Critical Habitat Determinations and Rationales

Introduction

Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species (50 CFR 402.02). While there are general physical and biological features (PBFs) that serve as the basis for all critical habitat designations, many critical habitat rules list specific PBFs related to the habitat needs of the species. In this assessment, when critical habitat rules did not list specific PBFs (primarily older critical habitat rules), we reviewed available information about the species' biology and habitat requirements to determine if features essential to the conservation value of the critical habitat for the species would be affected by the proposed action. We also reviewed other sections of the critical habitat rules, such as descriptions of special management considerations or protection and the application of the destruction or adverse modification standards for section 7(a)(2) consultations, to determine if these sections included information relevant to the effects of the Action on critical habitat.

Methodology

We assessed whether the registration of methomyl is likely to appreciably reduce the conservation value of designated critical habitat. Critical habitat designation rules have included a variety of terms, such as "physical or biological features" (PBFs), "primary constituent elements" (PCEs), or "essential features" to characterize the key components of critical habitat essential for the conservation of the listed species. Our analytical approach is the same regardless of whether the original critical habitat designation identified PCEs, PBFs or essential features. For those reasons, in this Opinion, we broadly use the term PBFs when referring to the key components of critical habitat that are described as essential for the conservation of the listed species in critical habitat designations as a standardized way to cover all features described by these terms.

We used information related to the PBFs to categorize the critical habitats and frame our critical habitat effects analyses. We identified four types of PBFs that would be susceptible to the effects of methomyl, specifically, those related to: (1) water quality, (2) arthropods as prey, pollinators, or seed dispersers, (3) non-arthropods, including prey, pollinators/seed dispersers and host fish, and (4) general habitat function requiring no or low levels of chemical contaminants. These types of PBFs are described in more detail in the "Critical Habitat Approach to the Assessment" section of the Opinion and are collectively referred to herein as the "relevant PBFs." We reviewed each critical habitat rule to determine if PBFs related to one or more of these factors is listed or discussed, and identified comparable habitat features, where applicable, for those critical habitats with rules that do not include specific PBFs. We then categorized designated critical habitats into two groups:

- Critical habitats that have specified PBFs, but not one of the four relevant types of PBFs that we anticipate would be affected by methomyl (e.g., sediment type, vegetative cover).
- Critical habitats that have relevant types of PBFs (whether explicitly outlined or inferred and assigned by our review of the critical habitat designation) that we anticipate would be affected by methomyl.

In cases where there were no relevant PBFs, we could not link the consequences of the proposed action to the PBFs of the critical habitat, including elements of the habitat that require special management considerations or protection and considerations when applying the adverse modification standard. Thus, based on the rationale that none of the essential features of the critical habitat would be affected by the proposed action, we determined that the proposed action was not likely to destroy or adversely modify critical habitats that fell into this category.

In cases where we identified relevant PBFs that we anticipate would be affected by methomyl, we continued our assessment of the consequences of the proposed action by evaluating the extent to which the critical habitat will be exposed to methomyl, the degree of anticipated adverse effects to the PBF(s), and anticipated effects on the critical habitat as a whole.

Exposure

We characterize the expected level of exposure using overlap data (including on- and off-field overlap), past methomyl usage data, including EPA's State Use and Usage Matrix (SUUM), USDA's Census of Agriculture (CoA), and the California Department of Pesticide Regulation's Pesticide Use Report (CalPUR), and any species-specific considerations such as life history information (e.g., habitat preferences, dispersal behavior) and existing protections or conservation actions. Critical habitats with greater than 10% total overlap with methomyl use sites and off-site transport areas are assigned a high overlap score, critical habitats with 5-10% overlap are assigned a medium overlap score, and critical habitats with less than 5% total overlap are assigned a low overlap score. In addition to overlaps with methomyl use sites, we considered past methomyl usage within critical (as informed by the SUUM) to determine the proportion of critical habitat we expect to be treated with methomyl each year of the proposed action. For critical habitats occurring in California, we replace the SUUM usage data with CalPUR data as this data is spatially specific and likely a more accurate description of potential exposure. Critical habitats that usage data indicate will have a large portion of their range (>10%) treated with methomyl each year are assigned a high usage score. Critical habitats that will have a medium proportion (5-10%) treated with methomyl each year are assigned a medium usage score, and critical habitats that data indicate will have a low proportion (<5%) treated with methomyl each year are assigned a low usage score. If any additional considerations are available, we qualitatively describe how those considerations influence the overall level of exposure.

Past usage data for methomyl is not available for critical habitats located on Pacific or Caribbean habitat islands including Hawaiʻi or Puerto Rico. Thus, in the absence of any additional exposure considerations for these species, our exposure assessment is based on total overlap of methomyl use sites for critical habitats that occur in these areas.

Toxicity

We characterize the expected impacts to critical habitats based on the anticipated level of adverse effects to PBFs. Our analysis of toxicity assumes critical habitats are exposed to methomyl 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. We consider estimated concentrations of methomyl on the landscape or within the environment and effects reported in available toxicity studies of various taxa of organisms to determine the level of impact to relevant PBFs. We also include any additional considerations regarding a listed species' life history that provides additional context to the specific parameters that PBFs need to meet to maintain their function (e.g., how sensitive a listed species is to methomyl may influence the level of impact to a water quality PBF relative to another species). We score the expected impact to each PBF by considering both the expected impact as informed by reference toxicity data and additional effect considerations and assign each relevant PBF a score of high, medium, or low.

Additional Considerations

The general framework for our critical habitat analysis is largely similar to our analysis for listed species. However, the nature of critical habitat results in some inherent differences and notable trends that we think are worth bringing to the readers' attention. While overlap and usage metrics are derived using the same data sources as for species ranges, we tend to see higher levels of overlap and usage, which is likely a result of the small size of designated critical habitat units relative to the species range. For instance, we observed that the percent critical habitat likely to be treated each year is the same as the total overlap for critical habitats where we used SUUM data to characterize past levels of usage. This is in contrast to results seen in our analysis of listed species where the past level of usage typically indicates that a portion of the range smaller than the total overlap is likely to be treated each year.

Another difference is in our assessment of critical habitat for aquatic species. In our analysis for listed species, we do not consider off-field overlap as the ranges of listed aquatic species usually encompass the entire HUC 12 watershed, which suggests the on-field overlap sufficiently captures the breadth of methomyl residues likely to enter aquatic habitats within the watershed. In contrast, critical habitat units designated for aquatic species are usually much smaller than the HUC 12 watershed and only delineate specific waterbodies or reaches of streams and rivers that are considered critical habitat. Thus, we also include calculations of off-field overlap up to 90 meters from the edge of methomyl use sites to capture the amount of exposure likely to occur to critical habitat.

Conclusion

To determine the overall impact of the proposed action to designated critical habitat, we assessed the impact score of each relevant PBF alongside the exposure ranking to determine both the overall adverse effect of methomyl exposure and the footprint of the anticipated adverse effect across the entire critical habitat.

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.

Critical Habitats with No Relevant PBFs

Our review found no relevant PBFs for the designated critical habitats listed in Table 1. Given that there is no link between methomyl exposure to any impacts to critical habitat function as defined by the relevant PBFs, we determine that the proposed action will not cause destruction or adverse modification to the critical habitats listed in Table 1.

Table 1. Summary of critical habitats with no relevant PBFs listed in their critical habitat designation.

Taxa Group	Scientific Name	Common Name	Determination
Amphibians	*Ambystoma californiense*	California tiger salamander	No Destruction or Adverse Modification
Amphibians	*Plethodon neomexicanus*	Jemez Mountains salamander	No Destruction or Adverse Modification
Amphibians	*Rana muscosa*	Mountain yellow-legged frog (Southern California DPS)	No Destruction or Adverse Modification
Birds	*Eremophila alpestris strigata*	Streaked horned lark	No Destruction or Adverse Modification
Birds	*Polioptila californica californica*	Coastal California gnatcatcher	No Destruction or Adverse Modification
Birds	*Strix occidentalis caurina*	Northern spotted owl	No Destruction or Adverse Modification
Birds	*Strix occidentalis lucida*	Mexican spotted owl	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Determination
Birds	*Vireo bellii pusillus*	Least Bell's vireo	No Destruction or Adverse Modification
Birds	*Zosterops rotensis*	Rota bridled white-eye	No Destruction or Adverse Modification
Fish	*Acipenser transmontanus*	White sturgeon	No Destruction or Adverse Modification
Fish	*Etheostoma nianguae*	Niangua darter	No Destruction or Adverse Modification
Insects	*Atlantea tulita*	Puerto Rican harlequin butterfly	No Destruction or Adverse Modification
Insects	*Desmocerus californicus dimorphus*	Valley elderberry longhorn beetle	No Destruction or Adverse Modification
Insects	*Dinacoma caseyi*	Casey's June beetle	No Destruction or Adverse Modification
Insects	*Drosophila digressa*	Hawaiian picture-wing fly	No Destruction or Adverse Modification
Insects	*Elaphrus viridis*	Delta green ground beetle	No Destruction or Adverse Modification
Insects	*Euchloe ausonides insulanus*	Island marble butterfly	No Destruction or Adverse Modification
Insects	*Euphydryas anicia cloudcrofti*	Sacramento Mountains checkerspot butterfly	No Destruction or Adverse Modification
Insects	*Hesperia dacotae*	Dakota skipper	No Destruction or Adverse Modification
Insects	*Icaricia icarioides fenderi*	Fenders blue butterfly	No Destruction or Adverse Modification
Insects	*Lycaena hermes*	Hermes copper butterfly	No Destruction or Adverse Modification
Insects	*Trimerotropis infantilis*	Zayante band-winged grasshopper	No Destruction or Adverse Modification
Mammals	*Dipodomys elator*	Texas kangaroo rat	No Destruction or Adverse Modification
Mammals	*Dipodomys merriami parvus*	San Bernardino Merriam's kangaroo rat	No Destruction or Adverse Modification
Mammals	*Dipodomys nitratoides exilis*	Fresno kangaroo rat	No Destruction or Adverse Modification
Mammals	*Lynx canadensis*	Canada lynx	No Destruction or Adverse Modification
Mammals	*Martes caurina*	Pacific marten	No Destruction or Adverse Modification
Mammals	*Oryzomys palustris natator*	Rice rat	No Destruction or Adverse Modification

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Taxa Group	**Scientific Name**	**Common Name**	**Determination**
Mammals	*Pekania pennanti*	Fisher	No Destruction or Adverse Modification
Mammals	*Peromyscus polionotus allophrys*	Choctawhatchee beach mouse	No Destruction or Adverse Modification
Mammals	*Peromyscus polionotus ammobates*	Alabama beach mouse	No Destruction or Adverse Modification
Mammals	*Peromyscus polionotus peninsularis*	St. Andrew beach mouse	No Destruction or Adverse Modification
Mammals	*Peromyscus polionotus trissyllepsis*	Perdido Key beach mouse	No Destruction or Adverse Modification
Mammals	*Rangifer tarandus caribou*	Woodland caribou	No Destruction or Adverse Modification
Mammals	*Tamias minimus astistriatus*	Penasco least chipmunk	No Destruction or Adverse Modification
Mammals	*Tamiasciurus hudsonicus grahamensis*	Mount Graham red squirrel	No Destruction or Adverse Modification
Mammals	*Thomomys mazama pugetensis*	Olympia pocket gopher	No Destruction or Adverse Modification
Mammals	*Thomomys mazama tumuli*	Tenino pocket gopher	No Destruction or Adverse Modification
Mammals	*Thomomys mazama yelmensis*	Yelm pocket gopher	No Destruction or Adverse Modification
Mammals	*Trichechus manatus*	West Indian manatee	No Destruction or Adverse Modification
Mammals	*Zapus hudsonius preblei*	Preble's meadow jumping mouse	No Destruction or Adverse Modification
Plants	*Agalinis navasotensis*	Navasota false foxglove	No Destruction or Adverse Modification
Plants	*Arabis georgiana*	Georgia rockcress	No Destruction or Adverse Modification
Plants	*Asclepias welshii*	Welsh's milkweed	No Destruction or Adverse Modification
Plants	*Astragalus lentiginosus var. coachellae*	Coachella Valley milk-vetch	No Destruction or Adverse Modification
Plants	*Bidens micrantha ctenophylla*	Ko'oko'olau	No Destruction or Adverse Modification
Plants	*Carex lutea*	Golden sedge	No Destruction or Adverse Modification
Plants	*Chromolaena frustrata*	Cape Sable thoroughwort	No Destruction or Adverse Modification
Plants	*Cyanea marksii*	Haha	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Determination
Plants	*Cyanea tritomantha*	‘Aku	No Destruction or Adverse Modification
Plants	*Cyrtandra nanawaleensis*	No common name	No Destruction or Adverse Modification
Plants	*Cyrtandra wagneri*	No common name	No Destruction or Adverse Modification
Plants	*Deinandra increscens ssp. villosa*	Gaviota tarplant	No Destruction or Adverse Modification
Plants	*Erigeron decumbens*	Willamette daisy	No Destruction or Adverse Modification
Plants	*Eriodictyon capitatum*	Lompoc yerba santa	No Destruction or Adverse Modification
Plants	*Eriogonum pelinophilum*	Clay-loving wild buckwheat	No Destruction or Adverse Modification
Plants	*Eryngium sparganophyllum*	Arizona eryngo	No Destruction or Adverse Modification
Plants	*Erysimum capitatum var. angustatum*	Contra Costa wallflower	No Destruction or Adverse Modification
Plants	*Helianthus paradoxus*	Pecos (puzzle paradox) sunflower	No Destruction or Adverse Modification
Plants	*Helianthus verticillatus*	Whorled sunflower	No Destruction or Adverse Modification
Plants	*Lasthenia conjugens*	Contra Costa goldfields	No Destruction or Adverse Modification
Plants	*Leavenworthia crassa*	Fleshy-fruit gladecress	No Destruction or Adverse Modification
Plants	*Lesquerella thamnophila*	Zapata bladderpod	No Destruction or Adverse Modification
Plants	*Lilaeopsis schaffneriana var. recurva*	Huachuca water-umbel	No Destruction or Adverse Modification
Plants	*Limnanthes floccosa ssp. californica*	Butte County meadowfoam	No Destruction or Adverse Modification
Plants	*Limnanthes floccosa ssp. grandiflora*	Large-flowered woolly meadowfoam	No Destruction or Adverse Modification
Plants	*Lomatium cookii*	Cooks lomatium	No Destruction or Adverse Modification
Plants	*Navarretia fossalis*	Spreading navarretia	No Destruction or Adverse Modification
Plants	*Oenothera deltoides ssp. howellii*	Antioch Dunes evening-primrose	No Destruction or Adverse Modification
Plants	*Panicum niihauense*	Lau ‘ehu	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Determination
Plants	*Phyllostegia floribunda*	No common name	No Destruction or Adverse Modification
Plants	*Physaria globosa*	Shorts bladderpod	No Destruction or Adverse Modification
Plants	*Pittosporum hawaiiense*	Hoawa	No Destruction or Adverse Modification
Plants	*Schiedea diffusa ssp. macraei*	No common name	No Destruction or Adverse Modification
Plants	*Scutellaria ocmulgee*	Ocmulgee skullcap	No Destruction or Adverse Modification
Plants	*Stenogyne cranwelliae*	No common name	No Destruction or Adverse Modification
Plants	*Trichomanes punctatum ssp. floridanum*	Florida bristle fern	No Destruction or Adverse Modification
Plants	*Tuctoria mucronata*	Solano grass	No Destruction or Adverse Modification
Reptiles	*Uma inornata*	Coachella Valley fringe-toed lizard	No Destruction or Adverse Modification

Critical Habitats with Low Toxic Effects: Snails

The critical habitats in Table 2 are those designated for listed snail species. Aside from the Morro shoulderband snail, all species in this group have one relevant PBF, which is water quality. The Morro shoulderband snail's only relevant PBF is habitat function as its critical habitat designation specifies a low level of chemical contaminants within designated units. Available toxicity data for mollusks indicate that snails are not sensitive to methomyl and are not likely to experience any adverse effects to survival, growth, or reproduction at environmentally relevant concentrations. Therefore, we do not anticipate any level of methomyl contamination in critical habitat resulting from the proposed action will result in more than low levels of water quality or general habitat function impairment for these listed snail species. As such, we determine there will be no destruction or adverse modification for any of the critical habitats listed in Table 2.

Table 2. Critical habitat designated for listed snail species that are not likely to experience more than low levels of adverse effects.

Taxa Group	Scientific Name	Common Name	Determination
Snails	*Assiminea pecos*	Pecos assiminea snail	No Destruction or Adverse Modification
Snails	*Helminthoglypta walkeriana*	Morro shoulderband (banded dune) snail	No Destruction or Adverse Modification
Snails	*Juturnia kosteri*	Koster's springsnail	No Destruction or Adverse Modification
Snails	*Leptoxis foremani*	Interrupted (=Georgia) rocksnail	No Destruction or Adverse Modification
Snails	*Pleurocera foremani*	Rough hornsnail	No Destruction or Adverse Modification
Snails	*Pseudotryonia adamantina*	Diamond tryonia	No Destruction or Adverse Modification
Snails	*Pyrgulopsis bernardina*	San Bernardino springsnail	No Destruction or Adverse Modification
Snails	*Pyrgulopsis roswellensis*	Roswell springsnail	No Destruction or Adverse Modification
Snails	*Pyrgulopsis texana*	Phantom springsnail	No Destruction or Adverse Modification
Snails	*Tryonia cheatumi*	Phantom tryonia	No Destruction or Adverse Modification
Snails	*Tryonia circumstriata (=stocktonensis)*	Gonzales tryonia	No Destruction or Adverse Modification
Snails	*Planorbella magnifica*	Magnificent ramshorn	No Destruction or Adverse Modification

Critical habitats with low exposure, informed by low overlap with agriculture

The critical habitats in Table 3 have a low extent of overlap between designated critical habitat and the action area. Given the conservative nature of total overlap (e.g., does not consider information on past methomyl usage, does not fully account for redundancy between crop use sites, assumes exposure is occurring in all possible areas at the same time), we have high confidence that these critical habitats will experience low levels of exposure. We discuss any anticipated effects to relevant PBFs within these small portions of the critical habitats below.

Table 3. Critical habitats that have a low total overlap with agriculture.

Taxa Group	Scientific Name	Common Name	Total Overlap (% critical habitat)	Determination
Amphibians	*Ambystoma cingulatum*	Frosted Flatwoods salamander	0.3	No Destruction or Adverse Modification
Amphibians	*Anaxyrus californicus*	Arroyo (arroyo southwestern) toad	1.9	No Destruction or Adverse Modification
Amphibians	*Anaxyrus canorus*	Yosemite toad	0.0	No Destruction or Adverse Modification
Amphibians	*Anaxyrus williamsi*	Dixie Valley toad	0	No Destruction or Adverse Modification
Amphibians	*Batrachoseps relictus*	Relictual slender salamander	1.5	No Destruction or Adverse Modification
Amphibians	*Batrachoseps simatus*	Kern Canyon slender salamander	1.4	No Destruction or Adverse Modification
Amphibians	*Eurycea tonkawae*	Jollyville Plateau salamander	0.8	No Destruction or Adverse Modification
Amphibians	*Rana draytonii*	California red-legged frog	2.9	No Destruction or Adverse Modification
Amphibians	*Rana muscosa*	Mountain yellow-legged frog	0.0	No Destruction or Adverse Modification
Amphibians	*Rana sevosa*	Dusky gopher frog	0.6	No Destruction or Adverse Modification
Amphibians	*Rana sierrae*	Sierra Nevada yellow-legged Frog	0.1	No Destruction or Adverse Modification
Birds	*Ammodramus maritimus mirabilis*	Cape Sable seaside sparrow	1.2	No Destruction or Adverse Modification
Birds	*Calidris canutus rufa*	Rufa red knot	0	No Destruction or Adverse Modification
Birds	*Charadrius melodus*	Piping plover (Atlantic DPS)	4.2	No Destruction or Adverse Modification
Birds	*Corvus kubaryi*	Mariana (aga) crow	1.7	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Total Overlap (% critical habitat)	Determination
Birds	*Grus canadensis pulla*	Mississippi sandhill crane	0.9	No Destruction or Adverse Modification
Bivalves	*Alasmidonta atropurpurea*	Cumberland elktoe	2.8	No Destruction or Adverse Modification
Bivalves	*Alasmidonta triangulata*	Southern elktoe	0.9	No Destruction or Adverse Modification
Bivalves	*Cyprogenia sp. cf. aberti*	Ouachita fanshell	3.2	No Destruction or Adverse Modification
Bivalves	*Pleurobema athearni*	Canoe Creek clubshell	2.6	No Destruction or Adverse Modification
Bivalves	*Pleurobema riddellii*	Louisiana pigtoe	3.3	No Destruction or Adverse Modification
Bivalves	*Potamilus amphichaenus*	Texas heelsplitter	2.5	No Destruction or Adverse Modification
Bivalves	*Potamilus metnecktayi*	Salina mucket	0	No Destruction or Adverse Modification
Bivalves	*Quadrula cylindrica strigillata*	Rough rabbitsfoot	3.3	No Destruction or Adverse Modification
Bivalves	*Truncilla cognata*	Mexican fawnsfoot	0	No Destruction or Adverse Modification
Bivalves	*Villosa perpurpurea*	Purple bean	3.2	No Destruction or Adverse Modification
Crustaceans	*Branchinecta sandiegonensis*	San Diego fairy shrimp	0.1	No Destruction or Adverse Modification
Crustaceans	*Cambarus callainus*	Big Sandy crayfish	0.5	No Destruction or Adverse Modification
Crustaceans	*Cambarus veteranus*	Guyandotte River crayfish	0.5	No Destruction or Adverse Modification
Crustaceans	*Streptocephalus woottoni*	Riverside fairy shrimp	0.5	No Destruction or Adverse Modification
Fish	*Acipenser oxyrinchus desotoi*	Atlantic sturgeon (Gulf subspecies)	1.8	No Destruction or Adverse Modification
Fish	*Catostomus discobolus yarrowi*	Zuni bluehead sucker	0.6	No Destruction or Adverse Modification
Fish	*Catostomus santaanae*	Santa Ana sucker	0.6	No Destruction or Adverse Modification
Fish	*Crenichthys baileyi baileyi*	White River springfish	0.5	No Destruction or Adverse Modification
Fish	*Crenichthys baileyi grandis*	Hiko White River springfish	2.1	No Destruction or Adverse Modification
Fish	*Crenichthys nevadae*	Railroad Valley springfish	1.6	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Total Overlap (% critical habitat)	Determination
Fish	*Cyprinella formosa*	Beautiful shiner	1.3	No Destruction or Adverse Modification
Fish	*Cyprinodon bovinus*	Leon Springs pupfish	0.3	No Destruction or Adverse Modification
Fish	*Cyprinodon nevadensis mionectes*	Ash Meadows Amargosa pupfish	0.1	No Destruction or Adverse Modification
Fish	*Dionda diaboli*	Devils River minnow	2.5	No Destruction or Adverse Modification
Fish	*Eremichthys acros*	Desert dace	0.9	No Destruction or Adverse Modification
Fish	*Erimystax cahni*	Slender chub	3.6	No Destruction or Adverse Modification
Fish	*Etheostoma chermocki*	Vermilion darter	4.3	No Destruction or Adverse Modification
Fish	*Etheostoma moorei*	Yellowcheek darter	0.2	No Destruction or Adverse Modification
Fish	*Etheostoma spilotum*	Kentucky arrow darter	0.8	No Destruction or Adverse Modification
Fish	*Etheostoma susanae*	Cumberland darter	1.6	No Destruction or Adverse Modification
Fish	*Fundulus julisia*	Barrens topminnow	0	No Destruction or Adverse Modification
Fish	*Gila bicolor ssp. snyderi*	Owens Tui Chub	0.1	No Destruction or Adverse Modification
Fish	*Gila cypha*	Humpback chub	0.3	No Destruction or Adverse Modification
Fish	*Gila ditaenia*	Sonora chub	0.0	No Destruction or Adverse Modification
Fish	*Gila elegans*	Bonytail chub	0.7	No Destruction or Adverse Modification
Fish	*Gila intermedia*	Gila chub	0.5	No Destruction or Adverse Modification
Fish	*Gila purpurea*	Yaqui chub	1.3	No Destruction or Adverse Modification
Fish	*Gila seminuda (=robusta)*	Virgin River chub	3.5	No Destruction or Adverse Modification
Fish	*Ictalurus pricei*	Yaqui catfish	1.3	No Destruction or Adverse Modification
Fish	*Lepidomeda mollispinis pratensis*	Big Spring spinedace	1.7	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Total Overlap (% critical habitat)	Determination
Fish	*Percina williamsi*	Sickle darter	2.0	No Destruction or Adverse Modification
Fish	*Meda fulgida*	Spikedace	1.0	No Destruction or Adverse Modification
Fish	*Noturus baileyi*	Smoky madtom	0.3	No Destruction or Adverse Modification
Fish	*Oncorhynchus aguabonita whitei*	Little Kern golden trout	0.0	No Destruction or Adverse Modification
Fish	*Percina aurora*	Pearl darter	0	No Destruction or Adverse Modification
Fish	*Percina pantherina*	Leopard darter	0.2	No Destruction or Adverse Modification
Fish	*Plagopterus argentissimus*	Woundfin	3.5	No Destruction or Adverse Modification
Fish	*Tiaroga cobitis*	Loach minnow	1.0	No Destruction or Adverse Modification
Insects	*Euphydryas editha bayensis*	Bay checkerspot butterfly	1.3	No Destruction or Adverse Modification
Insects	*Euphydryas editha quino (=E. e. wrighti)*	Quino checkerspot butterfly	0.0	No Destruction or Adverse Modification
Mammals	*Canis lupus*	Gray wolf	1.0	No Destruction or Adverse Modification
Mammals	*Corynorhinus (=Plecotus) townsendii virginianus*	Virginia big-eared bat	2.8	No Destruction or Adverse Modification
Mammals	*Eumops floridanus*	Florida bonneted bat	2	No Destruction or Adverse Modification
Plants	*Argythamnia blodgettii*	Blodgett's silverbush	0	No Destruction or Adverse Modification
Plants	*Astragalus ampullarioides*	Shivwits milk-vetch	0.7	No Destruction or Adverse Modification
Plants	*Astragalus holmgreniorum*	Holmgren milk-vetch	<0.1	No Destruction or Adverse Modification
Plants	*Astragalus lentiginosus var. piscinensis*	Fish Slough milk-vetch	0.6	No Destruction or Adverse Modification
Plants	*Astragalus pycnostachyus var. lanosissimus*	Ventura Marsh milk-vetch	4	No Destruction or Adverse Modification
Plants	*Chamaecrista lineata keyensis*	Big Pine partridge pea	0	No Destruction or Adverse Modification

D.A Animals and Plants: Critical Habitat Determinations and Rationales

Taxa Group	**Scientific Name**	**Common Name**	**Total Overlap (% critical habitat)**	**Determination**
Plants	*Chamaesyce deltoidei pinetorum*	Pineland sandmat	0	No Destruction or Adverse Modification
Plants	*Chamaesyce deltoidei serpyllum*	Wedge spurge	0	No Destruction or Adverse Modification
Plants	*Chlorogalum purpureum*	Purple amole	2.2	No Destruction or Adverse Modification
Plants	*Dalea carthagenesis floridana*	Florida prairie-clover	0	No Destruction or Adverse Modification
Plants	*Digitaria pauciflora*	Florida pineland crabgrass	0	No Destruction or Adverse Modification
Plants	*Echinomastus erectocentrus var. acunensis*	Acuña cactus	0.2	No Destruction or Adverse Modification
Plants	*Graptopetalum bartramii*	Bartram's stonecrop	0	No Destruction or Adverse Modification
Plants	*Linum Arenicola*	Sand flax	0	No Destruction or Adverse Modification
Plants	*Lupinus constancei*	Lassics lupine	0	No Destruction or Adverse Modification
Plants	*Pectic imberbis*	Beardless chinchweed	0.02	No Destruction or Adverse Modification
Plants	*Penstemon debilis*	Parachute beardtongue	2.2	No Destruction or Adverse Modification
Plants	*Phacelia submutica*	DeBeque phacelia	1.7	No Destruction or Adverse Modification
Plants	*Sideroxylon reclinatum ssp. austrofloridense*	Everglades bully	0	No Destruction or Adverse Modification
Plants	*Sphaeralcea gierischii*	Gierisch mallow	0.5	No Destruction or Adverse Modification
Plants	*Streptanthus bracteatus*	Bracted twistflower	2.1	No Destruction or Adverse Modification
Reptiles	*Crocodylus acutus*	American crocodile	0.4	No Destruction or Adverse Modification
Reptiles	*Diadophis punctatus acricus*	Key ring-necked snake	0.4	No Destruction or Adverse Modification
Reptiles	*Kinosternon sonoriense longifemorale*	Sonoyta mud turtle	0	No Destruction or Adverse Modification
Reptiles	*Masticophis lateralis euryxanthus*	Alameda whipsnake (striped racer)	0.4	No Destruction or Adverse Modification

Taxa Group	Scientific Name	Common Name	Total Overlap (% critical habitat)	Determination
Reptiles	*Pituophis melanoleucus lodingi*	Black pinesnake	0.9	No Destruction or Adverse Modification
Reptiles	*Pituophis ruthveni*	Louisiana pinesnake	0.4	No Destruction or Adverse Modification
Reptiles	*Plestiodon egregius egregius*	Florida Keys mole skink	2.2	No Destruction or Adverse Modification

Arthropods as prey, pollinators, or seed dispersers as PBFs: Of the critical habitats in this group, 28 list the presence of arthropods as an essential PBF, either in the form of pollinators (like the purple amole, Fish Slough milk-vetch, Monterey spineflower, among others) or as prey (like the Cape Sable seaside sparrow, woundfin, the Jollyville Plateau salamander, among others). Available toxicity data indicate that arthropods (such as insects and crustaceans) are likely to experience high levels of mortality when exposed methomyl (even at low concentrations). We expect there will be large reductions in the abundance of arthropod pollinators and prey in critical habitats exposed to methomyl. However, we do not expect all arthropod species are equally sensitive to methomyl due to natural variations in physiology and biochemistry across species. Therefore, we do not expect complete mortality of arthropod communities and that there will still be some pollinators and prey available to support the function of critical habitat. Furthermore, given methomyl's rapid degradation rate, we anticipate even sensitive arthropod species that experience high mortality will recover within a short period of time (from days to weeks), restoring any impairments to the arthropod PBFs for these critical habitats. Thus, while impacts of methomyl to arthropod pollinators and prey will be high, some pollinators and prey will be available after exposure and any losses will likely only be temporary. As such, we anticipate all critical habitats in this group that list arthropods as a necessary component will experience medium levels of adverse effect to the arthropod PBF in areas exposed to methomyl.

Non-arthropods, including prey, pollinators/seed dispersers and host fish as PBFs: There are seven critical habitats in this group that list the presence of non-arthropod prey species as an essential PBF, either as prey (such as the gray wolf, Alameda whipsnake, Leon Springs pupfish, and Atlantic sturgeon) or as fish hosts (such as the purple bean, rough rabbitsfoot, and the Cumberland elktoe). Available toxicity data indicate that non-arthropod animals' responses to methomyl can greatly range in sensitivities. Mollusks, like snails and clams, are not likely to experience any measurable adverse effects to survival, growth, or reproduction at environmentally relevant concentrations of methomyl. As such, we expect only low levels of adverse effects to non-arthropod prey resources in critical habitats designated for the Leon Spring pupfish and the Atlantic sturgeon.

Other critical habitats, like those designated for the gray wolf and the Alameda whipsnake, require terrestrial non-arthropod prey as an essential critical habitat feature. Available toxicity data in terrestrial vertebrates indicate that methomyl can cause high levels of adverse effects (including mortality), but only at high levels of exposure. We expect terrestrial vertebrate prey (i.e., mammals, birds, amphibians, reptiles) will only experience high levels of direct adverse effects if individuals forage on methomyl use sites immediately after an application of methomyl. Given the small presence of methomyl use sites within the gray wolf's and the Alameda whipsnake's critical habitat (0.2% and 0%, respectively), we anticipate only very small reductions in the overall availability of terrestrial non-arthropod prey will occur. As such, we anticipate only low levels of adverse effects will occur to the non-arthropod PBF for these critical habitats.

Three critical habitats designated for listed bivalves list the presence of fish hosts as non-arthropod resources as necessary features of their critical habitat. Available toxicity data indicate that fish are likely to experience high levels of mortality, but only in areas that accumulate high levels of methomyl (like low flow or low volume waterbodies). Given that the purple bean, rough rabbitsfoot, and Cumberland elktoe can occur in a variety of flow and water volume conditions, we expect mortality of fish hosts will only occur in select areas of critical habitat that are exposed to methomyl. As such, we anticipate medium levels of adverse effects to the non-arthropod PBF for these critical habitats in areas exposed to methomyl.

Water quality as PBFs: There are 41 critical habitats in this group that list water quality as an essential critical habitat PBF. Three of these critical habitats are designated for listed bivalve species: the purple bean, the rough rabbitsfoot, and the Cumberland elktoe. Available toxicity data in mollusks indicate that these species are not likely to experience any adverse effects to survival, growth, or reproduction at levels of methomyl predicted to occur in their critical habitats. Thus, we expect these critical habitats will experience only low levels of adverse effects to the water quality PBF. Similarly, EPA's exposure modeling show that terrestrial vertebrates are not likely to accumulate more than low levels of methomyl from exposure to contaminated water, which is not likely to result in any mortality and only low levels of sublethal adverse effects. As such, we do not expect the critical habitats designated for the Mariana crow, Cape Sable seaside sparrow, and piping plover, will experience more than low levels of adverse effects to the water quality PBF.

Available toxicity data indicate that fish and amphibians are likely to experience high levels of mortality, but only in areas that accumulate high levels of methomyl (like low flow or low volume waterbodies). Aside from the Sonora chub, the Hiko White River springfish, and the Cumberland darter, all fish and amphibians in this group occupy a mix of areas that include low flow/low volume waterbodies as well as high flow and large volume waterbodies that will only accumulate low levels of methomyl. As such, we anticipate high levels of water quality impairment are only likely to occur in select areas of exposed critical habitat, and that these effects will be temporary as methomyl has a rapid degradation rate. As such, we anticipate only a medium level of impacts to water quality are likely for these critical habitats in areas exposed to methomyl.

In contrast, critical habitats designated for the Hiko White River springfish, and the Cumberland darter, and for aquatic insects and crustaceans (including the Comal Springs dryopid beetle, the

Riverside fairy shrimp, and the San Diego fairy shrimp) are likely to experience high levels of adverse effects to their water quality PBF in areas exposed to methomyl, as predicted concentrations of methomyl are higher than levels where toxicity studies have observed adverse effects to fish and arthropods. However, we anticipate these impacts to water quality will be limited to a small area of critical habitat and will be temporary as methomyl has a rapid degradation rate. As such, we anticipate water quality will improve soon after exposure takes place and that the water quality of the overall critical habitat will not be appreciably reduced.

General habitat function requiring no or low levels of chemical contaminants as PBFs: There are four critical habitats in this group that list a low level of chemical contaminants present within critical habitat units in order for proper function (i.e., habitat function) as an essential critical habitat PBF: the Alameda whipsnake, Acuña cactus, the Quino checkerspot butterfly, and the Bay checkerspot butterfly. Available toxicity data in plants indicate no adverse effects survival, growth, or reproduction are likely to occur at predicted environmental concentrations of methomyl. Similarly, we do not anticipate contact with methomyl residues on surfaces is going to result in more than low levels of exposure to terrestrial vertebrates as dermal exposure is not a primary route of exposure for methomyl. Thus, we do not anticipate terrestrial vertebrates will likely experience more than low levels of sublethal adverse effects from contact with methomyl residues. As such, we anticipate only low levels of adverse effects to the habitat function PBF for the critical habitats designated for the Acuña cactus and the Alameda whipsnake.

In contrast, contact exposure to methomyl residues on surfaces is likely to result in significant exposures to insects like the Quino checkerspot butterfly and Bay checkerspot butterfly. Even low levels of contact will likely result in mortality of individuals given the high sensitivity of insects to methomyl. However, we expect this level of impact to basic critical habitat function will be very limited as methomyl rapidly degrades in natural environments (on the order of days to weeks). As such, we anticipate adverse effects to basic habitat function is not likely to persist for more than short periods, resulting in high but temporary adverse effects to the habitat function PBF. Furthermore, we anticipate these adverse effects will be restricted to select areas of critical habitat given that there is very little overlap between critical habitat units and the action area (total overlaps range from 0-1.3%), which is corroborated by low levels of past methomyl usage according to CalPUR data (0.7-1.7% range treated annually). As such, we anticipate there will be no more than medium levels of adverse effects to the habitat function PBF for the Quino checkerspot and Bay checkerspot butterflies in areas exposed to methomyl.

