortalities of radio-tagged CRCA in 1994 to 1995 were from collisions with vehicles (Morrison 1996).

Recovery

Reclassification Criteria:
Recovery Priority Number: 8C

Delisting Criteria:
1. Further loss, fragmentation, and degradation of habitat in south-central Florida has been prevented (USFWS 1999)

2. The number of territories in the historic range increases from 200 to 300 (USFWS 1999)

3. This number of territories has been maintained or exceeded for at least 10 years (USFWS 1999)

4. The territories are well-distributed throughout the core counties of Glades, DeSoto, Highlands, Okeechobee, and Osceola (USFWS 1999)

5. Additional breeding pairs have established territories on unoccupied or restored habitat (USFWS 1999)

6. Those lands have been protected through land acquisition, conservation easements, or cooperative agreements (USFWS 1999)

7. The Florida population exhibits an intrinsic rate of increase (r) equal to or greater than 0.0, sustained as a 3-year running average over at least 10 years (USFWS 1999)

Recovery Actions:

- Evaluate the effects of nest tree loss, quantify the effects of habitat conversion on adult and juvenile CRCA, and determine the threshold for a detrimental response (USFWS 2009).
- Develop and improve methods to assess population trends and breeding success rates (USFWS 2009).
- Continue work on juvenile and non-breeding individuals to better assess limitations to population growth and recruitment rates of young (USFWS 2009).
- Identify short-term and long-term priorities for management and recovery; establish quantitative objectives (USFWS 2009).
- Work with landowners to gain access so that monitoring on private lands can be improved.
- More clearly describe the range of the CRCA so that management actions can be most effectively targeted and range changes can be documented if they occur.
- Continue work on the CRCA tool and conservation strategy to better evaluate and offset impacts to the species.
- Actively work with owners of large ranches to enhance and maintain habitat for CRCA.
- Develop mechanism(s) to maintain CRCA habitat on private lands in cooperation with landowners.
- Minimize road-side mortalities of CRCA by posting signs and/or lowering speed limits in areas with high frequencies of mortality.
- Determine the availability of suitable breeding habitat; test habitat suitability models currently available.
- Develop a model to identify the most suitable parcels within the CRCA's range. Pursue conservation agreements and/or acquire land that includes these areas where CRCA are particularly successful.
- Revise the current listing to reflect the taxonomic change and evaluate formally listing the Florida population as a DPS.
- Revise the 1999 recovery plan, to reflect the current status and threats to the CRCA; develop or revise recovery criteria, objectives, and tasks.

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SPECIES ACCOUNT: *Sterna antillarum browni* (California least tern)

Species Taxonomic and Listing Information

Listing Status: Endangered; June 2, 1970 (35 FR 8491).

Physical Description

The California least tern (Sterna antillarum browni) is the smallest member of the subfamily Sterninae. California least terns are 21 to 23 centimeters (cm) (about 8 to 9 inches [in.]) long and measure 48 to 53 cm (about 19 to 21 in.) wide, including wingspan. Males and females look alike; they have black caps, and are mainly gray on top with gray wings, black wingtips, and a white underside. California least terns have yellow-orange legs and bills and a short, forked tail. Juveniles have darker plumage and a dark bill (NatureServe 2015; USFWS 1985; USFWS 2015).

Taxonomy

California least terns were listed as Sterna antillarum browni; however, the 47th supplement to the American Ornithologist Union checklist recognizes least terns under the previously published name Sternula antillarum, based on mitochondrial DNA molecular phylogeny. Within this species, classification of the various subspecies continues to be debated. Most genetic studies have found little or no evidence of differentiation among least tern subspecies (USFWS 2006).

Historical Range

The historical breeding range of the California least tern extended along the Pacific Coast from Moss Landing in Monterey County, California, to San Jose del Cabo in Baja California Sur, Mexico. California least terns migrate south along the California coast in fall to Baja California, west over mainland Mexico, or as far south as Costa Rica (USFWS 2006).

Current Range

Today, California least tern nesting is confined to 29 nesting areas that total approximately 487 hectares (ha) (1,204 acres (ac)) of habitat along the California coast. The total acreage of nesting habitat is higher than the previous number reported in the 2014 Species Report (USFWS 2014) due to the use of a more quantitative assessment rather than an expansion of nesting habitat. The number of California least tern pairs nesting at each nesting area is highly variable. For example, in 2016, the number of pairs estimated nesting at sites in California ranged from 1 (e.g., Sacramento Bufferlands, Pittsburg Power Plant) to 804 (e.g., Santa Margarita River–North Beach South) (Frost 2016, Appendix B-3). In 2016, the majority (approximately 85 percent) of California least tern breeding pairs were concentrated in southern California within the coastal Counties of Ventura, Los Angeles, Orange, and San Diego (Frost 2016, p. 11; Figure 2), and almost half of the birds in San Diego County nested within lands owned and managed by Marine Corps Base (MCB) Camp Pendleton. (USFWS, 2020)

Distinct Population Segments Defined

No

Critical Habitat Designated

No;

Life History

Feeding Narrative

Adult: California least terns primarily eat fish but will occasionally eat shrimp and small invertebrates. The food source is widely distributed along the Pacific coast. The California least tern forage within a few hundred meters (thousand feet) of their breeding colony, in waters less than 18.3 m (60 ft.), obtaining most of their food from shallow estuaries and lagoons, and from nearshore ocean waters. Competition from other marine life is not a limiting factor unless fish populations are low due to reasons such as environmental conditions or human disturbances. Food shortages have resulted in high mortality among hatchlings and fledglings. When breeding, California least terns reach adult size and plumage at 2 to 3 years. (NatureServe 2015; USFWS 1985; USFWS 2006; USFWS 2015)

Reproduction Narrative

Adult: California least terns are typically sexually mature at 3 years of age. They breed from mid-April to early May and are finished by June. Re-nesting occurs from June to August. California least terns nest primarily on open beaches kept free of vegetation by natural scouring from tidal action, or on open expanses of sand, dirt, or dried mud close to a lagoon or estuary with a dependable food supply. If habitat is limited, they will nest in airports or landfills. Courtship displays include males performing elaborate aerial displays and offering a fish to the female. Nesting starts shortly after bonds form, in colonies typically consisting of 25 nesting pairs. Nests are either scooped out by California least terns of made in existing depressions in the sand; the minimum distances between nests is 3.0 to 4.6 m (10 to 15 ft.), with averages usually much greater (USFWS 2015). Two to three eggs are typically laid, and incubation is 20 to 25 days. Egg success rate is about 80 percent (NatureServe 2015; USFWS 1985; USFWS 2006; USFWS 2015).

Geographic or Habitat Restraints or Barriers

Adult: Human activity and development has fragmented beaches, causing California least terns to nest in airports or landfills (USFWS 1985).

Spatial Arrangements of the Population

Adult: Clumped according to resources.

Environmental Specificity

Adult: Broad/generalist, or community with all key requirements common.

Tolerance Ranges/Thresholds

Adult: Moderate

Site Fidelity

Adult: Moderate to high.

Habitat Narrative

Adult: California least terns are aquatic birds that are found along the Pacific Coast on beaches, lagoons, rivers, bays, mudflats, and estuaries. California least terns have a broad environmental specificity but do need open beaches for nesting. When no open beaches are available, mostly due to human activity and habitat fragmentation from urban development, California least terns will nest on man-made open habitat such as airports and landfill. California least terns have moderate to high site fidelity (NatureServe 2015; USFWS 1985; USFWS 2006; USFWS 2015).

Dispersal/Migration

Motility/Mobility

Adult: Mobile

Migratory vs Non-migratory vs Seasonal Movements

Adult: Migratory

Dispersal

Adult: High

Immigration/Emigration

Adult: No

Dependency on Other Individuals or Species for Dispersal

Adult: No

Dispersal/Migration Narrative

Adult: California least terns are very mobile and have a high dispersal rate. California least terns migrate north for breeding and south for overwintering. California least terns arrive in northern breeding areas on the West Coast in April or early May, where they nest from Moss Landing in Monterey County, California, to San Jose del Cabo in Baja California Sur, Mexico. Most California least terns depart south by November (as early as August), and winter in western Mexico or as far south as Costa Rica (NatureServe 2015; USFWS 1985).

Additional Life History Information

Adult: California least terns arrive in northern breeding areas on the west coast in April or early May. Most California least terns depart south by November (as early as August), and winter in western Mexico (NatureServe 2015; USFWS 1985).

Population Information and Trends

Population Growth Rate:

Stable

Number of Populations:

One

Population Size:

~8,900 (USFWS, 2020)

Minimum Viable Population Size:

1,200 breeding pairs in 15 different breeding locations (USFWS 1985).

Resistance to Disease:

Disease has not been known to have a dramatic effect on California least tern populations (USFWS 2006).

Adaptability:

High

Population Narrative:

Historically, the California least tern was considered abundant along the California coast. At the time of listing, the California least tern was known to nest at 15 sites in the United States, from San Mateo County to San Diego County, California. Shortly after listing it was estimated that only 256 pairs remained. Since listing, the minimum number of pairs steadily increased to over 7,100 pairs in 2009. In 2016, fledglings were observed at 21 nesting areas, and the breeding population estimated at 3989 pairs (Frost 2017). Preliminary estimates of 4095 pairs in 2017 were reported at 29 nesting areas (Sin 2019, pers. comm.). Surveys of the Pacific coast of the Baja California Peninsula documented 300 nesting pairs at eight nesting areas in 2018. The primary threats at the time of listing were development of nesting sites, disturbance, off-road vehicle use, and predation. Many of these threats are ongoing, but existing conservation measures have helped to reduce impacts. Despite these efforts, the California least tern remains a conservation-reliant species (Scott et al. 2010). (USFWS, 2020)

Threats and Stressors

Stressor: Predation
Exposure: Direct; mortality.
Response: Mortality
Consequence: Mortality
Narrative: Predators include birds such as raptors and the American crow; and mammals such as raccoons, opossums, foxes, and domestic dogs and cats. California least terns are predated upon at all life stages, but are especially susceptible to predation during the nesting season, when chicks are too young to leave nests to escape or when fledglings are still clumsy to make a successful getaway. Predations can have a significant effect on reproductive success and can cause nest failure, re-nesting, and site abandonment in addition to direct and indirect mortality (USFWS 2006; USFWS 2015).

Stressor: Environmental contaminants
Exposure: Direct; ingestion of toxic contaminants. Indirect; contaminants on feather or body of California least tern, causing inability to regulate body temperature.
Response: Illness, mortality, nesting failure.
Consequence: Decreased reproductive success.
Narrative: Oil spills in the ocean can negatively affect California least terns; when exposed to oil, birds lose their ability to regulate their body temperature and can die of hypothermia or from toxic hydrocarbons ingested while preening. In addition, oil on eggs can limit their ability to breathe and can introduce toxic hydrocarbons into the eggs (USFWS 2006).

Stressor: Hunting
Exposure: Direct; mortality.
Response: Mortality
Consequence: Mortality

Narrative: Historically, California least terns suffered local losses due to shooting, but it is doubtful that these activities affected the population as a whole (USFWS 1985).

Stressor: Habitat destruction
Exposure: Direct; loss of nesting habitat.
Response: Reduction in population growth.
Consequence: Reduction in population growth.
Narrative: The chief limiting factor influencing the number of least tern breeding pairs is the availability of undisturbed suitable habitat, and few of the current nesting sites for California least terns are close to the historical high and moderate quality of natural habitats. Currently, there are no beaches devoid of human recreation, development, or military pressure, and airports and landfills are often new sites for nesting California least terns. By the 1940s, most terns were gone from the beaches of Orange and Los Angeles counties, and they were considered sparse everywhere. Continuing loss of both nesting and feeding habitat, and high levels of human disturbance at remaining colonies, have been responsible for the continued decline to the present time. Although habitat destruction has occurred historically, it is happening at an accelerated rate, and almost all the coastal habitats have been fragmented or degraded (USFWS 1985; USFWS 2006).

Recovery

Reclassification Criteria:
There are 1,200 breeding pairs with an overall mean productive rate in 15 secure coastal management areas, for a consecutive 3-year period.

Interim reclassification to threatened status can be considered when:

The 1,200 pair population level is achieved;

15 coastal management areas (including San Francisco Bay, Mission Bay, and San Diego Bay, which should have three, five, and four secure colonies, respectively) support viable colonies and are managed to conserve California least terns; and

A 3-year mean reproductive rate of at least 1.0 young/breeding pair is achieved. Once additional information on the Baja California colonies is available, possibly one or two secure sites of the above 15 may be located in Baja. Because of possible nonsecurity of Baja California habitats, it appears unlikely that the Mexican populations will contribute significantly to tern recovery. However, this must be more thoroughly investigated. As additional data become available, the prime objective may be modified to reflect current information.

Recovery Priority Number: 15C

Delisting Criteria:
If 1,200 pairs of California least tern are distributed among secure colonies in at least 20 secure coastal management areas throughout their breeding range, delisting of the species can be considered, with these provisions:

Sufficient habitat to support at least one viable tern colony (defined as consisting of a minimum of 20 breeding pairs with a 5-year mean reproductive rate of at least 1.0 young fledged per year per breeding pair) at each of the 20 coastal management areas (including San Francisco Bay, Mission Bay, and San Diego Bay, which should have four, six, and six secure colonies, respectively), that are managed to conserve least terns;

Land ownership and management objectives are such that future habitat management for the benefit of California least terns at those locations can be assured. The security and status of Baja California colonies must be assessed; if any such colonies are estimated to be secure and will be managed in perpetuity to benefit least terns, such colonies will also be incorporated into the quantified prime objective;

Each of the 20 “secure" coastal management areas must have at least 20 breeding pairs;

Each of the 20 “secure" coastal management areas must have a 5-year mean reproductive rate of at least 1.0 young fledge per breeding pair; and

San Francisco Bay, Mission Bay, and San Diego Bay must be included in the 20 secure management areas, with four, six, and six secure colonies, respectively.

Recovery Actions:
- Preserve and manage nesting habitat.
- Protect and manage nonnesting habitat.
- Monitor least tern population to determine status, distribution, and progress of management during the breeding season.
- Conduct research on California least tern to provide additional necessary information for tern management.
- Encourage the protection of population outside the United States.
- Use existing laws and regulations protecting least tern and their habitat.
- Develop and implement a conservation education program regarding recovery of California least tern.

