Integration and Synthesis Summary for Birds

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined will “likely be adversely affected” by the proposed action. Our jeopardy analysis of the proposed action’s impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine each individual species’ rankings, including environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how rankings were assessed and combined are in Appendix E. Status of the Species for each species can be found in Appendix B.

Vulnerability

For the bird species that we or EPA determined are “likely to be adversely affected” by the proposed action, we considered several factors for each species to determine the current vulnerability of that species to additional stressors. This effort allows us to consider whether a species’ current condition is stable, moving toward recovery or further decline. In general, we expect the species’ vulnerability to additional stressors to be higher if they are moving toward further decline than if they their condition is improving. We also identify which species are most (and least) susceptible to additional stressors in general based on information that could be surmised from species listing and recovery documents, or other sources as cited and considered in the Status section of this biological opinion.

Our assessment of vulnerability focuses on six factors: (1) the species listing status and recent 5-year status review recommendation (if available), (2) distribution, (3) number of populations, (4) species population trends, (5) if pesticides have been noted as a threat, and (6) impacts from activities associated with environmental baseline and cumulative effects. We obtained the information to create the vulnerability summary from the Status of the Species accounts (Appendix B), the overarching Environmental Baseline section of this Opinion, 5-year species status reviews, species recovery plans, species status assessments, and other sources containing the best available scientific information for the species.

We scored each of the six vulnerability components with high, medium, or low scores. We assigned a high vulnerability ranking to a species if all vulnerability components were scored as medium or high. We assigned a medium vulnerability ranking if a species’ scores were a mix of high, medium, and low (though exceptions were allowed for species that have a low status score or have an uplisting recommendation). We assigned a low vulnerability ranking to species with only low scores. Considerations regarding specific aspects of the species’ vulnerability or beyond what was included in the vulnerability ranking were applicable for some species depending on unique aspects of their life history. This information is reflected in the rationales for conclusion below.

Exposure

We anticipate birds will primarily be exposed to carbaryl through inhalation and dermal contact with residues on surfaces or in the air, we anticipate that the main route of exposure for mammals is dietary, through the consumption of contaminated food items. Carbaryl degrades quickly in natural environments (i.e., within a few days) and as such is not likely to persist in species' habitats for long periods of time.

Exposure to Agricultural Uses

We characterize the expected level of exposure using overlaps between the species' ranges and agricultural areas where carbaryl is registered for use (i.e., overlap data, including a 30-m off-site transport area adjacent to use sites), past carbaryl usage data (when available; the amount and location where carbaryl has been used in the past), any species-specific considerations such as life history information (e.g., habitat preferences, dispersal behavior), and existing protections or conservation actions (e.g., existing label measures, conservation measures from the action agency). Species with greater than 10% overlap between their range and agricultural carbaryl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps with carbaryl use sites, we considered past carbaryl usage data within a species' range to determine how much of a species' range we expect to be treated with carbaryl each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the Usage Analysis section of this biological opinion. Species that data indicate will have a large portion of their range (>10%) treated with carbaryl each year are assigned a high usage score. Species with 5-10% total usage are assigned a medium usage score, and species with less than 5% total usage are assigned a low usage score. Agricultural uses of carbaryl in the state of Hawaiʻi are no longer registered; however, agricultural uses are still registered for other island territories.

We determine the overall exposure ranking by qualitatively considering both the total overlap and total usage, as well as any additional exposure considerations that might modify the level of exposure likely to occur. When overlap and usage scores are the same, we assign the overall exposure ranking the same score (e.g., if both overlap and usage is high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions. (As usage is a subset of overlap, the overlap score will always be greater than the usage score). In cases where overlap is high, but usage is low, we anticipate a large portion of the range may be treated over the duration of the proposed action even if only a small portion of the range is treated in any given year (particularly if the areas treated occur in different locations each year), leading to an overall exposure ranking of medium. Past usage data for carbaryl is not available for species located on Pacific or Caribbean islands, including the Commonwealth of the Northern Mariana Islands, Guam, American Sāmoa, U.S.

Virgin Islands, and Puerto Rico. Thus, in the absence of any additional exposure considerations for these species, our ranking is based on total overlap of carbaryl use sites for species that occur in these areas. For all species, where there are additional exposure considerations, we adjust the overall exposure ranking to reflect this additional information, as appropriate.

Exposure to Non-agricultural Uses

Carbaryl has several registered non-agricultural uses, including use sites within developed, open space developed, nurseries, rangeland, managed forests, and rights of way Use Data Layers (UDLs). Rights of way includes roadsides, and we refer to roadsides when applicable. In many cases, data provided by EPA indicate low to high levels of overlap between species' ranges and non-agricultural UDLs. However, UDLs for non-agricultural uses tend to be less defined than those for agricultural UDLs and may not accurately represent the actual footprint of these use sites on the landscape. As such, we assess exposure of species to non-agricultural uses of carbaryl in a qualitative manner, considering the life history of species, methods of application, carbaryl usage, and any existing conservation measures to reduce drift and runoff or otherwise limit exposure to species. To facilitate this analysis, for every species in this Appendix, we reviewed species' documents (e.g., 5-Year Reviews, recovery plans, listing rules) to determine if the species and their prey/food resources occur on non-agricultural carbaryl use sites (i.e., managed forests, rights of way, developed, open space developed, nurseries, or rangelands) and the manner in which they may rely on these sites.

For most species, we anticipate that non-agricultural uses will not meaningfully add to the overall level of anticipated exposure considered in our analysis of agricultural uses and discuss each use in more detail in the *Overall Considerations for the Opinion* section of this Opinion. Briefly, we expect listed species are generally not likely to be exposed to non-agricultural uses of carbaryl as there are low levels of past usage and several existing mitigation measures that are protective of listed species. Usage data summarized by the EPA indicate that all non-agricultural UDLs have very low levels of past usage (at most 2.5% treatable areas treated with carbaryl annually). Some use patterns, like rights of way, have particularly low usage, with less than 500 lbs. of carbaryl applied nationally each year.

Additionally, based on application information, we anticipate carbaryl use in these UDLs are restricted to small application areas that are treated infrequently over long periods of time. Use patterns like forestry, rangeland, or rights of way may also be geographically restricted as available past usage data indicate carbaryl usage only occurs in certain areas of the country, such as the western conterminous U.S. Available usage data from the U.S. Forest Service indicate that, over a five-year period (from 2016-2020), the Forest Service treated 322 acres of forests in California and 557 acres of forests across three Forest Service Regions (covering North Dakota, Montana, South Dakota, Idaho, Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada), with the majority of applications taking place in small areas (less than 1 acre in size). Similarly, usage data from the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) show limited past carbaryl usage as well. From 2019-2023, APHIS as treated 92,309 acres of rangeland in seven states (Arizona, Idaho, Montana, Nevada, Utah, Washington, Wyoming) and 25 counties. While this represents a large area overall, when distributed across the areas within the seven states where usage occurs, we anticipate only a small percentage of any species' range is likely to be treated for this use pattern. Additionally, all but one of these applications were made using carbaryl bait, which we expect has a much lower risk profile as bait applications are not likely to attract most bird species or result in spray drift or contact exposure.

Additionally, there are several existing conservation and mitigation measures for non-agricultural uses of carbaryl that will reduce the likelihood of exposure to listed species. For example, from the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the areal extent that can be treated on many use sites within the developed, open space developed, and nurseries UDLs. Similarly, we anticipate all rangeland applications of carbaryl will be carried out in association with USDA APHIS as part of their grasshopper and Mormon cricket suppression programs (USFWS 2024), which include many conservation measures that are meant to protect listed species from exposure. Examples of measures include a reduced agent area treatment strategy that minimizes the amount of pesticide applied within a treatment block, allowance of only one application per year, reduced application rates, minimized treatment area size within 500 feet and 1,000 feet from listed species ranges for ground and aerial applications, respectively, and extended application buffers when applications are made near the listed species' habitat (e.g., up to 750 feet for some ground applications and up to a mile for some aerial applications).

To assess the likelihood of exposure to non-agricultural uses of carbaryl, we conducted a habitat assessment for each listed species, incorporating available information regarding habitat preferences, known occurrences, relevant life history traits or behaviors, as well as relevant available usage data (summarized in the above sections). For species that are known or presumed to occur in non-agricultural use sites, we consider, individually and qualitatively, the extent and manner of non-agricultural carbaryl usage within the species range to generally determine whether a small, moderate, or large number of individuals are likely to be exposed and the expected level of adverse effects from non-agricultural exposure of carbaryl.

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[1] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed

[1] While our Opinion considers all consequences of the proposed action (per the definition of effects of the action at 50 CFR Part 402.02), the terms "direct" and "indirect" effects were used in EPA's BE, and are used in

to carbaryl at levels estimated by EPA's environmental exposure modeling and is focused on determining the level of adverse effect expected to occur once exposure has taken place. Direct effects are based on the anticipated level of mortality and sublethal effects (i.e., neurological effects) likely to occur in exposed individuals. Indirect effects are based on the impact a listed species is likely to experience when the organisms they rely on, such as those that act as food or habitat resources, are exposed to carbaryl and experience adverse effects.

We consider estimated concentrations of carbaryl on the landscape or within the environment and effects reported in available toxicity studies to determine the level of direct and indirect adverse effects to listed species or critical habitat. Concentrations of carbaryl on food items can vary greatly depending on the particular item and whether exposure to carbaryl occurs on- or off-field. Based on available toxicity data, we do not expect birds to die from exposure to carbaryl at estimated environmental concentrations. However, birds exposed to carbaryl at sublethal concentrations may experience neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination) and/or immobility. For most species, these effects are only anticipated to be associated with the highest estimated environmental concentrations, such as on-field exposure following application at maximum rates.

We anticipate species that only rely on plant-based resources, such as nectar for food or vegetation as habitat, are not likely to experience any indirect adverse effects, as available toxicity data in plants indicate no reductions in plant survival or growth are likely to occur with carbaryl exposure. In contrast, species that rely on arthropods for food resources may experience high levels of indirect adverse effects as carbaryl exposure will likely reduce the abundance and availability of prey. We do not expect species that rely on other vertebrates for food resources to experience adverse indirect effects as available toxicity data indicate that adverse effects will not great enough to reduce abundance of these species at estimated environmental concentration.

We determine the overall toxicity ranking for birds by qualitatively assessing both the expected levels of direct adverse effects (e.g., neurological effects) and indirect effects (e.g., prey loss). Given that mortality is the most adverse of direct effects to an individual of a species, we assign the most weight to direct adverse effects resulting in mortality when determining the toxicity ranking. As mentioned previously, available toxicity data indicate birds are not likely to die directly from carbaryl exposure at estimated environmental concentrations. However, sublethal effects from at high-end environmental concentrations may affect fitness of individuals by increasing their susceptibility to predation, and decreasing their ability to find food, care for young, etc. Thus, we rank birds exposed at these concentrations from low to high depending on the nature and extent of exposure, considering factors such as dietary preference and time

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environmental risk assessment terminology in general, and do not have the same meaning as used in ESA regulations. As used in the effects analysis section, direct effects to species are those caused by the pesticide itself through dietary, dermal, or inhalation routes of exposure. Indirect effects occur when the pesticide acts on elements of the ecosystem that are required by the species, such as alterations to prey or shelter. Thus, in the effects analysis section, we may use these terms to link back to the analysis in EPA's BE.

expected to be spent foraging on-field. Ranking for indirect effects will be variable based upon effects to food resources.

Summary of Birds Conclusions

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the registration of carbaryl, as proposed, is not likely to jeopardize the continued existence of the 55 bird species in this Appendix.

In our analysis below, some species that had the same or very similar rationales for their conclusions were grouped together, to increase efficiency and avoid repetition. Relevant information and data unique to each individual species was considered when assigning species to groups and incorporated into the rationales as appropriate. Species-specific information (e.g., environmental baseline, cumulative effects, status of the species, exposure, and toxicity) was considered for all species, including those species in the grouped analyses, and are presented in full in Appendices B and E. Species with rationales that did not fit in a group, or warranted a separate rationale because of their life history, conservation status, or other information indicated that effects could be different, have an individual discussion to provide additional explanation. This approach allowed us to streamline our discussion in this Opinion by avoiding repeating our findings when species in the respective groupings would be expected to be affected similarly. The use of these groupings, therefore, does not mean that our evaluation failed to evaluate each individual species. On the contrary, our process and analysis for each species remained the same, regardless of the format of the discussion presented below.

Experimental, non-essential populations

The EPA included the experimental, non-essential populations for the following bird species in the consultation: Guam kingfisher, Guam rail, northern aplomado falcon, and whooping crane. We do not provide separate analyses or make jeopardy determinations for these populations independently. Rather, we treat any experimental and non-experimental populations as a single listed species for the purposes of conducting jeopardy analyses and making jeopardy determinations. By definition, a “non-essential experimental population” is not essential to the continued existence of the species. In cases where our assessment of the non-experimental population(s) of the species leads to a “not likely to jeopardize” determination, we generally assume any added effects to the experimental population will not change these determinations. However, we consider the role of the experimental population in the survival and recovery of the species and consider this information in our jeopardy analyses as appropriate.

Species proposed for de-listing

The following species is proposed for de-listing. While we present some specific information about the species in Table 1 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species account can be found in Appendix B.

Table 1.Bird species proposed for delisting.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Change in listing status	Determination
Numenius borealis	Eskimo curlew	High	High	Medium	Likely no longer extant	No Jeopardy

In the Service's 2021 5-year status review for the Eskimo curlew, we recommended delisting due to extinction (Table 1). We do not anticipate adverse effects will occur due to lack of exposure because the available information indicates this species is no longer extant in the wild and there are no captive individuals. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Eskimo curlew.

References

U.S. Fish and Wildlife Service. 2021. 5-Year Review Eskimo curlew (*Numenius borealis*). Fairbanks, Alaska. 2 pp.

Species with low exposure (informed by low overlap with agriculture)

The species in Table 2 are grouped together as they have low concern of adverse effects due to low exposure as informed by low overlap between the species' range and agricultural land uses where carbaryl is registered for use. While we present some specific information about the species in Table 2 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 2. Species with low exposure (informed by low overlap with agriculture).

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Accipiter striatus venator	Puerto Rican sharp-shinned hawk	High	Low	Low	0.3	No Jeopardy
Acrocephalus luscinia	Nightingale reed warbler (old world warbler)	High	Low	Medium	0.9	No Jeopardy
Aerodramus vanikorensis bartschi	Mariana gray swiftlet	High	Low	Medium	0.6	No Jeopardy
Amazona vittata	Puerto Rican parrot	High	Low	Low	0.3	No Jeopardy
Ammodramus maritimus mirabilis	Cape Sable seaside sparrow	High	Low	Medium	1.7	No Jeopardy
Antigone canadensis pulla	Mississippi sandhill crane	High	Low	Medium	0.5	No Jeopardy
Antrostomus noctitherus	Puerto Rican nightjar	High	Low	Medium	0.6	No Jeopardy
Buteo platypterus brunnescens	Puerto Rican broad-winged hawk	High	Low	Medium	0.4	No Jeopardy
Centrocercus urophasianus	Greater sage-grouse	Medium	Low	Medium	1.1	No Jeopardy
Charadrius nivosus nivosus	Western snowy plover	Low	Low	Medium	4.4	No Jeopardy
Colinus virginianus ridgwayi	Masked bobwhite (quail)	High	Low	Medium	0.1	No Jeopardy

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Scientific Name	**Common Name**	**Vulnerability Ranking**	**Exposure Ranking**	**Toxicity Ranking**	**Total Agricultural Use Overlap (% range)**	**Determination**
Columba inornata wetmorei	Puerto Rican plain pigeon	High	Low	Low	0.1	No Jeopardy
Corvus kubaryi	Mariana (=aga) crow	High	Low	Medium	1.0	No Jeopardy
Empidonax traillii extimus	Southwestern willow flycatcher	Medium	Low	Medium	3.2	No Jeopardy
Gallicolumba stairi	Friendly ground-dove	High	Low	Medium	0.4	No Jeopardy
Gallinula chloropus guami	Mariana common moorhen	High	Low	Medium	0.7	No Jeopardy
Halcyon cinnamomina cinnamomina	Guam kingfisher	High	Low	Medium	0.5	No Jeopardy
Lanius ludovicianus mearnsi	San Clemente loggerhead shrike	Medium	Low	Medium	0.2	No Jeopardy
Megapodius laperouse	Micronesian megapode	High	Low	Medium	0.5	No Jeopardy
Pipilo crissalis eremophilus	Inyo California towhee	Medium	Low	Medium	0.0	No Jeopardy
Polioptila californica californica	Coastal California gnatcatcher	Medium	Low	Medium	4.4	No Jeopardy
Polysticta stelleri	Steller's eider	Medium	Low	Medium	0.0	No Jeopardy
Rallus obsoletus levipes	Light-footed Ridgway's rail	Medium	Low	Medium	2.7	No Jeopardy
Rallus owstoni	Guam rail	High	Low	Medium	1.0	No Jeopardy
Setophaga angelae	Elfin-woods warbler	High	Low	Medium	0.2	No Jeopardy
Somateria fischeri	Spectacled eider	Medium	Low	Medium	0.0	No Jeopardy
Sterna antillarum browni	California least tern	Medium	Low	Low	2.5	No Jeopardy
Strix occidentalis caurina	Northern spotted owl	High	Low	Medium	0.8	No Jeopardy

Scientific Name	**Common Name**	**Vulnerability Ranking**	**Exposure Ranking**	**Toxicity Ranking**	**Total Agricultural Use Overlap (% range)**	**Determination**
Strix occidentalis lucida	Mexican spotted owl	Medium	Low	Medium	1.1	No Jeopardy
Strix occidentalis occidentalis	California spotted owl (Coastal DPS)	High	Low	Medium	1.0	No Jeopardy
Strix occidentalis occidentalis	California spotted owl (Sierra Nevada DPS)	High	Low	Medium	0.4	No Jeopardy
Zosterops rotensis	Rota bridled white-eye	High	Low	Medium	1.0	No Jeopardy

All the species listed in Table 2 have medium to high vulnerability rankings, except for the western snowy plover which has a low vulnerability, indicating that most of these species may be less robust to adverse effects that occur to individuals. However, all species in this group have a low exposure ranking, specifically based on the low level of total overlap between their ranges and agricultural use areas (including application sites and spray drift and runoff areas) in the action area. The total overlap metric we use for agricultural uses is a conservative estimate of exposure as it does not fully account for redundancy between use site layers, assumes exposure is occurring in all possible overlapping areas, and does not consider information on past carbaryl usage (which we expect would only further decrease the likelihood of exposure). As such, we expect that exposure of these species to carbaryl from agricultural uses will occur in an even smaller portion of the species' ranges and have high confidence that only small numbers of individuals of each of these species are likely to experience any exposure to carbaryl associated with agricultural uses.

In addition to agricultural uses, the species listed above may be exposed to carbaryl through non-agricultural uses. However, we do not expect non-agricultural use patterns to meaningfully add to the overall level of anticipated exposure or risk of adverse effects for these listed species given the low level of usage and limited anticipated exposure likely to occur on these use sites. Specifically, the California spotted owl (Sierra NV DPS), California spotted owl (Southern CA DPS), elfin-woods warbler, friendly ground-dove, Guam kingfisher, Guam rail, Mariana (aga) crow, Mexican spotted owl, Micronesian megapode, Mississippi sandhill crane, northern spotted owl, Puerto Rican broad-winged hawk, Puerto Rican nightjar, Puerto Rican parrot, Puerto Rican plain pigeon, Puerto Rican sharp-shinned hawk, Rota bridled white-eye, San Clemente loggerhead shrike, and southwestern willow flycatcher are known or are likely to use managed forests. However, based on usage data from the U.S. Forest Service, we anticipate carbaryl usage in managed forests to be low and localized, with the majority of applications in small areas of less than an acre in size. In addition, available usage data from the U.S. Forest Service show that carbaryl has only been applied to managed forests that may include the ranges of the California spotted owl (Coastal and Sierra Nevada DPSs), Mexican spotted owl, northern spotted owl, and southwestern willow flycatcher. In addition, usage data indicate that 879 acres of managed forests have been treated with carbaryl over a 5-year period (2016-2020), with the majority of applications covering less than 1 acre and distributed over 3 regions covering 11 different states (some of which contain the species ranges). Applications in these areas are made using hand-held mist blowers, which we expect to be a highly targeted application method that renders drift unlikely and reduces the extent of area treated, suggesting that exposure to the spotted owls and southwestern willow flycatcher are unlikely to occur. As such, we anticipate a low likelihood of carbaryl usage in the range of the listed bird species in Table 2, and that if usage did occur, exposure would be minimal.

Species like the California least tern, coastal California gnatcatcher, Guam rail, Mariana common moorhen, Mississippi sandhill crane, northern spotted owl, Puerto Rican plain pigeon, San Clemente loggerhead shrike, and western snowy plover can occur in and travel through developed areas and rights of ways where carbaryl can be used. Current product labels limit most residential and developed uses of carbaryl to spot and crack-and-crevice treatments using hand-held equipment, which we anticipate will greatly limit the extent of spray drift and off-target exposure to these species. Available data on open space developed uses of carbaryl (such as turf or golf course applications) indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl while only 500 pounds of carbaryl are used nationally on rights of way each year. While this open space developed and rights of way usage may result in a large treatment footprint if all treated areas were concentrated in one location or within one species' range, we expect this is highly unlikely to occur. Rather, we expect open space developed and rights of way usage are likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within a particular species' range. Given the variety of usage data available, as well as existing conservation measures, for non-agricultural uses of carbaryl, we anticipate no more than a small number of individuals of each of the species in Table 2 will be exposed and experience adverse effects from non-agricultural uses of carbaryl.

The coastal California gnatcatcher, greater sage-grouse, Guam rail, masked bobwhite (quail), Mississippi sandhill crane, and Puerto Rican plain pigeon are known or likely to use rangeland areas. However, based on APHIS usage data from 2019-2023, we expect only a small percentage of any species range that occurs in Arizona, Idaho, Montana, Nevada, Utah, Washington, Wyoming (only California least tern, California spotted owl [Sierra Nevada DPS], greater sage-grouse, masked bobwhite, Mexican spotted owl, northern spotted owl, and southwestern willow flycatcher ranges include areas in these states) is likely to be treated for this use, and the majority of applications are anticipated to use carbaryl bait which has a much lower risk profile to birds than other applications that may result in direct contact or spray drift that would expose individuals and their prey. Additionally, rangeland applications are anticipated to be carried out by APHIS under their grasshopper and Mormon cricket suppression program with conservation measures in place to protect listed species from exposure. Thus, little exposure is anticipated from these non-agricultural uses and adverse effects are not anticipated for these species (see also "Exposure to Non-agricultural Uses" section above).

All of the species in this group have a low or medium toxicity ranking. Direct mortality is not expected from exposure to carbaryl on- or off-field for any uses. However, temporary neurological effects and/or loss of prey items are expected for some species in certain situations when exposure occurs. We anticipate direct sublethal adverse effects are most likely to occur for individuals that primarily forage on carbaryl use sites or forage on prey items that have recently been exposed to carbaryl applications on those use sites with the highest allowable use rates (i.e., Citrus, Other Orchards, sod, turf, and golf course uses). We expect exposures at levels that would cause sublethal effects are unlikely to occur with any regular frequency, and would be in localized areas, as individuals of these species are unlikely to exclusively consume prey species that have recently been exposed to carbaryl on use sites at the highest application rates given that these rates are only allowable for a subset of uses, carbaryl use sites often do not represent preferred foraging habitat, agricultural sites make up a small portion of these species' ranges, and there is limited opportunity for exposure on non-agricultural sites. EPA's exposure modeling indicates that foraging in areas off-field or consuming prey that have only been exposed through spray drift or runoff is not expected to result in direct adverse effects to individuals.

We anticipate effects to some individuals of these species due to impacts to food resources. While no effects to plants are expected, we anticipate effects to the prey base, primarily invertebrates, from carbaryl exposure on or near use sites. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the prey abundance in these areas, but some prey (including invertebrate prey for insectivores) will be available after exposure and any losses will likely be during temporary periods after exposures. We anticipate prey reductions will be greater on use sites, where estimated environmental concentrations are likely to be higher than concentrations from spray drift. As birds are highly mobile, we expect most individuals will be able to find alternate prey and foraging sites to compensate for any localized losses. As such, even though toxicity to some prey items is anticipated to be high and some prey will be lost, we anticipate few individuals from the species in this group will be affected by reductions in prey that result in starvation, reduced growth, or impacts to their fitness.

While most species in this group have a high vulnerability, only small portions of their ranges will likely be exposed to carbaryl. Losses of individuals of those species with small, endemic, constrained, and/or isolated population(s) with declining or unknown population trends are likely at a higher risk of species-level effects as populations may not be sustainable and recolonization from other sites to compensate for losses may be less likely to occur. The species that fit these characteristics and that are likely to forage on agricultural sites where anticipated direct effects (sublethal only) would be more likely are the friendly ground-dove, Guam rail, Puerto Rican broad-winged hawk, Puerto Rican plain Pigeon, and Puerto Rican sharp-shinned hawk. The ranges of these species overlap with agricultural use sites by 0.1% to 1.0%. However, we anticipate few individuals would experience adverse effects, as sublethal effects are only expected for those foraging on prey exposed on field at the highest rates. These effects could lead to a temporary reduction in the ability of exposed birds to forage or higher susceptibility to predation, which could lead to mortality or impact reproduction and growth. However, we anticipate these effects will rarely occur due to the low anticipated exposure and specific circumstances that would be needed to lead to such impacts. We expect impacts to be even lower for the other species in this group due factors such as their increasing population trends, wider distributions where exposures are likely to be localized and limited to small overlapping areas, and preferences for forested, wetland, and other natural habitats where individuals and their prey will often receive some protection from off-site exposure due to the interception of spray drift and runoff by vegetation.

Thus, we anticipate a small number of individuals of the species in this group are likely to experience adverse effects from exposures that would result in sublethal effects that are great enough to lead to mortality, reduced growth, or reduced fitness due to temporary neurological effects that make them susceptible to predation or a reduced ability to forage. While we also anticipate losses of food resources in areas exposed to carbaryl that may lead to starvation or reduced fitness in a small number of individuals, we do not anticipate the loss of all prey where exposed, and given the high mobility of these bird species, we expect most individuals will be able to travel to alternate foraging locations during periods of temporary prey losses. As such, we determine the overall risk of adverse effects to these species is low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.

Note: The Guam kingfisher (EXPN Entity ID: 11728) and Guam rail (EXPN Entity ID: 4889) have non-essential experimental populations.

Species with low exposure (confirmed by low past usage from California Department of Pesticide Regulation data)

The species in Table 3 are grouped together because they occur completely within California and have low exposure for agricultural uses confirmed by low levels of past carbaryl usage within their ranges (% range treated), as informed by the California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data. While we present some specific information about the species in Table 3 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 3. Species with low exposure (confirmed by low past usage from California Department of Pesticide Regulation data)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Rallus longirostris obsoletus	California Ridgway's rail	High	Low	Medium	0.1	No Jeopardy
Vireo bellii pusillus	Least Bell's vireo	High	Low	Medium	0.1	No Jeopardy

Mandatory pesticide usage reporting data collected by the state of California indicates very little carbaryl has been used in agricultural areas where the California Ridgway's rail and least Bell's vireos occur from 2013-2022. Given that this usage data is mandated by the state of California and that this data is reported with relatively high spatial resolution, we have high confidence that the species likelihood of exposure to carbaryl associated with agricultural uses as a result of the proposed action is low. Therefore, we expect a very small number of individuals to die or experience sublethal effects that lead to reductions in fitness supporting reproductive capacity or growth as a result of agricultural uses of carbaryl under the proposed action.

In addition to agricultural uses, the least Bell's vireo and their prey may be exposed to carbaryl from non-agricultural uses on forest, developed and rangeland use sites. While CalPUR data include all agricultural usage, it is also inclusive of certain non-agricultural uses, such as those performed by professional commercial applicators. While these data no not capture all non-agricultural usage, such as residential applications by consumers, given our broad understanding of carbaryl usage, general information on non-agricultural use practices, and existing conservation measures we expect limited exposure from these uses of carbaryl. We anticipate localized exposure, especially where riparian habitat occurs in and within spray drift distance of managed forests, developed open space areas, right of ways, golf courses, and rangeland during feeding, breeding, and migration. The vireos are also likely to migrate through developed areas. While it is likely some individuals in these areas may be exposed to carbaryl, we do not expect non-agricultural use patterns to meaningfully add to the overall level of anticipated exposure or risk of adverse effects for the least Bell's vireo given the low level of usage that occurs in these use sites and low levels of anticipated exposure (see "Exposure to Non-agricultural Uses" above). As such, we only expect a few vireos will die or experience sublethal effects that lead to reductions in fitness supporting reproductive capacity from non-agricultural uses. The California Ridgway's rail is not expected to occur in non-agricultural use sites and no effects are expected.

Given that we only anticipate small numbers of least Bell's vireos and California Ridgway's rails are likely to be exposed and that most exposed individuals will not experience high levels of mortality, sublethal effects, or loss of food resources, we expect the proposed action will result in mortality or sublethal effects that lead to reductions in fitness supporting reproductive capacity or growth in a small number of individuals of these species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined that the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the least Bell's vireo or California Ridgway's rail.

References:

U.S. Fish and Wildlife Service. 2006. Least Bell's vireo (*Vireo bellii pusillus*) 5-Year Review Summary and Evaluation. Carlsbad, California. 27 pp.

Species with low past usage - Census of Agriculture

The species in Table 4 are grouped together because we expect low exposure (% range treated) for agricultural uses, confirmed by low levels of past insecticide usage within their ranges, as informed by the USDA's Census of Agriculture (CoA). While we present some specific information about the species in Table 4 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 4. Species with low past usage - Census of Agriculture.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Aphelocoma coerulescens	Florida scrub-jay	Medium	Low	Medium	4.5	No Jeopardy
Centrocercus minimus	Gunnison sage-grouse	Medium	Low	Medium	1.3	No Jeopardy
Coccyzus americanus	Yellow-billed cuckoo	Medium	Low	Medium	1.9	No Jeopardy
Falco femoralis septentrionalis	Northern Aplomado falcon	High	Low	Medium	4.7	No Jeopardy
Setophaga chrysoparia	Golden-cheeked warbler	High	Low	Medium	3.0	No Jeopardy

All the species listed in Table 4 have a medium or high vulnerability ranking, indicating that the species may be less robust to adverse effects that occur to individuals. The species in this group have a medium toxicity ranking, indicating that sublethal effects and/or loss of prey items are likely when exposure occurs. However, we anticipate adverse effects are most likely to occur for individuals that primarily forage on prey items that have recently been exposed to carbaryl applications at some of the highest application rates on use sites. We expect this is unlikely to occur with any regular frequency as individuals of these species are unlikely to forage on carbaryl use sites or exclusively encounter and consume prey species that have recently been exposed to carbaryl on-field given that carbaryl use sites do not represent preferred foraging habitat or that agriculture makes up a small portion of these species' ranges. EPA's exposure modeling indicates that foraging in areas off-field or consuming prey that have only been exposed through spray drift or runoff is not likely to result in direct mortality of these species, but sublethal effects are anticipated for a lower proportion of exposed individuals. Sublethal effects, and reductions in prey abundance, can lead to mortality, reduced growth, and reduced fitness. However, these species are anticipated to have limited exposure to carbaryl due to low overlaps and low usage. Low CoA usage indicates that very little insecticide usage (of any type) occurred in the past in the counties where these species' ranges occur. Given that this reporting broadly includes all insecticide usage, we consider CoA data to be conservative estimates of carbaryl usage that indicate very little of the species' ranges are likely to be treated. Therefore, we anticipate few individuals of these species are likely to experience adverse effects associated with agricultural use sites.

In addition to agricultural uses, the species listed above may be exposed to carbaryl through non-agricultural uses. While it is possible individuals in these areas may be exposed to carbaryl, we do not expect non-agricultural use patterns to meaningfully add to the overall level of anticipated exposure or risk of adverse effects for these listed species given the low level of usage and limited exposure that is anticipated in these use sites. Specifically, the golden-cheeked warbler and yellow-billed cuckoo are known or are likely to use managed forests, developed use sites, and rangeland areas. The northern aplomado falcon can also occur on rangelands. Based on usage data from the U.S. Forest Service, we anticipate carbaryl usage in managed forests to be low and localized, with the majority of applications in small areas of less than an acre in size. Applications in developed areas will be limited to very small areas with little to no spray drift, greatly reducing the likelihood of exposure to individuals or their prey. Based on APHIS usage data, we expect only a small percentage of species ranges that occur in Arizona, Idaho, Montana, Nevada, Utah, Washington, Wyoming (only Gunnison sage-grouse, northern aplomado falcon experimental population, and the yellow-billed cuckoo ranges include areas in these states) is likely to be treated for this use, and the majority of applications are anticipated to use carbaryl bait which has a much lower risk profile to birds than other applications that may result in direct contact or spray drift that would expose individuals and their prey. Additionally, rangeland applications are anticipated to be carried out by APHIS under their grasshopper and Mormon cricket suppression program with conservation measures in place to protect listed species from exposure. Thus, little exposure is anticipated from these non-agricultural uses (see also "Exposure to Non-agricultural Uses" section above). Therefore, we only expect a few individuals to die or experience sublethal effects that lead to reductions in fitness supporting reproductive capacity or growth as a result of these non-agricultural uses of carbaryl under the proposed action.

In summary, after considering likely exposure and past insecticide usage data within the ranges of these five species, we are confident that they will experience, at most, low exposure to carbaryl from the proposed action. As such, we anticipate only small numbers of individuals of the bird species in Table 4 are likely to be exposed and that most individuals will be exposed under conditions that will not result in mortality or adverse effects associated with losses of food resources or as a result of sublethal effects. We determine the overall risk of adverse effects to these species is low. Therefore, we expect a small number of individuals of each species to die or experience sublethal effects that lead to reductions in fitness supporting reproductive capacity or growth as a result of carbaryl uses under the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 4.

Note: The northern aplomado falcon has a non-essential experimental population (EXPN Entity ID: 9122).

Species proposed for delisting due to recovery with moderate risk

The wood stork is proposed for delisting due to its improved status and has low vulnerability, high exposure, and low toxicity rankings (Table 5). While we present some specific information about the species in Table 5 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species account can be found in Appendix B.

Table 5. Bird species proposed for delisting due to recovery with moderate risk.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Additional Considerations	Determination
Mycteria americana	Wood stork	Low	High	Low	Proposed for delisting	No Jeopardy

Wood storks breed in the southeastern U.S., Mexico, Central America, and South America. In the U.S., they colonially nest in bald cypress, sweetgum, and mangroves in wetlands. According to satellite telemetry studies, wood storks are positively correlated with agriculture. They feed on fish and crustaceans in natural and artificial wetlands, including both freshwater and saltwater habitats (USFWS 2021). In 2023, we proposed the wood stork for delisting due to recovery (i.e., population increases and habitat loss mitigations) (USFWS 2023).

The wood stork has a large percent overlap between agricultural use sites (including off-site transport) and its range (17.9%) and medium levels of past carbaryl usage based on state-level data (up to 6.7% annually). In addition, they may be found in wetland habitats within and adjacent to non-agricultural use sites such as roadsides, golf courses, and other developed areas. They eat aquatic prey, and we do not anticipate any direct impacts to wood storks that consume prey exposed to carbaryl off-field. We expect indirect impacts to the wood stork from losses of some sensitive prey items (i.e., crustaceans) that are exposed to carbaryl from runoff or drift. However, we do not anticipate reduction in fish prey from exposure to carbaryl. As such we anticipate most individuals will be able to locate alternative prey because they are known to travel 75 km or more in search of food (USFWS 2021). We anticipate prey losses will result in reduced reproduction or growth in at most, a small number of individuals. Therefore, even with high overlap and medium usage levels in the range, carbaryl likely poses low risk to the wood stork.

Given that we do not anticipate mortality of wood storks, and prey losses are anticipated to lead to reductions in growth and reproductive success in only a small number of individuals at most, we determine the overall risk of adverse effects to this species from the proposed action is low. Additionally, the status of the species has improved such that we have proposed delisting of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild.

Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the wood stork.

References:

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Removal of the Southeast U.S. Distinct Population Segment of the Wood Stork From the List of Endangered and Threatened Wildlife. Proposed Rule. Federal Register 88: 9830-9850.

U.S. Fish and Wildlife Service. 2021. Species status assessment report for the wood stork (*Mycteria americana*) U.S. breeding population Distinct Population Segment. Version 1.0. Atlanta, GA. 181 pp.