In summary, we anticipate a range of impacts will occur to the different PBFs of the critical habitats listed above in Table 3. While adverse effects to arthropod prey and pollinator PBFs are likely high in magnitude, particularly for sensitive species of arthropods, we expect that some arthropods will remain after exposure and the loss of individuals will be temporary within exposed areas of critical habitat. Adverse effects to non-arthropod species may be high, especially for fish hosts that occur in low flow or low volume waterbodies or for terrestrial vertebrate prey that forage on methomyl use sites. In contrast, we expect fish hosts in high flow or large volume waterbodies or terrestrial vertebrate prey that do not enter methomyl use sites are not likely to experience more than small reductions to survival, growth, or reproduction. Similarly, water quality will be impaired by methomyl exposure, but we expect high levels of impairment are only likely to occur in select areas (i.e., low flow or low volume water bodies). Adverse effects to the basic habitat function PBFs of terrestrial habitats is also likely to occur but are likely only highly impaired for species that are known to be sensitive to methomyl (i.e., arthropod species). We anticipate all adverse effects to all categories of PBFs will be temporary as methomyl degrades rapidly in natural environments. Additionally, we expect these adverse effects will be highly limited in area given the low level of overlap between these critical habitats and the action area (which is a conservative estimator of exposure). Thus, even though some critical habitats in this group will experience high levels of adverse effects to their PBFs, we anticipate these adverse effects will be temporary, limited to a very small area, and are not likely to appreciably reduce the conservation value of critical habitat as a whole for these species.

Critical Habitat with low exposure (informed by low past usage from USDA's Census of Agriculture (CoA))

The critical habitats in Table 4 all have a low level of past insecticide usage as informed by the USDA's Census of Agriculture (CoA). The CoA all insecticide usage data includes information on all insecticides, not just methomyl, and thus, is a very conservative measure of methomyl usage. Given that this additional usage dataset indicates very little of these critical habitats are likely to be treated with insecticides, we have high confidence that these critical habitats will experience low levels of methomyl exposure. We discuss any anticipated effects to relevant PBFs within these small portions of critical habitats that are likely to be treated with methomyl below.

Table 4. Critical habitats with low exposure, informed by low past usage from USDA's Census of Agriculture (CoA)that have a low all insecticide usage according to data from USDA's Census of Agriculture.

Taxa Group	Scientific Name	Common Name	Total % critical habitat treated (CoA)	Determination
Amphibians	*Eurycea chisholmensis*	Salado Salamander	2.4	No Destruction or Adverse Modification
Amphibians	*Eurycea nana*	San Marcos salamander	0.2	No Destruction or Adverse Modification
Amphibians	*Eurycea naufragia*	Georgetown Salamander	0.7	No Destruction or Adverse Modification
Amphibians	*Eurycea waterlooensis*	Austin blind Salamander	0.0	No Destruction or Adverse Modification
Amphibians	*Necturus alabamensis*	Black warrior (Sipsey Fork) Waterdog	0.7	No Destruction or Adverse Modification
Amphibians	*Rana chiricahuensis*	Chiricahua leopard frog	1.2	No Destruction or Adverse Modification
Amphibians	*Rana pretiosa*	Oregon spotted frog	0.4	No Destruction or Adverse Modification
Birds	*Charadrius melodus*	Piping Plover (Great Lakes DPS)	1.8	No Destruction or Adverse Modification
Bivalves	*Alasmidonta raveneliana*	Appalachian elktoe	0.1	No Destruction or Adverse Modification
Bivalves	*Cyclonaias necki*	Guadalupe orb	3.5	No Destruction or Adverse Modification
Bivalves	*Epioblasma brevidens*	Cumberlandian combshell	1.1	No Destruction or Adverse Modification
Bivalves	*Epioblasma capsaeformis*	Oyster mussel	1.1	No Destruction or Adverse Modification

Taxa Group	Scientific Name	Common Name	Total % critical habitat treated (CoA)	Determination
Bivalves	*Fusconaia burkei*	Tapered pigtoe	4.4	No Destruction or Adverse Modification
Bivalves	*Fusconaia escambia*	Narrow pigtoe	2.3	No Destruction or Adverse Modification
Bivalves	*Fusconaia rotulata*	Round ebonyshell	2.4	No Destruction or Adverse Modification
Bivalves	*Lampsilis altilis*	Finelined pocketbook	1.3	No Destruction or Adverse Modification
Bivalves	*Lampsilis bergmanni*	Guadalupe fatmucket	0.2	No Destruction or Adverse Modification
Bivalves	*Lampsilis bracteata*	Texas fatmucket	2.7	No Destruction or Adverse Modification
Bivalves	*Lampsilis perovalis*	Orangenacre mucket	1.6	No Destruction or Adverse Modification
Bivalves	*Lasmigona decorata*	Carolina heelsplitter	3.0	No Destruction or Adverse Modification
Bivalves	*Margaritifera marrianae*	Alabama pearlshell	1.3	No Destruction or Adverse Modification
Bivalves	*Medionidus acutissimus*	Alabama moccasinshell	1.3	No Destruction or Adverse Modification
Bivalves	*Medionidus parvulus*	Coosa moccasinshell	1.7	No Destruction or Adverse Modification
Bivalves	*Pleurobema decisum*	Southern clubshell	1.8	No Destruction or Adverse Modification
Bivalves	*Pleurobema furvum*	Dark pigtoe	0.4	No Destruction or Adverse Modification
Bivalves	*Pleurobema georgianum*	Southern pigtoe	1.7	No Destruction or Adverse Modification
Bivalves	*Pleurobema hanleyianum*	Georgia pigtoe	2.2	No Destruction or Adverse Modification
Bivalves	*Pleurobema perovatum*	Ovate clubshell	1.1	No Destruction or Adverse Modification
Bivalves	*Pleurobema strodeanum*	Fuzzy pigtoe	4.4	No Destruction or Adverse Modification
Bivalves	*Pleuronaia dolabelloides*	Slabside pearlymussel	1.9	No Destruction or Adverse Modification
Bivalves	*Popenaias popeii*	Texas hornshell	0.6	No Destruction or Adverse Modification
Bivalves	*Ptychobranchus greenii*	Triangular kidneyshell	1.2	No Destruction or Adverse Modification
Bivalves	*Ptychobranchus subtentum*	Fluted kidneyshell	1.2	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Total % critical habitat treated (CoA)	Determination
Bivalves	*Villosa choctawensis*	Choctaw bean	4.4	No Destruction or Adverse Modification
Crustaceans	*Cambarus cracens*	Slenderclaw crayfish	2.4	No Destruction or Adverse Modification
Crustaceans	*Faxonius peruncus*	Big Creek crayfish	0.4	No Destruction or Adverse Modification
Crustaceans	*Faxonius quadruncus*	St. Francis River crayfish	0.4	No Destruction or Adverse Modification
Crustaceans	*Gammarus pecos*	Pecos amphipod	0.1	No Destruction or Adverse Modification
Crustaceans	*Procambarus econfinae*	Panama City crayfish	0.1	No Destruction or Adverse Modification
Crustaceans	*Spelaeorchestia koloana*	Kauai cave amphipod	0.3	No Destruction or Adverse Modification
Crustaceans	*Stygobromus (=Stygonectes) pecki*	Pecks cave amphipod	0.1	No Destruction or Adverse Modification
Fish	*Catostomus warnerensis*	Warner sucker	0.1	No Destruction or Adverse Modification
Fish	*Chasmistes brevirostris*	Shortnose sucker	0.6	No Destruction or Adverse Modification
Fish	*Chasmistes liorus*	June sucker	0.2	No Destruction or Adverse Modification
Fish	*Chrosomus saylori*	Laurel dace	0.1	No Destruction or Adverse Modification
Fish	*Crystallaria cincotta*	Diamond darter	4.1	No Destruction or Adverse Modification
Fish	*Deltistes luxatus*	Lost River sucker	0.7	No Destruction or Adverse Modification
Fish	*Erimonax monachus*	Spotfin chub	0.2	No Destruction or Adverse Modification
Fish	*Etheostoma fonticola*	Fountain darter	0.2	No Destruction or Adverse Modification
Fish	*Etheostoma osburni*	Candy darter	0.2	No Destruction or Adverse Modification
Fish	*Etheostoma phytophilum*	Rush darter	1.1	No Destruction or Adverse Modification
Fish	*Etheostoma trisella*	Trispot darter	3.2	No Destruction or Adverse Modification
Fish	*Eucyclogobius newberryi*	Tidewater goby	1.8	No Destruction or Adverse Modification
Fish	*Hybognathus amarus*	Rio Grande silvery minnow	0.7	No Destruction or Adverse Modification

D.A Animals and Plants: Critical Habitat Determinations and Rationales

Taxa Group	Scientific Name	Common Name	Total % critical habitat treated (CoA)	Determination
Fish	*Lepidomeda albivallis*	White River spinedace	0.6	No Destruction or Adverse Modification
Fish	*Notropis buccula*	Smalleye shiner	3.3	No Destruction or Adverse Modification
Fish	*Notropis mekistocholas*	Cape Fear shiner	0.8	No Destruction or Adverse Modification
Fish	*Notropis oxyrhynchus*	Sharpnose shiner	3.3	No Destruction or Adverse Modification
Fish	*Notropis simus pecosensis*	Pecos bluntnose shiner	1.8	No Destruction or Adverse Modification
Fish	*Noturus flavipinnis*	Yellowfin madtom	0.5	No Destruction or Adverse Modification
Fish	*Noturus munitus*	Frecklebelly madtom	1.3	No Destruction or Adverse Modification
Fish	*Percina antesella*	Amber darter	1.1	No Destruction or Adverse Modification
Fish	*Percina jenkinsi*	Conasauga logperch	1.3	No Destruction or Adverse Modification
Fish	*Ptychocheilus lucius*	Colorado pikeminnow (squawfish)	0.4	No Destruction or Adverse Modification
Fish	*Salmo salar*	Atlantic salmon	0.6	No Destruction or Adverse Modification
Fish	*Salvelinus confluentus*	Bull trout	0.8	No Destruction or Adverse Modification
Fish	*Scaphirhynchus suttkusi*	Alabama sturgeon	2.5	No Destruction or Adverse Modification
Fish	*Xyrauchen texanus*	Razorback sucker	1.5	No Destruction or Adverse Modification
Insects	*Euphydryas editha taylori*	Taylors (whulge) Checkerspot	1.2	No Destruction or Adverse Modification
Mammals	*Zapus hudsonius luteus*	New Mexico meadow jumping mouse	2.1	No Destruction or Adverse Modification
Plants	*Arabis perstellata*	Brauns rock-cress	0.2	No Destruction or Adverse Modification
Plants	*Harrisia (=Cereus) aboriginum (=gracilis)*	Aboriginal prickly-apple	2.4	No Destruction or Adverse Modification
Plants	*Ipomopsis polyantha*	Pagosa skyrocket	1.7	No Destruction or Adverse Modification
Plants	*Leavenworthia exigua laciniata*	Kentucky glade cress	0.7	No Destruction or Adverse Modification

Taxa Group	Scientific Name	Common Name	Total % critical habitat treated (CoA)	Determination
Plants	*Lepidium papilliferum*	Slickspot peppergrass	1.1	No Destruction or Adverse Modification
Reptiles	*Thamnophis eques megalops*	Northern Mexican gartersnake	4.0	No Destruction or Adverse Modification
Reptiles	*Thamnophis rufipunctatus*	Narrow-headed gartersnake	0.3	No Destruction or Adverse Modification

Arthropods as prey, pollinators, or seed dispersers as PBFs: Of the critical habitats in this group, 28 list the presence of arthropods as an essential PBF, either in the form of pollinators (like the Braun's rockcress, aboriginal prickly-apple, slickspot peppergrass, Pagosa skyrocket, and the Kentucky glade cress) or as prey (like the Georgetown salamander, the Gunnison sage-grouse, or the rush darter, among others). Available toxicity data indicate that arthropods (like insects and crustaceans) are likely to experience high levels of mortality when exposed methomyl (even at low concentrations). We expect there will be large reductions in the abundance of arthropod pollinators and prey in critical habitats exposed to methomyl. However, we do not expect all arthropod species are equally sensitive to methomyl due to natural variations in physiology and biochemistry across species. Therefore, we do not expect complete mortality of arthropod communities and that there will still be some pollinators and prey available to support the function of critical habitat. Furthermore, given methomyl's rapid degradation rate, we anticipate even sensitive arthropod species that experience high mortality will recover within a short period of time (from days to weeks), restoring any impairments to the arthropod PBFs for these critical habitats. Thus, while impacts of methomyl to arthropod pollinators and prey will be high, some pollinators and prey will be available after exposure and any losses will likely only be temporary. As such, we anticipate all critical habitats in this group that list arthropods as a necessary component will experience medium levels of adverse effect to the arthropod PBF in areas exposed to methomyl.

Non-arthropods, including prey, pollinators/seed dispersers and host fish as PBFs: There are seven critical habitats in this group that list the presence of non-arthropod prey species as an essential PBF, either as prey (including the Black Warrior waterdog, bull trout, Atlantic salmon, narrow-headed gartersnake, and the Northern Mexican gartersnake) or as fish hosts (such as the Cumberlandian combshell, orangenacre mucket, or the oyster mussel). Available toxicity data indicate that non-arthropod animals' responses to methomyl can greatly range in sensitivities. Mollusks, like snails and clams, are not likely to experience any measurable adverse effects to survival, growth, or reproduction at environmentally relevant concentrations of methomyl. As such, we expect only very low levels of adverse effects to non-arthropod invertebrate prey resources in critical habitats designated for species that consume these taxa, like the Atlantic salmon, and the Black Warrior waterdog.

Other critical habitats, like those designated for the bull trout, narrow-headed gartersnake, and the Northern Mexican gartersnake require other types of non-arthropod prey as an essential critical habitat feature, such as fish, amphibians, and small terrestrial vertebrates. Available toxicity data indicate that fish (and presumably amphibian) prey are likely to experience high levels of adverse effects (including mortality) when exposed to high levels of methomyl (such as in areas of low flow and low water volume). Given that the bull trout, narrow-headed gartersnake, and Northern Mexican gartersnake can inhabit or forage in a variety of flow and water volume conditions, we expect mortality of fish and amphibian prey will only occur in select areas of critical habitat that are exposed to methomyl. As such, we anticipate medium levels of adverse effects to the non-arthropod PBF for these critical habitats. In contrast, we anticipate terrestrial vertebrate prey species will only experience high levels of adverse effects when foraging on methomyl use sites. Given that the on-field portion of the action area overlap with these critical habitats is low (up to 0.6% overlap with methomyl use sites), we anticipate adverse effects to terrestrial vertebrate prey will only occur on a very small portion of critical habitat, resulting in only low levels of adverse effects to the non-arthropod PBF.

Similarly, critical habitats designated for listed bivalves also list the presence of fish as essential non-arthropod resources of critical habitat. As noted above, we anticipate high levels of adverse effects to fish hosts are only likely to occur in areas of low flow or low water volume. Thus, for critical habitats designated for bivalves that only inhabit high flow waterbodies, such as the ovate clubshell or the Georgia pigtoe, we anticipate only low levels of adverse effects to fish hosts are likely to occur. For critical habitats designated for bivalves that can occupy a variety of flow or volume conditions (such as the finelined pocketbook, southern clubshell, and southern pigtoe, among many others), we expect adverse effects to fish hosts will only occur in some exposed areas of critical habitat, resulting in an overall medium level of adverse effects to the non-arthropod PBF. In cases where critical habitat is designated for listed bivalves that are host fish specialists (i.e., can only use a small number of species for successful reproduction), the risk of adverse effects to PBFs is higher as a reduction in the abundance of a small number of fish may still represent a significant loss of fish hosts. As such, critical habitats for fish host specialists, such as the Coosa moccasinshell, are likely to still experience high levels of adverse effects to the non-arthropod PBF even though we anticipate there will only be large reductions in fish host abundance in select areas of critical habitat exposed to methomyl. However, we anticipate the effects in these small areas of critical habitat will be temporary as methomyl has a rapid degradation rate in natural environments.

Water quality as a PBF: There are 57 critical habitats in this group that list water quality as an essential critical habitat PBF. Of these critical habitats, 22 are designated for listed bivalve species (such as the Carolina heelsplitter, the fuzzy pigtoe, and the fluted kidneyshell). Available toxicity data in mollusks indicate that these species are not likely to experience any adverse effects to survival, growth, or reproduction at levels of methomyl predicted to occur in their critical habitats. Thus, we expect these critical habitats will experience only low levels of adverse effects to the water quality PBF. Similarly, EPA's exposure modeling show that terrestrial vertebrates are not likely to accumulate more than low levels of methomyl from exposure to contaminated water, which is not likely to result in any mortality and only low levels of sublethal adverse effects. As such, we do not expect the presence of methomyl within exposed areas of critical habitat designated for the piping plover (Great Lakes DPS), narrow-headed gartersnake, and Northern Mexican gartersnake will cause more than low levels of adverse effects to the water quality PBF.

Available toxicity data indicate that fish (and presumably amphibians) are likely to experience high levels of mortality, but only in areas that accumulate high levels of methomyl (like low flow or low volume waterbodies). Thus, critical habitats designated for fish and amphibian species that only occupy areas of high flow or large volume (such as the Black warrior waterdog, Alabama sturgeon, amber darter, Conasauga logperch, Rio Grande silvery minnow, sharpnose shiner, and smalleye shiner) are unlikely to experience more than low levels of water quality impairment as their habitats will likely accumulate only low levels of methomyl. Critical habitats designated for fish and amphibian species that inhabit waterbodies with a variety of flow and volume characteristics (such as those designated for the Chiricahua leopard frog, tidewater goby, and diamond darter, among many others) are only likely to experience impaired water quality in select areas of exposed critical habitat. We anticipate that these effects will be temporary as methomyl has a rapid degradation rate in natural environments. As such, we anticipate these critical habitats will experience an overall medium level of adverse effects to the water quality PBF in areas exposed to methomyl.

In contrast, available toxicity data indicate that arthropod species like insects and crustaceans are likely to experience high levels of adverse effects (even at low predicted levels of methomyl). As such, critical habitats designated for aquatic insects and crustaceans (like the Pecos amphipod, Peck’s cave amphipod, and Kauai cave amphipod) are likely to experience high levels of adverse effects to their water quality PBF with methomyl exposure. However, we anticipate these impacts to water quality will be limited to small areas of critical habitat given the low level of past methomyl usage, which indicate that only a small portion of critical habitat is likely to be treated with methomyl (0.1-0.7% critical habitat treated annually with any insecticide, according to the CoA). Furthermore, we anticipate these water quality impairments will be temporary as methomyl has a rapid degradation rate in natural environments. Thus, we anticipate high but temporary adverse effects to the water quality PBF in small portions of the Pecos amphipod’s critical habitat exposed to methomyl.

In special cases where critical habitat designations involve cave systems, we anticipate only low levels of adverse effects to water quality are likely (even for critical habitats designated for sensitive taxa, like the Peck’s cave amphipod and Kauai cave amphipod). Given the rapid degradation of methomyl in natural environments as well as the typical slow transport rates from surface water to subterranean cave systems, like those designated for the Peck’s cave amphipod, Kauai cave amphipod, Georgetown salamander, Salado salamander, and Austin blind cave salamander, we expect only minute levels of methomyl are likely to reach the cave systems that make up critical habitat for these species. As such, we anticipate no more than low levels of adverse effects to these critical habitats.

General habitat function requiring no or low levels of chemical contaminants as a PBF: There are two critical habitats in this group that list a low level of chemical contaminants present within critical habitat units in order for proper function (i.e., habitat function) as an essential critical habitat PBF: the Kauai cave amphipod and the Taylor's checkerspot butterfly. As noted above, we expect most methomyl residues will degrade before reaching the cave systems that make up the Kauai cave amphipod's critical habitat, indicating that there will be no more than low levels of methomyl present in its critical habitat, causing no more than low levels of adverse effects to the general function of critical habitat. In contrast, methomyl residues on surfaces are likely to result in significant exposures to insects like the Taylor's checkerspot butterfly, which will likely result in mortality of individuals given the high sensitivity of insects to methomyl. However, we expect this level of impact to basic critical habitat function will be restricted in area given the low levels of past insecticide usage within the range (1.2% of the range treated annually with any insecticide) as indicated by CoA data. Additionally, we anticipate methomyl residues will degrade quickly after application (i.e., within days to weeks), indicating that these adverse effects will be temporary, and that critical habitat function will be restored soon after exposure. As such, we anticipate high, but restricted and temporary, adverse effects to critical habitat function PBF for the Taylor's checkerspot butterfly's critical habitat in areas exposed to methomyl.

In summary, we anticipate a range of impacts will occur to the different PBFs of the critical habitats listed above in Table 4. Adverse effects to arthropod prey and pollinator PBFs are likely high in magnitude, particularly for sensitive species of arthropods, but we anticipate some pollinators and prey will still be available after exposure and any losses will likely only be temporary. Adverse effects to non-arthropod species may be high, especially for fish hosts that occur in low flow or low volume waterbodies or for terrestrial vertebrate prey that forage on methomyl use sites. In contrast, we expect fish hosts in high flow or large volume waterbodies or terrestrial vertebrate prey that do not enter methomyl use sites are not likely to experience more than small reductions to survival, growth, or reproduction. Similarly, water quality will be impaired by methomyl exposure, but we expect high levels of impairment are likely to occur only in specific habitat types (i.e., low flow or low volume water bodies). Adverse effects to basic habitat function of terrestrial habitats are also likely to occur but is likely to occur only for species that are known to be sensitive to methomyl (i.e., arthropod species). We anticipate all adverse effects to all categories of PBFs will be temporary as methomyl degrades rapidly in natural environments. Additionally, we expect these adverse effects will be highly limited in area given the low level of past methomyl usage as informed by the CoA all insecticide data. Thus, even though some critical habitats in this group will experience high levels of adverse effects to their PBFs, we anticipate these adverse effects will be temporary, limited to a very small area, and will not appreciably reduce the conservation value of critical habitat as a whole for these species.

Critical Habitats with low exposure (informed by low past usage from California Department of Pesticide Regulation Pesticide Use Reporting data)

The critical habitats in Table 5 all have a low level of past insecticide usage as informed by the California Pesticide Use Report (CalPUR), which includes 10 years of data (2012-2021). Growers in California are required to report pesticide usage to the state, which summarizes this data at a section level (see the *Usage Analysis* section in the main Opinion for more details). Given that this data is spatially specific to the critical habitats within California and usage reporting is mandatory, we have high confidence that the past methomyl usage patterns reported in this dataset are accurate. As such, we have high confidence that critical habitats reporting low levels of usage are not likely to experience more than low levels of exposure to methomyl. We discuss any anticipated effects to relevant PBFs within these small portions of critical habitats that are likely to be treated with methomyl below. In cases where there is a small sample size of growers reporting usage in the sections containing critical habitats, we pull those critical habitats out of the grouped rationale for additional analysis to provide a more thorough analysis to ensure that our assumptions of low exposure are maintained or if additional analyses are needed.

Table 5. Critical habitats with low exposure informed by low past usage from the California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data.

Taxa Group	Scientific Name	Common Name	Total % critical habitat treated annually (CalPUR)	Determination
Amphibians	*Ambystoma californiense*	California tiger Salamander	0.2	No Destruction or Adverse Modification
Amphibians	*Ambystoma californiense*	California tiger Salamander	1.6	No Destruction or Adverse Modification
Crustaceans	*Branchinecta conservatio*	Conservancy fairy shrimp	0.0	No Destruction or Adverse Modification
Crustaceans	*Branchinecta longiantenna*	Longhorn fairy shrimp	0.0	No Destruction or Adverse Modification
Crustaceans	*Lepidurus packardi*	Vernal tadpole fairy shrimp	0.4	No Destruction or Adverse Modification
Fish	*Hypomesus transpacificus*	Delta smelt	3.9	No Destruction or Adverse Modification
Mammals	*Dipodomys heermanni morroensis*	Morro Bay kangaroo rat	0.0	No Destruction or Adverse Modification
Plants	*Brodiaea filifolia*	Thread-leaved brodiaea	0.0	No Destruction or Adverse Modification

Taxa Group	Scientific Name	Common Name	Total % critical habitat treated annually (CalPUR)	Determination
Plants	*Chorizanthe pungens* var. *pungens*	Monterey spineflower	3.9	No Destruction or Adverse Modification
Plants	*Chorizanthe robusta* var. *hartwegii*	Scotts Valley spineflower	0	No Destruction or Adverse Modification
Plants	*Cirsium hydrophilum* var. *hydrophilum*	Suisun thistle	0.0	No Destruction or Adverse Modification
Plants	*Cordylanthus mollis* ssp. *mollis*	Soft bird's-beak	0	No Destruction or Adverse Modification
Plants	*Hibiscadelphus giffardianus*	Otay tarplant	0	No Destruction or Adverse Modification
Plants	*Holocarpha macradenia*	Santa Cruz tarplant	2.6	No Destruction or Adverse Modification
Plants	*Polygonum hickmanii*	Scotts Valley polygonum	0	No Destruction or Adverse Modification
Plants	*Thlaspi californicum*	Kneeland Prairie penny-cress	0.0	No Destruction or Adverse Modification

Arthropods as prey, pollinators, or seed dispersers as PBFs: There are six critical habitats in this group that list the presence of arthropods, either as pollinators (like the thread-leaved brodiaea, the Suisun thistle, the Santa Cruz tarplant, and the Kneeland Prairie penny-cress) or as prey (like the Delta smelt and the Morro Bay kangaroo rat). Available toxicity data indicate that arthropods (such as insects and crustaceans) are likely to experience high levels of mortality when exposed methomyl (even at low concentrations). We expect there will be large reductions in the abundance of arthropod pollinators and prey in portions of critical habitats exposed to methomyl. However, we do not expect all arthropod species are equally sensitive to methomyl due to natural variations in physiology and biochemistry across species. Therefore, we do not expect complete mortality of arthropod communities and expect there will still be some pollinators and prey available to support the function of critical habitat. Furthermore, given methomyl's rapid degradation rate, we anticipate even sensitive arthropod species that experience high mortality will recover within a short period of time (from days to weeks), restoring any impairments to the arthropod PBFs for these critical habitats. Thus, while impacts of methomyl to arthropod pollinators and prey will be high, we anticipate some pollinators and prey will still be available after exposure and any losses will likely only be temporary. As such, we anticipate all critical habitats in this group that list arthropods as a necessary component will experience medium levels of adverse effect to the arthropod PBF in areas exposed to methomyl.

Non-arthropods, including prey, pollinators/seed dispersers and host fish as PBFs: The Morro Bay kangaroo rat's critical habitat is the only one in this group that lists non-arthropod species as an essential critical habitat PBF. In addition to vegetation and insects, the Morro Bay kangaroo rat can consume terrestrial snails, making them a non-arthropod prey resource. Available data indicate that mollusks, like snails, are not likely to experience any measurable adverse effects to survival, growth, or reproduction at environmentally relevant concentrations of carbamate insecticides. As such, we expect only very low levels of adverse effects to non-arthropod prey resources in areas of the Morro Bay kangaroo rat's critical habitat exposed to methomyl.

Water quality as a PBF: There are five critical habitats in this group that list water quality as an essential critical habitat feature: the California tiger salamander (Central California and Santa Barbara DPS), the conservancy fairy shrimp, the longhorn fairy shrimp, and the Delta smelt.

Available toxicity data indicate that fish (and presumably amphibians) are likely to experience high levels of mortality, but only in areas that accumulate high levels of methomyl (like low flow or low volume waterbodies). Thus, critical habitats designated for fish and amphibian species that only occupy areas of high flow or large water volume (such as the Delta smelt) are unlikely to experience more than low levels of water quality impairment as these areas will accumulate only low levels of methomyl. Critical habitats designated for fish and amphibians that occupy habitats with a variety of flow and volume conditions (such as the California tiger salamander DPS's) are only likely to experience high levels of water quality impairment in select areas of exposed critical habitat. However, we anticipate these adverse effects to water quality will be restricted in area as CalPUR data indicate that only a small portion of critical habitat is likely to be treated each year (0.2-1.6% critical habitat treated annually). Furthermore, we anticipate these impacts to water quality will only be temporary as methomyl degrades rapidly (one the order of days to weeks), indicating that areas with impaired water quality will recover soon after exposure. As such, while we anticipate some areas of critical habitat will experience high levels of water quality impairment, we anticipate these adverse effects will be limited in area and only temporary, resulting in a medium level of adverse effects to water quality overall.

As noted above, arthropods (including crustaceans) are likely to experience high levels of adverse effects (e.g., mortality) with exposure to methomyl, even at low levels of exposure. As such, we anticipate methomyl exposure will cause high levels of adverse effects to the water quality PBF of the conservancy fairy shrimp and the longhorn fairy shrimp. However, CalPUR data indicate that no methomyl has been used within the areas containing critical habitat from 2012-2021, so we have high confidence that very little of critical habitat is likely to experience this high level of water quality impairment. Furthermore, should any portion of critical habitat be exposed to methomyl in the future, we anticipate any adverse effects to water quality would not persist for long periods of time given the rapid degradation rate of methomyl. As such, while exposure could result in high levels of adverse effects to the water quality PBF in areas exposed to methomyl for the conservancy fairy shrimp and longhorn fairy shrimp's critical habitats, we anticipate exposure is unlikely to occur and that any adverse effects that do result would only be temporary.

In summary, we anticipate a range of impacts will occur to the different PBFs of the critical habitats listed above in Table 5. Adverse effects to arthropod prey and pollinator PBFs are likely high in magnitude, particularly for sensitive species of arthropods, but we anticipate some pollinators and prey will be available after exposure and any losses will likely only be temporary given that we expect methomyl residues with degrade rapidly. Adverse effects to non-arthropod species are likely to be low as toxicity studies show only low levels of adverse effects to mollusk prey (like snails) are not likely at predicted environmental concentrations of methomyl. We expect water quality will be impaired by methomyl exposure, but only in areas of low flow or low water volume. We anticipate all adverse effects to all categories of PBFs will be temporary as methomyl degrades rapidly in natural environments. Additionally, we expect these adverse effects will be highly limited in area given the low level of past methomyl usage as reported by CalPUR. Thus, even though some critical habitats in this group will experience high levels of adverse effects to their PBFs, we anticipate these adverse effects will be temporary, limited to a very small area, and will not appreciably reduce the conservation value of critical habitat as a whole for these species.

Critical Habitats with Individual Determinations and Rationales

For the following critical habitats, our preliminary assessments indicated that the proposed action may result in levels of adverse effects that warranted an in-depth analysis. As such, we discuss each of these critical habitats in more detail in individual summaries below.

Table 6. Critical habitats with moderate to high adverse effects anticipated from the proposed action. We addressed each critical habitat in individual summaries.

Taxa Group	Scientific Name	Common Name	Determination
Amphibians	*Bufo houstonensis*	Houston toad	No Destruction or Adverse Modification
Amphibians	*Eleutherodactylus cooki*	Guajón	No Destruction or Adverse Modification
Amphibians	*Necturus lewisi*	Neuse River waterdog	No Destruction or Adverse Modification
Amphibians	*Ambystoma bishopi*	Reticulated flatwoods salamander	No Destruction or Adverse Modification
Birds	*Grus americana*	Whooping crane	No Destruction or Adverse Modification
Birds	*Agelaius xanthomus*	Yellow-shouldered blackbird	No Destruction or Adverse Modification
Birds	*Charadrius alexandrinus nivosus*	Western snowy plover	No Destruction or Adverse Modification
Birds	*Empidonax traillii extimus*	Southwestern willow flycatcher	No Destruction or Adverse Modification
Birds	*Centrocercus minimus*	Gunnison sage-grouse	No Destruction or Adverse Modification
Birds	*Coccyzus americanus*	Yellow-billed cuckoo	No Destruction or Adverse Modification
Bivalves	*Elliptoideus sloatianus*	Purple bankclimber (mussel)	No Destruction or Adverse Modification
Bivalves	*Pleurobema pyriforme*	Oval pigtoe	No Destruction or Adverse Modification
Bivalves	*Lampsilis subangulata*	Shinyrayed pocketbook	No Destruction or Adverse Modification
Bivalves	*Amblema neislerii*	Fat threeridge (mussel)	No Destruction or Adverse Modification
Bivalves	*Medionidus penicillatus*	Gulf moccasinshell	No Destruction or Adverse Modification
Bivalves	*Medionidus simpsonianus*	Ochlockonee moccasinshell	No Destruction or Adverse Modification
Bivalves	*Elliptio chipolaensis*	Chipola slabshell	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Determination
Bivalves	*Quadrula cylindrica cylindrica*	Rabbitsfoot	No Destruction or Adverse Modification
Bivalves	*Lampsilis rafinesqueana*	Neosho mucket	No Destruction or Adverse Modification
Bivalves	*Elliptio spinosa*	Altamaha spinymussel	No Destruction or Adverse Modification
Bivalves	*Hamiota australis*	Southern sandshell	No Destruction or Adverse Modification
Bivalves	*Medionidus walkeri*	Suwannee moccasinshell	No Destruction or Adverse Modification
Bivalves	*Ptychobranchus jonesi*	Southern kidneyshell	No Destruction or Adverse Modification
Bivalves	*Truncilla macrodon*	Texas fawnsfoot	No Destruction or Adverse Modification
Bivalves	*Fusconaia masoni*	Atlantic pigtoe	No Destruction or Adverse Modification
Bivalves	*Simpsonaias ambigua*	Salamander mussel	No Destruction or Adverse Modification
Bivalves	*Elliptio lanceolata*	Yellow lance	No Destruction or Adverse Modification
Bivalves	*Cyclonaias petrina*	Texas pimpleback	No Destruction or Adverse Modification
Bivalves	*Fusconaia mitchelli*	False spike	No Destruction or Adverse Modification
Bivalves	*Lasmigona subviridis*	Green floater	No Destruction or Adverse Modification
Bivalves	*Obovaria subrotunda*	Round hickorynut	No Destruction or Adverse Modification
Bivalves	*Cyprogenia aberti*	Western fanshell	No Destruction or Adverse Modification
Bivalves	*Fusconaia subrotunda*	Longsolid	No Destruction or Adverse Modification
Crustaceans	*Branchinecta lynchi*	Vernal pool fairy shrimp	No Destruction or Adverse Modification
Crustaceans	*Gammarus desperatus*	Noel’s amphipod	No Destruction or Adverse Modification
Crustaceans	*Gammarus hyalleloides*	Diminutive amphipod	No Destruction or Adverse Modification
Crustaceans	*Cambarus williami*	Brawleys Fork crayfish	No Destruction or Adverse Modification
Fish	*Etheostoma sellare*	Maryland darter	No Destruction or Adverse Modification

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Taxa Group	Scientific Name	Common Name	Determination
Fish	*Speoplatyrhinus poulsoni*	Alabama cavefish	No Destruction or Adverse Modification
Fish	*Etheostoma boschungi*	Slackwater darter	No Destruction or Adverse Modification
Fish	*Menidia extensa*	Waccamaw silverside	No Destruction or Adverse Modification
Fish	*Notropis girardi*	Arkansas River shiner	No Destruction or Adverse Modification
Fish	*Notropis topeka (=tristis)*	Topeka shiner	No Destruction or Adverse Modification
Fish	*Noturus furiosus*	Carolina madtom	No Destruction or Adverse Modification
Fish	*Noturus crypticus*	Chucky madtom	No Destruction or Adverse Modification
Fish	*Elassoma alabamae*	Spring pygmy sunfish	No Destruction or Adverse Modification
Fish	*Macrhybopsis tetranema*	Peppered chub	No Destruction or Adverse Modification
Insects	*Somatochlora hineana*	Hine's emerald dragonfly	No Destruction or Adverse Modification
Insects	*Heterelmis comalensis*	Comal Springs riffle beetle	No Destruction or Adverse Modification
Insects	*Stygoparnus comalensis*	Comal Springs dryopid beetle	No Destruction or Adverse Modification
Insects	*Cicindela nevadica lincolniana*	Salt Creek tiger beetle	No Destruction or Adverse Modification
Insects	*Strymon acis bartrami*	Bartram's scrub hairstreak butterfly	No Destruction or Adverse Modification
Insects	*Anaea troglodyta floridalis*	Florida leafwing butterfly	No Destruction or Adverse Modification
Insects	*Oarisma poweshiek*	Poweshiek skipperling	No Destruction or Adverse Modification
Insects	*Cicindelidia floridana*	Miami tiger beetle	No Destruction or Adverse Modification
Mammals	*Myotis sodalis*	Indiana bat	No Destruction or Adverse Modification
Mammals	*Sorex ornatus relictus*	Buena Vista Lake ornate shrew	No Destruction or Adverse Modification
Plants	*Cirsium loncholepis*	La Graciosa thistle	No Destruction or Adverse Modification
Plants	*Sidalcea keckii*	Keck's checker-mallow	No Destruction or Adverse Modification

D.A Animals and Plants: Critical Habitat Determinations and Rationales

Taxa Group	Scientific Name	Common Name	Determination
Plants	*Lupinus sulphureus* ssp. *kincaidii*	Kincaid's lupine	No Destruction or Adverse Modification
Plants	*Piperia yadonii*	Yadon's piperia	No Destruction or Adverse Modification
Plants	*Brickellia mosieri*	Florida brickell-bush	No Destruction or Adverse Modification
Plants	*Physaria douglasii* ssp. *tuplashensis*	White Bluffs bladderpod	No Destruction or Adverse Modification
Plants	*Linum carteri carteri*	Carters small-flowered flax	No Destruction or Adverse Modification
Plants	*Mimulus fremontii* var. *vandenbergensis*	Vandenberg monkeyflower	No Destruction or Adverse Modification
Plants	*Chorizanthe robusta* var. *robusta*	Robust spineflower	No Destruction or Adverse Modification
Plants	*Asclepias prostrata*	Prostrate milkweed	No Destruction or Adverse Modification
Plants	*Cirsium wrightii*	Wright's marsh thistle	No Destruction or Adverse Modification
Plants	*Phacelia argentea*	Sand dune phacelia	No Destruction or Adverse Modification
Reptiles	*Pseudemys rubriventris bangsi*	Plymouth redbelly turtle	No Destruction or Adverse Modification
Reptiles	*Tantilla oolitica*	Rim rock crowned snake	No Destruction or Adverse Modification

Amphibians

Houston toad (*Bufo houstonensis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

The final critical habitat rule does not describe PBFs for the critical habitat. However, adult and juvenile Houston toads feed on a variety of insects and other invertebrates in aquatic and terrestrial habitats. The toad uses aquatic habitats during the breeding season (between February and June). Aquatic habitats used for breeding and the aquatic phases of the toad (e.g., egg, tadpole and early metamorph life stages) include smaller, low flowing and ponded habitats. Stressors to the species include pesticides that can absorb through their semi-permeable skin and change the quality and quantity of amphibian food and habitat. Therefore, we have identified arthropods and water quality as relevant PBFs.