Conservation Measures and Best Management Practices:
- RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS The actions listed below are recommendations to be completed over the next 5 years. These will help guide continuing recovery of the California least tern by providing information to better manage nesting sites. Conservation of the California least tern is dependent on continued cooperation with our partners to minimize impacts from current threats and aid in future restoration. 1. Continue to coordinate with CDFW, San Diego State University, and other partners to conduct analysis of existing least tern data, to determine trends; create reliable, accurate population models that identify demographic requirements for a stable population; quantify long-term trends; and direct future management priorities to determine population and breeding colony stability. 2. Work with the DOD (the Navy, the Marine Corps, and Air Force), CDFW, California Department of Parks and Recreation, and other partners to continue current successful site management that minimizes impacts of encroaching vegetation, predation, and human disturbance. Investigate innovative techniques of site management and monitoring to reduce costs and better protect the species. 3. Continue food availability studies already started by monitors or initiate new studies on the impact that shifting

food resources have on survival, productivity, and colony dynamics of the California least tern. 4. Partner with Mexican nongovernmental organizations, scientists, and Federal agencies on potential recovery and management actions at nesting sites in Mexico. 5. Update the California least tern recovery plan and recovery criteria with current science, population data, and biology. Utilize threats-based analysis to develop recovery goals. 6. Continue efforts to identify the wintering range of the California least tern and the threats that impact the species on its wintering grounds and migration route. 7. Develop banding protocol to create unified data collection rangewide. Continue banding and recapture studies to determine age structure, survival, and movement. 8. Develop standardized monitoring protocols and on-line data portal to facilitate synthesis, analysis, and sharing of data. 9. Enter into long-term agreements that will assure continued protection and management of California least tern nest sites. (USFWS, 2020)

- We are recommending the following actions prior to reconsidering the status of the subspecies: 1. Analyze existing California least tern data to develop a population model that estimates the population demographics necessary for population and breeding colony stability. 2. Continue to work with our partners regarding ongoing site management activities to minimize impacts of predation, encroaching vegetation, and human disturbance. 3. Investigate the impact of shifting food resources on survival, productivity, and colony dynamics of the California least tern, and explore potential for new nesting areas that address any anticipated changes in nesting distribution driven by shifting food resources. 4. Update the California least tern recovery plan and recovery criteria with current science, population data, and biology. Utilize threats-based criteria and analysis to develop updated recovery objectives supported by population modeling. 5. Analyze genetic samples to better understand the current distribution of California least terns and other subspecies in Mexico. (USFWS, 2020)

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SPECIES ACCOUNT: *Tympanuchus cupido attwateri* (Attwater's greater prairie-chicken)

Species Taxonomic and Listing Information

Commonly-used Acronym: APC

Listing Status: Endangered; 03/11/1967; Pacific Region (R1) (USFWS, 2016)

Physical Description

The Attwater's prairie chicken is a brownish, chunky, hen-like bird with dark bars above and below. Males have short rounded black tails and female's tails are barred. Males have yellow-orange eye combs and both sexes have elongated dark neck feathers, which in males are longer and erected during courtship. Males have large orange air sacs on the sides of their necks and during mating season, they make a "booming" sound, amplified by inflating the air sacs on their necks that can be heard 1/2 mile away.

Current Range

The Attwater's prairie chicken was formerly found throughout Gulf Coast prairies of southwestern Louisiana and Texas, south to the Rio Grande. Presently, less than 200,000 fragmented acres of coastal prairie habitat remain and it is restricted to a narrow band along the Texas coast, some offshore islands, and remnant inland populations (NatureServe website 2007). Currently only two APC populations exist in the wild, one at the Attwater Prairie Chicken National Wildlife Refuge in Colorado/Austin County and one on private lands in Goliad County, Texas. There are no known populations of APCs in Aransas, Calhoun, Refugio, and Victoria counties (personal communication, T. Rossignol, Attwater Prairie Chicken National Wildlife Refuge, August 2015).

Critical Habitat Designated

No;

Life History

Feeding Narrative

<u>Adult:</u> The APC diet consists mostly of insects, especially grasshoppers during the summer and at other times eats fruit, leaves, flowers, shoots, seeds, or grain (Campbell 1995).

Reproduction Narrative

<u>Adult:</u> Males gather for communal courtship (10-30 birds) called leks. Breeding begins early April. Clutch size averages about 12. Incubation lasts 23-24 days. Young leave the nest a few hours after hatching; tended by female. Nests are usually located on average 1.6 km from the booming grounds and more than 60% are lost to predation.

Habitat Narrative

<u>Adult:</u> The Attwater's prairie chicken uses different areas of coastal prairie grassland, preferring a variety of short, mid and tall grass prairie. The habitat is usually dominated by tall dropseed (Sporobolus asper), little bluestem (Schizachyrium scoparium), sumpweed (Iva frutescens),

broomweed (Xanthocephalum texanum), ragweed (Ambrosia psilostachya) and big bluestem (Andropogon gerardii) (Service 1983). They may use grass areas less than 10 inches in height for courtship, feeding, and to avoid moisture. Grass up to 10-16 inches tall is used for roosting and feeding, whereas 16-24 inches of grass (maximum height) are used for nesting, loafing, feeding, and escape. Interspaces between grass clumps should be relatively open to facilitate movement. Densely vegetated areas over 24 inches in height are generally avoided, but may be used occasionally for protection from inclement weather and predators, and as fall feeding grounds (Service 1983).

Dispersal/Migration

Motility/Mobility

Adult: High

Migratory vs Non-migratory vs Seasonal Movements

Adult: Non-migratory

Population Information and Trends

Number of Populations:

Two

Population Size:

104

Population Narrative:

In Goliad County, the population peaked in 1974 at 486 birds and declined to 62 by 1982. The 1980 estimate for Refugio County was 726 individuals; declined to 438 by 1982 (Service 1983). The 1982 populations in Austin and Colorado counties were 250 and 200, respectively. Aransas County population in 1982 was estimated at 20. As of 1991, over 2/3 of the wild population (318 birds) occurred in a contiguous area of primarily private land (O'Conner Ranch) in Aransas, Goliad, and Refugio counties. Birds previously occurring on the Tatton Unit of Aransas National Wildlife Refuge have since disappeared. About 1/4 (126 birds) of the remaining population occurred in Austin and Colorado counties, mostly on Attwater Prairie Chicken National Wildlife Refuge. About 30 birds survived on a 120-ha island of prairie habitat in Galveston County, and another 18 birds occurred in Victoria County. In 1999, fewer than 50 birds remained in the wild despite the introduction of 167 birds from a captive breeding program in 1995-1998 on the Attwater Prairie-Chicken National Wildlife Refuge, Colorado County and The Nature Conservancy of Texas’ Galveston Bay Prairie Preserve, Galveston County (NatureServe website 2007). Currently, a total of 104 birds are estimated at the last two remaining wild populations, Attwater Prairie Chicken National Wildlife Refuge (2015 estimate of 100 birds) and on private lands in Goliad County, Texas (2015 estimate of 4 birds) (personal communication, T. Rossignol, Attwater Prairie Chicken National Wildlife Refuge, August 2015).

Threats and Stressors

Stressor: Habitat loss
Exposure:

Response:
Consequence:
Narrative: Threats to the Attwater's prairie chicken include habitat loss, fragmentation, and degradation of coastal prairie habitat due to agricultural practices, development, brush invasion, overgrazing; and competition with introduced exotic species (pheasants) (Phasianus colchicus). Losses may also be attributed to fire ants (Solenopsis invicta), wild and feral mammals, and raptors. Areas that are no longer suitable due to overgrazing or habitat succession potentially can be restored by reducing livestock numbers or by instituting a program of prescribed burning (Service 1983).

Stressor: Known impediments to population growth
Exposure:
Response:
Consequence:
Narrative: Although tremendous gains in information needed to guide Attwater's prairie-chicken recovery have occurred since the last status review, populations remain extremely vulnerable to extirpation in large part due to their small size. Known impediments to population growth, and in turn to species persistence, include (1) impacts of red imported fire ants on invertebrates required as food for chicks, (2) stochastic weather events, (3) and continued loss and fragmentation of habitat from woody species encroachment and urban expansion. The long-term consequences associated with the extreme population bottleneck experienced by this species, especially with regard to population genetics, are unknown. Availability of suitable grassland habitat will ultimately limit recovery progress, but the ubiquitous presence of fire ants within existing grasslands is a much more immediate threat. Research suggests that progress toward recovery will only occur if significant resources are available to manage fire ants at the landscape scale required to support Attwater's prairie-chicken populations. Until then, this subspecies will remain in imminent danger of extinction. Therefore, no change in status is warranted or recommended. (USFWS, 2021)

Recovery

Reclassification Criteria:
Recovery Priority Number: 6

Recovery Actions:

- Conservation measures to benefit the Attwater's prairie chicken include creating, restoring, and/or enhancing habitat on private lands in an effort to increase their numbers and distribution. Good range management could produce good patchy, open cover and a diversity of forbes that provide the bulk of adult Attwater's prairie chickens diet. Prescribed burning, which should be completed by late February keeps woody plant invasion under control, reduces growth of vegetation that is too dense for Attwater's prairie chickens, improves plant diversity, improves availability of food, and provides nesting sites and booming grounds for Attwater's prairie chickens. Mechanical or chemical management techniques (dozing, roller chopping, or shredding followed by prescribed burn or herbicide application) helps control of large, dense brush and provide feeding areas and brood habitat and control undesirable plant growth. Shredding during the nesting and brooding season (March through June 15) could result in the destruction of nests and incidental take of young chicks unable to fly. Habitat improvements may result in occupancy by Attwater's prairie chickens. If such occupancy does occur, the landowner can return the restored habitat to baseline conditions and incidental take of the species may occur in the future. Improvements of currently unsuitable habitat adjacent to habitat occupied by Attwater's prairie chickens could also cause the movement of Attwater's prairie chickens from the occupied habitat to the improved habitat. Lack of management may result in the loss of Attwater's prairie. However, if newly created habitat functions as successful nesting habitat for the Attwater's prairie chicken it will provide a source for dispersing young to occupy other nearby suitable habitats.

Conservation Measures and Best Management Practices:

- RECOMMENDATIONS FOR FUTURE ACTIONS Future actions should include continued focus on captive propagation, release efforts to supplement existing populations, and the establishment of new populations where quality habitat exists (recovery plan objectives 2 and 3). This requires continued work to restore and maintain a network of large, high quality prairie habitats within the historic range of the Attwater's prairiechicken (recovery plan objective 1). Fire ant management must be an integral part of the restoration and maintenance of habitat quality. Research is needed to optimize fire ant management with regard to retreatment intervals and selection of areas for treatment (recovery plan task 3.7). Support for existing captive rearing facilities is essential to provide source stock for the continued expansion of wild populations, and to serve as a hedge against extinction until viable populations are established in the wild (recovery plan objective 2). (USFWS, 2021)

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SPECIES ACCOUNT: *Tympanuchus pallidicinctus* (Lesser prairie-chicken)

Species Taxonomic and Listing Information

Commonly-used Acronym: LEPC

Listing Status: Threatened

Physical Description

The LEPC is a species of prairie grouse endemic to the southern and central high plains of the United States, commonly recognized for its feathered tarsi (legs), stout build, grounddwelling habit, and lek mating behavior (Figure 2.1). The LEPC is closely related and generally similar in life history strategy, although not identical in every aspect of behavior and life history, to other species of North American prairie grouse (e.g., greater prairie-chicken, Attwater's prairie-chicken, sharp-tailed grouse, greater sage-grouse (Centrocercus urophasianus), and Gunnison's sage-grouse (C. minimus)). Plumage of the LEPC is characterized by a cryptic pattern of alternating brown and buff-colored barring and is similar in appearance to, although somewhat lighter in color than, the greater prairie-chicken. Males have long tufts of feathers on the sides of the neck, termed pinnae, which are erected during courtship displays. Pinnae are smaller and less prominent in females. Males also display brilliant yellow supraorbital eyecombs and dull reddish esophageal air sacs during courtship displays (Copelin 1963, p. 12; Sutton 1977, entire; Johnsgard 1983, p. 318). A more detailed summary of the physical appearance of the LEPC is provided in Hagen and Giesen (2005, unpaginated). Lesser prairie-chickens are dimorphic in size, with the females being smaller than the males (See Table 1 in Hagen and Giesen 2005, unpaginated). Adult LEPC body length varies from 15 to 16 inches [in] (38 to 41 centimeters (cm)) (Johnsgard 1973, p. 275; Johnsgard 1983, p. 318), and adult body mass varies from 1.4 to 2.0 pounds (lbs) (618 to 897 grams (g)) for males and 1.1 to 1.7 lbs (517 to 772 g) for females (Haukos et al. 1989, p. 271; Giesen 1998, p. 14). (USFWS, 2021)

Taxonomy

The LEPC is in the order Galliformes, family Phasianidae, subfamily Tetraoninae; it is generally recognized as a species separate from the greater prairie-chicken (Tympanuchus cupido pinnatus) (Jones 1964, pp. 65–73; American Ornithologist's Union 1998, p. 122). The LEPC is closely related to the other prairie grouse that are included in the genus Tympanuchus. While the LEPC is related to the sharp-tailed grouse (Tympanuchus pasianellus), it is most closely related to the greater prairie-chicken, the federally endangered Attwater's prairie-chicken (Tympanuchus cupido attwateri) and the extinct Heath Hen (Tympanuchus cupido cupido) (Boal and Haukos 2016, p. 3). The taxonomy of LEPC was first described as a subspecies of the greater prairie-chicken (Ridgway 1873, p. 199) and later named a full species in 1885 (Ridgway 1885, p. 355). As recently as the early 1980s, some species experts (Johnsgard 1983, p. 316) still regarded the extinct Heath Hen, the greater prairie-chicken, the LEPC, and the Attwater's prairie-chicken to be four subspecies within Tympanuchus cupido. However, estimates of population divergence and migration between a number of morphologically similar subspecific taxa, including the greater prairie-chicken, the Attwater's prairie-chicken, and the extinct Heath Hen suggest these taxa are as differentiated from each other as they are from other Tympanuchus species (Johnson 2008, p. 165). While genetic resolution within the Tympanuchus genus may be relatively low as discussed in DeYoung and Williford (2016, pp. 78–82), LEPC, sharp-tailed grouse, and greater prairie-chickens all clearly display behavioral and morphological differences. For further discussion of the genetic and morphological differences within the Tympanuchus genus see DeYoung and Williford (2016, pp. 77–97). For purposes of this SSA, we will follow the American Ornithologist's Union taxonomic classification, which is based on observed differences in appearance, morphology, behavior, social interaction, and habitat affinities. The species classification adopted here is: Class: Aves Order: Galliformes Family: Phasianidae Subfamily: Tetraoninae Genus and Species: Tympanuchus pallidicinctus (USFWS, 2021)

Historical Range

There have been several estimates of the potential maximum historical range of the LEPC (e.g., Johnsgard 2002, p. 32; Taylor and Guthery 1980a, p. 1, based on Aldrich 1963, p. 537; Playa Lakes Joint Venture 2007, p. 1) with a wide range of estimates on the order of about 100,000 to 180,000 square miles (64 to 115 million ac, 26 to 47 million ha). Figure 2.2 shows the most recent estimate of the historical range as depicted in the RWP (Van Pelt et al. 2013, p. 3) and referenced by Boal and Haukos (2016, p. 6). Presumably not all of the area within this range was evenly occupied by LEPC, and some of the area was not likely to have been suitable to regularly support LEPC populations (Boal and Haukos 2016, p. 6). (USFWS, 2021)

Current Range

Northern Distinct Population Segment – Kansas, Colorado, Oklahoma, and northeastern Texas panhandle.