Species with Individual Integration and Synthesis Summaries

For the species in Table 6, our preliminary exposure and toxicity rankings indicate that the proposed action may result high adverse effects. As such, we discuss each species in more detail in individual Integration and Synthesis summaries below. In some cases, we modified initial exposure and toxicity rankings due to additional information regarding exposure and effects for individual species, as described below. For species that had a jeopardy determination in the draft Opinion, EPA incorporated species-specific conservation measures that the registrants agreed to incorporate into the description of the action to minimize exposure to the species. When relevant, we retained our evaluation that led to our Preliminary Conclusion and the need for species-specific measures and added an updated Final Conclusion to reflect the impacts of these species-specific measures.

Additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity can be found in Appendix E. The status of the species accounts can be found in Appendix B.

Table 6. Species with high risk of adverse effects.

Scientific Name	Common Name	Determination
Grus americana	Whooping crane	No Jeopardy
Tympanuchus cupido attwateri	Attwater's greater prairie-chicken	No Jeopardy
Rallus obsoletus yumanensis	Yuma Ridgway's rail	No Jeopardy
Picoides borealis	Red-cockaded woodpecker	No Jeopardy
Polyborus plancus audubonii	Crested caracara (Audubon''s) [FL DPS]	No Jeopardy
Charadrius melodus	Piping plover (Great Lakes DPS)	No Jeopardy
Charadrius melodus	Piping plover (Atlantic and Northern Great Plains DPS)	No Jeopardy
Ammodramus savannarum floridanus	Florida grasshopper sparrow	No Jeopardy
Rostrhamus sociabilis plumbeus	Everglade snail kite	No Jeopardy
Eremophila alpestris strigata	Streaked horned lark	No Jeopardy
Calidris canutus rufa	Red knot	No Jeopardy
Laterallus jamaicensis ssp. *Jamaicensis*	Eastern black rail	No Jeopardy
Agelaius xanthomus	Yellow-shouldered blackbird	No Jeopardy
Glaucidium brasilianum cactorum	Cactus ferruginous pygmy-owl	No Jeopardy

Integration and Synthesis Summary: Whooping crane

Scientific Name:	Common Name:	Entity ID:
Grus americana	Whooping crane	67

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is low. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the whooping crane. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 8/28/2023; Wherever found, except where listed as an experimental population; *States within the range:* KS, LA, MT, ND, NE, OK, SD, TX

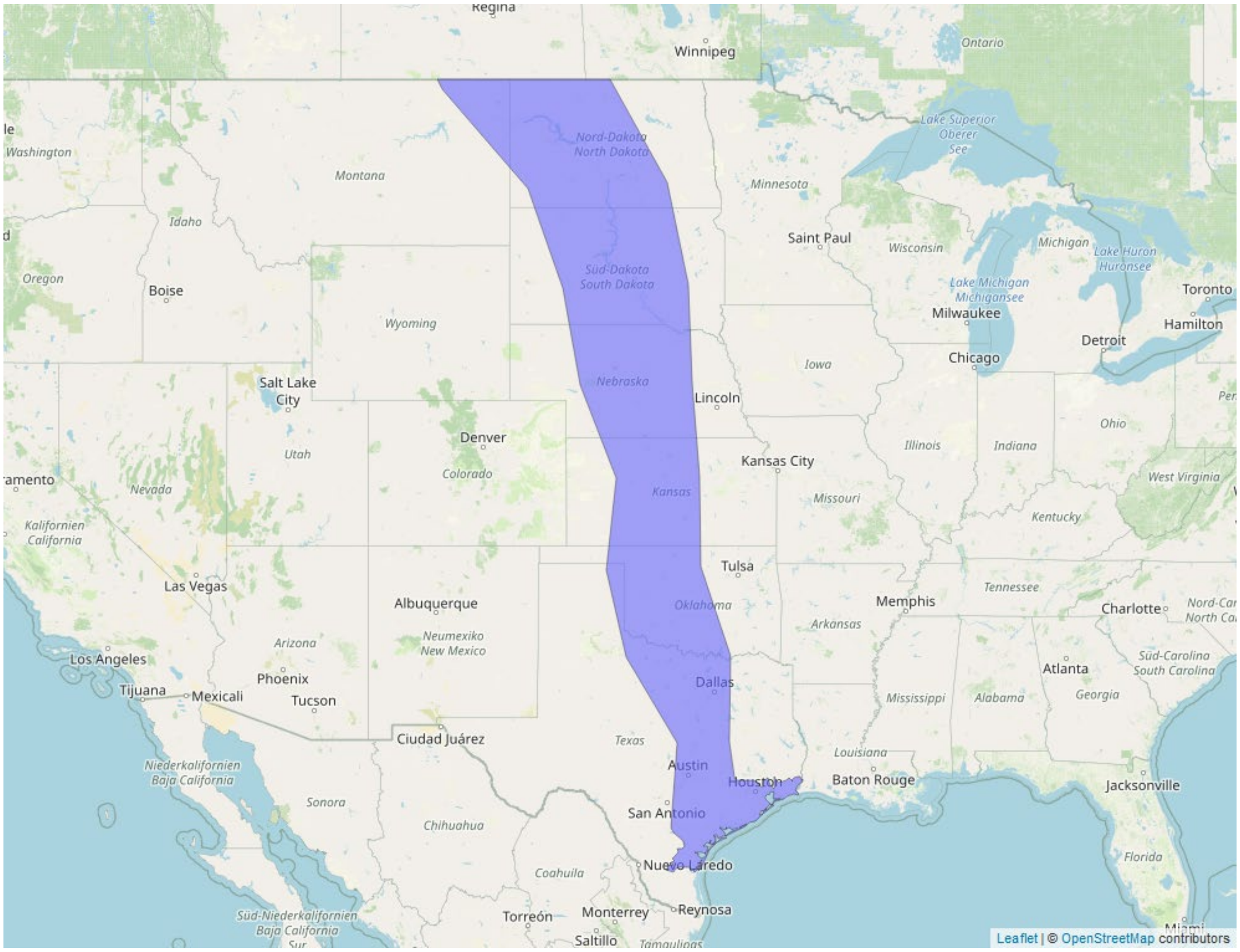

Figure 1. Range map of whooping crane (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/758.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of status

Listing status: Endangered

Most recent 5-Year Status Review recommendation: No change in status

Most recently completed 5-Year Status Review: 2/13/2012

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The whooping crane is a long-lived migratory wetland bird formerly found from the Arctic coast south to central Mexico, from UT east to NJ, SC, GA, and FL. They migrate between Canada and the northern US to Mexico and the southern US each year. Historically, over 10,000 whooping cranes populated North America. By the mid-1800s, an estimated 1,400 whooping cranes remained. By the mid-1900s, a few birds remained; they nested in Aransas-Wood Buffalo National Park (Wood Buffalo) in Canada and wintered in South Texas at what is now the Aransas National Wildlife Refuge (Aransas). Approximately 2/3 of the genetic material of the species was lost when the whooping crane went through a bottleneck of only 15 birds in 1941 (CWS and Service 2007). Since then, the Wood Buffalo/Aransas population has slowly increased to an estimated 279 individuals (April 2011) due to conservation efforts, including strict legal protection, habitat preservation, and continuous international cooperation between Canada and the United States. As of 2012, four geographically distinct populations existed in the wild; the only natural population remains at Wood Buffalo/Aransas (n=279), a reintroduced experimental non-migratory population in central Florida (n=20), an experimental population that migrates between Wisconsin and Florida (n=106), and a non-migratory flock in Louisiana (n=4, with an additional 2 individuals of unknown status). None of the reintroduced populations are self-sustaining (USFWS 2012).

Whooping crane population declines were caused primarily by shooting and destruction of habitat in the prairies from agricultural development (CWS and USFWS 2007). Significant portions of the migratory corridor were impacted by development, conversion to non-compatible land uses, or on-going land management resulting in habitat loss, degradation and fragmentation caused by draining of wetlands for conversion to croplands, urbanization, construction of roads and power lines, and most recently wind farms. Reintroduced whooping crane flocks lack large blocks of suitable habitat in which the species could prosper. Human population growth continues to expand into formerly suitable wintering habitat for whooping cranes, including development of homes, power lines, cell towers, and roads. As of 2012, 60% of wintering whooping cranes used the Aransas and Matagorda Island National Wildlife Refuges. With development occurring on private lands as people move to the Texas coast, potential for future flock expansion may be limited unless there is a large effort to protect additional lands.

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 Aransas. Inflows are needed to maintain proper salinity gradients, nutrient loadings, and sediments that produce an ecologically healthy and productive estuary, and they are essential to produce foods used by whooping cranes, especially blue crab populations. Collisions with power lines are a substantial cause of whooping crane mortality in migration.

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 could also reduce the number and severity of winter freezes at Aransas, allowing black mangrove (*Avicennia germinans*) to spread its range northward into the crane area, an event that has been occurring over the past decade. Dense mangrove shrubs reduce visibility for cranes and would make the area unusable for cranes. Sea level rise and flooding of coastal wetlands are major threats. Since whooping cranes mostly only use water < 20 inches deep, projected sea level rise that could exceed 39 inches by the end of the century would make the current whooping crane winter range unusable.

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. Eggshell thickness, a measure of contaminant exposure, was measured in eggs taken from the wild and captivity from the 1970s to 2012; no evidence of shell thinning was detected. One confirmed whooping crane chick and potentially other cases of acetylcholinesterase inhibition were associated with the experimental Eastern Migratory Population on Necedah National Wildlife Refuge. Acetylcholinesterase inhibition is suggestive of organophosphate exposure, though pesticides were not tested for in these cases. The refuge is downstream of cranberry bogs, and runoff from these sites is a suspected cause of any pesticide exposure (Pers. comm. 2020 with Sarah Warner, USFWS). As carbaryl is not registered for use on cranberry bogs, we do not suspect carbaryl exposure in these cases.

(Note: The whooping crane has three experimental populations: EXPN Entity IDs 4679, 7342, and 10124.)

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

The species range map presented above represents migratory and wintering grounds of the Aransas-Wood Buffalo National Park population of the whooping crane. No individuals from this population breed in the action area. Data indicate that 40.4% of this portion of the species' range overlaps with agricultural use sites and 18.2% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 7). In total, there is approximately 58.6% overlap between the species' range and exposures associated with agricultural use sites for carbaryl. As the species winters in the Aransas and Matagorda Island National Wildlife Refuges and surrounding areas, most of this overlap represents the migratory pathway.

Table 7. Agricultural use overlap and annual usage data (% Range Treated) for the whooping crane.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	2.6	2.6	5.2	0.2	0.3	0.5
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	15.2	4.2	19.4	0.8	0.2	1.1
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	7.5	4.3	11.8	5.9	3.1	9
Other Grains	10.6	5.3	16	0.3	0.2	0.5
Other Orchards	0.1	0.2	0.3	<0.1	<0.1	<0.1
Other Row Crops	2.2	0.8	2.9	0.1	<0.1	0.2
Soybeans	14.2	3.6	17.8	0.8	0.2	1
Vegetables and Ground Fruit	2.1	0.9	3	0.2	0.1	0.3
Total	**40.4**	**18.2**	**58.6**	**7.6**	**4**	**11.6**

Usage

Past usage data indicate that up to 11.6% of the species' range has been treated with carbaryl annually from agricultural uses (Table 7).

Additional Exposure Considerations

During winter, we expect that exposure to carbaryl use sites and adjacent areas will be minimal, as most foraging occurs in the brackish bays, marshes, and salt flats on the edge of the mainland and on barrier islands. Some individuals occur occasionally on nearby privately owned pasture or croplands. The winter diet consists predominately of animal foods, especially blue crabs, clams, and the plant wolfberry. Furthermore, 60 percent of whooping cranes winter within the Aransas and Matagorda Island NWRs (USFWS 2012).

Whooping cranes are omnivorous and do feed on agricultural crops during migration, although they have not adapted to agricultural production 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 (USFWS 2012). 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. Some whooping cranes use upland sites frequently in most years, but agricultural croplands adjacent to Aransas National Wildlife Refuge are rarely visited (CWS and Service 2007).

Agricultural areas, including corn and grain fields, are important stopover sites for whooping cranes during migration. Cranes have been known consume seeds from recently planted fields in spring, and forage in agricultural fields after harvest during the fall and winter forage. Corn, wheat, barley, rice, and sunflower seeds are desirable foods. However, given the timing of migration during spring and fall, we expect that exposure to carbaryl will be low given that foraging is most likely to occur prior to or shortly after planting or after harvest.

Non-agricultural Uses

We do not anticipate the whooping crane will occur in developed, open space developed, nurseries, or forested areas. During winter, we expect that exposure to non-agricultural use sites for carbaryl will be minimal as most foraging occurs in the brackish bays, marshes, and salt flats on the edge of the mainland and on barrier islands. Similar to agricultural areas, whooping cranes may forage in rangeland areas during migratory stopovers (see Conservation Measures for rangelands below).

Conservation Measures

We expect rangeland uses of carbaryl will be through the USDA APHIS grasshopper and Mormon cricket suppression program. Carbaryl applications made through this program are required to implement conservation measures for the protection of listed species, including standard ground and aerial buffers to known locations of whooping cranes or their critical habitat (500-ft. for ground applications and 0.5 miles for aerial applications), reduced application rates, and reduced number of applications made per year. We expect these measures will be sufficiently protective of the whooping crane to rangeland uses of carbaryl.

Exposure Summary

While there is a high extent of overlap between the action area and the species' range, and a high level of usage within the species' migratory pathway, we expect carbaryl exposure to be low based on life history characteristics of the species. Whooping cranes wintering on roosting sites in coastal Texas are unlikely to forage on or near agriculture sites. Though migrating whooping cranes are likely to forage in agricultural areas during stopovers, the timing of migration is unlikely to coincide with carbaryl usage. As such, we expect a small number of individuals will experience exposure from the agricultural use of carbaryl.

We anticipate individuals may occasionally occur in non-agricultural use sites, including rangelands. However, based on existing conservation measures, we do not expect non-agricultural uses will result in the exposure of more than a small number of individuals.

Overall Exposure Ranking: Low

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to whooping cranes. Consumption of plant and animal food items on carbaryl use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 52 mg/kg-bw, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to whooping cranes, including mortality or sublethal effects.

Indirect Effects

The whooping crane relies on amphibians, small mammals, arthropods, birds, fruit, seeds, benthic invertebrates, and fish for food resources. When foraging in treated fields, seeds are known to be a preferred dietary item. While no effects to plants are expected, we anticipate effects to the prey base, primarily invertebrates, from carbaryl exposure on or near use sites. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but some prey will be available after exposure and any losses will likely only be temporary. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. Given its association with agricultural areas and rangeland, during migration, we expect a greater effect during this period of the whooping crane life cycle. However, as a generalist feeder, we anticipate that whooping cranes will be less affected by any specific loss of prey items and can consume other available dietary items. As such, even though toxicity to prey items is anticipated to be high, we anticipate a low level of indirect adverse effects are likely to occur.

Toxicity Summary

Consumption of plant and animal food items that have been exposed to carbaryl either on use sites or from spray drift is not expected to result in direct adverse effects to whooping cranes, including mortality and sublethal effects. No effects are expected to plants used as a food sources, including seeds on treated fields. Though we anticipate carbaryl exposure will cause a high level of mortality to invertebrates, we expect as a generalist feeder, the whooping crane will be less affected by the loss of any specific dietary item. As such, we determine the whooping crane has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

Though agricultural overlap and usage are high within the species' range, the whooping crane has a low exposure ranking due to the low likelihood of exposure to carbaryl. Whooping cranes are unlikely to forage on or near agriculture sites near their wintering sites in coastal Texas. While migrating whooping cranes are expected to forage in agricultural areas and rangeland during stopovers, the timing of migration is unlikely to coincide with agricultural carbaryl usage and existing conservation measures are expected to significantly reduce exposure of the whooping crane from rangeland uses. As such, we expect a small number of individuals will experience exposure from the proposed action.

The whooping crane has a low toxicity ranking. We do not anticipate direct adverse effects to the whooping crane from consumption of dietary items exposed to carbaryl. While some prey species are expected to die as a result of carbaryl exposure, particularly invertebrates, whooping cranes are generalist feeders that are likely to switch between available food resources.

Given that we expect a small number of individuals are likely to experience exposure and that we expect a low level of indirect adverse effects, we determine the overall risk of adverse effects to the species is low.

Conclusion

The whooping crane historically once numbered over 10,000 individuals. It is currently comprised of four geographically distinct populations in the wild. Only one is a natural population numbering 279 individuals in 2011, located at the Aransas National Wildlife Refuge. There are also three experimental non-migratory populations. One was reintroduced to an area in central Florida (n=20), one migrates between Wisconsin and Florida (n=106), and on is a non-migratory flock in Louisiana (n=4, with an additional 2 individuals of unknown status). None of the reintroduced populations are self-sustaining. Threats to the species include impacts to significant portions of the migratory corridor from habitat degradation and fragmentation caused by draining of wetlands for conversion to croplands, urbanization, construction of roads and power lines, and more recently wind farms. Collisions with power lines are a substantial cause of crane mortality during migration. A big problem for reintroduced whooping crane flocks may be the lack of large blocks of suitable habitat. With development continuing on private lands, the potential for future flock expansion may become more limited unless there is a large effort to protect additional lands. The species has a high vulnerability ranking.

The whooping crane has a low exposure ranking. While we expect 58.6% of the migratory and wintering grounds of the Aransas National Wildlife Refuge population (the non-experimental population) to overlap with agricultural use sites and off-site transport areas, and we anticipate up to 11.6% of this portion of the species' range will be treated with carbaryl, we expect carbaryl exposure to be low. Whooping cranes wintering in coastal Texas are unlikely to forage on or near agriculture sites. Though migrating whooping cranes are likely to forage in agricultural areas during stopovers, the timing of migration is unlikely to coincide with carbaryl usage. Whooping cranes are not expected to forage in most non-agricultural use sites of carbaryl and are expected to have little exposure to carbaryl in rangeland due to existing conservation measures developed by USDA APHIS for their grasshopper and Mormon cricket suppression program. As such, we expect a small number of individuals will experience exposure from the proposed action.

The whooping crane has a low toxicity ranking. We do not expect that whooping cranes consuming plant and animal food items that have been exposed to carbaryl either on use sites or from spray will be adversely affected. Though some prey species are expected to die as a result of carbaryl concentrations on- and off-field, we anticipate a low level of indirect adverse effects as whooping cranes are generalist feeders that will likely be able to switch between different available food resources. We expect prey losses will lead to a reduction in reproductive success or likelihood of survival in a small number of individuals.

In summary, we expect a reduction in reproductive success and the loss of a small number of individuals over the project duration. Even though the species is highly vulnerable, the overlap with carbaryl use sites is high, and the percent of the species range and migratory pathway treated annually is high, we expect exposure of whooping cranes will be low. Migrating whooping cranes are not expected to forage in use sites during times when exposure will be most likely. While there may be losses of some prey items, the species is a generalist feeder, and we expect most individuals will be able to find adequate prey availability in the vicinity with minimal impacts to survival and fitness. We do not expect the effects from the proposed action will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the whooping crane.

References

U.S. Fish and Wildlife Service. 2012. Whooping Crane (*Grus americana*) 5-Year Review: Summary and Evaluation. Aransas National Wildlife Refuge, Austwell, Texas and Corpus Christi Ecological Service Field Office, Texas. 44 pp.

Canadian Wildlife Service and U.S. Fish and Wildlife Service. 2007. International Recovery Plan for the Whooping Crane (*Grus americana*). Ottawa: Recovery of Nationally Endangered Wildlife (RENEW) and Service Region 2. 162 pp.

Integration and Synthesis Summary: Attwater's greater prairie-chicken

Scientific Name:	Common Name:	Entity ID:
Tympanuchus cupido attwateri	Attwater's greater prairie-chicken	83

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determined the risk of adverse effects to the species was high.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate species-specific conservation measures as part of the action. We now expect exposure for the Attwater's greater prairie chicken to be low. After incorporating conservation measures into the proposed action, adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Attwater's greater prairie chicken. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 3/19/2018; Wherever found; *States within the range:* TX

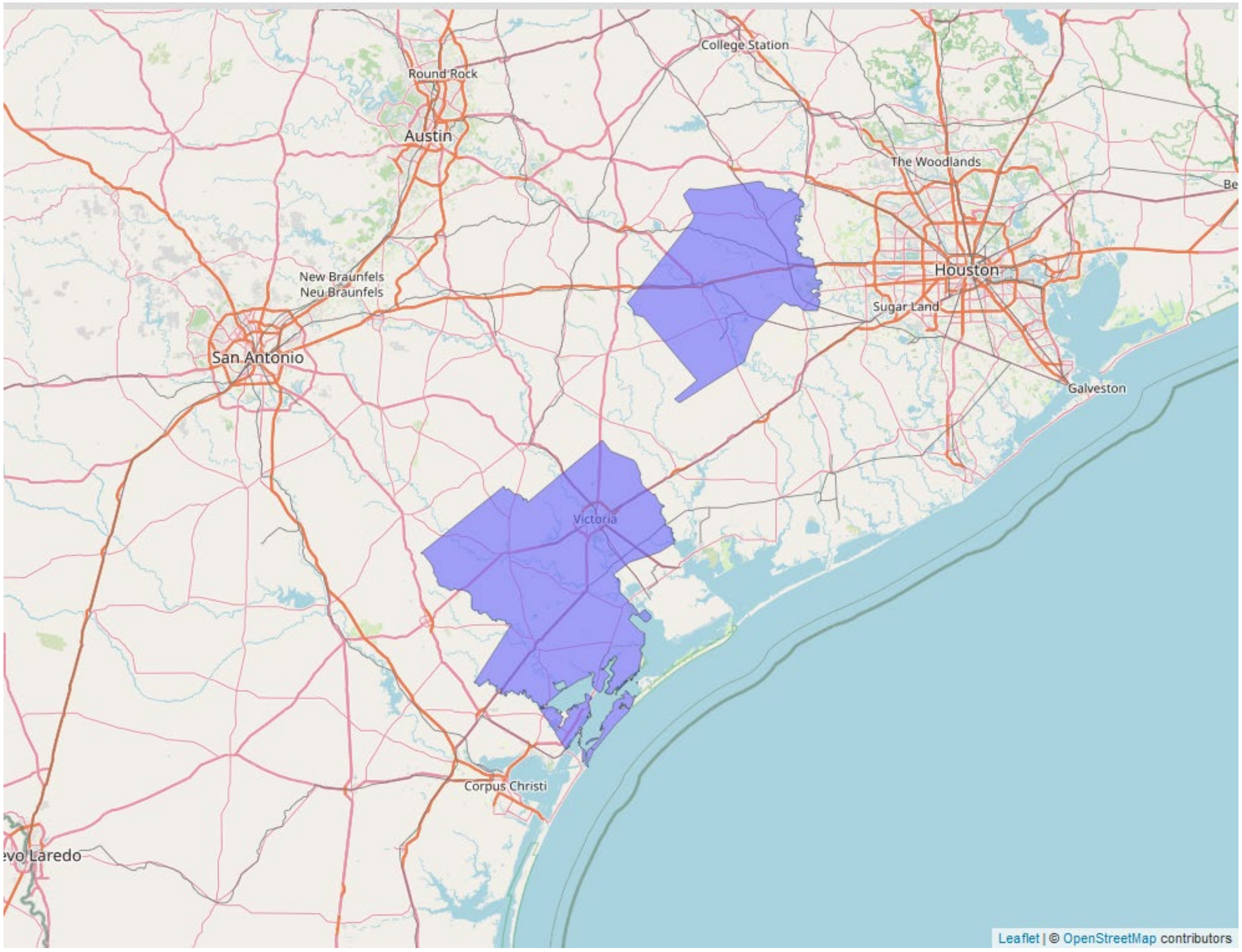

Figure 2. Range map of Attwater's greater prairie-chicken (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7259.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of status

Listing status: Endangered

Most recent 5-Year Status Review recommendation: No change in status

Most recently completed 5-Year Status Review: 6/1/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Attwater's prairie-chicken represents the southern-most subspecies of Tympanuchus cupido, and currently occurs in the wild at only two locations - the Attwater Prairie Chicken National Wildlife Refuge (Colorado County, TX) and on private ranchlands in Goliad County, TX. Free-ranging Attwater's prairie-chicken populations have remained on the precipice of extinction since 1996 following years of population declines. Breeding birds are maintained at four facilities: Fossil Rin Wildlife Center, Houston Zoo, Caldwell Zoo, and Sutton Avian Research Center. Continued supplementation of wild populations with releases of captive-reared stock from a breeding program established in 1992 has kept the Attwater's prairie-chicken from extinction in the wild. Over the last five years (as of 2021), breeding facilities produced an average of over 300 captive reared prairie-chickens for release back into the wild. Populations at the Attwater Prairie Chicken National Wildlife Refuge and private ranchlands in Goliad County continue to be supplemented with captive-reared birds. Captive birds have also been released at the Texas City Prairie Preserve, but none have been released since 2010 and Attwater's prairie-chickens have not been observed at this site since 2012. Periods of population growth between 2007-2011 and 2012-2016 were ended by a near-historic drought and catastrophic flooding followed by impacts of hurricane Harvey, respectively. However, while numbers remain low, populations have shown continued growth since 2017, and in 2021 reached numbers not seen since 1993.

Analyses point to invertebrate abundance and fire ant treatment, along with favorable rainfall conditions, particularly in May when most chicks hatch, for recent population growth (USFWS 2021). Primary threats to Attwater's prairie chickens are habitat loss (e.g., grassland loss from woody species encroachment and expansion of urban centers), disease (e.g., reticuloendotheliosis virus, avian pox, cryptosporidiosis in captive populations), predation, inbreeding and loss of evolutionary potential, husbandry issues, and poor brood survival. Poor survival of chicks produced by released captive-reared Attwater's prairie-chickens was found to be the single-most factor limiting significant progress toward recovery in the 2010 revision of the Attwater's Prairie-Chicken Recovery Plan (USFWS 2010). Invertebrate abundance at Attwater's prairie-chicken brood sites was directly related to brood survival during the critical first two weeks post-hatch and invasive red imported fire ants (*Solenopsis invicta*) reduced invertebrate abundance by 26–27%.

It is likely that invasion by fire ants contributed, at least in part, to the precipitous declines of Attwater's prairie-chicken populations toward near extinction. The ubiquitous distribution and rapid colonization potential of fire ants means that annual biological control measures are necessary to maintain suppression (USFWS 2021). Considerable grassland restoration and maintenance has been accomplished, particularly in Goliad County. The Goliad County Study Site retains the greatest extent of potential high-quality habitat to evaluate as potential future introduction sites. Despite good nest success, survival of chicks has been consistently poor across release sites. Populations remain small and threats from imported fire ants, stochastic weather events, and continued loss and fragmentation of habitat from woody species encroachment are expected to continue into the future. Until fire ants are removed and are no longer a threat in grasslands used by Attwater's prairie-chickens, we expect the species to remain in imminent danger of extinction (USFWS 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 14.6% of the species' range overlaps with agricultural use sites and 10.1% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff) (Table 8). In total, there is approximately 24.7% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 8. Agricultural use overlap and annual usage data (% Range Treated) for the Attwater's greater prairie-chicken.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	5	3.2	8.2	4.5	2.9	7.4
Grapes	0	0	0	0	0	0
Other Crops	5.2	3.2	8.4	5.2	3.2	8.4
Other Grains	4.3	2.9	7.1	4.3	2.9	7.1
Other Orchards	0.2	0.8	1	0.2	0.8	1
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	0.8	0.8	1.5	0.4	0.5	0.9

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Vegetables and Ground Fruit	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total	**14.6**	**10.1**	**24.7**	**14.2**	**9.8**	**24**

Usage

Past usage data indicate that up to 24% of the species' range has been treated with carbaryl annually from agricultural uses (Table 8).

Additional Exposure Considerations

We expect some individuals of the Attwater's greater prairie-chicken will occur and forage on agricultural fields, and thus, are at risk of dietary exposure to carbaryl through ingestion of contaminated food items.

Non-agricultural Uses

The Attwater's greater prairie-chicken may forage in rangeland areas, but we do not anticipate that it will occur in developed, open space developed, nurseries, or forested areas.

Conservation Measures

As the range of the Attwater's greater prairie chicken is outside the action area for the grasshopper and Mormon cricket program, we anticipate there is a low likelihood of the need to apply these program measures as grasshopper and Mormon cricket populations do not reach the level where they would need to be suppressed in these areas. However, if there were a need to use carbaryl on rangeland in the future within the range of the species, we anticipate that buffers and other mitigation measures would be applied as discussed in the USDA APHIS biological assessment to reduce exposure of the Attwater's greater prairie chicken to rangeland uses of carbaryl.

Exposure Summary

There is a high extent of overlap between the agricultural use sites for carbaryl and the species' range. Based on past usage data, we expect a high level of annual agricultural usage within the species' range. As such, we expect a large number of individuals are likely to experience exposure from agricultural uses of carbaryl.

We anticipate individuals may occasionally occur in non-agricultural use sites, including rangelands. However, based on existing conservation measures, we do not expect non-agricultural uses will result in the exposure of more than a small number of individuals.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to Attwater's greater prairie-chickens. Consumption of plant and animal food items on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 66.4 mg/kg-bw on crops with maximum application rates up to 2 lbs/acre, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to Attwater's greater prairie-chickens, including mortality or sublethal effects.

For uses with a maximum application rate of 5 lbs/acre, dosages are expected to range up to 166 mg/kg-bw, particularly for individuals that exclusively consume vegetation that has been exposed to carbaryl on use sites. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. Use layers that contain crops with allowable application rates up to 5 /bs/acre include Other Crops (for use on sod), Citrus, Other Orchards, and Open Space Developed (for use on golf courses). However, we do not expect that Attwater's greater prairie chicken will forage in these use sites, either due to their lack of proximity to these sites or because they do not contain suitable foraging habitat. We anticipate that foraging by the Attwater's greater prairie-chicken will only occur on use sites with lower maximum application rates, and thus do not expect any direct effects to individuals from use of carbaryl at these application rates.

Indirect Effects

Attwater's greater prairie-chicken relies on plants, arthropods, and seeds for food resources. While no effects to plant resources are expected, we anticipate mortality to arthropods from carbaryl exposure on or near use sites. Because arthropods taken as food exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but some prey will be available after exposure and any losses will likely only be temporary. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. As a generalist feeder, we anticipate that Attwater's greater prairie-chickens will be less affected by any specific loss of prey items and can consume other available dietary items. As such, we anticipate a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

We do not expect individuals will be present on-field during spray application, however, some individuals are likely to be exposed to contaminated food sources as the species is known to forage on-field. However, we do not expect concentrations of carbaryl to reach levels associated with direct effects in birds. Though we anticipate carbaryl exposure will cause mortality to some organisms that act as food resources for this species, we expect as a generalist feeder, the Attwater's greater prairie-chicken will be less affected by the loss of any specific dietary item. Given the low level of direct effects and medium level of indirect effects, we determine the Attwater's greater prairie-chicken has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The Attwater's greater prairie-chicken has a high exposure ranking. Based on past carbaryl usage data, we expect up to 24% of the range where the species is likely to forage will be treated annually but may potentially cover up to 24.7% of potential foraging areas (overlapping use sites) within the range over the duration of the proposed action depending how usage patterns may change over time. As such, we expect a moderate number of individuals are likely to be exposed to carbaryl.

We do not expect direct effects from exposure of foraging individuals to carbaryl but anticipate mortality for arthropods exposed to carbaryl concentrations on- and off-field. We anticipate a medium level of indirect adverse effects as Attwater's greater prairie-chickens are generalist feeders that are likely to switch to available food resources. However, invertebrate prey reductions are a known concern that may be impacting the reproductive success of this species.

Given that we expect a high number of individuals are likely to experience exposure, and a medium level of direct and indirect adverse effects, we determine the overall risk of adverse effects to the species is high.

Preliminary Conclusion

The Attwater's greater prairie chicken has a high vulnerability ranking based on its status, environmental baseline, and cumulative effects. The species currently occurs in the wild at only two locations - the Attwater Prairie Chicken National Wildlife Refuge (Colorado County, Texas) and on private ranchlands in Goliad County, Texas. They have been near extinction since 1996 following years of population declines, although there has been more recent population growth since 2017. Numbers are still low, but recovery efforts have included releases of captive-reared stock that have kept the species from extinction. Poor survival of chicks produced by released captive-reared Attwater's prairie-chickens was found to be the single-most important factor limiting significant progress toward recovery in the 2010 revision of the Attwater's Prairie-

Chicken Recovery Plan. It was concluded that invertebrate abundance at Attwater's prairie-chicken brood sites was directly related to brood survival during the critical first two weeks post-hatch. Spray drift from pesticides used on surrounding agricultural lands is noted as a potential threat to the species due to a reduction in the availability of insects, particularly as a food source for chicks.

We do not expect direct effects from exposure of foraging individuals to carbaryl. However, we anticipate losses of insect prey that are exposed to carbaryl. In our draft Opinion, before incorporating species-specific conservation measures, exposure was anticipated to be medium due to the high extent of overlap of use sites within the species range, and high amount of usage (up to 24% of the species range treated annually on agricultural use sites). We anticipated medium toxicity for this species as the loss of arthropod prey is also expected to impact the species since insects are an important, limited resource for the species, particularly during the breeding season. We expected prey losses would lead to reduced fitness and starvation in adults and impacts to the survival and growth of chicks in exposed areas over the duration of the proposed action. The risk to the species posed by carbaryl uses across the range was anticipated to be high.

Although the recent population trend has shown some improvement, numbers remain low and the Attwater's greater prairie-chicken remains on the brink of extinction. We expect any carbaryl usage on the Attwater Prairie Chicken National Wildlife Refuge to be minimal if there is any usage on the refuge at all. However, exposure on use sites or from spray drift in other parts of the range was expected to result in the loss of insect prey, affecting population numbers due to reduced fitness and reduced survival of chicks and adults needed for recovery. Without the conservation measures subsequently adopted as part of the action, as discussed below, we determined that these adverse effects to the reproduction, numbers and distribution of the species would likely cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above, EPA and the applicants agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Attwater's prairie chicken:

1. *For agricultural uses, carbaryl must be applied using a 105-foot buffer for ground applications and a 160-foot buffer for airblast applications.*

Based on AgDRIFT modeling, the buffers will reduce spray drift from entering terrestrial habitat for Attwater's prairie chicken by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.

The PULA for the Attwater's prairie chicken will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently *considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of carbaryl.*

After incorporating these conservation measures, we expect these pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, with adverse effects limited to a very small number of individuals due to losses of invertebrate prey that lead to minor reductions in fitness supporting reproductive capacity or growth of chicks. However, effects will not likely reduce the reproduction, numbers, and distribution of the species. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the species-specific conservation measures that are now incorporated into the proposed action), we determined the proposed action is not likely to appreciably reduce the survival and recovery of the Attwater's prairie chicken in the wild. Thus, it is our biological opinion that the registration of carbaryl, as proposed, is not likely to jeopardize the continued existence of the Attwater's prairie-chicken.

References

U.S. Fish and Wildlife Service. 2021. Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*) 5-year review: Summary and Evaluation. Houston, Texas. 20 pp.

U.S. Fish and Wildlife Service. 2010. Attwater's Prairie-Chicken Recovery Plan, Second Revision. Albuquerque, New Mexico. 117 pp.