Effects of the Action

Methomyl use is likely to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (14.5% total overlap) (Table 7). There is a high level of past methomyl usage (up to 14.5% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action. However, additional data from the USDA Census of Agriculture indicate low levels of past insecticide use in the counties containing critical habitat units (up to 0.7% of the critical habitat treated annually with any insecticide), suggesting that exposure to this critical habitat may have a lower level of exposure than the overlap and usage data report.

Even though the Houston toad has low past usage (0.7%) as informed by the USDA's Census of Agriculture, we provide this full description of our analysis due to concerns identified from the species' jeopardy analysis.

Table 7. Overlap and past usage data for the critical habitat of the Houston toad.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
2	12.5	14.5	2	12.5	14.5

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the Houston toad's habitat will range from 22.5-479.7 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to die when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the Houston toad is an invertebrate generalist that can consume a wide range of invertebrate prey, we anticipate there will likely still be some food resources available in critical habitat despite a reduction in the abundance of sensitive prey species.

Additionally, we anticipate impacted prey species will recover over time once methomyl residues have degraded (which should occur within days to weeks of exposure). As such, we expect some arthropod prey will be still available after exposure and any losses will likely only be temporary. Furthermore, the low level of usage indicated by the Census of Agriculture suggests that impacts to arthropod prey may not be a frequent occurrence over the duration of the proposed action. Thus, we anticipate episodic, but high, impacts to the arthropod prey PBF will occur in localized areas within the critical habitat.

Based on available toxicity data in fish (which we use as surrogate data for aquatic phase amphibians), we anticipate amphibians exposed in shallow waterbodies are likely to be exposed to high levels of methomyl and die, indicating a substantial impact to water quality. In contrast, individuals exposed to methomyl in areas with larger water volume are not likely to experience adverse effects (including mortality or sublethal effects). Given that methomyl is not considered persistent and degrades rapidly in natural environments (on the order of days to weeks), we anticipate these impairments to water quality will only occur for short periods after applications. While there is a high extent of overlap, the low level of usage from the Census of Agriculture data suggests that water quality impairments will not likely occur frequently over the duration of the proposed action. As such, we anticipate methomyl use is likely to impact water quality that make some parts of its critical habitat periodically unsuitable, resulting in high level impacts to the water quality PBF, if only for temporary periods and in limited portions of the critical habitat over the project duration.

Table 8. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	--	--	--
water quality	X	Large volume waterbodies, Low flow/Low volume waterbodies	Low – High (depending on waterbody)
habitat function	--	--	--

In summary, we anticipate a large extent of overlap between the action area and critical habitat, though only a small portion is likely to be treated each year. Within exposed areas, we anticipate there will be high levels of impacts to both the arthropod prey and water quality PBFs that occur repeatedly over the duration of the proposed action (Table 8). However, we anticipate a number of existing conservation measures on product labels, including a rain restriction and required buffers to waterbodies, will reduce the level of exposure to critical habitat. Therefore, we anticipate the overall risk of adverse effects to the PBFs of critical habitat is moderate.

Rationale for Conclusion

While there is a high extent of overlap between the action area, usage is anticipated to be low over the project duration despite that up to 14.5% critical habitat may be treated annually, but this is likely an overestimate. This is because we anticipate usage will occur at lower levels based on data from the USDA Census of Agriculture that indicate up to 0.7% of the critical habitat has been treated annually with any insecticide. We anticipate impacts to the arthropod PBF due to losses of prey used by juvenile and adult toads after exposures on use sites and through spray drift and runoff. We also anticipate impacts to the water quality PBF, particularly due to the exposure of breeding adults and the aquatic phases (e.g., egg and larval life stages) of the toad from runoff and spray drift entering smaller, low flowing habitats where tadpoles and early metamorphs are found. Impacts to the arthropod prey and water quality PBFs will likely prevent some individuals from occupying or foraging at sites, and lead to mortality and sub-lethal effects to the toad from exposure and reductions in prey abundance where exposed. Exposure in limited breeding habitats where large numbers of adult and larval life stages of the toad would be affected would have high consequences for the species. However, we expect these impacts will occur infrequently, and will be limited to a small portion of the critical habitat, based on annual usage levels that are likely to be low. In addition, while we expect exposures will occur periodically over the project duration, we do not expect the entire arthropod prey community will die when exposed, leaving some prey available. While some juveniles and adults may not find a sufficient abundance of food for survival and normal growth after reductions in exposed prey, we expect the number of toads impacted will be small over the project duration. Impairments to water quality will be during temporary periods after applications, returning to baseline conditions after methomyl residues degrade. Required conservation measures on methomyl product labels (e.g., rain restrictions, buffers to waterbodies) will further reduce the likelihood of adverse effects to critical habitat PBFs by reducing the level of exposure to critical habitat. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Houston toad.

References

U.S. Fish and Wildlife Service. 2020. Species Account: *Bufo houstonensis* (Houston toad), 3/25/2020 draft for review. Falls Church, Virginia.

U. S. Fish and Wildlife Service. 1978. Determination of Critical Habitat for the Houston toad. Final Rule. Federal Register 43:4022-4026.

Guajón (*Eleutherodactylus cooki*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Subtropical forest (which may include trees such as *Cecropia schreberiana, Dendropanax arboreus, Guarea guidonia, Piper aduncum, Spathodea campanulata, Syzygium jambos,* and *Thespesia populnea*) at elevations from 118 to 1,183 ft (36 to 361 m) above sea level.
- Plutonic, granitic, or sedimentary rocks/boulders that form caves, crevices, and grottoes (interstitial spaces) in a streambed; and that are in proximity, or connected, to a permanent, ephemeral, or subterranean clear-water stream or water source. The interstitial spaces between or underneath rocks provide microenvironments characterized by generally higher humidity and cooler temperatures than outside the rock formations.
- Vegetation-covered rocks (the vegetation typically includes moss, ferns, and hepatics such as *Thuidium urceolatum, Taxilejeunea sulphurea,* and *Huokeria acutifolia*) extending laterally to a maximum of 99 ft (30 m) on each bank of the stream; these rocks provide cover and foraging sites and help conserve humidity.

Management considerations and protection include protection of the guajón and its habitat from threats posed by deforestation and earth movement near streams for road construction, and for agricultural, urban, and rural development. These threats may result in changes in the composition and abundance of vegetation surrounding guajón habitat, as well as degradation of water quality from illegal garbage dumping, untreated sewage, and agricultural practices (*e.g.*, use of herbicides, fertilizers, or insecticides).

Effects of the Action

Methomyl use is likely to affect water quality, which is a critical habitat PBF essential for the conservation of the species.

There is a low extent of overlap between the action area and the critical habitat (0.2% total overlap) (Table 9). There is a low level of past methomyl usage (up to 0.2% critical habitat treated annually), suggesting that only a small portion of the critical habitat is likely to be exposed over the duration of the proposed action. Even though the guajón only overlaps 0.2% with methomyl use areas, we provide this full description of our analysis due to concerns identified from the species' jeopardy analysis.

Table 9. Overlap and past usage data for the critical habitat of the guajón.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
0	0.2	0.2	0	0.2	0.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the guajón's habitat will range from 27.9-1716.3 μg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data in fish (which we use as surrogate data for aquatic phase amphibians), we anticipate amphibians exposed in shallow waterbodies are likely to be exposed to high levels of methomyl and die, indicating a substantial impact to water quality. In contrast, individuals exposed to methomyl in areas with high flow rates are not likely to experience adverse effects (including mortality or sublethal effects). Given that methomyl is not considered persistent and will likely degrade rapidly in natural environments (on the order of days to weeks), we anticipate these impairments to water quality will only be during temporary periods after applications. Due to the low overlap and usage expected to occur within the critical habitat, we do not anticipate methomyl usage in or near the critical habitat will be a frequent occurrence over the duration of the proposed action.

Table 10. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow rate waterbodies, Low flow/Low volume waterbodies	Low – High (depending on waterbody)
habitat function	--	--	--

In summary, we anticipate a small extent of overlap between the action area and critical habitat, as well as a low level of usage in areas near critical habitat. Within exposed areas, we anticipate there will be moderate, episodic impacts to the water quality PBF (Table 10). Therefore, we anticipate the overall risk of adverse effects to the PBF of the critical habitat is moderate.

Rationale for Conclusion

Impacts to the water quality PBF are expected to be high where exposed, but we expect exposure in critical habitat areas to be very low and adverse effects to be limited to only certain areas of exposed critical habitat (e.g., areas of low flow rate). There is a low extent of overlap between the action area and the critical habitat, and annual usage is anticipated to be low over the project duration (both occurring in 0.2% of designated critical habitat areas). Critical habitat consists of subtropical forest as well as caves, crevices, and grottoes (interstitial spaces) in a streambed that are in proximity, or connected, to a permanent, ephemeral, or subterranean clear-water stream or water source. The degradation of water quality from activities including insecticide usage for agricultural practices is a management consideration discussed in the critical habitat final rule designating critical habitat. While we anticipate adverse effects to the water quality PBF, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species based on the limited overlap with methomyl use sites and low anticipated methomyl usage. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the guajón.

References

U. S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Guajón (*Eleutherodactylus cooki*). Final Rule. Federal Register 72: 60068-60114.

Neuse River waterdog (*Necturus lewisi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of native aquatic fauna (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt- free gravel, small cobble, coarse sand, and leaf litter substrates) as well as abundant cover and burrows used for nesting.
- Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain instream habitats where the species is found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the waterdog's habitat, food availability, and ample oxygenated flow for spawning and nesting habitat.
- Water quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- Invertebrate and fish prey items, which are typically hellgrammites, crayfish, mayflies, earthworms, snails, beetles, centipedes, slugs, and small fish.

The features essential to the conservation of the Carolina madtom and Neuse River waterdog may require special management considerations or protections to reduce the following threats: (1) Urbanization of the landscape, including (but not limited to) land conversion for urban and commercial use, infrastructure (roads, bridges, utilities), and urban water uses (water supply reservoirs, wastewater treatment, etc.); (2) nutrient pollution and sedimentation from agricultural activities that impact water quantity and quality; (3) significant alteration of water quality; (4) improper forest management or clearcuts in riparian areas; (5) culvert and pipe installation that create barriers to movement; (6) impacts from invasive species; (7) changes and shifts in seasonal precipitation patterns as a result of climate change; and (8) other watershed and floodplain disturbances that release sediments or nutrients into the water.

Effects of the Action

Methomyl use is likely to affect arthropod prey, non-arthropod prey, and water quality, which are critical habitat PBFs essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (54.5% total overlap) (Table 11). There is a high level of past methomyl usage (up to 54.5% critical habitat treated annually), suggesting a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 11. Overlap and past usage data for the critical habitat of the Neuse River waterdog.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
54.5	54.5

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Neuse River waterdog's habitat will range from 27.9-171 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the Neuse River waterdog is an invertebrate generalist that can consume a wide range of invertebrate prey, we anticipate there will still be some food resources available in critical habitat despite a high reduction in the abundance of sensitive species. Additionally, given methomyl's low persistence in water, we expect adverse effects to aquatic prey will be temporary as upstream sources of prey will replenish prey resources in affected areas of critical habitat. Therefore, we anticipate no more than medium levels of adverse effects to the arthropod prey PBF.

In contrast, available toxicity data indicate that non-arthropod prey species are not likely to experience more than low levels of adverse effects at estimated environmental concentrations. Available toxicity data indicate that non-arthropod invertebrates like snails, slugs, and earthworms, are not likely to experience any adverse effects at even the highest concentrations of methomyl predicted to occur in the environment. Similarly, while fish prey can experience adverse effects from methomyl exposure, we do not anticipate estimated environmental concentrations of methomyl in critical habitat is likely to cause more than low levels of fish prey mortality. As such, we anticipate there will be sufficient non-arthropod prey available for individuals occupying critical habitat to forage on. Thus, we anticipate there will likely be no more than low levels of adverse effects to the non-arthropod PBF.

Available toxicity data in fish (which we use as surrogate data for aquatic phase amphibians) show that amphibians can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair water quality for individuals of the species. However, we expect the Neuse River waterdog is not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the water quality PBF are likely.

Table 12. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	X	Presence of small fish, snail, slug, and earthworm prey	Low
water quality	X	High flow rate waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we anticipate a large extent of overlap between the action area and critical habitat, as well as a high level of usage in areas near critical habitat. Within exposed areas, we anticipate there will be high but temporary adverse effects to the arthropod PBF and low levels of adverse effects to the non-arthropod prey and water quality PBFs (Table 12).

Rationale for Conclusion

A large portion of critical habitat is likely to be exposed to methomyl over the project duration due to the high extent of overlap and usage. Within exposed areas, we anticipate there will be moderate levels of adverse effects to the arthropod prey PBF as we anticipate reductions in prey abundance will only be temporary as methomyl has low persistence in water. We anticipate only low levels of adverse effects to the non-arthropod and water quality PBFs as estimated environmental concentrations of methomyl in critical habitat are not likely to cause any mortality to non-arthropod invertebrate prey and no more than low levels of mortality to fish and amphibians. While there will be repeated instances of arthropod prey mortality, we do not anticipate this will appreciably diminish the value of critical habitat as a whole for the conservation of the species as we anticipate the critical habitat will contain sufficient alternative food resources to support the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Neuse River waterdog.

References

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Neuse River Waterdog, Endangered Species Status for Carolina Madtom, and Designations of Critical Habitat. Final Rule. Federal Register 86.

Reticulated flatwoods salamander (*Ambystoma bishopi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Small (generally less than 1-10 ac), isolated ponds that are typically acidic, tannin-stained, ephemeral, and located within mesic to intermediate-mesic flatwoods
  - Seasonally flooded by rainfall in late fall or early winter and dry in late spring or early summer
  - Relatively open canopy to maintain herbaceous layers
  - Have burrowing crayfish fauna, but lack large, predatory fish due to period drying
- Upland pine flatwoods-savanna habitat that is open, mesic woodland maintained by frequent fires and that contains crayfish burrows or other underground habitat that flatwoods salamanders depend upon and dominated by wiregrasses in abundant herbaceous ground cover to support the flatwoods salamander's arthropod prey
- Upland areas that facilitate movement between breeding and non-breeding area, characterized by subsurface structures like those created by deep litter cover or crayfish burrows.

The critical habitat final rule (see *Primary Constituent Elements: Food, Water, Air, Light, or Other Nutritional or Physiological Requirements*) states that "[w]etland water quality is important to maintain the aquatic invertebrate fauna eaten by larval salamanders. An unpolluted wetland with water free of predaceous fish, sediment, pesticides, and the chemicals associated with road runoff, is important to maintain the aquatic invertebrate fauna [that is] eaten by larval salamanders." Water quality would be reduced with the use of pesticides, which would affect the arthropod prey (particularly, crustaceans and other aquatic invertebrates) upon which larva and adult reticulated flatwoods salamanders rely for food.

Effects of the Action

Methomyl use is likely to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species.

There is a moderate extent of overlap between the action area and the critical habitat (9.2% total overlap) (Table 13). There is a moderate level of past methomyl usage (up to 9.2% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 13. Overlap and past usage data for the critical habitat of the reticulated flatwoods salamander.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
0.4	8.7	9.2	0.4	8.7	9.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the reticulated flatwoods salamander's habitat will range from 14.4-244.8 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the reticulated flatwoods salamander is an invertebrate generalist that can consume a wide range of invertebrate prey, we anticipate there will still be some food resources available in critical habitat despite a reduction in the abundance of sensitive arthropod species. Additionally, we anticipate arthropod prey abundance will recover once methomyl residues degrade, which should happen rapidly in natural environments (on the order of days to weeks). As such, while adverse effects to prey can be high, we expect these effects will be temporary and that there will be sufficient prey resources for the species.

Available toxicity data in fish (which we use as surrogate data for aquatic phase amphibians) show that amphibians can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair water quality for individuals of the species. We expect estimated environmental concentrations of methomyl will not result in more than low levels of exposure that will not result in more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations. As such, we anticipate moderate levels of impacts to the water quality PBF are likely.

Table 14. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we anticipate a moderate portion of critical habitat is likely to be exposed to methomyl over the duration of the proposed action. Within exposed areas, we anticipate there will be moderate, episodic impacts to the arthropod prey PBF and low levels of adverse effects to the water quality PBF depending on the crops applied and the areas of critical habitat exposed (Table 14).

Rationale for Conclusion

There is a moderate extent of overlap between the action area and the critical habitat, and usage is anticipated to be moderate. Impacts to the arthropod prey PBF would have moderate to high impacts to the species due to impacts to prey abundance. While we anticipate some prey species will remain available, and the prey community is expected to recover over time, this species has limited mobility that would likely affect the ability of individuals to find alternative prey during periods when abundance is reduced. In contrast, we do not anticipate methomyl residues will cause more than low levels of adverse effects to exposed amphibians as estimated environmental concentrations are not likely to cause more than low levels of mortality or sublethal adverse effects to individuals. Therefore, we have determined the proposed action is likely to result in the destruction or adverse modification of the designated critical habitat for the reticulated flatwoods salamander.

References

U.S. Fish and Wildlife Service. 2009. Endangered and Threatened Wildlife and Plants, Determination of Endangered Status for Reticulated Flatwoods Salamander, Designation of Critical Habitat for Frosted Flatwoods Salamander and Reticulated Flatwoods Salamander. Federal Register 74(26): 6700-6774.

Birds

Whooping crane (*Grus americana*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Each pair requires several hundred acres of undisturbed habitat. Unmated subadults must have suitable habitat that is not regularly defended by paired cranes.
- Various crustaceans and mollusks (i.e., prey) found in tidal flats and marshes. During spring migration, whooping cranes prey on crayfish, frogs, small fish, and other small animals in wetlands. During fall migration, whooping cranes seem to feed more extensively in recently harvested grain fields where insects and wasted grains constitute the bulk of their diet.
- Open expanse for nightly roosting; cranes use sand or gravel bars in rivers and lakes for nightly roosting. During migrations, feeding cranes are often found within short flight distances of reservoirs, lakes, and large rivers that offer bare islands for nightly roosting.
- Habitats essential to the rearing of young whooping cranes, including sites for training and protection as well as feeding and other normal behavior.
- Close proximity to wetlands that provide undisturbed roosting sites.

The description of the critical habitat for the whooping crane includes the elements above. The rule states that “The Critical Habitat zones include roosting areas used during migration, as well as rearing and wintering areas.” Adequate invertebrate and small vertebrate prey populations are needed within those habitats for suitable foraging opportunities to breed, rear young, migrate and overwinter.

Effects of the Action

We expect methomyl use will impact arthropod prey and non-arthropod prey, which are critical habitat PBFs that are essential for the conservation of the species. Whooping cranes are opportunistic foragers and can consume a wide array of food items, ranging from plant matter to an assortment of invertebrates (including arthropods like crustaceans and other invertebrates like snails), fish, small mammals, amphibians, and reptiles.

There is a high extent of overlap between the action area and critical habitat (24.5% total overlap) (Table 15). There is a high level of past methomyl usage (up to 24.5% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be treated over the duration of the proposed action.

Table 15. Overlap and past usage data for the critical habitat of the whooping crane.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
8.9	15.5	24.5	8.9	15.5	24.5

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the whooping crane's habitat will range from 5.6-407.7 μg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that crustaceans and other arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the whooping crane is an opportunistic forager that can consume a wide range of invertebrate prey, we anticipate individuals will still have food resources available despite a reduction in the abundance of sensitive species. Additionally, we anticipate methomyl will degrade rapidly in natural environments (on the order of days to weeks), suggesting that impacted prey species are likely to recover over time. As such, we anticipate some arthropod prey will still be available after exposure and any losses will likely only be temporary, resulting in high but episodic impacts to the arthropod prey PBF over the project duration.

In contrast, available toxicity data indicate that non-arthropod prey species are not likely to experience more than low levels of adverse effects at estimated environmental concentrations. Available toxicity data indicate that non-arthropod invertebrates like snails, slugs, and earthworms, are not likely to experience any adverse effects at even the highest concentrations of methomyl predicted to occur in the environment. Similarly, while fish (and presumably amphibian) prey can experience adverse effects from methomyl exposure, we do not anticipate estimated environmental concentrations of methomyl in critical habitat is likely to cause more than low levels of fish and amphibian prey mortality. Similarly, while small mammal and bird prey (as well as terrestrial amphibian and reptile prey, which use bird toxicity data as surrogates) are likely to experience high levels of mortality on methomyl use sites, we do not anticipate small vertebrate prey are likely to experience more than low levels of mortality in off-field areas. Additionally, we expect methomyl will degrade quickly (i.e., within a few days), indicating that prey species foraging on use sites are only likely to die if they feed immediately after an application of methomyl (i.e., within 24 hours of application). Thus, we anticipate non-arthropod prey are not likely to experience more than low levels of adverse effects, which are only likely to be temporary during periods after applications before methomyl residues degrade. Furthermore, given that the whooping crane has such a varied diet and can opportunistically change dietary items, we anticipate low level impacts to the conservation value of the habitat. Individual prey items are likely to experience from low to high levels of impact from losses of sensitive prey species while other prey will likely remain unexposed or unaffected, and therefore available and fit for consumption. As such, we expect there will be episodic, low-level impacts to the non-arthropod PBF.

Table 16. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	X	presence fish, small mammal, small bird, amphibian, and reptile prey	Low
water quality	--	--	--
habitat function	--	--	--

In summary, a large portion of the critical habitat is likely to be exposed to methomyl throughout the duration of the proposed action. We anticipate a high level of impact will occur to the arthropod prey PBF but no more than low levels of adverse effects to the non-arthropod prey PBF (Table 16). Losses of arthropod prey are likely to be episodic, occurring over temporary periods immediately following applications, as methomyl degrades quickly. While we anticipate losses of arthropod prey items, we expect alternative, non-arthropod prey will remain available. In addition, we expect the whooping crane would be able to fly to alternative critical habitat areas as needed to forage. Therefore, we anticipate the overall risk of adverse effects to the PBFs of critical habitat can range from low to high.

Rationale for Conclusion

We expect episodic losses of some arthropod prey items in a high portion of the critical habitat. However, since the whooping crane is a dietary generalist that forages on a variety of arthropod and non-arthropod prey items, we anticipate there will likely still be food resources available in exposed critical habitat areas despite a reduction in the abundance of sensitive prey species. In addition, the whooping crane is highly mobile, and we expect individuals would be able to travel to alternative foraging sites as needed. As such, while we expect impacts to the arthropod PBF, the whooping crane would be able to forage on alternative prey that are not likely to be sensitive to methomyl exposure. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the whooping crane.

References

U.S. Fish and Wildlife Service. 1978. Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Whooping Crane. Final Rule. Federal Register 43: 20938-20942.

Yellow-shouldered blackbird (*Agelaius xanthomus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

The final critical habitat rule does not describe PBFs for the critical habitat. The yellow-shouldered blackbird is generally an opportunistic omnivore as individuals have been observed feeding on a wide variety food items. However, the species is primarily an arboreal insectivore. During the nesting season, the diet of young blackbirds can be up to 90% arthropod material. As such, we determine that arthropod prey is a relevant PBF for the species' critical habitat. Based on the 2023 5-year status review for the species, food availability seems to be a major factor affecting the survival and breeding success of yellow-shouldered blackbird.

Effects of the Action

We expect methomyl use will impact arthropod prey, which is a critical habitat PBFs that is essential for the conservation of the species. Yellow-shouldered blackbirds primarily consume arthropod prey.

There is a low extent of overlap between the action area and critical habitat (1.4% total overlap) (Table 17). There is a low level of past methomyl usage (up to 1.4% critical habitat treated annually), suggesting that only a small portion of the critical habitat is likely to be treated over the duration of the proposed action.

Table 17. Overlap and past usage data for the critical habitat of the yellow-shouldered blackbird.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
0.7	0.7	1.4	0.7	0.7	1.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the yellow-shouldered blackbird is an invertebrate generalist that can consume a wide range of arthropod prey, we anticipate there will likely still be food resources available in critical habitat despite a reduction in the abundance of sensitive prey species. Additionally, we anticipate impacted prey species will recover over time, particularly those that are less sensitive and more common, once methomyl residues have degraded (which should occur on the order of days to weeks). As such, we do not expect the entire arthropod prey community will die and that the community will recover after methomyl exposure, resulting in high but episodic impacts to the arthropod prey PBF over the project duration.

Table 18. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, a small portion of the critical habitat is likely to be exposed to methomyl throughout the duration of the proposed action. We anticipate a high level of impact to the arthropod prey PBF is likely (Table 18). However, we expect some food resources will still be available within critical habitat despite the high impact and that the prey community will recover once methomyl residues degrade, which should occur within a short period after exposure takes place.

Rationale for Conclusion

We expect episodic losses of prey items in a limited portion of the critical habitat. The yellow-shouldered blackbird is generally an opportunistic omnivore, although the species is primarily an arboreal insectivore. During the nesting season, the diet of young blackbirds can be up to 90% arthropod material. Food availability seems to be a major factor affecting the survival and breeding success of the blackbirds. While we anticipate impacts to the arthropod PBF periodically over the project duration, these impacts are expected to be limited to up to 1.4% of the critical habitat that overlaps with on- and off-field sites that are likely to be exposed. We expect food resources will remain available in nearby areas, and insect communities are expected to rebound after losses occur. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the yellow-shouldered blackbird.

References

U.S. Fish and Wildlife Service. 1976. Determination of the yellow-shouldered blackbird as an endangered species and designation of critical habitat. Federal Register 41: 51019 51022.

U.S. Fish and Wildlife Service. 2023. Status Review, Yellow-shouldered blackbird or mariquita (*Agelaius xanthomus*). Mayagüez, Puerto Rico. 19 pp.

Western snowy plover (*Charadrius alexandrinus nivosus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Areas that are below heavily vegetated areas or developed areas and above the daily high tides
- Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or low water flow and annual high tide or high-water flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams, and ostracods, that are essential food sources
- Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates described in PCE 2 for food, and provides cover or shelter from predators and weather, and assists in avoidance of detection (crypsis) for nests, chicks, and incubating adults
- Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and for normal behavior

These habitat features can be summarized as sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites. Use of pesticides could affect the non-arthropod and arthropod prey of the western snowy plover.

Effects of the Action

We expect methomyl use will impact arthropod and non-arthropod prey, which are critical habitat PBFs that are essential for the conservation of the species. Western snowy plovers can consume a wide range of dietary items, including arthropod and non-arthropod invertebrates.

There is a moderate extent of overlap between the action area and critical habitat (6.2% total overlap) (Table 19). There is a moderate level of past methomyl usage (up to 6.2% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be treated over the duration of the proposed action.

Table 19. Overlap and past usage data for the critical habitat of the western snowy plover.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
0.3	5.9	6.2	0.3	5.9	6.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the reticulated western snowy plover's habitat will range from 86.4-1029.6 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that crustaceans, insects, and other arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the western snowy plover can consume a wide range of invertebrate prey, we anticipate there will still be food resources available within critical habitat despite a reduction in the abundance of sensitive prey species. Additionally, we anticipate methomyl will degrade rapidly in natural environments (on the order of days to weeks), suggesting that some arthropod prey will still be available after exposure and any losses will likely only be temporary. As such, we do not expect the entire arthropod prey community will experience complete mortality and that the community will recover after methomyl exposures, resulting in high, but episodic, impacts to the arthropod prey PBF.

In contrast, available toxicity data indicate that the non-arthropod prey that the western snowy plover consumes (e.g., worms, clams, snails) are not very sensitive to methomyl exposure. We do not anticipate any non-arthropod prey are likely to experience any mortality nor any sublethal effects (e.g., reduced growth or reproduction) at predicted concentrations of methomyl. As such, we anticipate low levels of adverse effects to the non-arthropod prey PBF are likely to occur.

Table 20. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey (insects, arachnids, crustaceans)	High
non-arthropods (as prey or hosts)	X	presence of non-arthropod prey (snails, clams, worms)-	Low
water quality	--	--	--
habitat function	--	--	--

In summary, there is a moderate portion of critical habitat that is likely to be exposed to methomyl over the duration of the proposed action. Impacts to the arthropod prey PBF, while high, are likely to be only temporary given the quick degradation of methomyl and expected recovery of the prey community (Table 20). We do not anticipate more than low levels of adverse effects to the non-arthropod PBF. As such, we anticipate the proposed action will not result in more than low levels of adverse effects to the overall critical habitat that would not appreciably affect the conservation value of the western snowy plover's designated critical habitat as a whole.

Rationale for Conclusion

We expect episodic losses of some prey items in a moderate portion of the critical habitat. However, the western snowy plover forages on a variety of arthropod and non-arthropod prey items. Methomyl is not expected to impact the types of non-arthropod prey used by this species. While we expect impacts to the arthropod PBF, it is likely the western snowy plover would be able to forage on alternative prey. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the western snowy plover.

References

U.S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Pacific Coast Population of the Western Snowy Plover. Final Rule. Federal Register 77: 36727-36869.

Southwestern willow flycatcher (*Empidonax traillii extimus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Riparian vegetation along a dynamic river or lakeside, in a natural or manmade successional environment comprised of trees and shrubs (e.g., Gooddings willow, coyote willow, Geyer's willow, arroyo willow, red willow, yewleaf willow, pacific willow, boxelder, tamarisk, Russian olive, buttonbush, cottonwood, stinging nettle, alder, velvet ash, poison hemlock, blackberry, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut) and some combination of:
    - Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2 to 30 m (about 6 to 98 ft). Lower-stature thickets (2 to 4 m or 6 to 13 ft tall) are found at higher elevation riparian forests and tall-stature thickets are found at middle and lower-elevation riparian forests.
    - Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub or tree level as a low, dense canopy.
    - Sites for nesting that contain a dense (~50-100%) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground).
    - Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 ac) or as large as 70 ha (175 ac).
- Variety of insect prey populations found within or adjacent to riparian floodplains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies, moths, and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

The PBFs for the southwestern willow flycatcher can be summarized as riparian habitat with adequate invertebrate prey populations found within and adjacent to those habitats. The species description in the critical habitat final rule notes the flycatcher eats a wide range of invertebrate prey including flying, and ground- and vegetation-dwelling, insect species of terrestrial and aquatic origins. Activities that may affect critical habitat, as described in the critical habitat final rule (see *Application of the "Adverse Modification" Standard*), includes actions that would remove, thin, or destroy riparian flycatcher habitat through a variety of means, including herbicides or biocontrol agents.

Effects of the Action

We expect methomyl use will impact arthropod prey, which is a critical habitat PBF that is essential for the conservation of the species. The southwestern willow flycatcher is a generalist invertivore and can consume a wide range of insect species (in addition to occasional berries).

There is a high extent of overlap between the action area and the critical habitat (23.9% total overlap) (Table 21). There is a high level of past methomyl usage (up to 23.9% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 21. Overlap and past usage data for the critical habitat of the southwestern willow flycatcher.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
2.4	21.5	23.9	2.4	21.5	23.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below.

Available toxicity data indicate that insects are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the southwestern willow flycatcher is an opportunistic forager that can consume a wide range of insect prey, and because they are able to forage in dense vegetation where insects would be less likely to be exposed and would remain available, we anticipate individuals will still have food resources in critical habitat available despite a reduction in the abundance of sensitive species. Additionally, we anticipate impacted prey species will recover over time once methomyl residues have degraded (which should occur within days to weeks of exposure). As such, we anticipate some arthropod prey will be available after exposure and any losses will likely only be temporary, resulting in high, but episodic, impacts to the arthropod prey PBF.

Table 22. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed to methomyl over the proposed action's duration. However, while there will be large reductions in the abundance of sensitive prey species, we anticipate these reductions will temporary given methomyl's quick degradation rate and the likely recovery of the insect prey community over time (Table 22). Furthermore, as generalist insectivores, individual flycatchers will likely still have sufficient prey available within critical habitat despite a reduction in the abundance of sensitive insect species at any given time, as we do not expect all insect species are equally as sensitive to methomyl. As such, we do not anticipate the proposed action will result in levels of adverse effects to the arthropod prey PBF.

Rationale for Conclusion

We expect episodic losses of prey in a high portion of the critical habitat. However, the Southwestern willow flycatcher is an insectivore generalist that forages on a variety of arthropod prey items, and we do not anticipate all prey will be lost at the same time. The critical habitat rule includes a variety of insect prey populations as a PBF. While we expect periodic impacts to some of the insects that comprise the arthropod PBF, the Southwestern willow flycatcher would be able to forage on alternative prey. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Southwestern willow flycatcher.

References

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Southwestern Willow Flycatcher. Final Rule. Federal Register 78: 343-534.

Gunnison sage-grouse (*Centrocercus minimus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Extensive sagebrush landscapes capable of supporting a population of Gunnison sage-grouse.
- Breeding habitat composed of sagebrush plant communities.
- Summer-late fall habitat composed of sagebrush plant communities.
- Winter habitat composed of sagebrush plant communities.
- Alternative, mesic habitats used primarily in the summer-late fall season, such as riparian communities, springs, seeps, and mesic meadows.

These PBFs focus on specific habitat structure and vegetation communities to meet sage-grouse needs for wintering, nesting, and breeding season. However, the critical habitat final rule (see *Application of the "Adverse Modification Standard"*) identifies actions that "would result in the loss or reduction in native herbaceous understory plant cover or height, and a reduction or loss of associated arthropod communities" include "the application of herbicides or insecticides." The rule also states that insects, along with forbs and sagebrush, are important dietary components outside of winter when the diet is nearly 100% sagebrush. During the pre-laying period from late-March to early April, hens are particularly dependent on forbs as well as insects, and these foods are essential nutritional components for sage-grouse chicks with insects being the primary food of chicks during the first three weeks after hatching.

Effects of the Action

We expect methomyl use will impact arthropod prey, which is a critical habitat PBF that is essential for the conservation of the species. The Gunnison sage-grouse is an opportunistic forager that primarily consumes vegetation but can also consume invertebrates, which are a particularly important food source for newly hatched chicks.

There is a high extent of overlap between the action area and the critical habitat (14.6% total overlap) (Table 23). There is a high level of past methomyl usage (up to 14.6% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action. However, additional data from the USDA Census of Agriculture indicate low levels of past insecticide use in the counties containing critical habitat units (up to 1.3% critical habitat treated annually with any insecticide), suggesting that exposure to this critical habitat may have a lower level of exposure than the overlap and usage data report.

Table 23. Overlap and past usage data for the critical habitat of the Gunnison sage-grouse.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
3.9	10.7	14.6	3.9	10.7	14.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insects are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the Gunnison sage-grouse is an opportunistic forager that can consume a wide range of insect prey, we anticipate there will still be some food resources available within critical habitat despite a reduction in the abundance of sensitive arthropod species.