Critical Habitat Designated

No;

Life History

Food/Nutrient Resources

Food Source

Adult: Plants/Insects

Food/Nutrient Narrative

Adult: In general, adult LEPC diet consists largely of plant materials especially during the fall, winter, and early spring when insects are less common. Insects are a key component of the diet during the late spring and summer and are especially important for broods to provide nutrition for early growth periods. For a complete discussion of LEPC diet, refer to Haukos and Zavaleta (2016, pp. 113–116) and Sullins et al. (2018, entire). (USFWS, 2021)

Reproductive Strategy

Adult: Oviparity

Lifespan

Adult: average < 5 yrs

Breeding Season

Adult: April - June

Reproduction Narrative

Adult: Lesser prairie-chickens are polygamous (a mating pattern in which a male mates with more than one female in a single breeding season) and exhibit a lek mating system. The lek is a place where males traditionally gather to conduct a communal, competitive courtship display. The males use their specialized plumage and vocalizations (commonly referred to as booming) to attract females for mating. Leks are normally located on the tops of wind-swept ridges, exposed knolls, sparsely vegetated dunes, and similar features in areas having low vegetation height (4 in (10 cm) or less or bare soil and enhanced visibility of the surrounding area (Copelin 1963, p. 26; Jones 1963, p. 771; Taylor and Guthery 1980a, p. 8; Giesen 1998, p. 4). Disturbed habitats with sparse vegetation, such as those found after early spring fires (Cannon and Knopf 1979, pp. 44– 45) or on roads, oil and gas pads, and similar forms of human disturbance (Giesen 1998, p. 4), can create habitat conditions that may encourage lek establishment. However, the human disturbance often associated with artificial lek sites can be detrimental during the breeding season (Taylor 1979, p. 707). The physical characteristics of the landscape associated with lek sites also may contribute to the transmission of sounds produced during lekking (Sparling 1983, pp. 40–41; Butler et al. 2010, entire), and these sounds may aid females in locating lek sites (Hagen and Giesen 2005, unpaginated). Lesser prairie-chicken females arrive at the lek in early spring after the males begin displaying, with peak hen attendance at leks typically occurring in early to mid-April (Copelin 1963, p. 26; Hoffman 1963, p. 730; Crawford and Bolen 1975, p. 810; Davis et al. 1979, p. 84; Merchant 1982, p. 41; Haukos 1988, p. 49). Males will continue to visit lek sites into June to mate with females that were not successful with their first nesting attempt. Females may visit multiple leks before copulating (Giesen 1994a, pp. 97–98). Reproduction: Nesting Within 1 to 2 weeks of successful mating, the hen will select a nest site based upon available nesting habitat, normally within 0.6 to 2.4 mi (1 to 4 km) of an active lek4 (Copelin 1963, p. 44; Giesen 1994a, p. 97), construct a nest, and lay a clutch of 8 to 14 eggs with regional variability (Bent 1932, p. 282; Copelin 1963, p. 34; Merchant 1982, p. 44; Fields 2004, pp. 88, 115–116; Hagen and Giesen 2005, unpaginated; Pitman et al. 2006a, p. 26). Females may return to nest in areas of previously successful nests (Riley 1978, p. 36). Nesting is generally initiated in midApril and concludes in late May (Copelin 1963, p. 35; Snyder 1967, p. 124; Merchant 1982, p. 42; Haukos 1988, pp. 7–8). Hens most commonly lay one egg per day and initiate incubation once the clutch is complete (Hagen and Giesen 2005, unpaginated). Incubation lasts 24 to 27 days (Coats 1955, p. 18; Sutton 1968, p. 679; Pitman et al. 2006a, p. 26) with hatching generally peaking in late May through mid-June (Copelin 1963, p. 34; Merchant 1982, p. 42; Pitman et al. 2006a, p. 26). Hens typically leave the nest within 24 hours after the last egg hatches (Hagen and Giesen 2005, unpaginated). Re-nesting may occur when the first attempt at a nest fails to produce offspring (Johnsgard 1973, pp. 63–64; Merchant 1982, p. 43; Pitman et al. 2006a, p. 25). Re-nesting is more likely when nest failure occurs early in the nesting season and becomes less common as the nesting season progresses (Pitman et al. 2006a, p. 27). Re-nesting rates also vary among the different ecoregions (Patten et al. 2005b, entire). (USFWS, 2021) Lesser prairie-chickens have a relatively short lifespan and high annual mortality. Campbell (1972, p. 694) estimated a 5-year maximum lifespan, although an individual nearly 7 years old has been documented in the wild by the Sutton Avian Research Center (Sutton Center) (Wolfe 2010, pers. comm.). However, the average generation time was calculated, based on work by Farner (1955, entire), to be 1.95 years (Van Pelt et al. 2013, p. 130). Pruett et al. (2011, p. 1209) also estimated generation time in LEPC and found generation times were similar in Oklahoma (1.92 years) but lower than in New Mexico (2.66 years). So it is presumed that most LEPC adults likely live less than 5 years and have a generation time of 2 to 3 years. (USFWS, 2021)

Habitat Type

Adult: These four ecoregions are the Short-Grass Prairie/Conservation Reserve Program Mosaic Ecoregion in Kansas; Sand Sagebrush Prairie Ecoregion in Colorado, Kansas and Oklahoma; Mixed-Grass Prairie Ecoregion in Kansas, Texas, and Oklahoma; and Shinnery Oak Prairie Ecoregion of New Mexico and Texas.

Habitat Narrative

Adult: The LEPC is a unique species of prairie grouse that once ranged across the Southern Great Plains. Its range has been much reduced, and the LEPC now occurs within four ecoregions (Figure ES.1). Each ecoregion is associated with unique environmental conditions based on habitat and climatic variables and some genetic differentiation. These four ecoregions are the Short-Grass Prairie/Conservation Reserve Program Mosaic Ecoregion in Kansas; Sand Sagebrush Prairie Ecoregion in Colorado, Kansas and Oklahoma; Mixed-Grass Prairie Ecoregion in Kansas, Texas, and Oklahoma; and Shinnery Oak Prairie Ecoregion of New Mexico and Texas. We consider the four ecoregions to be four representative areas within which the LEPC can maintain the remaining ecological and genetic diversity for future adaptive capacity. For LEPC, populations within the ecoregions to be healthy and resilient, they require large, ecologically functioning grasslands and shrublands with a diversity of grass and low-growing shrub species with limited anthropogenic structures and trees. LEPC avoid using areas with trees, vertical structures, and other human disturbances in areas with otherwise adequate habitat conditions (USFWS, 2023).

Dispersal/Migration

Motility/Mobility

Adult: High

Dispersal

Adult: High

Dispersal/Migration Narrative

Adult: Typically, LEPC home ranges vary both by sex and by season and may be influenced by a variety of landscape conditions (Haukos and Zavaleta 2016, pp. 108–112). Lesser prairiechickens are not territorial, except for the small area defended by males on the lek, so home ranges of individual birds likely overlap to some extent. Habitat quality presumably influences the extent to which individual home ranges overlap. Adults tend to spend much of their daily and seasonal activity within 3.0 mi (4.8 km) of a lek (Giesen 1994a, p. 97; Riley et al. 1994, p. 185; Woodward et al. 2001, p. 263). Males tend to have smaller home ranges than do females, with the males generally remaining closer to the leks than do the females (Giesen 1998, p. 11). Male LEPC exhibit strong site fidelity to their lek (Copelin 1963, pp. 29–30; Hoffman 1963, p. 731; Campbell 1972, pp. 698–699, Hagen et al. 2005, entire). Once a lek site is selected, males persistently return to that same lek year after year (Hagen et al. 2005, entire; Wiley 1974, pp. 203–204) and may remain faithful to that site for life. They often will continue to use these traditional areas even when the surrounding habitat has declined in value (for example, concerning greater sage-grouse; see Harju et al. 2010, entire). Davis (2005, p. 3) states that the combined home range of all LEPC at a single lek is about 12,000 ac (4,900 ha). Dispersal plays an important role in maintaining healthy, robust LEPC populations by contributing to population expansion, recolonization, and gene flow (Sutherland et al. 2000, unpaginated). Many grouse species are known to exhibit relatively limited dispersal tendencies and juvenile dispersal is normally less than 25 mi (40 km) (Braun et al. 1994, pp. 432–433; Ellsworth et al. 1994, p. 666). Environmental conditions may influence dispersal patterns in LEPC, particularly in fragmented landscapes where predation rates may be higher and habitat suitability may be reduced in smaller-sized patches (Kraft 2016, pp. 113, 116–119). Lesser prairie-chickens appear to be sensitive to the size of habitat patches and may avoid using patches below a particular size. As the landscape becomes more fragmented, longer dispersal distances over areas of unusable habitat may be required (Patten et al. 2011, pp. 60–61). While longdistance movement of breeding-age birds has been documented to exceed 44 mi (71 km), this long of a movement distance is likely rare, depending on the specific landscape conditions through which birds are moving, since the mean distance reported was 10 mi (16 km) (Earl et al. 2016, p. 10). Thus it is important, for LEPC movements, to have relatively small distances between usable habitat patches. (USFWS, 2021)

Population Information and Trends

Population Trends:
Decreasing

Species Trends:
Decreasing

Number of Populations:
Four ecoregions (USFWS, 2022)

Population Size:
90% confidence interval: 15,690, 59,981 (USFWS, 2021)

Population Narrative:
The results of our geospatial analysis indicate that the estimated area of current potential usable area for the LEPC is approximately 19% of the total analysis area and ranges from approximately 12 to 33% of the analysis area within each of the ecoregions. Recent population estimates from aerial surveys suggest low population numbers for three of the four ecoregions with approximately 62% of the current population occurring within the Short-Grass/CRP Ecoregion (Nasman et al. 2020, p. 21), although the estimated current abundance of all LEPC populations has generally declined substantially when compared to historical estimates in response to landscape-scale loss and fragmentation of grassland habitat. Aerial survey results estimated the LEPC population abundance, averaged over the most recent 5 years of surveys (2015-2020, no surveys in 2019), at 27,384 (90% confidence interval: 15,690, 59,981) (Nasman et al. 2020, p. 21). (USFWS, 2021)

Threats and Stressors

Stressor: Extreme Weather Events (USFWS, 2021)
Exposure:
Response:
Consequence:

Narrative: Weather-related events such as drought, snow, and hail storms can influence habitat quality or result in direct mortality of LEPC. Although hail storms typically only have a localized effect, the effects of snow storms and drought can often be more wide-spread and can affect considerable portions of the LEPC range. Drought is considered a universal ecological driver across the Great Plains (Knopf 1996, p. 147). Annual precipitation within the Great Plains is highly variable (Wiens 1974, p. 391), with prolonged drought capable of causing local extinctions of annual forbs and grasses within stands of perennial species, and recolonization is often slow (Tilman and El Haddi 1992, p. 263). Grassland bird species in particular are impacted by climate extremes such as extended drought, which acts as a bottleneck that allows only a limited number of individuals to survive through the relatively harsh conditions (Wiens 1974, pp. 388, 397; Zimmerman 1992, p. 92). Drought also interacts with many of the other factors addressed in this report, such as amplifying the effects of incompatible grazing and predation. (USFWS, 2021)

Stressor: Insecticides (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Concerns over pesticides affecting vertebrate wildlife populations have recently focused on systemic products which exert broad-spectrum toxicity (Gibbons et al. 2014. p. 104). Recent studies have shown that neonicotinoid insecticides (a class of insecticides that share a common mode of action that targets the central nervous system of insects), which are used within the range of the LEPC, have adverse effects on non-target invertebrate species (Hallmann et al. 2014, p. 341). Invertebrates constitute a substantial part of the diet of many bird species, including LEPC, during the breeding season and are vital for raising offspring (Hallmann et al. 2014, p. 341). Although this has not been investigated specifically in relation to LEPC, Hallmann et al. (2014, entire) illustrated that local bird populations in the Netherlands declined by 3.5% annually in areas where there was a higher concentration of the neonicotinoid imidacloprid, and this spatial pattern of decline appeared only after the introduction of imidacloprid in the mid-1990s (even after accounting for spatial differences in land use changes). Use of imidacloprid and clothianidin (two neonicotinoid insecticides) as seed treatments on some crops also poses risks to small birds, and ingestion of even a few treated seeds could cause mortality or reproductive impairment to sensitive bird species (Gibbons et al. 2014, p. 103). Despite these concerns, we currently have no information that indicates insecticides are influencing LEPC populations. (USFWS, 2021)