Integration and Synthesis Summary: Yuma Ridgway's rail

Scientific Name:	Common Name:	Entity ID:
Rallus obsoletus yumanensis	Yuma Ridgway's rail	84

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is medium. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Yuma Ridgway's rail. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 8/25/2022; Wherever found; *States within the range:* AZ, CA, NV

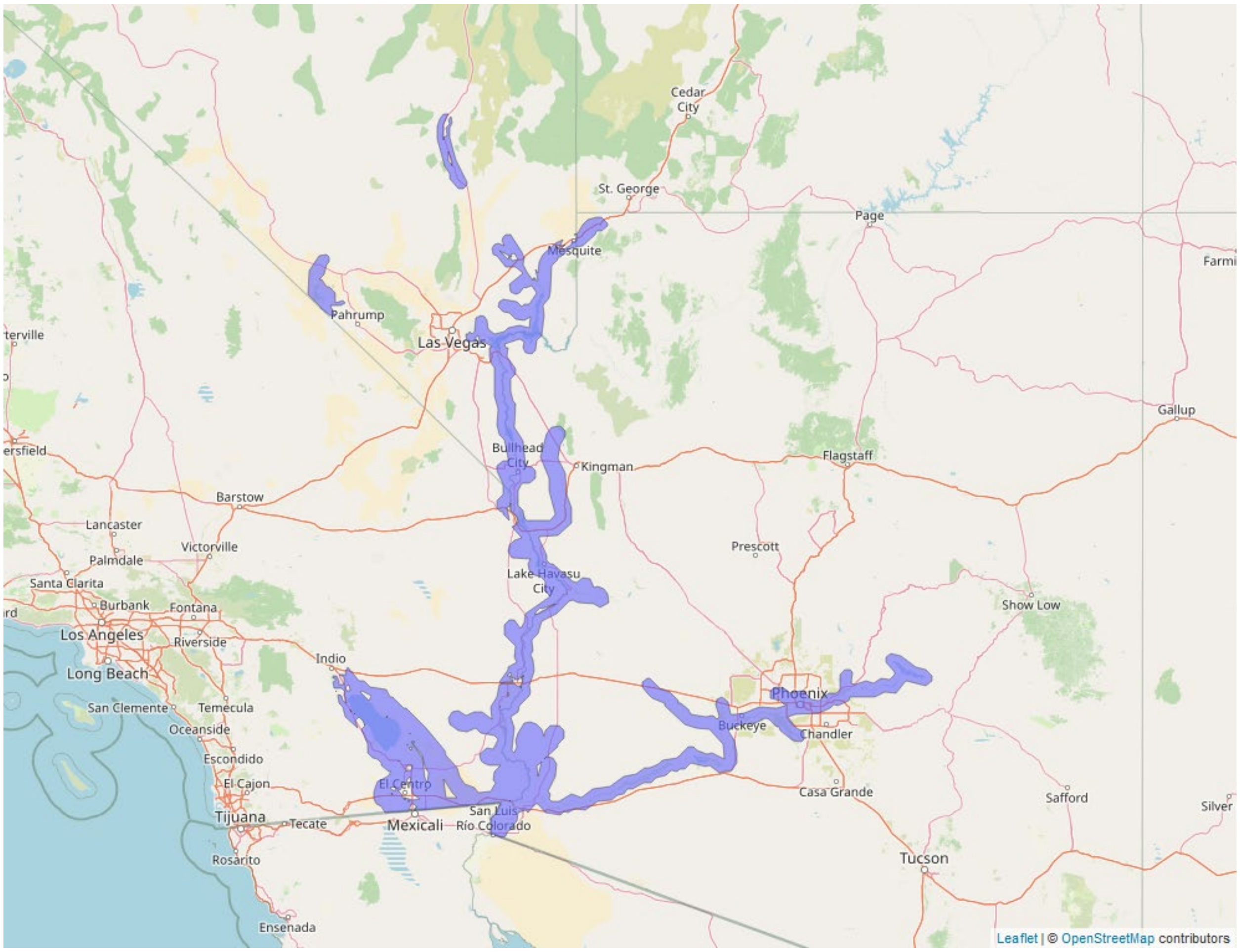

Figure 3. Range map of Yuma Ridgway's rail (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3505.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of status

Listing status: Endangered

Most recent 5-Year Status Review recommendation: No change in Status

Most recently completed 5-Year Status Review: 9/11/2006

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: All populations stable, with none known to be increasing or decreasing

Pesticides noted in Service documents as a threat to the species: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Yuma clapper [Ridgway's] rail is found primarily in Mexico, but its U.S. range includes portions of Arizona and California. The diet of Yuma Ridgway's rails is dominated by crayfish and subsidized with small fish, tadpoles, clams, and other aquatic invertebrates. The Yuma Ridgway's rail is the only subspecies of clapper rail found in freshwater marshes. Existing habitats are primarily either human-made (e.g., the managed ponds at Salton Sea, the effluent-supported marshes at the Cienega de Santa Clara) or formed behind dams and diversions on the Lower Colorado River at the time those structures were created. The most recent estimate of potentially suitable Yuma Ridgway's rail habitat present on the Lower Colorado River is 3,653 ha with 1,083 ha of that on four National Wildlife Refuges: Havasu, Bill Williams River, Cibola, and Imperial. Over the 2000-2008 period, the numbers of birds fluctuated between 503 and 890, reaching the minimum recovery population size of over 700 in 5 of those 9 years (USFWS 2010). Yuma Ridgway's rail habitat is subject to succession processes that reduce habitat value over time without also being subject to natural restorative events generated by a natural hydrograph.

The greatest threat to the Yuma Ridgway's rail is habitat loss from lack of water sources that support their freshwater marsh habitats. Other threats to this species include land use changes in floodplains, flooding events, human activities, environmental contaminants (particularly increases in selenium levels), and reductions in connectivity between core habitat areas. The current levels of selenium at the Salton Sea, Lower Colorado River, and the Cienega de Santa Clara are sources of concern for the Yuma Ridgway's rail populations in those habitats, but more research is needed. Other contaminants, including heavy metals and pesticides, have not been identified as significant threats. While it appears reasonable to assume that Yuma Ridgway's rails may be affected by climate change, we lack sufficient certainty to know how such changes will affect the subspecies. We believe the effects would likely be related to water availability. Due to the limited population size and restricted range, this species is potentially at risk from stochastic events (USFWS 2006).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 25.3% of the species' range overlaps with agricultural use sites and 12.4% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff) (Table 9). In total, there is approximately 37.7% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 9. Agricultural use overlap and annual usage data (% Range Treated) for the Yuma Ridgway's rail.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	10.4	3.4	13.7	1.2	0.4	1.6
Citrus	1.3	1.3	2.7	0.6	0.6	1.2
Corn	0.7	0.5	1.2	0.5	0.4	0.8
Grapes	0.5	0.6	1.1	0.4	0.4	0.8
Other Crops	4.3	3	7.4	4.3	3	7.4
Other Grains	0.7	0.6	1.3	0.2	0.2	0.3
Other Orchards	1.1	1.1	2.2	0.7	0.6	1.3
Other Row Crops	1.9	1.1	3	0.1	<0.1	0.2
Soybeans	<0.1	<0.1	<0.1	0.0	0	0.0
Vegetables and Ground Fruit	5.9	2.4	8.3	4.7	2.1	6.8
Total	**25.3**	**12.4**	**37.7**	**11.8**	**6.7**	**18.5**

Usage

Past usage data indicate that up to 18.5% of the species' range has been treated with carbaryl annually from agricultural uses (Table 9).

Additional Exposure Considerations

The Yuma Ridgway's rail forages for crayfish, small fish, tadpoles, clams, and other aquatic invertebrates in the freshwater and brackish marshes it inhabits. As such, we do not expect the Yuma Ridgway's rail to forage in agricultural use sites. However, we expect exposure from off-site transport (via spray drift or runoff) in 12.4% of the rail's range and we expect up to 6.7% of the range to be treated annually in off-field areas.

Non-agricultural Uses

The Yuma Ridgway's rail is not expected to occur in most non-agricultural use sites of carbaryl, including managed forests, developed areas, or golf courses, but may forage, roost, or breed close to roads if the road is by suitable habitat. Carbaryl is not registered for use in aquatic habitats, so exposure from rights of way use would only occur from spray drift or runoff, which is expected to be low given that localized treatments are expected in these use sites. Additionally, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally on an annual basis. As such, we anticipate a low likelihood that carbaryl usage would occur in those rights of ways within the range of the Yuma Ridgway's rail containing suitable habitat for this species, and we expect non-agricultural uses will result in the exposure of few, if any, individuals.

Conservation Measures

We expect rangeland uses of carbaryl will be through the USDA APHIS grasshopper and Mormon cricket suppression program. Carbaryl applications made through this program are required to implement conservation measures for the protection of listed species, including standard ground and aerial buffers from the edge of known locations of Yuma Ridgway's rail (500-ft. for ground applications and 1,320-ft. for aerial applications), reduced application rates, and reduced number of applications made per year. We expect these measures will be sufficiently protective of the Yuma Ridgway's rail to rangeland uses of carbaryl.

Exposure Summary

There is a high extent of overlap between the action area and potential foraging areas within the species' range, totaling up to 12.4% in areas adjacent to agricultural use sites of carbaryl. Based on past usage data, we expect a medium level of usage in potential foraging areas within the species' range, with usage on up to 6.7% of the range annually. Given that the extent of overlap is high, and the expected usage is medium, we expect a high number of individuals are likely to experience exposure from the proposed action.

We expect a low likelihood of exposure from non-agricultural use sites. Based on low anticipated usage and low expected off-sites transport in rights of way, and existing conservation measure requirements for rangeland applications of carbaryl, we do not expect non-agricultural uses will result in the exposure of more than few, if any, individuals.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects

The Yuma Ridgway's rail forages for crayfish, small fish, tadpoles, clams, and other aquatic invertebrates, which are not expected to occur on carbaryl use sites. Spray drift or run off may enter the freshwater and brackish marshes where the species feeds. However, no direct adverse effects are expected to the Yuma Ridgway's rail from foraging on these dietary items if exposed to carbaryl.

Indirect Effects

The Yuma Ridgway's rail relies on benthic invertebrates, filter feeders, and fish for food resources. Based on available toxicity data, we do not expect reductions of fish but expect invertebrate prey will likely die with exposure to carbaryl in areas where spray drift or runoff enter their habitats. However, we expect invertebrates to exhibit a range of sensitivities to carbaryl. As such, we expect exposure will reduce the abundance of some prey items in areas subject to carbaryl spray drift or runoff, but some prey will be available after exposure and any losses will likely only be temporary. As such, even though toxicity to prey items is anticipated to be high, we anticipate a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

No direct adverse effects are expected for Yuma Ridgway's rails consuming dietary items exposed to carbaryl from spray drift or runoff. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will reduce the abundance in areas subject to spray drift or runoff, but some prey will be available after exposure and any losses will likely only be temporary. As such, we determine the Yuma Ridgway's rail has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The Yuma Ridgway's rail has a high exposure ranking. Though this species is not expected to forage in carbaryl use sites, based on past carbaryl usage data, we expect up to 6.7% of the range subject to spray drift or runoff may be treated annually, but may potentially cover up to 12.4% of the range over the duration of the proposed action depending how usage patterns change over time. This indicates that a large portion of the species' range is likely to be treated overall and a large number of individuals are likely to be exposed to carbaryl. Though Yuma Ridgway's rail may occur in areas adjacent to roads with suitable habitat, we do not expect non-agricultural uses will result in the exposure of more than a few, if any, individuals.

The Yuma Ridgway's rail has a medium toxicity ranking. While we do not expect adverse effects to Yuma Ridgway's rails through the consumption of contaminated food items, we expect a medium level of indirect adverse effects are likely to occur as we expect carbaryl exposure will reduce the abundance of invertebrate prey species in areas subject to spray drift or runoff.

Given that we expect a high number of individuals are likely to be exposed, and a moderate level of indirect adverse effects, we determine the overall risk of adverse effects to the species is medium.

Conclusion

The Yuma Ridgway's rail occurs in Arizona and California. The species is currently found in freshwater marshes that are primarily either human-made, such as the managed ponds at Salton Sea or the effluent-supported marshes at the Cienega de Santa Clara or formed behind dams and diversions on the Lower Colorado River. The species uses dense herbaceous or woody vegetation associated with these aquatic habitats for nesting and foraging. The greatest threat to the Yuma Ridgway's rail is that without active management and protection of water sources supporting the habitat, these habitat areas will be permanently lost. Other threats include a variety of issues, including environmental contaminants such as increases in selenium levels in their habitats. Due to the limited population size and restricted range, this species is potentially at risk from stochastic events. The species has a high vulnerability ranking.

The Yuma Ridgway's rail has a high exposure ranking. The rail's diet is dominated by crayfish, with small fish, tadpoles, clams, and other aquatic invertebrates. We expect 12.4% of foraging areas in the species range overlaps with areas near agricultural use sites of carbaryl that are likely to be exposed through off-site transport within the action area. Based on past usage data, we expect agricultural usage in up to 6.7% of potential foraging areas within the species' range annually. We do not anticipate exposure from non-agricultural uses for more than a few, if any, individuals. We do not anticipate direct effects to the rail from foraging on dietary items exposed to carbaryl. However, we expect losses of invertebrate prey items due to mortality after exposure to carbaryl. We expect invertebrate prey species used by the rail will exhibit a range of sensitivities to carbaryl, such that some prey will be available after exposure and any losses will likely only be during temporary periods. As such, even though toxicity to prey items is anticipated to be high, we anticipate a medium level of indirect adverse effects to the rail are likely to occur. While we expect some alternative resources will remain available for the rail after exposure in the vicinity, and rails will likely be able to travel to unexposed foraging sites if needed to find sufficient prey, we expect losses of prey will lead to impacts to a small number of individuals from starvation or inadequate food for successful reproduction.

In summary, the species has a high vulnerability. The overall risk of the proposed action to the species is moderate. We expect the impacts to a small number of individuals over the project duration from lack of adequate resources for survival and reproduction due to losses of prey items, but no impacts from exposure through dietary items over the duration of the proposed action. We do not expect the effects will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Yuma Ridgway's rail.

References

U.S. Fish and Wildlife Service. 2006. Yuma Clapper Rail (*Rallus longirostris yumanensis*) 5-Year Review. Albuquerque, New Mexico. 29 pp.

U.S. Fish and Wildlife Service. 2010. Yuma Clapper Rail (*Rallus longirostris yumanensis*) Recovery Plan. Draft First Revision. Albuquerque, New Mexico. 73 pp.

Integration and Synthesis Summary: Red-cockaded woodpecker

Scientific Name:	Common Name:	Entity ID:
Picoides borealis	Red-cockaded woodpecker	107

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is low. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is medium. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the woodpecker. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 9/13/2023; Wherever found; *States within the range:* AL, AR, FL, GA, LA, MS, NC, OK, SC, TX, VA

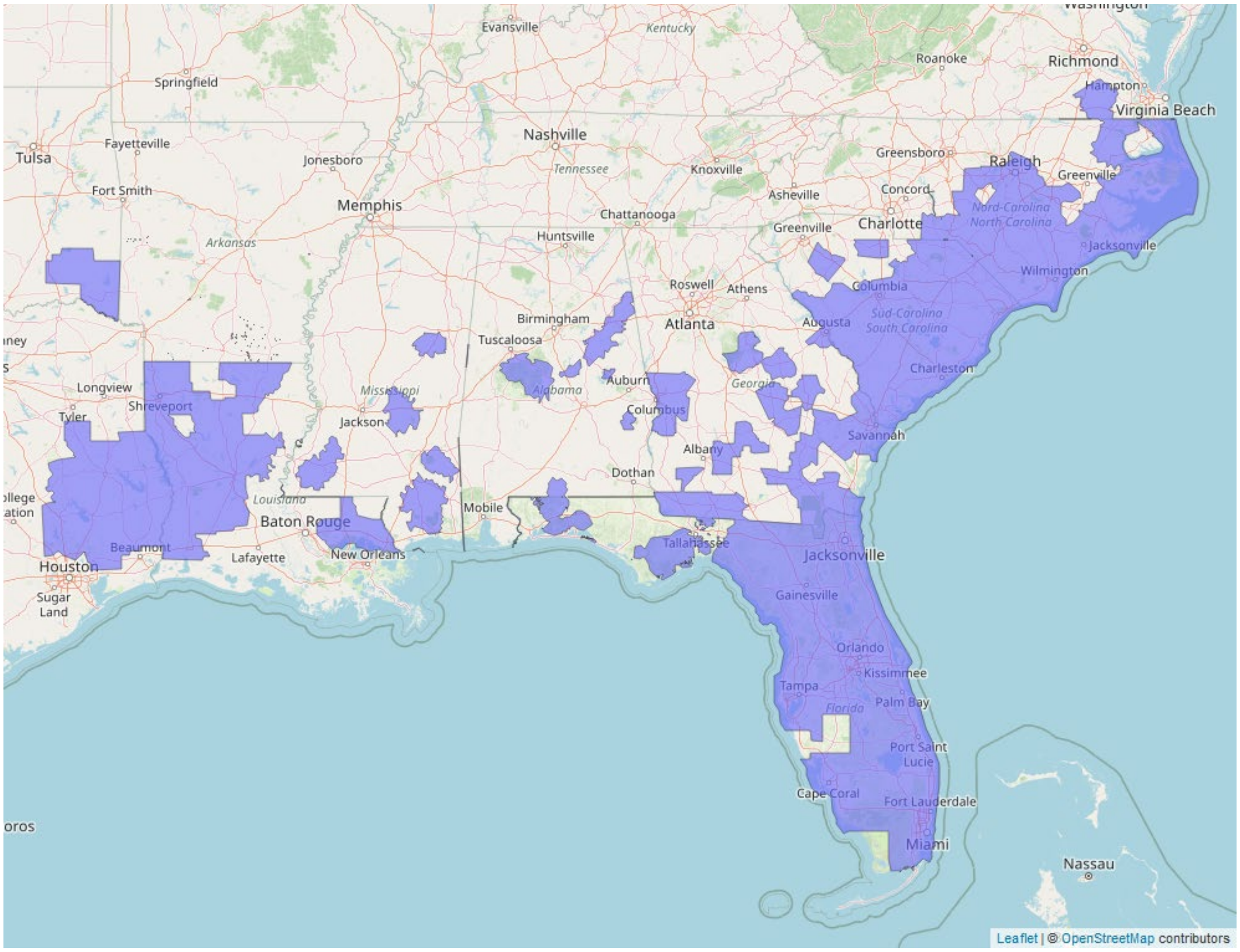

Figure 4. Range map of Red-cockaded woodpecker (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7614.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of status

Listing status: Threatened (reclassified from endangered status on 10/25/2024)

Most recent 5 Year Status Review recommendation: Downlist to Threatened

Most recently completed 5 Year Status Review: 10/8/2020

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (numerous)

Species trends: Increasing population(s)

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Red-cockaded woodpeckers were once considered a common bird across the southeastern U.S. They are found in open pine woodlands and savannahs with large old pines for nesting and roosting. They are non-migratory and live in groups that share territories throughout the year. They have a cooperative breeding system, where some mature adults forgo reproduction and instead assist in raising the offspring of the group's breeding male and female. A potential breeding group consists of a breeding pair, or a pair with up to five helpers. Red-cockaded woodpeckers rely on cavities to breed and compete intensely for openings in high-quality habitat rather than excavate new cavities in poor quality habitat. When artificial cavities are added to unoccupied but otherwise suitable habitat, it immediately becomes high-quality habitat and is occupied. Number of high-quality territories depends on the number and distribution of suitable cavities, which then determines breeding population size.

At the time of listing in 1970, the species was severely threatened by lack of adequate habitat due to historical logging, incompatible forest management, and conversion of forests to urban and agricultural uses. Fire-maintained old growth pine savannas, on which the species depends, were extremely rare. What little habitat remained was mostly degraded due to fire suppression and silvicultural practices that hindered the development of older, larger trees needed by the species for cavity development and foraging. Even after listing, the species continued to decline. Kleptoparasitism (a cavity created and used by a red-cockaded woodpecker that is usurped by another species, such as southern flying squirrels) may threaten critically small populations or isolated groups due to losses of nests or cavities, but is less likely to impact larger, healthy populations. Cavity enlargement by other species (i.e., pileated woodpeckers, red-bellied woodpeckers, red-headed woodpeckers, northern flickers) may deem them unusable by red-cockaded woodpeckers (USFWS 2020). Other factors unrelated to habitat loss may threaten the species, including pesticides, but their importance has not been determined (USFWS 2003). However, new restoration techniques, such as creating artificial cavities, along with changes in silvicultural practices and wider use of prescribed fire to recreate open pine parkland structure, has led to stabilization of the species' viability and resulted in an increase in the number and distribution of populations.

The red-cockaded woodpecker was estimated range-wide around the time of listing in 1970 to be fewer than 10,000 individuals (approximately 1,500 to 3,500 active clusters; an aggregate of cavity trees used by a group of woodpeckers for nesting and roosting) in widely scattered, isolated, and declining populations. As of 2022, the Service's conservative estimate is that there are 7,800 active clusters range-wide, almost double the number of clusters that existed in 1995. The clusters comprise 124 populations across 13 ecoregions, with 71 on lands managed by Federal agencies, 7 on lands under mixed Federal and state ownership, and 31 on lands managed solely by State agencies. Thus, 88% are on lands managed by Federal and State agencies with statutes that require management plans to address the conservation of natural resources, and some of the other populations are on lands managed for species conservation (e.g., private lands enrolled in Safe Harbor Agreements). While most populations are still small and vulnerable to stochastic events, 87% of the populations for which we were able to determine trends were stable or increasing, and 13% were declining. All of the population objectives from the 2003 recovery plan have yet to be reached. However, the primary recovery task of increasing existing populations on Federal and State lands has been successful, and the population growth rates indicate sufficient resiliency to stochastic disturbances with effective management. In addition, redundancy of moderate to very high resiliency populations suggests that risks from future catastrophic events to overall viability are low. The primary stressor affecting the status of the red-cockaded woodpecker remains the lack of suitable habitat. Wildfire, pine beetles, ice storms, tornadoes, hurricanes, and other naturally occurring disturbances that destroy pines used for cavities and foraging are stressors for the red-cockaded woodpecker, especially given the high number of very small woodpecker populations. The species was reclassified from endangered to threatened in 2024 due to its improvement in status (USFWS 2024).

Overall Vulnerability: Low

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 10.6% of the species' range overlaps with agricultural use sites and 7.4% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 18% overlap between the species' range and the agricultural footprint of carbaryl use (Table 10).

Table 10. Agricultural use overlap and annual usage data (% Range Treated) for the red-cockaded woodpecker.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Citrus	0.8	0.5	1.3	<0.1	<0.1	0.2
Corn	3.9	2.4	6.3	0.3	0.2	0.5
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Crops	2.1	2.2	4.2	1.1	1.2	2.4
Other Grains	1	0.7	1.7	<0.1	<0.1	<0.1
Other Orchards	0.4	0.5	0.9	0.2	0.2	0.4
Other Row Crops	1.8	1.1	2.9	0.1	<0.1	0.2
Soybeans	4.4	2.4	6.8	0.5	0.3	0.8
Vegetables and Ground Fruit	0.5	0.5	1.1	0.2	0.2	0.4
Total	**10.6**	**7.4**	**18**	**2.2**	**2.1**	**4.3**

Usage

Past usage data indicate that up to 4.3% of the species' range has been treated with carbaryl annually from agricultural uses (Table 10).

Additional Exposure Considerations

The red-cockaded woodpecker is endemic to open, mature, and old growth pine ecosystems and is not expected to forage or roost in agricultural fields, row crops, or orchards and vineyards. (pers. comm. 2016 co-occurrence information, USFWS field office request). Though carbaryl can enter these habitats via spray drift, given the broad nature of the range map for this species, it is unlikely that the entire area of overlap adjacent to agriculture represents red-cockaded woodpecker habitat. Therefore, it is expected the area of red cockaded woodpecker habitat exposed to spray drift is lower than the 7.4% overlap and 2.1% treated. In addition, though red-cockaded woodpeckers prefer open pine systems, spray drift is still expected to be reduced to some extent by interception with the forested habitat, further lowering the extent of habitat likely to be exposed.

Non-agricultural Uses

We do not anticipate the red-cockaded woodpecker will occur on rangeland or rights of way use sites. The red-cockaded woodpecker primarily occurs in open, mature, and old growth pine ecosystems, and may also use golf courses, residential areas, and other developed areas with sufficient residual large or old pines.

While forests comprise the primary habitat of the red-cockaded woodpecker, available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the red-cockaded woodpecker. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As such, we anticipate a low likelihood of carbaryl usage on managed forests in the range, and that if usage did occur, exposure to the red-cockaded woodpecker would be minimal such no more than a few, if any, individuals would be exposed.

Similarly, available usage data indicate only low levels of past carbaryl usage in open space developed areas within the red cockaded-woodpecker's range, with, at most, up to 2.4% of the species' range likely to be treated each year. Given that this usage is likely to occur in many habitat types within this land use site, we anticipate an even lower level of usage within those areas containing suitable habitat for red cockaded woodpeckers. Furthermore, we expect many carbaryl applications in developed areas will be limited to hand-held equipment and treatments to small areas that greatly limit the extent of off-site transport and non-target exposure, further reducing the likelihood that individuals will be exposed to carbaryl from use on developed sites such as golf courses and residential areas.

Conservation Measures

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated in developed use sites.

Exposure Summary

The red-cocked woodpecker is not expected to forage in agricultural use sites. Given that all areas adjacent to agriculture in the species' range are unlikely to be red-cockaded woodpecker habitat and the expectation that the forested habitat will reduce spray drift, we anticipate a medium extent of overlap between the action area and the species' range that could be exposed via spray drift, with a low extent of usage in these areas. As such, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

While forests represent the primary habitat of the red-cockaded woodpecker, we anticipate low levels of usage, small treatment areas, and limited off-site movement of carbaryl in use sites such as managed forests and developed area that contain suitable habitat. As such, we anticipate a low level of exposure from non-agricultural uses of carbaryl.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items that have been exposed to spray drift near carbaryl use sites to be the primary route of carbaryl exposure to red-cockaded woodpeckers. Consumption of plant and animal food items on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 48.2 mg/kg-bw on crops with maximum application rates up to 2 lbs/acre, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to red-cockaded woodpeckers, including mortality or sublethal effects.

For uses with a maximum application rate of 5 lbs/acre, dosages are expected to range up to 120.6 mg/kg-bw, particularly for individuals that exclusively consume arthropods that have been exposed to carbaryl on use sites. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. However, we do not expect the red-cockaded woodpecker to forage in use sites that contain crops with allowable application rates up to 5 /bs/acre including Other Crops (for use on sod), Citrus, Other Orchards, and Open Space Developed (for use on golf courses).

We do not anticipate that exposure to carbaryl from food items that have been exposed via spray drift from an adjacent use site will result in any direct effects to red-cockaded woodpeckers, even at maximum application rates.

Indirect Effects

The red-cockaded woodpecker relies on arthropods, fruit, and seeds for food resources. Over 75% of the diet of red-cockaded woodpeckers consists of arthropods, especially ants and roaches, but also beetles, spiders, centipedes, true bugs, crickets, and moths. Though red-cocked woodpeckers capture arthropods on and under bark, most prey are not exclusively bark residents, so drift into their habitat can broadly expose prey (Hanula and Horn 2004). Based on available toxicity data, we expect that exposure from spray drift is likely to cause mortality of these prey species. However, because arthropods taken as food items exhibit a range of sensitivities to carbaryl, we that expect that to exposure to carbaryl from spray drift will reduce the abundance, but some prey will be available after exposure and any losses will likely only be temporary. Studies of red-cockaded woodpeckers found prey selection is related to abundance, as opposed to preference for particular species (Hanula and Horn 2004). We do not expect exposure to carbaryl to result in any reductions in plants. Therefore, as a generalist feeder of arthropods, we anticipate that red-cockaded woodpeckers will be less affected by the loss of specific species and will consume other available dietary items.

Toxicity Summary

We do not expect direct effects to red-cockaded woodpeckers from exposure to arthropods or plant material at predicted exposure levels. As arthropods are the primary dietary item of red-cockaded woodpeckers, we expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. However, because not all species of arthropods are expected to die from spray drift exposure, we expect the red-cockaded woodpecker, as a generalist feeder, will be able to consume available dietary items. As such, we determine the red-cockaded woodpecker has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The red-cockaded woodpecker has a medium exposure ranking. Given that all areas adjacent to agriculture in the species' range are unlikely to be red-cockaded woodpecker habitat, we anticipate that exposure will be less than the 7.4% of spray drift areas that overlap with the species' range and the 2.1% of the species' range that is likely to be treated. In addition, we expect that the forested habitat of the red-cockaded woodpecker will result in interception of spray drift, thus further reducing the extent of the species' habitat exposed to carbaryl. While forests represent the primary habitat of the red-cockaded woodpecker, we anticipate low levels of usage, small treatment areas, and limited off-site movement of carbaryl in use sites such as managed forests and developed area that contain suitable habitat. As such, we expect a moderate number of individuals are likely to experience exposure from the proposed action from carbaryl use in agricultural and non-agricultural use sites.

We do not expect direct effects to red-cockaded woodpeckers from exposure to arthropods or plant material at predicted exposure levels. As arthropods are the primary dietary item of red-cockaded woodpeckers, we expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. However, because not all species of arthropods are expected to die from spray drift exposure, we expect the red-cockaded woodpecker, as a generalist feeder, will be able to consume available dietary items. As such, we determine the red-cockaded woodpecker has a medium toxicity ranking.

Given that we expect a moderate number of individuals are likely to experience exposure and given that we expect a moderate level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is medium.

Conclusion

The red-cockaded woodpecker was once considered a common bird across the southeastern U.S. At the time of listing in 1970, the species was severely threatened by lack of adequate habitat due to historical logging, incompatible forest management, and conversion of forests to urban and agricultural uses. However, new restoration techniques, such as artificial cavities, along with changes in silvicultural practices and wider use of prescribed fire to recreate open pine parkland structure, has led to stabilization of the species' viability and resulted in an increase in the number and distribution of populations. This species continues to have a wide distribution. There are currently at least 124 populations across 13 ecoregions. While most populations are still small and vulnerable to stochastic events, the majority are stable or increasing and the species was reclassified from endangered to threatened in 2024 due to its improvement in status. The species has a low vulnerability ranking.

The red-cockaded woodpecker has a medium exposure ranking. While we expect 18% of the species range overlaps with carbaryl use sites or is likely to be exposed through off-site transport within the action area, and usage is anticipated to expose 4.3% of these areas annually, exposure is only likely in off-site areas only where there is 7.4% overlap, of which 2.1% is likely to be exposed annually. This is because the species occurs in open pine woodlands and savannahs and is not expected to forage in agricultural use sites, and exposure from non-agricultural uses is expected to be minimal with few, if any, individuals affected. Given that areas adjacent to agriculture in the species' range are unlikely to all be red-cockaded woodpecker habitat, we expect that the species' forested habitat will reduce spray drift, and we do not expect exposure levels to result in direct effects to the red-cockaded woodpecker, we do not anticipate direct effects. However, we expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. Not all species of arthropods are expected to die from spray drift exposure, and we expect most red-cockaded woodpeckers, as generalist feeders that are highly mobile, will be able to find available dietary items to consume. However, we expect starvation or reduced fitness in a small number of individuals as a consequence of losses of prey items over the duration of the proposed action.

In summary, the species has a low vulnerability, and the overall risk to the species is medium. While overlap with use sites is high and usage in the range is moderate, this species is not expected to occur on agricultural sites. Therefore, the most likely route of exposure to the species is from exposure from consuming to arthropods or plant material, but adverse effects are not anticipated at predicted exposure levels. Exposure from non-agricultural uses is expected to be minimal, with effects to few, if any, individuals from these uses. We expect the loss of a small number of individuals and reduced fitness from losses of exposed prey items over the duration of the proposed action. However, we anticipate most individuals will be able to move to alternative sites to forage as needed to find sufficient prey after losses in localized areas. Additionally, this species has a wide distribution with multiple populations, and we do not anticipate large segments of the population will be affected by losses of exposed prey at any given site. While we anticipate impacts to a small number of individuals, we do not expect the adverse effects from the proposed action will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the red-cockaded woodpecker.

References

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U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Reclassification of the Red-Cockaded Woodpecker from Endangered to Threatened with a Section 4(d) Rule. Proposed Rule. Federal Register 85: 63474-63499.

U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Reclassification of the Red-Cockaded Woodpecker From Endangered to Threatened With a Section 4(d) Rule. Final rule. Federal Register 89: 85294-85338.

Integration and Synthesis Summary: Crested caracara (Audubon’s) [FL DPS]

Scientific Name:	Common Name:	Entity ID:
Caracara plancus audubonii	Crested caracara (Audubon's) [FL DPS]	125

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species’ vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species’ range, past annual usage of carbaryl within the species’ range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is medium. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Audubon’s crested caracara. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 4/26/2022; U.S.A. (FL); *States within the range:* FL

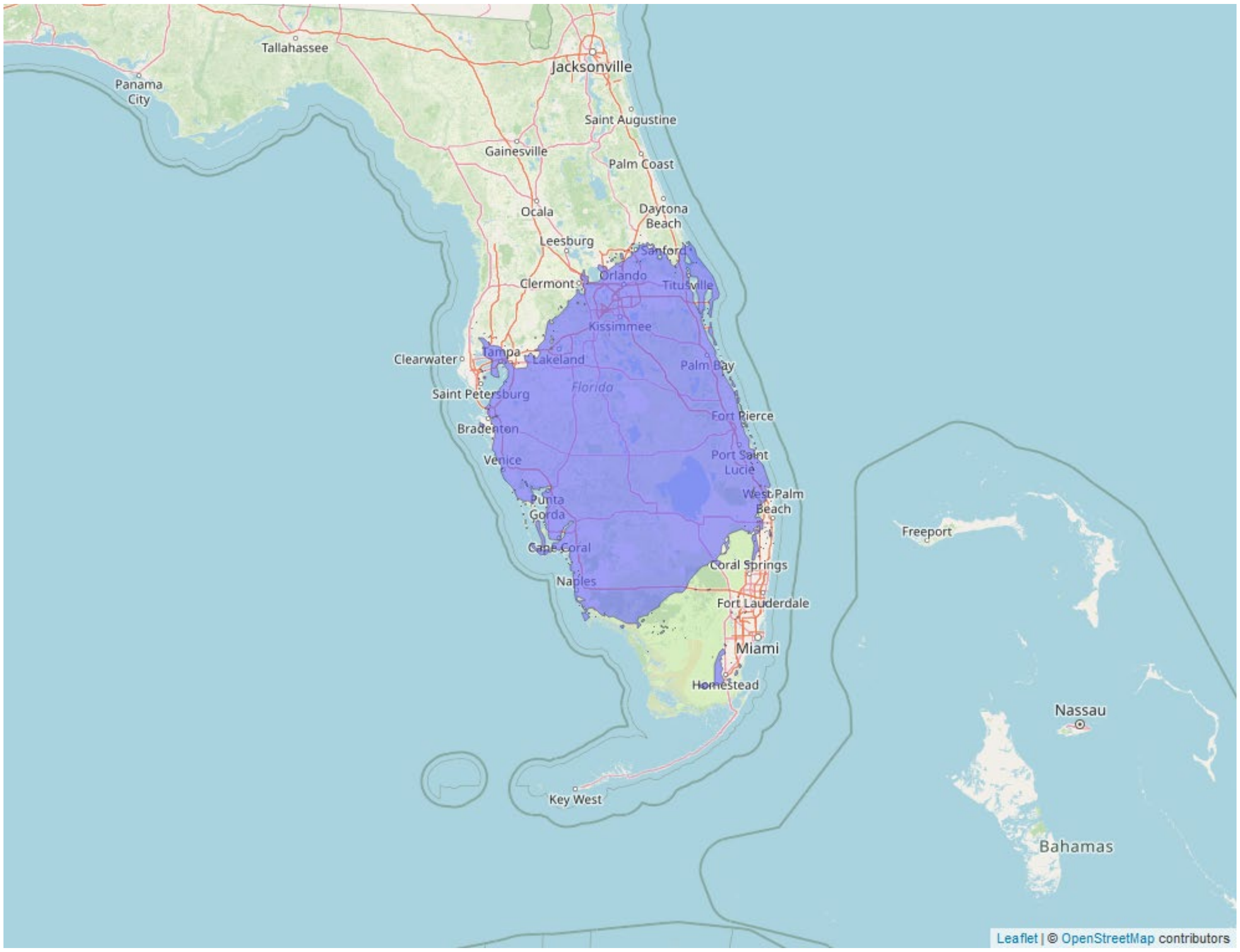

Figure 5. Range map of crested caracara (Audubon's) [FL DPS] (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8250.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of status

Listing status: Threatened

Most recent 5-Year Status Review recommendation: No change in status

Most recently completed 5-Year Status Review: 8/14/2009

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Though listed as Audubon's crested caracara (*Polyborus plancus audubonii*), taxonomic research revealed that the Florida population should be recognized as the northern crested caracara (*Caracara cheriway*). They occur in improved pasture lands and lightly wooded areas with limited stretches of open grassland also (USFWS 1987). Caracaras are highly opportunistic in their feeding habits, eating carrion and capturing live prey (e.g., rabbits, skunks, prairie dogs, opossums, rats, mice, squirrels, frogs, lizards, young alligators, crabs, crayfish, fish, young birds, cattle egrets, beetles, grasshoppers, maggots, and worms), insects and other invertebrates, fish, snakes, turtles, birds, and mammals.

The northern crested caracara ranges from northern Brazil through Central America and Mexico, north to the United States. Primary habitat in Florida consists of prairies interspersed with marshes and cabbage palm hammocks. Conversion of native prairie to agriculture or urban uses, and habitat degradation from disruption of the natural fire regime has led to a significant reduction in available habitat. Current habitat use of the caracara, 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. Nesting habitat may be limiting caracara population growth. Caracara 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. Nesting on private lands appears to be preferred over public lands, perhaps due to more rigorous management of privately owned grasslands.

In the United States, the species exists as a relatively small, isolated population in Florida. As of 2009, over 500 individuals inhabited Florida and used over 150 nest sites. Abundance estimates are dubious due to the bird's low detectability and surveyors' limited access to suitable habitat on private lands. Population trends are also difficult to interpret because of the bird's long lifespan, site-fidelity, and the lack of data on recruitment rates of young. Results from research initiated in 2006 suggested all territories identified in the 1990s remained occupied, but breeding success has not been evaluated and caracara may exhibit site fidelity regardless of degraded habitat quality and low nesting success. A population viability analysis demonstrated that while it may have been stable at the time, the caracara population in Florida was sensitive to habitat loss, particularly within core habitat. Audubon's crested caracaras rely on open country: dry prairies with wetter areas and scattered cabbage palm (Sabal palmetto) constitute typical habitat (USFWS 2009).