Additionally, we anticipate impacted prey species will recover over time once methomyl residues have degraded (which should occur within days to weeks of exposure). As such, we anticipate there will still be some prey available in critical habitat after exposure and any losses will likely only be temporary, resulting in high, but episodic, impacts to the arthropod prey PBF.

Given the low level of insecticide usage within the counties containing critical habitat units reported by the Census of Agriculture, we anticipate methomyl usage and exposure to critical habitat are not likely to be frequent or occur over a large portion of critical habitat each year.

Table 24. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed to methomyl over the proposed action's duration. While there will be large reductions in the abundance of sensitive prey species, we anticipate these reductions will temporary given methomyl's quick degradation rate and the likely recovery of the insect prey community (Table 24). Applications are not likely to occur frequently given the low level of insecticide usage reported by the Census of Agriculture, although we anticipate periodic impacts that will reduce the abundance of arthropod prey throughout the project duration.

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat (14.6% total overlap). While some data indicates a high level of past methomyl usage (up to 14.6% of the critical habitat), data from the USDA Census of Agriculture indicates that only up 1.3% of the critical habitat has been treated annually with any insecticide. While usage in the critical habitat is likely to be fairly low, we expect losses of arthropod prey in a portion of the critical habitat. In addition, the Gunnison sage-grouse is known to use agricultural areas during breeding and lekking, which likely coincides with periods of methomyl application, and the arthropod PBF is a particularly important resource during the breeding period. While the Gunnison sage-grouse feeds on plants (e.g., leaves, grasses, forbs) and arthropod prey, hens are dependent on forbs as well as insects during the pre-laying season and chicks primarily eat invertebrates. While not all arthropod prey are likely to be impacted, we expect large reductions in arthropod abundance where exposed. Actions identified in the critical habitat final rule "Adverse Modification Standard" include those that would result in a reduction or loss of associated arthropod communities, including from the application of insecticides. Given the importance of arthropod prey to key development periods of the sage-grouse's life cycle, even temporary losses of arthropod prey may have large impacts to the critical habitat's ability to support the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Gunnison sage-grouse's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for Gunnison sage-grouse by >95% for terrestrial habitat. 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 Gunnison sage-grouse's critical habitat is the entirety of the designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Gunnison sage-grouse's critical habitat will be low. As such, we anticipate there will be sufficient arthropod prey available to support the species occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Gunnison sage-grouse.

References

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Gunnison sage-grouse. Final Rule. Federal Register 79: 69311-69363.

Yellow-billed cuckoo (*Coccyzus americanus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Range-wide breeding habitat. Riparian woodlands across the Distinct Population Segment (DPS); Southwestern breeding habitat, primarily in Arizona and New Mexico:

Drainages with varying combinations of riparian, xeroriparian, and/or non-riparian trees and large shrubs. This physical or biological feature includes breeding habitat found throughout the DPS range as well as additional breeding habitat characteristics unique to the Southwest.

- Adequate prey base. Presence of prey base consisting of large insect fauna (for example, cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies, moth larvae, spiders), lizards, or frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas.
- Hydrologic processes. The movement of water and sediment in natural or altered systems that maintains and regenerates breeding habitat. This physical or biological feature includes hydrologic processes found in range-wide breeding habitat as well as additional hydrologic processes unique to the Southwest in southwestern breeding habitat.

These habitat features can be summarized as riparian woodlands with dynamic riverine processes that support adequate arthropod and non-arthropod prey. As stated in the critical habitat final rule (see *Application of the "Adverse Modification" Standard*), "[s]praying of pesticides that would reduce insect prey populations within or adjacent to riparian habitat" is an action that "would appreciably diminish habitat value or quality through direct or indirect effects" for the yellow-billed cuckoo.

Effects of the Action

We expect methomyl use will impact arthropod prey and non-arthropod prey, which are critical habitat PBFs that are essential for the conservation of the species. The yellow-billed cuckoo consumes a wide range of insects as well as some vertebrate prey like tree frogs and lizards.

There is a high extent of overlap between the action area and the critical habitat (44% total overlap) (Table 25). There is a high level of past methomyl usage (up to 44% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action. While there is high overlap with methomyl sites, about 46% of the range is on federal and state lands where agricultural uses are relatively uncommon and exposure to methomyl would likely be minimal.

Table 25. Overlap and past usage data for the critical habitat of the yellow-billed cuckoo.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
6.1	37.9	44	6.1	37.9	44

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below.

Available toxicity data indicate that insects are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate there will likely still be food resources in critical habitat despite a reduction in the abundance of sensitive prey species. Furthermore, the yellow-billed cuckoo is generalist feeder that can consume a wide range of insect prey, and they are able to forage in dense vegetation where insects would be less likely to be exposed and would remain available. We anticipate individuals will often still have food resources available despite a reduction in the abundance of sensitive species. Additionally, we anticipate impacted prey species will recover over time once methomyl residues have degraded after applications (which should occur within days to weeks of exposure). As such, we expect that some arthropod prey will still be available after exposure and any losses will likely only be temporary, resulting in moderate, episodic impacts to the arthropod prey PBF.

We expect methomyl exposure will adversely affect non-arthropod prey as well (such as tree frogs). Available toxicity data in birds (which we use as surrogate data for terrestrial-phase amphibians) indicate that frogs are likely to experience high levels of mortality if individuals feed on methomyl use sites. However, we expect prey species that do not feed on methomyl use sites are likely to experience only low levels of adverse effects. Additionally, we expect methomyl will degrade quickly (i.e., within days to weeks after exposure), indicating that prey species foraging on use sites are only likely to die if they feed shortly after an application of methomyl. Thus, we anticipate amphibian prey are likely to experience high levels of adverse effects, but only in certain areas within critical habitat (i.e., on methomyl use sites), which are only likely to be temporary during periods after applications, as methomyl will degrade quickly. Amphibian populations would likely take a long time to recover if many individuals were lost. As such, we expect there will be episodic impacts to the non-arthropod PBF in localized areas.

Table 26. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	X	presence of amphibian prey	Low – High (depending on where prey are located)
water quality	--	--	--
habitat function	--	--	--

In summary, we expect a large portion of critical habitat is likely to be exposed to methomyl over the proposed action's duration. Impacts in the large portion of the critical habitat under federal and state ownerships where agriculture is generally uncommon would likely be minimal due to lack of methomyl exposure. Within exposed areas of critical habitat, we anticipate adverse effects to the overall relevant PBFs are likely (Table 26). We expect there will be high levels of mortality in sensitive insect prey species exposed to methomyl. However, given the broad dietary items the cuckoo can consume, the natural variation in insect sensitivity to methomyl, and the ability of the species to forage in dense vegetation where insects would be less likely to be exposed, we anticipate there will often be sufficient arthropod food resources available despite reductions in the abundance of sensitive insect species.

We anticipate high levels of mortality will occur to amphibian prey under certain circumstances. While we cannot rule out amphibian prey loss, we do not anticipate amphibian prey mortality is likely to occur frequently given that methomyl degrades quickly in the environment and that mortality would only be limited to those individuals foraging in localized areas on or near methomyl sites during or shortly after applications. Should amphibian prey loss occur, the amphibian population may not readily recover. Losses of prey during sensitive periods, such as the breeding season, would likely have greater consequences to the cuckoo such as by affecting fecundity or leading to starvation. This indicates low to high levels of adverse effect to the non-arthropod prey PBF are likely, depending on the extent and frequency of applications and the size and condition of the affected arthropod and non-arthropod populations.

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat, and we anticipate high usage in the overlapping areas (both in 44% of the critical habitat). We expect there will be high levels of mortality in sensitive insect prey species where exposed, although we do not expect the entire insect community will experience complete mortality. We also anticipate mortality of amphibian prey where exposed, although we expect mortality would be limited to those individuals foraging in localized areas on or near methomyl sites during or shortly after applications. We anticipate impacted prey species will recover over time once methomyl residues have degraded after applications (within days to weeks), with insect populations likely to recover more quickly than amphibian populations. Given the broad dietary items the cuckoo can consume, the natural variation in insect sensitivity to methomyl, and the ability of the species to forage in dense vegetation where insects and other prey would be less likely to be exposed, we anticipate there will often be sufficient arthropod and non-arthropod food resources available despite reductions in the abundance of sensitive insect species and other prey. However, losses of prey in the species' critical habitat during sensitive periods, such as the breeding season, would likely have consequences to the cuckoo such as by affecting fecundity or leading to starvation of adults or young. Thus, while we expect the yellow-billed cuckoo would often likely be able to forage on alternative prey, episodic losses of prey during sensitive periods for the cuckoo (e.g., during the breeding season) or when alternative prey are less abundant in a large portion of the critical habitat over the project duration is likely to impact the function of the prey-based PBFs. The critical habitat final rule designating critical habitat identifies spraying of pesticides that would reduce insect prey populations within or adjacent to riparian habitat as an action that could appreciably diminish habitat value or quality of the habitat for the species through direct or indirect effects to the yellow-billed cuckoo. This suggests impacts to the arthropod prey PBF are likely to have high effects to the overall PBF.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the yellow-billed cuckoo's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for yellow-billed cuckoo by >95% for terrestrial habitat. 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-billed cuckoo's critical habitat is the entirety of the designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the yellow-billed cuckoo's critical habitat will be low. As such, we anticipate there will be sufficient arthropod and non-arthropod prey available to support the species occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the yellow-billed cuckoo.

References

U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo. Final Rule. Federal Register 86: 20798-21005.

Bivalves

Purple bankclimber (mussel) (*Elliptoideus sloatianus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channel.
- Predominantly sand, gravel, and/or cobble stream substrate with low to medium amounts of silt and clay.
- Permanently flowing water.
- Water quality, including temperature, turbidity, dissolved oxygen, and chemical constituents.
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval stages.

In the critical habitat final rule, the narrative for the water quality PBF discusses the impacts of pesticides on mussels: "[s]everal studies have described adverse effects of pesticides on mussels … Commonly used pesticides were cited as the likely cause of a mussel die-off in a North Carolina stream." In the Special Management Considerations and Protection section, the critical habitat states "[s]treams that receive a high proportion of their flow from the discharge of springs are vulnerable to nutrient enrichment from fertilizers and to other pollutants applied in the recharge areas of those springs (units 1, 2, and 7), which may extend far from the streams themselves." As stated in the critical habitat final rule, "[t]he temperature, dissolved oxygen (DO), pH, and conductivity ranges that define suitable habitat conditions for purple bankclimbers have not been specifically investigated. As sedentary animals, mussels must tolerate the full range of these parameters to persist in a stream. Quantifying water quality tolerances for purple bankclimbers is further complicated by their dependency on fish hosts, which may exhibit different tolerances" (see *Principle Constituent Elements* section in the critical habitat final rule).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The purple bankclimber is a fish host generalist that can use multiple species of fish hosts for reproduction.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the

critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (3.3% total overlap) (Table 27). There is a low level of past methomyl usage (up to 3.3% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 27. Overlap and past usage data for the critical habitat of the purple bankclimber.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
3.3	3.3

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the purple bankclimber's habitat will range from 25-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

Additionally, the purple bankclimber is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl (as differences in physiologies, life histories, and behaviors will result in different risks of mortality), we anticipate individuals can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Thus, while we expect a high level of mortality to fish hosts is likely to occasionally occur in some parts of critical habitat when methomyl is used on particular crops, we expect there will still be sufficient resources within critical habitat to support the species' reproduction.

Table 28. Summary of relevant physical and biological features (PBFs), feature characteristics, and level of concern for each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (generalist)	Medium
water quality	X	High flow waterbodies, Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 28). While we anticipate high levels of adverse effects to host fish can occur, we expect these effects will only occur occasionally with methomyl use on specific crop types, in areas with low flow and low water volume, limited to a small portion of critical habitat. Additionally, given that the species can use a wide variety of host fish species for successful reproduction, we anticipate moderate levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

There is a low level of exposure as there is a low extent of overlap and low level of past usage in the watershed containing designated critical habitat. We anticipate no more than low levels of adverse effects to the water quality PBF as bivalves are not sensitive to carbamate insecticides. While there may be high levels of host fish mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate this adverse effect will be limited to a small portion of critical habitat and will only occur occasionally as typical estimated environmental concentrations are not likely to result in high levels of exposure and host fish mortality. Furthermore, since we do not expect all fish are equally sensitive to methomyl exposure and since the purple bankclimber is a fish host generalist that can use a wide number of fish host species, we anticipate there will still be sufficient fish hosts available in critical habitat even in scenarios where sensitive host species die with methomyl exposure. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the purple bankclimber.

References

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Final Rule. Federal Register 72: 64286 – 64340.

Oval pigtoe (*Pleurobema pyriforme*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channel.
- Predominantly sand, gravel, and/or cobble stream substrate with low to medium amounts of silt and clay.
- Permanently flowing water.
- Water quality, including temperature, turbidity, dissolved oxygen, and chemical constituents.
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval stages.

In the critical habitat final rule, the narrative for the water quality PBF discusses the impacts of pesticides on mussels: "[s]everal studies have described adverse effects of pesticides on mussels … Commonly used pesticides were cited as the likely cause of a mussel die-off in a North Carolina stream." In the Special Management Considerations and Protection section, the critical habitat states "[s]treams that receive a high proportion of their flow from the discharge of springs are vulnerable to nutrient enrichment from fertilizers and to other pollutants applied in the recharge areas of those springs (units 1, 2, and 7), which may extend far from the streams themselves." As stated in the critical habitat final rule, "[t]he temperature, dissolved oxygen (DO), pH, and conductivity ranges that define suitable habitat conditions for oval pigtoes have not been specifically investigated. As sedentary animals, mussels must tolerate the full range of these parameters to persist in a stream. Quantifying water quality tolerances for oval pigtoes is further complicated by their dependency on fish hosts, which may exhibit different tolerances" (see *Principle Constituent Elements* section).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The oval pigtoe is a fish host generalist that can use a variety of fish host species for successful reproduction.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (3.9% total overlap) (Table 29). There is a low level of past methomyl usage (up to 3.9% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 29. Overlap and past usage data for the critical habitat of the oval pigtoe.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
3.9	3.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the oval pigtoe's habitat will range from 244-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

Additionally, the oval pigtoe is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl (as differences in physiologies, life histories, and behaviors will result in different risks of mortality), we anticipate individuals can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Thus, while we expect a high level of mortality to fish hosts is likely to occasionally occur in some parts of critical habitat when methomyl is used on particular crops, we expect there will still be sufficient resources within critical habitat to support the species' reproduction.

Table 30. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (generalist)	Medium
water quality	X	High flow waterbodies, Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 30). While we anticipate high levels of adverse effects to host fish can occur, we expect these effects will only occur occasionally with methomyl use on specific crop types in areas with low flow and low water volume and will be limited in area given the small extent of overlap. Additionally, given that the species can use a wide variety of host fish species for successful reproduction, we anticipate moderate levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

There is a low level of exposure as there is a low extent of overlap and low level of past usage in the watershed containing designated critical habitat. We anticipate no more than low levels of adverse effects to the water quality PBF as bivalves are not sensitive to carbamate insecticides. While there may be high levels of host fish mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate this adverse effect will be limited to a small portion of critical habitat and will only occur occasionally as typical estimated environmental concentrations are not likely to result in high levels of exposure and host fish mortality. Furthermore, since we do not expect all fish are equally sensitive to methomyl exposure and since the oval pigtoe is a fish host generalist that can use a wide number of fish host species, we anticipate there will still be sufficient fish hosts available in critical habitat even in scenarios where sensitive host species die with methomyl exposure. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the oval pigtoe.

References

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Final Rule. Federal Register 72: 64286-64340.

Shinyrayed pocketbook (*Lampsilis subangulata*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channel.
- Predominantly sand, gravel, and/or cobble stream substrate with low to medium amounts of silt and clay.
- Permanently flowing water.
- Water quality, including temperature, turbidity, dissolved oxygen, and chemical constituents.
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval stages.

In the critical habitat final rule, the narrative for the water quality PBF discusses the impacts of pesticides on mussels: "[s]everal studies have described adverse effects of pesticides on mussels … Commonly used pesticides were cited as the likely cause of a mussel die-off in a North Carolina stream." In the Special Management Considerations and Protection section, the final rule states “[s]treams that receive a high proportion of their flow from the discharge of springs are vulnerable to nutrient enrichment from fertilizers and to other pollutants applied in the recharge areas of those springs (units 1, 2, and 7), which may extend far from the streams themselves.” As stated in the critical habitat final rule, “[t]he temperature, dissolved oxygen (DO), pH, and conductivity ranges that define suitable habitat conditions for shinyrayed pocketbooks have not been specifically investigated. As sedentary animals, mussels must tolerate the full range of these parameters to persist in a stream. Quantifying water quality tolerances for shinyrayed pocketbooks is further complicated by their dependency on fish hosts, which may exhibit different tolerances” (see *Principle Constituent Elements* section).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The shinyrayed pocketbook is a fish host generalist that can use a wide variety of fish host species for successful reproduction.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (4.1% total overlap) (Table 31). There is a low level of past methomyl usage (up to 4.1% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 31. Overlap and past usage data for the critical habitat of the shinyrayed pocketbook.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
4.1	4.1

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the shinyrayed pocketbook's habitat will range from 244-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

Additionally, the shinyrayed pocketbook is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl (as differences in physiologies, life histories, and behaviors will result in different risks of mortality), we anticipate individuals can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Thus, while we expect a high level of mortality to fish hosts is likely to occasionally occur in some parts of critical habitat when methomyl is used on particular crops, we expect there will still be sufficient resources within critical habitat to support the species' reproduction.

Table 32. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (generalist)	Medium
water quality	X	High flow waterbodies, Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 32). While we anticipate high levels of adverse effects to host fish can occur, we expect these effects will only occur occasionally with methomyl use on specific crop types in areas with low flow and low water volume and will be limited in area given the small extent of overlap. Additionally, given that the species can use a wide variety of host fish species for successful reproduction, we anticipate moderate levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

There is a low level of exposure as there is a low extent of overlap and low level of past usage in the watershed containing designated critical habitat. We anticipate no more than low levels of adverse effects to the water quality PBF as bivalves are not sensitive to carbamate insecticides. While there may be high levels of host fish mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate this adverse effect will be limited to a small portion of critical habitat and will only occur occasionally as typical estimated environmental concentrations are not likely to result in high levels of exposure and host fish mortality. Furthermore, since we do not expect all fish are equally sensitive to methomyl exposure and since the shinyrayed pocketbook is a fish host generalist that can use a wide number of fish host species, we anticipate there will still be sufficient fish hosts available in critical habitat even in scenarios where sensitive host species die with methomyl exposure. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the shinyrayed pocketbook.

References

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Final Rule. Federal Register 72: 64286-64340.

Fat threeridge (mussel) (*Amblema neislerii*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channel.
- Predominantly sand, gravel, and/or cobble stream substrate with low to medium amounts of silt and clay.
- Permanently flowing water.
- Water quality, including temperature, turbidity, dissolved oxygen, and chemical constituents.
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval stages.

In the critical habitat final rule, the narrative for the water quality PBF discusses the impacts of pesticides on mussels: "Several studies have described adverse effects of pesticides on mussels … Commonly used pesticides were cited as the likely cause of a mussel die-off in a North Carolina stream." In the Special Management Considerations and Protection section, the critical habitat states “[s]treams that receive a high proportion of their flow from the discharge of springs are vulnerable to nutrient enrichment from fertilizers and to other pollutants applied in the recharge areas of those springs (units 1, 2, and 7), which may extend far from the streams themselves.” As stated in the critical habitat final rule, “[t]he temperature, dissolved oxygen (DO), pH, and conductivity ranges that define suitable habitat conditions for fat threeridge mussels have not been specifically investigated. As sedentary animals, mussels must tolerate the full range of these parameters to persist in a stream. Quantifying water quality tolerances for fat threeridge mussels is further complicated by their dependency on fish hosts, which may exhibit different tolerances” (see *Primary Constituent Elements* section).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a medium extent of overlap between the action area and the critical habitat (7.4% total overlap) (Table 33). There is a moderate level of past methomyl usage (up to 7.4% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 33. Overlap and past usage data for the critical habitat of the fat threeridge.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
7.4	7.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within fat threeridge's habitat will range from 244-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

Additionally, the fat threeridge is a fish host generalist that can successfully reproduce using 23 different species of host fish. Given that we do not anticipate all fish species are equally sensitive to methomyl (as differences in physiologies, life histories, and behaviors will result in different risks of mortality), we anticipate individuals can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Furthermore, some of the fat threeridge's known host species are highly abundant within critical habitat (such as the bluegill or largemouth bass), indicating that even at high mortality rates, there will likely still be a sufficiently large number of fish hosts available for the species to use.

Table 34. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (generalist; abundant host species)	Low
water quality	X	High flow waterbodies, Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a moderate portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 34). While we anticipate high levels of adverse effects to host fish can occur, we expect these effects will only occur occasionally with methomyl use on specific crop types in areas with low flow and low water volume. Additionally, given that the species can use a wide variety of host fish species for successful reproduction, including fish species that are highly abundant, we anticipate there will still be sufficient fish hosts available for the species to use for reproduction, even in high exposure scenarios. As such, we expect only low levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

While there is a moderate level of exposure, we anticipate no more than low levels of adverse effects to the water quality PBF and, at most, low levels of adverse effects to the fish host non-arthropod PBF. While there may be high levels of mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate typical estimated environmental concentrations are not likely to result in high levels of fish host mortality. Furthermore, since we do not expect all fish are equally sensitive to methomyl exposure and since the fat threeridge is a fish host generalist that can use a wide number of fish host species (including species that are highly abundant within critical habitat), we anticipate there will still be sufficient fish hosts available in critical habitat even in scenarios where sensitive host species die with methomyl exposure. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the fat threeridge.

References

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Final Rule. Federal Register 72: 64286-64340.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for Fat Threeridge (*Amblema neislerii*), Amendment. Atlanta, Georgia. 10 pp.

Gulf moccasinshell (*Medionidus penicillatus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channel.
- Predominantly sand, gravel, and/or cobble stream substrate with low to medium amounts of silt and clay.
- Permanently flowing water.
- Water quality, including temperature, turbidity, dissolved oxygen, and chemical constituents.
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval stages.

In the critical habitat final rule, the narrative for the water quality PBF discusses the impacts of pesticides on mussels: "[s]everal studies have described adverse effects of pesticides on mussels … Commonly used pesticides were cited as the likely cause of a mussel die-off in a North Carolina stream." In the Special Management Considerations and Protection section, the final rule states “[s]treams that receive a high proportion of their flow from the discharge of springs are vulnerable to nutrient enrichment from fertilizers and to other pollutants applied in the recharge areas of those springs (units 1, 2, and 7), which may extend far from the streams themselves.” As stated in the critical habitat final rule, “[t]he temperature, dissolved oxygen (DO), pH, and conductivity ranges that define suitable habitat conditions for Gulf moccasinshells have not been specifically investigated. As sedentary animals, mussels must tolerate the full range of these parameters to persist in a stream. Quantifying water quality tolerances for Gulf moccasinshells is further complicated by their dependency on fish hosts, which may exhibit different tolerances” (see *Principle Constituent Elements* section).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The Gulf moccasinshell is a fish host generalist that can use a variety of fish host species for successful reproduction.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (4.5% total overlap) (Table 35). There is a low level of past methomyl usage (up to 4.5% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 35. Overlap and past usage data for the critical habitat of the Gulf moccasinshell.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
4.5	4.5

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within Gulf moccasinshell's habitat will range from 244-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

Additionally, the Gulf moccasinshell is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl (as differences in physiologies, life histories, and behaviors will result in different risks of mortality), we anticipate individuals can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Thus, while we expect a high level of mortality to fish hosts is likely to occasionally occur in some parts of critical habitat when methomyl is used on particular crops, we expect there will still be sufficient resources within critical habitat to support the species' reproduction.

Table 36. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (generalist)	Medium
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 36). While we anticipate high levels of adverse effects to host fish can occur, we expect these effects will only occur occasionally with methomyl use on specific crop types in areas with low flow and low water volume and we anticipate these adverse effects will be limited to a small portion of critical habitat given the low extent of overlap. Additionally, given that the species can use a wide variety of host fish species for successful reproduction, we anticipate moderate levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

There is a low level of exposure as there is a low extent of overlap and low level of past usage in the watershed containing designated critical habitat. We anticipate no more than low levels of adverse effects to the water quality PBF as bivalves are not sensitive to carbamate insecticides. While there may be high levels of host fish mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate this adverse effect will be limited to a small portion of critical habitat and will only occur occasionally as typical estimated environmental concentrations are not likely to result in high levels of exposure and host fish mortality. Furthermore, since we do not expect all fish are equally sensitive to methomyl exposure and since the Gulf moccasinshell is a fish host generalist that can use a wide number of fish host species, we anticipate there will still be sufficient fish hosts available in critical habitat even in scenarios where sensitive host species die with methomyl exposure. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Gulf moccasinshell.

References

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Final Rule. Federal Register 72: 64286-64340.

Ochlockonee moccasinshell (*Medionidus simpsonianus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channel.
- Predominantly sand, gravel, and/or cobble stream substrate with low to medium amounts of silt and clay.
- Permanently flowing water.
- Water quality, including temperature, turbidity, dissolved oxygen, and chemical constituents.
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval stages.

In the critical habitat , the narrative for the water quality PBF discusses the impacts of pesticides on mussels: "[s]everal studies have described adverse effects of pesticides on mussels … Commonly used pesticides were cited as the likely cause of a mussel die-off in a North Carolina stream." In the Special Management Considerations and Protection section, the critical habitat states "[s]treams that receive a high proportion of their flow from the discharge of springs are vulnerable to nutrient enrichment from fertilizers and to other pollutants applied in the recharge areas of those springs (units 1, 2, and 7), which may extend far from the streams themselves." As stated in the critical habitat final rule, "[t]he temperature, dissolved oxygen (DO), pH, and conductivity ranges that define suitable habitat conditions for Ochlockonee moccasinshells have not been specifically investigated. As sedentary animals, mussels must tolerate the full range of these parameters to persist in a stream. Quantifying water quality tolerances for Ochlockonee moccasinshells is further complicated by their dependency on fish hosts, which may exhibit different tolerances" (see *Principle Constituent Elements* section of the critical habitat rule).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. There is little information available about that Ochlockonee moccasinshell's fish hosts. As such, we presume the species is a fish host specialist to maintain conservative assumptions.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (19.6% total overlap) (Table 37). There is a high level of past methomyl usage (up to 19.6% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 37. Overlap and past usage data for the critical habitat of the Ochlockonee moccasinshell.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
19.6	19.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Ochlockonee moccasinshell's habitat will range from 28.9-112 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and specific crop treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

We typically expect fish host specialists (and those presumed to be specialists, such as the Ochlockonee moccasinshell) are at greater risk of adverse indirect effects than fish host generalists as a reduction in the abundance of even a small number of species may represent a large impact to their limited fish host base. However, based on available toxicity data in fish, we anticipate no more than low levels of adverse effects to fish hosts are likely to occur at the levels of methomyl that are predicted to occur within critical habitat (i.e., <1% of exposed fish are likely to die) due to the high flow water bodies used by this species. Thus, we expect low levels of adverse effects to the host fish PBF.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Table 38. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (unknown)	Low
water quality	X	High flow waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 38). Furthermore, we anticipate no more than low levels of adverse effects to fish host species given the low level of methomyl predicted to occur within the high flow waterbodies used by the species in the critical habitat. Thus, while we expect a large area of critical habitat is likely to be exposed to methomyl, we anticipate exposed areas are not likely to experience more than low levels of adverse effects. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the Ochlockonee moccasinshell's designated critical habitat as a whole.

Rationale for Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. We anticipate impacts to the non-arthropod PBF due to losses of host fish periodically in parts of the critical habitat. While this mussel may be a host fish specialist that uses a limited number of species (fish hosts are unknown), this species is associated with high flow waterbodies where there would be less risk of adverse effects to exposed fish. Water quality is also a PBF for the critical habitat. However, we do not anticipate adverse effects to the water quality PBF due to the low toxicity of methomyl to the species. While we anticipate impacts to non-arthropods, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Ochlockonee moccasinshell.

References

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Final Rule. Federal Register 72: 64286-64340.

Chipola slabshell (*Elliptio chipolaensis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channel.
- Predominantly sand, gravel, and/or cobble stream substrate with low to medium amounts of silt and clay.
- Permanently flowing water.
- Water quality, including temperature, turbidity, dissolved oxygen, and chemical constituents.
- Fish hosts (such as largemouth bass, sailfin shiner, brown darter) that support the larval stages.

In the critical habitat , the narrative for the water quality PBF discusses the impacts of pesticides on mussels: "[s]everal studies have described adverse effects of pesticides on mussels … Commonly used pesticides were cited as the likely cause of a mussel die-off in a North Carolina stream." In the Special Management Considerations and Protection section, the critical habitat states "[s]treams that receive a high proportion of their flow from the discharge of springs are vulnerable to nutrient enrichment from fertilizers and to other pollutants applied in the recharge areas of those springs (units 1, 2, and 7), which may extend far from the streams themselves." As stated in the critical habitat final rule, "[t]he temperature, dissolved oxygen (DO), pH, and conductivity ranges that define suitable habitat conditions for Chipola slabshells have not been specifically investigated. As sedentary animals, mussels must tolerate the full range of these parameters to persist in a stream. Quantifying water quality tolerances for Chipola slabshells is further complicated by their dependency on fish hosts, which may exhibit different tolerances" (see *Principle Constituent Elements* section of the critical habitat rule).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The Chipola slabshell is a fish host specialist and can only use a few species of fish for successful reproduction.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a moderate extent of overlap between the action area and the critical habitat (7.3% total overlap) (Table 39). There is a moderate level of past methomyl usage (up to 7.3% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 39. Overlap and past usage data for the critical habitat of the Chipola slabshell.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
7.3	7.3

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Chipola slabshell's habitat will range from 143-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated with methomyl. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

While the Chipola slabshell is a host fish specialist that can only successfully metamorphosize on a select few species of fish hosts, the known fish hosts include many species of fish that are common and occur in high abundances within critical habitat (such as the bluegill sunfish and largemouth bass). While these species of fish may experience high levels of mortality with methomyl exposure, we anticipate there will still be sufficient host fish remaining for the Chipola slabshell to use as hosts given the high abundances of these species. As such, we anticipate only low levels of adverse effects are likely to occur to the non-arthropod PBF.

Table 40. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (specialist; highly abundant fish hosts)	Low
water quality	X	High flow waterbodies, Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a moderate portion of critical habitat that is likely to be exposed over the proposed action's duration. We do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 40). While we anticipate there will likely be high levels of mortality in fish, we expect mortality will only occur in some parts of critical habitat (such as shallow areas with low flow rates) after methomyl use on specific crop use sites (i.e., crops in the "other row crops" category). Furthermore, given that the Chipola slabshell uses highly abundant fish host species, we anticipate there will still be sufficient fish hosts available for the species to use, even in scenarios where there are high levels of fish mortality. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the Chipola slabshell's designated critical habitat as a whole.

Rationale for Conclusion

While there is a medium extent of exposure, we anticipate no more than low levels of adverse effects to the water quality PBF and, at most, low levels of adverse effects to the fish host non-arthropod PBF. While there may be high levels of mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate typical estimated environmental concentrations are not likely to result in high levels of fish host mortality. Furthermore, since the Chipola slabshell uses highly abundant fish host species, we anticipate there will still be sufficient fish hosts available in critical habitat even in scenarios where there is a high level of fish mortality. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Chipola slabshell.

References

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered and Two Threatened Mussels in Four Northeast Gulf of Mexico Drainages. Final Rule. Federal Register 72: 64286-64340.

Rabbitsfoot (*Quadrula cylindrica cylindrica*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Water and sediment quality, including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- The occurrence of natural fish assemblages, reflected by fish species richness, relative abundance, and community composition, for each inhabited river or creek that will serve as an indication of appropriate presence and abundance of fish hosts necessary for recruitment of the rabbitsfoot. Suitable fish host for rabbitsfoot may include, but are not limited to, blacktail shiner (*Cyprinella venusta*) from the Black and Little River and cardinal shiner (*Luxilus cardinalis*), red shiner (*C. lutrensis*), spotfin shiner (*C. spiloptera*), bluntface shiner (*C. camura*), rainbow darter (*Etheostoma caeruleum*), rosyface shiner (*Notropis rubellus*), striped shiner (*L. chrysocephalus*), and emerald shiner (*N. atherinoides*).

In the critical habitat rule (see *Physical or Biological Features*), pesticides were identified as a factor that can alter the water quality. Adequate water quality is essential for normal behavior, growth, and viability during all life stages of the rabbitsfoot and fish assemblages are needed with suitable fish hosts. In the Special Management Considerations or Protection section, chemical contaminants, including pesticides, was listed as a primary threat to critical habitat.

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The rabbitsfoot is a fish host generalist and can use a wide variety of fish species for successful reproduction.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (11.3% total overlap) (Table 41). There is a high level of past methomyl usage (up to 11.3% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 41. Overlap and past usage data for the critical habitat of the rabbitsfoot.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
11.3	11.3

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within rabbitsfoot's habitat will range from 309-321 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for individuals of the species. However, we expect the rabbitsfoot's host fish are not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the non-arthropod PBF are likely.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Table 42. Summary of relevant physical and biological features (PBFs), feature characteristics, and level of concern for each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (generalist)	Low

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Impact to PBF
water quality	X	High flow waterbodies, Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 42). We similarly do not anticipate more than low levels of adverse effects to the non-arthropod PBF as estimated environmental concentrations of methomyl within the rabbitsfoot's critical habitat will not be high enough to cause adverse effects to fish survival. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the rabbitsfoot's designated critical habitat as a whole.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality and non-arthropod PBF as estimated concentrations of methomyl are likely to be low. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the rabbitsfoot.

References

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Neosho Mucket and Rabbitsfoot. Final Rule. Federal Register 80: 24691-24774.

U.S. Fish and Wildlife Service. 2023. Recovery Plan for the Rabbitsfoot (*Quadrula cylindrica cylindrica*). Atlanta, Georgia. 11 pp.

Neosho mucket (*Lampsilis rafinesqueana*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Water and sediment quality, including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.

- The occurrence of natural fish assemblages, reflected by fish species richness, relative abundance, and community composition, for each inhabited river or creek that will serve as an indication of appropriate presence and abundance of fish hosts necessary for recruitment of the Neosho mucket. Suitable fish hosts for Neosho mucket glochidia include smallmouth bass (*Micropterus dolomieu*), largemouth bass *(Micropterus salmoides*), and spotted bass *(Micropterus punctulatus*).

In the critical habitat rule (see *Physical or Biological Features*), pesticides were identified as a factor that can alter the water quality. Adequate water quality is essential for normal behavior, growth, and viability during all life stages of the Neosho mucket and fish assemblages are needed with suitable fish hosts. In the Special Management Considerations or Protection section, chemical contaminants, including pesticides, was listed as a primary threat to critical habitat.

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (10.6% total overlap) (Table 43). There is a high level of past methomyl usage (up to 10.6% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 43. Overlap and past usage data for the critical habitat of the Neosho mucket.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
10.6	10.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within Neosho mucket's habitat will range from 309-321 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl, as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for individuals of the species. However, we expect the Neosho mucket's host fish are not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the non-arthropod PBF are likely.

Table 44. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	Presence of fish hosts (specialists, but abundant hosts)	Low
water quality	X	High flow waterbodies, Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 44). We similarly do not anticipate more than low levels of adverse effects to the non-arthropod PBF as estimated environmental concentrations of methomyl within the Neosho mucket's critical habitat will not be high enough to cause adverse effects to fish survival. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the Neosho mucket's designated critical habitat as a whole.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality and non-arthropod PBF as estimated concentrations of methomyl are likely to be low. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Neosho mucket.

References

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Neosho Mucket and Rabbitsfoot. Final Rule. Federal Register 80: 24691-24774.

U.S. Fish and Wildlife Service. 2018. Final Recovery Plan for the Neosho Mucket (*Lampsilis rafinesqueana*). Atlanta, Georgia. 4 pp.

Altamaha spinymussel (*Elliptio spinosa*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Water quality necessary for normal behavior, growth, and viability of all life stages, including specifically temperature (less than 32.6 °C (90.68 °F) with less than 2 °C (3.6 °F) daily fluctuation)), pH (6.1 to 7.7), oxygen content (daily average DO concentration of 5.0 mg/l and a minimum of 4.0 mg/ l), an ammonia level not exceeding 1.5 mg N/L, 0.22 mg N/L (normalized to pH 8 and 25 °C (77 °F)), and other chemical characteristics.
- The presence of fish hosts (currently unknown) necessary for recruitment of the Altamaha spinymussel. The continued occurrence of diverse native fish assemblages currently occurring in the basin will serve as an indication of host fish presence until appropriate host fishes can be identified for the Altamaha spinymussel.