Stressor: Fire (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Fire, or its absence, is understood to be one of three major ecological drivers of grasslands in the Southern Great Plains, with the remaining two being climate and grazing (Anderson 2006, entire; Koerner and Collins 2014, entire; Wright and Bailey 1982, pp. 80–137). Fire is an ecological process important to maintaining grasslands by itself and in coupled interaction with grazing and climate. The interaction of these ecological processes results in increasing heterogeneity on grasslands through the creation of temporal and spatial diversity in plant community composition and structure and concomitant response of wildlife (Fuhlendorf and Engle 2001, entire; Fuhlendorf and Engle 2004, entire; Fuhlendorf et al. 2017a, pp. 169–196). Some landowners working in these landscapes use fire as one of many tools to manage livestock

behavior, forage quantity and quality and to increase performance of livestock (Fuhlendorf et al. 2017a, pp. 169– 196). Acknowledging the role and importance of fire, grassland conservation recommendations often promote prescribed fire use and provide incentives to landowners' use of fire through conservation program efforts such as training and education, cost share, and planning assistance. (USFWS, 2021)

Stressor: Parasites and Diseases (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Although parasites and diseases have the potential to influence LEPC population dynamics, little is known regarding the consequences of parasites or diseases at the LEPC population level (Peterson 2016, p. 173). Past adverse impacts to LEPC populations have not been observed, although diseases and parasites have been found in LEPC (Peterson 2016, p. 173). Some degree of impact from parasites and disease is a naturally occurring phenomenon for most wildlife species and is one element of compensatory mortality (the phenomenon that various causes of mortality in wildlife tend to balance each other, allowing the total mortality rate to remain constant) that operates among many species. However, there is no information that indicates parasites or disease have caused, or contributed to, the decline of any LEPC populations, and, at this time, we have no basis for concluding that disease or parasite loads are a concern to any LEPC populations. For a more detailed discussion of parasites and diseases of the LEPC, please refer to Peterson (2016, pp. 159–183). (USFWS, 2021)

Stressor: Predation (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Predation is a naturally occurring process and generally does not independently pose a substantial risk to wildlife populations, including the LEPC. Natural predation can be confounding cause for species declines when populations are extremely small, when habitat conditions have been altered to create increased predatory opportunities or increased effectiveness for predators, or when the species has an abnormal level of vulnerability to predation. The LEPC's cryptic plumage and behavioral adaptations allow the species to persist under normal predation pressures. LEPC predation varies seasonally during different life stages, with higher predation during the breeding season compared to the nonbreeding season (Boal 2016, p. 145). Although all age classes of LEPC may experience relatively constant, year-round risk from mammals, higher predation risk is seen during LEPC breeding season in the spring and summer from ravens (Corvus corax) and from various species of snakes preying on eggs and young, and during raptor migration seasons in the fall and spring from raptors preying on juveniles and adults (Boal 2016, p. 147). Adults may be most susceptible to predation while on the lek when birds are more conspicuous. Both Patten et al. (2005b, p. 240) and Wolfe et al. (2007, p. 100) reported that raptor predation increased with lek attendance. Patten et al. (2005b, p. 240) stated that male LEPC are more vulnerable to predation when exposed during lek displays than they are at other times of the year and that male LEPC mortality was chiefly associated with predation. However, during 650 hours of lek observations in Texas, raptor predation at leks was considered to be uncommon and an unlikely reason for declines in LEPC populations (Behney et al. 2011, pp. 336–337). Behney et al. (2012, p. 294) further observed that the timing of lekking activities in their study area corresponded with the lowest observed densities of raptors and that

LEPC contend with a more abundant and diverse assemblage of raptors in other seasons. (USFWS, 2021)

Stressor: Collision Mortality from Fences (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Fencing is a fundamental tool of livestock management and is often essential for proper herd and grazing management. Fencing is used to confine livestock and prevent them from grazing areas such as public roads, agricultural fields, lands intended for hay production, outside of property boundaries, and those lands enrolled in some types of conservation programs. However, fencing, particularly at higher densities, can contribute to fragmentation of the landscape and hinder efforts to conserve grasslands on a landscape scale (Samson et al. 2004, p. 11–12). Fencing can be particularly detrimental to the LEPC in areas, such as Western Oklahoma, where initial settlement patterns favored larger numbers of smaller parcels for individual settlers (Patten et al. 2005b, p. 245). Fencing large numbers of small parcels increases the density of fences on the landscape, increasing the potential for LEPC to encounter fences during flight. In addition to direct mortality of LEPC through collisions during flight, fencing can also indirectly lead to mortality by creating hunting perches used by raptors and by facilitating corridors that may enhance movements of mammalian predators (Wolfe et al. 2007, pp. 96–97, 101). Wolfe et al. (2007, p. 101) and Patten et al. (2005b, p. 241) found high proportions of mortality to fence collisions in Oklahoma; however, the majority of studies range-wide have found little evidence that fence collisions are a large contribution to direct mortality of LEPC (Hagen et al. 2007, p. 524; Grisham and Boal 2015, p., 6; Kukal 2010, p. 54; Pirius 2011, p. 24; Robinson et al. 2016, entire). Therefore, in most areas where the landscapes have not been fenced as intensively as in Oklahoma, fence collision risk is not as high and not likely to result in population level effects. (USFWS, 2021)

Stressor: Hunting, and Other Recreational, Educational, and Scientific Use (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: In the late 19th century, LEPC were subject to commercial hunting (Jackson and DeArment 1963, p. 733; Fleharty 1995, pp. 38–45; Jensen et al. 2000, p. 170). Harvest throughout the species' historical range has been regulated since approximately the turn of the 20th century (Crawford 1980, pp. 3–4). Currently, the LEPC is classified as a game species in Kansas, New Mexico, Oklahoma, and Texas, although authorized harvest is no longer allowed in any of the states. The LEPC has been listed as a State-threatened species in Colorado, eliminating harvest of the species under the State's Nongame and Endangered or Threatened Species Conservation Act, since 1973. In March of 2009, Texas adopted a temporary, indefinite suspension of their previous 2-day season until LEPC populations could recover to harvestable levels. This suspension is still in effect. The hunting season for LEPC in Oklahoma has been closed since 1998, with harvest estimated to have peaked at near 16,000 birds in 1970, followed by a drastic decrease to less than a 1,000 by 1975, then rebounding to an annual estimated harvest ranging from 6,000–12,000 through the 1980s (Haukos et al. 2016, pp. 138–139). In New Mexico, the LEPC was legally hunted until 1996 (Hunt 2004, p. 39). The annual harvest in the 1960s averaged about 1,000 birds, but harvest declined to only 130 birds in 1979. Harvest rebounded a few years later, peaking in 1987 and 1988 when average harvest was about 4,000 birds (Hunt 2004, p. 39).

Harvest subsequently declined through the early 1990s. In Kansas, LEPC could legally be hunted up until 2014. The bag limit was one LEPC daily south of Interstate 70, and two LEPC north of Interstate 70. For additional information on harvest of LEPC refer to Haukos et al. (2016, pp. 133–144). (USFWS, 2021)

Stressor: Livestock Grazing (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Grazing has long been an ecological driving force throughout the ecosystems of the Great Plains (Stebbins 1981, p. 84), and much of the untilled grasslands within the range of the LEPC is currently grazed by livestock and other animals. Historically, the interaction of fire, drought, prairie dogs (Cynomys ludovicianus), and large ungulate grazers created and maintained distinctively different plant communities in the Western Great Plains that resulted in a mosaic of vegetation structure and composition that maintained the prairie ecosystem that sustained LEPC and other grassland bird populations (Derner et al. 2009, p. 112). As such, grazing by domestic livestock is not inherently detrimental to LEPC management and, in many cases, is needed to maintain appropriate vegetative structure through disturbance. However, grazing practices that tend to result in overutilization of forage, as well as decreasing vegetation heterogeneity (incompatible grazing), can produce habitat conditions that differ in significant ways from the historical grassland mosaic by altering the vegetation structure and composition and degrading the quality of habitat for the LEPC. The more heavily altered conditions are the least valuable for the LEPC (Jackson and DeArment 1963 p. 733; Davis et al. 1979, pp. 56, 116; Taylor and Guthery 1980a, p. 2; Bidwell and Peoples 1991, pp. 1–2) and, in some cases, can result in areas that do not contain the biological components necessary to support the LEPC. It is important that grazing being managed at a given site to account for a variety of factors including past management, soils, precipitation and other factors to ensure that the resulting vegetative composition and structure will support the LEPC as needed management will vary across the range. (USFWS, 2021)

Stressor: Shrub Control and Eradication (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Shrub control and eradication are additional forms of habitat alteration that can influence the availability and suitability of habitat for LEPC (Jackson and DeArment 1963, pp. 736–737). Most shrub control and eradication efforts in LEPC habitat are primarily focused on sand shinnery oak for the purpose of increasing forage for livestock grazing. Sand shinnery oak is toxic if eaten by cattle when it first produces leaves in the spring, and it also competes with more palatable grasses and forbs for water and nutrients (Peterson and Boyd 1998, p. 8), which is why it is a common target for control and eradication efforts by rangeland managers. Prior to the late 1990s, approximately 100,000 ac (40,000 ha) of sand shinnery oak in New Mexico and approximately 1,000,000 ac (405,000 ha) of sand shinnery oak in Texas were lost due to the application of tebuthiuron and other herbicides for agriculture and range improvement (Peterson and Boyd 1998, p. 2). (USFWS, 2021)

Recovery

Conservation Measures and Best Management Practices:

-

Additional Threshold Information:

-
-

References

USFWS. 2021. Species Status Assessment for the Lesser Prairie-Chicken (Tympanuchus pallidicinctus), Version 2.2. 110 pp. + Appendices.

USFWS. 2021. Species Status Assessment for the Lesser Prairie-Chicken (Tympanuchus pallidicinctus), Version 2.2. 110 pp. + Appendices. USFWS. 2023. Recovery Outline for the Northern and Southern Distinct Population Segments of the Lesser Prairie-Chicken (Tympanuchus pallidicinctus). Southwest Region. Nine pages.

USFWS. 2021. Species Status Assessment for the Lesser Prairie-Chicken (Tympanuchus pallidicinctus), Version 2.2. 110 pp. + Appendices. USFWS. 2022. Species status assessment report for the lesser prairie-chicken (Tympanuchus pallidicinctus), Version 2.3. 109 pp. + Appendices.

SPECIES ACCOUNT: *Tympanuchus pallidicinctus* (Lesser prairie-chicken)

Species Taxonomic and Listing Information

Listing Status: Endangered

Physical Description

The LEPC is a species of prairie grouse endemic to the southern and central high plains of the United States, commonly recognized for its feathered tarsi (legs), stout build, grounddwelling habit, and lek mating behavior (Figure 2.1). The LEPC is closely related and generally similar in life history strategy, although not identical in every aspect of behavior and life history, to other species of North American prairie grouse (e.g., greater prairie-chicken, Attwater's prairie-chicken, sharp-tailed grouse, greater sage-grouse (Centrocercus urophasianus), and Gunnison's sage-grouse (C. minimus)). Plumage of the LEPC is characterized by a cryptic pattern of alternating brown and buff-colored barring and is similar in appearance to, although somewhat lighter in color than, the greater prairie-chicken. Males have long tufts of feathers on the sides of the neck, termed pinnae, which are erected during courtship displays. Pinnae are smaller and less prominent in females. Males also display brilliant yellow supraorbital eyecombs and dull reddish esophageal air sacs during courtship displays (Copelin 1963, p. 12; Sutton 1977, entire; Johnsgard 1983, p. 318). A more detailed summary of the physical appearance of the LEPC is provided in Hagen and Giesen (2005, unpaginated). Lesser prairie-chickens are dimorphic in size, with the females being smaller than the males (See Table 1 in Hagen and Giesen 2005, unpaginated). Adult LEPC body length varies from 15 to 16 inches [in] (38 to 41 centimeters (cm)) (Johnsgard 1973, p. 275; Johnsgard 1983, p. 318), and adult body mass varies from 1.4 to 2.0 pounds (lbs) (618 to 897 grams (g)) for males and 1.1 to 1.7 lbs (517 to 772 g) for females (Haukos et al. 1989, p. 271; Giesen 1998, p. 14). (USFWS, 2021)

Taxonomy

The LEPC is in the order Galliformes, family Phasianidae, subfamily Tetraoninae; it is generally recognized as a species separate from the greater prairie-chicken (Tympanuchus cupido pinnatus) (Jones 1964, pp. 65–73; American Ornithologist's Union 1998, p. 122). The LEPC is closely related to the other prairie grouse that are included in the genus Tympanuchus. While the LEPC is related to the sharp-tailed grouse (Tympanuchus pasianellus), it is most closely related to the greater prairie-chicken, the federally endangered Attwater's prairie-chicken (Tympanuchus cupido attwateri) and the extinct Heath Hen (Tympanuchus cupido cupido) (Boal and Haukos 2016, p. 3). The taxonomy of LEPC was first described as a subspecies of the greater prairie-chicken (Ridgway 1873, p. 199) and later named a full species in 1885 (Ridgway 1885, p. 355). As recently as the early 1980s, some species experts (Johnsgard 1983, p. 316) still regarded the extinct Heath Hen, the greater prairie-chicken, the LEPC, and the Attwater's prairie-chicken to be four subspecies within Tympanuchus cupido. However, estimates of population divergence and migration between a number of morphologically similar subspecific taxa, including the greater prairie-chicken, the Attwater's prairie-chicken, and the extinct Heath Hen suggest these taxa are as differentiated from each other as they are from other Tympanuchus species (Johnson 2008, p. 165). While genetic resolution within the Tympanuchus genus may be relatively low as discussed in DeYoung and Williford (2016, pp. 78–82), LEPC, sharp-tailed grouse, and greater prairie-chickens all clearly display behavioral and morphological differences.