Threats to the Audubon's crested caracara include habitat loss, fragmentation, and degradation; hydrologic management; climate change; disease; and predation. Cattle ranching appears to be compatible with caracara survival, but conversion of improved pasture to citrus, sugarcane, or residential development would clearly be unsuitable for the caracara. Analyses by Zwick and Carr (2006) indicated that the central Florida region was expected to experience "explosive" growth, with continuous urban development from Ocala to Sebring; virtually all the natural systems and wildlife corridors in this region will be fragmented, if not replaced, by urban development (USFWS 2009).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 18.7% of the species' range overlaps with agricultural use sites and 8.1% of the species' range overlaps with areas adjacent to use sites that are likely to be exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 26.8% overlap between the species' range and the agricultural footprint of carbaryl use (Table 11).

Table 11. Agricultural use overlap and annual usage data (% Range Treated) for the Audubon's crested caracara.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Citrus	8	4.1	12.1	0.8	0.4	1.2
Corn	0.4	0.3	0.7	0.1	<0.1	0.2
Grapes	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Other Crops	4.6	2.2	6.8	4.6	2.2	6.8
Other Grains	5.1	0.8	5.9	<0.1	<0.1	<0.1
Other Orchards	0.4	0.4	0.8	0.4	0.4	0.8
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Vegetables and Ground Fruit	0.6	0.7	1.2	0.1	0.1	0.2
Total	**18.7**	**8.1**	**26.8**	**5.7**	**2.8**	**8.5**

Usage

Past usage data indicate that up to 8.5% of the species' range has been treated with carbaryl annually from agricultural uses (Table 11).

Additional Exposure Considerations

While the species' range map encompasses a large portion of the state, the fragmentation and degradation of habitat from land use changes has resulted in patchy suitable areas where individuals occur in a clustered distribution. Core habitat lies within the Kissimmee Prairie, located northwest of Lake Okeechobee, and includes less than 1000 km^2 of suitable habitat. However, non-breeding caracaras range more widely than breeding caracaras and may occur more broadly through the range.

Primary crested caracara habitat in Florida consists of prairies interspersed with marshes and cabbage palm hammocks. Current habitat use 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. The Audubon's crested caracara could enter agricultural areas, including orchards, to forage, roost, or breed (Pers. comm. 2016 co-occurrence information, USFWS field office request). Though these areas represent a smaller proportion of use by caracaras than other habitats, non-breeding caracaras have been shown to use citrus groves based on availability, particularly those adjacent to pasture (Dwyer et al., 2013).

As stated above, caracaras are highly opportunistic in their feeding habits. Several authors have noted that caracaras may consume unusual items, including turtle and other eggs as well as coconut meat. Caracaras are diurnal and hunt on the wing, from perches, and on the ground. In pastures, caracaras forage on foot, which typically support small vertebrate prey as well as invertebrates associated with cattle, including those under cattle feces. They will also regularly patrol sections of highway in search of carrion.

Audubon's crested caracaras are resident and non-migratory. Home ranges may encompass an area of up to 2,389 ha with an average of 1,552 ha. However, in recent years, more observations of caracara are occurring along the Atlantic Coast as far north as Nova Scotia; it is unclear if this is a new phenomenon or not. If these are Florida birds, then they will still be protected under the

ESA. The assumption is that these birds are transitory and may return to Florida annually (Pers. comm. 2016 biological information, USFWS field office request).

Non-agricultural Uses

As discussed, Audubon's crested caracaras may forage or roost in a variety of habitat types, including those that may be within or adjacent to non-agricultural use sites for carbaryl. In particular, Audubon's crested caracaras may roost in forested areas including mixed upland hardwoods and pinelands. They may also forage in and adjacent to developed areas. However, we expect low exposure of Audubon's crested caracaras to carbaryl within each of these use sites.

Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the Audubon's crested caracara. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As such, we anticipate a low likelihood of carbaryl usage in the range, and that if usage did occur, exposure to the Audubon's crested caracara would be minimal.

Similarly, available usage data indicate only low levels of past carbaryl usage in open space developed areas within the Audubon's crested caracara's range, with, at most, up to 2.4% of the species' range likely to be treated each year. Given that this usage is likely to occur many habitat types within this land use site, we anticipate an even lower level of usage within those areas containing suitable habitat for the Audubon's crested caracara. Furthermore, we expect many carbaryl applications in developed areas will be limited to hand-held equipment and treatments to small areas that greatly limit the extent of off-site transport and non-target exposure, further reducing the likelihood that individuals will be exposed to carbaryl from use in developed areas.

Conservation Measures

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated in developed use sites.

Exposure Summary

There is a high extent of overlap between the agricultural use sites and the species' range. Based on past usage data, we expect a medium level of usage within the species' range. The Audubon's crested caracara's is expected to roost within citrus groves, which represent the agricultural use site with the highest extent of overlap and past usage within the range. Given that the extent of overlap is high, and that expected usage is medium, we expect a large number of individuals are likely to experience exposure from the proposed action.

We also expect the Audubon's crested caracaras to forage or roost within or adjacent to non-agricultural use sites for carbaryl, such as managed forests and developed areas. However, we expect low exposure of Audubon's crested caracaras to carbaryl within each of these use sites.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to Audubon's crested caracaras. Consumption of prey or carrion on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 66.4 mg/kg-bw on crops with maximum application rates up to 2 lbs/acre, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to Audubon's crested caracaras, including mortality or sublethal effects.

For uses with a maximum application rate of 5 lbs/acre, dosages are expected to range up to 118 mg/kg-bw, particularly for individuals that exclusively consume soil invertebrates that have been exposed to carbaryl on use sites. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. Use sites that contain crops with allowable application rates up to 5 /bs/acre include Other Crops (for use on sod), Citrus, Other Orchards, and Open Space Developed (for use on golf courses). While this species is known to roost on citrus and in forested areas adjacent to golf courses, Audubon's crested caracara is a generalist, opportunistic feeder with a wide range of dietary items. We do not expect consumption of other food items from recently treated fields to result in direct adverse effects to this species. As such, we anticipate a low likelihood that individuals will forage exclusively on contaminated soil invertebrates on recently treated use sites and be exposed to carbaryl at levels that would result in subsequent adverse effects.

Indirect Effects

Audubon's crested caracara relies on a wide variety of animal species including benthic invertebrates, soil invertebrates, amphibians, reptiles, small mammals, arthropods, birds, and fish for food resources. Based on available toxicity data, we expect arthropods, soil invertebrates, benthic invertebrates, and small mammals will die from on-field exposure of carbaryl. However, we only expect off-field exposure to result in effects to invertebrates. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but some prey will be available after exposure and any losses will likely be episodic, with recovery of prey communities after exposures. We anticipate prey reductions will be greater on use sites, where estimated environmental concentrations are higher than those anticipated from spray drift or runoff. However, due to the highly opportunistic nature of Audubon's crested caracara and its ability to feed on both live prey and carrion, we expect a low level of indirect adverse effects are likely to occur.

Toxicity Summary

We anticipate a low likelihood of direct adverse effects to Audubon's crested caracara, though individuals foraging in fields treated at maximum application rates could experience temporary neurological effects in certain circumstances. We do not anticipate any adverse effects in individuals that consume prey that have been exposed to carbaryl in fields treated with lower application rates, or from spray drift or runoff. We expect a low level of indirect effects are likely to occur from prey losses. Though the Audubon's crested caracara consumes species that are expected to die following exposure to carbaryl on- and off-field, the highly opportunistic nature of the caracara, including its ability to scavenge, results in a low likelihood that individuals will be affected by reductions in prey from carbaryl exposure. Taken together, we determine the Audubon's crested caracara has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The Audubon's crested caracara has a high exposure ranking. Based on past carbaryl usage data, we expect up to 8.5% of the range may be treated annually in agricultural areas but may expose up to 26.8% of the range over the duration of the proposed action depending how usage patterns may change over time within overlapping areas. In addition, the Audubon's crested caracara's is expected to roost within citrus groves, which represent the agricultural use site with the highest extent of overlap and past usage within the range. We also expect the Audubon's crested caracaras to forage or roost within or adjacent to non-agricultural use sites for carbaryl, such as managed forests and developed areas. However, we expect low exposure of Audubon's crested caracaras to carbaryl within each of these use sites. Overall, we expect a large number of individuals are likely to be exposed to carbaryl.

The Audubon's crested caracara has a low toxicity ranking. We expect that carbaryl exposure could lead to temporary neurological effects to individuals foraging in fields, but only under the most extreme scenarios (feeding exclusively on soil invertebrates immediately following treatment at maximum applications). We do not anticipate any adverse effects in individuals that consume prey that have been exposed to carbaryl from spray drift or runoff. Reductions in prey abundance are unlikely to result in adverse effects to crested caracara due to their highly opportunistic feeding style and ability to scavenge off carrion, thus indirect adverse effects are expected to be low.

Given that we expect a large number of individuals to experience exposure and given that we expect a low level of adverse effects, we determine the overall risk of adverse effects to the species is medium.

Conclusion

The Audubon's crested caracara exists as a relatively small, isolated population in Florida. Based on recent data indicating there are at least 150 nest sites within a limited portion of the bird's range in Florida, it is estimated that over 500 individuals inhabit Florida. Most occupied territories are inaccessible to surveyors, as most caracaras occur on private land. A population viability analysis demonstrated that while it may be stable under present conditions, the population is sensitive to even modest habitat loss. Threats to the species include habitat loss and degradation, climate change, disease, and predation. The central Florida region is expected to experience "explosive" growth, with extensive urban development that will likely further replace and fragment the natural systems and wildlife corridors in the region. The species has a high vulnerability ranking.

The caracara has a medium exposure ranking. We expect 26.8% of the species range overlaps with agricultural use sites or is likely to be exposed through off-site transport from these areas. Within these overlapping areas, we anticipate 8.5% will be exposed to carbaryl annually. The Audubon's crested caracara could enter agricultural areas, including orchards, to forage, roost, or breed. Though these areas represent a smaller proportion of use by caracaras than other habitats, non-breeding caracaras have been shown to use citrus groves when available. Citrus overlaps with 12.7% of the range. Usage data indicates citrus is treated with carbaryl on 1.2% of the range annually, which could result in exposure throughout the overlapping area over the project duration. Exposure from non-agricultural uses of carbaryl is expected to be minimal, leading to sublethal effects in a few individuals from these uses under the proposed action.

Given that the extent of overlap is high and expected usage is moderate, we expect a large number of individuals, and their prey are likely to experience exposure over a large portion of the range from the proposed action. We do not expect mortality will occur on- or off-field as a result of dietary exposure through the consumption of contaminated food items, but sublethal effects are anticipated for a moderate number of individuals that feed on soil invertebrates immediately after treatments at maximum applications. Reduction in prey abundance is also anticipated, but the reductions are unlikely to result in adverse effects to the caracara due to their highly opportunistic feeding style and high mobility, indicating they will be able to find alternate prey and foraging sites to compensate for localized losses. Given that we expect a large number of individuals to experience exposure and prey losses but given that we expect a low level of adverse effects, we determine the overall risk of adverse effects to the species is medium.

In summary, the Audubon's crested caracara has a high vulnerability, and the overall risk to the species is medium. We expect sublethal effects to a moderate number of individuals over the project duration, as well as losses of prey items over the duration of the proposed action.

However, while the population is small and somewhat fragmented, the range is fairly large and not all areas overlap with areas that will be exposed to carbaryl. Those areas that overlap are not likely to be exposed at the same time. Additionally, we do not expect individuals will frequently be found on use sites where there will be adverse effects to individuals from consuming contaminated prey due to their habitat preferences and anticipated toxicity levels that would result in sublethal, but not lethal, effects at estimated concentrations for only those individuals that consume soil invertebrates exposed to carbaryl at the highest application rates. Also, while prey losses are anticipated, we expect individuals will be able to move to alternative sites to forage as needed to find sufficient prey. While we anticipate sublethal effects to a moderate number of individuals and losses of some of their prey, we do not expect these effects will likely result in mortality or reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Audubon's crested caracara.

References

U.S. Fish and Wildlife Service. 2009. Florida Population of the Audubon's Crested Caracara (*Polyborus plancus audubonii*) = Northern Crested Caracara (*Caracara cheriway*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 17 pp.

U.S. Fish and Wildlife Service. 1987. Endangered and Threatened Wildlife and Plants; Threatened Status for the Florida Population of Audubon's Crested Caracara. Final Rule. Federal Register 52: 25229-25234.

Integration and Synthesis Summary: Piping plover

Scientific Name:	Common Name:	Entity ID:
Charadrius melodus	Piping plover (Great Lakes DPS)	130

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is medium. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is high. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the piping plover (Great Lakes DPS). We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 7/30/2021; [Great Lakes watershed DPS] - Great Lakes, watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI and Canada (Ont.); *States within the range*: IL, IN, MI, MN, NY, OH, PA, WI.

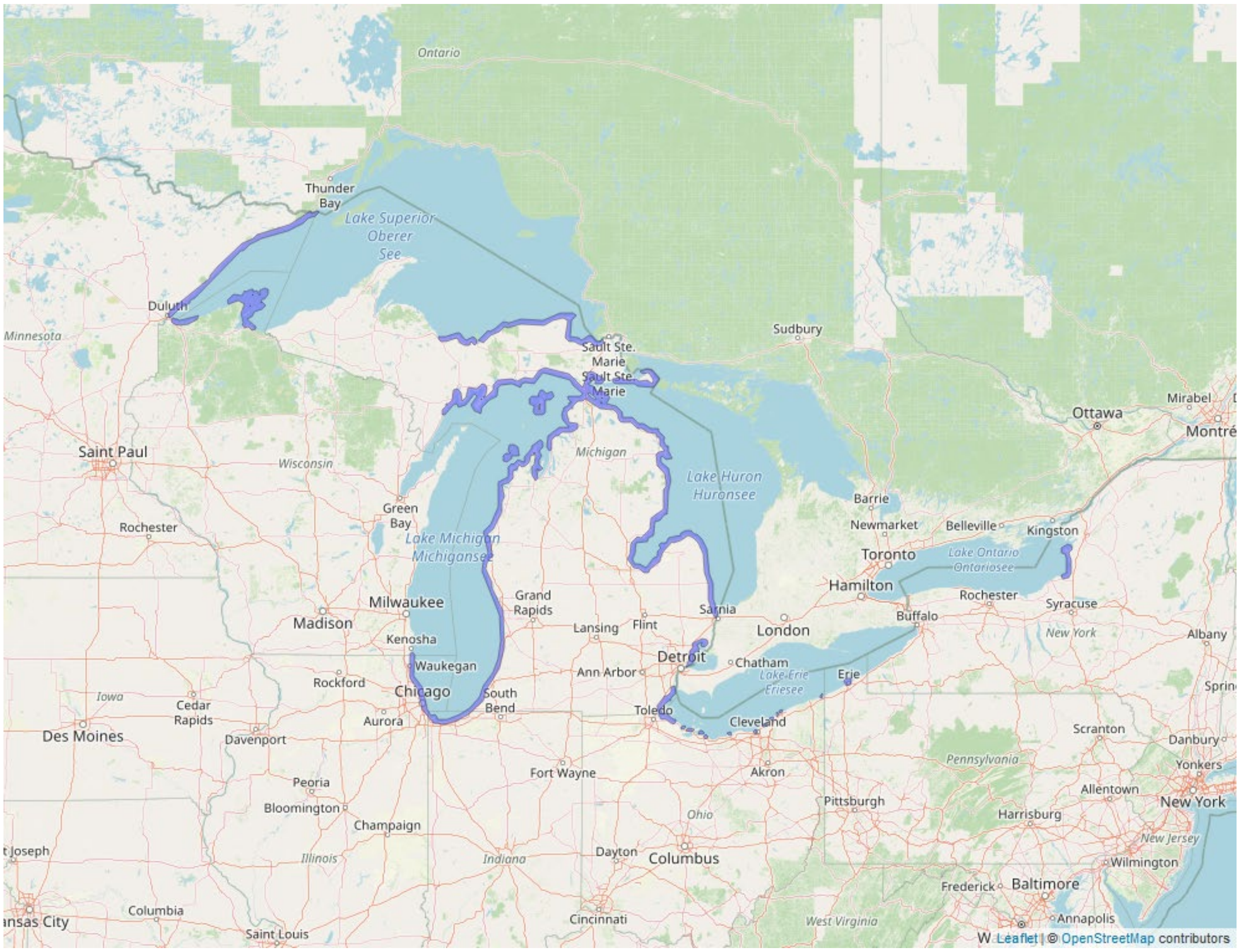

Figure 61. Range map of piping plover (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6039.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Most recently completed 5-Year Review: 3/26/2020

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Population size/location(s) unknown

Species trends: Increasing population(s)

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Shoreline development continues as the leading cause of habitat destruction in the Great Lakes. Habitat improvement and protection through acquisition has occurred, but not at rates which offset the impacts of development. Overall, disease has emerged as a potential new threat in the Great Lakes population, although currently the threat level remains low. This could change rapidly, however, as disease outbreaks in the vicinity of piping plover breeding areas are increasing. Predation remains a major threat to the Great Lakes distinct population segment (DPS). Predation of piping plover adults by predatory birds has increased in recent years. Overall, the magnitude of the threats regarding climate change is yet unknown, but the impact of regional changes will have to be monitored closely to ensure the piping plover's persistence.

The population has shown significant growth, from approximately 17 pairs at the time of listing in 1986 to 76 pairs in 2017, representing just over 50% of the current recovery goal of 150 breeding pairs for the Great Lakes population. However, they dropped to 67 pairs in 2018. The average fledging rate has been 1.7, above the recovery goal of 1.5 fledglings per breeding pair, although analysis of banded plovers suggests that after-hatch year survival (adult) rates may be declining (Saunders et al. 2014, Saunders et al. 2018). Data indicates they remain vulnerable to major threats that remain persistent and pervasive, including habitat degradation, predation, and human disturbance. Piping plover populations, including the Great Lakes population, are inherently vulnerable to even small declines in their most sensitive vital rates, i.e., survival of adults and fledged juveniles. The survival and recovery of breeding populations of piping plovers in the Great Lakes DPS is fundamentally dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual life cycle. Progress towards recovery, attained primarily through intensive protections to increase productivity on the breeding grounds, will be quickly slowed or reversed by even small, sustained decreases in survival rates during migration and wintering.

Review of threats to piping plovers and their habitat in their migration and wintering range indicates a continuing loss and degradation of habitat due to sand placement projects, inlet stabilization, sand mining, groins, seawalls and revetments, exotic and invasive vegetation, and wrack removal. This cumulative habitat loss is, by itself, of grave concern for piping plovers. However, artificial shoreline stabilization also impedes the processes by which coastal habitats adapt to accelerating sea-level rise, thus setting the stage for compounding future losses. While the Great Lakes DPS of piping plovers is few in number, they are spread out over a relatively large geographic area and were never very abundant. Though potentially vulnerable to stochastic events due to low population numbers, the current status of the DPS suggests they are increasing in number and expanding their current range.

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

We expect 75.7% of the species range will overlap with carbaryl use sites or is likely to be exposed through off-site transport within the action area (Table 12). Up to 62.5% of the species' range overlaps with carbaryl use sites while 13.2% of the range occurs off-field (but may still be exposed to spray drift or runoff).

Table 12. Overlap and usage data for the piping plover (Great Lakes DPS).

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	0.7	0.7	1.4	0.3	0.4	0.7
Citrus	0	0	0	0	0	0
Corn[2]	54.8	9.8	64.6	22.4	4.0	26.4
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.9	2.8	5.7	2.9	2.8	5.7
Other Grains	0.2	0.1	0.3	<0.1	<0.1	0.1
Other Orchards	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	58.7	9.6	68.3	22.4	3.7	26.1
Vegetables and Ground Fruit	<0.1	<0.1	0.1	<0.1	<0.1	0.1
Total	**62.5**	**13.2**	**75.7**	**25.6**	**7.0**	**32.6**

[2] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Usage

Based on past usage data, we anticipate up to 32.6% of the species' range will be treated with carbaryl annually (Table 12).

Additional Exposure Considerations

The species range for the piping plover Great Lakes watershed DPS was updated on May 1, 2024. The updated range no longer includes polygons in Illinois, which likely significantly reduce the 75.7% overlap found with the prior range (as shown in Table 12), as the polygons in Illinois included a significant amount of agricultural use sites. With the overlaps reduced, the usage shown in Table 12 (32.6%) is likely overestimated as well. However, we expect overlap and usage are still likely to be high considering the very high levels of overlap and usage associated with the prior range.

Piping plovers forage by gleaning invertebrates from the substrate or running and pecking on the substrate with short runs between pecks. 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. Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks. Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival.

Piping plovers return to their breeding grounds in late April to early May and initiate nesting by mid- to late May. Hatching begins in late May to early June, generally peaking in June and early July. The young leave the nest within hours of hatch and begin to forage almost immediately. Piping plovers migrate July through September in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico. 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 are sparsely distributed across their Atlantic Coast breeding range.

Piping plovers are unlikely to enter carbaryl sites during breeding but may migrate through agricultural, golf courses, and other areas with the open space developed land use category (USFWS field office request, pers. comm. 2016 co-occurrence information). Given the broad nature of the range map for this species in certain areas, it is unlikely that the entire area of overlap adjacent to these use sites represents piping plover habitat.

Non-agricultural Uses

Piping plovers are not expected to occur in non-agricultural use sites of carbaryl during breeding but may migrate through and stopover at sites containing turf, such as golf courses and other areas within the open space developed land use category. These inland migratory stopover sites have not been found to contain large concentrations of piping plovers, rather most reports of birds at inland sites were single individuals (Pompei and Cuthbert 2004). Individuals appear to stop opportunistically along the migratory route rather than show fidelity to specific sites, with duration typically lasting no longer than one day (Pompei and Cuthbert 2004).

Available usage data indicate only low levels of past carbaryl usage in open space developed areas within the piping plover's migratory range, with, at most, up to 2.4% of the species' range likely to be treated each year. Given that this usage is likely to occur many habitat types within this land use site, we anticipate an even lower level of usage within those areas containing suitable habitat for piping plover stopovers.

Exposure Summary

There is a high extent of overlap between the agricultural use sites and the species' range. While the piping plover could enter certain agricultural fields during migration, the most likely route of exposure for this species is from spray drift entering their preferred habitat from use on adjacent crops. Based on past usage data, we expect a medium level of usage within these areas of the species' range. Given that the extent of overlap is high, and that expected usage is medium, we expect a large number of individuals are likely to experience exposure from the proposed action.

Piping plovers may occur in use sites containing turf within the open space developed land use category during migratory stopovers. Given that most observations of piping plovers in inland stopover sites are of a single individual, the duration of occupancy by individuals is short (no longer than a day), and past usage within this landcover category is low, we anticipate a low likelihood of piping plovers occurring in non-agricultural areas following application of carbaryl such that few, if any individuals would be exposed.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to piping plovers. Consumption of aquatic and terrestrial invertebrates on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 48.2 mg/kg-bw on crops with maximum application rates up to 2 lbs/acre, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to piping plovers, including mortality or sublethal effects.

For uses with a maximum application rate of 5 lbs/acre, dosages are expected to range up to 120.6 mg/kg-bw, particularly for individuals that exclusively consume terrestrial arthropods that have been exposed to carbaryl on use sites. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. Of those use sites with allowable applications rates up to 5 /bs/acre, piping plovers may occur on-site during migration in areas that contain turf, including sod and golf courses. While these effects are expected to be temporary (all birds in laboratory studies recovered within 48 hours), they may leave affected individuals vulnerable to other stressors including predation and weather events, render them unable to forage, and/or otherwise disrupt migration. We do not expect that exposure from consuming benthic invertebrate prey along shorelines will result in adverse effects under any exposure scenario.

Indirect Effects

The piping plover relies on benthic invertebrates and arthropods for food resources, gleaning prey from the substrate or running and pecking on the substrate. Based on available toxicity data, we expect that exposure on-field or from spray drift is likely to cause mortality of these prey species. However, because arthropods taken as food items exhibit a range of sensitivities to carbaryl, we that expect that exposure to carbaryl will reduce the abundance, but not completely eliminate the prey base. Therefore, as a generalist feeder of invertebrates, we anticipate that piping plovers will be less affected by the loss of specific species and will consume other available dietary items.

Toxicity Summary

We do not expect that piping plovers consuming invertebrate prey exposed to carbaryl on treated fields with application rates up to 2 lb/acre, or as a result of spray drift or runoff from any application rates will result in adverse effects to individuals. Piping plovers that exclusively consume terrestrial arthropods that have been recent exposed to carbaryl (i.e., within 24 hours) on use sites with maximum application rates up to 5 lb/acre are expected to experience neurological effects such as ataxia, hyper-sensitivity, and immobility. Of the use sites with allowable application rates up to 5 lb/acre, piping plovers are known to occur on turf during migratory stopovers. We expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. However, because not all species of arthropods are expected to die from spray drift exposure, we expect the piping plover, as a generalist feeder, will be able to consume available dietary items. As such, we determine the piping plover has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The piping plover has a high exposure ranking. Based on past carbaryl usage data, we expect up to 7.0% of the range may be treated annually for agriculture in areas adjacent to carbaryl use sites but may potentially cover up to 13.2% of the range over the duration of the proposed action depending how agricultural usage patterns change over time. This indicates that a large portion of the species' range is likely to be treated overall. We anticipate a low likelihood of piping plovers occurring in non-agricultural areas such as turf following application of carbaryl such that few, if any individuals would be exposed during migration. As such, we expect a large number of individuals are likely to be exposed to carbaryl overall, primarily from transport off agricultural use sites.

The piping plover has a medium toxicity ranking. We expect that most exposures to dietary items exposed to carbaryl either on or adjacent to use sites will not result in direct adverse effects to piping plovers. While we anticipate migratory piping plovers that consume arthropods on turf recently treated at maximum application rates to experience adverse neurological impacts, we expect this to be rare occurrence based on low usage on these use sites and piping plover migration behavior. We do not expect that exposure from consuming benthic invertebrate prey along shorelines will result in adverse effects under any exposure scenario. We expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. However, because not all species of arthropods are expected to die from spray drift exposure, we expect the piping plover, as a generalist feeder, will be able to consume available dietary items.

Given that we expect a large number of individuals are likely to experience exposure and given that we expect a medium level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is high.

Conclusion

The piping plover (Great Lakes DPS) population has increased from approximately 17 pairs at the time of listing in 1986 to 76 pairs in 2017 and 67 pairs in 2018. Data indicates they remain vulnerable to major threats that remain persistent and pervasive, including habitat degradation, predation, and human disturbance. The piping plover DPS is inherently vulnerable to even small declines in their most sensitive vital rates, i.e., survival of adults and fledged juveniles. The survival and recovery of breeding populations of piping plovers in the Great Lakes DPS is fundamentally dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual life cycle. While the population in the DPS is few in number, they are spread out over a relatively large geographic area and were never very abundant. The species has a medium vulnerability ranking.

The piping plover DPS has a high exposure ranking. Based on the prior species range map, 75.7% of the species range overlapped with agricultural use sites or in areas likely to be exposed through off-site transport from these areas. Within these overlapping areas, we anticipated 32.6% would be exposed to carbaryl annually (see Table 12). Based on a recent update to the range map, we anticipate the overlap and usage will both be less due to the removal of areas in Illinois that contained agricultural use sites, although we still expect overlaps and usage to be high based on the very high levels associated with the prior range map. We do not expect that exposure from consuming benthic invertebrate prey along shorelines will result in adverse effects under any exposure scenario. Piping plovers are only expected to use agricultural fields during migration.

We do not expect mortality or sublethal effects of piping plovers feeding on prey exposed to carbaryl in or around carbaryl use sites with application rates up to 2 lbs/acre. However, for uses with application rates up to 5 lbs/acre, we expect exposure to result in temporary (i.e., recovery within 48 hours) neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility, particularly for those individuals that consume terrestrial arthropods exposed on use sites. Of those use sites with allowable applications rates up to 5 lbs/acre, piping plovers may occur on-site during migration in areas that contain turf, including sod and golf courses. We expect these temporary effects will leave affected individuals vulnerable to other stressors including predation and weather events, render them unable to forage, and/or otherwise disrupt migration. These use sites are in open space developed areas where usage data indicates, at most, up to 2.4% of the range is likely to be treated annually. Thus, we expect the loss of some individuals as a result of sublethal effects that lead to predation, starvation, or migration setbacks. However, we expect birds exposed and affected at these sites will typically be single individuals stopping opportunistically for periods of up to a day during migration rather than large concentrations of piping plovers.

We also expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. We expect most plovers will likely be able to locate other dietary items to compensate for localized prey losses because not all species of arthropods are expected to die from spray drift exposure, and the piping plover is a highly mobile, generalist feeder that will be able to travel to other areas to forage as needed. However, we expect starvation or reduced fitness in a small number of plovers as a consequence of losses of prey items over the duration of the proposed action.

In summary, the species DPS has a medium vulnerability, and the overall risk to the species is high. We expect reduced fitness and the loss of a small number of individuals due to carbaryl exposure and losses of prey items over the duration of the proposed action. However, because this species DPS has a wide distribution, direct mortality from exposure is not anticipated, and sublethal effects likely to lead to mortality are only anticipated from exposure of individuals foraging on turf following carbaryl applications during migratory stopovers, we anticipate the loss of a small number of individuals. While we anticipate the loss of prey, we expect most individuals will be able to move to alternative sites to forage as needed to find sufficient prey, and individuals will not likely experience adverse effects from consuming many of their exposed prey items when foraging in benthic environments. In addition, individuals may migrate through agricultural areas but will not be likely to enter agricultural sites during the breeding season. As such, we do not expect these effects will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the piping plover (Great Lakes DPS).

References

Pompei, V.D., and F.J. Cuthbert. 2004. Spring and fall distribution of piping plovers in North America: Implications for migration stopover conservation. Report to the U.S. Army Corps of Engineers. University of Minnesota; St. Paul, Minnesota.

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U.S. Fish and Wildlife Service. 2009. Piping plover (*Charadrius melodus*) 5-year review: Summary and evaluation. Hadley, Massachusetts. 214 pp.

Integration and Synthesis Summary: Piping plover

Scientific Name:	Common Name:	Entity ID:
Charadrius melodus	Piping plover (Atlantic Coast and Northern Great Plains populations)	131

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is medium. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is medium. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the piping plover (Atlantic Coast and Northern Great Plains populations). We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 9/13/2023; [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered.; *States within the range:* AL, AR, CO, CT, DE, FL, GA, IA, KS, LA, MA, MD, ME, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OK, RI, SC, SD, TN, TX, VA, WY

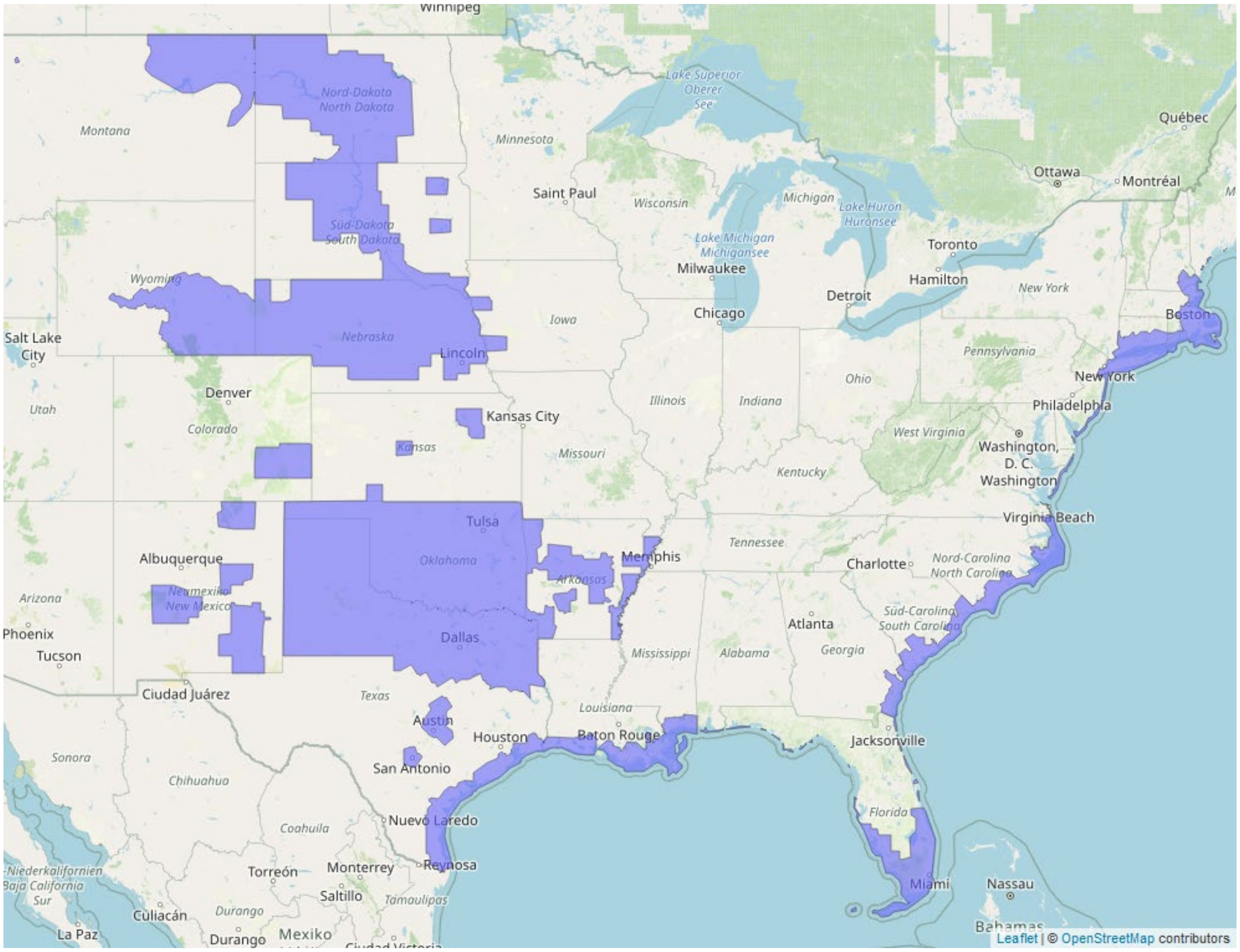

Figure 7. Range map of piping plover (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6039.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Threatened

Most recent 5-Year Status Review recommendation: No change in Status

Most recently completed 5-Year Status Review: 3/26/2020

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (few)

Species trends: Increasing population(s)

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Piping plovers are small shorebirds that feed on macroinvertebrates and nest above the high tide line on coastal beaches, sandflats, gently sloping foredunes, blowout areas behind foredunes, sparsely vegetated dunes, and washover areas. Endangered Species Act (ESA) actions are recognized in three separate breeding populations of piping plovers: Atlantic Coast (threatened), Great Lakes (endangered), and Northern Great Plains (threatened). Although a recent analysis shows strong patterns in the wintering distribution of piping plovers from different breeding populations, partitioning is not complete and major information gaps persist (USFWS 2009).

The survival and recovery of all piping plover breeding populations are dependent on the continued availability of sufficient habitat in their coastal migration and wintering range, where the species spends more than two-thirds of its annual cycle. 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; while those breeding on the Northern Great Plains predominate in coastal Mississippi, Louisiana, and Texas; wintering ranges of all three breeding populations overlap on the Gulf Coast of Florida. Piping plovers demonstrate high fidelity to winter regions where they use a mosaic of habitats within their home ranges (USFWS 2016, USFWS 2020). The breeding population of the Northern Great Plains piping plover extends from NE north along the Missouri River through SD, ND, and eastern MT, and on alkaline (salty) lakes along the Missouri River Coteau (a large plateau extending north and east of the Missouri River) in ND, MT, and extending into Canada. Most piping plovers from Prairie Canada winter along the south Texas coast, while breeding piping plovers from the U.S. Great Plains are more widely distributed along the Gulf Coast from FL to TX. In the Northern Great Plains, piping plovers breed and raise young on sparsely vegetated sandbars, reservoir shorelines on river systems, and on the shorelines of alkaline lakes. 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.