In the critical habitat rule, the narrative for the water quality PBF states that pesticides are one of the factors that can alter water quality. Fish assemblages with suitable fish hosts is also a PBF. In the critical habitat rule, we stated "[m]alathion, one of the most important pesticides used in cotton farming, inhibits physiological activities of mussels."

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. Species that serve as fish hosts are unknown, so the continued occurrence of diverse native fish assemblages currently occurring in the basin currently serves as an indication of host fish presence.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a moderate extent of overlap between the action area and the critical habitat (8.8% total overlap) (Table 45). There is a moderate level of past methomyl usage (up to 8.8% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 45. Overlap and past usage data for the critical habitat of the Altamada spinymussel.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
8.8	8.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the Altamaha spinymussel's habitat will range from 11-28 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for individuals of the species. However, we expect the Altamaha spinymussel's host fish are not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the non-arthropod PBF are likely.

Table 46. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	presence of host fish (presumed generalist)	Low
water quality	X	High flow waterbodies, low flow/low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a moderate portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 46). We similarly do not anticipate more than low levels of adverse effects to the non-arthropod PBF as estimated environmental concentrations of methomyl within the Altamaha spinymussel's critical habitat will not be high enough to cause adverse effects to fish survival. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the Altamaha spinymussel's designated critical habitat as a whole.

Rationale for Conclusion

While there is a moderate level of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality and non-arthropod PBF as estimated concentrations of methomyl are likely to be low. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Altamaha spinymussel.

References

U.S. Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; Endangered Status for the Altamaha Spinymussel and Designation of Critical Habitat. Final Rule. Federal Register 76: 62928-62960.

Southern sandshell (*Hamiota australis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Water quality, including temperature (not greater than 32 °C), pH (between 6.0 to 8.5), oxygen content (not less than 5.0 milligrams per liter), hardness, turbidity, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.
- The presence of fish hosts. Diverse assemblages of native fish species will serve as a potential indication of host fish presence until appropriate host fishes can be identified.

In the critical habitat final rule (see *Physical or Biological Features, Water*), pesticides were identified as a factor that can alter the water quality. Adequate water quality is essential for normal behavior, growth, and viability during all life stages of the species.

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. Little is known about the southern sandshell's fish hosts. As such, we assume the species is a fish host specialist to maintain conservative assumptions.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (2.6% total overlap) (Table 47). There is a low level of past methomyl usage (up to 2.6% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 47. Overlap and past usage data for the critical habitat of the southern sandshell.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
2.6	2.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within southern sandshell's habitat will range from 143-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

However, given that the southern sandshell's fish hosts are unknown, we assume the species is a host specialist that can only successfully metamorphosize on a select few species of host fish. Given this presumed narrow range of available host fish species that are usable, we expect even low levels of host fish mortality can represent a significant decrease in the species' ability to successfully reproduce. Thus, we expect high levels of adverse effects to the non-arthropod PBF are likely.

Table 48. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (unknown; presume specialist)	High
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 48). In contrast, we anticipate there will likely be high levels of mortality in fish, particularly in shallow areas with low flow rates. However, given the low extent of overlap, we anticipate these adverse effects will be limited to only a small portion of critical habitat. Thus, while there may be a high level of adverse effect to the non-arthropod PBF in areas where exposure occurs, given that there is a low level of exposure, we anticipate proposed action will diminish the conservation value of the southern sandshell's designated critical habitat as a whole.

Rationale for Conclusion

There is a low level of exposure to critical habitat as there is very low overlap between the action area and designated critical habitat. We anticipate no more than low levels of adverse effects to the water quality PBF as bivalves are not sensitive to carbamate insecticides. While there may be high levels of host fish mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate this adverse effect will be limited to a small portion of critical habitat given the low extent of overlap between the action area and designated critical habitat. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the southern sandshell.

References

U.S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat. Final Rule. Federal Register 77: 61663-61719.

U.S. Fish and Wildlife Service. 2022. Round Ebonyshell (*Reginaia rotulata*), Southern Kidneyshell (*Ptychobranchus jonesi*), Choctaw Bean (*Obovaria choctawensis*), Tapered Pigtoe (*Fusconaia burkei*), Narrow Pigtoe (*Fusconaia escambia*), Southern Sandshell (*Hamiota australis*), and Fuzzy Pigtoe (*Pleurobema strodeanum*) Status Review: Summary and Evaluation. Panama City, Florida. 49 pp + appendix.

Suwannee moccasinshell (*Medionidus walkeri*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Geomorphically stable stream channels (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation).
- Stable substrates of muddy sand or mixtures of sand and gravel, and with little to no accumulation of unconsolidated sediments and low amounts of filamentous algae.
- A natural hydrologic flow regime (magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species is found, and connectivity of stream channels with the floodplain, allowing the exchange of nutrients and sediment for habitat maintenance, food availability, and spawning habitat for native fishes.
- Water quality conditions needed to sustain healthy Suwannee moccasinshell populations, including low pollutant levels (not less than State criteria), a natural temperature regime, pH (between 6.0 to 8.5), adequate oxygen content (not less than State criteria), hardness, turbidity, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.
- The presence of abundant fish hosts necessary for recruitment of the Suwannee moccasinshell. The presence of blackbanded darters (*Percina nigrofasciata*) and brown darters (*Etheostoma edwini*) will serve as an indication of fish host presence.

The Suwannee moccasinshell, similar to other mussels, is dependent on areas with flow refuges, where shear stress is relatively low and sediments remain stable during high flow events. In the Special Management Considerations or Protection section of the critical habitat final rule, "reductions in pesticide and fertilizer use especially in groundwater recharge areas and near stream channels" is one of the items listed to ameliorate threats to Suwannee moccasinshell habitat. The final rule also states "Food availability and quality for the Suwannee moccasinshell is affected by habitat stability, floodplain connectivity, flow, and water and sediment quality" (see *Physical or Biological Features Essential to the Conservation of the Species* section), and "Actions that would introduce contaminants or alter water chemistry or temperature" may destroy or adversely modify critical habitat by altering "water quality conditions to levels that are beyond the tolerances of the mussel or its host fish" (see *Application of the "Destruction of Adverse Modification" Standard* section).

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The Suwannee moccasinshell is a host fish specialist and can only use a few species of fish for successful reproduction.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (23.9% total overlap) (Table 49). There is a high level of past methomyl usage (up to 23.9% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 49. Overlap and past usage data for the critical habitat of the southern kidneyshell.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
23.9	23.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Suwannee moccasinshell's habitat will range from 244-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

However, given that the Suwannee moccasinshell is a fish host specialist that can only successfully metamorphosize on a select few species of host fish, we expect the species is highly vulnerable to fish host losses as even low levels of host fish mortality can represent a significant decrease in the species' ability to successfully reproduce. Thus, even though we anticipate methomyl exposures will only occasionally result in high mortality of fish hosts, we expect high levels of adverse effects to the non-arthropod PBF are likely.

Table 50. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (specialist)	High
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. We do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 50). However, we anticipate there will likely be high levels of mortality in fish, particularly in shallow areas with low flow rates. While we do not anticipate all fish species are equally sensitive to methomyl exposure, given that Suwannee moccasinshell is a host fish specialist, even a low level of mortality in host fish can represent a significant decrease in the abundance of host fish resources for the species. This adverse effect to fish hosts will result in a significant impact to the fish host PBF. As such, we anticipate proposed action will result in a high level of adverse effects to the conservation value of the Suwannee moccasinshell's designated critical habitat as a whole.

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. We anticipate high levels of impacts to the non-arthropod PBF as the species is a host specialist and can experience high levels of impacts to reproduction and recruitment with even low levels of fish mortality. We anticipate that high levels of mortality in just a few sensitive species could result in a significant reduction in the abundance of suitable fish hosts for individuals to use. In contrast, we do not anticipate adverse effects to the water quality PBF due to the low toxicity of methomyl to the species. Based on anticipated impacts to the non-arthropod PBFs from the losses of fish that could serve as hosts, we anticipate the application of methomyl, as proposed, will likely appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Suwannee moccasinshell's critical habitat:

1) *Methomyl must be applied using the following buffers: 50 feet for aerial applications, 10 feet for ground applications, and 25 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for Suwannee moccasinshell by 74-99% for aquatic habitat. 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.*
2) *Applicators need 3 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the critical habitat of the Suwannee moccasinshell by an order of magnitude (i.e., a 10-fold reduction).*

The PULA for the Suwannee moccasinshell's critical habitat is the entirety of the designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Suwannee moccasinshell's critical habitat will be low. As such, we anticipate there will be sufficient host fish available to support the species occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Suwannee moccasinshell.

References

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Suwannee Moccasinshell. Final Rule. Federal Register 86: 34979 34998.

Southern kidneyshell (*Ptychobranchus jonesi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Water quality, including temperature (not greater than 32 °C), pH (between 6.0 to 8.5), oxygen content (not less than 5.0 milligrams per liter), hardness, turbidity, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages.
- The presence of fish hosts. Diverse assemblages of native fish species will serve as a potential indication of host fish presence until appropriate host fishes can be identified.

In the critical habitat final rule (see *Physical or Biological Features, Water*), pesticides were identified as a factor that can alter the water quality. Adequate water quality is essential for normal behavior, growth, and viability during all life stages of the species.

Effects of the Action

We expect methomyl use will impact non-arthropods (i.e., fish hosts) and water quality, which are critical habitat PBFs that are essential for the conservation of the species. We currently do not have any information on the southern kidneyshell's host fishes. As such, we assume the species is a fish host specialist to maintain conservative assumptions.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (1.4% total overlap) (Table 51). There is a low level of past methomyl usage (up to 1.4% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 51. Overlap and past usage data for the critical habitat of the southern kidneyshell.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
1.4	1.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the southern kidneyshell's habitat will range from 143-813 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 24% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops such as those in the "other row crops" category (which are not the most prevalent use site within or around critical habitat). Furthermore, we anticipate these high environmental exposures will only occur in areas of low flow or low water volume and that fish host mortality will be substantially lower in areas of high flow or in large volume waterbodies, indicating that fish host mortality will only occur in some areas of critical habitat.

However, given that the southern kidneyshell is a fish host specialist that can only successfully metamorphosize on a select few species of host fish, we expect the species is highly vulnerable to fish host losses as even low levels of host fish mortality can represent a significant decrease in the species' ability to successfully reproduce. Thus, even though we anticipate methomyl exposures will only occasionally result in high mortality of fish hosts, we expect high levels of adverse effects to the non-arthropod PBF are likely.

Table 52. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (unknown)	Medium
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 52). In contrast, we anticipate there will likely be high levels of mortality in fish, particularly in shallow areas with low flow rates. However, given the low extent of overlap, we anticipate these adverse effects will be limited to only a small portion of critical habitat. Thus, while there may be a high level of adverse effect to the non-arthropod PBF in areas where exposure occurs, given that there is a low level of exposure, we anticipate proposed action will not diminish the conservation value of the southern kidneyshell's designated critical habitat as a whole.

Rationale for Preliminary Conclusion

There is a low level of exposure to critical habitat as there is very little overlap between the action area and designated critical habitat. We anticipate no more than low levels of adverse effects to the water quality PBF as bivalves are not sensitive to carbamate insecticides. While there may be high levels of host fish mortality in certain parts of critical habitat when methomyl is used on certain crops, we anticipate this adverse effect will be limited to a small portion of critical habitat given the low extent of overlap between the action area and designated critical habitat. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the southern kidneyshell.

References

U.S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status for the Alabama Pearlshell, Round Ebonyshell, Southern Kidneyshell, and Choctaw Bean, and Threatened Species Status for the Tapered Pigtoe, Narrow Pigtoe, Southern Sandshell, and Fuzzy Pigtoe, and Designation of Critical Habitat. Final Rule. Federal Register 77: 61663-61719.

U.S. Fish and Wildlife Service. 2022. Round Ebonyshell (*Reginaia rotulata*), Southern Kidneyshell (*Ptychobranchus jonesi*), Choctaw Bean (*Obovaria choctawensis*), Tapered Pigtoe (*Fusconaia burkei*), Narrow Pigtoe (*Fusconaia escambia*), Southern Sandshell (*Hamiota australis*), and Fuzzy Pigtoe (*Pleurobema strodeanum*) Status Review: Summary and Evaluation. Panama City, Florida. 49 pp + appendix.

Texas fawnsfoot (*Truncilla macrodon)*

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).
- Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussels' and fish hosts' habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
- Water and sediment quality (including, but not limited to, dissolved oxygen levels greater than 2 mg/L, conductivity, hardness, turbidity, temperatures below 29°C (84.2°F), pH (low salinity, less than 2 ppt), low total ammonia (less than 0.77 mg/L total ammonia nitrogen), heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- The presence and abundance of fish hosts necessary for recruitment of the central Texas mussels.

Effects of the Action

We expect methomyl use will impact fish hosts and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (23.8% total overlap) (Table 53). There is a high level of past methomyl usage (up to 19.0% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 53. Overlap and past usage data for the critical habitat of the Texas fawnsfoot.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
23.8	19.0

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Texas fawnsfoot's habitat will range from 351-475 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from 1-4% of exposed individuals, which we consider a low level of mortality to fish hosts. Given that the species' presumed host, the freshwater drum, is a highly abundant species that is likely to be found in all parts of the fawnsfoot's critical habitat, we anticipate there will still be sufficient fish host resources available to individuals even at maximum predicted mortality rates from methomyl exposure. As such, we anticipate only low levels of impacts to the non-arthropod PBF are likely.

Table 54. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (specialist, common host fish)	Low
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 54). We similarly do not anticipate more than low levels of adverse effects to the non-arthropod PBF as estimated environmental concentrations of methomyl within the Texas fawnsfoot critical habitat will not be high enough to cause more than low levels of adverse effects to host fish survival. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the Texas fawnsfoot's designated critical habitat as a whole.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality and non-arthropod PBF as estimated concentrations of methomyl are likely to be low. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Texas fawnsfoot.

References

U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Endangered Species Status With Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, Balcones Spike, and False Spike, and Threatened Species Status With Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Final Rule. Federal Register: 89

Atlantic pigtoe (*Fusconaia masoni)*

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).
- Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain benthic habitats where the species is found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussel's and fish

hosts' habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.

- Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- The presence and abundance of fish hosts necessary for recruitment of the Atlantic pigtoe.

Effects of the Action

We expect methomyl use will impact fish hosts and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (19.1% total overlap) (Table 55). There is a moderate level of past methomyl usage (up to 9.9% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 55. Overlap and past usage data for the critical habitat of the Atlantic pigtoe.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
19.1	9.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Atlantic pigtoe's habitat will range from 229-608.4 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 10% of exposed individuals at high end estimates. However, the Atlantic pigtoe is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl based on differences in physiologies, life histories, and behaviors, we anticipate the Atlantic pigtoe can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Therefore, we anticipate a moderate level of adverse effects to the non-arthropod PBF.

Table 56. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (generalist)	Medium
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that overlaps with the action area and there is a high level of past methomyl usage within critical habitat. We expect a wide range of estimated environmental concentrations of methomyl will occur in critical habitat, depending on local environmental characteristics and what specific crops are being treated with methomyl. We do not anticipate any concentrations of methomyl reasonably certain to occur in critical habitat will cause adverse effects to bivalve growth or survival, indicating only low levels of adverse effects to the water quality PBF are likely. While high end estimates of environmental concentrations can cause a high level of mortality in fish hosts, we expect these concentrations will only occur occasionally as they are only associated with methomyl applications to certain crops (such as crops in the “other row crops” category), which are not the most prevalent within critical habitat. Furthermore, the Atlantic pigtoe is a fish host generalist that can successfully reproduce in many fish host species. Thus, while we anticipate high levels of mortality in some fish species, we anticipate there will still be sufficient fish hosts available for individuals to use, resulting in moderate levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

While there is a high extent of exposure, we anticipate no more than low levels of adverse effects to the water quality PBF and, at most, moderate adverse effects to the fish host PBF. Given that adverse effects to fish hosts will only be an occasional occurrence associated with specific crop types and that the Atlantic pigtoe will likely still have sufficient fish hosts available in high estimated environmental concentration scenarios, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Atlantic pigtoe.

References

U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Atlantic Pigtoe and Designation of Critical Habitat. Final Rule. Federal Register: 86

Salamander mussel (*Simpsonaias ambigua)*

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the salamander mussel and its host, the mudpuppy, are found and to maintain stream connectivity.
- Suitable substrates and connected instream habitats, characterized by geomorphologically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support the salamander mussel and mudpuppy (e.g., large rock shelters, woody debris, and bedrock crevices within stable zones of swift current with low amounts of fine sediment silt).
- Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including (but not limited to) dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86°F (°F) (30° Celsius (°C)). Additionally, concentrations of contaminants, including (but not limited to) ammonia, nitrate, copper, and chloride, are below acute toxicity levels for mussels.
- The presence and abundance of the mudpuppy host.

Effects of the Action

We expect methomyl use will impact water quality and amphibian hosts, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats proposed for aquatic species, rather than using the proposed critical habitat units, the EPA uses the HUC-12 watersheds that contain the proposed critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat proposed for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (25.7% total overlap) (Table 57). There is a high level of past methomyl usage (up to 14.4% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 57. Overlap and past usage data for the critical habitat of the salamander mussel.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
25.7	14.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the salamander mussel's habitat will range from 48-98 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that aquatic amphibians can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair amphibian host resources for individuals of the species. However, we expect the salamander mussel's host amphibians are not likely to experience mortality at predicted exposures as estimated environmental concentrations of methomyl are well below levels where toxicity studies have observed mortality in amphibians. As such, we anticipate only low levels of impacts to the non-arthropod PBF are likely.

Table 58. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of amphibian hosts (specialist)	Low
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 58). We similarly do not anticipate more than low levels of adverse effects to the non-arthropod PBF as estimated environmental concentrations of methomyl within the salamander mussel's critical habitat will not be high enough to cause more than low levels of adverse effects to host amphibian survival. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the salamander mussel's proposed critical habitat as a whole.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality and non-arthropod PBF as estimated concentrations of methomyl are likely to be low. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the proposed critical habitat for the salamander mussel.

References

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Salamander Mussel and Designation of Critical Habitat. Proposed Rule. Federal Register: 88

Yellow lance (*Elliptio lanceolata*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussels and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).
- Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain benthic habitats where the species is found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussel's and fish host's habitat, food availability, spawning habitat for native fishes, and the ability of newly transformed juveniles to settle and become established in their habitats.
- Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- The presence and abundance of fish hosts necessary for yellow lance recruitment.

Effects of the Action

We expect methomyl use will impact water quality and fish hosts, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (16.1% total overlap) (Table 59). There is a high level of past methomyl usage (up to 13.8% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 59. Overlap and past usage data for the critical habitat of the yellow lance.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
16.1	13.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Atlantic pigtoe's habitat will range from 229-571 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for individuals of the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 8% of exposed individuals at high end estimates, which is a moderate effect to fish hosts. However, the yellow lance is a fish host generalist that can successfully reproduce using a number of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl based on differences in physiologies, life histories, and behaviors, we anticipate the yellow lance can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Therefore, we anticipate a low level of adverse effects to the non-arthropod PBF.

Table 60. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (generalist)	Low
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that overlaps with the action area and there is a high level of past methomyl usage within critical habitat. We expect a wide range of estimated environmental concentrations of methomyl will occur in critical habitat, depending on local environmental characteristics and what specific crops are being treated with methomyl. We do not anticipate any concentrations of methomyl reasonably certain to occur in critical habitat will cause adverse effects to bivalve growth or survival, indicating only low levels of adverse effects to the water quality PBF are likely (Table 60). While high end estimates of environmental concentrations can cause a moderate level of mortality in fish hosts, we expect these concentrations will only occur occasionally as they are only associated with methomyl applications to certain crops (such as crops in the "other row crops" category), which are not the most prevalent within critical habitat. Furthermore, the yellow lance is a fish host generalist that can successfully reproduce in a number of fish host species. Thus, while we anticipate moderate levels of mortality in some fish species, we anticipate there will still be sufficient fish hosts available for individuals to use, resulting in low levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

While there is a high extent of exposure, we anticipate no more than low levels of adverse effects to the water quality PBF. Given that adverse effects to fish hosts will only be an occasional occurrence associated with specific crop types and that the yellow lance, as a fish host generalist, will likely still have sufficient fish hosts available in high estimated environmental concentration scenarios, we also expect only low levels of adverse effects to the non-arthropod PBF. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the yellow lance.

References

U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Yellow Lance. Final Rule. Federal Register: 86

Texas pimpleback (*Cyclonaias petrina*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).

- Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussels' and fish hosts' habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
- Water and sediment quality (including, but not limited to, dissolved oxygen levels greater than 2 mg/L, conductivity, hardness, turbidity, temperatures below 29°C (84.2°F), pH (low salinity, less than 2 ppt), low total ammonia (less than 0.77 mg/L total ammonia nitrogen), heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- The presence and abundance of fish hosts necessary for recruitment of the central Texas mussels.

Effects of the Action

We expect methomyl use will impact fish hosts and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (18.2% total overlap) (Table 61). There is a high level of past methomyl usage (up to 16.5% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 61. Overlap and past usage data for the critical habitat of the Texas pimpleback.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
18.2	16.5

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Texas pimpleback's habitat will range from 155-407 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish species can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for individuals of the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from 1-2% of exposed individuals, which we consider a low level of mortality to fish hosts. Furthermore, given that the species' is a host fish generalist that can successfully reproduce using a wide array of fish host species, we anticipate individuals are even less likely to experience adverse effects as individuals can readily use alternative fish host species when sensitive fish host species die. As such, we anticipate only low levels of impacts to the non-arthropod PBF are likely.

Table 62. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (generalist)	Low
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 62). We similarly do not anticipate more than low levels of adverse effects to the non-arthropod PBF as estimated environmental concentrations of methomyl within the Texas pimpleback's critical habitat will not be high enough to cause more than low levels of adverse effects to host fish survival. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the Texas pimpleback's designated critical habitat as a whole.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality and non-arthropod PBF as estimated concentrations of methomyl are likely to be low. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Texas pimpleback.

References

U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Endangered Species Status With Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, Balcones Spike, and False Spike, and Threatened Species Status With Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Final Rule. Federal Register: 89

False spike (*Fusconaia mitchelli)*

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).
- Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussels' and fish hosts' habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
- Water and sediment quality (including, but not limited to, dissolved oxygen levels greater than 2 mg/L, conductivity, hardness, turbidity, temperatures below 29°C (84.2°F), pH (low salinity, less than 2 ppt), low total ammonia (less than 0.77 mg/L total ammonia nitrogen), heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- The presence and abundance of fish hosts necessary for recruitment of the central Texas mussels.

Effects of the Action

We expect methomyl use will impact water quality and fish hosts, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (11.4% total overlap) (Table 63). There is a moderate level of past methomyl usage (up to 8.8% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 63. Overlap and past usage data for the critical habitat of the false spike.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
11.4	8.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the false spike's habitat will range from 257-663 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 13% of exposed individuals at high end estimates. While the false spike is a fish host specialist that can only successfully reproduce on a few species of host fish, both of its hosts (the blacktail shiner and red shiner) are common and highly abundant fish species within the mussel's range (and presumably its critical habitat). Thus, while we expect a high level of mortality is likely to occur at high end exposure estimates, we anticipate there will still be sufficient fish host resources remaining in critical habitat to support the reproduction of the species. Therefore, we anticipate a moderate level of adverse effects to the non-arthropod PBF.

Table 64. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of host fish (specialist; abundant host fish)	Medium
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that overlaps with the action area and there is a high level of past methomyl usage within critical habitat. We expect a wide range of estimated environmental concentrations of methomyl will occur in critical habitat, depending on local environmental characteristics and what specific crops are being treated with methomyl. We do not anticipate any concentrations of methomyl reasonably certain to occur in critical habitat will cause adverse effects to bivalve growth or survival, indicating only low levels of adverse effects to the water quality PBF are likely (Table 64). While high end estimates of environmental concentrations can cause a high level of mortality in fish hosts, we expect these concentrations will only occur occasionally as they are only associated with methomyl applications to certain crops (such as crops in the "other orchards" category), which are not the most prevalent within critical habitat. Furthermore, the false spike's fish hosts are common species that are highly abundant within the species' range (and presumably critical habitat). Thus, while we anticipate high levels of mortality in fish, we expect there will still be sufficient fish hosts available for individuals to use given the high abundance of the host species, resulting in moderate levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

While there is a high extent of exposure, we anticipate no more than low levels of adverse effects to the water quality PBF and, at most, moderate adverse effects to the fish host PBF. Given that adverse effects to fish hosts will only be an occasional occurrence associated with specific crop types and that the false spike will likely still have sufficient fish hosts available in high estimated environmental concentration scenarios, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the false spike.

References

U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Endangered Species Status With Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, Balcones Spike, and False Spike, and Threatened Species Status With Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Final Rule. Federal Register: 89

Green floater (*Lasmigona subviridis)*

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Flows adequate to maintain both benthic habitats and stream connectivity, allow glochidia and juveniles to become established in their habitats, allow the exchange of nutrients and oxygen to mussels, and maintain food availability and spawning habitat for host fishes. The characteristics of such flows include a stable, not flashy, flow regime, with slow to moderate currents to provide refugia during periods of higher flows.
- Suitable sand and gravel substrates and connected instream habitats characterized by stable stream channels and banks and by minimal sedimentation and erosion.
- Sufficient amount of food resources, including microscopic particulate matter (plankton, bacteria, detritus, or dissolved organic matter).
- Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including, but not limited to, those general to other mussel species:
  - Adequate dissolved oxygen;
  - Low salinity;
  - Low temperature (generally below 86°F (30°C));
  - Low ammonia (generally below 0.5 parts per million total ammonia- nitrogen), PAHs, PCBs, and heavy metal concentrations; and
  - No excessive total suspended solids and other pollutants, including contaminants of emerging concern.
- The presence and abundance of fish hosts necessary for recruitment of the green floater (including, but not limited to, mottled sculpin (Cottus bairdii), rock bass (Ambloplites rupestris), central stoneroller (Campostoma anomalum), blacknose dace (Rhinichthys atratulus), and margined madtom (Noturus insignis)).

Effects of the Action

We expect methomyl use will impact water quality and fish hosts, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats proposed for aquatic species, rather than using the proposed critical habitat units, the EPA uses the HUC-12 watersheds that contain the proposed critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat proposed for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (12.0% total overlap) (Table 65). There is a low level of past methomyl usage (up to 4.6% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 65. Overlap and past usage data for the critical habitat of the green floater.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
12.0	4.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the green floater's habitat will range from 224-608 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 10% of exposed individuals at high end estimates. However, the green floater is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl based on differences in physiologies, life histories, and behaviors, we anticipate the green floater can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Additionally, the green floater is unique among freshwater mussels in that its larvae can also metamorphosize without a host fish. Thus, while we expect a high level of mortality to fish hosts is likely to occur at high end exposure estimates, we expect there will still be sufficient resources within critical habitat to support the species' reproduction. Therefore, we anticipate a low level of adverse effects to the non-arthropod PBF.

Table 66. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (generalist; can also metamorphosize without a host)	Low
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that overlaps with the action area and there is a high level of past methomyl usage within critical habitat. We expect a wide range of estimated environmental concentrations of methomyl will occur in critical habitat, depending on local environmental characteristics and what specific crops are being treated with methomyl. We do not anticipate any concentrations of methomyl reasonably certain to occur in critical habitat will cause adverse effects to bivalve growth or survival, indicating only low levels of adverse effects to the water quality PBF are likely (Table 66). While high end estimates of environmental concentrations can cause a high level of mortality in fish hosts, we expect these concentrations will only occur occasionally as they are only associated with methomyl applications to certain crops (such as alfalfa), which are not the most prevalent within critical habitat. Furthermore, the green floater is a host fish generalist that can also successfully reproduce without host fish. Thus, while we anticipate high levels of mortality in fish, we expect only low levels of impact to the species' reproductive capabilities within proposed critical habitat, resulting in low levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

While there is a high extent of exposure, we anticipate no more than low levels of adverse effects to the water quality PBF. Given that adverse effects to fish hosts will only be an occasional occurrence associated with specific crop types, that the green floater will likely still have sufficient fish hosts available in high estimated environmental concentration scenarios, and that the green floater can metamorphosize without a host fish, we anticipate methomyl exposure will only result in low levels of adverse effects to the non-arthropod PBF as well. Thus, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the proposed critical habitat for the green floater.

References

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Green Floater and Designation of Critical Habitat. Proposed Rule. Federal Register: 88.

Round hickorynut (*Obovaria subrotunda)*

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Clean, flowing water with appropriate water quality and temperate conditions, such as (but not limited to) dissolved oxygen above 2 to 3 parts per million (ppm), ammonia generally below 0.5 ppm total ammonia-nitrogen, temperatures generally below 86 degrees Fahrenheit (°F) (30 degrees Celsius (°C)), and (ideally) an absence of excessive total suspended solids and other pollutants.
- Natural flow regimes that vary with respect to timing, magnitude, duration, and frequency of river discharge events
- Predominantly silt-free, stable sand, gravel, and cobble substrates
- Suspended food and nutrients in the water column including (but not limited to) phytoplankton, zooplankton, protozoans, detritus, and dissolved organic matter
- presence of host fish species to ensure recruitment

Effects of the Action

We expect methomyl use will impact water quality and fish hosts, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (11.3% total overlap) (Table 67). There is a high level of past methomyl usage (up to 10.7% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 67. Overlap and past usage data for the critical habitat of the round hickorynut.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
11.3	10.7

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the round hickorynut's habitat will range from 244-732 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 18% of exposed individuals at high end estimates. However, the round hickorynut is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl based on differences in physiologies, life histories, and behaviors, we anticipate the round hickorynut can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Thus, while we expect a high level of mortality to fish hosts is likely to occasionally occur at high end exposure estimates, we expect there will still be sufficient resources within critical habitat to support the species' reproduction. Therefore, we anticipate a moderate level of adverse effects to the non-arthropod PBF.

Table 68. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (generalist)	Medium
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 68). While high end estimates of environmental concentrations can cause a high level of mortality in fish hosts, we expect these concentrations will only occur occasionally as they are only associated with methomyl applications to certain crops (such as alfalfa), which are not the most prevalent within critical habitat. Furthermore, the round hickorynut is a fish host generalist that can successfully reproduce in a number of fish host species. Thus, while we anticipate moderate levels of mortality in some fish species, we anticipate there will still be sufficient fish hosts available for individuals to use, resulting in moderate levels of adverse effects to the non-arthropod PBF.

Rationale for Conclusion

While there is a high extent of exposure, we anticipate no more than low levels of adverse effects to the water quality PBF and, at most, moderate adverse effects to the fish host PBF. Given that adverse effects to fish hosts will only be an occasional occurrence associated with specific crop types and that the round hickorynut will likely still have sufficient fish hosts available in high estimated environmental concentration scenarios, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the round hickorynut.

References

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; 12-Month Finding for Purple Lilliput; Threatened Species Status With Section 4(d) Rule for Longsolid and Round Hickorynut and Designation of Critical Habitat. Proposed Rule. Federal Register 85 FR 61384 61458.

Western fanshell (*Cyprogenia aberti)*

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain stream connectivity, specifically providing for the exchange of nutrients and sediment for maintenance of the mussels' and fish hosts' habitat and food availability, maintenance of spawning habitat for native host fishes, and the ability for newly transformed juveniles to settle and become established in their habitats. Adequate flows ensure delivery of oxygen, enable reproduction, deliver food to filter-feeding mussels, and reduce contaminants and fine sediments from interstitial spaces.

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (that is, channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt- free gravel and coarse sand substrates)
- Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including, but not limited to: dissolved oxygen (generally above 3 parts per million (ppm)) and water temperature (generally below 80 degrees Fahrenheit (°F) (27 degrees Celsius (°C)). Additionally, water and sediment should be low in ammonia (generally below 1.0 ppm total ammonia)-nitrogen, and heavy metals, and lack excessive total suspended solids and other pollutants.
- The presence and abundance of fish hosts necessary for recruitment of the western fanshell [… T]his includes logperch (*Percina caprodes*), rainbow darter (*Etheostoma caeruleum*), slenderhead darter (*Percina phoxocephala*), fantail darter (*Etheostoma flabellare*), or orangebelly darter *(Etheostoma radiosum*)

Effects of the Action

We expect methomyl use will impact water quality and fish hosts, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (17.5% total overlap) (Table 69). There is a high level of past methomyl usage (up to 17.1% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 69. Overlap and past usage data for the critical habitat of the western fanshell.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
17.5	17.1

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the western fanshell's habitat will range from 23-48 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for individuals of the species. However, we expect the western fanshell's host fish are not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the non-arthropod PBF are likely.

Table 70. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (generalist)	Low
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 70). We similarly do not anticipate more than low levels of adverse effects to the non-arthropod PBF as estimated environmental concentrations of methomyl within the western fanshell's critical habitat will not be high enough to cause adverse effects to fish survival. As such, we anticipate proposed action will result in low levels of adverse effects to the conservation value of the western fanshell's designated critical habitat as a whole.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality and non-arthropod PBF as estimated concentrations of methomyl are likely to be low. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the western fanshell.

References

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Western Fanshell and ‘‘Ouachita’’ Fanshell and Designation of Critical Habitat. Final Rule. Federal Register: 88

Longsolid (Fusconaia subrotunda)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Clean, flowing water with appropriate water quality and temperate conditions, such as (but not limited to) dissolved oxygen above 2 to 3 parts per million (ppm), ammonia generally below 0.5 ppm total ammonia-nitrogen, temperatures generally below 86 degrees Fahrenheit (°F) (30 degrees Celsius (°C)), and (ideally) an absence of excessive total suspended solids and other pollutants.
- Natural flow regimes that vary with respect to timing, magnitude, duration, and frequency of river discharge events
- Predominantly silt-free, stable sand, gravel, and cobble substrates
- Suspended food and nutrients in the water column including (but not limited to) phytoplankton, zooplankton, protozoans, detritus, and dissolved organic matter
- presence of host fish species to ensure recruitment

Effects of the Action

We expect methomyl use will impact water quality and fish hosts, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a medium extent of overlap between the action area and the critical habitat (5.5% total overlap) (Table 71). There is a low level of past methomyl usage (up to 4.8% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 71. Overlap and past usage data for the critical habitat of the longsolid.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
5.5	4.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the longsolid's habitat will range from 244-732 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data, we do not anticipate water quality will be degraded for the species by the presence of methomyl as bivalves are not sensitive to carbamates. As such, we do not expect any adverse effects to the water quality PBF will occur.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair fish host resources for the species. We anticipate fish mortality at maximum predicted methomyl concentrations will range from <1% of exposed individuals at low end estimates and can reach up to 18% of exposed individuals at high end estimates, which are usually associated with methomyl use on specific crops like alfalfa (which are not the most prevalent use site within or around critical habitat). However, the longsolid is a fish host generalist that can successfully reproduce using a wide range of fish host species. Given that we do not anticipate all fish species are equally sensitive to methomyl based on differences in physiologies, life histories, and behaviors, we anticipate the longsolid can still successfully reproduce within critical habitat when sensitive fish hosts die as they can rely on other fish hosts that are more robust to methomyl exposure. Thus, while we expect a high level of mortality to fish hosts is likely to occasionally occur at high end exposure estimates, we expect there will still be sufficient resources within critical habitat to support the species' reproduction.

Additionally, we expect many of this species' host fish, such as the central stoneroller, whitetail shiner, striped shiner, river chub, and warpaint shiner, are commonly found, abundant species within the longsolid's critical habitat. This high abundance of fish hosts suggests that there will likely still be sufficient fish hosts for the longsolid to use even in scenarios of high exposure and mortality. Therefore, we anticipate a low level of adverse effects to the non-arthropod PBF.

Table 72. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	X	Presence of fish hosts (generalist)	Low
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a moderate portion of critical habitat that is likely to be exposed over the proposed action's duration. However, within areas that are exposed, we do not anticipate any adverse effects to the water quality PBF are likely given that toxicity studies have demonstrated bivalves are not sensitive to carbamates (Table 72). While some uses of methomyl can result in high levels of fish host mortality, we do not anticipate more than low levels of adverse effects to the non-arthropod PBF as the longsolid is a fish host generalist that can successfully reproduce and a wide number of host species, many of which we expect to be abundant within critical habitat. Thus, even in scenarios where fish mortality is high, we anticipate there will be sufficient hosts available for the species to use for reproduction.

Rationale for Conclusion

While there is a moderate extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we anticipate only low levels of impacts to the water quality will be low as estimated concentrations of methomyl are not likely high enough to cause direct adverse effects to bivalve species. While estimated environmental concentrations may occasionally be high enough to cause high levels of fish host mortality, we anticipate there will still be sufficient fish host resources available within critical habitat as the longsolid can rely on a wide range of fish host species, many of which are abundant within critical habitat. As such, we anticipate the application of methomyl, as proposed, will not likely appreciably diminish the value of critical habitat as a whole for the conservation of the species and we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the longsolid.