For further discussion of the genetic and morphological differences within the Tympanuchus genus see DeYoung and Williford (2016, pp. 77–97). For purposes of this SSA, we will follow the American Ornithologist's Union taxonomic classification, which is based on observed differences in appearance, morphology, behavior, social interaction, and habitat affinities. The species classification adopted here is: Class: Aves Order: Galliformes Family: Phasianidae Subfamily: Tetraoninae Genus and Species: Tympanuchus pallidicinctus (USFWS, 2021)

Historical Range

There have been several estimates of the potential maximum historical range of the LEPC (e.g., Johnsgard 2002, p. 32; Taylor and Guthery 1980a, p. 1, based on Aldrich 1963, p. 537; Playa Lakes Joint Venture 2007, p. 1) with a wide range of estimates on the order of about 100,000 to 180,000 square miles (64 to 115 million ac, 26 to 47 million ha). Figure 2.2 shows the most recent estimate of the historical range as depicted in the RWP (Van Pelt et al. 2013, p. 3) and referenced by Boal and Haukos (2016, p. 6). Presumably not all of the area within this range was evenly occupied by LEPC, and some of the area was not likely to have been suitable to regularly support LEPC populations (Boal and Haukos 2016, p. 6). (USFWS, 2021)

Current Range

Southern Distinct Population Segment – New Mexico and southwestern Texas panhandle.

Critical Habitat Designated

No;

Life History

Food/Nutrient Resources

Food Source

Adult: Plants/Insects

Reproductive Strategy

Adult: Oviparity

Lifespan

Adult: average < 5 yrs

Breeding Season

Adult: April - June

Reproduction Narrative

Adult: Lesser prairie-chickens are polygamous (a mating pattern in which a male mates with more than one female in a single breeding season) and exhibit a lek mating system. The lek is a place where males traditionally gather to conduct a communal, competitive courtship display. The males use their specialized plumage and vocalizations (commonly referred to as booming) to attract females for mating. Leks are normally located on the tops of wind-swept ridges, exposed knolls, sparsely vegetated dunes, and similar features in areas having low vegetation height (4 in (10 cm) or less or bare soil and enhanced visibility of the surrounding area (Copelin 1963, p. 26; Jones 1963, p. 771; Taylor and Guthery 1980a, p. 8; Giesen 1998, p. 4). Disturbed habitats with sparse vegetation, such as those found after early spring fires (Cannon and Knopf 1979, pp. 44– 45) or on roads, oil and gas pads, and similar forms of human disturbance (Giesen 1998, p. 4), can create habitat conditions that may encourage lek establishment. However, the human disturbance often associated with artificial lek sites can be detrimental during the breeding season (Taylor 1979, p. 707). The physical characteristics of the landscape associated with lek sites also may contribute to the transmission of sounds produced during lekking (Sparling 1983, pp. 40–41; Butler et al. 2010, entire), and these sounds may aid females in locating lek sites (Hagen and Giesen 2005, unpaginated). Lesser prairie-chicken females arrive at the lek in early spring after the males begin displaying, with peak hen attendance at leks typically occurring in early to mid-April (Copelin 1963, p. 26; Hoffman 1963, p. 730; Crawford and Bolen 1975, p. 810; Davis et al. 1979, p. 84; Merchant 1982, p. 41; Haukos 1988, p. 49). Males will continue to visit lek sites into June to mate with females that were not successful with their first nesting attempt. Females may visit multiple leks before copulating (Giesen 1994a, pp. 97–98). Reproduction: Nesting Within 1 to 2 weeks of successful mating, the hen will select a nest site based upon available nesting habitat, normally within 0.6 to 2.4 mi (1 to 4 km) of an active lek4 (Copelin 1963, p. 44; Giesen 1994a, p. 97), construct a nest, and lay a clutch of 8 to 14 eggs with regional variability (Bent 1932, p. 282; Copelin 1963, p. 34; Merchant 1982, p. 44; Fields 2004, pp. 88, 115–116; Hagen and Giesen 2005, unpaginated; Pitman et al. 2006a, p. 26). Females may return to nest in areas of previously successful nests (Riley 1978, p. 36). Nesting is generally initiated in midApril and concludes in late May (Copelin 1963, p. 35; Snyder 1967, p. 124; Merchant 1982, p. 42; Haukos 1988, pp. 7–8). Hens most commonly lay one egg per day and initiate incubation once the clutch is complete (Hagen and Giesen 2005, unpaginated). Incubation lasts 24 to 27 days (Coats 1955, p. 18; Sutton 1968, p. 679; Pitman et al. 2006a, p. 26) with hatching generally peaking in late May through mid-June (Copelin 1963, p. 34; Merchant 1982, p. 42; Pitman et al. 2006a, p. 26). Hens typically leave the nest within 24 hours after the last egg hatches (Hagen and Giesen 2005, unpaginated). Re-nesting may occur when the first attempt at a nest fails to produce offspring (Johnsgard 1973, pp. 63–64; Merchant 1982, p. 43; Pitman et al. 2006a, p. 25). Re-nesting is more likely when nest failure occurs early in the nesting season and becomes less common as the nesting season progresses (Pitman et al. 2006a, p. 27). Re-nesting rates also vary among the different ecoregions (Patten et al. 2005b, entire). (USFWS, 2021) Lesser prairie-chickens have a relatively short lifespan and high annual mortality. Campbell (1972, p. 694) estimated a 5-year maximum lifespan, although an individual nearly 7 years old has been documented in the wild by the Sutton Avian Research Center (Sutton Center) (Wolfe 2010, pers. comm.). However, the average generation time was calculated, based on work by Farner (1955, entire), to be 1.95 years (Van Pelt et al. 2013, p. 130). Pruett et al. (2011, p. 1209) also estimated generation time in LEPC and found generation times were similar in Oklahoma (1.92 years) but lower than in New Mexico (2.66 years). So it is presumed that most LEPC adults likely live less than 5 years and have a generation time of 2 to 3 years. (USFWS, 2021)

Habitat Type

Adult: These four ecoregions are the Short-Grass Prairie/Conservation Reserve Program Mosaic Ecoregion in Kansas; Sand Sagebrush Prairie Ecoregion in Colorado, Kansas and Oklahoma; Mixed-Grass Prairie Ecoregion in Kansas, Texas, and Oklahoma; and Shinnery Oak Prairie Ecoregion of New Mexico and Texas (USFWS, 2023).

Habitat Narrative

Adult: The LEPC is a unique species of prairie grouse that once ranged across the Southern Great Plains. Its range has been much reduced, and the LEPC now occurs within four ecoregions (Figure ES.1). Each ecoregion is associated with unique environmental conditions based on habitat and climatic variables and some genetic differentiation. These four ecoregions are the Short-Grass Prairie/Conservation Reserve Program Mosaic Ecoregion in Kansas; Sand Sagebrush Prairie Ecoregion in Colorado, Kansas and Oklahoma; Mixed-Grass Prairie Ecoregion in Kansas, Texas, and Oklahoma; and Shinnery Oak Prairie Ecoregion of New Mexico and Texas. We consider the four ecoregions to be four representative areas within which the LEPC can maintain the remaining ecological and genetic diversity for future adaptive capacity. For LEPC, populations within the ecoregions to be healthy and resilient, they require large, ecologically functioning grasslands and shrublands with a diversity of grass and low-growing shrub species with limited anthropogenic structures and trees. LEPC avoid using areas with trees, vertical structures, and other human disturbances in areas with otherwise adequate habitat conditions (USFWS, 2023).

Dispersal/Migration

Motility/Mobility

Adult: High

Dispersal/Migration Narrative

Adult: Typically, LEPC home ranges vary both by sex and by season and may be influenced by a variety of landscape conditions (Haukos and Zavaleta 2016, pp. 108–112). Lesser prairiechickens are not territorial, except for the small area defended by males on the lek, so home ranges of individual birds likely overlap to some extent. Habitat quality presumably influences the extent to which individual home ranges overlap. Adults tend to spend much of their daily and seasonal activity within 3.0 mi (4.8 km) of a lek (Giesen 1994a, p. 97; Riley et al. 1994, p. 185; Woodward et al. 2001, p. 263). Males tend to have smaller home ranges than do females, with the males generally remaining closer to the leks than do the females (Giesen 1998, p. 11). Male LEPC exhibit strong site fidelity to their lek (Copelin 1963, pp. 29–30; Hoffman 1963, p. 731; Campbell 1972, pp. 698–699, Hagen et al. 2005, entire). Once a lek site is selected, males persistently return to that same lek year after year (Hagen et al. 2005, entire; Wiley 1974, pp. 203–204) and may remain faithful to that site for life. They often will continue to use these traditional areas even when the surrounding habitat has declined in value (for example, concerning greater sage-grouse; see Harju et al. 2010, entire). Davis (2005, p. 3) states that the combined home range of all LEPC at a single lek is about 12,000 ac (4,900 ha). Dispersal plays an important role in maintaining healthy, robust LEPC populations by contributing to population expansion, recolonization, and gene flow (Sutherland et al. 2000, unpaginated). Many grouse species are known to exhibit relatively limited dispersal tendencies and juvenile dispersal is normally less than 25 mi (40 km) (Braun et al. 1994, pp. 432–433; Ellsworth et al. 1994, p. 666). Environmental conditions may influence dispersal patterns in LEPC, particularly in fragmented landscapes where predation rates may be higher and habitat suitability may be reduced in smaller-sized patches (Kraft 2016, pp. 113, 116–119). Lesser prairie-chickens appear to be sensitive to the size of habitat patches and may avoid using patches below a particular size. As the landscape becomes more fragmented, longer dispersal distances over areas of unusable habitat may be required (Patten et al. 2011, pp. 60–61). While longdistance movement of breeding-age birds has been documented to exceed 44 mi (71 km), this long of a movement distance is likely rare, depending on the specific landscape conditions through which birds are moving, since the mean distance reported was 10 mi (16 km) (Earl et al. 2016, p. 10). Thus it is important, for LEPC movements, to have relatively small distances between usable habitat patches. (USFWS, 2021)

Population Information and Trends

Population Trends:
Decreasing

Species Trends:
Decreasing

Number of Populations:
Four ecoregions (USFWS, 2022)

Population Size:
90% confidence interval: 15,690, 59,981 (USFWS, 2021)

Population Narrative:
The results of our geospatial analysis indicate that the estimated area of current potential usable area for the LEPC is approximately 19% of the total analysis area and ranges from approximately 12 to 33% of the analysis area within each of the ecoregions. Recent population estimates from aerial surveys suggest low population numbers for three of the four ecoregions with approximately 62% of the current population occurring within the Short-Grass/CRP Ecoregion (Nasman et al. 2020, p. 21), although the estimated current abundance of all LEPC populations has generally declined substantially when compared to historical estimates in response to landscape-scale loss and fragmentation of grassland habitat. Aerial survey results estimated the LEPC population abundance, averaged over the most recent 5 years of surveys (2015-2020, no surveys in 2019), at 27,384 (90% confidence interval: 15,690, 59,981) (Nasman et al. 2020, p. 21). (USFWS, 2021). The LEPC is a unique species of prairie grouse that once ranged across the Southern Great Plains. Its range has been much reduced, and the LEPC now occurs within four ecoregions (Figure ES.1). Each ecoregion is associated with unique environmental conditions based on habitat and climatic variables and some genetic differentiation. These four ecoregions are the Short-Grass Prairie/Conservation Reserve Program Mosaic Ecoregion in Kansas and Colorado; Sand Sagebrush Prairie Ecoregion in Colorado, Kansas, and Oklahoma; Mixed-Grass Prairie Ecoregion in Kansas, Texas, and Oklahoma; and Sand Shinnery Oak Prairie Ecoregion in New Mexico and Texas (USFWS, 2022).

Threats and Stressors

Stressor: Extreme Weather Events (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Weather-related events such as drought, snow, and hail storms can influence habitat quality or result in direct mortality of LEPC. Although hail storms typically only have a localized effect, the effects of snow storms and drought can often be more wide-spread and can affect considerable portions of the LEPC range. Drought is considered a universal ecological driver across the Great Plains (Knopf 1996, p. 147). Annual precipitation within the Great Plains is highly

variable (Wiens 1974, p. 391), with prolonged drought capable of causing local extinctions of annual forbs and grasses within stands of perennial species, and recolonization is often slow (Tilman and El Haddi 1992, p. 263). Grassland bird species in particular are impacted by climate extremes such as extended drought, which acts as a bottleneck that allows only a limited number of individuals to survive through the relatively harsh conditions (Wiens 1974, pp. 388, 397; Zimmerman 1992, p. 92). Drought also interacts with many of the other factors addressed in this report, such as amplifying the effects of incompatible grazing and predation. (USFWS, 2021)

Stressor: Insecticides (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Concerns over pesticides affecting vertebrate wildlife populations have recently focused on systemic products which exert broad-spectrum toxicity (Gibbons et al. 2014. p. 104). Recent studies have shown that neonicotinoid insecticides (a class of insecticides that share a common mode of action that targets the central nervous system of insects), which are used within the range of the LEPC, have adverse effects on non-target invertebrate species (Hallmann et al. 2014, p. 341). Invertebrates constitute a substantial part of the diet of many bird species, including LEPC, during the breeding season and are vital for raising offspring (Hallmann et al. 2014, p. 341). Although this has not been investigated specifically in relation to LEPC, Hallmann et al. (2014, entire) illustrated that local bird populations in the Netherlands declined by 3.5% annually in areas where there was a higher concentration of the neonicotinoid imidacloprid, and this spatial pattern of decline appeared only after the introduction of imidacloprid in the mid-1990s (even after accounting for spatial differences in land use changes). Use of imidacloprid and clothianidin (two neonicotinoid insecticides) as seed treatments on some crops also poses risks to small birds, and ingestion of even a few treated seeds could cause mortality or reproductive impairment to sensitive bird species (Gibbons et al. 2014, p. 103). Despite these concerns, we currently have no information that indicates insecticides are influencing LEPC populations. (USFWS, 2021)

Stressor: Fire (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Fire, or its absence, is understood to be one of three major ecological drivers of grasslands in the Southern Great Plains, with the remaining two being climate and grazing (Anderson 2006, entire; Koerner and Collins 2014, entire; Wright and Bailey 1982, pp. 80–137). Fire is an ecological process important to maintaining grasslands by itself and in coupled interaction with grazing and climate. The interaction of these ecological processes results in increasing heterogeneity on grasslands through the creation of temporal and spatial diversity in plant community composition and structure and concomitant response of wildlife (Fuhlendorf and Engle 2001, entire; Fuhlendorf and Engle 2004, entire; Fuhlendorf et al. 2017a, pp. 169–196). Some landowners working in these landscapes use fire as one of many tools to manage livestock behavior, forage quantity and quality and to increase performance of livestock (Fuhlendorf et al. 2017a, pp. 169– 196). Acknowledging the role and importance of fire, grassland conservation recommendations often promote prescribed fire use and provide incentives to landowners’ use of fire through conservation program efforts such as training and education, cost share, and planning assistance. (USFWS, 2021)