The Northern Great Plains population is geographically widespread, with many birds in areas with small human populations. Rough estimates of adult piping plover numbers in the Great Plains population (U.S. & Canada combined) varied from about 3,500 in 1991, 4,600 in 2006, and 2,250 in 2011 (USFWS 2016). Due to difficulty in surveying the species, the population trend seen in Northern Great Plains abundance data is unreliable (USFWS 2020). The Atlantic Coast piping plover population breeds from Newfoundland to SC and winters along the Atlantic

Coast from NC south along the Gulf Coast and in the Caribbean. The population was estimated to be 790 pairs at listing in 1986, nearly 1,350 pairs in 1995, and 1,849 pairs in 2008 (USFWS 1996, USFWS 2009). The population is unevenly distributed and there have been several documented declines in sub-populations over this time period (i.e., plovers in Maine decreased from 66 pairs in 2002 to 24 pairs in 2008). Substantially higher productivity rates were observed in New England than elsewhere in the population's range (USFWS 1996).

All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates (i.e., adult and fledged juvenile survival). Cumulative habitat loss is of grave concern for all piping plovers. Major threats to the Northern Great Plains population include changes in the quality and quantity of riverine habitat due primarily to damming and water withdrawals. For the Atlantic Coast population, primary threats include development and shoreline stabilization. Artificial shoreline stabilization impedes the processes by which coastal habitats adapt to accelerating sea-level rise, thus setting the stage for compounding future losses. Human disturbance, predation, invasive plants, and pesticides further reduce breeding and wintering habitat quality and affect survival for all plover populations (USFWS 2016). Human activities affect activity patterns, types, and numbers of predators, exacerbating natural predation in many areas. In areas where predation appeared to drive extremely low productivity in the Great Plains, predation control (i.e., great horned owl, gulls, mammal trapping) was implemented with limited success. Predation control was effective to improve interim productivity, but because high predation rates were a symptom of insufficient available habitat, ensuring that sufficient high-quality habitat was available was more effective for plover recovery. Sandbar islands were mechanically created in South Dakota and Nebraska from 2004-2011; birds readily used them for nesting, but breeding success declined with sandbar age (USFWS 2016). Human recreational disturbance is a major threat to coastal migration and wintering range for piping plovers; interactions with dogs elicit a strong response from shorebirds. Shorebirds are more likely to flush from a dog, especially off-leash, than a person (USFWS 2020). Elevated stress levels in the nonbreeding season can carry over into the breeding season and impact future reproductive success by reducing survival and fecundity rates for plovers. The magnitude of the threats regarding climate change is yet unknown, but the impact of regional changes will have to be monitored closely to ensure the piping plover's persistence (USFWS 2020).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 25.3% of the species' range overlaps with agricultural use sites and 11.9% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff) (Table 13). In total, there is approximately 37.2% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 13. Agricultural use overlap and annual usage data (% Range Treated) for the piping plover.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	1.7	1.6	3.3	0.2	0.2	0.4
Citrus	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Corn	9.6	2.5	12	0.8	0.2	1
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	5	3.2	8.2	2.7	1.5	4.2
Other Grains	6.1	3.4	9.5	0.2	0.1	0.3
Other Orchards	0.1	0.1	0.3	<0.1	<0.1	<0.1
Other Row Crops	1.3	0.5	1.7	<0.1	<0.1	0.1
Soybeans	9.1	2.1	11.2	0.9	0.2	1.1
Vegetables and Ground Fruit	1.6	0.7	2.3	0.1	<0.1	0.2
Total	**25.3**	**11.9**	**37.2**	**4.3**	**2.2**	**6.5**

Usage

Past usage data indicate that up to 6.5% of the species' range has been treated with carbaryl annually from agricultural uses (Table 13).

Additional Exposure Considerations

Piping plovers forage by gleaning invertebrates from the substrate or running and pecking on the substrate with short runs between pecks. 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. Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks. Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival.

Piping plovers return to their breeding grounds in late April to early May and initiate nesting by mid- to late May. Hatching begins in late May to early June, generally peaking in June and early July. The young leave the nest within hours of hatch and begin to forage almost immediately. Piping plovers migrate July through September in coastal areas of the U.S. from North Carolina to Texas and in portions of Mexico. 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 are sparsely distributed across their Atlantic Coast breeding range.

Piping plovers are unlikely to enter carbaryl sites during breeding but may migrate through agricultural, golf courses, and other areas with the open space developed land use category (USFWS field office request, pers. comm. 2016 co-occurrence information). Given the broad nature of the range map for this species in certain areas, it is unlikely that the entire area of overlap adjacent to these use sites represents piping plover habitat.

Non-agricultural Uses

Piping plovers are not expected to occur in non-agricultural use sites of carbaryl during breeding but may migrate through and stopover at sites containing turf, such as golf courses and other areas within the open space developed land use category. These inland migratory stopover sites have not been found to contain large concentrations of piping plovers, rather most reports of birds at inland sites were single individuals (Pompei and Cuthbert 2004). Individuals appear to stop opportunistically along the migratory route rather than show fidelity to specific sites, with duration typically lasting no longer than one day (Pompei and Cuthbert 2004).

Available usage data indicate only low levels of past carbaryl usage in open space developed areas within the piping plover's migratory range, with, at most, up to 2.4% of the species' range likely to be treated each year. Given that this usage is likely to occur many habitat types within this land use site, we anticipate an even lower level of usage within those areas containing suitable habitat for piping plover stopovers.

Exposure Summary

There is a high extent of overlap between the agricultural use sites and the species' range. While the piping plover could enter certain agricultural fields during migration, the most likely route of exposure for this species is from spray drift entering their preferred habitat from use on adjacent crops. Based on past usage data, we expect a low level of usage within these areas of the species' range. Given that the extent of overlap is high, and that expected usage is low, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Piping plovers may occur in use sites containing turf within the open space developed land use category during migratory stopovers. Given that most observations of piping plovers in inland stopover sites are of a single individual, the duration of occupancy by individuals is short (no longer than a day), and past usage within this landcover category is low, we anticipate a low likelihood of piping plovers occurring in non-agricultural areas following application of carbaryl such that few, if any individuals would be exposed.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to piping plovers. Consumption of aquatic and terrestrial invertebrates on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 48.2 mg/kg-bw on crops with maximum application rates up to 2 lbs/acre, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to piping plovers, including mortality or sublethal effects.

For uses with a maximum application rate of 5 lbs/acre, dosages are expected to range up to 120.6 mg/kg-bw, particularly for individuals that exclusively consume terrestrial arthropods that have been exposed to carbaryl on use sites. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. Of those use sites with allowable applications rates up to 5 /bs/acre, piping plovers may occur on-site during migration in areas that contain turf, including sod and golf courses. While these effects are expected to be temporary (all birds in laboratory studies recovered within 48 hours), they may leave affected individuals vulnerable to other stressors including predation and weather events, render them unable to forage, and/or otherwise disrupt migration. We do not expect that exposure from consuming benthic invertebrate prey along shorelines will result in adverse effects under any exposure scenario.

Indirect Effects

The piping plover relies on benthic invertebrates and arthropods for food resources, gleaning prey from the substrate or running and pecking on the substrate. Based on available toxicity data, we expect that exposure on-field or from spray drift is likely to cause mortality of these prey species. However, because arthropods taken as food items exhibit a range of sensitivities to carbaryl, we that expect that exposure to carbaryl will reduce the abundance, but not completely eliminate the prey base. Therefore, as a generalist feeder of invertebrates, we anticipate that piping plovers will be less affected by the loss of specific species and will consume other available dietary items.

Toxicity Summary

We do not expect that piping plovers consuming invertebrate prey exposed to carbaryl on treated fields with application rates up to 2 lb/acre, or as a result of spray drift or runoff from any application rates will result in adverse effects to individuals. Piping plovers that exclusively consume terrestrial arthropods that have been recent exposed to carbaryl (i.e., within 24 hours) on use sites with maximum application rates up to 5 lb/acre are expected to experience neurological effects such as ataxia, hyper-sensitivity, and immobility. Of the use sites with allowable application rates up to 5 lb/acre, piping plovers are known to occur on turf during migratory stopovers. We expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. However, because not all species of arthropods are expected to die from spray drift exposure, we expect the piping plover, as a generalist feeder, will be able to consume available dietary items. As such, we determine the piping plover has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The piping plover has a medium exposure ranking. Based on past carbaryl usage data, we expect up to 2.2% of the range may be treated annually for agriculture in areas adjacent to carbaryl use sites but may potentially cover up to 11.9% of the range over the duration of the proposed action depending how agricultural usage patterns change over time. This indicates that a moderate portion of the species' range is likely to be treated overall. We anticipate a low likelihood of piping plovers occurring in non-agricultural areas such as turf following application of carbaryl such that few, if any individuals would be exposed during migration. As such, we expect a moderate number of individuals are likely to be exposed to carbaryl overall.

The piping plover has a medium toxicity ranking. We expect that most exposures to dietary items exposed to carbaryl either on or adjacent to use sites will not result in direct adverse effects to piping plovers. While we anticipate migratory piping plovers that consume arthropods on turf recently treated at maximum application rates to experience adverse neurological impacts, we expect this to be rare occurrence based on low usage on these use sites and piping plover migration behavior. We do not expect that exposure from consuming benthic invertebrate prey along shorelines will result in adverse effects under any exposure scenario. We expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. However, because not all species of arthropods are expected to die from spray drift exposure, we expect the piping plover, as a generalist feeder, will be able to consume available dietary items.

Given that we expect a moderate number of individuals are likely to experience exposure and given that we expect a medium level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is medium.

Conclusion

The piping plover Atlantic Coast and Northern Great Plains populations are widely distributed across many states (see Figure 7). All piping plover populations are inherently vulnerable to even small declines in their most sensitive vital rates, i.e., survival of adults and fledged juveniles. A review of threats to piping plovers and their habitat in their migration and wintering range indicates a continuing loss and degradation of habitat due to sand placement projects, inlet stabilization, sand mining, groins, seawalls and revetments, exotic and invasive vegetation, and wrack removal, as well as other threats. Several studies on the Atlantic Coast indicate that foraging habitat and food resources ultimately affect piping plover survival. The species has a medium vulnerability ranking.

The piping plover has a medium exposure ranking. We expect 11.9% of the species range where the species occurs is likely to be exposed through off-site transport from agricultural use sites. Piping plovers are only expected to use agricultural fields during migration. We do not expect mortality or sublethal effects of piping plovers feeding on prey exposed to carbaryl in or around carbaryl use sites with application rates up to 2 lbs/acre. However, for uses with application rates up to 5 lbs/acre, we expect exposure to result in temporary (i.e., recovery within 48 hours) neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility, particularly for those individuals that consume terrestrial arthropods exposed on use sites. Of those use sites with allowable applications rates up to 5 lbs/acre, piping plovers may occur on-site during migration in areas that contain turf, including sod and golf courses. We expect these temporary effects will leave affected individuals vulnerable to other stressors including predation and weather events, render them unable to forage, and/or otherwise disrupt migration. These use sites are in open space developed areas where usage data indicates, at most, up to 2.4% of the range is likely to be treated annually. Thus, we expect the loss of some individuals as a result of sublethal effects that lead to predation, starvation, or migration setbacks. However, we expect birds exposed and affected at these sites will typically be single individuals stopping opportunistically for periods of up to a day during migration rather than large concentrations of piping plovers.

We also expect a reduction of the prey base where exposure to carbaryl from spray drift occurs. We expect most plovers will likely be able to locate other dietary items to compensate for localized prey losses because not all species of arthropods are expected to die from spray drift exposure, and the piping plover is a highly mobile, generalist feeder that will be able to travel to other areas to forage as needed. However, we expect starvation or reduced fitness in a small number of plovers as a consequence of losses of prey items over the duration of the proposed action.

In summary, the species has a medium vulnerability, and the overall risk to the species is medium. We expect reduced fitness and the loss of a small number of individuals due to carbaryl exposure and losses of prey items over the duration of the proposed action. Individuals may migrate through agricultural areas but will not be likely to enter agricultural sites during the breeding season. The most likely route of exposure to the species is from spray drift. However, we do not expect individuals will experience adverse effects from consuming their exposed prey items when foraging in benthic environments. Additionally, this species has a wide distribution, and we do not anticipate large segments of the population will be affected at any given site or at any given time. Direct mortality from exposure is not anticipated, and sublethal effects likely to lead to mortality are only anticipated for a small number of exposed individuals foraging on turf following carbaryl applications during migratory stopovers. We anticipate the loss of prey, although we also anticipate most individuals will be able to move to alternative sites to forage as needed to find sufficient prey. While we anticipate impacts to individuals and their prey, we do not expect the adverse effects from the proposed action will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the piping plover (Atlantic Coast and Northern Great Plains populations).

References

Pompei, V.D., and F.J. Cuthbert. 2004. Spring and fall distribution of piping plovers in North America: Implications for migration stopover conservation. Report to the U.S. Army Corps of Engineers. University of Minnesota; St. Paul, Minnesota.

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Integration and Synthesis Summary: Florida grasshopper sparrow

Scientific Name:	Common Name:	Entity ID:
Ammodramus savannarum floridanus	Florida grasshopper sparrow	133

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determined the risk of adverse effects to the species was medium.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate species-specific conservation measures as part of the action. We now expect exposure to be low. After incorporating conservation measures into the proposed action, adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the Florida grasshopper sparrow. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Florida grasshopper sparrow. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 3/24/2023; Wherever found; *States within the range:* FL

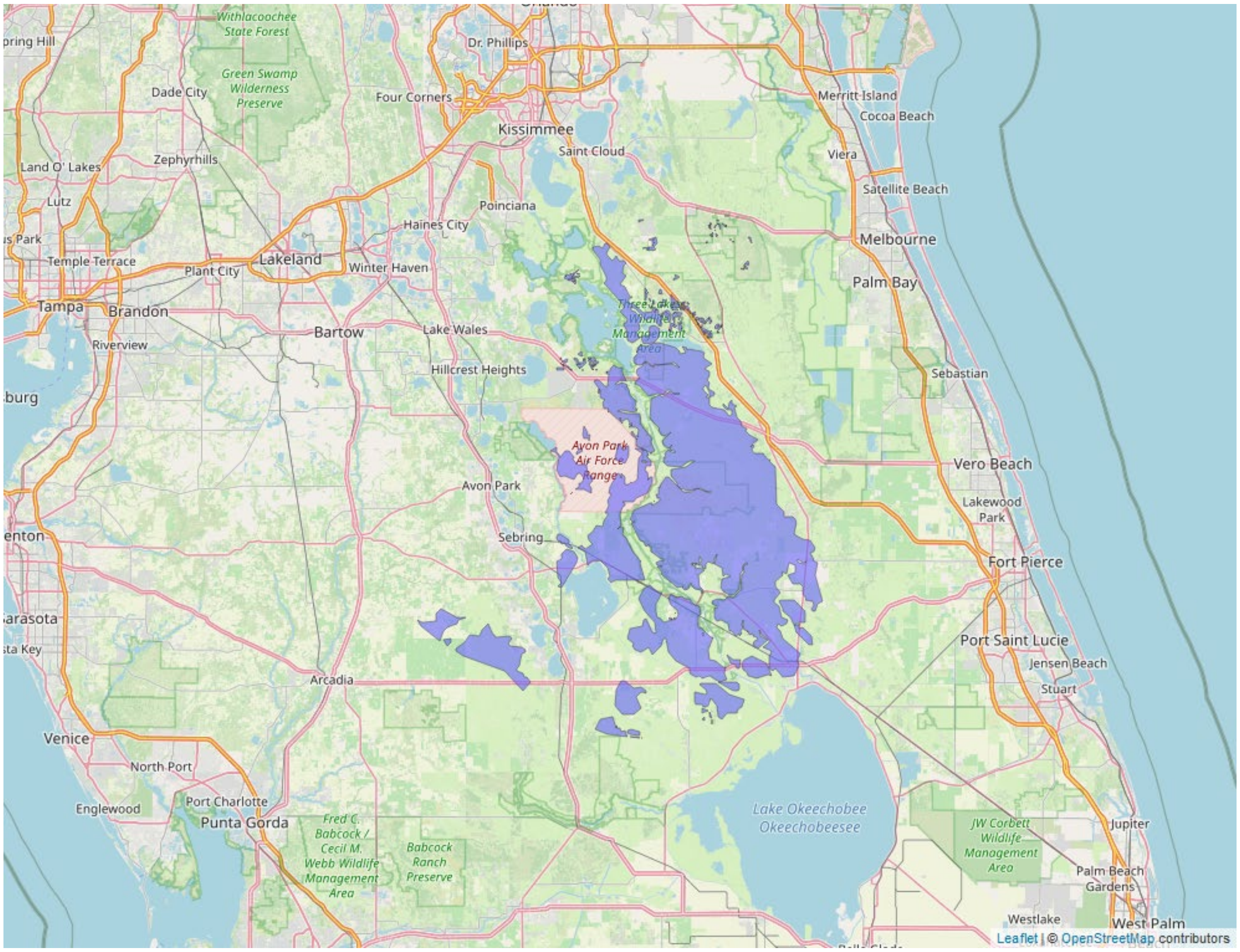

Figure 8. Range map of Florida grasshopper sparrow (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/32.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Endangered

Most recent 5-Year Status Review recommendation: No change in status

Most recently completed 5 Year Status Review: 4/17/2023

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Unlike the migratory Eastern grasshopper sparrow (*Ammodramus savannarum pratensis*) that overwinters in Florida, the Florida grasshopper sparrow is non-migratory and is limited to the prairie region of south-central Florida. The sparrow requires relatively large tracts of treeless prairie. Appropriate hydrology and frequent fire are necessary to maintain open prairie habitat and prevent encroachment of trees and overgrowth of woody vegetation.

The historical range of the Florida grasshopper sparrow is not known with certainty, but there are records from Collier, Miami-Dade, DeSoto, Glades, Hendry, Highlands, Polk, Okeechobee, and Osceola Counties. The species is restricted to an estimated 5% of its historical range (i.e., less than 45,000 hectares of potential sparrow habitat exists) (USFWS 2008). Since 2007, the sparrow was known from three discrete breeding aggregations on public conservation lands at Three Lakes Wildlife Management Area (Three Lakes), Kissimmee Prairie Preserve State Park (Kissimmee), and Avon Park Air Force Range (Avon Park). In 2013, grasshopper sparrows were discovered on a privately-owned cattle ranch in Osceola County and in 2020, the property was donated to the University of Florida as the DeLuca Preserve. In January 2022, the Florida Department of Environmental Protection acquired a 1,174-ac parcel of a ranch with occupied habitat called Corrigan Ranch (USFWS 2023). These breeding aggregations and the relatively common dispersal events among them form a metapopulation. As of 2023, the subspecies' range was known to include remnant habitat patches in Highlands, Okeechobee, Osceola, and Polk Counties. Between 1998-2017, the Florida grasshopper sparrow declined on public lands: Avon Park (96% decline), Kissimmee Prairie (96 to 100% decline), and Three Lakes (65% decline). A historical low was recorded in 2018 when only 23 wild breeding pairs (<48 singing males) were estimated to occur.

Due to the severe population decline, the Service initiated a captive propagation program in 2015. The captive population was intended to boost productivity with the goal of releasing captive-reared Florida grasshopper sparrows to supplement the wild population. At the end of the 2019 breeding season, there were 102 sparrows in captivity. Due to the remarkable success of the captive propagation program, the Service, Florida Fish and Wildlife Commission, and conservation partners began releasing captive-reared birds to the wild at Three Lakes in 2019. A total of 105 birds (43 females, 52 males, 10 unknown sex) were released in 2019 with the majority (88) of the birds being independent juveniles that were hatched in captivity that year. As of 2022, there were five known breeding aggregations with 102 confirmed Florida grasshopper sparrow breeding pairs: Three Lakes (52 breeding pairs; 70 singing males), Kissimmee Prairie (2 breeding pairs; 4 singing males), Avon Park (18 breeding pairs; 19 singing males), DeLuca Preserve (8 breeding pairs; 17 singing males), and Corrigan Ranch (22 breeding pairs; 26 singing males) (USFWS 2023).

The Florida grasshopper sparrow was listed as endangered in 1986 (51 FR 27492) due to habitat loss and degradation resulting from conversion of native vegetation to improved pasture and agriculture. Loss of habitat was a factor in the subspecies' decline to endangered status, but the population is so small now that large areas of seemingly high-quality habitat are not occupied. Sparrows are threatened by habitat loss or degradation, predation from native animals and non-native red-imported fire ants, effects from small population sizes, and flooding events. Low nest survival is likely a major factor contributing to population declines, primarily due to nestling and egg predation. Low population densities can lead to inbreeding and loss of genetic diversity, biased sex ratios, difficulty locating mates, and increased susceptibility to diseases. Especially when coupled with events such as flooding, reduced food availability, and/or reduced reproductive success, small and isolated populations may experience severe declines or extirpation. The 2008 5-year review stated that the metapopulation may be too small to ensure against extinction and protected areas are not enough to meet recovery goals (USFWS 2008, USFWS 2023). Habitat enhancement and expansion and demographic improvements at existing locations may restore some Florida grasshopper sparrow populations. Florida grasshopper sparrows at the two state-managed properties (Three Lakes and Kissimmee) and the one federally-managed property (Avon Park) are sufficiently protected under existing state and federal regulations. Land acquisition, habitat restoration, translocations, and further research focused on management strategies are warranted future tasks to conserve this declining subspecies. The private ranch with the second largest known Florida grasshopper sparrow population is implementing a management plan drafted by the Service that includes actions to benefit the sparrow (USFWS 2019, USFWS 2023).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 5.8% of the species' range overlaps with agricultural use sites and 4.6% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 10.4% overlap between the species' range and the agricultural footprint of carbaryl use (Table 14).

Table 14. Agricultural use overlap and annual usage data (% Range Treated) for the Florida grasshopper sparrow.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	0	0	0	0	0	0
Citrus	4.8	2.6	7.4	4.8	2.6	7.4
Corn	0.3	0.4	0.6	0.3	0.4	0.6
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	0.5	1.1	1.7	0.5	1.1	1.7
Other Grains	0.2	0.3	0.5	<0.1	0.2	0.3
Other Orchards	0.2	0.2	0.4	0.2	0.2	0.4
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	<0.1	0.1	0.2	<0.1	0.1	0.2
Total	**5.8**	**4.6**	**10.4**	**5.7**	**4.5**	**10.2**

Usage

Past usage data indicate that up to 10.2% of the species' range has been treated with carbaryl annually from agricultural uses (Table 14).

Additional Exposure Considerations

Florida grasshopper sparrows are endemic to dry prairie habitats within central and southern Florida, and are strongly habitat-specific, occupying native, treeless fire-maintained dry prairie vegetation communities and some semi-improved pasture sites that were presumably dry prairie prior to conversion to pasture. Restrictions to movement include forested edges and even sparsely stocked pine flatwoods. These habitat restrictions make the Florida grasshopper sparrow less likely to frequent agricultural areas and other land use sites where carbaryl is registered for use. As such, we expected exposure will primarily occur as a result of spray drift into Florida grasshopper sparrow habitat from adjacent areas.

Non-agricultural Uses

Florida grasshopper sparrows are habitat specialists and as such we do not expect them to occur in non-agricultural use sites of carbaryl. Due to the limited usage, small treatment areas, and application methods associated with non-agricultural uses within the species' range, we do not expect these applications to result in drift into the habitat of the Florida grasshopper sparrow. As such, we do not expect non-agricultural uses will result in the exposure of individuals.

Conservation Measures

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated in developed use sites.

Exposure Summary

There is a high extent of overlap between the agricultural use sites of carbaryl and the species' range. While we expect up to 10.4% of the species range to overlap with agricultural use sites, exposure is mostly likely within the 4.6% of the range that may be exposed to spray drift from these uses. Based on past usage data, we expect a high level of usage within the species' range, up to 10.2% of the range total, with up to 4.2% of the range exposed from off-site transport. Given that the extent of overlap is high, but the area likely to be affected by spray drift is low, with low expected usage, we expect a moderate number of individuals are likely to experience exposure from the agricultural use within the range. We do not expect that exposure via drift from non-agricultural use adjacent to the habitat of the Florida grasshopper sparrow is likely to occur, and as such, we do not expect non-agricultural uses will result in the exposure of individuals.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

We expect consumption of dietary items in and around carbaryl use sites to be the primary route of carbaryl exposure to Florida grasshopper sparrows. We do not expect any adverse effects from consumption of seeds or arthropods that have been exposed to carbaryl from spray drift.

Consumption of arthropods on use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 293 mg/kg-bw, depending on application rate (which varies by use type). At these concentrations, we expect exposure would result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. We anticipate these effects could occur on any use site, with a greater likelihood of these effects occurring with increasing application rates. However, given the low likelihood that Florida grasshopper sparrows will forage within carbaryl use sites, we expect a low likelihood of direct adverse effects. We do not expect consumption of seeds on treated use sites to result in adverse effects.

Indirect Effects

The Florida grasshopper sparrow relies on arthropods and seeds for food resources. While no effects to plants are expected, we anticipate effects to arthropods from carbaryl exposure on or near use sites. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. However, as a generalist feeder, we anticipate that the Florida grasshopper sparrow will be less affected by any specific loss of prey items and can consume other available dietary items. As such, even though toxicity to arthropods items is anticipated to be high, we anticipate a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

We expect a low level of direct adverse effects as we anticipate a low likelihood that Florida grasshopper sparrows will forage within carbaryl use sites. We do not anticipate direct adverse effects from consumption of food items that have been exposed to carbaryl from spray drift. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but we expect that individuals will be able to consume available resources. As such, we determine the Florida grasshopper sparrow has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The Florida grasshopper sparrow has a medium exposure ranking. Of the 10.4% of the species range expected to overlap with agricultural use sites, 4.6% may be exposed to spray drift from these uses. Based on past carbaryl usage data, we expect up to 10.2% of the range may be treated annually for agriculture but exposure is most likely to occur within to 4.2% of the range exposed via off-site transport. We do not expect that exposure via drift from non-agricultural use adjacent to the habitat of the Florida grasshopper sparrow is likely to occur, and as such, we do not anticipate non-agricultural uses will add to the overall exposure of carbaryl to the species. As such, we expect a moderate number of individuals are likely to be exposed to carbaryl.

The Florida grasshopper sparrow has a medium toxicity ranking. We do not anticipate direct adverse effects from consumption of food items that have been exposed to carbaryl from spray drift, which is the most likely route of exposure from carbaryl use, or from consumption of seeds on treated fields. While we expect individuals that forage on arthropods in use sites that have been recently treated with carbaryl (i.e., within 24 hours) to experience neurological effects, we anticipate a low likelihood that this exposure will occur. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but we expect that individuals will be able to consume available resources. As such, we determine the Florida grasshopper sparrow has a medium toxicity ranking.

Given that we expect a moderate number of individuals are likely to experience exposure and we expect a medium level of indirect adverse effects, we determine the overall risk of adverse effects to the species is medium.

Preliminary Conclusion

The Florida grasshopper sparrow is limited to the prairie region of south-central Florida. The was listed as endangered in 1986 due to habitat loss and degradation resulting from conversion of native vegetation to improved pasture and agriculture. The sparrow requires relatively large tracts of treeless prairie, with appropriate hydrology and frequent fire to maintain open prairie habitat and prevent encroachment of woody vegetation. Estimates of potential sparrow habitat in 2007 indicate a 95 percent loss from pre-settlement estimates. The current range of sparrow is now generally restricted to three management units under public ownership where habitat is sufficiently protected, and three known private ranches, one of which supports that second largest population and is being managed under a plan developed in partnership with the Service. The number of known sites is a decline from eight occupied locations documented in 2000 - 2004 surveys. Populations have declined to historic lows at all known sites, and as of 2018, there were only 23 estimated wild breeding pairs at sites where the sparrow is being monitored. The population is at high risk of extinction due to environmental, demographic, and genetic stochasticity. Especially when coupled with events such as flooding, reduced food availability, and/or reduced reproductive success, small and isolated populations may experience severe declines or extirpation. Due to the severe population decline, the Service initiated a captive propagation program in 2015. A total of 105 birds (43 females, 52 males, 10 unknown sex) were released in 2019. The species has a high vulnerability ranking.

In our draft Opinion, before incorporating species-specific conservation measures, we determined the Florida grasshopper sparrow had a medium exposure ranking. We expect 10.4% of the species range overlaps with agricultural use sites or is likely to be exposed through off-site transport from these areas. However, we anticipate that the sparrow will primarily occur in off-field areas. We expected 4.6% of the range off-field overlaps with areas that may be exposed via spray drift or runoff from agricultural use sites. Past carbaryl usage data in off-field areas indicate 4.5% is likely to be exposed from carbaryl usage annually. We expected consumption of food items in and around agricultural fields to be the primary route of carbaryl exposure to Florida grasshopper sparrows. The sparrow consumes a mixture of insects and plant matter. During non-nesting season, individuals switch to a seed-dominated diet, but still consume some animal matter.

We do not expect any adverse effects from consumption of seeds or arthropods that have been exposed to carbaryl from spray drift, or from consumption of seeds on treated use sites. However, consumption of arthropods on use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in exposure that causes neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. We anticipated these effects could occur on any use site, with a greater likelihood of these effects occurring with increasing application rates. However, given the low likelihood that Florida grasshopper sparrows will forage within carbaryl use sites, we expected a low likelihood of these direct adverse effects.

We anticipate the loss of insect prey where exposed. However, based on the varied diet and mobility of this species, we expect that most individuals in exposed areas will be able to forage on other available resources in the vicinity. Based on the extent of overlap and areas to be exposed from carbaryl usage in the range, particularly within off-field areas, we expected a moderate number of individuals would likely experience indirect adverse effects from the loss of arthropod prey. We anticipated these losses would likely lead to reduced fitness and survival for a small number of individuals.

In summary, the Florida grasshopper sparrow has a high vulnerability, and we anticipated the overall risk to the species was medium. We do not expect mortality or sublethal effects for individuals from consuming contaminated prey or seeds due to low doses and lack of anticipated foraging on use sites. However, we expected losses of arthropod prey items, particularly in agricultural spray drift areas that comprise 4.6% of the range, would be likely to lead to reduced fitness and survival of a small number of individuals over the duration of the proposed action due to the lack of resources and need for some individuals to expend energy traveling to alternate foraging sites. We anticipated 4.5% of the range within these off-field areas would be exposed from carbaryl usage annually.

The species is currently restricted to an estimated 5% of its historical range. While four of six known occupied sites are protected or managed in part for the conservation of the sparrow, data indicates sparrow populations have been declining. A historical low was recorded in 2018 when only 23 wild breeding pairs were estimated to occur. Captive breeding and reintroduction efforts are underway to improve the status of the species, but there are still low numbers of wild individuals at all six sites. Due to the small and isolated populations, the species is at high risk of extinction due to stochastic events. Additionally, higher population numbers, increasing population trends, and additional sites are needed to meet recovery goals. Without the conservation measures subsequently adopted as part of the action, as discussed below, we anticipated reduced fitness and mortality of even a small number of individuals would likely reduce the reproduction, numbers, and distribution of the species to an extent that would cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above, EPA and the applicant agreed to incorporate the following species-specific measures as part of the proposed action. Within the Pesticide Use Limitation Area (PULA) for the Florida grasshopper sparrow:

1. *For agricultural uses, carbaryl must be applied using a 105-foot buffer for ground applications and a 160-foot buffer for airblast applications.*

Based on AgDRIFT modeling, the buffers will reduce spray drift from entering terrestrial habitat for the Florida grasshopper sparrow by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.

The PULA for the Florida grasshopper sparrow will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of carbaryl.

After incorporating these conservation measures, we expect these pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, with adverse effects limited to a very small number of individuals due to loses invertebrate prey that lead to minor reductions in fitness supporting reproductive capacity or growth. However, effects will not likely reduce the reproduction, numbers, and distribution of the species. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the species-specific conservation measures that are now incorporated into the proposed action), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the Florida grasshopper sparrow in the wild. Thus, it is our biological opinion that the registration of carbaryl, as proposed, is not likely to jeopardize the continued existence of the Florida grasshopper sparrow.

References

U. S. Fish and Wildlife Service. 2023. Florida grasshopper sparrow (*Ammodramus savannarum floridanus*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 17 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), Amendment 1. Atlanta, Georgia. 14 pp.

U. S. Fish and Wildlife Service. 2008. Florida grasshopper sparrow (*Ammodramus savannarum floridanus*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 19 pp.

Integration and Synthesis Summary: Everglade snail kite

Scientific Name:	Common Name:	Entity ID:
Rostrhamus sociabilis plumbeus	Everglade snail kite	1221

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is low. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Everglade snail kite. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 9/22/2023; Wherever found; *States within the range:* FL

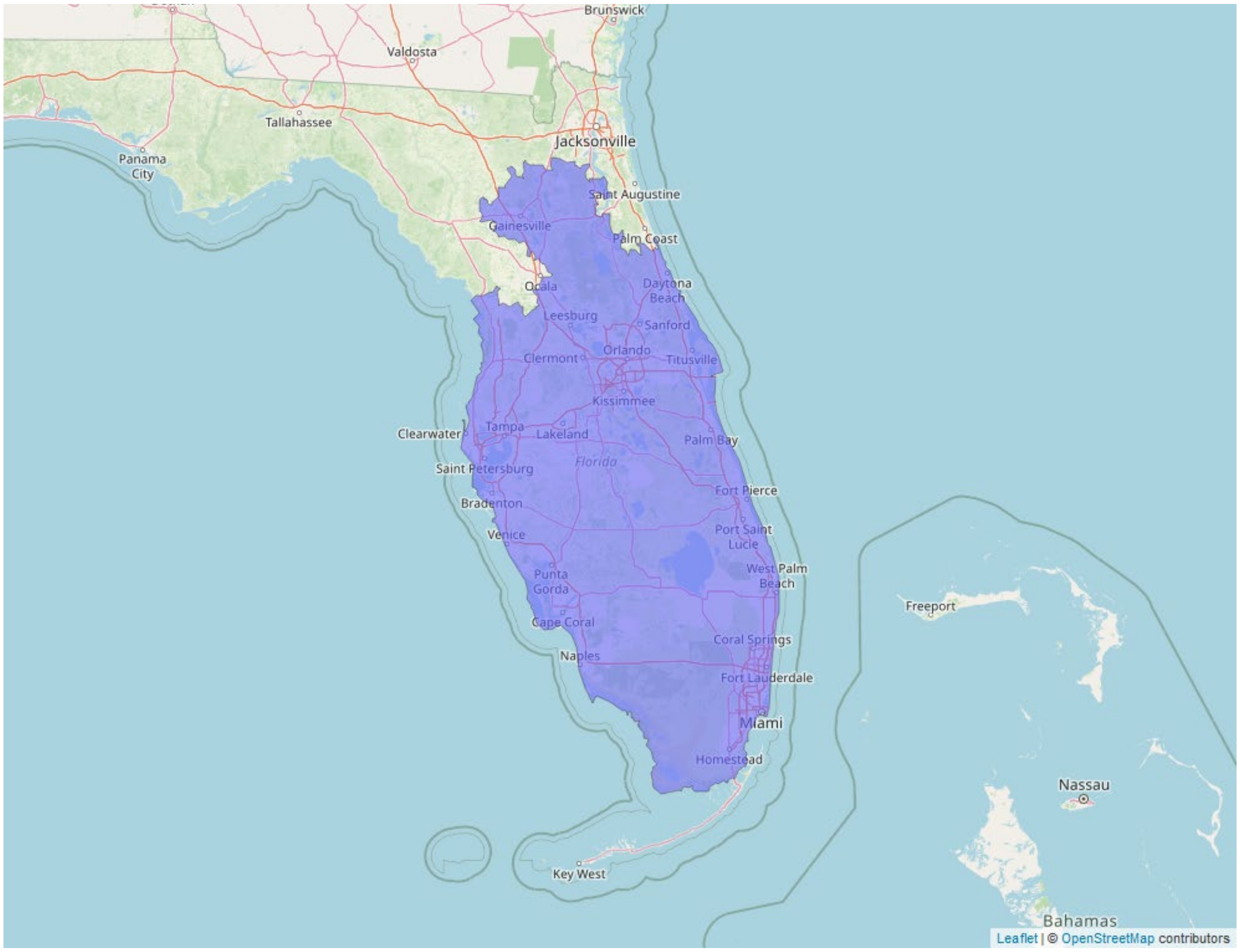

Figure 9. Range map of Everglade snail kite (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7713.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Endangered

Most recent 5 Year Status Review recommendation: No change in status

Most recently completed 5 Year Status Review: 7/10/2023

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Everglade snail kite is a mid-sized raptor that feeds almost exclusively on Florida apple snails. Its habitat consists of freshwater marshes and the shallow vegetated edges of lakes (natural and man-made) where apple snails are found.

By the time of the 2007 5-year review, the Everglade snail kite was limited to central and southern portions of Florida in the United States and the population showed a 50% reduction over the 10 years prior to that review. Under favorable environmental conditions, kites can achieve high reproductive rates (USFWS 2007). Since 2007, snail kites numbers have increased and they have been observed nesting in new sites (i.e., Paynes Prairie). The 2019 draft recovery plan amendment discusses a new method of estimating populations that showed the overall snail kite population exhibited steep declines from 1999 to 2002 and from 2006 to 2008 but rebounded slightly starting in 2010. In 2014, the population estimate was significantly higher (1,754 birds), although it was also noted that from 2010 to present, juvenile survival was trending downwards (USFWS 2019).