References

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; 12-Month Finding for Purple Lilliput; Threatened Species Status With Section 4(d) Rule for Longsolid and Round Hickorynut and Designation of Critical Habitat. Proposed Rule. Federal Register 85 FR 61384 61458.

Crustaceans

Vernal pool fairy shrimp (*Branchinecta lynchi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features:

- Topographic features characterized by mounds, swales, and depressions that result in complexes of continuously or intermittently flowing surface water.
- Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains (hold water minimum 41 days).
- Sources of food, expected to be detritus occurring in the pools, contributed by overland flow from the pools' watershed, or the results of biological processes within the pools themselves, such as single-celled bacteria, algae, and dead organic matter.
- Structure within the pools consisting of organic and inorganic materials (i.e., living and dead plants, rocks, debris) that provide shelter.

This species lives in vernal pools (shallow depressions that hold water seasonally), swales (shallow drainages that carry water seasonally), and ephemeral (short duration) freshwater habitats. Most nutrients in vernal pool habitats come from detritus (decaying matter) washed into pools from adjacent uplands, and these nutrients provide the foundation for a vernal pool aquatic community's food source. Detritus (both living and dead organic matter) is a primary food source for the conservancy fairy shrimp. The critical habitat final rule does not specifically mention pesticides, however, it identifies sedimentation or chemical pollution from roadway or other urban runoff as one of the threats to the lands that fall within the critical habitat designation. The final rule (see *Special Management Considerations and Protection*) also states, "[o]nce a vernal pool habitat has been protected from direct filling, it is still necessary to ensure that the habitat is not rendered unsuitable for vernal pool species because of factors such as altered hydrology, contamination, nonnative species invasions, or other incompatible land uses."

Effects of the Action

We expect methomyl use will impact water quality, which is a critical habitat PBF that is essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the HUC-12 watersheds containing the species' designated critical habitat units (4.6% total overlap) (Table 73). While some of the vernal pool fairy shrimp's critical habitat units occur in Oregon, the majority of its designated critical habitat units occur in California (i.e., 28 out of 32 units are located entirely in California). As such, we include California specific past usage data as an additional line of evidence for our analysis of this critical habitat. Mandatory reporting data from the state of California indicates that, on average, between 2012-2021, only 0.4% of the critical habitat has been treated with methomyl annually. Given that the extent of overlap and past methomyl usage are both low.

Table 73. Overlap and past usage data for the critical habitat of the vernal pool fairy shrimp.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
4.6	0.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the vernal pool fairy shrimp's habitat will range from 2.7-3,065 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that crustaceans are sensitive to methomyl exposure and are likely to experience high levels of mortality, even at low exposure concentrations. As such, we expect the presence of methomyl will reduce water quality to a level where individuals may not be able to use areas of critical habitat exposed to methomyl.

Table 74. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	X	Large volume waterbodies, Low flow/Low volume waterbodies	High
habitat function	--	--	--

In summary, while we anticipate there will be high levels of impacts to the water quality PBF in areas that are exposed to methomyl (Table 74), we anticipate impacted areas will be limited to only small portions within the species' designated critical habitat. Given that California usage data is mandated by the state and is collected at a high spatial resolution with a large sample size, we have high confidence that exposure is likely to be low.

Rationale for Conclusion

While impacts to the water quality PBF would have high impacts to the species, we expect these adverse effects will be limited to only small areas of critical habitat. Based on spatially refined mandatory pesticide usage reporting in the state of California, which encompasses the vast majority of the designated critical habitat units for the vernal pool fairy shrimp, we anticipate only small portions of critical habitat are likely to be exposed to methomyl. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the vernal pool fairy shrimp.

References

U.S. Fish and Wildlife Service. 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants. Final Rule. Federal Register 71: 7118-7316.

Noel's amphipod (*Gammarus desperatus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- The PBFs of critical habitat for Noel's amphipod is springs and spring-fed wetland systems that:
    - Have permanent, flowing water with no or no more than low levels of pollutants;
    - Have slow to moderate water velocities;
    - Have substrates including limestone cobble and aquatic vegetation;
    - Have stable water levels with natural diurnal (daily) and seasonal variations;
    - Consist of fresh to moderately saline water;
    - Have minimal sedimentation;
    - Vary in temperature between 50– 68 °F (10–20 °C) with natural seasonal and diurnal variations slightly above and below that range; and
    - Provide abundant food, consisting of: (A) Submergent vegetation and decaying organic matter; (B) A surface film of algae, diatoms, bacteria, and fungi; and (C)

Microbial foods, such as algae and bacteria, associated with aquatic plants, algae, bacteria, and decaying organic material.

Threats to the species include reducing or eliminating water in suitable or occupied habitat through drought or pumping; introducing pollutants to levels unsuitable for the species from urban areas, agriculture, release of chemicals, and oil and gas operations; fires that reduce or eliminate available habitat; and introducing non-native species into the species inhabited spring systems such that suitable habitat is reduced or eliminated.

Effects of the Action

We expect methomyl use will impact water quality, which is a critical habitat PBF that is essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

We anticipate exposure is unlikely to occur to any significant degree as all units of the species' critical habitat occurs on the Bitter Lake National Wildlife Refuge. Pesticide usage records from the U.S. Fish and Wildlife Service indicate that no methomyl has been previously applied to national wildlife refuges. As such, we do not anticipate any areas of critical habitat are likely to be treated with methomyl (Table 75). Visual inspection of areas surrounding the national wildlife refuge indicate no agricultural areas are in the vicinity of the refuge at this time, suggesting that off-site transport of methomyl from adjacent use sites into the species' critical habitat is also unlikely to occur to any significant degree.

Table 75. Overlap and past usage data for the critical habitat of the Noel's amphipod.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
0[1]	0

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section

[1] Overlaps for this critical habitat were determined by reviewing satellite imagery of designated critical habitat units and surrounding areas rather than using overlap data provided by the EPA.

below. EPA's environmental fate modeling predicts methomyl concentrations within the Noel's amphipod's habitat will range from 158-2,943 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that crustaceans are sensitive to methomyl exposure and are likely to experience high levels of mortality, even at low exposure concentrations. As such, we expect the presence of methomyl will reduce water quality to a level where individuals may not be able to use areas of critical habitat exposed to methomyl.

Table 76. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	X	Low flow waterbodies	High
habitat function	--	--	--

In summary, while we anticipate areas of critical habitat exposed to methomyl will experience high levels of adverse effects to the water quality PBF, we do not expect any areas of critical habitat are likely to be exposed to any significant degree as critical habitat is located within the Bitter Lake National Wildlife Refuge, which is unlikely to be treated with methomyl or experience any exposure from off-site transport of methomyl as agricultural areas are not nearby at this time (Table 76). As such, we anticipate proposed action will not result in any measurable adverse effects to the conservation value of the Noel's amphipod's designated critical habitat as a whole.

Rationale for Conclusion

Impacts to the water quality PBF would be high if exposed, but there is an extremely low extent of overlap between the action area and the critical habitat based on current land uses, and usage is anticipated to be extremely low over the project duration. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Noel's amphipod.

References

U.S. Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Roswell Springsnail, Koster's Springsnail, Noel's Amphipod, and Pecos Assiminea. Final Rule. Federal Register 76: 33036-33064.

Diminutive amphipod (*Gammarus hyalleloides*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Permanent, flowing, unpolluted water (free from contamination) emerging from the ground and flowing on the surface.
- Abundant food, consisting of algae, bacteria, decaying organic material, and submergent vegetation that contributes the necessary nutrients, detritus, and bacteria on which these species forage.

This species occurs in desert spring outflow channels on substrates, often within interstitial spaces on and underneath rocks and within gravel and are most commonly found in microhabitats with flowing water. The diminutive amphipod is often found in beds of submerged aquatic plants and is considered an omnivore, feeding on algae, submergent vegetation, and decaying organic matter.

Effects of the Action

We expect methomyl use will impact water quality, which is a critical habitat PBF that is essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (1.9% total overlap) (Table 77). There is a moderate level of past methomyl usage (up to 1.9% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action. This low level of usage is corroborated by the USDA's Census of Agriculture, which indicates that very little insecticides have been applied within the species' critical habitat in the past (up to 0.1%). Because Census of Agriculture data is collected at a more geographically specific scale then other usage data, we expect this to be a more accurate indicator of insecticide usage within the range. As such, we have high confidence that there will be a low level of exposure to critical habitat.

Table 77. Overlap and past usage data for the critical habitat of the diminutive amphipod.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
1.9	1.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the diminutive amphipod's habitat will range from 10-243.6 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that crustaceans are sensitive to methomyl exposure and are likely to die, even at low exposure concentrations. As such, we expect the presence of methomyl will reduce water quality to a level where individuals may not be able to use areas of critical habitat exposed to methomyl.

Table 78. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow waterbodies	High
habitat function	--	--	--

In summary, we anticipate a large adverse effect to the water quality PBF (Table 78). However, we anticipate these adverse effects will be limited to only a small portion of critical habitat as the extent of overlap and past methomyl usage is low. This low level of usage is corroborated by the USDA Census of Agriculture, which shows very little insecticide usage, in general, has occurred in the counties containing designated critical habitat. As such, we anticipate the proposed action will result in low levels of adverse effects to the conservation value of the diminutive amphipod's designated critical habitat as a whole.

Rationale for Conclusion

While the diminutive amphipod relies on clean, uncontaminated water for its survival and recovery, we anticipate very few areas within critical habitat will likely experience adverse effects to water quality as there is a low level of overlap with methomyl use sites and a low level of past methomyl usage within the areas containing designated critical habitat. As such, we do not anticipate the species will lose the ability to use the vast majority of its critical habitat. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the diminutive amphipod.

References

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Six West Texas Aquatic Invertebrates. Final Rule. Federal Register 78: 40970-40996

Brawleys Fork crayfish (*Cambarus williamsi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Moderate to fast-flowing stream with unembedded cherty-gravel and cobble substrate within an unobstructed stream continuum (i.e., riffle, run, pool complexes) of perennial, small- to moderate-sized (generally third order or smaller) streams and rivers (up to the ordinary high-water mark as defined at 33 CFR 329.11)
- Stream banks with intact riparian cover to maintain stream morphology and reduce erosion and sediment inputs that may reduce availability of substrate interstitial spaces.
- Water quality characterized by seasonally moderated, or spring influenced, water temperatures and physical and chemical parameters (e.g., pH, conductivity, dissolved oxygen) sufficient for the normal behavior, growth, reproduction, and viability of all life stages.
- Adequate food base, indicated by a healthy aquatic community structure including native benthic macroinvertebrates, fishes, and plant matter (e.g., leaf litter, algae, detritus).
- An interconnected network of streams and rivers that have the physical and biological features described in paragraphs (2)(i) through (iv) of this entry that allow for the movement of individual crayfish in response to environmental, physiological, or behavioral drivers. The connectivity of the stream network should be sufficient to allow for gene flow within and among watersheds.

Effects of the Action

We expect methomyl use will impact water quality, arthropod prey, and non-arthropod prey, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats proposed for aquatic species, rather than using the proposed critical habitat units, the EPA uses the HUC-12 watersheds that contain the proposed critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat proposed for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (10.4% total overlap) (Table 79). There is a high level of past methomyl usage (up to 10.4% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 79. Overlap and past usage data for the critical habitat of the Brawleys Fork crayfish.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
10.4	10.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Brawley Forks crayfish's habitat will range from 26-50 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that crustaceans are sensitive to methomyl exposure and are likely to experience high levels of mortality, even at low exposure concentrations. As such, we expect the presence of methomyl will reduce water quality to a level where individuals may not be able to use areas of critical habitat exposed to methomyl. Similarly, we anticipate methomyl residues in critical habitat will also result in high levels of impact the Brawleys Fork crayfish's arthropod prey.

In contrast, non-arthropod prey, such as fish, are not likely to experience more than low levels of mortality or sublethal adverse effects to growth or reproduction as estimated environmental concentrations of methomyl within critical habitat are lower than levels where toxicity studies in fish have observed adverse effects. As such, we do not anticipate there will be more than low levels of impacts to the non-arthropod prey PBF.

Table 80. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Benthic macroinvertebrates	High
non-arthropods (as prey or hosts)	X	Fish	Low
water quality	X	High flow waterbodies	High
habitat function	--	--	--

In summary, we anticipate high levels of impacts to water quality and arthropod prey PBFs in all areas of critical habitat, given how sensitive arthropod species like the Brawleys Fork crayfish and its prey are to methomyl (Table 80). In contrast, non-arthropod prey are less sensitive to methomyl exposure and are not likely to experience any adverse effects as a result of the proposed action.

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. While impacts to the non-arthropod PBF would be low, impacts to the water quality and arthropod prey PBFs would have high impacts to the species, preventing individuals from occupying sites and leading to high levels of mortality where exposure occurs. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Brawleys Fork crayfish's proposed critical habitat.

1) *Applicators need 3 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the proposed critical habitat of the Brawleys Fork crayfish by an order of magnitude (i.e., a 10-fold reduction).*

The PULA for the Brawleys Fork crayfish's critical habitat is the entirety of the proposed critical habitat. 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 methomyl.*

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Brawleys Fork crayfish's critical habitat will be low. As such, we anticipate there will be sufficient arthropod prey resources available and sufficiently high water quality to support the individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the proposed critical habitat for the Brawleys Fork crayfish.

References

U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Brawleys Fork Crayfish and Designation of Critical Habitat. Proposed Rule. Federal Register: 88.

Fish

Maryland darter (*Etheostoma sellare*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Continuity and sufficiency of streamflow.
- Permanence of riffle habitat (shallower, swifter segments of streams).
- High oxygen in swift waters (i.e., pollution sensitivity).
- Presence and quality of cover (i.e., crevices among stones, smaller pebbles, vegetation, or trapped wood flotsam) from predators and for spawning.

Maryland darters feed primarily on small riffle insects, snails, and invertebrates. As stated in the critical habitat (see *Critical Habitat* section), "darters [are] among the first fishes to show respiratory stress and failure with any reduction of oxygen availability" and "selective mortality of darters in habitats subjected to various other kinds of pollution is also documented."

Effects of the Action

We expect methomyl use will impact arthropod prey and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a moderate extent of overlap between the action area and the critical habitat (8.9% total overlap) (Table 81). There is a moderate level of past methomyl usage (up to 8.9% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 81. Overlap and past usage data for the critical habitat of the Maryland darter.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
8.9	8.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Maryland darter's habitat will range from 139-141 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crops being treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate individuals will still have some food resources available despite a reduction in the abundance of sensitive species. We also anticipate some of the impacted prey species will recover over time once methomyl residues have degraded after applications (which should occur within days to weeks of exposure). Therefore, we anticipate no more than medium levels of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair water quality for individuals of the species. However, we expect the Maryland darter is not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the water quality PBF are likely.

Table 82. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a moderate portion of critical habitat that is likely to be exposed over the proposed action's duration. We anticipate all exposed areas of critical habitat will likely experience moderate levels of adverse effects to arthropod prey abundance (Table 82). In contrast, we anticipate exposed areas are not likely to experience high levels of water quality impairments as estimated environmental concentrations of methomyl are not likely to cause more than low levels of mortality or sublethal adverse effects.

Rationale for Conclusion

There is a medium extent of overlap between the action area and the critical habitat, and usage is anticipated to be moderate. We anticipate moderate impacts to the arthropod prey PBF but anticipate no more than low levels of impacts to the water quality PBF throughout the designated critical habitat. However, in the Service's 2021 5-year status review for the Maryland darter, we recommended delisting due to extinction. Because the available information indicates this species is no longer extant in the wild, we do not anticipate the application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Maryland darter.

References

U.S. Fish and Wildlife Service. 1984. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Endangered Maryland Darter. Final Rule. Federal Register 49: 34228-34232.

Alabama cavefish (*Speoplatyrhinus poulsoni*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical and Biological Features

The final critical habitat rule does not describe PBFs for the critical habitat. The species forages on isopods, copepods, amphipods, and small crayfish. Groundwater degradation caused by fertilizers, pesticides, herbicides, animal wastes, petroleum, and other toxins is a threat to the species habitat and its prey source. Therefore, we have identified arthropod prey, non-arthropod prey, and water quality as relevant PBFs.

Effects of the Action

We expect methomyl use will impact arthropod prey, non-arthropod prey, and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the

critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

The species' critical habitat occurs within Key Cave National Wildlife Refuge. EPA's analysis shows that there is a high extent of overlap between the action area and the critical habitat (21.1% total overlap) (Table 83). However, available pesticide usage data on national wildlife refuges show no methomyl has been previously used on wildlife refuges managed by the U.S. Fish and Wildlife Service. As such, we do not anticipate any part of critical habitat will be directly treated with methomyl. However, off-site transport of methomyl used in adjacent agricultural areas may result in critical habitat exposure.

Table 83. Overlap and past usage data for the critical habitat of the Alabama cavefish.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
21.1	0[2]

Methomyl may reach the Alabama cavefish's habitat through sinkholes, groundwater recharge areas, and percolation through the soil. The karst habitats occupied by this species are susceptible to groundwater contamination from surface runoff because of the rapid penetration of karst rock and little natural filtration. However, we expect recharge of karst cave systems, or the process of aboveground water reaching the groundwater supply, will often take weeks to months, at which point we expect methomyl to be degraded and no longer present in the water as it enters the cave due to its low persistence in the environment. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat. However, given that we anticipate only low levels of methomyl are likely to enter critical habitat and that we anticipate remaining methomyl residues will degrade quickly after applications, we anticipate arthropod prey are likely to experience no more than low levels of adverse effects and are likely to recover quickly once methomyl residues degrade. Therefore, we anticipate no more than low levels of adverse effects to the arthropod prey PBF.

Similarly, we do not anticipate levels of methomyl that enter the Alabama cavefish's critical habitat are likely below levels where toxicity studies have observed adverse effects to test fish species. As such, we expect no more than low levels of adverse effects to the non-arthropod prey PBF and the water quality PBF are likely to occur.

[2] On-field usage data for this critical habitat represent methomyl usage on National Wildlife Refuges according to U.S. Fish and Wildlife Services pesticide usage reporting instead of usage data provided by the EPA.

Table 84. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	Low
non-arthropods (as prey or hosts)	X	presence of fish prey	Low
water quality	X	Large volume waterbodies	Low
habitat function	--	--	--

In summary, we do not anticipate the Alabama cavefish's critical habitat is likely to be directly exposed to methomyl applications on use sites, as U.S. Fish and Wildlife Service pesticide usage records indicate no methomyl usage has taken place on the refuge previously. While high levels of usage in adjacent agricultural areas may result in off-site transport into critical habitat areas, we anticipate very little methomyl is likely to enter the species' cave habitats given the long transport time required for surface water to enter the cave systems and methomyl's quick degradation rate after applications. We anticipate only low levels of adverse effects are likely to occur to the arthropod, non-arthropod, and water quality PBFs on an episodic basis (Table 84).

Rationale for Conclusion

The species' critical habitat occurs within Key Cave National Wildlife Refuge. Available pesticide usage data on national wildlife refuges show no methomyl has been previously used on wildlife refuges managed by the U.S. Fish and Wildlife Service. As such, we do not anticipate any part of critical habitat will be directly treated with methomyl. However, there are high levels of usage in adjacent agricultural areas that may result in off-site transport. While methomyl could be transported into critical habitat areas, we anticipate very little methomyl is likely to enter the species' cave habitats given the long transport time required for surface water to enter the cave systems and methomyl's quick degradation rate after applications. Recharge of karst cave systems, or the process of aboveground water reaching the groundwater supply, will often take weeks to months, at which point we expect methomyl to be degraded and no longer present in the water as it enters the cave due to its low persistence in the environment. We expect methomyl that enters the cave system where the cavefish occurs will be degraded and diluted, resulting in very low-level impacts to the arthropod prey, non-arthropod prey, and water quality PBFs of the critical habitat. Therefore, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Alabama cavefish.

References

U.S. Fish and Wildlife Service. 1977. Final Threatened Status and Critical Habitat for Five Species of Southeastern Fishes. Final Rule. Federal Register 42: 45526-45530.

Slackwater darter (*Etheostoma boschungi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

The final critical habitat rule does not describe PBFs for the critical habitat. Based on information in the 2024 5-Year Status Review, the species occurs in two required habitat types: nonbreeding habitat and breeding habitat. For the-majority-of the year, they live in small (60 cm wide to 15 cm deep) to moderately large (12 m wide and up to 2 m deep) gravel-bottomed pools of creeks where current is usually slow. As the name suggests, slackwater darters prefer streams with slow current or "slack" water. The breeding habitat is shallow water (5 to 10 cm deep), which originates in spring seeps, spring boils, or flooded fields that slowly run off into adjacent streams. Slackwater darter populations are entirely dependent upon connectivity between these two habitat types for successful recruitment. The slackwater darter primarily forages on crustaceans and insects. Pesticides are known to degrade surfacewater and groundwater and are listed as threats to the species. Therefore, we have identified arthropods and water quality as relevant PBFs.

In the 2024 5-Year Status Review, we state "[d]egradation of surface and groundwater caused by the intrusion of toxins, pesticides, herbicides, fertilizers, as well as industrial and domestic wastes from sewage/septic tank seepage, and stockyard runoff are current threats to the slackwater darter by reducing their survival and reproductive capacity. Farming and cattle are the principal industries surrounding the darter's habitat, increasing indirect habitat modifications through organic run-off and chemical run-off from surrounding land use practices. Since the breeding habitats are so limited, even a small chemical spill or biological pollutant could completely exterminate a breeding population."

Effects of the Action

We expect methomyl use will impact arthropod prey and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the

critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a medium extent of overlap between the action area and the critical habitat (7.6% total overlap) (Table 85). There is a moderate level of past methomyl usage (up to 7.6% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 85. Overlap and past usage data for the critical habitat of the slackwater darter.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
7.6	7.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the slackwater darter's habitat will range from 164-244 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crop treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the slackwater darter is an invertebrate generalist that can consume a wide range of invertebrate prey, we anticipate there will still be some food resources available in critical habitat despite a high reduction in the abundance of sensitive species. Additionally, given methomyl's low persistence in water, we expect adverse effects to aquatic prey will be temporary as upstream sources of prey will replenish prey resources in affected areas of critical habitat. Therefore, we anticipate no more than medium levels of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair water quality for individuals of the species. However, we expect the slackwater darter is not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the water quality PBF are likely.

Table 86. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBFs
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a moderate portion of critical habitat that is likely to be exposed over the proposed action's duration. We anticipate all exposed areas of critical habitat will likely experience high levels of adverse effects to arthropod prey abundance (Table 86). In contrast, we anticipate exposed areas are not likely to experience high levels of water quality impairments as estimated environmental concentrations of methomyl are not likely to cause more than low levels of mortality or sublethal adverse effects.

Rationale for Conclusion

There is a medium extent of overlap between the action area and the critical habitat, and usage is anticipated to be moderate. We do not anticipate more than low levels of impacts to the water quality PBF as estimated environmental concentrations of methomyl will be low within critical habitat. While there will be temporary impacts to arthropod prey availability, we do not anticipate the entire prey community will die with exposure to methomyl as we expect different species will exhibit different sensitivity to insecticides. Given that the slackwater darter is an opportunistic invertivore, we anticipate individuals will be able to rely on alternative prey species when sensitive prey species die from methomyl exposure. Furthermore, given that the prey community will recover after methomyl residues degrade (which will occur rapidly in natural environments), we expect these impacts to arthropod prey will only be temporary. Therefore, while we anticipate impacts to the water quality and arthropod prey PBFs, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the slackwater darter.

References

U.S. Fish and Wildlife Service. 1977. Final Threatened Status and Critical Habitat for Five Species of Southeastern Fishes. Final Rule. Federal Register 42: 45526-45530.

U.S. Fish and Wildlife Service. 1977. Final Correction and Augmentation of Critical Habitat Reorganization. Final Rule. Federal Register 42: 47840-47845.

U.S. Fish and Wildlife Service. 2024. Slackwater darter (*Etheostoma boschungi*) 5-Year Status Review: Summary and Evaluation. Daphne, Alabama. 11 pp.

Waccamaw silverside (*Menidia extensa*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- High-quality, clear, open water with a neutral pH
- Clean sand substrate

In the critical habitat rule (see *Critical Habitat* section), "pesticide/herbicide application" is listed as an activity that occurs in the watershed and could impact the critical habitat for the Waccamaw silverside.

Effects of the Action

Methomyl use is likely to affect water quality, which is a critical habitat PBF essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat's watershed (2.4% total overlap) (Table 87). There is a low level of past methomyl usage (up to 2.4% critical habitat's watershed treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action. This low level of usage is corroborated by additional data from the USDA Census of Agriculture indicate low levels of past insecticide use in the counties containing critical habitat units (up to 2.4% critical habitat treated annually with any insecticide). As such, we have high confidence that there is a low level of exposure to critical habitat.

Table 87. Overlap and past usage data for the critical habitat of the Waccamaw silverside.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
2.4	2.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Waccamaw silverside's habitat will range from 28-35 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Based on available toxicity data in fish, we anticipate predicted environmental concentrations of methomyl are not likely to cause more than low levels of mortality and sublethal effects (e.g., reduced growth and reproduction). Additionally, since methomyl degrades quickly in natural environments (on the order of days to weeks), we anticipate these impairments to water quality will be limited to short periods after applications. Due to the low level of insecticide usage reported by the Census of Agriculture, we anticipate methomyl exposure is not likely to occur frequently over the duration of the proposed action.

Table 88. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow rate waterbodies, Large volume waterbodies	Low
habitat function	--	--	--

In summary, we anticipate a small extent of overlap between the action area and critical habitat, and that only a small portion is likely to be treated each year. Within exposed areas, we anticipate there will be low levels of adverse effects to water quality that will only be temporary and are not likely to occur frequently over the project duration (Table 88). Therefore, we anticipate the overall risk of adverse effects to the PBFs of critical habitat is low.

Rationale for Conclusion

There is a low extent of overlap between the action area and the critical habitat (2.4%) and low levels of past methomyl usage (up to 2.4% watershed treated annually), which is corroborated by low levels of insecticide usage reported in the USDA Census of Agriculture. Water quality is a PBF of the critical habitat. However, we anticipate only low adverse effects to the water quality PBF due to the low anticipated exposure from usage within the range, and the high flow and large volume water bodies used by this species which would result in low methomyl concentrations with low toxicity to the species. Therefore, while we anticipate impacts to the water quality PBF are possible, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Waccamaw silverside.

References

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Neuse River Waterdog, Endangered Species Status for Carolina Madtom, and Designations of Critical Habitat. Final Rule. Federal Register 86.

Arkansas River shiner (*Notropis girardi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Natural, unregulated hydrologic regime with episodes of flood and drought or, if flows are modified or regulated, a hydrologic regime characterized by the duration, magnitude, and frequency of flow events capable of forming and maintaining channel and instream habitat.
- A complex, braided channel with pool, riffle (shallow area in a streambed causing ripples), run, and backwater components.
- Unimpounded stretches of flowing water of sufficient length to allow hatching and development of the larvae.
- Substrates of predominantly sand, with some patches of silt, gravel, and cobble
- Water quality characterized by low concentrations of contaminants and natural, daily, and seasonally variable temperature, turbidity, conductivity, dissolved oxygen, and pH.
- Suitable reaches of aquatic habitat and adjacent riparian habitat sufficient to support abundant terrestrial, semiaquatic, and aquatic invertebrates.
- Few or no predatory or competitive non-native fish species present

The critical habitat final rule (see *Effects of Critical Habitat Designation*) states that activities that may adversely affect critical habitat for the Arkansas River shiner include, "[a]ctions that significantly and detrimentally alter the water chemistry in any of the designated stream segments. Possible actions would include intentional or unintentional release of chemical lor biological pollutants into the surface water or connected groundwater as a point source or by dispersed release (non-point)."

Effects of the Action

We expect methomyl use will impact arthropod prey and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (4.6% total overlap) (Table 89). There is a low level of past methomyl usage (up to 4.6% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 89. Overlap and past usage data for the critical habitat of the Arkansas River shiner.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
4.6	4.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the Arkansas River shiner's habitat will range from 407-816 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crop treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the Arkansas River shiner is an invertebrate generalist that can consume a wide range of invertebrate prey, we anticipate individuals will still have some food resources available despite a reduction in the abundance of sensitive species. We also anticipate some of the impacted prey species will recover over time once methomyl residues have degraded after applications (which should occur within days to weeks of exposure). As such, while we expect some arthropod prey will still be available after exposure and any losses will likely only be temporary, we anticipate overall moderate levels of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, indicating that the presence of methomyl in critical habitat can impair water quality for individuals of the species. In areas that accumulate high levels of methomyl (such as areas of low flow or shallow areas with low water volume), fish are likely to experience a high level of mortality (up to 2-24% of exposed individuals will die, depending on the specific methomyl use). In contrast, areas with high flow rates or larger water volume (e.g., deeper pools) are not likely to accumulate more than low levels of methomyl, which will not cause direct adverse effects to fish species (including mortality or sublethal effects to growth and reproduction). Thus, we anticipate only some areas within critical habitat will experience water quality impairments at a level that would prevent individuals from using those areas of critical habitat. Given that methomyl will degrade quickly (over the course of days to weeks), we anticipate impairments to water quality will be limited to short periods after applications, and that the PBF can recover once methomyl residues degrade. However, these temporary impacts will likely occur repeatedly over the duration of the proposed action based on the high level of past usage within critical habitat. As such, we anticipate low to high adverse effects to the water quality PBF are likely to occur after applications, depending on the size of the waterbody.

Table 90. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low-High (depending on waterbody)
habitat function	--	--	--

In summary, we anticipate areas of critical habitat exposed to methomyl will experience temporary moderate impacts to arthropod prey abundance (Table 90). Similarly, we anticipate some areas of critical habitat (such as low flow and shallow areas) will experience high levels of water quality impairments when exposed to methomyl. However, we anticipate adverse effects will be limited to only a small portion of critical habitat as there is a low extent of overlap between the action area and the watershed containing designated critical habitat as well as a low level of past methomyl usage within the watershed. As such, we anticipate proposed action will result in no more than low levels of adverse effects to the conservation value of the Arkansas River shiner's designated critical habitat as a whole.

Rationale for Conclusion

There is a low extent of overlap between the action area and the critical habitat, and usage within the critical habitat is anticipated to be low. Impacts to the arthropod prey and water quality PBFs could have high impacts to the species, however, we anticipate these adverse effects will be limited to only small areas of critical habitat given the low extent of overlap and past usage within the watershed containing designated critical habitat. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Arkansas River shiner.

References

U.S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for the Arkansas River Basin Population of the Arkansas River Shiner (*Notropis girardi*). Final Rule. Federal Register 70: 59808-59846.

Topeka shiner (*Notropis topeka (=tristis)*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Streams most often with permanent flow, but that can become intermittent during dry periods.
- Side-channel pools and oxbows either seasonally connected to a stream or maintained by groundwater inputs, at a surface elevation equal to or lower than the bankfull discharge stream elevation.
- Water quality including temperature (1 to 30° C), total suspended solids (0 to 2000 ppm), conductivity (100 to 800 mhos), dissolved oxygen (4 ppm or greater), pH (7.0 to 9.0), and other chemical characteristics that may change seasonally.
- Pools or runs with water velocities less than 0.5 m/sec (20 in/sec) and depths between 0.1 to 2.0 m (4 to 80 in).
- Medium amounts of instream aquatic cover, such as woody debris, overhanging terrestrial vegetation, and aquatic plants.
- Sand, gravel, cobble, and silt substrates with amounts of fine sediment and substrate embeddedness that allows for nest building and maintenance of nests and eggs.
- Adequate terrestrial, semiaquatic, and aquatic invertebrate populations.
- A hydrologic regime capable of forming, maintaining, or restoring the flow periodicity, channel morphology, fish community composition, off-channel habitats, and habitat components.
- Few or no nonnative predatory or nonnative competitive species present.

In the critical habitat rule (see *Effects of Critical Habitat Designation*), "release of chemical or biological pollutants into the surface water or connected groundwater at a point source or by dispersed release (non-point)" is listed as an action that would "[s]ignificantly and detrimentally [alter] the water chemistry" of Topeka shiner critical habitat.

Effects of the Action

We expect methomyl use will impact arthropod prey and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (10.2% total overlap) (Table 91). There is a high level of past methomyl usage (up to 10.2% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 91. Overlap and past usage data for the critical habitat of the Topeka shiner.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
10.2	10.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Topeka shiner's habitat will range from 321-789 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crop treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the Topeka shiner is an invertebrate generalist that can consume a wide range of invertebrate prey, we anticipate some food resources will still be available in critical habitat despite a reduction in the abundance of sensitive species. Additionally, we anticipate methomyl will degrade quickly in natural environments (on the order of days to weeks), indicating that some of the impacted prey species will recover over time after applications once methomyl residues have degraded. As such, we expect some arthropod prey will still be available after exposure and any losses will likely only be temporary, resulting in moderate levels of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, indicating that the presence of methomyl in critical habitat can impair water quality for individuals of the species. In areas that accumulate high levels of methomyl (such as areas of low flow or shallow areas with low water volume), fish are likely to experience a high level of mortality (up to 22% mortality of exposed individuals). In contrast, areas with high flow rates or larger water volume (e.g., deeper pools) are not likely to accumulate more than low levels of methomyl, which will not cause direct adverse effects to fish species (including mortality or sublethal effects to growth and reproduction). Thus, we anticipate only some areas within critical habitat will experience water quality impairments at a level that would prevent individuals from using those areas of critical habitat. Given that methomyl will degrade quickly (over the course of days to weeks), we anticipate impairments to water quality will be limited to short periods after applications, and that the PBF can recover once methomyl residues degrade. However, these temporary periods of water quality degradation will likely occur episodically after applications given the high level of past usage in critical habitat. As such, we anticipate a range of low to high levels of adverse effects to the water quality PBF are likely to occur after applications, depending on the size of the exposed waterbody.

Table 92. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBFs
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low-High (depending on waterbody)
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action's duration. We anticipate all exposed areas of critical habitat will likely experience moderate impacts to arthropod prey abundance (Table 92). We also anticipate exposed areas are likely to experience a range of low to high levels of water quality impairments (depending on the waterbody's characteristics). While we anticipate adverse effects will be limited to short periods after applications and are likely to recover once remaining methomyl residues degrade (which should occur within days to weeks of exposure), impacts to both PBFs are expected to occur episodically in a large portion of the critical habitat after applications. As such, we anticipate proposed action will result in high levels of adverse effects to the Topeka shiner's designated critical habitat as a whole.

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. Impacts to the arthropod prey and water quality PBFs would have high impacts to the species, preventing individuals from occupying or foraging at sites, and leading to high levels of mortality, sub-lethal effects or losses of sufficient types or quantities of prey items required by the shiner in exposed areas. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Topeka shiner's critical habitat.

1) *Methomyl must be applied using the following buffers: 50 feet for aerial applications, 10 feet for ground applications, and 25 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for Topeka shiner by 74-99% for aquatic habitat. 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.*
2) *Applicators need 6 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the critical habitat of the Topeka shiner by two orders of magnitude (i.e., a 100-fold reduction).*

The PULA for the Topeka shiner's critical habitat is the entirety of the designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Topeka shiner's critical habitat will be low. As such, we anticipate there will be sufficient arthropod prey resources available and sufficiently high levels of water quality to support the individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Topeka shiner.

References

U.S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants Final Designation of Critical Habitat for the Topeka Shiner. Final Rule. Federal Register 69: 44736-44770.

Carolina madtom (*Noturus furiosus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel, small cobble, coarse sand, and leaf litter substrates) as well as abundant cover used for nesting.
- Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain instream habitats where the species is found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the fish's habitat, food availability, and ample oxygenated flow for spawning and nesting habitat.
- Water quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- Aquatic macroinvertebrate prey items, which are typically dominated by larval midges, mayflies, caddisflies, dragonflies, and beetle larvae.

The features essential to the conservation of the Carolina madtom and Neuse River waterdog may require special management considerations or protections to reduce the following threats: (1) Urbanization of the landscape, including (but not limited to) land conversion for urban and commercial use, infrastructure (roads, bridges, utilities), and urban water uses (water supply reservoirs, wastewater treatment, etc.); (2) nutrient pollution and sedimentation from agricultural activities that impact water quantity and quality; (3) significant alteration of water quality; (4) improper forest management or clearcuts in riparian areas; (5) culvert and pipe installation that create barriers to movement; (6) impacts from invasive species; (7) changes and shifts in seasonal precipitation patterns as a result of climate change; and (8) other watershed and floodplain disturbances that release sediments or nutrients into the water.