Stressor: Parasites and Diseases (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Although parasites and diseases have the potential to influence LEPC population dynamics, little is known regarding the consequences of parasites or diseases at the LEPC population level (Peterson 2016, p. 173). Past adverse impacts to LEPC populations have not been observed, although diseases and parasites have been found in LEPC (Peterson 2016, p. 173). Some degree of impact from parasites and disease is a naturally occurring phenomenon for most wildlife species and is one element of compensatory mortality (the phenomenon that various causes of mortality in wildlife tend to balance each other, allowing the total mortality rate to remain constant) that operates among many species. However, there is no information that indicates parasites or disease have caused, or contributed to, the decline of any LEPC populations, and, at this time, we have no basis for concluding that disease or parasite loads are a concern to any LEPC populations. For a more detailed discussion of parasites and diseases of the LEPC, please refer to Peterson (2016, pp. 159–183). (USFWS, 2021)

Stressor: Predation (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Predation is a naturally occurring process and generally does not independently pose a substantial risk to wildlife populations, including the LEPC. Natural predation can be confounding cause for species declines when populations are extremely small, when habitat conditions have been altered to create increased predatory opportunities or increased effectiveness for predators, or when the species has an abnormal level of vulnerability to predation. The LEPC's cryptic plumage and behavioral adaptations allow the species to persist under normal predation pressures. LEPC predation varies seasonally during different life stages, with higher predation during the breeding season compared to the nonbreeding season (Boal 2016, p. 145). Although all age classes of LEPC may experience relatively constant, year-round risk from mammals, higher predation risk is seen during LEPC breeding season in the spring and summer from ravens (Corvus corax) and from various species of snakes preying on eggs and young, and during raptor migration seasons in the fall and spring from raptors preying on juveniles and adults (Boal 2016, p. 147). Adults may be most susceptible to predation while on the lek when birds are more conspicuous. Both Patten et al. (2005b, p. 240) and Wolfe et al. (2007, p. 100) reported that raptor predation increased with lek attendance. Patten et al. (2005b, p. 240) stated that male LEPC are more vulnerable to predation when exposed during lek displays than they are at other times of the year and that male LEPC mortality was chiefly associated with predation. However, during 650 hours of lek observations in Texas, raptor predation at leks was considered to be uncommon and an unlikely reason for declines in LEPC populations (Behney et al. 2011, pp. 336–337). Behney et al. (2012, p. 294) further observed that the timing of lekking activities in their study area corresponded with the lowest observed densities of raptors and that LEPC contend with a more abundant and diverse assemblage of raptors in other seasons. (USFWS, 2021)

Stressor: Collision Mortality from Fences (USFWS, 2021)
Exposure:

Response:
Consequence:
Narrative: Fencing is a fundamental tool of livestock management and is often essential for proper herd and grazing management. Fencing is used to confine livestock and prevent them from grazing areas such as public roads, agricultural fields, lands intended for hay production, outside of property boundaries, and those lands enrolled in some types of conservation programs. However, fencing, particularly at higher densities, can contribute to fragmentation of the landscape and hinder efforts to conserve grasslands on a landscape scale (Samson et al. 2004, p. 11–12). Fencing can be particularly detrimental to the LEPC in areas, such as Western Oklahoma, where initial settlement patterns favored larger numbers of smaller parcels for individual settlers (Patten et al. 2005b, p. 245). Fencing large numbers of small parcels increases the density of fences on the landscape, increasing the potential for LEPC to encounter fences during flight. In addition to direct mortality of LEPC through collisions during flight, fencing can also indirectly lead to mortality by creating hunting perches used by raptors and by facilitating corridors that may enhance movements of mammalian predators (Wolfe et al. 2007, pp. 96–97, 101). Wolfe et al. (2007, p. 101) and Patten et al. (2005b, p. 241) found high proportions of mortality to fence collisions in Oklahoma; however, the majority of studies range-wide have found little evidence that fence collisions are a large contribution to direct mortality of LEPC (Hagen et al. 2007, p. 524; Grisham and Boal 2015, p., 6; Kukal 2010, p. 54; Pirius 2011, p. 24; Robinson et al. 2016, entire). Therefore, in most areas where the landscapes have not been fenced as intensively as in Oklahoma, fence collision risk is not as high and not likely to result in population level effects. (USFWS, 2021)

Stressor: Hunting, and Other Recreational, Educational, and Scientific Use (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: In the late 19th century, LEPC were subject to commercial hunting (Jackson and DeArment 1963, p. 733; Fleharty 1995, pp. 38–45; Jensen et al. 2000, p. 170). Harvest throughout the species’ historical range has been regulated since approximately the turn of the 20th century (Crawford 1980, pp. 3–4). Currently, the LEPC is classified as a game species in Kansas, New Mexico, Oklahoma, and Texas, although authorized harvest is no longer allowed in any of the states. The LEPC has been listed as a State-threatened species in Colorado, eliminating harvest of the species under the State’s Nongame and Endangered or Threatened Species Conservation Act, since 1973. In March of 2009, Texas adopted a temporary, indefinite suspension of their previous 2-day season until LEPC populations could recover to harvestable levels. This suspension is still in effect. The hunting season for LEPC in Oklahoma has been closed since 1998, with harvest estimated to have peaked at near 16,000 birds in 1970, followed by a drastic decrease to less than a 1,000 by 1975, then rebounding to an annual estimated harvest ranging from 6,000–12,000 through the 1980s (Haukos et al. 2016, pp. 138–139). In New Mexico, the LEPC was legally hunted until 1996 (Hunt 2004, p. 39). The annual harvest in the 1960s averaged about 1,000 birds, but harvest declined to only 130 birds in 1979. Harvest rebounded a few years later, peaking in 1987 and 1988 when average harvest was about 4,000 birds (Hunt 2004, p. 39). Harvest subsequently declined through the early 1990s. In Kansas, LEPC could legally be hunted up until 2014. The bag limit was one LEPC daily south of Interstate 70, and two LEPC north of Interstate 70. For additional information on harvest of LEPC refer to Haukos et al. (2016, pp. 133–144). (USFWS, 2021)

Stressor: Livestock Grazing (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Grazing has long been an ecological driving force throughout the ecosystems of the Great Plains (Stebbins 1981, p. 84), and much of the untilled grasslands within the range of the LEPC is currently grazed by livestock and other animals. Historically, the interaction of fire, drought, prairie dogs (Cynomys ludovicianus), and large ungulate grazers created and maintained distinctively different plant communities in the Western Great Plains that resulted in a mosaic of vegetation structure and composition that maintained the prairie ecosystem that sustained LEPC and other grassland bird populations (Derner et al. 2009, p. 112). As such, grazing by domestic livestock is not inherently detrimental to LEPC management and, in many cases, is needed to maintain appropriate vegetative structure through disturbance. However, grazing practices that tend to result in overutilization of forage, as well as decreasing vegetation heterogeneity (incompatible grazing), can produce habitat conditions that differ in significant ways from the historical grassland mosaic by altering the vegetation structure and composition and degrading the quality of habitat for the LEPC. The more heavily altered conditions are the least valuable for the LEPC (Jackson and DeArment 1963 p. 733; Davis et al. 1979, pp. 56, 116; Taylor and Guthery 1980a, p. 2; Bidwell and Peoples 1991, pp. 1–2) and, in some cases, can result in areas that do not contain the biological components necessary to support the LEPC. It is important that grazing being managed at a given site to account for a variety of factors including past management, soils, precipitation and other factors to ensure that the resulting vegetative composition and structure will support the LEPC as needed management will vary across the range. (USFWS, 2021)

Stressor: Shrub Control and Eradication (USFWS, 2021)
Exposure:
Response:
Consequence:
Narrative: Shrub control and eradication are additional forms of habitat alteration that can influence the availability and suitability of habitat for LEPC (Jackson and DeArment 1963, pp. 736–737). Most shrub control and eradication efforts in LEPC habitat are primarily focused on sand shinnery oak for the purpose of increasing forage for livestock grazing. Sand shinnery oak is toxic if eaten by cattle when it first produces leaves in the spring, and it also competes with more palatable grasses and forbs for water and nutrients (Peterson and Boyd 1998, p. 8), which is why it is a common target for control and eradication efforts by rangeland managers. Prior to the late 1990s, approximately 100,000 ac (40,000 ha) of sand shinnery oak in New Mexico and approximately 1,000,000 ac (405,000 ha) of sand shinnery oak in Texas were lost due to the application of tebuthiuron and other herbicides for agriculture and range improvement (Peterson and Boyd 1998, p. 2). (USFWS, 2021)

Recovery

Conservation Measures and Best Management Practices:

-

Additional Threshold Information:

-
-

References

USFWS. 2021. Species Status Assessment for the Lesser Prairie-Chicken (Tympanuchus pallidicinctus), Version 2.2. 110 pp. + Appendices.

USFWS. 2021. Species Status Assessment for the Lesser Prairie-Chicken (Tympanuchus pallidicinctus), Version 2.2. 110 pp. + Appendices. USFWS. 2023. Recovery Outline for the Northern and Southern Distinct Population Segments of the Lesser Prairie-Chicken (Tympanuchus pallidicinctus). Southwest Region. Nine pages.

USFWS. 2021. Species Status Assessment for the Lesser Prairie-Chicken (Tympanuchus pallidicinctus), Version 2.2. 110 pp. + Appendices. USFWS. 2022. Species status assessment report for the lesser prairie-chicken (Tympanuchus pallidicinctus), Version 2.3. 109 pp. + Appendices.

SPECIES ACCOUNT: *Vireo bellii pusillus* (Least Bell's vireo)

Species Taxonomic and Listing Information

Commonly-used Acronym: LBV

Listing Status: Endangered; May 2, 1986 (51 FR 16474).

Physical Description

The least Bell's vireo is a small, olive-gray, migratory songbird (51 FR 16474). They are only 11.5 to 12.5 centimeters (about 4.5 to 5.0 inches) long, with short, rounded wings and short, straight bills. Feathers are mostly dull olive-gray above and whitish below, with a faint white eye ring and wing bars (CDFW 2005). This is a common protective marking in birds; seen from below the bird blends into the clouds, from above it blends into the land cover.

Taxonomy

All four of the subspecies of Bell's vireo are similar in behavior and life history, but are isolated from one another on both the breeding and wintering grounds. The least Bell's vireo (Vireo bellii pusillus) breeds in California and northwestern Baja California, Mexico, and winters in southern Baja California; the eastern Bell's vireo (V. b. bellii) is found in the central United States from Colorado to Tennessee; the Texas vireo (V. b. medius) is distributed in southwestern Texas and eastern Mexico; and the Arizona Bell's vireo (V. b. arizonae) occurs in Arizona, Utah, Nevada, California, and Sonora, Mexico. The three latter species winter at different longitudes on mainland Mexico and thus are apparently geographically segregated from one another on wintering grounds (USFWS 1998). The least Bell's vireo is slightly larger than the Arizona Bell's vireo, while the Arizona subspecies is more brightly colored than the least Bell's vireo (CDFW 2005).

Historical Range

The historical breeding range of the least Bell's vireo extended from interior northern California (near Red Bluff, Tehama County) to northwestern Baja California (51 FR 16474). The subspecies was once widespread and common throughout riparian woodlands in the Central Valley and low-elevation riverine valleys of California and northern Baja California (USFWS 1998). Historically, the San Joaquin and Sacramento valleys were considered to be the center of the vireo's breeding range (USFWS 2006).

Current Range

The populations are currently distributed in southern California, with 54 percent of the total population occurring in San Diego County and 30 percent of the population occurring in Riverside County (USFWS 2006). There has not yet been any meaningful recolonization of the San Joaquin and Sacramento valleys, although one breeding pair was observed in the San Joaquin Valley in 2005 and 2006, and there have been incidental sightings in the Salinas Valley (USFWS 2006).

Distinct Population Segments Defined

No

Critical Habitat Designated

Yes; 2/2/1994.

Legal Description
On February 2, 1994, the Fish and Wildlife Service (Service) designated critical habitat for the least Bell's vireo (Vireo bellii pusillus), an endangered species, pursuant to the Endangered Species Act of 1973, as amended (59 FR 4845 - 4867). This designation encompasses a total of about 36,000 acres at 10 localities in portions of 6 counties in southern California. This designation results in additional protection requirements undersection 7 of the Act for activities that are funded, authorized, or carried out by a Federal agency.

Critical Habitat Designation
The Service is designated critical habitat for the least Bell's vireo at 10 areas encompassing approximately 38,000 acres (15,200ha) in Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, and San Diego Counties, California. Critical habitat for the vireo occurs on the Santa Ynez River (Santa Barbara County), Santa Clara River (Ventura and Los Angeles Counties), Santa Ana River (Riverside and San Bernardino Counties), and Santa Margarita River, San Luis Rey River, Sweetwater River, San Diego River, Tijuana River, Coyote Creek, and Jamul-DuLzura Creeks (San Diego County).

1. Santa Ynez River, Santa Barbara County. T. 5 N.,R. 27 W: secs. 1, W½, and 12, all except NE1/4. In addition, all adjacent lands within the following circumscribed area: beginning at a point 0.25 mi south of the northeast corner of sec. 12, T. 5 N., R. 27 W.; thence east about 0.5 mi; thence north about 1.25 mi; thence east approximately 1.3 mi to the intersection of Mono Creek and the Los Prietos Y Najalayegua land grant boundary; thence south about 2.5 mi; thence east approximately 2.6 mi to Agua Caliente Creek (at a point about 0.4 mi north and 0.1 mi east of the Pendola Guard Station); thence south about 0.5 mi; thence east about 1.0 mi; thence south about 0.25 mi; thence east about 0.5 mi; thence south about 0.75 mi to the southwest corner of T. 5 N., R. 25 W., sec. 19; thence east to the southeast corner of T. 5 N., R. 25 W., sec 20; thence south about 0.63 mi; thence west to western boundary of T. 5 N., R. 26 W., sec. 25; thence south about 0.16 mi; thence west to eastern boundary of T. 5 N., R. 26 W., sec. 27; thence north about 0.25 mi; thence west to western boundary of T. S N., R. 26 W., sec. 27; thence north to the northeastern corner of T. 5 N., R. 26 W., sec. 27; thence north to the northeastern corner of T. 5 N., R. 26 W., sec. 28; thence west to the northwest corner of T. 5 N., R. 26 W., sec. 28; thence north to the northeast cornerof T 5 N., R. 26 W.. partially unsurveyed sec. 20 thence west to the northeastcorner of T. 5 N., R. 26 W., unsurveyed sec. 19; thence north about 0.5 mi; thence west to the southeast corner of T. 5 N., R. 27 W., sec. 13 NE1/4; and thence north to the southeast corner of T. 5 N., R. 27W., sec. 12.