The snail kite population decline from 1999 to 2003 was due largely to regional drought that affected southern FL between 2000-2001. Now, the principal threat is loss or degradation of wetlands in central and southern FL. Nearly half of the Everglades have been drained for agriculture and urban development. Controlling invasive plant species (i.e., Hydrilla, others) is beneficial to snail kites, but application of herbicides to snail kite nesting substrates has occurred and is known to kill submerged aquatic vegetation, resulting in reduced suitability for Florida apple snails. Nest predation is a common cause of snail kite nest failure. The occurrence of nest predation has increased, largely due to hydrologic management in areas where kites nest. Data on changes in snail abundance support the conclusion that availability of apple snails to kites may be declining, and snail densities may be lower than those that are favorable for kite foraging. The spread of non-native apple snails (*Pomacea insularum*) may represent a reduction in the suitability of habitat for kites. While Everglade snail kites can feed on introduced apple snail species, the larger non-native species may not be as available as a prey item to juvenile kites, which may result in food limitation and lower survival for juveniles.

In addition to the overall population decline of the snail kite, documented declines in habitat amount and suitability and declines in abundance of native apple snails have occurred throughout many portions of the kite's range. Water management has affected and will continue to affect habitat characteristics. As Everglades restoration plans are developed and implemented, more favorable hydrologic regimes are likely. Even though many of the observed habitat declines are reversible under favorable conditions and are expected to recover over time, these factors appear likely to continue to limit the snail kite population growth in the near future. Threats resulting from increasing development, exotic and invasive species, and human disturbance also appear likely to continue to affect the kite population, and these threats may continue to increase. Although Everglades restoration projects are currently being planned that may improve hydrologic conditions for the kite, various threats continue to affect the snail kite and its habitat, and the degree of threat posed is stable or increasing (USFWS 2019, USFWS 2023).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 11.4% of the species' range overlaps with agricultural use sites and 5.7% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 17.1% overlap between the species' range and the agricultural footprint of carbaryl use (Table 15).

Table 15. Agricultural use overlap and annual usage data (% Range Treated) for the Everglade snail kite.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Citrus	4.7	2.7	7.4	0.5	0.3	0.7
Corn	0.3	0.2	0.5	<0.1	<0.1	0.1
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.8	1.6	4.4	2.8	1.6	4.4
Other Grains	3	0.5	3.5	<0.1	<0.1	<0.1
Other Orchards	0.5	0.5	1	0.4	0.3	0.7
Other Row Crops	0.1	0.1	0.2	0.1	0.1	0.2
Soybeans	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Vegetables and Ground Fruit	0.5	0.6	1.1	<0.1	<0.1	0.1
Total	**11.4**	**5.7**	**17.1**	**3.5**	**2.1**	**5.6**

Usage

Past usage data indicate that up to 5.6% of the species' range has been treated with carbaryl annually from agricultural uses (Table 15).

Additional Exposure Considerations

Everglade snail kites may use nearly any wetland within southern Florida. Snail kite habitat consists of freshwater marshes and the shallow vegetated edges of lakes (natural and man-made) where apple snails can be found. Non-breeding snail kites use communal roosts throughout the year in association with other birds, particularly anhingas (*Anhinga anhinga*), herons, and vultures. Roosting sites are also almost always located over water. Suitable foraging habitat for the snail kite is typically a combination of low profile marsh with an interdigitated matrix of shallow open water, which is relatively clear and calm. As such, we do not expect the Everglade snail kit to forage in use sites where carbaryl is registered for use, but these habitats may be exposed by spray drift or runoff. As such, while there is overlap between the species' range and agricultural use sites, we do not anticipate any individuals are likely to be exposed directly on agricultural use sites. To account for this difference in exposure potential, we only consider off-site exposure in our assessment, indicating that total overlap with agricultural areas is 5.7% and up to 2.1% of the range is likely to be treated annually.

Non-agricultural Uses

As Everglade snail kites almost always nest and roost over water, and forage in aquatic habitats, we do not expect them to occur in non-agricultural use sites of carbaryl. Due to the limited usage, small treatment areas, and application methods associated with non-agricultural uses within the species' range, we expect these applications to result in at most, low levels of off-site transport into the habitat of the Everglade snail kite. As such, we do not expect non-agricultural uses will result in the exposure of more than a very small number of individuals.

Conservation Measures

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated in developed use sites.

Exposure Summary

Everglade snail kites are not expected to forage on agricultural sites where carbaryl is registered for use. There is a medium extent of overlap, up to 5.7%, between the species' range and areas that may be exposed from spray drift or runoff from agriculture. Based on past usage data, we expect a low level of usage within these areas at 2.1% of the species' range. Given that the extent of overlap is medium and that expected usage is low, we expect a moderate number of individuals are likely to experience exposure from the agricultural uses of carbaryl.

We do not expect that exposure via drift from non-agricultural use adjacent to the habitat of the Everglade snail kite is likely to occur, and as such, we do not anticipate non-agricultural uses will add to the overall exposure of carbaryl to the species.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

The Everglade snail kite has a highly specific diet composed almost entirely of apple snails (*Pomacea paludosa*). We do not expect the Everglade snail kite to experience any direct adverse effects from the consumption of apple snails or other aquatic prey species.

Indirect Effects

Since the snail kite feeds almost exclusively on apple snails, effects to the snail prey base were calculated using a taxa-specific toxicity value, consistent with our analysis of effects to listed snails. As snails have been determined to be tolerant of carbaryl in laboratory studies, effects to the snail prey base are not anticipated at estimated environmental concentrations. However, some effects are anticipated to crayfish and fish, which the snail kite takes on rare occasions. Because aquatic invertebrates and fish exhibit a range of sensitivities to carbaryl, their abundance is expected to be reduced where exposure occurs, but not completely eliminated. As the Everglade snail kite relies primarily on apple snails, we expect that indirect effects will be low.

Toxicity Summary

We do not expect direct adverse effects to Everglade snail kites from consumption of apple snails or other aquatic prey species. We expect a low level of indirect effects as we do not anticipate that carbaryl exposure will cause direct adverse effects to apple snails but may cause mortality to other aquatic prey species exposed from spray drift or runoff. As such, we determine the Everglade snail kite has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The Everglade snail kite has a medium exposure ranking. Based on past carbaryl usage data, we expect up to 2.1% of the range may be treated annually from agricultural use and exposed to spray drift or runoff but may potentially cover up to 5.7% of the range over the duration of the proposed action depending how usage patterns change over time. This indicates that a moderate portion of the species' range is likely to be treated overall. We do not expect that exposure via drift from non-agricultural use adjacent to the habitat of the Everglade snail kite is likely to occur, and as such, we do not anticipate non-agricultural uses will add to the overall exposure of carbaryl to the species. As such, we expect a moderate number of individuals are likely to be exposed to carbaryl.

The Everglade snail kite has a low toxicity ranking. We do not direct adverse effects to snail kites from consuming apple snails or other aquatic prey items that have been exposed to carbaryl through spray drift or runoff. We expect a low level of indirect effects as apple snails are not expected to be adversely affected by carbaryl exposure, but abundance of other aquatic prey items could be reduced from exposure to spray drift or runoff.

Conclusion

The distribution of the Everglade snail kite is limited to central and southern portions of Florida, though a kite may occasionally be reported outside of this area. The principal threat to the snail kite is the loss or degradation of wetlands. Nearly half of the Everglades have been drained for agriculture and urban development. Based on the 2007 5-year status review, the snail kite population declined by approximately 50 percent over the prior 10 years and has shown little sign of recovery. In 2014, the population estimate was significantly higher (1,754 birds), although it was also noted that juvenile survival had been trending downwards. In addition to the overall population decline of the snail kite, documented declines in habitat amount and suitability and declines in abundance of native apple snails (the primary prey of the kite) have occurred throughout many portions of the kite's range. Threats resulting from increasing development, exotic and invasive species, and human disturbance have impacted the kite population. Various threats continue to affect the snail kite and its habitat, and the degree of threats posed to the kite is stable or increasing. The species has a high vulnerability ranking.

The Everglade snail kite has a medium exposure ranking. We do not expect the kites will forage on agricultural sites where carbaryl is registered for use. There is a medium extent of overlap, with up to 5.7% of the species' range that may be exposed to carbaryl from agricultural spray drift or runoff off-field where individuals may forage. Based on past usage data, we expect a low level of exposure within these areas, with usage affecting 2.1% of the species' range annually in off-site areas associated with agriculture. Given that the extent of overlap for agricultural use sites is medium and that expected usage is low, and non-agricultural uses are not anticipated to expose more than a very small number of individuals, we expect a moderate number of individuals are likely to experience exposure from the proposed action. Where exposure does occur, we do not expect direct adverse effects to Everglade snail kites from consumption of exposed apple snails or other aquatic prey species. We also do not anticipate losses of apple snails, the kite's primary prey, from carbaryl exposure, although carbaryl may cause mortality to other aquatic prey species exposed from spray drift or runoff. As such, we determine the Everglade snail kite has a low toxicity ranking. Given that we expect a moderate number of individuals and their prey are likely to experience exposure, but that we anticipate a low level of adverse effects, we determine the overall risk of adverse effects to the species is low.

In summary, while the Everglade snail kite has a high vulnerability, the overall risk to the species is low. We anticipate exposure is likely to occur in 5.7% of the range where the species forages, but we do not expect direct adverse effects from individuals consuming prey. Although we expect losses of some prey in exposed areas over the project duration, we do not expect losses of the kite's preferred food item, which are apple snails. We anticipate some individuals will need to find alternative resources due to losses of other prey items in localized areas, which is likely to lead to a reduction in reproductive success or the likelihood of survival in a very small number of individuals. However, we do not expect these effects will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Everglade snail kite.

References

U.S. Fish and Wildlife Service. 2023. Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*), 5-Year Review: Summary and Evaluation. Vero Beach, Florida.13 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for the Endangered Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*), Draft Amendment 1. Vero Beach, Florida.

U.S. Fish and Wildlife Service. 2007. Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*), 5-Year Review: Summary and Evaluation. Vero Beach, Florida.

Integration and Synthesis Summary: Streaked horned lark

Scientific Name:	Common Name:	Entity ID:
Eremophila alpestris strigata	Streaked horned lark	4296

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is high. However, while there is extensive overlap of the range with the proposed action and high anticipated usage that will likely expose a large number of individuals and their prey, which is likely to impact a moderate number of individuals over the project duration, we do not anticipate adverse effects across all areas throughout the fairly wide distribution of the streaked horned lark and pesticides have not been found to influence populations or have species-level effects. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the streaked horned lark. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 8/9/2022; Wherever found; *States within the range:* OR, WA

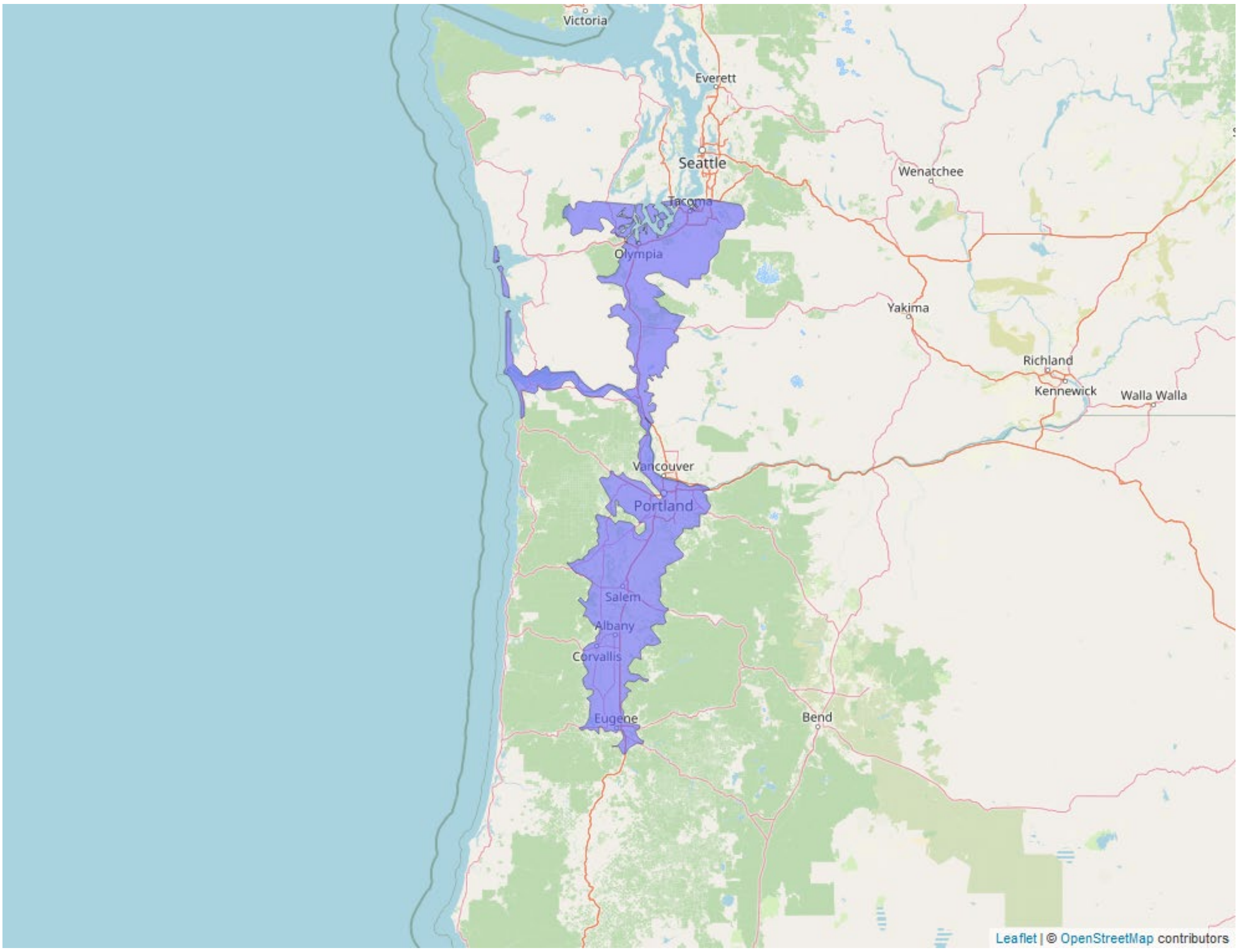

Figure 10. Range map of streaked horned lark (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7268.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Threatened

Most recent 5 Year Status Review recommendation: No change in status

Most recently completed 5 Year Status Review: 4/13/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The streaked horned lark is a small ground-dwelling songbird endemic to the Pacific Northwest. Historically, they nested in flat, open areas of grasslands, estuaries, sandy beaches, and dune habitats, areas that were maintained by flooding, fire, coastal sediment transport dynamics, and Native American burning. Today, these processes no longer operate due to human intervention. As of 2021, they nested in 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, fields denuded by overwintering Canada geese (*Branta canadensis*), gravel roads or gravel shoulders of lightly traveled roads, airports, and dredge material placement sites along the Columbia River. Streaked horned larks exhibit high nest site fidelity, generally returning to a site until it becomes too densely vegetated to be suitable for breeding. A key attribute of suitable lark habitat is an open landscape free from visual obstructions, and many of them are ephemeral or subject to frequent human disturbance. They forage on seeds of grasses and forbs, insects, and wrack line debris in coastal areas. The streaked horned lark is considered extirpated from British Columbia and none were observed during surveys of the San Juan Islands during surveys in 1999 and 2000. They were common permanent residents of the Umpqua and Rogue Valleys in the early 1900s, but there were no recent reports of breeding streaked horned larks in either location until a possible flock was observed in the Rogue River Valley in winter 2015-2016. As of 2021, larks occurred in three regions: South Puget Lowlands in WA, Pacific Coast of WA and Lower Columbia River in OR, and Willamette Valley in OR.

The most recent range-wide population estimate for streaked horned larks is about 1,170 to 1,610 individuals. This estimate was based on data compiled from multiple survey efforts by state, university, and regional researchers and anecdotal observations (2008 to 2010), plus extrapolation to areas of potential suitable habitat not surveyed (e.g., inaccessible private lands), particularly in the Willamette Valley. The largest known population of streaked horned larks breeds at the Corvallis Municipal Airport (up to 100 breeding pairs). The species was believed to be declining until at least the mid-2000s. By 2021, some of the 42 total populations in the South Puget Lowlands, the Pacific Coast, and Lower Columbia River were believed to be increasing or stable and others are believed to declining based on data from 2013-2019 (USFWS 2021). Main threats to the streaked horned lark include habitat loss (from development, dredge material deposition, natural disturbance processes, incompatible habitat management, successional changes in grassland habitats, spread of invasive beach grasses); adverse effects of military training; airport management operations; agricultural activities; small population issues and potential inbreeding depression; predation pressures; recreation; and stochastic weather events. Recently, additional stressors have been identified: male-skewed sex ratio at some sites, avian pox in the South Puget Lowlands region, and possible poisoning caused by rodenticides used in agricultural fields. In 2014, seven streaked horned larks died after application of the rodenticide zinc phosphide; four were analyzed for phosphine gas (a residual from exposure to zinc phosphide) and they were positive.

Streaked horned larks have suffered genetic diversity loss due to a population bottleneck, the effect of which may be exacerbated by continued small total population size. Habitat changes from climate change may benefit the subspecies, and as such climate change is not currently considered a threat; however, stochastic weather events may pose a threat to wintering flocks in the Willamette Valley. Death of individual larks caused by aircraft strikes is a threat to small populations at airports, as the loss of even a single breeding individual can have an adverse effect on the population. Recreation activities can degrade streaked horned lark habitat and cause direct mortality of nests and young. Threats that influence individuals but are not known to influence populations or have a species-level affect, include predation, disease, and pesticides.

Conservation actions to benefit the lark have been implemented at several sites throughout the lark's range, partially ameliorating the adverse effects of these threats (USFWS 2021). In the future, we expect loss and conversion of suitable habitat, land management activities, recreation, and synergistic effects of climate change and small population size to continue and increase. Habitat may be lost from vegetation succession, invasive species, development, and conversion of agricultural practices to those less suitable to streaked horned lark habitat. Land management includes mowing, other airport activities, military training, and other activities at Joint Base Lewis-McChord will continue and airstrikes will still cause mortality (USFWS 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 29.5% of the species' range overlaps with agricultural use sites and 18.8% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 48.3% overlap between the species' range and the agricultural footprint of carbaryl use (Table 16).

Table 16. Agricultural use overlap and annual usage data (% Range Treated) for the streaked horned lark.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	0.3	0.5	0.8	0.3	0.5	0.8
Citrus	0.0	0.0	0.0	0	0	0
Corn	1.6	1.5	3.1	0.5	0.5	1
Grapes	1.0	1.1	2.1	0.4	0.4	0.8
Other Crops	18.1	6.2	24.3	18.1	6.2	24.3
Other Grains	0.6	0.9	1.6	<0.1	<0.1	<0.1
Other Orchards	4.5	5.3	9.8	1.6	1.9	3.4
Other Row Crops	0.6	0.8	1.3	<0.1	<0.1	<0.1
Soybeans	0.0	0.0	0.0	0	0	0
Vegetables and Ground Fruit	3.9	3.6	7.4	1.2	1.3	2.4
Total	**29.5**	**18.8**	**48.3**	**21.6**	**10.4**	**32.1**

Usage

Past usage data indicate that up to 32.1% of the species' range has been treated with carbaryl annually from agricultural uses (Table 16).

Additional Exposure Considerations

Streaked horned larks forage on the ground in low vegetation or on bare ground; adults feed on a wide variety of grass and weed seeds, but feed insects to their young. Habitat used by larks is generally flat with substantial areas of bare ground and sparse low-stature vegetation primarily composed of grasses and forbs. 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, fields denuded by overwintering Canada geese, moderately- to heavily-grazed pastures, gravel roads or gravel shoulders of lightly-traveled roads, airports, and dredge deposition sites in the lower Columbia River. Streaked horned larks exhibit high nest site fidelity, generally returning to a site until it becomes too densely vegetated to be suitable for breeding. A key attribute of suitable lark habitat is an open landscape free from visual obstructions, and many of them are ephemeral or subject to frequent human disturbance. They forage on seeds of grasses and forbs, insects, and wrack line debris in coastal areas.

Wintering streaked horned larks use habitats that are very similar to breeding habitats. The streaked horned lark is a local migrant, most wintering in the Willamette Valley and on the islands in the lower Columbia River; the rest spend the winter on the Washington coast or in the south Puget Sound. 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. If one of these flocks were exposed to pesticide use, a greater number of individuals could be affected than that predicted by assuming a uniform distribution.

Larks are attracted to the wide-open landscape context and low vegetation structure in agricultural fields, especially in grass seed fields. The switch from grass seed production to crops that lack the low-statured vegetation and bare ground preferred by the streaked horned lark (e.g., wheat, stock for nurseries and greenhouses, grapes, blueberries, and hazelnuts) has contributed to a decline in suitable habitat for this species. Maintenance of extensive agricultural lands (primarily grass seed farms) has been noted as an important factor in maintaining the population of streaked horned larks in the Willamette Valley and aiding in the recovery of the subspecies in Oregon. As such, take prohibitions for routine agricultural activities on non-federal lands are excepted throughout the range of the streaked horned lark as a means to maintain suitable habitat and remove incentives to decrease that suitable habitat to avoid liability under the ESA. The rule excepting these activities from take prohibition contains a number of examples of common agricultural practices, including “Planting, harvesting, rotation, mowing, tilling, discing, burning, and herbicide application to crops”. In addition, while the rule does not specifically mention insecticides in the exceptions from prohibitions, it does mention the removal or other management of noxious weeds using methods that include herbicide and fungicide application, and fumigation.

Streaked horned larks use agricultural lands for breeding, foraging, and winter roosting. Habitat characteristics of agricultural lands used by streaked horned larks include: (1) Bare or sparsely vegetated areas within or adjacent to grass seed fields, pastures, or fallow fields; (2) recently planted (0 to 3 years) conifer farms with extensive bare ground; and (3) wetland mudflats or ‘‘drown outs’’ (i.e., washed out and poorly performing areas within grass seed or row crop fields) (USFWS 2022). Of all agricultural types, grass seed provides the most habitat for the lark. In addition, if the landscape context is open, larks may use newly planted orchards and vineyards (i.e., “Grapes”) for breeding, foraging, and winter roosting (Pers. comm. 2016 co-occurrence information, USFWS field office request). Carbaryl is registered for use on grass seeds, part of the “Other Crops” use layer which accounts for over half of the overlap and usage of carbaryl for agricultural use within the range of the species. Streaked horned larks will also nest in pasture, represented by the alfalfa use layer, which has relatively low overlap and usage within the range. In addition, though larks may use sites when fields are fallow, that use is unlikely to coincide with carbaryl usage.

Non-agricultural Uses

Streaked horned larks may occur in a variety of non-agricultural use sites of carbaryl where suitable habitat occurs. They will nest on gravel roads or gravel shoulders of lightly-traveled roads, airports, and dredge deposition sites in the lower Columbia River. In addition, if the landscape context is open, larks may use developed spaces, and developed open spaces for breeding, foraging, and winder roosting, and rights of way that traverse agricultural lands. Larks do not use forested habitats, including managed forests (Pers. comm. 2016 co-occurrence information, USFWS field office request).

Available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally on an annual basis. While this may result in a large treatment footprint if all rights of way usage were concentrated in one location or within one species' range, we expect this is highly unlikely to occur and rather expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the streaked horned lark's range for rights of way uses. Thus, while the streaked horned lark may occur in rights of way use sites where the landscape is open and habitat is suitable, we do not anticipate more than minimal exposure to carbaryl in these use sites is likely to occur.

Similarly, available usage data indicate only low levels of past carbaryl usage in open space developed areas within the streaked horned lark's range, with, at most, up to 2.4% of the species' range likely to be treated each year. Given that this usage is likely to occur many habitat types within this land use site, we anticipate an even lower level of usage within those areas containing suitable habitat for streaked horned lark. Furthermore, we expect many carbaryl applications in developed areas will be limited to hand-held equipment and treatments to small areas that greatly limit the extent of off-site transport and non-target exposure, further reducing the likelihood that individuals will be exposed to carbaryl from use on developed sites such as golf courses and residential areas. One exception to these limitations is use on turf, which could consist of broadcast applications at relatively high application rates (up to 5 lb/acre). Currently, streaked horned larks are found in open areas free from visual obstructions like grasslands, prairies, wetlands, beaches, dunes, and modified or temporarily disturbed habitats such as agricultural or grass seed fields, airports, dredged material placement sites, and gravel roads. Streaked horned larks need relatively flat landscapes with sparse vegetation, preferring habitats with an average of 17 percent bare ground for foraging and 31 percent of bare ground for nesting. Typically, preferred habitats contain short vegetation, contain forbs and grasses that are less than 13 inches (in) (33 centimeters (cm)) in height, and have few or no trees or shrubs. The large, open areas used by populations of larks are regularly disturbed via burning, mowing, herbicide application, crop rotation, dredging material placement, and/or other anthropogenic regimes (USFWS 2022). Many areas consisting of managed turf, such as lawns, parks, and golf courses, would be inconsistent with suitable habitat for streaked horned larks due to the presence of trees and other visual obstructions, inadequate areas with bare ground, and lack of interstitial spaces between plants on large tracts of land (>150 acres) as needed by the species (Anderson and Pearson

2015). Additionally, the final listing rule does not mention use of residential areas, lawns or golf courses by streaked horned larks (USFWS 2022). As such, we expect a low likelihood of exposure on these use sites with exposure to a few, if any, individuals.

Conservation Measures

We expect rangeland uses of carbaryl will be through the USDA APHIS grasshopper and Mormon cricket suppression program. While the streaked horned lark was not specifically addressed in the APHIS consultation for this use, carbaryl applications made through this program are required to implement conservation measures for the protection of listed species, including standard ground and aerial buffers (500-ft. for ground applications and 1,000-ft. for aerial applications), reduced application rates, and reduced number of applications made per year. We expect these measures will be sufficiently protective of the streaked horned larks to rangeland uses of carbaryl if they were to occur.

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated in developed use sites.

Exposure Summary

There is a high extent of overlap between agricultural use sites for carbaryl and the species' range. Based on past usage data, we expect a high level of usage within the species' range. While we do not expect that all carbaryl use sites will provide suitable habitat to streaked horned larks, especially when crops are active, a high proportion of agricultural overlap is comprised of the land use category that contains grass seed, where streaked horned larks are known to occur. As such, we consider the potential for exposure on agricultural use sites to be high and expect a large number of individuals to experience exposure from agricultural use.

Streak horned larks may also occur in non-agricultural use sites of carbaryl, including rights of way and developed areas. However, due to the limited usage, small treatment areas, and application methods associated with non-agricultural uses within the species' range, as well as habitat requirements of streaked horned larks that are incompatible with many carbaryl use sites, we expect a low likelihood of exposure from these uses, resulting in, at most, low levels of exposure.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to streaked horned larks. Consumption of seeds on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 9.1 mg/kg-bw, depending on application rate (which varies by use type) and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to streaked horned larks, including mortality or sublethal effects.

Consumption of arthropods exposed to carbaryl on use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 238.5 mg/kg-bw for uses with a maximum application rate of 5 lbs/acre. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. Use sites with maximum application rates up to 5 lbs/acre include orchards, sod, golf courses, and other turf. While these effects are expected to be temporary (all birds in laboratory studies recovered within 48 hours), they may leave affected individuals vulnerable to other stressors including predation and weather events or render them unable to forage. Lower allowable application rates on use sites where streaked horned larks are known to occur, including grass seed fields, pasture, and rights of way are expected to result in doses up to 71.5 mg/kg-bw, which are not expected to result in direct adverse effects to streaked horned larks. We do not expect consumption of arthropods exposed via spray drift resulting from applications at any rate to result in direct adverse effects to streaked horned larks.

Indirect Effects

Streaked horned lark adults feed on a wide variety of grass and weed seeds, and feed insects to their young. Based on available toxicity data, we do not expect adverse effects to plant resources but expect that arthropods will die with exposure to carbaryl, both on- and off-field. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. As such, even though toxicity to prey items is anticipated to be high, we anticipate a medium level of indirect adverse effects are likely to occur, particularly during the time of nesting and chick growth.

Toxicity Summary

We do not expect direct adverse effects to streaked horned lark from most carbaryl exposure (i.e., consumption of seeds, consumption of arthropods exposed on fields treated with lower application rates, consumption of arthropods exposed via spray drift). Streaked horned larks feed insects to their young, and we expect consumption of arthropods exposed to carbaryl on use sites recently treated with carbaryl at application rates up to 5 lb/acre to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. We anticipate that some use sites with these application rates could contain suitable habitat for streaked horned lark nesting, but that the overall incidence of this occurring would be low.

We expect a medium level of indirect effects are likely to occur due to decreases in prey abundance during the period of nesting and chick growth.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The streaked horned lark has a high exposure ranking. Based on past carbaryl usage data, we expect up to 32.1% of the range may be treated annually from agricultural use but may potentially cover up to 48.3% of the range over the duration of the proposed action depending how usage patterns change over time. While we do not expect that all carbaryl use sites will provide suitable habitat to streaked horned larks, especially when crops are active, a high proportion of agricultural overlap is comprised of the land use category that contains grass seed, where streaked horned larks are known to occur. As such, we expect a large number of individuals are likely to be exposed to carbaryl from agricultural use. Streak horned larks may also occur in non-agricultural use sites of carbaryl; however, we expect a low likelihood of exposure from these uses, resulting in, at most, low levels of exposure.

The streaked horned lark has a medium toxicity ranking. We expect neurological effects to occur to chicks fed insects that have been exposed to carbaryl on use sites with maximum application rates up to 5 lbs/acre. However, we anticipate a low incidence of this occurring and do not expect any direct adverse effects from other exposures to carbaryl, either on-field or from spray drift. We expect a medium level of indirect effects are likely to occur due to decreases in prey abundance during the period of nesting and chick growth.

Given that we expect a large number of individuals are likely to experience exposure and given that we expect a medium level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is high.

Conclusion

The streaked horned lark has been extirpated as a breeding subspecies throughout much of its range, including all its former range in British Columbia, the San Juan Islands, the northern Puget Trough, the Washington coast north of Grays Harbor, the Oregon coast, and the Rogue and Umpqua Valleys in southwestern Oregon. The current range of the streaked horned lark can be divided into three regions: (1) The south Puget Sound in Washington; (2) the Washington coast and lower Columbia River islands (including dredge spoil deposition sites near the Columbia

River in Portland, Oregon); and (3) the Willamette Valley in Oregon. Streaked horned larks use a wide variety of habitats that are often ephemeral or subject to frequent human disturbance, including agricultural crop fields. Genetic analysis has shown that streaked horned larks have suffered a loss of genetic diversity due to a population bottleneck. The current influences on streaked horned lark viability are the ongoing loss and degradation of suitable habitat, activities associated with military training, land management activities and related effects, recreation, and aircraft strikes. Pesticides have not been found to influence populations or have a species-level affect. Conservation actions to benefit the lark have been implemented at a number of sites throughout the lark's range. The species has a high vulnerability ranking.

The streaked horned lark has a high exposure ranking. Data indicate 48.3% of the species range overlaps with agricultural use sites or is likely to be exposed through off-site transport within the action area, and we anticipate up to 32.1% of the species' range will be treated with carbaryl annually based on past usage data for agricultural uses of carbaryl. Streaked horned larks are known to use agricultural lands for breeding, foraging, and winter roosting. Adults feed on a wide variety of grass and weed seeds, but feed insects to their young. They forage on the ground in areas with low stature vegetation or on bare ground, which can be found in some agricultural fields. As such, areas with extensive agricultural lands has been noted as an important factor in maintaining the population of streaked horned larks in parts of the range. Exposure to carbaryl use sites is expected to be lower than is predicted by the overlap due to the lark's preferred habitats and timing of use, as they prefer low-statured vegetation and bare ground that may be limited in some crop fields during the active growing season. Additionally, habitat conditions in some types of agricultural fields will be more favorable when they are fallow, a time period when carbaryl applications will be less likely to occur.

We expect a low likelihood of exposure of streak horned larks in non-agricultural use sites of carbaryl resulting in, at most, low levels of exposure that affect few individuals. We expect consumption of food items in and around agricultural fields to be the primary route of carbaryl exposure to streaked horned larks. We expect neurological effects to occur to chicks fed insects that have been exposed to carbaryl on use sites with maximum application rates up to 5 lbs/acre. However, we anticipate a low incidence of this occurring and do not expect any direct adverse effects from other exposures to carbaryl, either on-field or from spray drift. Indirect effects are likely to occur due to decreases in prey abundance. We expect most individuals will be able to move to areas with alternate prey when losses occur in localized areas, although we anticipate reduced reproductive success, starvation, and reduced chick growth for a small number of individuals in localized areas, particularly during the period of nesting and chick growth. While we do not expect that all carbaryl use sites will provide suitable habitat to streaked horned larks, especially when crops are active, we consider the potential for exposure to be high due to the extensive occurrence of agriculture and use sites within the range. As such, we expect a large number of individuals and their prey are likely to be exposed to carbaryl. Given that we expect a large level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is high.

In summary, the streaked horned lark has a high vulnerability and a high overall risk associated with the proposed action. However, this species has a fairly wide distribution, occurring in three different regions of western Oregon and Washington. We do not anticipate adverse affects will occur in all areas at the same time or from all exposures, although we expect sublethal effects in chicks that eat insects exposed to carbaryl on use sites with maximum application rates up to 5 lbs/acre, and reduced reproductive success, starvation, and reduced chick growth for a moderate number of individuals in localized areas due to losses of prey items across overlapping portions of the range over the duration of the proposed action. We expect most individuals will be able to move to areas with alternate food items when losses of insects occur in localized areas due to exposure to carbaryl. According to the 2021 Species Status Assessment for the streaked horned lark, pesticides may affect individuals but are not known to influence populations or have a species-level affect. Thus, while there is extensive overlap of the range with the proposed action and high anticipated usage that will likely expose a large number of individuals and their prey, which is likely to impact a moderate number of individuals over the project duration, we do not expect these effects will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the streaked horned lark.

References

Anderson, H.E., and S.F. Pearson, 2015. Streaked Horned Lark Habitat Characteristics. Final Report to U.S. Fish and Wildlife Service. Center for Natural Lands Management, Olympia, WA.

U.S. Fish and Wildlife Service. 2012. Determination of Endangered Status for the Taylor's Checkerspot Butterfly and Threatened Status for the Streaked Horned Lark. Federal Register 77(197): 61938-62058.

U.S. Fish and Wildlife Service. 2021. Species Status Assessment for the Streaked Horned Lark (*Eremophila alpestris strigata*). Version 1.0. Portland, Oregon. 78 pp.

U.S. Fish and Wildlife Service. 2022. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Streaked Horned Lark With Section 4(d) Rule. Final rule. Federal Register 87: 21783-21812.