Effects of the Action

Methomyl use is likely to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (42.3% total overlap) (Table 93). There is a high level of past methomyl usage (up to 42.3% critical habitat treated annually), suggesting a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 93. Overlap and past usage data for the critical habitat of the Carolina madtom.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
42.3	42.3

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the Carolina madtom's habitat will range from 234-244 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crop treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Since the Carolina madtom is an invertebrate generalist that can consume a wide range of invertebrate prey, we anticipate there will still be some food resources available in critical habitat despite a high reduction in the abundance of sensitive species. Additionally, given methomyl's low persistence in water, we expect adverse effects to aquatic prey will be temporary as upstream sources of prey will replenish prey resources in affected areas of critical habitat. Therefore, we anticipate no more than medium levels of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair water quality for individuals of the species. However, we expect the Carolina madtom is not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the water quality PBF are likely.

Table 94. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow rate waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat that is likely to be exposed over the proposed action’s duration. We anticipate all exposed areas of critical habitat will likely experience medium levels of adverse effects to arthropod prey abundance, resulting in overall moderate effects to the PBF (Table 94). In contrast, we anticipate exposed areas are not likely to experience high levels of water quality impairments as estimated environmental concentrations of methomyl are not likely to cause more than low levels of mortality or sublethal adverse effects.

Rationale for Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. We do not anticipate more than low levels of impacts to the water quality PBF as estimated environmental concentrations of methomyl will be low within critical habitat. While there will be adverse effects to arthropod prey availability, we do not anticipate the entire prey community will die with exposure to methomyl as we expect different species will exhibit different sensitivity to insecticides. Given that the Carolina madtom is an opportunistic invertivore, we anticipate individuals will be able to rely on alternative prey species when sensitive prey species die from methomyl exposure. Furthermore, given that the prey community will recover after methomyl residues degrade (which will occur rapidly in natural environments), we expect these impacts to arthropod prey will only be temporary. Therefore, while we anticipate impacts to the water quality and arthropod prey PBFs, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Carolina madtom.

References

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Neuse River Waterdog, Endangered Species Status for Carolina Madtom, and Designations of Critical Habitat. Final Rule. Federal Register 86.

Chucky madtom (*Noturus crypticus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Gently flowing run and pool reaches of geomorphically stable streams with cool, clean, flowing water; shallow depths; and connectivity between spawning, foraging, and resting sites to promote gene flow throughout the species' range.
- Stable bottom substrates composed of relatively silt-free, flat gravel, cobble, and slab-rock boulders.
- An instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) sufficient to provide permanent surface flows, as measured during years with average rainfall, and to maintain benthic habitats utilized by the species.
- Adequate water quality characterized by medium stream temperatures, acceptable dissolved oxygen concentrations, medium pH, and low levels of pollutants.
- Aquatic macroinvertebrates, including midge larvae, mayfly nymphs, caddisfly larvae, and stonefly larvae.

As stated in the final rule designating critical habitat, the current range of the Chucky madtom is restricted an approximate 3 km (1.8 mi) reach of Little Chucky Creek in Green County, Tennessee. Contaminants associated with agriculture (e.g., fertilizers, pesticides, herbicides, and animal waste) can cause degradation of water quality and habitats through instream oxygen deficiencies, excess nutrification, and excessive algal growths. Activities that may affect critical habitat, as outlined in the application of the *"Adverse Modification" Standard* in the final rule, include "Actions that would significantly alter water quantity or water quality (for example, temperature, pH, contaminants, and excess nutrients). Such activities could include, but are not limited to, hydropower discharges, or the release of chemicals, biological pollutants, or heated effluents into surface water or connected groundwater at a point source or by dispersed release (nonpoint source). These activities could alter water conditions that are beyond the tolerances of these fishes and result in direct or cumulative adverse effects to these species." The *Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirements*" section of the rule states, "we identify aquatic macroinvertebrate prey items; cool, clean, flowing water; shallow depths; permanent surface flows, as measured during average rainfall years; and adequate water quality with substrates that are relatively silt-free to be an essential physical or biological feature for the Chucky madtom." The Chucky madtom's specific prey items are unknown but are inferred from prey used by the least madtom (*Noturus hildebrandi*). The critical habitat final rule also states that, "As relatively sedentary animals, madtoms must tolerate the full range of such parameters that occur naturally within the streams where they persist."

Effects of the Action

We expect methomyl use will impact arthropod prey and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a low extent of overlap between the action area and the critical habitat (2.1% total overlap) (Table 95). There is a low level of past methomyl usage (up to 2.1% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action. Furthermore, additional data from the USDA Census of Agriculture indicate low levels of past insecticide use in the counties containing critical habitat units (up to 0.7% critical habitat treated annually with any insecticide), suggesting that exposure to this critical habitat may have a lower level of exposure than the overlap and usage data report. Because Census of Agriculture data is collected at a more geographically specific scale then other usage data, we expect this to be a more accurate indicator of insecticide usage within the range.

Table 95. Overlap and past usage data for the critical habitat of the Topeka shiner.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
2.1	2.1

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts maximum methomyl concentrations within the chucky madtom's habitat will reach up to 164 μg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific crop treated. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Thus, we anticipate individuals will have at least some food resources available in critical habitat despite a reduction in the abundance of sensitive species. We anticipate methomyl will degrade rapidly in natural environments (on the order of days to weeks), suggesting that some of the impacted prey species will recover over time after applications once methomyl residues have degraded. As such, while we expect impacts to arthropod prey, we anticipate impacts will be temporary, resulting in overall moderate levels of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, suggesting that the presence of methomyl in critical habitat can impair water quality for individuals of the species. However, we expect the chucky madtom is not likely to experience more than low levels of mortality (i.e., <1% exposed individuals will die) or sublethal adverse effects at estimated environmental concentrations of methomyl expected to occur in critical habitat. As such, we anticipate only low levels of impacts to the water quality PBF are likely.

Table 96. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBFs
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a small portion of critical habitat that is likely to be exposed over the proposed action's duration. We anticipate all exposed areas of critical habitat will likely experience moderate levels of adverse effects to arthropod prey abundance (Table 96). In contrast, we anticipate exposed areas are not likely to experience high levels of water quality impairments as estimated environmental concentrations of methomyl are not likely to cause more than low levels of mortality or sublethal adverse effects.

Rationale for Conclusion

There is a low extent of overlap between the action area and the critical habitat, and usage is anticipated to be low. Additional usage data from the USDA Census of Agriculture indicates very low levels of insecticides are used within the areas containing designated critical habitat. We do not anticipate more than low levels of impacts to the water quality PBF as estimated environmental concentrations of methomyl will be low within critical habitat. While there will be temporary impacts to arthropod prey availability, we do not anticipate the entire prey community will die with exposure to methomyl as we expect different species will exhibit different sensitivity to insecticides. Given that the chucky madtom is an opportunistic invertivore, we anticipate individuals will be able to rely on alternative prey species when sensitive prey species die from methomyl exposure. Furthermore, we anticipate these impacts will be limited to only small portions of critical habitat. Therefore, while we anticipate impacts to the water quality and arthropod prey PBFs, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. As such, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the chucky madtom.

References

U.S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace. Final Rule. Federal Register 77: 63604-63668.

Spring pygmy sunfish (*Elassoma alabamae*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Springs and connecting spring-fed reaches and wetlands that are geomorphically stable and relatively low-gradient
- Yearly averages of water quality with optimal temperatures of 57.2 to 68°F (14 to 20°C), pH 6.0 to 7.7, dissolved oxygen of 6.0 parts per million (ppm) or greater, low concentrations of free or suspended solids with turbidity measuring less than 15 NTU and 20 mg/l TSS
- Hydrologic flow regime (magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain spring habitats
- Macroinvertebrates, including *Daphnia* spp., amphipods, chironomids, or small snails
- Aquatic, emergent, and semi-emergent vegetation

Activities that may affect critical habitat that are described in the "Application of the "Adverse Modification" Standard section of the final rule include, "Actions that would significantly alter water chemistry or water quality (e.g., temperature, pH, contaminants, and excess nutrients). Such activities could include, but are not limited to, the unsustainable use or release of chemicals, such as pesticides and fertilizers and biological pollutants, into surface water or groundwater. These activities could alter water conditions that are beyond the tolerances of this species and result in direct or cumulative adverse effects to the species and its life cycle." Adequate water quality is essential for normal behavior, growth, and viability during all life stages of the spring pygmy sunfish.

Effects of the Action

We expect methomyl use will impact arthropod prey, non-arthropod prey, and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a high extent of overlap between the action area and the critical habitat (47.4% total overlap) (Table 131). There is a high level of past methomyl usage (up to 39.2% critical habitat treated annually). While there is a large extent of overlap and usage, we expect exposure is unlikely to occur as over 90% of critical habitat is located on federally owned land, including the Wheeler National Wildlife Refuge and the Swan Creek Wildlife Management Area. Pesticide usage records from the U.S. Fish and Wildlife Service indicate no methomyl has been used within the Wheeler National Wildlife Refuge since 2013, suggesting that methomyl use and exposure is unlikely to occur.

Table 97. Overlap and past usage data for the critical habitat of the spring pygmy sunfish.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
47.4	39.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the spring pygmy sunfish's habitat will reach up to 164.7 µg/L, based on the methomyl use sites most prevalent in the vicinity of critical habitat. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Thus, we anticipate individuals will have at least some food resources available in critical habitat despite a reduction in the abundance of sensitive species. Additionally, we anticipate methomyl will degrade rapidly in natural environments (on the order of days to weeks), suggesting that some of the impacted prey community will recover quickly. As such, we an overall moderate level of impact to the arthropod prey PBF.

In contrast to arthropod prey, available toxicity data indicate that the non-arthropod invertebrate species that the spring pygmy sunfish consumes, including aquatic snails, are not likely to experience more than low levels of adverse effects to survival, growth, or reproduction at concentrations of methomyl likely to occur in critical habitat. As such, we expect there will be no more than low levels of impacts to non-arthropod prey availability and no adverse effects to the non-arthropod PBF.

We expect fish can experience adverse effects from methomyl exposure, indicating that the presence of methomyl in critical habitat can impair water quality for individuals of the species. However, based on available toxicity data in fish, we do not anticipate direct adverse effects are likely to occur at estimated environmental concentrations of methomyl in critical habitat. As such, we only anticipate low levels of impacts to the water quality PBF.

Table 98. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Macroinvertebrate prey	Moderate
non-arthropods (as prey or hosts)	X	Gastropod prey	Low
water quality	X	Low flow waterbodies	Low
habitat function	--	--	--

We anticipate the arthropod prey PBF will experience moderate levels of impact as we expect temporary large decreases in the availability of arthropod prey species. However, we do not expect all arthropod prey will die as we expect natural variability in sensitivities to methomyl across different species and anticipate the arthropod prey community will recover once methomyl residues degrade. Furthermore, given that non-arthropod prey species will not likely experience any decreases in their abundance, we expect the spring pygmy sunfish will still have food resources available. While methomyl residues may cause adverse effects to fish, we do not anticipate estimated environmental concentrations of methomyl in the spring pygmy sunfish's critical habitat will be high enough to cause any adverse effects to individuals, indicating no more than low levels of impacts to the water quality PBF. As such, we anticipate the overall risk of adverse effects to critical habitat is low.

Rationale for Conclusion

While there is a high extent of overlap and past methomyl usage within critical habitat, we do not anticipate methomyl use is likely to result in exposure as the vast majority of critical habitat is on federal lands (including a National Wildlife Refuge), where we expect pesticide usage will be low, and carried out in a manner that is intended to avoid and minimize exposure and impacts to listed species resources. Thus, while we expect temporary but high levels of adverse effects to arthropod prey PBFs, we expect exposure will be minimized and that the proposed action is not likely to destroy or adversely modify critical habitat.

References

U. S. Fish and Wildlife Service. 2019. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Spring Pygmy Sunfish. Final Rule. Federal Register 84:24987-25009.

Peppered chub (*Macrhybopsis tetranema*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Unobstructed river segments greater than 127 river miles in length that are characterized by a complex braided channel and substrates of predominantly sand, with some patches of silt, gravel, and cobble.
- Flowing water with adequate depths to support all life stages and episodes of elevated discharge to facilitate successful reproduction, channel and floodplain maintenance, and sediment transportation.
- Water of sufficient quality to support survival and reproduction, which includes, but is not limited to, the following conditions:
    - Water temperatures generally less than 98.2 degrees Fahrenheit (36.8 degrees Celsius);
    - Dissolved oxygen concentrations generally greater than 3.7 parts per million;
    - Conductivity generally less than 16.2 millisiemens per centimeter;
    - pH generally ranging from 5.6 to 9.0; and
    - sufficiently low petroleum and other pollutant concentrations such that reproduction and/or growth is not impaired.
- Native riparian vegetation capable of maintaining river water quality, providing a terrestrial prey base, and maintaining a healthy riparian ecosystem.
- A level of predatory or competitive, native or nonnative fish present such that any peppered chub population's resiliency is not affected.

Effects of the Action

We expect methomyl use will impact arthropod prey and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

For critical habitats designated for aquatic species, rather than using the designated critical habitat units, the EPA uses the HUC-12 watersheds that contain the designated critical habitat units to calculate the extent of overlap and past methomyl usage. Given this expansion of area considered for overlap and usage, we only use on-field overlap to characterize potential exposure as we anticipate all residues that leave use sites will be collected in the waterbodies within the critical habitat regardless of how residues leave treated sites or where in the watershed they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that critical habitat designated for aquatic species will experience.

There is a moderate extent of overlap between the action area and the critical habitat (8.6% total overlap) (Table 99). There is a low level of past methomyl usage (up to 3.7% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 99. Overlap and past usage data for the critical habitat of the peppered chub.

% Total Critical Habitat Overlap	% Critical Habitat Treated Annually
8.6	3.7

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the peppered chub's habitat will range from 356-789 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume) and the specific application of methomyl used. These estimated environmental concentrations incorporate relevant existing conservation measures on product labels, which include a 48-hour rain restriction and application buffers to waterbodies.

Available toxicity data indicate that arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Thus, we anticipate individuals will have at least some food resources available in critical habitat despite a reduction in the abundance of sensitive species We anticipate methomyl will degrade rapidly in natural environments (on the order of days to weeks), suggesting that some of the impacted prey species will recover over time after applications once methomyl residues have degraded. As such, we anticipate an overall moderate level of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that fish can experience adverse effects from methomyl exposure, indicating that the presence of methomyl in critical habitat can impair water quality for individuals of the species. In areas that accumulate high levels of methomyl (such as areas of low flow or shallow areas with low water volume), fish are likely to experience a high level of mortality (up to 22.6% mortality of exposed individuals). In contrast, areas with high flow rates are not likely to accumulate more than low levels of methomyl, which will not cause direct adverse effects to fish species (including mortality or sublethal effects to growth and reproduction). Thus, we anticipate only some areas within critical habitat will experience water quality impairments at a level that would prevent individuals from using those areas of critical habitat. As such, we anticipate a range of low to high levels of adverse effects to the water quality PBF are likely to occur after applications, depending on the size of the waterbody.

Table 100. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Larval insects, small crustaceans	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	Low flow/low volume waterbodies, high flow waterbodies	Low – High (depending on waterbody)
habitat function	--	--	--

Rationale for Preliminary Conclusion

There is a moderate extent of overlap between the action area and the critical habitat, and usage is anticipated to be low. We expect moderate impacts to the arthropod prey PBF and potentially high impacts to the water quality PBF as estimated environmental concentrations may cause high levels of mortality and prevent individuals from occupying critical habitat. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the peppered chub's critical habitat.

1) *Applicators need 3 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the critical habitat of the peppered chub by an order of magnitude (i.e., a 10-fold reduction).*

The PULA for the peppered chub's critical habitat is the entirety of the designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the peppered chub's critical habitat will be low. As such, we anticipate there will be sufficient arthropod prey resources available and sufficiently high levels of water quality to support the individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the peppered chub.

References

U.S. Fish and Wildlife Service. 2018. Species status assessment report for the Arkansas River shiner (*Notropis girardi*) and peppered chub (*Macrhybopsis tetranema*), version 1.0, with appendices. October 2018. Albuquerque, NM. 172 pp

U.S. Fish and Wildlife Service. 2022. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Peppered Chub and Designation of Critical Habitat. Final Rule. Federal Register 87

Insects

Hine's emerald dragonfly (*Somatochlora hineana*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Organic soils (histosols, or with organic surface horizon) overlying calcareous substrate (predominantly dolomite and limestone bedrock).
- Calcareous water from intermittent seeps and springs and associated shallow, small, slow flowing streamlet channels, rivulets, and/or sheet flow within fens.
- Emergent herbaceous and woody vegetation for emergence facilitation and refugia.
- Occupied burrows maintained by crayfish for refugia.
- Aquatic macroinvertebrates, including mayflies, aquatic isopods, caddisflies, midge larvae, and aquatic worms.
- Natural plant communities near the breeding/larval habitat which may include fen, marsh, sedge meadow, dolomite prairie, and the fringe (up to 328 ft (100m)) of bordering shrubby and forested areas with open corridors for movement and dispersal.
- Small flying insect species (e.g., dipterans) for adult foraging.

The PBFs focus on areas containing the characteristics necessary to support life-history traits, including feeding, breeding, and sheltering for all life stages of the species. The Hine's emerald dragonfly prey includes macroinvertebrates and insects. In the critical habitat final rule (see *Adverse Modification Standard*), "[a]ctions that would significantly alter water quantity and quality", including "release of chemicals, biological pollutants, or heated effluents," may affect critical habitat.

Effects of the Action

We expect methomyl use will impact arthropod prey and water quality, which are critical habitat PBFs that are essential for the conservation of the species.

There is a moderate extent of overlap between the action area and the critical habitat (8.8% total overlap) (Table 101). There is a medium level of past methomyl usage (up to 8.8% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action. However, additional data from the USDA Census of Agriculture indicate low levels of past insecticide use in the counties containing critical habitat units (up to 0.7% critical habitat treated annually with any insecticide), suggesting that exposure to this critical habitat may have a lower level of exposure than the overlap and usage data report.

Table 101. Overlap and past usage data for the critical habitat of Hine's emerald dragonfly.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
1	7.8	8.8	1	7.8	8.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that terrestrial and aquatic arthropods are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. As such, we anticipate that larvae exposed to methomyl in aquatic habitats will die, indicating a high level of adverse effects to the water quality PBF.

Similarly, we anticipate there will be adverse effects to the aquatic and terrestrial arthropods that the species feeds on as larvae and adults, respectively. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Thus, we anticipate individuals will still have food resources available in critical habitat despite a reduction in the abundance of sensitive species, resulting in a medium level of adverse effects to the arthropod prey PBF.

We expect methomyl will degrade rapidly in natural environments (likely within days to weeks). As such, we anticipate adverse effects to arthropod prey and water quality are temporary and are likely to recover after methomyl residues degrade. Given the low level of insecticide usage within the counties containing critical habitat units reported by the Census of Agriculture, we anticipate methomyl usage and exposure to critical habitat are not likely to be frequent over the duration of the proposed action or occur over a large portion of critical habitat each year.

Table 102. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	X	Low flow waterbodies	High
habitat function	--	--	--

In summary, a moderate portion of critical habitat overlaps with the action area. In areas exposed, we anticipate a medium level of adverse effects to the arthropod prey PBF and a high level of adverse effects to the water quality PBF are likely to occur (Table 102). However, we anticipate these adverse effects will be temporary, limited to a small area, and not likely to occur frequently over the duration of the proposed action given the low level of insecticide usage reported by the Census of Agriculture.

Rationale for Conclusion

While the Hine's emerald dragonfly relies on a healthy arthropod prey community and uncontaminated water for their survival and recovery, we do not anticipate that individual dragonflies will experience an appreciable decrease in their ability to find prey or persist in waters within their preferred habitats as methomyl exposure is temporary, limited to a small area of critical habitat, and not likely to occur frequently over the duration of the proposed action given the low level of insecticide usage reported by the Census of Agriculture. As such, we anticipate the species will continue to be able to use all areas of critical habitat for recovery. In summary, we expect temporary, limited losses of the arthropod prey community PBF and temporary impairment of the water quality PBF from methomyl contamination within a small portion of critical habitat. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Hine's emerald dragonfly.

References

U. S. Fish and Wildlife Service. 2010. Endangered and Threatened Wildlife and Plants; Final Revised Critical Habitat for Hine's Emerald Dragonfly (*Somatochlora hineana*). Final Rule. Federal Register 75:21394-21453.

Comal Springs riffle beetle (*Heterelmis comalensis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Springs, associated streams, and underground spaces immediately inside of or adjacent to springs, seeps, and upwellings that include.
    - High-quality water with no or minimal pollutant levels of soaps, detergents, heavy metals, pesticides, fertilizer nutrients, petroleum hydrocarbons, and semivolatile compounds such as industrial cleaning agents.
- Food supply that includes, but is not limited to, detritus (decomposed materials), leaf litter, living plant material, algae, fungi, bacteria, other microorganisms, and decaying roots.

This species occurs in spring outlets and subsurface areas. In the critical habitat rule, we identified pesticides and herbicides associated with pathogenic organisms or invasive species as one of the threats to water quantity and quality.

Effects of the Action

We expect methomyl use will impact water quality, which is a critical habitat PBF that is essential for the conservation of the species.

There is a moderate extent of overlap between the action area and the critical habitat (9.1% total overlap) (Table 103). There is a medium level of past methomyl usage (up to 9.1% critical habitat treated annually), suggesting that a moderate portion of the critical habitat is likely to be exposed over the duration of the proposed action. However, additional data from the USDA Census of Agriculture indicate low levels of past insecticide use in the counties containing critical habitat units (up to 0.2% critical habitat treated annually with any insecticide), suggesting that exposure to this critical habitat may have a lower level of exposure than the overlap and usage data report.

Table 103. Overlap and past usage data for the critical habitat of Comal Springs riffle beetle.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
0.3	8.8	9.1	0.3	8.8	9.1

The Comal Springs riffle beetle lives in flowing waters from spring runs at Comal Springs and San Marcos Springs. Given the rapid degradation rate of methomyl, we anticipate no more than minute levels of methomyl are likely to occur in the waters emerging from the springs themselves as methomyl residues are likely to degrade in the time required for surface waters to percolate into the groundwater aquifers that feed the species' spring habitats. However, spray drift deposition and runoff from nearby agriculture may still result in exposure to the species' critical habitat. EPA's environmental fate modeling predicts methomyl concentrations within the Comal Spring riffle beetle's habitat will range from 16.6-2,978 µg/L depending on the specific habitat characteristics (e.g., flow rate, water volume). Available toxicity data indicate that aquatic insects are sensitive to methomyl exposure and are likely to die, even at low exposure concentrations. As such, we expect the presence of methomyl will reduce water quality to a level where individuals may not be able to use areas of critical habitat exposed to methomyl.

We expect methomyl will degrade rapidly in natural environments (likely within days to weeks). As such, we anticipate adverse effects to water quality are temporary and are likely to recover after methomyl residues degrade. Given the low level of insecticide usage within the counties containing critical habitat units reported by the Census of Agriculture, we anticipate methomyl usage and exposure to critical habitat are not likely to be frequent over the duration of the proposed action or occur over a large portion of critical habitat each year.

Table 104. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	X	High flow waterbodies, Low flow waterbodies	High
habitat function	--	--	--

In summary, a moderate portion of critical habitat overlaps with the action area. In areas exposed, we anticipate a high level of adverse effects to the water quality PBF are likely to occur (Table 104). However, we anticipate these adverse effects will be temporary, limited to a small area, and not likely to occur frequently over the duration of the proposed action given the low level of insecticide usage reported by the Census of Agriculture.

Rationale for Conclusion

While the Comal Springs riffle beetle relies on clean, uncontaminated water for their survival and recovery, we do not anticipate that individual beetles will experience an appreciable decrease in their ability to persist in waters within their preferred habitat as methomyl exposure is temporary, limited to a small area of critical habitat, and not likely to occur frequently over the duration of the proposed action given the low level of insecticide usage reported by the Census of Agriculture. As such, we anticipate the species will continue to be able to use all areas of critical habitat for recovery. In summary, we expect temporary impairment of the water quality PBF from methomyl contamination within a small portion of the critical habitat. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Comal Springs riffle beetle.

References

U. S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Comal Springs Dryopid Beetle, Comal Springs Riffle Beetle, and Peck's Cave Amphipod. Final Rule. Federal Register 78:63100-63127.

Comal Springs dryopid beetle (*Stygoparnus comalensis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Springs, associated streams, and underground spaces immediately inside of or adjacent to springs, seeps, and upwellings that include.
    - High-quality water with no or minimal pollutant levels of soaps, detergents, heavy metals, pesticides, fertilizer nutrients, petroleum hydrocarbons, and semivolatile compounds such as industrial cleaning agents.
- Food supply that includes, but is not limited to, detritus (decomposed materials), leaf litter, living plant material, algae, fungi, bacteria, other microorganisms, and decaying roots.

This species occurs in spring outlets and subsurface areas. In the critical habitat rule, we identified pesticides and herbicides associated with pathogenic organisms or invasive species as one of the threats to water quantity and quality.

Effects of the Action

We expect methomyl use will impact water quality, which is a critical habitat PBF that is essential for the conservation of the species.

There is a low extent of overlap between the action area and the critical habitat (4.2% total overlap) (Table 105). There is a low level of past methomyl usage (up to 4.2% critical habitat treated annually), suggesting that a small portion of the critical habitat is likely to be exposed over the duration of the proposed action. This low level of usage is corroborated by additional data from the USDA Census of Agriculture, which indicate low levels of past insecticide use in the counties containing critical habitat units (up to 0.1% critical habitat treated annually with any insecticide).

Even though the Comal Springs dryopid beetle only overlaps 4.2% with methomyl usage areas, we provide this full description of our analysis due to concerns identified in the species' jeopardy analysis.

Table 105. Overlap and past usage data for the critical habitat of Comal Springs dryopid beetle.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
0.1	4	4.2	0.1	4	4.2

The Comal Springs dryopid beetle is the only known subterranean member of the Dryopidae family. The species primarily live in flowing water and are presumed to be associated with airfilled voids inside spring orifices. The karst habitats occupied by this species are susceptible to groundwater contamination from surface runoff because of the rapid penetration of karst rock and little natural filtration. However, we expect recharge of karst cave systems, or the process of aboveground water reaching the groundwater supply, will often take weeks to months, at which point we expect methomyl to be degraded and no longer present in the water as it enters the cave due to its low persistence in the environment. As such, we do not anticipate more than low levels of adverse effects to the water quality PBF. Additionally, given the low level of insecticide usage reported by the Census of Agriculture, we anticipate any exposures that may occur are likely to be limited to small areas of critical habitat and will not occur frequently over the duration of the proposed action.

Table 106. Summary of relevant physical and biological features (PBFs), feature characteristics, and level of concern for each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Impacts to PBFs
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	X	Low flow waterbodies	Low
habitat function	--	--	--

In summary, only a small portion of critical habitat overlaps with the action area. While available toxicity data indicate that arthropods are highly sensitive to methomyl exposures, we do not anticipate the subterranean spring habitats the species requires is likely to be exposed to more than minute levels of methomyl that are not likely to cause more than low levels of adverse effects to the water quality PBF (Table 106). Given the low level of insecticide usage reported by the Census of Agriculture, we anticipate exposure events are likely infrequent in nature.

Rationale for Conclusion

While the Comal Springs dryopid beetle relies on clean, uncontaminated water for their survival and recovery, we do not anticipate that individual beetles will experience an appreciable decrease in their ability to persist in waters within their preferred habitats as methomyl exposure is temporary, limited to a small area of critical habitat, not likely to occur frequently over the duration of the proposed action given the low level of insecticide usage reported by the Census of Agriculture, and the unlikely presence of methomyl in spring water. As such, we anticipate the species will continue to be able to use all areas of critical habitat for recovery. In summary, we expect temporary impairment of the water quality PBF from methomyl contamination within a small portion of the critical habitat. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Comal Springs dryopid beetle.

References

U. S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Comal Springs Dryopid Beetle, Comal Springs Riffle Beetle, and Peck's Cave Amphipod. Final Rule. Federal Register 78:63100-63127.

Salt Creek tiger beetle (*Cicindela nevadica lincolniana*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Exposed mudflats associated with saline wetlands or the exposed banks and islands of streams and seeps that contain adequate soil moisture and soil salinity are essential core habitats. The "Salmo" soil series is the only soil type that currently supports occupied habitat; "Saltillo" has adequate soil moisture and salinity and can provide suitable habitat.
- Vegetated wetlands adjacent to core habitats that provide shade for subspecies thermoregulation, support a source of prey for adults and larval forms of Salt Creek tiger beetles, and protect core habitats.

The PBFs specific to the Salt Creek tiger beetle pertain to saline barrens and seeps found within saline wetland habitat in Little Salt, Rock, Oak and Haines Branch Creeks. The PBFs focus on maintaining suitable habitat that contains specific soil dynamics and wetlands that support a source of prey and other requirements for the species to complete its life cycle. Salt Creek tiger beetle prey species include insects belonging to the orders Coleoptera (beetles), Orthoptera (grasshoppers and crickets), Hemiptera (true bugs), Hymenoptera (ants, bees, and wasps), Odonata (dragonflies), Diptera (flies), and Lepidoptera (moths and butterflies). Ants appear to be the most commonly observed prey of adult tiger beetles.

Effects of the Action

We expect methomyl use will impact arthropod prey, which is a critical habitat PBF that is essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (57% total overlap) (Table 107). There is a high level of past methomyl usage (up to 57% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 107. Overlap and past usage data for the critical habitat of the salt creek tiger beetle.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
9.5	47.5	57	9.5	47.5	57

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We anticipate many impacted prey species will recover over time once methomyl residues have degraded after applications (which should occur within days to weeks of exposure). However, critical habitat is likely to experience repeated exposures to methomyl over the duration of the proposed action based on the high levels of past usage in the critical habitat. As such, while we do not expect the entire arthropod prey community will experience complete mortality and that some species in the community will recover after methomyl exposure, we anticipate high, episodic impacts to the arthropod prey PBF.

Table 108. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, a large portion of critical habitat is likely to be exposed to methomyl over the proposed action's duration. In areas exposed, we anticipate a high level of impacts to arthropod prey resources as insect prey species are likely to experience high levels of mortality, reducing the abundance of insect prey for the salt creek tiger beetle (Table 108). While we expect these impacts are temporary during periods after applications, given methomyl's rapid degradation rate, we anticipate these adverse effects will be episodic and will result in substantial impacts to the critical habitat PBFs, reducing the conservation value of the overall critical habitat.

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. Impacts to the arthropod prey PBF would have high impacts to the species from losses of prey in exposed areas across large portions of the critical habitat. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Salt Creek tiger beetle's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for Salt Creek tiger beetle by >95% for terrestrial habitat. 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 Salt Creek tiger beetle will be the entirety of the designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Salt Creek tiger beetle's critical habitat will be low. As such, we anticipate there will be sufficient arthropod prey available to support individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Salt Creek tiger beetle.

References

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Revision of Critical Habitat for Salt Creek Tiger Beetle. Final Rule. Federal Register 79: 26013-26038.

Bartram's scrub hairstreak butterfly (*Strymon acis bartrami*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Pine rockland habitat, sometimes associated with rockland hammocks and hydric pine flatwoods. Characteristics include:

  - Open canopy, semi-open subcanopy, and understory.
  - Substrate of oolitic limestone rock.
  - Plant community of predominately native vegetation.
  - Rockland hammock habitat associated with pine rocklands contains:
    - Canopy gaps and edges with an open to semi-open canopy, subcanopy, and understory.
    - Substrate with a thin layer of highly organic soil covering limestone or organic matter that accumulates on top of the underlying limestone rock.
    - Plant community of predominately native vegetation.
  - Hydric pine flatwood habitat associated with pine rocklands contains:
    - Open canopy with a sparse or absent subcanopy, and dense understory.
    - Substrate with a thin layer of poorly drained sands and organic materials that accumulates on top of the underlying limestone or calcareous rock.
    - Plant community of predominately native vegetation.
  - Pesticide levels low enough to have minimal effect on survival of the butterfly or its ability to occupy the habitat.
- Low abundance of competitive nonnative plant species.
- Presence of the butterfly's hostplant, pineland croton, in sufficient abundance for larval recruitment, development, and food resources, and for adult butterfly roosting habitat and reproduction.
- A dynamic natural disturbance regime or one that artificially duplicates natural ecological processes (e.g., fire, hurricanes, or other weather events, at appropriate intervals) that maintains the pine rockland habitat and associated rockland hammock and hydric pine flatwood plant communities.

The PBFs focus on habitats that are suitable for Bartram's hairstreak butterflies and its host plant, including vegetation composition and structure, size, and underlying rock formation. Suitable habitat must have low levels of pesticides to have minimal effect on survival of the species. Activities that may affect critical habitat, as outlined in the *Application of the "Adverse Modification" Standard* section of the critical habitat final rule, include "[a]ctions that would introduce chemical pesticides into the pine rockland and associated rockland hammock and hydric pine flatwood habitats in a manner that impacts the butterflies. Such activities may include use of adulticides for control of mosquitos or agricultural-related pests."

Effects of the Action

We expect methomyl use will impact the general function of critical habitat as the designation specifies that there needs to be low levels of pesticides as part of the critical habitat's PBFs.

There is a high extent of overlap between the action area and the critical habitat (57% total overlap) (Table 109). However, we anticipate exposure this overlap metric is overestimated and exposure is unlikely to occur as the majority of the species' critical habitat (~85%) occurs on protected lands, such as the Everglades National Park, Key Deer National Wildlife Refuge, Department of Defense installations, land owned and occupied by other federal agencies (including U.S. Coast Guard, National Oceanic and Atmospheric Administration, Federal Bureau of Prisons), and state and county-controlled land. We do not anticipate any agricultural activity is likely occurring in these areas are in nearby areas, indicating that a substantial portion of the designated critical habitat is not likely to be exposed to methomyl.

Table 109.Overlap and past usage data for the critical habitat of the Bartram's scrub hairstreak butterfly.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
4.0	22.7	26.7	4	22.7	26.7

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Based on available toxicity data, we anticipate insect species are sensitive to methomyl and are likely to experience high levels of mortality with exposure. Critical habitat exposed to methomyl through direct application or through spray drift is likely not able to function as critical habitat as the presence of aerosolized pesticide or residues on surfaces are likely high enough to cause mortality to insects, precluding its use for individuals of the species. However, while mortality is anticipated for individuals exposed shortly after applications, methomyl is not considered persistent in natural environments and is likely to degrade within a few days to weeks after application. As such, while the presence of methomyl residues in critical habitat is likely to impair its conservation function, we anticipate this impairment is episodic and will be limited to a short period after each methomyl application. However, we anticipate applications will occur repeatedly over the project duration based on the high level of past usage, impacting the PBF episodically and posing risks to individuals in exposed areas during periods after applications.

Table 110. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	X	--	Medium

In summary, overlap data predicts a large portion of the critical habitat is likely to be exposed to methomyl over the duration of the proposed action. However, we expect these metrics are overestimated as the majority of the species' critical habitat occurs in areas that are not likely to apply methomyl or be near areas where off-site transport might expose critical habitat. In the remaining areas of critical habitat not located on protected lands, we anticipate temporary but episodic and high levels of adverse effects to critical habitat function, resulting in an overall moderate impact to the PBF (Table 110). As such, we anticipate proposed action will result in moderate levels of adverse effects to the conservation value of the Bartram's scrub hairstreak's designated critical habitat as a whole.

Rationale for Preliminary Conclusion

While we do not anticipate pesticides will render the critical habitat unsuitable over large areas that are on protected lands or lands otherwise managed for conservation or uses other than agriculture, there is still a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. We anticipate high impacts to the species from pesticides entering their habitat, as exposure would generally lead to mortality of individuals. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Bartram's scrub hairstreak butterfly's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Bartram's scrub hairstreak butterfly by >95% for terrestrial habitat. 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 Bartram's scrub hairstreak butterfly's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Bartram's scrub hairstreak butterfly's critical habitat will be low. As such, we anticipate there will be sufficiently low levels of methomyl that would not cause mortality to individuals occupying critical habitat, preserving the general function of designated critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Bartram's scrub hairstreak butterfly.

References

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Florida Leafwing and Bartram's Scrub-Hairstreak Butterflies. Final Rule. Federal Register 79: 47179-47220.