2. Santa Clara River, Los Angeles and Ventura Counties. T. 4 N., Rs. 17 and 18 W.: all land within 3,500 feet perpendicularly and generally southward or westward of a line commencing at a point 100 yards west of BM 740 (a point about 2.3 mi east of the intersection of Main Street and State Highway 126 in Piru); thence east along State Highway 126 to its intersection with The Old Road at Castaic Junction; and thence eastward and southward along The Old Road to its intersection with Rye Canyon Road.

3. Santa Asia River, Riverside and San Bernardino Counties. All lands belowthe 543-foot contour in partially surveyed T. 3 S., R. 7 W., within the Prado Flood Control Basin (upstream from Prado Dam). In addition, the following adjacent lands above the 543-foot contour in the Santa Ana River

bottom and within the following boundaries: commencing at a point 0.1 mi east and 0.2 mi north of the southwest corner of sec. 2, T. 3 S., R. 7 W.; thence north about 0.4 mi; thence to a point 0.25 mi east and 0.4 mi north of southwest corner of sec. 31, T. 2 S., R. 6 W.; thence to the northeast corner of sec. 31, T. 2 S., R. 6 W.; thence east 0.35 mi; thence to midpoint of southern section line of sec. 21, T. 2 S., R. 6 W.; thence to a point 0.6 mi south of the northwest corner of sec. 25, T. 2 S., R. 6W.; thence east about 0.6 mi; thence to a point 0.2 mi north of the center of sec. 30, T. 2 S., R. 5 W.; thence east about 0.7 mi; thence to a point 0.6 mi east of the southwest corner of sec. 20, T. 2 S., R. 5 W.; thence east about 0.8 mi; thence 0.6 mi south; thence to a point 0.3 mi north of the southwest corner of sec. 28, T. 2 S., R. 5 W.; thence to a point 0.45 mi north of the southwest corner of sec. 29, T. 2 S., R. 5 W.; thence generally westward and southward along the Riverside Corporation Boundary (as shown on USGS Riverside Quadrangle 1980) to its Intersection with Van Buren Blvd.; thence to a point 0.2 mi east and 0.75 mi south ofthe northwest corner of sec. 27, T. 2 S., R. 6 W.; thence 0.25 mi north; thence 0.7 mi west; thence to a point 0.85 mi north of the southwest corner of sec. 32, T. 2 S., R. 6 W.; thence to a point 0.75 mi west and 0.1 mi south ofthe northeast corner of sec. 6, T. 3 S., R. 6 W.; thence 0.5 mi west; and thence to the 543-foot contour at a point 0.3 mi west of the southeast corner of sec. 2, T. 3 5., R. 7 W.

4. Coyote Creek. San Diego County. T. 9 S., R. 5 E.: secs. 22, N½,S E¼;and 23, SW¼.

5. Santa Margarita River, San Diego County. T. 9 S., R. 3 W.: secs. 4, all lands below the 600-foot contour; 5 SE1/4; 7; and 8. In T 9 S., R. 4 W., Sec. 12 E1/2; 13 NE¼.

6. San Luis Rey River, San Diego County. T. 11 S., R. 5 W.:s ecs. 13, S½NE¼, SE1/4NW1/4, SW1/4; 14, SE¾SW¾, S12SE1/4; and 23, NW1/4. T. 11 S., R. 4 W.: secs. 3, all land north of Murray Road; 4, E½NE¼, E1/2 SE¼SW1/4W½NE¼SE1/4E½NW1/4SE1/4, SW1/4 SE1/4; 7,N½NE¼NE1/4, NW¼NE¼, E½W½. SW1/4SW1/4; 8, N½NE1/4,N½N½NW¼; 9, N1/2SNW1/4; and 18, NW1/4. T. 10 S., R. 4 W.: sec. 34, S1/2SW¼. Surveyed and unsurveyed portions according to the following metes and bounds; bordered on the north by a line commencing at the intersection of North RiverRoad and the surveyed eastern section line ofsec. 3, T. 11 S., R. 4 W.; thence east along said road to its junction with Via Puerta Del Sol; thence east approximately 0.5 mi to State Highway 76 nearest the midpoint of sec. 31, T. 10 S., R. 3 W.; thence northward and eastward along said highway to its intersection with theeastern section line of sec. 27, T. 9 S., R. 2 W.; and bordered on the south by a line commencing at the intersection of Murray Road and the surveyed eastern section line of sec. 3, T. 11 S., R. 4 W.; thence southward and eastward along said road to its junction with State Highway 76; thence eastward and northward along said highway to itsjunction with Santa Fe Avenue; thence southeastward 3,000 feet along said avenue; thence northward along a straight line to Guajome Lake Road at a point 800 feet from thejunction of said road and State Highway 76; thence northwestward along Guajome Lake Road to its junction with said highway; thence eastward along said highway to its junction with River Road in sec. 31, T. 105., R. 3 W.; thence northward along said road to its intersection with the surveyed eastern section line of sec. 20. T. 10 S., R. 3 W.; thence north to andnortheasterly along the 250-foot contour in sec. 21 through partially surveyed sec. 15, T. 10 S., R. 3 W.; thence north to a point about 0.2 mi south of the northwest corner of sec. 14 and continuing along the 300-foot contour from the western section line ofsec. 14 eastward through unsurveyed sec. 11, surveyed secs. 13 and 12, T. 10S., R. 3 W.; and surveyed sec. 18, T. 10S., R. 2 W.; thence east to and along the 325-foot contour through sec. 1, T. 10 S., R. 3 W.; thence south to and along the 350-foot contour in secs. 6 and 5, T. 10S., R. 2 W., and secs. 32 and 33, T. 9 S., R. 2 W., to the northern section line of

sec. 33; thence eastapproximately 1.5 mi to the southeastern corner of sec. 27, T. 9 S., R. 2 W.; and thence north about 0.4 mi to State Highway 76 in Pala.

7. San Diego River, San Diego County. T. 15 S., Rs. 1 and 2 W.: commencing at the intersection of the Second San Diego Aqueduct and Mission Gorge Road; thence eastward along said road to the western-most intersection with Father Junipero Serra Trail; thence northward and eastward along said trail to theeastern-most intersection of said trail and said road; thence eastward along Mission Gorge Road to its intersection with Canton Hills Blvd.; thence northward to its intersection with Canton Oaks Drive; thence westward along said drive to its eastern-most intersection with Inverness Road; thence westward alongsaid road to its intersection with Carlton Oaks Drive; thence westward along said drive to its intersection with Mast Street; thence westward and southward along the 320-foot contour to its intersection with the Second San Diego Aqueducton the north side of the Sail Diego River; thence southeastward along said aqueduct to its intersection with Mission Gorge Road.

8. Sweetwater River, San Diego County. T. 16 and 17 S., R. 1 W.: commencing at the intersection of the 320-foot contour and 116o58o14”W longitude immediately north of the confluence of Sweetweter River and Sweetwater Reservoir; thence eastward along the contour to the intersection of said contour with State Highway 94; thence northward along said highway to its intersection with State Highway 54; thence northeastward along said highway to the San Bernardino Meridian; thence south approximately 1,500 feet to the intersection with the 340-foot contour; thence westward and southward along said contour to the south end of the Steele Canyon Bridge on State Highway 94; thence south approximately 900 feet to the 340-foot contour; thence southwesterly along said contour to its intersection with 116o58o14”W longitude; thence north to starting point.

9. Jarnul-Dulzura Creeks, San Diego County. T. 17 and 18 S., R. 1 E.: commencing from a point approximately 2,200 feet west of BM 515 along Otay Lakes Road, in sec. 5, T. 18 S., R. 1 E.; thence east approximately one mile to the crossing of said road at a bridge over Jamul Creek, including all land within 1,500 feet southward of Otay Lakes Road as measured perpendicularly from the road; thence eastward for about 2.4 mi along said road and including all lands within 1,500 feet northward ofsaid road as measured perpendicularly from the road, and including all lands within 500 feet of said bridge not otherwise included above.

10. Tijuana River, San Diego County. T. 18 S., R 2 W.: secs. 34, S½SE1/4SE1/4; and 35, S½SW¼, SW1/4SW1/4SE¼. T. 19 S., R. 2 W.; secs. 1, W½SW¼NW¾: 2, S½NE¼NE¼, NW¼NE¼, N½SE1/4 NE1/4, N½NE¾NW¾, W½NW¼; 3, N½;and 4, NE¾,N½NW¼.

Primary Constituent Elements/Physical or Biological Features

Primary constituent elements: riverine and floodplain habitats (particularly willow-dominated riparian woodland with dense understory vegetation maintained, in part, in a non-climax stage by periodic floods or other agents) and adjacent coastalsage scrub. chaparral, or other upland plant communities.

Special Management Considerations or Protections

Activities that disturb or remove the primary constituent elements within proposed critical habitat areas may constitute destruction or adverse modification of critical habitat. In the case of the vireo, these activities include: (1) Removal or destruction of riparian vegetation, (2) thinning of riparian growth, particularly near ground level, (3) removal or destruction of adjacent chaparral or other upland habitats used for foraging, and (4) increasesin human-associated or human-induced disturbance.

Life History

Feeding Narrative

Juvenile: See Adult life stage narrative.

Adult: Least Bell's vireos are invertivores that opportunistically prey on insects (beetles, grasshoppers, moths, and caterpillars), spiders, snails, and fruits (NatureServe 2015; USFWS 1998). They glean prey from leaves and bark and occasionally by hovering in the air (NatureServe 2015). Foraging occurs most often in dense brush and less frequently in treetops in riparian and adjacent chaparral habitat (51 FR 16474, NatureServe 2015). Approximately 70 percent of foraging occurs about 180 to 270 m (600 to 900 ft.) from the nest site (51 FR 16474).

Reproduction Narrative

Juvenile: See Adult life stage narrative.

Adult: Least Bell’s vireos arrive in their breeding habitats in mid-March to early April, with males arriving in advance of females by several days. Males establish and defend territories through counter-singing, chasing, and sometimes physically confronting neighboring males. Monogamous breeding pairs form, and parents construct a nest over the course of 4 to 5 days (USFWS 1998). Nests are constructed in low thickets (within 1 m [3 ft.] of the ground) along willow-dominated riparian habitat. Egg-laying begins 1 to 2 days after nest construction, and females typically lay three to four eggs per nest. Eggs are incubated by both parents for approximately 14 days. Hatchlings remain in the nest and are fed by both parents for 10 to 12 additional days; adults continue to care for the young for at least 2 weeks after fledging (51 FR 16474; USFWS 1998). Breeding pairs may nest as many as five times in a single breeding season, although most pairs fledge young from only one or two nests. Factors leading to nest failure include nest parasitism by brown-headed cowbirds (Molothus ater), and egg predation by various species (USFWS 1998). Annual rates of fledging success per egg laid have ranged from 0.37 to 0.75 fledgling per egg (USFWS 1998). Least Bell's vireos depart in late August and September for their wintering range in Mexico (51 FR 16474).Between 5 and 29 percent of juveniles survive to their first breeding season (USFWS 1998). Those that survive return to breed after their first winter. Individuals can live up to 7 years, and females can produce as many as 140 eggs during their lifetime (7-year lifespan, three to four eggs per nest, up to five nests per breeding season) (USFWS 1998).

Spatial Arrangements of the Population

Juvenile: Random; territory size ranges from 0.2 to 3.0 hectares (ha) (0.5 to 7.5 acres [ac.]) (USFWS 1998).

Adult: Random; territory size ranges from 0.2 to 3.0 ha (0.5 to 7.5 ac.) (USFWS 1998).

Environmental Specificity

Juvenile: Narrow; specialist or community with key requirements common.

Adult: Narrow; specialist or community with key requirements common.

Tolerance Ranges/Thresholds

Juvenile: Moderate

Adult: Moderate

Site Fidelity

Juvenile: Once birds select a breeding site they often return to it year after year, sometimes even nesting in the same nest tree or shrub (USFWS 1998).

Adult: Once birds select a breeding site they often return to it year after year, sometimes even nesting in the same nest tree or shrub (USFWS 1998).

Habitat Narrative

Juvenile: See Adult life stage narrative.

Adult: Least Bell’s vireos inhabit dense, willow-dominated early successional riparian habitat with lush understory vegetation in the immediate vicinity of water courses (51 FR 16474; USFWS 1998). Optimal least Bell’s vireo habitat consists of riparian woodland vegetation that generally contains both canopy and shrub layers, and includes some associated upland habitats. Two habitat features appear to be essential to least Bell's vireo: (1) the presence of dense cover within 1 to 2 m (3 to 6 ft.) of the ground, where nests are typically placed; and (2) a dense, stratified canopy for foraging (USFWS 1998). The selection of breeding sites does not appear to be limited to riparian stands of a specific age, although least Bell's vireos are characterized as preferring early successional riparian habitat. However, vegetation structure more than simply age appears to be the important determinant of site use; early successional riparian habitat typically supports the dense shrub cover required for nesting, and for a structurally diverse canopy for foraging. Little is known about the least Bell's vireo's wintering habitat requirements, although it appears that they are not exclusively dependent on riparian habitat on the wintering grounds (USFWS 1998).Least Bell’s vireos maintain territories ranging from 0.2 to 3.0 ha (0.5 to 7.5 ac.). They have high site fidelity, often returning to the same breeding site year after year and sometimes even nesting in the same tree or shrub (USFWS 1998). The quantity and integrity of least Bell’s vireo habitat is threatened by human activity including agriculture, construction of dams, water diversion into canals, livestock grazing, and urban development (USFWS 1998; USFWS 2006).