Integration and Synthesis Summary: Rufa red knot

Scientific Name:	Common Name:	Entity ID:
Calidris canutus rufa	Rufa red knot	8621

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is medium. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is low. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the rufa red knot. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 9/13/2023; Wherever found; *States within the range:* AL, AR, CO, CT, DE, FL, GA, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, WI, WV, WY

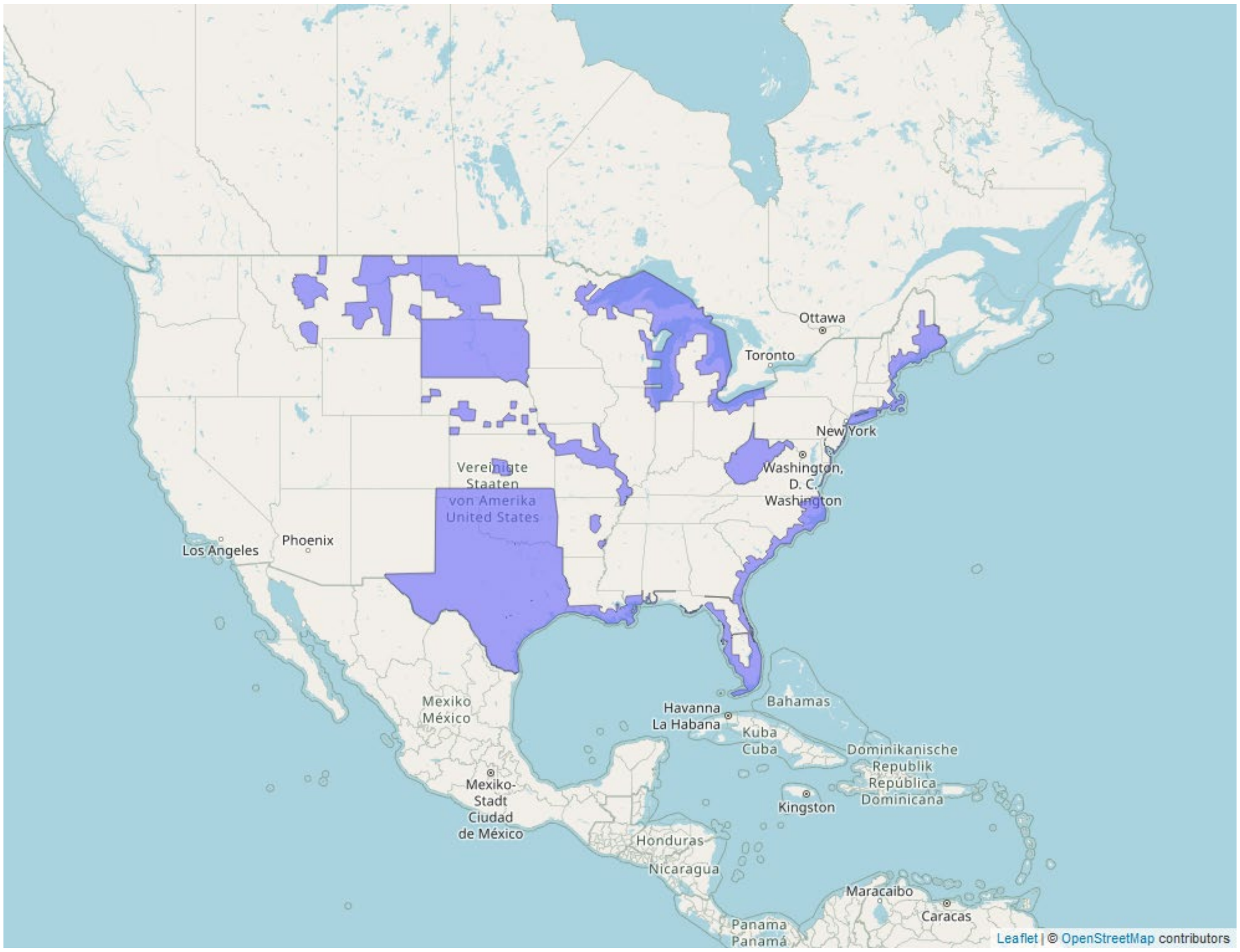

Figure 11. Range map of rufa red knot (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1864.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Threatened

Most recent 5-Year Status Review recommendation: No change in Status

Most recently completed 5-Year Status Review: 12/6/2021

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The rufa red knot is a medium-sized shorebird that ranges across nearly the full latitude gradient of the Western Hemisphere. Rufa red knots migrate annually between their breeding grounds on the central Canadian arctic tundra and four wintering regions: (1) Southern: Atlantic coasts of Argentina and Chile (particularly, Tierra del Fuego); (2) North Coast of South America: northern coast of South America; (3) Northwestern Gulf of America/Central American: western Gulf of America from the Mexican State of Tamaulipas through TX to MS and extending south along both coasts of Central America and along the Pacific coast of South America to Chiloé Island in Chile; and (4) Southeast U.S/Caribbean: southeast United States from AL to NC.. Each subspecies has distinctive migration routes and breeding areas in the Canadian Arctic; they generally breed in dry, slightly elevated tundra locations and winter on coastal shorelines. The wintering grounds are believed to represent different populations and they show site fidelity to their wintering and breeding grounds each year.

During both annual migrations, rufa red knots rely on key staging areas and other stopover areas to rest and feed (USFWS 2023). The single most important spring staging area is along the shores of Delaware Bay in Delaware and New Jersey (e.g., 50-80% of all rufa red knots stopover in Delaware Bay each year) (USFWS 2021), where rufa red knots achieve very high rates of weight gain feeding on the eggs of spawning horseshoe crabs. A sustained decline of red knot numbers occurred at Delaware Bay during the 2000s, which may have driven an overall species decline for the rufa red knot. Long-term aerial surveys have been conducted of Delaware Bay and Tierra del Fuego and 70-75% reductions in red knot counts were observed between the 1980s and 2010s in both locations. The Southern wintering population stabilized at a relatively low level since 2011. Modeling efforts suggest that the declines of the Southern population occurred after 2000 and southern rufa red knots are disproportionately reliant upon Delaware Bay during migration (USFWS 2014).

As of 2020, population sizes and trends for the other three wintering regions are less certain, though the Northwestern Gulf of America/Central American wintering population is thought to have declined recently and the other two were considered stable (USFWS 2020). The decline in red knots at Delaware Bay was likely caused by horseshoe crab overharvest, which is no longer considered a threat under current fishery management. Horseshoe crab population growth may be limited by a biological lag time because crabs take up to 10-years to become sexually mature and it may take at least that long for harvest restrictions (which have been phased in since 2000) to produce a corresponding increase in crab populations. Other factors (e.g., early life stage mortality, undocumented or underreported mortality) may also slow crab population growth. Most data suggest that the volume of horseshoe crab eggs is currently sufficient to support the Delaware Bay's stopover population of red knots at its present size. However, because of the uncertain trajectory of horseshoe crab population growth, it is not yet known if their egg resource will continue to adequately support red knot population growth over the next decade.

Additional threats include climate change, prey reduction, aquaculture activities, increased predation in nonbreeding areas, human disturbance, oil spills, and development, especially near the coasts. Rufa red knots are affected by climate change through habitat loss (i.e., sea level rise), reduced quality and quantity of prey resources, and timing mismatches with favorable food and weather conditions during migration and breeding. Natural rodent/predator cycles are disrupted by climate change, which may increase predation rates on shorebirds over the long term and have subspecies level effects. The documented collapse or dampening of rodent (e.g., lemmings) population cycles over the last 20 to 30 years in parts of the Arctic can be attributed to climate change with "high confidence". Specifically, red knot prey is negatively affected by ocean acidification, warming coastal waters, marine diseases, parasites, invasive species, sediment placement, recreation, and fisheries. Red knots are also threatened by habitat loss due to shoreline hardening and development. Beach nourishment can be beneficial or detrimental to red knot habitat, though negative effects are mostly considered short-term. A new threat to the species' Arctic habitat is overabundant goose herbivory, which permanently damages habitat formerly used by red knots (USFWS 2020, USFWS 2021). Effects of climate change are expected to continue as sea levels continue to rise, Arctic ice continues to melt, and predator/prey cycles continue to shift in response. Habitat loss due to shoreline hardening, wind energy development, and other anthropogenic activities is also expected to continue into the future. Even though rufa red knots shift among nonbreeding sites, effects of habitat loss and prey decimation in one site (e.g., Delaware Bay) can affect the entire species. Several other threats, including harmful algal blooms, human disturbance, invasive vegetation, and predation in nonbreeding areas, are expected to increase in the future (USFWS 2021).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 21.8% of the species' range overlaps with agricultural use sites and 11.5% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff) (Table 17). In total, there is approximately 33.3% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 17. Agricultural use overlap and annual usage data (% Range Treated) for the rufa red knot.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	1.6	1.6	3.2	0.2	0.2	0.3
Citrus	<0.1	<0.1	0.2	<0.1	<0.1	<0.1
Corn	8.2	2.5	10.7	0.6	0.2	0.8
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	4.5	3.1	7.6	2.8	1.8	4.6
Other Grains	5	3	8	0.1	<0.1	0.2
Other Orchards	0.2	0.2	0.4	<0.1	<0.1	0.1
Other Row Crops	1.1	0.4	1.5	<0.1	<0.1	0.1
Soybeans	7.9	2	9.9	0.7	0.2	0.9
Vegetables and Ground Fruit	1.4	0.7	2	0.1	<0.1	0.2
Total	**21.8**	**11.5**	**33.3**	**4**	**2.4**	**6.4**

Usage

Past usage data indicate that up to 6.4% of the species' range has been treated with carbaryl annually from agricultural uses (Table 17).

Additional Exposure Considerations

Red knots migrate in large flocks northward through the conterminous United States mainly April-June, southward July-October. The species is more abundant in migration along the U.S. Atlantic coast than on the Pacific coast. This species typically makes long flights between stops. Delaware Bay is the most important spring migration stopover in the eastern United States

Red knots are not expected to forage in agricultural areas where carbaryl is registered for use, but suitable habitat adjacent to use sites could be exposed from spray first of runoff (Pers. Comm. 2016 co-occurrence information, USFWS field office request). Given the broad nature of the range map for this species in certain areas, it is unlikely that the entire area of overlap adjacent to agriculture represents red knot foraging habitat. Therefore, it is expected the area of red knot habitat exposed to spray drift is lower than the 11.5% overlap and 2.4% treated.

Non-agricultural Uses

As the rufa red knot is typically found scouring sand or mud for aquatic invertebrates, and as such, we do not expect them to occur in non-agricultural use sites of carbaryl. Due to the limited usage, small treatment areas, and application methods associated with non-agricultural uses within the species' range, we expect these applications to result in at most, low levels of off-site transport into the habitat of the rufa red knot. As such, we do not expect non-agricultural uses will result in the exposure of more than a small number of individuals.

Exposure Summary

The red knot is not expected to forage in agricultural use sites. Given that all areas adjacent to agriculture in the species' range are unlikely to be red knot habitat, we anticipate a medium extent of overlap between the action area and the species' range that could be exposed via spray drift, and a low extent of usage in these areas. As such, we expect a moderate number of individuals are likely to experience exposure from agricultural use from the proposed action.

We do not expect the rufa red knot to occur in non-agricultural use sites of carbaryl or be exposed to more than low levels of spray drift or runoff. As such, we do not anticipate non-agricultural uses will result in exposures of more than a few individuals, if any.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

We do not expect the red knot to experience any direct adverse effects from dietary exposure to estimated environmental concentrations of carbaryl concentrations.

Indirect Effects

The red knot is an invertivore that consumes mollusks, eggs of crab (primarily horseshoe crab), seeds, and small fishes. Horseshoe crab eggs are an important source of food for north-bound migrants at Delaware Bay. Based on available toxicity data, we expect individuals of these prey species will likely die with exposure to carbaryl as a result of spray drift or runoff. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but not completely eliminate the prey base in these portions of the range. As the red knot eats a variety of dietary items we anticipate that they will generally be able to adapt to the loss any particular prey item. In addition, this species is highly mobile and thus anticipate alternative foraging areas will be available if local foraging sites become unsuitable due to lack of adequate food resources. While reduced food availability from horseshoe crab decline has been cited as a causal factor of red knot decline, horseshoe crabs are not expected to be in proximity to carbaryl use sites due to their coastal and offshore habitats. As such, even though toxicity to prey items is anticipated to be high, we anticipate a low level of indirect adverse effects are likely to occur.

Toxicity Summary

We do not expect any direct adverse effects to red knots through dietary exposure of contaminated prey. Though we anticipate carbaryl exposure will cause mortality to some organisms that act as food resources for the red knot, we expect as a generalist feeder, the red knot will be less affected by the loss of any specific dietary item. In addition, carbaryl usage is not expected to contribute to the decline in horseshoe crabs that decreased food resources at the significant stopover location in Delaware Bay. As such, we determine the red knot has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The red knot has a medium exposure ranking. The red knot is not expected to forage in agricultural use sites. Given that all areas adjacent to agriculture in the species' range are unlikely to be red knot habitat, we anticipate a medium extent of overlap between the action area and the species' range that could be exposed via spray drift, and a low extent of usage in these areas. We do not expect non-agricultural uses will result in the exposure of more than a small number of individuals. As such, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

The red knot has a low toxicity ranking. We do not expect any direct adverse effects to red knots through dietary exposure of contaminated prey. Though we anticipate carbaryl exposure will cause mortality to some organisms that act as food resources for the red knot, we expect as a generalist feeder, the red knot will be less affected by the loss of any specific dietary item. In addition, carbaryl usage is not expected to contribute to the decline in horseshoe crabs that decreased food resources at the significant stopover location in Delaware Bay. As such, we determine the red knot has a low toxicity ranking.

Given that we expect a moderate number of individuals are likely to experience exposure, no direct adverse effects are expected, and only low levels of indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is low.

Conclusion

Red knot numbers experienced a sustained declines at Tierra del Fuego and in the Delaware Bay in the 2000s, although these red knot populations appear to have stabilized at a relatively low level more recently. Habitat losses and degradation in wintering and migration areas have reduced the resilience of the red knot. Other threats include reductions in the current and future quality and quantity of prey resources. Reduced food availability of horseshoe crab eggs in the Delaware Bay was considered a primary causal factor in red knot population declines in the 2000s. Red knots rely on this food resource during their spring stopover. It is not yet known if the horseshoe crab egg resource will continue to adequately support red knot population growth over the next decade. In addition, the red knot faces ongoing and future increases in asynchronies (timing mismatches) throughout its migration and breeding range as a result of climate change and unknown causes. Successful annual migration and breeding of red knots is highly dependent on the timing of departures and arrivals to coincide with favorable food and weather conditions, as well as the timing of prey/predator cycles. Disruptions in the rodent/predator cycle may have already affected red knot populations and are likely to increase due to climate change. These and other threats are likely to continue into the future. We assigned a medium vulnerability ranking to this species.

The rufa red knot has a medium exposure ranking. We expect 33.3% of the species range overlaps with agricultural use sites or is likely to be exposed through off-site transport from these areas. Within these overlapping areas, anticipate 6.4% will be exposed to carbaryl annually. However, rufa red knots are not expected to forage in agricultural areas where carbaryl is registered for use. Off-field areas that will be exposed overlap with 11.5% of the range, and we expect 2.4% of the range will be exposed in these off-field areas annually. However, we do not anticipate the red knot will be exposed in all of these areas, and where exposed, we do not expect the red knot will experience direct adverse effects. Prey losses are likely to occur, although prey items exhibit a range of sensitivities to carbaryl, and some prey are likely to remain in exposed areas. We do not expect the rufa red knot to occur in non-agricultural use sites of carbaryl or be exposed to more than low levels of spray drift or runoff that would expose no more than a few, if any, individual knots or their prey. Horseshoe crabs are not expected to be in proximity to carbaryl use sites due to their coastal and offshore habitats, and thus we do not anticipate impacts to horseshoe crab eggs from the proposed action. In addition, the red knot forages on a variety of prey and seeds and is highly mobile, thus individuals are likely to find alternative foraging areas when there are localized reductions in prey. Therefore, we determine the overall risk of the proposed action to the species is low, although we expect a small number of individuals will be affected from the losses of invertebrate prey that lead to starvation during migration or reduced fitness.

In summary, the rufa red knot has a medium vulnerability, and the overall risk to the species is low. The rufa red knot is not likely to be directly affected from consuming exposed food items, and most individuals will likely move to alternative sites to forage as needed to find sufficient prey when there are losses of invertebrates in localized areas. We expect impacts to a small number of individuals due to starvation or lower reproductive success as a consequence of losses of prey items over the duration of the proposed action. However, we do not expect these effects will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the rufa red knot.

References

U.S. Fish and Wildlife Service. 2023. Recovery Plan for the Rufa Red Knot (*Calidris canutus rufa*). Galloway, New Jersey. 22 pp.

U.S. Fish and Wildlife Service. 2021. Rufa Red Knot (*Calidris canutus rufa*) 5-Year Review Summary and Evaluation. Galloway, New Jersey. 35 pp.

U.S. Fish and Wildlife Service. 2020. Species Status Assessment Report for the Rufa Red Knot (*Calidris canutus rufa*) Version 1.1. Galloway, New Jersey. 55 pp.

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Rufa Red Knot. Final rule. Federal Register 79:73705-73748.

Integration and Synthesis Summary: Eastern black rail

Scientific Name:	Common Name:	Entity ID:
Laterallus jamaicensis ssp. jamaicensis	Eastern black rail	11319

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is medium. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is medium. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the eastern black rail. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/24/2024; Wherever found; *States within the range:* AL, AR, CO, FL, GA, IN, LA, MS, NC, SC, TN, TX

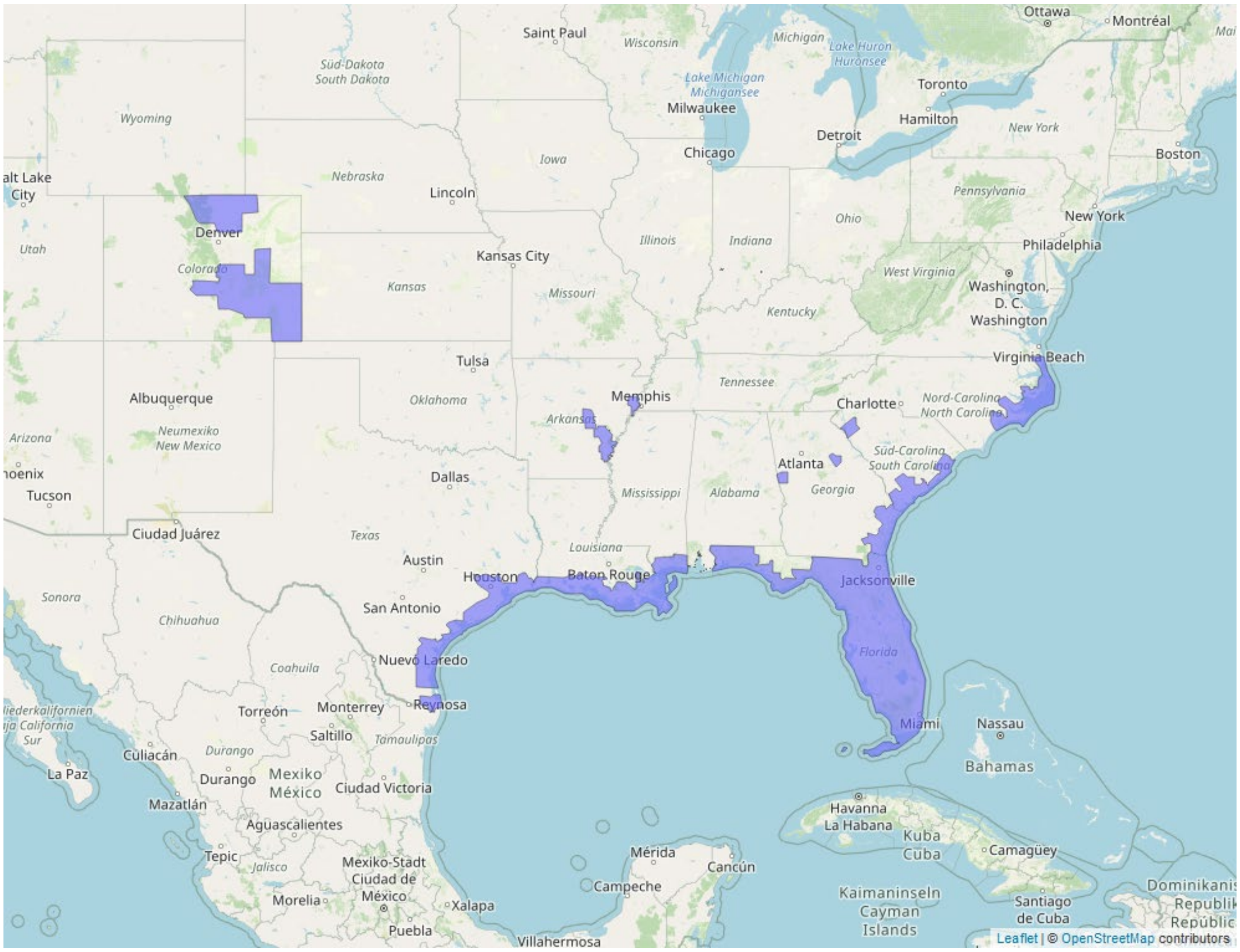

Figure 12. Range map of eastern black rail (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/10477.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Threatened

Most recent 5-Year Status Review recommendation: N/A

Most recently completed 5-Year Status Review: N/A

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The eastern black rail is a subspecies of black rail, a small, cryptic marsh bird that occurs in salt, brackish, and freshwater. They are found in coastal and interior areas, but most detections are from coastal sites. Eastern black rails occupy relatively high elevations along heavily vegetated wetland gradients, with soils moist or flooded to a shallow depth. Plant structure is considered more important than plant species composition in predicting habitat suitability. The species nests in high portions of salt marshes, shallow freshwater marshes, wet meadows, and flooded grassy vegetation. Nests are constructed of live and dead emergent, herbaceous plants, like fine grasses, rushes or sedges, often with a dense clump of vegetation that conceals the nest from above. The black rail eats seeds (such as bulrush or cattail) and small invertebrates, including aquatic beetles, spiders, snails, small crustaceans, weevils, earwigs, woodlice, grasshoppers, and ants.

The northernmost part of the species range contracted from MA to NJ, and regional strongholds in the Southeast and Southwest still exist for this subspecies. The best available scientific data suggest that the remaining strongholds support a relatively small total population across the contiguous United States (i.e., an estimated 1,299 individuals on the upper Texas coast within specific protected areas prior to Hurricane Harvey, and an estimated 355-815 breeding pairs on the Atlantic Coast from NJ to FL (including the Gulf Coast of FL)) prior to multiple recent major hurricanes. There are no current population estimates from the interior States (CO, KS, OK), although there are consistent populations of eastern black rails at Quivira National Wildlife Refuge in KS and at least four sites in CO where the subspecies is encountered in the spring and summer. Some of the eastern black rail populations migrate; for example, birds that breed in CO and KS migrate to TX to overwinter (USFWS 2019).

Habitat degradation and fragmentation from conversion of marshes and wetlands to agricultural lands or urban areas have contributed to the present condition of the eastern black rail, and we anticipate these activities to continue in the future. Past activities in the action area that have contributed to the species' decline include, but are not limited to, marsh draining and ditching, the change of hay harvesting from traditional methods to mechanical methods, coastal prairie habitat conversion to pasture for cattle grazing and agriculture, incompatible land management techniques (e.g., such as application of poorly timed and planned prescribed fires, intense grazing, or haying), habitat loss from sea level rise, hurricanes and other flood events, and wide-spread use of pesticides for mosquito control (USFWS 2019, USFWS 2021).

In addition to activities that have adversely impacted the species, activities that benefit this species have also occurred within the action area. For example, the Delmarva Ornithological

Society hosts the Delaware Bird-a-Thon, which focuses on fundraising for and providing awareness about the coastal habitats of the Delaware Bayshore, some of which provide habitat for the eastern black rail. This program has raised over $450,000 in its first 12 years. Funds have been leveraged to acquire and protect over 1,900 acres of key coastal habitat in Delaware, including salt marsh, coastal freshwater marsh, and adjacent upland buffers. Protection of these habitats was made possible through multiple partnerships, including The Conservation Fund, Delaware Wild Lands, Inc., and the State of Delaware Division of Natural Resources and Environmental Control. While this project does not directly focus on the eastern black rail, it is an action that should support its habitat requirements (USFWS 2019).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 14.8% of the species' range overlaps with agricultural use sites and 7.4% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 22.2% overlap between the species' range and the agricultural footprint of carbaryl use (Table 18).

Table 18. Agricultural use overlap and annual usage data (% Range Treated) for the eastern black rail.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	0.6	0.3	0.9	<0.1	<0.1	<0.1
Citrus	1.3	0.7	2	0.1	<0.1	0.2
Corn	2.8	1.5	4.2	0.5	0.3	0.8
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	5.1	2.5	7.5	4.3	2	6.3
Other Grains	4.2	1.6	5.7	0.3	0.1	0.5
Other Orchards	0.2	0.2	0.4	0.1	0.1	0.3
Other Row Crops	0.7	0.5	1.2	<0.1	<0.1	0.2
Soybeans	2	0.6	2.6	0.6	0.3	0.9

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Vegetables and Ground Fruit	0.3	0.3	0.6	<0.1	<0.1	0.1
Total	**14.8**	**7.4**	**22.2**	**5.6**	**2.8**	**8.3**

Usage

Past usage data indicate that up to 8.3% of the species' range has been treated with carbaryl annually from agricultural uses (Table 18).

Additional Exposure Considerations

Eastern black rails occupy relatively high elevations along heavily vegetated wetland gradients, with soils moist or flooded to a shallow depth. Eastern black rails fly little during the breeding and wintering seasons, and will remain on the ground, running quickly through dense vegetation likely using the runways of rodents and rabbits. As such, black rails require dense vegetative cover that allows movement underneath the canopy.

As the eastern black rail is a wetland specialist, individuals are not expected to enter agricultural fields but could be exposed to carbaryl from spray drift or runoff where wetlands are adjacent to agricultural fields. Given the relatively broad nature of the species' range map, we do not expect that all areas adjacent to carbaryl use sites will be wetland habitats suitable for eastern black rails. In addition, where these areas occur adjacent to agricultural fields, we expect the dense vegetation of the marsh habitats where the black rail resides will limit off-site movement of carbaryl to some degree. Thus, we expect that overlap and usage that will result in exposure will be less than the 7.4% of the range and 2.8% of the range treated annually estimated within the spray drift and runoff zone.

Non-agricultural Uses

As the black rail is a wetland specialist, we do not expect them to occur in non-agricultural use sites of carbaryl. Due to the limited usage, small treatment areas, and application methods associated with non-agricultural uses within the species' range, we expect these applications to result in at most, low levels of off-site transport into the habitat of the eastern black rail. As such, we do not expect non-agricultural uses will result in the exposure of more than a small number of individuals.

Conservation Measures

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated in developed use sites.

Exposure Summary

The eastern black rail is not expected to forage in agricultural fields. Given the habitat requirements of the black rail, we expect a medium extent of overlap between adjacent off-field sites within the action area and the species' range. Based on past usage data, we expect a low level of usage within the species' range. We do not expect the eastern black rail to occur in non-agricultural use sites of carbaryl, and we anticipate at most, low levels of off-site transport from non-agricultural uses into the habitat of the eastern black rail. Given that the extent of overlap is medium and that expected usage is low, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in areas around carbaryl use sites fields to be the primary route of exposure to eastern black rails. Eastern black rails forage on a variety of small aquatic and terrestrial invertebrates and seeds, by gleaning or pecking at individual items. We do not expect eastern black rails to forage in carbaryl use sites, and we do not anticipate that consumption of plants or aquatic prey items contaminated with carbaryl via spray drift or runoff is expected to result in adverse effects to eastern black rails. As such, we expect a low level of direct adverse effects to the eastern black rail.

Indirect Effects

The eastern black rail is thought to be an opportunistic forager and relies on a variety of small aquatic and terrestrial invertebrates, especially insects, and seeds. While no effects to plants are expected, we anticipate effects to aquatic and terrestrial invertebrates from carbaryl exposure from adjacent use sites. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but not completely eliminate the prey base in these portions of the range. However, as a generalist feeder, we anticipate that eastern black rails will be less affected by any specific loss of prey items and can consume other available dietary items. As such, even though toxicity to prey items is anticipated to be high, we anticipate a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

We do not expect eastern black rails to forage in carbaryl use sites, and we do not expect direct adverse effects are likely to occur from exposure via spray drift or runoff at predicted exposure levels. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but that eastern black rail will be able to adapt as opportunistic feeders. As such, we determine the eastern black rail has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The eastern black rail has a medium exposure ranking. The eastern black rail is not expected to forage in agricultural fields. Based on past carbaryl usage data, we expect up to 2.8% of the off-field overlap with the range may be treated annually for agricultural but may potentially cover up to 7.4% of the range over the duration of the proposed action. This indicates that a moderate portion of the species' range is likely to be treated overall. As such, we expect a moderate number of individuals are likely to be exposed to carbaryl.

The eastern black rail has a medium toxicity ranking. We do not expect direct adverse effects are likely to occur from exposure via spray drift or runoff at predicted exposure levels. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but that eastern black rail will be able to adapt as opportunistic feeders.

Given that we expect a moderate number of individuals are likely to experience exposure and given that we expect a moderate level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is medium.

Conclusion

The eastern black rail is a small, cryptic marsh bird that occurs in salt, brackish, and freshwater wetlands east of the Rocky Mountains. Despite having a wide distribution, the species currently has low redundancy across its range. Eastern black rails occupy relatively high elevations along heavily vegetated wetland gradients, with soils moist or flooded to a shallow depth. The subspecies requires dense vegetative cover that allows movement underneath the canopy, and because birds are found in a variety of salt, brackish, and freshwater wetland habitats that can be tidally or non-tidally influenced, plant structure is considered more important than plant species composition in predicting habitat suitability.

While there are regional differences in threats to the species, in general eastern black rails are impacted by the loss, degradation, and fragmentation of wetland habitats resulting from conversion of wetlands to agricultural or urban land uses, sea level rise along the coast, and ground- and surface-water withdrawals across the range. Incompatible land management practices may also have negative impacts on the eastern black rail, i.e., poorly timed and planned prescribed fires, excessive grazing, and/or certain mechanical treatments (USFWS 2021).

In relative terms, regional strongholds in the Southeast and Southwest still exist for this subspecies; however, the best available scientific data suggest that the remaining strongholds support a relatively small total population size across the contiguous United States, i.e., an estimated 1,299 individuals on the upper Texas coast within specific protected areas prior to Hurricane Harvey, and an estimated 355 – 815 breeding pairs on the Atlantic Coast from New Jersey to Florida (including the Gulf Coast of Florida) prior to multiple recent major hurricanes. There are no current population estimates from the interior States (Colorado, Kansas, or Oklahoma) (USFWS 2019).

The species range overlaps 22.2% with agricultural use sites and areas that could be exposed through off-site transport within the action area. Within these overlapping areas, 8.3% has been treated with carbaryl annually in the past. However, Eastern black rails are not expected to use agricultural fields and given the relatively broad nature of the species' range map, we do not expect that all areas adjacent to carbaryl use sites in areas that are likely to be exposed will be wetland habitats suitable for eastern black rails. Where suitable habitat occurs adjacent to agricultural fields, we expect the dense vegetation of the marsh habitats where the black rail resides will limit off-site movement of carbaryl to some degree. Thus, we expect exposure in off-field areas to be less than the 7.4% of the range estimated within the spray drift and runoff zone. We do not expect the eastern black rail to occur in non-agricultural use sites of carbaryl. We anticipate at most, low levels of off-site transport from non-agricultural uses into the habitat of the eastern black rail, leading to exposure of very few individuals.

We do not anticipate direct adverse effects for eastern black rails consuming food items contaminated with carbaryl from spray drift or runoff. Carbaryl exposure will cause mortality to a moderate level of the invertebrate prey base of the species. However, eastern black rails are opportunistic feeders, and we anticipate they will be able to adapt to a temporary decreases in the abundance of certain prey types by foraging on those that are present or moving to other areas to forage. As a result, we anticipate the species will experience minimal adverse effects, in the form of decreased fitness and survival of a small number of individuals, from the loss of invertebrate prey within a moderate portion (less than 7.4%) of the range.

In summary, we expect moderate losses of prey items leading to reductions in fitness or survival in a small number of individuals over the duration of the proposed action. Because the species has a wide distribution, is an opportunistic feeder and will be able to access alternative available prey, is not expected to experience exposure on use sites, and its dense habitat is anticipated to limit off-site movement of carbaryl and therefore decrease exposure, we do not expect the stated effects will likely reduce the reproduction, numbers and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the eastern black rail.

References

U.S. Fish and Wildlife Service. 2019. Species status assessment report for the eastern black rail (*Laterallus jamaicensis jamaicensis*), Version 1.3. Atlanta, Georgia. 194 pp.

U.S. Fish and Wildlife Service. 2021. Recovery Outline for the Eastern black rail (*Laterallus jamaicensis jamaicensis*). South Carolina Ecological Services Field Office, Charleston, South Carolina. 14 pp.

Integration and Synthesis Summary: Yellow-shouldered blackbird

Scientific Name:	Common Name:	Entity ID:
Agelaius xanthomus	Yellow-shouldered blackbird	117

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determined the risk of adverse effects to the species was medium. We anticipated mortality and reduced fitness in a moderate number of individuals from consuming contaminated food and prey losses over the project duration.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate species-specific conservation measures as part of the action. After incorporating conservation measures into the effects of the action, adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the yellow-shouldered blackbird. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the yellow-shouldered blackbird. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 6/6/2018; Wherever found; *States within the range:* PR. Figure 12 depicts a map of the species' range.

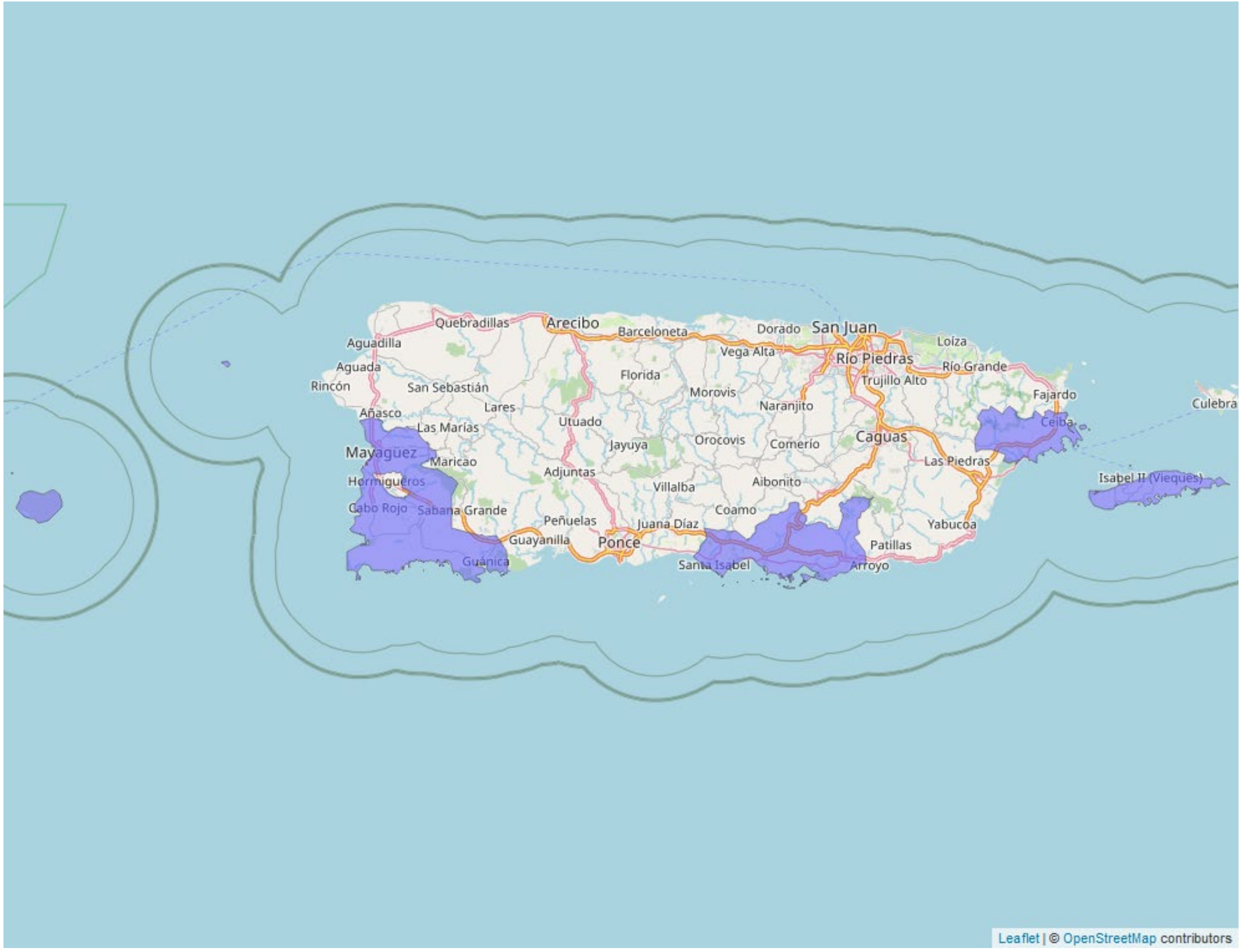

Figure 2. Range map of yellow-shouldered blackbird (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7383.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Most recently completed 5-Year Review: 8/22/2023

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: All populations stable, with none known to be increasing or decreasing

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The yellow-shouldered blackbird is endemic to Puerto Rico and the adjacent Mona and Monito islands. The species was once common in the coastal forests, but during the early 20th century most Puerto Rico's coastal forests were replaced by agriculture and development. Currently, the species is mainly limited to four areas: Mona and Monito islands, and three small disjunct populations in eastern, southern, and southwestern Puerto Rico. The size of individual disjunct populations continues to remain relatively low. According to the most recent surveys, the greatest numbers of the yellow-shouldered blackbirds occur in the southwestern population, ranging annually between approximately 100-500 individuals. This is followed by the Mona and Monito Island population, with approximately 100 individuals. The southern and eastern populations have approximately 55 and 12 individuals, respectively.

The primary stressors to the yellow-shouldered blackbird are ongoing and include habitat loss and degradation due to human activities, opportunistic predators, a restricted distribution, low population numbers, climate change, hurricane impacts, invasive species, and nest parasitism by shiny cowbirds. Destruction of foraging, roosting, and nesting habitat from residential and tourist development, as well as agricultural activities, is a major threat to the species. The cumulative effects of hurricane impacts (i.e., habitat destruction, reduction of food sources, some direct impacts to individuals) and persistently low yellow-shouldered blackbird population numbers could be detrimental to the species. Additionally, nesting areas are extremely vulnerable to storm surges caused by hurricanes and sea level rise due to their proximity to the sea, and recent studies on climate change predict a reduction in land cover of coastal wetlands due to sea-level rise in response to global warming.

Although variable from year to year, yellow-shouldered blackbird natural nesting attempts have generally declined since 1999, likely driven by the lack of natural nesting opportunities since the early 2000’s and other threats that have reduced nesting success and breeding population size (USFWS 2023). Since the 1980s, the Puerto Rico Department of Natural and Environmental Resources has implemented actions to improve the breeding success of the yellow-shouldered blackbirds, which have helped the species to persist. However, the number of yellow-shouldered blackbirds produced during each breeding season does not appear to be enough to augment the overall species’ population (i.e., in any given span of years, the number of young surviving to adulthood are not more than losses of adults). Artificial nest structures have been introduced to reduce parasitism by shiny cowbirds, and shiny cowbird eggs have been removed from yellow-shouldered blackbird nests to improve nesting success. Although nesting in natural substrates is occurring, it appears the primary nesting for the species is now within the artificial nesting structures, likely because of the loss of habitat.

Studies have shown major causes of egg failure were disappearance, not hatched, abandoned, and punctured, likely due to a wide variety of avian and mammalian predators. Natural nests and fledglings that have poor flight abilities are both particularly vulnerable to predation (USFWS 2023). Yellow-shouldered blackbirds may also face competition for nest-sites with other bird species such as grackles and rock doves (USFWS 1996, USFWS 2018). Nest infestation by two species of blood-feeding mites may lead to nest abandonment by adult yellow-shouldered blackbird and premature nest desertion by young birds. Lice may also affect nesting yellow-shouldered blackbirds, particularly those in cavity (covered) nests and re-used nests from the previous breeding event. Avian pox has also been identified as a potential problem for the yellow-shouldered blackbird, as blackbirds infected with avian pox had significantly lower survival rates than uninfected birds (USFWS 1996).

In addition to the loss of breeding habitat, food availability seems to be another major factor affecting the survival and breeding success of the yellow-shouldered blackbird. Yellow-shouldered blackbirds are omnivorous, but some scientists consider the species as arboreal insectivores since the majority of their diet consists of insects. They also eat arachnids, unidentified mollusks, and plant matter including fruits, seeds, and nectar from various plant species. The species also consumes processed foods such as cattle ration, human food (cooked rice and sugar), dog food, and monkey chow, among others. Lack of food availability is worst during the dry season when food resources are limited and competition for food between siblings can increase. This situation may be exacerbated if shiny cowbird chicks are present in the yellow-shouldered blackbird nest because they can also outcompete yellow-shouldered blackbird chicks for food resources, further exacerbating the species' struggle to maintain its population. A study to determine yellow-shouldered blackbird survival during the post-fledging period confirmed that there is strong competition for food between nestlings, which directly affects post-fledgling survival rate. The study also found that carcasses of fledglings within the first five days post-fledging were in areas with dead mangroves and minimal cover, indicating that if fledglings are not able to reach adequate cover, they face dehydration and possible death during their juvenile stage. Yellow-shouldered blackbirds have been observed foraging in cultivated fields where insecticides are commonly applied to the crops. Therefore, some authors believe that yellow-shouldered blackbird may also be negatively affected by such insecticides (Lewis et al. 1999, as cited in USFWS 2018).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 1.6% of the species' range will overlap with agricultural use sites of carbaryl or is likely to be exposed through off-site transport within the action area (Table 19. Up to 1.3% of the species' range occurs on carbaryl agricultural use sites while 0.3% of the range occurs off-field but may still be exposed through spray drift and runoff from these uses.

Table 19. Overlap data for the yellow-shouldered blackbird.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	1.3	0.3	1.6

Usage

Past carbaryl usage data in Puerto Rico is unavailable. However, prior usage data indicate that 20-70% of agricultural crops per municipality in Puerto Rico have been treated with insecticides annually, with carbaryl presumably among these insecticides. We broadly use this data as confirmation that carbaryl usage likely occurs on these islands.

Additional Exposure Considerations

The yellow-shouldered blackbird, although omnivorous, can be basically characterized as an arboreal insectivore. During the nesting season the young's diet is about 90% arthropod material. At urban bird feeders and around domestic animals, this blackbird has been observed to take cattle feed, dog food, nectar, fruit, cooked rice, and granulated sugar.

Due to the landcover data available for Puerto Rico, the extent of overlap between the species range and the action area is based on any cultivated land, not just those crops where carbaryl is registered for use. As such, overlap values may overestimate the extent of carbaryl use sites on these islands.

Non-agricultural Uses

The yellow-shouldered blackbird uses mud flats and salt flats; offshore red mangrove cays; black mangrove forest; lowland pastures (dry coastal forest); suburban areas; coconut plantations; and coastal cliffs for nesting but prefers nesting in black mangrove forests. They may forage or roost in a variety of habitat types, including those that may be within or adjacent to non-agricultural use sites for carbaryl, including developed, open space developed, nurseries, rangeland, managed forests, and rights of way use sites as yellow-shouldered blackbirds have been observed in suburban areas, pastures, vacant private farms with patches of secondary forest or agricultural fields, sites used for hay production, private forests, and other areas. Foraging and nesting activities are prevalent on private lands (USFWS 2018). However, we generally expect low exposure of yellow-shouldered blackbirds to carbaryl within each of these use sites.

Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the yellow-shouldered blackbird. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As such, we anticipate a low likelihood of carbaryl usage for managed forests in the range, and that if usage did occur, exposure to the yellow-shouldered blackbird would be minimal. Similarly, available usage data from USDA APHIS indicate that, from 2019-2023, no rangeland habitats in Puerto Rico have been treated with carbaryl, suggesting that there is a low likelihood of the species being exposed to this non-agricultural use.

As a result of the 2022 Proposed Interim Decision and 2024 NMFS biological opinion on carbaryl, most residential applications are limited to hand-held equipment and treatments to small areas (e.g., spot, crack-and-crevice, or narrow perimeter band treatments) that greatly limit the extent of off-site transport and non-target exposure, further reducing the likelihood that individuals will be exposed to carbaryl from use in many developed areas. Though existing conservation measures do not apply to certain developed and open space developed uses such as sod farm and golf course applications, we expect that the prevalence of these use sites within the range to be very low. Given the wide range of habitats that the yellow-shouldered blackbird is known to occupy (including some of these use sites), we cannot rule out non-agricultural exposure from these uses.

Exposure Summary

While there is a low level of overlap between agricultural areas and the species' range, given that the species is known to occur on and forage in agricultural areas and that there is additional potential exposure from non-agricultural uses (as we cannot rule out exposure on some developed and open space developed use sites), we determine the species has a medium exposure ranking. As such, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around agricultural fields to be the primary route of carbaryl exposure to yellow-shouldered blackbirds. The yellow-shouldered blackbird is primarily an arboreal insectivore but will opportunistically take other food items as available. We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to yellow-shouldered blackbirds. Consumption of food items on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 92 mg/kg-bw on crops with maximum application rates up to 2 lbs/acre, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to yellow-shouldered blackbirds, including mortality or sublethal effects.

For uses with a maximum application rate of 5 lbs/acre, dosages are expected to range up to 230 mg/kg-bw, particularly for individuals that exclusively consume arthropods that have been exposed to carbaryl on use sites. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. While these effects are expected to be temporary (all birds in laboratory studies recovered within 48 hours), they may leave affected individuals vulnerable to other stressors including predation and weather events or render them unable to forage. Use layers that contain crops with allowable application rates up to 5 lbs/acre include Other Crops (for use on sod), Citrus, Other Orchards, and Open Space Developed (for use on golf courses). Yellow-shouldered blackbirds are likely to forage in a variety of agricultural and non-agricultural habitats. As such, we expect that they will forage in these use sites. While usage is expected to be low, we expect direct effects to a moderate number of individuals exposed to carbaryl at these application rates, primarily from carbaryl usage in Citrus and Other Orchards use sites. We anticipate a low prevalence of sod farms and golf courses within the range of the yellow-shouldered blackbird.

Indirect Effects

The yellow-shouldered blackbird is primarily an insectivore but is opportunistic as other food items are available. While no effects to plants are expected, we anticipate effects to terrestrial invertebrates from carbaryl exposure on or near use sites. Because species taken as food items exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but some prey will be available after exposure and any losses will likely only be temporary. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. However, as a generalist feeder, we anticipate that the yellow-shouldered blackbird will be less affected by any specific loss of prey items and can consume other available dietary items. As such, even though toxicity to invertebrates is anticipated to be high, we anticipate a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

We anticipate low levels of exposure, although direct adverse effects are anticipated for yellow-shouldered blackbirds foraging in fields and non-agricultural use sites treated at maximum application rates. In these situations, temporary neurological effects are expected that will leave affected individuals vulnerable to other stressors including predation and weather events or render them unable to forage, which could lead to mortality, reduced growth, or reduced fitness. We do not anticipate any adverse effects in individuals that consume prey that have been exposed to carbaryl in fields treated with lower application rates, or from spray drift or runoff. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, although we expect yellow-shouldered blackbirds will often be able to consume other available resources. As such, we determine the yellow-shouldered blackbird has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

Though the yellow-shouldered blackbird has a medium exposure ranking with up to 1.6% of the range overlapping with cultivated areas and additional overlap with non-agricultural use sites, we expect the extent of exposure to be somewhat lower when considering only areas where carbaryl is registered for use. As such, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

The yellow-shouldered blackbird has a high toxicity ranking. We expect a high level of direct adverse effects as sublethal effects that could lead to mortality and reduced reproduction are expected when yellow-shouldered blackbirds consume food resources both on-field or on non-agricultural use sites with high application rates. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but we expect that the opportunistic nature of the yellow-shouldered blackbird will often result in individuals consuming other available resources.

Given that we expect a moderate number of individuals are likely to experience exposure and a high level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is medium.

Preliminary Conclusion

The yellow-shouldered blackbird occurs in forested habitats in southwestern Puerto Rico. A post-breeding census in 2007 found approximately 994 blackbirds, which was an increase from 759 found in 2004. However, recent surveys have shown declines, with the largest population in the southwest ranging annually between approximately 100-500 individuals, the Mona and Monito Island population consisting of 100 individuals, and the southern and eastern populations consisting of approximately 55 and 12 individuals, respectively. Threats include the invasion of nesting areas by avian and mammalian predators; the destruction of feeding, roosting, and nesting habitat due to development, and agricultural activities; uses of waters, cays, and shoreline that are incompatible with the needs of the species for roosting and nesting; nest infestation by blood-feeding mites and lice; and avian pox. Additionally, the blackbird has been observed foraging in non-agricultural use sites and in cultivated fields where insecticides are commonly applied to the crops, and some studies indicate that the species may be negatively affected by such insecticides. The species has a high vulnerability ranking.

In our draft Opinion, before incorporating species-specific conservation measures, we determined the yellow-shouldered blackbird had a medium exposure ranking. We expect 1.6% of the species range overlaps with carbaryl use sites in agricultural areas, along with additional overlap with non-agricultural use sites and areas likely to be exposed through off-site transport from use sites within the action area. Past carbaryl usage data in Puerto Rico is unavailable. However, prior usage data indicate that 20-70% of agricultural crops per municipality in Puerto Rico have been treated with insecticides annually, with carbaryl presumably among these insecticides. Due to the landcover data available for Puerto Rico, the extent of agricultural use site overlap between the species range and the action area is based on any cultivated land, not just those crops where carbaryl is registered for use. As such, overlap values may overestimate the extent of carbaryl use sites for agriculture in Puerto Rico. However, we expect the species range overlaps with additional areas where non-agricultural use sites occur. We anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but we expect that most yellow-shouldered blackbird will be able to consume other available resources as the species is highly mobile and eats a wide variety of food items. However, we expected losses of prey items would lead to starvation or reduced fitness in a small number of individuals. We also anticipated a moderate level of direct adverse effects as temporary neurological effects are likely to result in mortality, reduced growth, and reduced fitness for individuals that consume prey exposed on use sites at the highest application rates, primarily from agricultural uses. In all, we anticipated a moderate number of individuals would be likely to experience exposure, and direct and indirect adverse effects would be likely in exposed areas. We determined the overall risk of adverse effects to the species is medium.

In summary, the yellow-shouldered blackbird has a high vulnerability. In our draft Opinion, before incorporating species-specific conservation measures, we determined the overall risk to the species was medium. The species has been observed foraging in cultivated fields and non-agricultural use sites where carbaryl is labeled for use. Studies indicate insecticides may be causing negative effects to the species. We expected sublethal effects that would lead to the loss of or reduced fitness in individuals that consumed contaminated prey, as well as losses of prey items over the duration of the proposed action that would lead to starvation or reduced reproductive success. We anticipated exposure from consuming contaminated prey would be limited to a medium portion of the range where there is carbaryl usage and spray drift. While individuals eat a wide variety of dietary items and most will likely travel to alternative sites to forage as needed to find sufficient prey as needed when losses occur in localized areas, we anticipated mortality and reduced fitness in some individuals, as food availability seems to be a major factor affecting the survival and breeding success of yellow-shouldered blackbird. With these impacts, we anticipated mortality and reduced fitness in a moderate number of individuals over the project duration. Data indicates populations have recently declined, and there are many ongoing threats to the species. Without the conservation measures subsequently adopted as part of the action, as discussed below, we expected the effects to exposed individuals and their prey would likely reduce the reproduction, numbers, and distribution of the species to an extent that would cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we determined the proposed action was expected to appreciably reduce the likelihood of survival and recovery of the species in the wild.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above, EPA and the applicants agreed to incorporate the following species-specific measures as part of the proposed action. Within the Pesticide Use Limitation Area (PULA) for the yellow-shouldered blackbird:

1. *For agricultural uses, carbaryl must be applied using the following buffers:105 feet for ground applications, and 160 feet for airblast applications. Carbaryl may not be applied at rates greater than two lbs/acre (except for citrus, stone, and pomme fruit crops).*

Based on AgDRIFT modeling, the buffers described above and limitation in maximum application rate will reduce spray drift from entering habitat for the yellow-shouldered blackbird by >95% and reduce any remaining residues to levels sufficient to minimize adverse effects. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.

The PULA for the yellow-shouldered blackbird will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of carbaryl.

After incorporating these conservation measures, we expect these pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, with adverse effects limited to a small number of individuals due to losses of invertebrate prey that lead to minor reductions in fitness supporting reproductive capacity or the growth and survival of chicks. However, effects will not likely reduce the reproduction, numbers, and distribution of the species. After reviewing the current status of the species, environmental baseline for the action area, cumulative effects, and effects of the action (including the species-specific conservation measures that are now incorporated into the proposed action), we have determined the proposed action is not likely to appreciably reduce the survival and recovery of this species in the wild.

Thus, it is our biological opinion that the registration of carbaryl, as proposed, is not likely to jeopardize the continued existence of the yellow-shouldered blackbird.

References

U.S. Fish and Wildlife Service. 1996. Yellow-shouldered blackbird (*Agelaius xanthomus*) revised recovery plan. Atlanta, Georgia. 77 pp.

U.S. Fish and Wildlife Service. 2011. Mariquita or yellow-shouldered blackbird (*Agelaius xanthomus*) 5-Year Review: Summary and Evaluation. Boquerón, Puerto Rico. 34 pp.

U.S. Fish and Wildlife Service. 2023. Yellow-shouldered blackbird or mariquita (*Agelaius xanthomus*) 5-year status review: Summary and evaluation. Caribbean Ecological Services Field Office, Mayaguez, Puerto Rico. 19 pp.

Integration and Synthesis Summary: Cactus ferruginous pygmy-owl

Scientific Name:	Common Name:	Entity ID:
Glaucidium brasilianum cactorum	Cactus ferruginous pygmy-owl	11666

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, based on overlap of the action area with the species' range, past annual usage of carbaryl within the species' range, and the direct and indirect effects to the species from carbaryl exposure, we determine the risk of adverse effects to the species is medium. Based on this information and other factors in our analysis of the consequences of the action on the likelihood of the survival and recovery of this species in the wild, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the cactus ferruginous pygmy-owl. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/25/2024; Wherever found; *States within the range:* AZ, TX

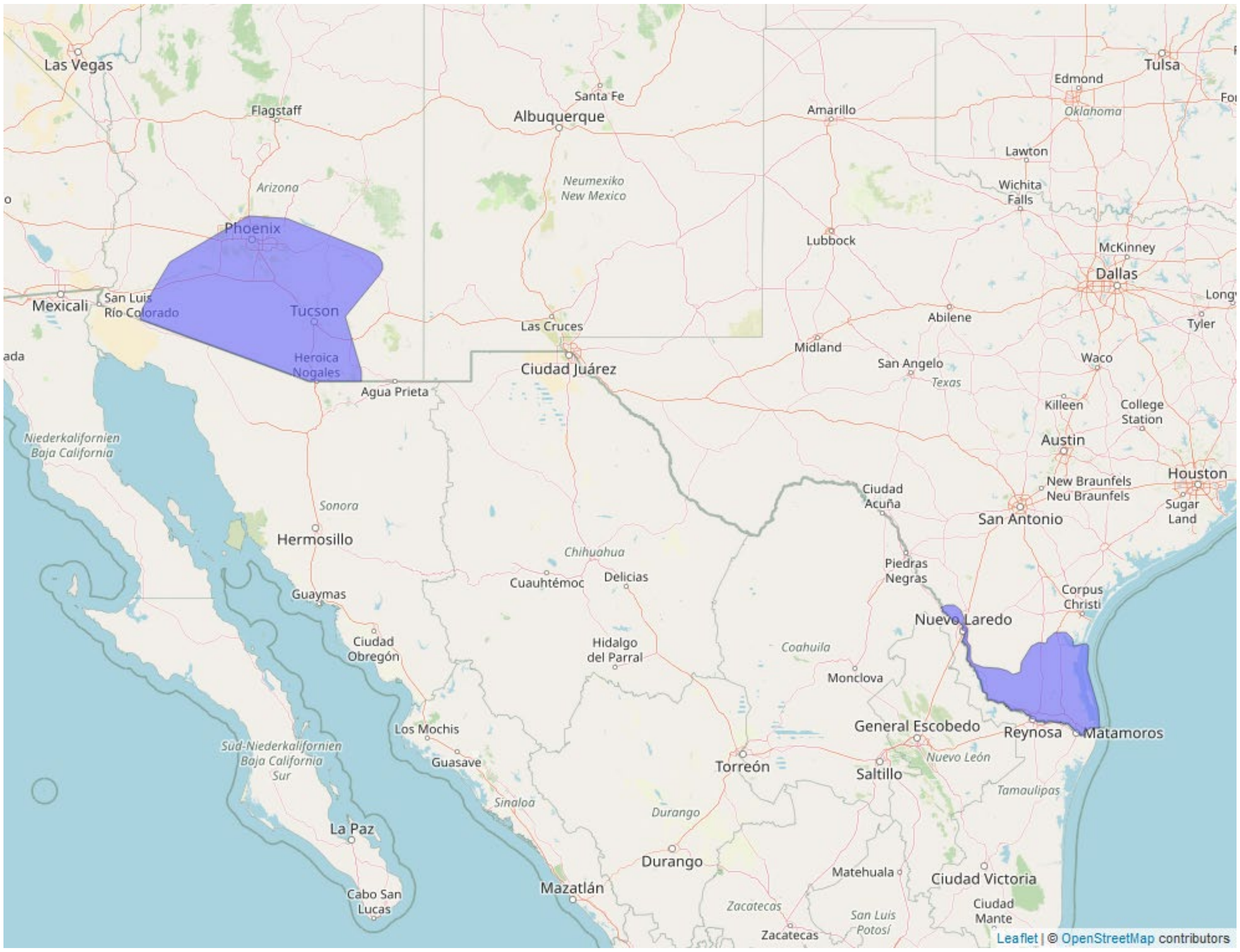

Figure 13. Range map of cactus ferruginous pygmy-owl (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1225.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Threatened

Most recent 5-Year Status Review recommendation: N/A

Most recently completed 5-Year Status Review: N/A

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The cactus ferruginous pygmy-owl is a small, cavity-nesting owl found in southwestern U.S. and northwestern Mexico. They are the northern most subspecies of ferruginous pygmy-owl and are found in Sonoran desertscrub, semidesert grasslands, thornscrub and dry deciduous forests, brushland, and live oak forest. Cactus ferruginous pygmy-owls are considered an edge species, often found in edges of thorny scrub and woodlands in association with giant cacti, scattered patches of woodlands in open landscapes, dry woods, evergreen secondary growth, and residential areas. They use natural cavities and those created by woodpeckers in giant cacti, trees, and sand banks. Cactus ferruginous pygmy-owls are primarily active during dawn and dusk, with limited activity in the middle of the day and night unless there is a full moon (i.e., they are more active at night when there is a full moon). They are nonmigratory, but some can make significant movements (i.e., juvenile males can disperse 2-50 km). Males disperse to the next available habitat patch, and females will often disperse farther, only stopping when they find a mate. Their prey includes young chickens, mourning doves, desert spiny lizards, amphibians, eastern meadowlarks, cotton rats, other small mammals, large insects, possibly bats, and other prey items up to twice their size. They occur from central Arizona south through Texas and western Mexico and are generally recognized in two populations: western (Arizona, Northern Sonora, and Western Mexico) and eastern (Texas and Northeastern Mexico). The two populations are separated by biogeographic barriers, including the Chihuahuan desert and mountain ranges, and the Sierra Madre Occidental and Oriental and Mexican Plateaus, that may prevent contact between them because there is no record of the cactus ferruginous pygmy-owl between Arizona and south Texas in the U.S. In the U.S., the Arizona population is believed to have an abundance in the low hundreds and the Texas population is believed to be in the high hundreds. In the U.S., primarily in Arizona, the cactus ferruginous pygmy-owl is found on federal, state, and local government lands and Tribal lands. Remaining occupied lands in Arizona, Texas, and Mexico are privately owned. In addition, a captive breeding pilot program started in 2006, and three release occurred between 2006-2022. There is now a second captive breeding population at the Phoenix Zoo (USFWS 2022).

Threats to the species include effects to habitat from drought and climate change, increase in invasive species, urbanization, agricultural production and wood harvesting, improper livestock grazing, increased predation and human activity from border walls and patrols, habitat damage from off-highway vehicle use, and effects of small population sizes. Drought and climate change affects vegetation and cover that includes availability of nest cavities, prey availability, predator avoidance, and thermoregulation. Climate changes will include changes to precipitation, temperature, and frequency and intensity of drought and hurricanes, all of which will negatively affect cactus ferruginous pygmy-owls and their habitat. Non-native grasses (i.e., buffelgrass) increase fire risk. Some areas occupied by the cactus ferruginous pygmy-owl are adapted to fire, but the Sonoran Desert is not fire adapted, so fire can devastate these communities. Urbanization, agricultural production, and wood harvesting increases habitat fragmentation and substantially impacts the availability and connectivity of owl habitat. Agricultural development is declining in some parts of the pygmy-owl's range and seems concentrated in the northern portion of the range. Improper livestock grazing and range-management programs are believed to have had some of the biggest effects on vegetation in the owl's range in the past. Many areas of pygmy-owl habitat have recovered from historical effects of grazing; however, other areas like the Sonoran Desert are slow to recover and may never recover. Pesticides and pesticide residues are mentioned as potential threats to the species, as evidenced by seven organochlorine families detected in blood samples collected in Mexican pygmy owls (USFWS 2022).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 10.8% of the species' range overlaps with agricultural use sites and 6.2% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 17% overlap between the species' range and the agricultural footprint of carbaryl use (Table 20).

Table 20. Agricultural use overlap and annual usage data (% Range Treated) for the cactus ferruginous pygmy-owl.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	1.6	0.6	2.2	0.2	<0.1	0.2
Citrus	0.2	0.2	0.4	<0.1	<0.1	<0.1
Corn	1.8	1.3	3.1	0.6	0.5	1.1
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.4	1.5	4	2.4	1.5	4
Other Grains	3.9	1.9	5.7	1	0.4	1.4

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Orchards	<0.1	0.1	0.2	<0.1	<0.1	<0.1
Other Row Crops	0.2	0.1	0.4	<0.1	<0.1	<0.1
Soybeans	<0.1	<0.1	0.1	<0.1	<0.1	0.1
Vegetables and Ground Fruit	0.6	0.6	1.2	0.5	0.4	0.9
Total	**10.8**	**6.2**	**17**	**4.7**	**3**	**7.8**

Usage

Past usage data indicate that up to 7.8% of the species' range has been treated with carbaryl annually from agricultural uses (Table 20).

Additional Exposure Considerations

We do not expect cactus ferruginous pygmy-owls to forage on agricultural use sites but could consume prey that have either been exposed to carbaryl on-field or via spray drift in the 6.2% of the range adjacent these areas. We expect up to 3% the range to be exposed via spray drift from carbaryl usage for agricultural annually.

Non-agricultural Uses

Cactus ferruginous pygmy-owls are considered an edge species, often found in edges of thorny scrub and woodlands in association with giant cacti, scattered patches of woodlands in open landscapes, dry woods, evergreen secondary growth, and residential areas. As such, we consider the potential for exposure to non-agricultural uses of carbaryl for forested and developed areas.

Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the cactus ferruginous pygmy-owl. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As such, we anticipate a low likelihood of carbaryl usage in the range, and that if usage did occur, exposure to the cactus ferruginous pygmy-owl would be minimal, affecting a few individuals, at most.

Similarly, available usage data indicate only low levels of past carbaryl usage in open space developed areas within the cactus ferruginous pygmy-owl's range, with, at most, up to 2.4% of the species' range likely to be treated each year. Given that this usage is likely to occur many habitat types within this land use site, we anticipate an even lower level of usage within those areas containing suitable habitat for cactus ferruginous pygmy-owls. Furthermore, we expect many carbaryl applications in developed areas will be limited to hand-held equipment and treatments to small areas that greatly limit the extent of off-site transport and non-target exposure, further reducing the likelihood that many individuals will be exposed to carbaryl from use on developed sites such as golf courses and residential areas. In all, we expect a small number of individuals will be exposed to carbaryl from non-agricultural uses.

Conservation Measures

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated in developed use sites.

Exposure Summary

The cactus ferruginous pygmy-owl is not expected to forage in agricultural fields. We expect a medium extent of overlap between adjacent off-field sites within the action area and the species' range. Based on past usage data, we expect a low level of usage within the species' range. Given that the extent of overlap with agricultural use sites is medium and that expected usage is low, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

The cactus ferruginous pygmy-owl is an edge species, so may forage in areas where prey species have been exposed on or adjacent to non-agricultural use sites, particularly forests and developed areas. We expect a low level of exposure to carbaryl from use on these sites.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects

We expect consumption of food items in and around carbaryl use sites to be the primary route of carbaryl exposure to the cactus ferruginous pygmy-owl. Consumption of prey items on or adjacent to use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 65.4 mg/kg-bw on use sites with maximum application rates up to 2 lbs/acre, depending on application rate (which varies by use type), dietary item consumed, and whether exposure occurred on or off use sites. We do not expect these doses to result in direct adverse effects to cactus ferruginous pygmy-owls, including mortality or sublethal effects.

For uses with a maximum application rate of 5 lbs/acre, dosages are expected to range up to 163.6 mg/kg-bw for individuals that exclusively consume prey that has been exposed to carbaryl on use sites. At these concentrations, we expect exposure to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. While these effects are expected to be temporary (all birds in laboratory studies recovered within 48 hours), they may leave affected individuals vulnerable to other stressors including predation and weather events or render them unable to forage. Due to their small size and occurrence in similar habitats as many of their predators, pygmy-owls are preyed upon by a variety of species. We do not expect consumption of arthropods exposed via spray drift resulting from applications at this rate to result in direct adverse effects to cactus ferruginous pygmy-owls.

Of the agricultural use layers that contain crops with allowable application rates up to 5 lbs/acres, only Other Crops (for use on sod) has appreciable on-field overlap (2.4%). We do not expect overlap with Citrus or Other Orchards to exceed 0.2% of the range of the cactus ferruginous pygmy-owl. Within non-agricultural use sites, allowable application rates range up to 5lbs/acre only within developed use layers, for use on turf and golf courses. The cactus ferruginous pygmy-owl may occur in habitats that border golf courses or areas where carbaryl may be applied for turf such as scattered patches of woodlands in open landscapes and residential areas. However, we expect carbaryl usage within developed areas to be low, as described above.

Indirect Effects

We expect mortality of arthropods and small mammals if exposed to carbaryl on use sites, and mortality of arthropods from exposure via spray drift. Because prey species exhibit a range of sensitivities to carbaryl, we expect exposure will reduce the abundance in these areas, but some prey will be available after exposure and any losses will likely only be temporary. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. In addition, the cactus ferruginous pygmy-owl is an opportunistic predator that is known to respond to adapt to changes in prey availability, such as the emergence of insects or the presence of nestlings in nearby nests. As such, we anticipate that cactus ferruginous pygmy-owls will be less affected by any specific loss of prey items and can consume other available dietary items. As such, we anticipate a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

We do not expect direct adverse effects to cactus ferruginous pygmy-owls from consumption of food items exposed via spray drift or exposed on use sites with maximum application rates up to 2 lb/acre. We expect consumption of prey exposed on use sites with maximum application rates up to 5 lbs/acre, particularly sod and golf courses, to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. While temporary, these effects would leave affected cactus ferruginous pygmy-owls vulnerable, especially to increased predation. We anticipate that some use sites with these application rates could contain suitable habitat for cactus ferruginous pygmy-owls, but that the overall incidence of this occurring would be low. However, due to the low occurrence of these use sites within the cactus ferruginous pygmy-owl's range, the low anticipated usage of carbaryl on these sites, and the types of application methods associated with many developed uses, we expect a low level of exposure such that few individuals will experience these adverse effects.

We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but that pygmy-owl will be able to adapt as opportunistic feeders. As such, we determine the cactus ferruginous pygmy-owl has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The cactus ferruginous pygmy-owl has a medium exposure ranking. Based on past carbaryl usage data, we expect up to 3.0% of the range may be treated annually for agriculture in areas adjacent to carbaryl use sites but may potentially cover up to 6.3% of the range over the duration of the proposed action depending how agricultural usage patterns change over time. This indicates that a moderate portion of the species' range is likely to be treated overall for agricultural uses. Cactus ferruginous pygmy-owls may occur in non-agricultural use sites such as forests and in developed areas. However, based on past usage, we anticipate a low level of exposure in these areas. As such, we expect a moderate number of individuals are likely to be exposed to carbaryl overall.

However, due to the low occurrence of these use sites within the cactus ferruginous pygmy-owl's range, the low anticipated usage of carbaryl on these sites, and the types of application methods associated with many developed uses, we expect a low level of exposure such that few individuals will experience these adverse effects.

The cactus ferruginous pygmy-owl has a medium toxicity ranking. We anticipate that cactus ferruginous pygmy-owls consuming prey exposed to carbaryl on use sites with higher allowable application rates, such as sod, turf, and golf courses will experience adverse neurological impacts likely to impact, fitness, including increased vulnerability to predation. However, due to the low occurrence of these use sites within the cactus ferruginous pygmy-owl's range, the low anticipated usage of carbaryl on these sites, and the types of application methods associated with many developed uses, we expect a low level of exposure such that few individuals will experience these adverse effects. We do not expect that consumption of prey items exposed to carbaryl from off-site transport, or on any other use sites will result in direct adverse effects. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate carbaryl exposure will cause mortality to organisms that act as food resources for the species, but that cactus ferruginous pygmy-owls will be able to adapt as opportunistic feeders.

Given that we expect a moderate number of individuals are likely to experience exposure and given that we expect a medium level of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is medium.

Conclusion

The cactus ferruginous pygmy-owl occurs from central Arizona south through Texas and western Mexico and is generally recognized in two populations: western (Arizona, Northern Sonora, and Western Mexico) and eastern (Texas and Northeastern Mexico). In the U.S., the Arizona population is believed to have an abundance in the low hundreds and the Texas population is believed to be in the high hundreds. In the U.S., primarily in Arizona, the cactus ferruginous pygmy-owl is found on federal, state, and local government lands and Tribal lands. Remaining occupied lands in Arizona, Texas, and Mexico are privately owned. A captive breeding pilot program started in 2006 had three releases between 2006 and 2022, and a second captive breeding population has been initiated at the Phoenix Zoo. Threats to the species include effects to habitat from drought and climate change, increase in invasive species, urbanization, agricultural production and wood harvesting, improper livestock grazing, increased predation and human activity from border walls and patrols, habitat damage from off-highway vehicle use, and effects of small population sizes. We assigned a high vulnerability ranking to this species.

The cactus ferruginous pygmy-owl has a medium exposure ranking. We expect 17% of the species range overlaps with agricultural use sites or is likely to be exposed through off-site transport from these areas. Within these overlapping areas, we anticipate 7.8% of the species range will be exposed to carbaryl usage annually. However, the pygmy-owl is not expected to forage in agricultural areas where carbaryl is registered for use. Off-field areas that will be exposed overlap with 6.2% of the range, and we expect 3% of the range will be treated annually in these off-field areas. The pygmy-owl is an edge species, so may forage in areas where prey species have been exposed on or adjacent to agricultural and non-agricultural (particularly forests and developed areas) use sites. We expect a small number of individuals will experience exposure in these areas. However, we do not anticipate the pygmy-owl will be exposed in all of these areas, and where exposed, we anticipate variable effects. We do not anticipate direct effects from consumption of food items exposed to carbaryl from most uses, although exclusive consumption of prey exposed to uses with maximum application rates of 5 lbs/acre is likely to result in neurological effects such as hypo-reactivity (under-responsive to sensory input), ataxia (lack of muscle coordination), and/or immobility. These are anticipated to be temporary effects that leave individuals vulnerable to stressors such as predation and weather events or render them unable to forage until they recover. The agricultural uses with these higher rates include Other Crops, Citrus, and Other Orchards, which have on-field overlaps of 2.4%, 0.2%, and 0.1% of the range, respectively. Annual usage is anticipated in the majority of these areas. Non-agricultural use sites with the higher use rates are limited to Developed uses for turf and golf courses. The pygmy-owl may occur in habitats that border golf courses or areas where carbaryl may be applied for turf such as scattered patches of woodlands in open landscapes and residential areas. However, we expect carbaryl usage within developed areas to be low. Thus, we expect the loss of a few individuals as a result of sublethal effects that lead to predation, starvation, or impacts from weather, although these effects will be limited due to the low occurrence of these use sites within the cactus ferruginous pygmy-owl's range, the low anticipated usage of carbaryl on these sites, and application methods associated with many developed uses that would limit transport off-site.

We also anticipate indirect effects are likely to occur to individuals from loss of exposed prey exposed to carbaryl. Cactus ferruginous pygmy-owl prey includes young chickens, mourning doves, desert spiny lizards, amphibians, eastern meadowlarks, cotton rats, other small mammals, large insects, possibly bats, and other prey items up to twice their size. While we expect mortality of arthropods and small mammals if exposed to carbaryl on use sites, and mortality of arthropods from exposure via spray drift, we expect some prey will be available after exposure due to their range of sensitivities to carbaryl. Additionally, the cactus ferruginous pygmy-owl is an opportunistic predator that is known to respond to adapt to changes in prey availability. As such, we anticipate that cactus ferruginous pygmy-owls will be less affected by any specific loss of prey items and will be able to consume other available dietary items. As such, we anticipate a medium level of indirect adverse effects are likely to occur, with a small number of individuals experiencing losses of prey that lead to starvation or reduced fitness.

In summary, the cactus ferruginous pygmy-owl has a high vulnerability, and the overall risk to the species is medium. The pygmy-owl is not likely to be directly affected from consuming exposed food items from most use sites and off-site areas exposed to carbaryl, and most individuals will likely find sufficient prey when there are losses of invertebrates in localized areas. However, we expect the loss of a few individuals that exclusively consume prey on use sites with the highest allowable application rates as a result of sublethal effects (neurological impacts) that lead to their temporary susceptibility to predation and weather events, or reduced ability to forage. We also anticipate starvation or lower reproductive success in a small number of individuals as a consequence of losses of prey items over the duration of the proposed action. However, we do not expect these effects will likely reduce the reproduction, numbers, and distribution of the species to an extent that will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the cactus ferruginous pygmy-owl.

References

U.S. Fish and Wildlife Service. 2022. Species Status Assessment Report for Cactus Ferruginous Pygmy-owl (*Glaucidium brasilianum cactorum*). Version 1.2. Albuquerque, New Mexico. 261 pp.