Dispersal/Migration

Motility/Mobility

Juvenile: High; individuals travel approximately 3,200 kilometers (km) (2,000 miles [mi.]) annually between breeding and wintering grounds (USFWS 1998).

Adult: High; individuals travel approximately 3,200 km (2,000 mi.) annually between breeding and wintering grounds (USFWS 1998).

Migratory vs Non-migratory vs Seasonal Movements

Juvenile: Migratory

Adult: Migratory

Dispersal

Juvenile: High; most first-time breeders return to their natal sites to nest, but an average of approximately 20 percent disperse to other drainages as far as 210 km (130 mi.) from their natal sites (USFWS 1998).

Adult: Moderate

Immigration/Emigration

Juvenile: High

Adult: Moderate

Dependency on Other Individuals or Species for Dispersal

Juvenile: No

Adult: No

Dispersal/Migration Narrative

Juvenile: See Adult life stage narrative.

Adult: Least Bell's vireos migrate approximately 3,200 km (2,000 mi.) annually between breeding grounds in southern California and northwestern Baja California, Mexico, and wintering grounds in southern Baja California, Mexico (USFWS 1998). Juveniles breed after their first winter, and most first-time breeders return to their natal nest sites (USFWS 1998). However, approximately 20 percent of first-time breeders disperse to other drainages as far as 210 km (130 mi.) from their natal sites (USFWS 1998). After the first breeding year, most least Bell's vireos return to the same breeding location year after year (USFWS 1998).

Population Information and Trends

Population Trends:

Increasing; population growth has been the greatest in San Diego County (621 percent increase) and Riverside County (2,997 percent increase), with lesser but significant increases in Orange, Ventura, San Bernardino, and Los Angeles counties. The population in Santa Barbara County has declined 54 percent since the original listing, although it is uncertain whether this population was historically significant (USFWS 2006).

Species Trends:

Increasing; the population has grown during each 5-year period since the original listing, although the rate of increase has slowed over the last 10 years. The population has increased tenfold since its listing in 1986, from 291 to 2,968 known territories (USFWS 2006).

Population Growth Rate:

Long-term decline of greater than 90 percent, short-term increase of greater than 25 percent (NatureServe 2015).

Number of Populations:

Eleven populations in southern California contain approximately 90 percent of the known vireo territories (USFWS 2006).

Population Size:

The number of territories in California was estimated as 2,968, with 84 percent in San Diego and Riverside counties (USFWS 2006). Population size in Mexico is unknown but presumably less than that in the United States (NatureServe 2015).

Resistance to Disease:

Low

Additional Population-level Information:

In 2005 and 2006, one least Bell's vireo breeding pair was observed in the San Joaquin Valley. There have also been sightings of individuals in the Salinas Valley. However, least Bell's vireos do not appear to have successfully recolonized the San Joaquin or Salinas valleys as of 2006 (USFWS 2006).

Population Narrative:

In the long term, the abundance of least Bell’s vireos has declined by more than 90 percent. However, the population has begun to rebound since its listing in 1986; the subspecies has grown tenfold in numbers, with a short-term population growth rate of more than 25 percent. Numbers of least Bell’s vireos have grown during each 5-year period since the subspecies’ listing, although the rate of increase has slowed over the last 10 years (USFWS 2006).There are 11 populations of least Bell's vireo in southern California that contain approximately 90 percent of the known vireo territories (USFWS 2006). The number of territories in California was estimated as 2,968, with 84 percent in San Diego and Riverside counties (NatureServe 2015). Population size in Mexico is unknown, but is presumably less than that in the United States (NatureServe 2015). Population growth has been the greatest in San Diego County (621 percent increase) and Riverside County (2,997 percent increase), with lesser but significant increases in Orange, Ventura, San Bernardino, and Los Angeles counties (USFWS 2006). The population in Santa Barbara County has declined 54 percent since the original listing, although it is uncertain whether this population was historically significant (USFWS 2006).In 2005 and 2006, one least Bell's vireo breeding pair was observed in the San Joaquin Valley. There have also been sightings of individuals in the Salinas Valley. However, least Bell's vireos do not appear to have successfully recolonized the San Joaquin or Salinas valleys as of 2006 (USFWS 2006).

Threats and Stressors

Stressor: Habitat loss and degradation
Exposure: Human activities including agriculture, dam construction, flood control, diverting water to canals, livestock grazing, and urban development.
Response: Habitat loss and degradation.
Consequence: Less available habitat for least Bell's vireos.
Narrative: As human populations increased in California, an estimated 95 percent of riparian woodlands were cleared, primarily for agricultural purposes. Rivers were diked to prevent winter flooding of bottomlands. Dams were built to impound water for agricultural, industrial, and

domestic use. As a result, large amounts of least Bell's vireo breeding habitat were inundated or removed. Impounding water upstream and diverting water to canals and cropland lowered water tables downstream so that dense vegetation could not grow or was reduced. Flood control projects and channelization of rivers further reduced available least Bell's vireo habitat. Livestock grazing destroyed the choice lower strata of vegetation preferred by the least Bell's vireo, and provided foraging areas for brown-headed cowbirds. As the state's human population continues to increase, highway projects and urban, commercial, and recreational developments continue to encroach on what little riparian habitat remains. Similar activities are responsible for the decline of riparian habitat in Baja California.

Stressor: Brood parasitism
Exposure: Brood parasitism by brown-headed cowbirds.
Response: Reduced nesting success.
Consequence: Declining populations of least Bell's vireos.
Narrative: Declines in the least Bell's vireo population brought about by extensive habitat loss and degradation have been exacerbated by parasitism by the brown-headed cowbird. Cowbirds are distinguished by their unusual reproductive strategy of laying eggs in the nests of other species, leaving the "host" to raise the cowbird young, generally at the expense of the host's own young. The least Bell's vireo is a common host and readily accepts cowbird eggs, leading to lower nesting success. Nest predation rates on vireos can exceed 60 percent of the vireo nests in a given area within a year, but typical nest predation rates average around 30 percent.

Stressor: Urbanization
Exposure: Urban development.
Response: A.) Displacement of former agriculture and grazing, and B.) Increased habitat fragmentation and decreased riparian/urban buffering.
Consequence: A.) Reducing riparian habitat degradation caused by agriculture, potentially leading to recovery of populations, and B.) Habitat degradation due to fragmentation and proximity to urban development, potentially leading to increased predation and reductions in population size.
Narrative: Urbanization appears to have displaced former agriculture and grazing operations in many areas in southern California, thereby indirectly reducing riparian habitat degradation caused by these activities. Agriculture and grazing continue to threaten riparian habitat within the larger historic range, particularly in the Salinas, San Joaquin, and Sacramento valleys. Where the impacts of grazing and agriculture are reduced as a consequence of displacement by urbanization, improved habitat quality may come at the cost of increased habitat fragmentation and decreased riparian/urban buffering.

Stressor: Invasive plants
Exposure: Invasion by giant reed and other exotic plant species.
Response: Displacement of riparian habitat.
Consequence: Less available habitat for least Bell's vireos.
Narrative: In the past decade, control of giant reed and other exotic plants has been and continues to be systemically conducted on both the Santa Ana River and at Camp Pendleton. This effort has been effective at removing giant reed over large portions of these specific population areas. Recovery of riparian habitat after giant reed removal has been limited at some locations, but recovery has been more noticeable on the Santa Ana River near Prado Basin. Although control of giant reed has made great progress since the original listing of the vireo, invasions by

other exotic plants (e.g. Tamarix species and perennial pepperweed [Lepidium latifolium]) continue to degrade existing riparian habitat and impede recovery efforts.

Stressor: Predation
Exposure: Increased exposure to predators at urban interfaces.
Response: Higher rates of predation.
Consequence: Potential for local extirpation of small, isolated least Bell's vireo populations.
Narrative: In highly urbanized areas, where habitat is fragmented and upland plant community buffers are minimal or nonexistent, there is a potential for an increase in nest and adult predation due to mesopredator release and/or the addition of nonnative predators (i.e., domestic cats [Felis catus]). This may lead to local extirpation of small, isolated bird populations. Argentine ants (Linepithema humile) has been observed to be a predator of vireo nests where they co-occur. Argentine ants may pose a problem to vireos if the riparian-urban interface of occupied vireo habitat increases without adequate buffers.

Recovery

Reclassification Criteria:
The following criteria are from a draft recovery plan for the least Bell's vireo (USFWS 1998). This plan was never finalized and remains in draft form. The 5-year review suggests revisions that should be made to finalize the recovery plan, including modifying and refining recovery goals and strategies, addressing a solution to the underlying threats that led to the initial decline and listing, and revising downlisting and delisting criteria to incorporate population dynamics and observed growth since the subspecies' listing (USFWS 2006). The 5-year review also recommends downlisting the least Bell's vireo to threatened status (USFWS 2006).

Reclassification to threatened may be considered when the following criterion has been met for a period of five consecutive years: stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, are protected and managed at the following sites: Tijuana River, Dulzura Creek/Jamul Creek/Otay River, Sweetwater River, San Diego River, San Luis Rey River, Camp Pendleton/Santa Margarita River, Santa Ana River, an Orange County/Los Angeles metapopulation, Santa Clara River, Santa Ynez River, and an Anza Borrego Desert metapopulation.

Recovery Priority Number: 9C

Delisting Criteria:
The following criteria are from a draft recovery plan for the least Bell's vireo (USFWS 1998). This plan was never finalized and remains in draft form. The 5-year review suggests revisions that should be made to finalize the recovery plan, including modifying and refining recovery goals and strategies, addressing a solution to the underlying threats that led to the initial decline and listing, and revising downlisting and delisting criteria to incorporate population dynamics and observed growth since the subspecies' listing (USFWS 2006). The 5-year review also recommends downlisting the least Bell's vireo to threatened status (USFWS 2006).

Delisting may be considered when the species meets the criterion for downlisting, and the following criteria have been met for five consecutive years:

Stable or increasing least Bell's vireo populations/metapopulations, each consisting of several hundred or more breeding pairs, have become established and are protected and managed at the following sites: Salinas River, a San Joaquin Valley metapopulation, and a Sacramento Valley metapopulation.

Threats are reduced or eliminated so that least Bell's vireo populations/metapopulations listed above are capable of persisting without significant human intervention, or perpetual endowments are secured for cowbird trapping and exotic plant (Arundo) control in riparian habitat occupied by least Bell's vireo.

Recovery Actions:

- The following list includes recovery criteria from the draft recovery plan (USFWS 1998) and recommended future actions from the 5-year review (USFWS 2006). The recovery plan was never finalized and remains in draft form.
- Protect and manage riparian and adjacent upland habitats within the least Bell's vireo's historical range by developing management plans for the 14 population/metapopulation units (Tijuana River, Dulzura Creek/Jamul Creek/Otay River, Sweetwater River, San Diego River, San Luis Rey River, Camp Pendleton/Santa Margarita River, Santa Ana River, Orange County/Los Angeles County, Santa Clara River, Santa Ynez River, Anza Borrego Desert, Salinas River, San Joaquin Valley, and Sacramento Valley), preparing management plans for least Bell's vireo habitats, establishing a protocol for monitoring least Bell's vireo populations and habitat, conducting annual monitoring of the 14 population/metapopulation units, continuing cowbird removal, developing alternative means of controlling cowbird parasitism, controlling nonnative plant species, and establishing perpetual endowments for brown-headed cowbird control and/or exotic plant control in least Bell's vireo habitat (USFWS 1998).
- Conduct research, including identifying additional and potential least Bell's vireo breeding habitat within its historical range (by conducting a statewide inventory of riparian habitat and conducting thorough range-wide surveys); investigating the status of wintering habitat and identifying current or potential threats (including establishing a cooperative agreement with Mexico to obtain information on vireo wintering grounds in Baja California, Mexico); collecting demographic data on least Bell's vireos (by continuing color-banding least Bell's vireos and collecting data for demographic and dispersal analyses, determining the relationships between population density and reproductive characteristics, and determining the relationships between population density and dispersal); investigating the relationship between habitat characteristics, least Bell's vireo behaviors, and access to necessary resources; and developing biocontrol methods for Arundo and other nonnative plant species (USFWS 1998).
- Develop and evaluate least Bell's vireo habitat restoration techniques by implementing long-term monitoring of restoration sites and their use by least Bell's vireos and other riparian species, developing less costly methods of creating sites with the vegetation composition and structure required by nesting least Bell's vireos, evaluating restoration efforts and effectiveness of methods used, and conducting habitat restoration (USFWS 1998).
- Reintroduce least Bell's vireos to unoccupied habitat in the historical range through translocation (USFWS 1998).
- Evaluate progress of recovery and effectiveness of management and recovery actions, and revise management plans (USFWS 1998).

- Provide public information and education (USFWS 1998).
- Complete a functional recovery plan for the vireo with realistic, objectively based recovery goals (USFWS 2006).
- Provide funding and technical support for further studies investigating continuing threats to the vireo from cowbird parasitism, exotic plant invasion of riparian habitats, and potentially elevated predation pressures due to habitat fragmentation or presence of exotic predators (i.e., domestic cats and Argentine ants) (USFWS 2006).
- Complete an assessment or support other efforts (such as the Riparian Habitat Joint Venture effort) to assess the amount and distribution of riparian habitat in California, including: a) establishment of baseline values for comparison to past and future estimates, including an assessment of various riparian habitat subtypes; b) an evaluation of changes in distribution and connectivity of riparian habitat at different stream-order levels (primary, secondary, tertiary, etc.); and c) an evaluation of the amount of riparian habitat restoration attempted and successfully completed since the listing, including restoration not driven by regulatory compliance (USFWS 2006).
- Develop and implement: a) a systematic survey program to locate vireo re-colonizations of the Salinas, San Joaquin, and Sacramento valleys so that appropriate management can be developed and implemented; and b) systematic survey programs for watersheds in southern California that are no longer regularly surveyed within a given 5-year period (e.g., Dulzura Creek/Jamul Creek/Otay River, San Diego River, San Dieguito River/Santa Ysabel Creek, and San Gabriel River). It is possible that these systematic surveys may need to rely on volunteer efforts organized and supported by the U.S. Fish and Wildlife Service (USFWS 2006).
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Additional Threshold Information:

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