Florida leafwing butterfly (*Anaea troglodyta floridalis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Pine rockland habitat, sometimes associated with rockland hammocks and hydric pine flatwoods. Characteristics include:
    - Open canopy, semi-open subcanopy, and understory.
    - Substrate of oolitic limestone rock.
    - Plant community of predominately native vegetation.
    - Rockland hammock habitat associated with pine rocklands contains:
        - Canopy gaps and edges with an open to semi-open canopy, subcanopy, and understory.
        - Substrate with a thin layer of highly organic soil covering limestone or organic matter that accumulates on top of the underlying limestone rock.
        - Plant community of predominately native vegetation.
    - Hydric pine flatwood habitat associated with pine rocklands contains:
        - Open canopy with a sparse or absent subcanopy, and dense understory.
        - Substrate with a thin layer of poorly drained sands and organic materials that accumulates on top of the underlying limestone or calcareous rock Plant community of predominately native vegetation.
    - Pesticide levels low enough to have minimal effect on survival of the butterfly or its ability to occupy the habitat.
- Low abundance of competitive nonnative plant species.
- Presence of the butterfly's hostplant, pineland croton, in sufficient abundance for larval recruitment, development, and food resources, and for adult butterfly roosting habitat and reproduction.

- A dynamic natural disturbance regime or one that artificially duplicates natural ecological processes (e.g., fire, hurricanes, or other weather events, at appropriate intervals) that maintains the pine rockland habitat and associated rockland hammock and hydric pine flatwood plant communities.

The PBFs focus on habitats that are suitable for Florida leafwing butterflies and its host plant, including vegetation composition and structure, size, and underlying rock formation. Suitable habitat must have low levels of pesticides to have minimal effect on survival of the species. Activities that may affect critical habitat, as outlined in the *Application of the "Adverse Modification" Standard* section of the critical habitat final rule, include "[a]ctions that would introduce chemical pesticides into the pine rockland and associated rockland hammock and hydric pine flatwood habitats in a manner that impacts the butterflies. Such activities may include use of adulticides for control of mosquitos or agricultural-related pests."

Effects of the Action

We expect methomyl use will impact habitat function, which is a critical habitat PBF that are essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (14.9% total overlap) (Table 111). Exposure is unlikely to occur as the majority of the species' critical habitat (~85%) occurs on protected lands, such as the Everglades National Park, Key Deer National Wildlife Refuge, Department of Defense installations, land owned and occupied by other federal agencies (including U.S. Coast Guard, National Oceanic and Atmospheric Administration, Federal Bureau of Prisons), and state and county-controlled land. We do not anticipate any agricultural activity is likely occurring in these areas, indicating that a substantial portion of the designated critical habitat is not likely to be exposed to methomyl.

Table 111. Overlap and past usage data for the critical habitat of the Florida leafwing butterfly.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
1.9	13	14.9	1.9	13	14.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Based on available toxicity data, we anticipate insect species are sensitive to methomyl and are likely to experience high levels of mortality with exposure. Critical habitat exposed to methomyl through direct application or through spray drift is likely not able to function as critical habitat as the presence pesticide residues are likely high enough to cause mortality to insects, precluding its use for individuals of the species. However, while mortality is anticipated for individuals exposed shortly after applications, methomyl is not considered persistent in natural environments and is likely to degrade within days to weeks after application. As such, while the presence of methomyl residues in critical habitat is likely to impair its conservation function, we anticipate this impairment will be episodic, limited to short periods after each methomyl application. We anticipate there is an overall medium risk to the critical habitat's PBFs as we anticipate impacts to the PBF, with PBF functions restored within a short period of time after applications. However, we anticipate applications will occur repeatedly over the project duration, impacting the PBF episodically and posing risks to individuals in exposed areas during periods after applications.

Table 112. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	**Feature of Critical Habitat**	**Feature Characteristics**	**Potential Impacts to PBF**
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	X	--	Medium

In summary, the EPA predicts a large portion of the critical habitat is likely to be exposed to methomyl over the duration of the proposed action. However, we expect the majority of the species' critical habitat occurs in areas that are not likely to be exposed to methomyl. In areas of critical habitat not located on protected lands, we anticipate temporary but episodic, high levels of adverse effects to critical habitat function, resulting in an overall moderate impact to the PBF (Table 112). As such, we anticipate proposed action will result in moderate levels of adverse effects to the conservation value of the Florida leafwing butterfly's designated critical habitat as a whole.

Rationale for Preliminary Conclusion

While we do not anticipate pesticides will render the critical habitat unsuitable over large areas that are on protected lands or lands otherwise managed for conservation or uses other than agriculture, there is still a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. We anticipate high impacts to the species from pesticides entering their habitat, as exposure would generally lead to mortality of individuals. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Florida leafwing butterfly's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Florida leafwing butterfly by >95% for terrestrial habitat. 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 leafwing butterfly's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Florida leafwing butterfly's critical habitat will be low. As such, we anticipate there will be sufficiently low levels of methomyl that would not cause mortality to individuals occupying critical habitat, preserving the general function of designated critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Florida leafwing butterfly.

References

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Florida Leafwing and Bartram's Scrub-Hairstreak Butterflies. Final Rule. Federal Register 79: 47179-47220.

Poweshiek skipperling (*Oarisma poweshiek*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Wet-mesic to dry tallgrass remnant untilled prairies or remnant moist meadows containing:
  - Predominantly native grasses and native flowering forbs.

  - Undisturbed (untilled) glacial soil types including, but not limited to, loam, sandy loam, loamy sand, gravel, organic soils (peat), or marl that provide the edaphic features necessary.
  - If present, depressional wetlands or low wet areas, within or adjacent to prairies.
  - If present, trees or large shrub cover <5% of area in dry prairies and <25% in wet-mesic prairies and prairie fens.
  - If present, nonnative invasive plant species occurring in <5% of the area.
- Prairie fen habitats containing:
  - Predominantly native grasses and native flowering forbs.
  - Undisturbed (untilled) glacial soil types including, but not limited to, organic soils (peat), or marl that provide the edaphic features necessary.
  - Depressional wetlands or low wet areas, within or adjacent to prairies.
  - Hydraulic features necessary to maintain prairie fen groundwater flow and prairie fen plant communities.
  - If present, trees or large shrub cover <25% of the unit.
  - If present, nonnative invasive plant species occurring in <25% of area.
- Native grasses and native flowering forbs for larval and adult food and shelter, specifically;
  - Native grasses to provide larval food and shelter sources: Prairie dropseed (Sporobolus heterolepis), little bluestem (Schizachyrium scoparium), sideoats grama (Bouteloua curtipendula), or mat muhly (Muhlenbergia richardsonis).
  - Forbs in bloom to provide nectar and water sources: Purple coneflower (Echinacea angustifolia), black-eyed Susan (Rudbeckia hirta), smooth ox-eye (Heliopsis helianthoides), stiff tickseed (Coreopsis palmata), palespike lobelia (Lobelia spicata), sticky tofieldia (Triantha glutinosa), or shrubby cinquefoil (Dasiphora fruticosa ssp. floribunda).
- Dispersal grassland habitat that is within 1 km (0.6 mi) of native high-quality remnant prairie that connects high quality wet-mesic to dry tallgrass prairies, moist meadows, or prairie fen habitats.
  - Undeveloped open areas dominated by perennial grassland with limited or no barriers to dispersal including tree or shrub cover <25% of the area and no row crops such as corn, beans, potatoes, or sunflowers.

The PBFs focus on the presence of suitable vegetation and habitat structure, including areas that provide host plants for feeding, breeding, sheltering. In the critical habitat final rule (see *Special Management Considerations or Protection*), "pesticide application" is listed as a threat to Poweshiek skipperling habitat for both direct and indirect effects. Spraying of pesticides is considered an "[a]ction that would significantly alter the native plant community such that native grasses or flowering forbs are not readily available during the adult flight period or larval stages." The native grasses and flowering forbs listed above are referred to as "host larval plants" several times in the final rule.

Effects of the Action

We expect methomyl use will impact habitat function, which is a critical habitat PBF that are essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (46.2% total overlap) (Table 113). There is a high level of past methomyl usage (up to 46.2% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 113. Overlap and past usage data for the critical habitat of the Poweshiek skipperling.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
4.5	41.7	46.2	4.5	41.7	46.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Based on available toxicity data, we anticipate insect species are sensitive to methomyl and are likely to experience high levels of mortality with exposure. Critical habitat exposed to methomyl through direct application or through spray drift is likely not able to function as critical habitat as the presence of aerosolized compound or residues on surfaces are likely high enough to cause mortality to insects, precluding its use for individuals of the species. However, while mortality is anticipated for individuals exposed shortly after applications, methomyl is not considered persistent in natural environments and is likely to degrade within a few days to weeks after application. As such, while the presence of methomyl residues in critical habitat is likely to impair its conservation function, we anticipate this impairment will be episodic, limited to a short period after each methomyl application. We anticipate there is an overall medium risk to the critical habitat's PBFs as we anticipate impacts to PBFs, with functions restored within a short period of time after applications. However, we anticipate applications will occur repeatedly over the project duration, impacting the habitat function PBF episodically and posing risks to individuals in exposed areas during periods after applications.

Table 114. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	--	--	--
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
habitat function	X	--	High

In summary, we expect a large portion of the critical habitat is likely to be exposed to methomyl over the duration of the proposed action. The presence of methomyl within critical habitat is likely to substantially alter critical habitat function as the presence of methomyl residues may result in exposure and subsequent mortality of butterflies due to high levels of pesticides episodically in their critical habitat (Table 114).

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. We anticipate high impacts to the species from pesticides entering their habitat, as exposure would generally lead to mortality of individuals. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Poweshiek skipperling's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Poweshiek skipperling by >95% for terrestrial habitat. 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 Poweshiek skipperling's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Poweshiek skipperling's critical habitat will be low. As such, we anticipate there will be sufficiently low levels of methomyl that would not cause mortality to individuals occupying critical habitat, preserving the general function of designated critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Poweshiek skipperling.

References

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Dakota Skipper and Poweshiek Skipperling. Final Rule. Federal Register 80: 59247-59384.

Miami tiger beetle (*Cicindelidia floridana*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- South Florida pine rockland habitat of at least 2.5 ac (1 ha) in size that is maintained by natural or prescribed fire or other disturbance regimes; and
- Open sandy areas within or directly adjacent to the south Florida pine rockland habitat with little to no vegetation that allows for or facilitates normal behavior and growth such as thermoregulation, foraging, egg-laying, larval development, and habitat connectivity, which promotes the overall distribution and expansion of the species.

The PBFs include arthropod prey, based on habitat that allows for foraging and the arthropod-based food requirements of the species. The discussion on food requirements in the proposed critical habitat rule states, “Although we do not have specific information on Miami tiger beetle diets, observations by various entomologists indicate small arthropods, especially ants, are the most common prey for tiger beetles. Over 30 kinds of insects from many families have been identified as prey for tiger beetles, and scavenging is also common in some species...Alterations or reductions in the prey base through pesticide exposure could affect foraging of Miami tiger beetles.”

In the *Special Management Considerations or Protection* section of the proposed rule, we state “[p]esticides used in and around pine rockland habitat are a potential threat to the Miami tiger beetle through direct exposure to adults and larvae, secondary exposure from insect prey, overall reduction in availability of adult and larval prey, thus limiting foraging opportunities, or any combination of these factors. Actions that could ameliorate threats include, “Use of pesticide spray buffers to prevent potential exposure to the species and probable limitation of foraging opportunities.” Activities that may affect critical habitat, as outlined in the *Application of the “Adverse Modification” Standard* described in the rule, include “Actions that would introduce chemical pesticides into the pine rockland ecosystem in a manner that impacts the Miami tiger beetle. Such activities may include but are not limited to mosquito control and agricultural pesticide applications.”

Effects of the Action

We expect methomyl use will impact arthropod prey, which is a critical habitat PBF that is essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (53.7% total overlap) (Table 115). There is a high level of past methomyl usage (up to 53.7% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 115. Overlap and past usage data for the critical habitat of Miami tiger beetle.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
8.2	45.5	53.7	8.2	45.5	53.7

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. We anticipate many impacted prey species will recover over time once methomyl residues have degraded after applications (which should occur within days to weeks of exposure), critical habitat is likely to be repeatedly exposed to methomyl over the duration of the proposed action based on the high levels of past usage in the critical habitat. As such, expect some arthropod prey will still be available after exposure and any losses will likely only be temporary, we anticipate high, episodic impacts to the arthropod prey PBF.

Table 116. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, a large portion of critical habitat is likely to be exposed to methomyl over the proposed action's duration. In areas exposed, we anticipate a high level of impacts to arthropod prey resources as insect prey species are likely to die in a large portion of the critical habitat, reducing the abundance of insect prey for the Miami tiger beetle (Table 116). While we expect these impacts are temporary during periods after applications, given methomyl's rapid degradation rate, we anticipate these adverse effects will be episodic, but will result in substantial impacts to the critical habitat PBFs given the large portion of the critical habitat affected, thus reducing the conservation value of the critical habitat as a whole.

Rationale for Preliminary Conclusion

Because the Miami tiger beetle relies on a healthy insect prey community for their survival and recovery, we anticipate individual beetles will experience an appreciable decrease in their ability to find prey due to arthropod prey mortality from methomyl exposure in a significant portion of the critical habitat. As such, the species will lose the ability to use all areas of critical habitat for recovery. In summary, we expect temporary, but significant losses of the arthropod prey community PBF within a large portion of the critical habitat. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Miami tiger beetle's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Miami tiger beetle by >95% for terrestrial habitat. 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 Miami tiger beetle's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Miami tiger beetle's critical habitat will be low. As such, we anticipate there will be sufficient arthropod prey available to support individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Miami tiger beetle.

References

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Miami Tiger Beetle (*Cicindelidia Floridana*). Proposed Rule. Federal Register 86:49945-49985.

Mammals

Indiana bat (*Myotis sodalis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

The final critical habitat rule does not describe PBFs for the critical habitat. The species feeds on flying insects and occasionally spiders. Therefore, we have identified arthropod prey as the relevant PBF.

Effects of the Action

We expect methomyl use will impact arthropod prey, which is a critical habitat PBF that is essential for the conservation of the species. The Indiana bat is a generalist insectivore and can feed on a variety of flying insects.

There is a high extent of overlap between the action area and the critical habitat (16.2% total overlap) (Table 117). There is a high level of past methomyl usage (up to 16.2% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 117. Overlap and past usage data for the critical habitat of the Indiana bat.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
4.8	11.4	16.2	4.8	11.4	16.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Thus, we anticipate there will still be some food resources available in critical habitat despite a reduction in the abundance of sensitive species. Additionally, we anticipate most impacted prey species will recover over time once methomyl residues have degraded after applications (which we expect to occur on the order of days to weeks). The Indiana bat is also highly mobile and would likely find adequate prey availability at alternative foraging sites not exposed to methomyl. As such, we expect some arthropod prey will still be available after exposure and any losses will likely only be temporary, resulting in episodic, moderate levels of impacts to the arthropod prey PBF.

Table 118. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we anticipate a large portion of critical habitat is likely to be exposed over the duration of the proposed action. Within exposed areas, we anticipate a large number of insect prey are likely to die, reducing the abundance of available prey for the species (Table 118). However, the Indiana bat is a generalist insectivore that can switch to prey species that are less sensitive to methomyl that are likely still abundant and would be able to fly to alternative sites as needed to forage. Furthermore, we anticipate impacted prey species will recover in abundance once methomyl residues degrade (which should be within a few days to weeks from exposure), although they are likely to experience repeated exposures over the duration of the proposed action based on the high levels of anticipated usage in the critical habitat. As such, we anticipate there will be a moderate level of adverse effect to critical habitat PBFs, which will reduce the conservation value of the overall critical habitat.

Rationale for Conclusion

We expect episodic losses of prey in a high portion of the critical habitat. However, the Indiana bat is a generalist insectivore that forages on a variety of insect prey items. We do not anticipate all prey will be lost in large areas at the same time or for long periods. In addition, the bat is highly mobile, and we expect individuals would be able to move to alternative foraging sites as needed. As such, while we expect periodic impacts to the arthropod PBF, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Indiana bat.

References

U.S. Fish and Wildlife Service. 1977. Endangered and Threatened Wildlife and Plants; Correction and Augmentation of Published Rulemaking. Final Rule. Federal Register 42: 47840-47845.

U.S. Fish and Wildlife Service. 1976. Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for American Crocodile, California Condor, Indiana Bat, and Florida Manatee. Final Rule. Federal Register 41: 41914-41916.

Buena Vista Lake ornate shrew (*Sorex ornatus relictus*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Permanent and intermittent riparian or wetland communities that contain:
    - Consistent and diverse supply of prey. Although the specific prey species used by the Buena Vista Lake ornate shrew have not been identified, ornate shrews are known to eat a variety of terrestrial and aquatic invertebrates, including amphipods, slugs, and insects.

These PBFs discuss the importance of riparian and wetland habitats to provide the Buena Vista Lake ornate shrew's food sources. Buena Vista Lake ornate shrew's critical habitat is surrounded by agriculture in the South San Joaquin Valley of California. In the critical habitat final rule (see *Application of the "Adverse Modification" Standard*), activities "that could affect water quality within critical habitat" may adversely modify critical habitat.

Effects of the Action

We expect methomyl use will impact arthropod prey, non-arthropod prey, and water quality, which are critical habitat PBFs that are essential for the conservation of the species. The Buena Vista Lake ornate shrew is a generalist invertivore and can feed on a variety of invertebrates, including arthropods like crustaceans and insects and non-arthropods like slugs, snails, and earthworms. Given that the shrew relies on wetland habitat and aquatic prey species, water quality is also an important aspect of critical habitat.

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum yearly overlap between the critical habitat and agricultural areas reporting any pesticide usage was 24.2 % (Table 119). Of those areas reporting pesticide usage, up to 18.3 % reported use on any insecticide. Based on this reporting data, no areas within the species' critical habitat have been treated with methomyl in this period. However, these pesticide usage statistics are based on a small sample size of pesticide users (an average of 13 per year), indicating that there are high levels of uncertainty regarding the level of methomyl usage. Thus, despite no methomyl use reported in the 10-year period, we expect all insecticide usage overlap is a more appropriate estimate of potential exposure. As such, we anticipate a large portion of critical habitat (18.3%) is likely to be exposed.

Table 119. Overlap and past usage data for the critical habitat of the Buena Vista Lake ornate shrew.

% overlap with all pesticide usage areas	% overlap with all insecticide usage areas	% overlap with methomyl usage areas
24.2	18.3	0

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that arthropod species, like the crustaceans and insects the species consumes, are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Thus, we anticipate there will still be some food resources available in critical habitat despite a reduction in the abundance of sensitive species. Additionally, we anticipate impacted prey species will recover over time once methomyl residues have degraded (which should occur over days to weeks). However, the species requires a consistent and diverse supply of prey, and we expect adverse effects to arthropod prey are likely to repeatedly occur over the duration of the proposed action. As such, while we expect some arthropod prey will still be available after exposure and any losses will likely only be temporary, we anticipate episodic, moderate to high levels of impacts to the arthropod prey PBF.

In contrast, available toxicity data indicate that the non-arthropod species that the shrew consumes, including snails, slugs, and earthworms, are not likely to experience more than low levels of adverse effects to survival, growth, or reproduction at concentrations of methomyl likely to occur in critical habitat. As such, we expect there will be no more than low levels of impacts to non-arthropod prey availability and no adverse effects to the non-arthropod PBF.

Methomyl is not likely to bioaccumulate. As such, while the aquatic habitats within the shrew's critical habitat are likely to contain methomyl residues, EPA's exposure modeling indicate that individuals are not likely to accumulate more than low levels of methomyl through exposure to contaminated water. We do not anticipate this exposure through water will result in more than low levels of adverse effects to individual shrews. As such, we expect methomyl will not cause water quality impairments that prevent individuals from using critical habitat, indicating no more than low levels of adverse effects to the water quality PBF.

Table 120. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	X	Presence of insect prey	High

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
non-arthropods (as prey or hosts)	X	Presence of mollusk prey (snails)	Low
water quality	X	Low flow/low volume waterbodies	Low
habitat function	--	--	--

In summary, there is a large portion of critical habitat likely to be exposed over the duration of the proposed action. Within exposed areas, we anticipate there will be high levels of adverse effects to arthropod prey (Table 120). We expect these impacts will be temporary during periods after applications, given methomyl's quick degradation rate, although applications are likely to be repeated over the project duration. We do not anticipate any adverse effects to non-arthropod prey as snails, slugs, and earthworms are not sensitive to methomyl exposure. We also do not anticipate significant adverse effects to water quality as methomyl exposure through water is not likely to cause more than low levels of adverse effects in shrews, indicating that the presence of methomyl is not likely to impair water quality beyond low levels. Thus, given that we anticipate high, episodic adverse effects to the arthropod prey PBF and low level effects to the non-arthropod and water quality PBFs.

Rationale for Preliminary Conclusion

There is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high. While we anticipate low levels of effects to the non-arthropod and water quality PBFs, impacts to the arthropod prey PBF is expected to have high impacts to the species, as the species needs a consistent and diverse supply of prey. While arthropod prey communities would likely recover over time after exposure, losses would likely be episodic throughout the project duration from repeated applications over the duration of the proposed action. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Buena Vista Lake ornate shrew's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Buena Vista Lake ornate shrew by >95% for terrestrial habitat. 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 Buena Vista Lake ornate shrew's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Buena Vista Lake ornate shrew's critical habitat will be low. As such, we anticipate there will be sufficient arthropod prey available to support individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Buena Vista Lake ornate shrew.

References

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Buena Vista Lake Shrew. Final Rule. Federal Register 77: 39835-39867.

Plants

La Graciosa thistle (*Cirsium loncholepis*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Mesic areas associated with.
  - Margins of dune swales, dune lakes, marshes, and estuaries.
  - Margins of dynamic riparian systems.
  - Freshwater seeps and intermittent streams found in other habitats.
- Associated plant communities, including Central dune scrub, coastal dune, coastal scrub, freshwater seep, coastal and valley freshwater marsh and fen, riparian scrub, oak woodland, intermittent streams, and other wetland communities.
- Soils with a sandy component including dune sands, Oceano sands, Camarillo sandy loams, riverwash, and sandy alluvial soils.
- Features that allow dispersal and connectivity between populations:
  - Natural riparian drainages that are not channelized or confined by barriers or dams.
  - Natural aeolian geomorphology.

As described in the Pollinators section of the critical habitat final rule (under *Primary Constituent Elements*), *C. loncholepis* is "pollinated by bees (e.g., mason bees, carpenter bees, leaf cutter bees, introduced honey bees), butterflies, flies, beetles, ground beetles, black ants, and hummingbirds," though the species is "capable of both self-fertilization and cross-fertilization." Pollinators are not listed as a PCE for this species, though connectivity between populations is listed as a PCE and is essential for dispersal (primarily by wind).

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF essential for the conservation of the species. The La Graciosa thistle can be pollinated by a wide variety of insect species (a pollinator generalist) but can also rely on self-fertilization in the absence of insect pollinators.

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum yearly overlap between the critical habitat and agricultural areas reporting any pesticide usage was 38.2% (Table 121). Of those areas reporting pesticide usage, up to 35.8% reported use of any insecticide. Based on this reporting data, we expect 6.3% of the critical habitat is likely to be treated with methomyl, specifically. As such, we anticipate a moderate portion of the critical habitat is likely to be treated with methomyl over the duration of the proposed action.

Table 121. Overlap and past usage data for the critical habitat of the La Graciosa thistle.

% overlap with all pesticide usage areas	% overlap with all insecticide usage areas	% overlap with methomyl usage areas
38.2	35.8	6.3

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses. As such, we anticipate there will likely be pollinators available for individuals to use for reproduction despite methomyl exposure in critical habitat. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in a moderate portion of critical habitat (6.3%).

Table 122. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts for each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	X	Insect pollination	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, while we expect a high level of adverse effects to sensitive pollinator species, we do not anticipate there will be mortality of the entire pollinator community and there will still be pollinators available in critical habitat in the form of less sensitive species. Additionally, we anticipate the pollinator community will recover once methomyl residues degrade, which should occur within a short period after application. As such, we expect an overall medium level impact to the arthropod PBF (Table 122).

Rationale for Conclusion

The La Graciosa thistle can use a variety of insect species for pollination and successful reproduction, in addition to the ability to reproduce by self-fertilization in the absence of pollinating insects. As such, we anticipate individual plants will not experience an appreciable decrease in their reproductive output and will continue to be able to use all areas of critical habitat for recovery. Thus, while we expect temporary losses of the most sensitive species of the pollinator community in a moderate portion of the critical habitat, due to the species' described life history traits, we expect the proposed action will result in small reductions in the conservation value of the pollinator PBF. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the La Graciosa thistle.

References

U.S. Fish and Wildlife Service. 2009. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for *Cirsium loncholepis* (La Graciosa Thistle). Final Rule. Federal Register 74: 56978-57046.

Keck's checker-mallow (*Sidalcea keckii*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Minimally shaded annual grasslands in the foothills of the Sierra Nevada Mountains containing open patches in which competing vegetation is relatively sparse.
- Serpentine soils or other soils that tend to restrict competing vegetation.

As stated in the critical habitat (see *Effects of the Critical Habitat Designation*), "[a]ctivities which significantly degrade or destroy *Sidalcea keckii* pollinator populations (e.g., pesticide applications)" may "destroy or adversely modify critical habitat for *Sidalcea keckii*." The primary pollinators of *S. keckii* are likely bees, bumble bees, and bee flies, as these are the primary pollinators of closely related species (i.e., *S. oregano ssp. spicata* and *S. malviflora ssp. malviflora*). As stated in the Background of the critical habitat, "[m]any bees of the solitary bee genus *Diadasia* specialize in collecting pollen solely from members of the Malvaceae family."

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that are essential for the conservation of the species. The Keck's checker-mallow can be pollinated by a variety of insect species.

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum yearly overlap between the critical habitat and agricultural areas reporting any pesticide usage was 10.7% (Table 123). Of those areas reporting pesticide usage, up to 7.2 % reported use of any insecticide. Based on this reporting data, we expect 0% of the critical habitat is likely to be treated with methomyl. However, these pesticide usage statistics are based on a small sample size of pesticide users (an average of 2.2 users per year), indicating that there are high levels of uncertainty regarding the level of methomyl usage. Thus, despite no methomyl use reported in the 10-year period, we expect the all-insecticide usage overlap is a more appropriate estimate of potential exposure. As such, we anticipate a moderate portion of critical habitat (7.2%) is likely to be exposed.

Table 123. Overlap and past usage data for the critical habitat of the Keck's checker-mallow.

% overlap with all pesticide usage areas	% overlap with all insecticide usage areas	% overlap with methomyl usage areas
10.7	7.2	0

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate there will likely be insect pollinators available for individuals to use despite methomyl exposure. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in a moderate portion of critical habitat (7.2%).

Table 124. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	X	Presence of insect pollinators	Medium
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, while we expect a high level of adverse effects to sensitive pollinator species, we do not anticipate there will be mortality of the entire pollinator community and that there will still be pollinators available in critical habitat in the form of less sensitive species. Additionally, we anticipate the pollinator community will recover once methomyl residues degrade, which should occur within a short period after application. As such, we expect an overall medium level impact to the arthropod PBF (Table 124).

Rationale for Conclusion

The Keck's checker-mallow can use a variety of insect species for pollination and successful reproduction, so we anticipate individual plants will not experience an appreciable decrease in their reproductive output and will continue to be able to use all areas of critical habitat for recovery. As such, while we expect temporary losses of the most sensitive species of the pollinator community in a moderate portion of the critical habitat, due to the species' described life history trait, we expect the proposed action will result in small reductions in the conservation value of the pollinator PBF. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Keck's checker-mallow.

References

U.S. Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for *Sidalcea keckii* (Keck's checker-mallow) Final Rule. Federal Register 68: 12863-12880.

Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Early seral upland prairie, or oak savanna habitat with a mosaic of low-growing grasses and forbs and spaces to establish seedlings or new vegetative growth, an absence of dense canopy vegetation, and undisturbed subsoils.

- Insect outcrossing pollinators (e.g., *Bombus mixtus*, *B. californicus*) with unrestricted movement between existing lupine patches.

Pollen dispersal for this species is provided mainly by insect pollinators, which are listed as a PCE in the critical habitat final rule.

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that are essential for the conservation of the species. The Kincaid's lupine can use a variety of species of bees and bumblebees as pollinators but can also use vegetative reproduction (the species can spread extensively underground) in the absence of insect pollinators. There is a high extent of overlap between the action area and the critical habitat (19.8% total overlap) (Table 125). There is a high level of past methomyl usage (up to 19.8% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 125. Overlap and past usage data for the critical habitat of the Kincaid's lupine.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
1.1	18.8	19.8	1.1	18.8	19.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate there will still be some pollinators remaining after methomyl exposure for individuals to use for pollination. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in a large portion of critical habitat (19.8%).

While Kincaid's lupine can spread vegetatively, it still needs to reproduce sexually through insect pollination and outcrossing to produce sufficient seeds and maintain genetic diversity and viable populations over time (USFWS 2006). Furthermore, Kincaid's lupine populations tend to be fragmented and need insect pollinators to be able to fly among populations to successfully transfer pollen (and thus genetic information) between individuals.

Table 126. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
arthropods (as prey or pollinators)	X	Insect pollination	High

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we expect high levels of adverse effects to the most sensitive species of the pollinator community within a large portion of the critical habitat. While these impacts are likely temporary and while we anticipate the pollinator community will recover after exposure, we expect these impacts are likely to occur repeatedly over the duration of the proposed action, resulting in a high level of adverse effects to the arthropod PBF overall (Table 126).

Rationale for Preliminary Conclusion

While the Kincaid's lupine can use a variety of bee species for pollination, in addition to the ability to spread vegetatively, outcrossing by insect pollinators is essential to its reproductive success. As such, we anticipate individual plants will experience an appreciable decrease in their reproductive output due to methomyl- caused insect pollinator mortality and will lose the ability to use a substantial portion (19.8%) of critical habitat for recovery. As a result, we expect the proposed action will result in substantial reductions in the pollinator PBF, to the extent that it would affect the conservation value of the designated critical habitat as a whole. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Kincaid's lupine's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Kincaid's lupine by >95% for terrestrial habitat. 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.*
2) *Applicators within the PULA are prohibited from applying methomyl from two hours after sunrise until two hours before sunset on mint, cucurbits, and squash crops. Applicators cannot apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on berries, snap beans, peas, dry beans, chickpeas, fresh beans, cranberries, and blueberries and all registered crops in the "other orchards" UDL.*

The PULA for the Kincaid's lupine's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Kincaid's lupine's critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Kincaid's lupine.

References

U.S. Fish and Wildlife Service. 2006. Designation of Critical Habitat for the Fender's blue butterfly (*Icaricia icarioides fenderi*), *Lupinus sulphureus ssp. kincaidii* (Kincaid's lupine), and *Erigeron decumbens var. decumbens* (Willamette daisy): Final Rule. Federal Register 71: 63862-63977.

U.S. Fish and Wildlife Service. 2010. Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington. Portland, Oregon. 255 pp.

Yadon's piperia (*Piperia yadonii*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Vegetative structure providing filtered sunlight on sandy soils, including coastal pine forest and maritime chaparral ridges with dwarfed shrubs.
- Nocturnal, short-tongued moths in the families Pyralidae, Geometridae, Noctuidae, and Pterophoridae.

As stated in the critical habitat final rule, pollen dispersal for this species is provided mainly by moths (listed as a PCE) and bees.

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF essential for the conservation of the species. Nocturnal moths are the dominant pollinator of Yadon's piperia. One researcher identified 14 moths as pollinators, nine of which were known to be common, two assumed to be common, and the remaining three not known to be rare (USFWS 2021).

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum yearly overlap between the critical habitat and agricultural areas reporting pesticide usage was 6.9% (Table 127). Of those areas reporting pesticide usage, up to 6.2% reported use of any insecticide and 0.5% reported use of methomyl. However, these pesticide usage statistics are based on a small sample size of pesticide users (an average of 12.6 users per year), indicating that there are high levels of uncertainty regarding the level of methomyl usage. Thus, while there is very low methomyl use reported in the 10-year period, we expect the all-insecticide usage overlap is a more appropriate estimate of potential exposure. As such, we anticipate a moderate portion of critical habitat (6.2%) is likely to be exposed.

Table 127. Overlap and past usage data for the critical habitat of the Yadon's piperia.

% overlap with all pesticide usage areas	% overlap with all insecticide usage areas	% overlap with methomyl usage areas
6.9	6.2	0.5

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to die when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. Yadon's piperia can use a variety of moth species for pollination. Hawk moths are known to be sensitive to methomyl, so while they may be common, they also are more likely, as a group, to die from methomyl exposure throughout the moderate portion of critical habitat exposed. As such, we anticipate the impacted pollinator species, particularly because they are common, will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary sustained reductions of moth pollinator species in a moderate portion of critical habitat (6.2%).

Table 128. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	X	Presence of insect pollinators	Medium

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

Because Yadon's piperia rely on a healthy moth pollinator community for their survival and recovery, in addition to suffering from a pre-existing reproductive deficit, we anticipate individual plants will experience an appreciable decrease in their reproductive output and will lose the ability to use all areas of critical habitat for recovery. In summary, we expect temporary, but continued losses of a portion of the hawk moth pollinator community within a moderate portion of the critical habitat. Thus, we expect the proposed action will result in moderate reductions in the pollinator PBF (Table 128).

Rationale for Preliminary Conclusion

Yadon's piperia are capable of fertilization through pollinator facilitated outcrossing or pollinator facilitated selfing (geitonogamy). Experimental treatments and observations suggest that the most common form of fertilization is through pollinator facilitated selfing, meaning the species cannot self-fertilize without an insect pollinator and needs moth pollinators to initiate seed set (USFWS 2021). When Yadon's piperia outcrosses, the amount of fruit produced increases, further indicating the importance of moth pollinators to the species' successful reproduction and survival. In addition, a number of factors have been shown to reduce the reproductive potential of the species, including high rates of herbivory that have significantly affected the populations of Yadon's piperia over time by reducing the ability of individual plants to survive and reproduce (USFWS 2009). As such, the presence of a healthy moth pollinator community (PBF) is essential to the recovery and survival of this species. As such, we anticipate individual plants will experience an appreciable decrease in their reproductive output and will lose the ability to use all areas of critical habitat for recovery. In summary, we expect temporary, but continued losses of a portion of the hawk moth pollinator community within a moderate portion of the critical habitat. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Yadon's piperia critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Yadon's piperia by >95% for terrestrial habitat. 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 Yadon's piperia's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Yadon's piperia's critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Yadon's piperia.

References

U.S. Fish and Wildlife Service. 2021. *Piperia yadonii* (Yadon's piperia) 5-Year Review: Summary and Evaluation. Ventura, California. 19 pp.

U.S. Fish and Wildlife Service. 2009. *Piperia yadonii* (Yadon's piperia) 5-Year Review: Summary and Evaluation. Ventura, California. 23 pp.

U.S. Fish and Wildlife Service. 2007. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for *Piperia yadonii (*Yadon's piperia). Final Rule. Federal Register 72: 60410-60450.

Florida brickell-bush (*Brickellia mosieri*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Areas of pine rockland habitat that contain.
    - Open canopy, semi-open subcanopy, understory.
    - Substrate of oolitic limestone.
    - Plant community of predominantly native vegetation.

- Disturbance regime that naturally or artificially duplicates natural ecological processes and maintains pine rockland habitat.
- Habitats that are connected and of sufficient area to sustain viable populations.
    - Availability of pollinators of appropriate type and in sufficient numbers.

Pollen dispersal for this species is provided mainly by insect pollinators, which are listed as a PCE in the critical habitat final rule. Because the specific type(s) and number of pollinators of *B. mosieri* are unknown and may include non-generalist species closely tied to pine rockland habitats, preserving and restoring connectivity of pine rockland habitat fragments is essential to the long- term conservation of the species. Sufficient connectivity of pine rockland habitat is necessary to support establishment of new populations through seed dispersal, and to preserve and enhance genetic diversity. Therefore, habitat connectivity of sufficient size and suitability that supports the species' growth, distribution, and population expansion is included as a PCE for *B. mosieri.*

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that are essential for the conservation of the species. The Florida brickell-bush is an insect pollinator generalist that can use a variety of insect species for successful reproduction.

There is a high extent of overlap between the action area and the critical habitat (95.9% total overlap) (Table 129). There is a high level of past methomyl usage (up to 95.9% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 129. Overlap and past usage data for the critical habitat of the Florida brickell-bush.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
17.6	78.2	95.9	17.6	78.2	95.9

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate there will likely be some pollinators available in critical habitat after methomyl exposure for individuals to use. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in almost the entire critical habitat (95.9%).

Table 130. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	X	Insect pollination	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we expect temporary, but episodic losses of a substantial portion of the most sensitive species of the pollinator community within a large portion of the critical habitat. As the Florida brickell-bush requires insect pollinators for successful reproduction, we expect the proposed action will result in high levels of adverse effects to the pollinator PBF as a whole (Table 130).

Rationale for Preliminary Conclusion

While the Florida brickell-bush can use a variety of insect species for pollination, outcrossing by insect pollinators is essential to its reproductive success. As such, we anticipate individual plants will experience an appreciable decrease in their reproductive output due to methomyl- caused insect pollinator mortality and will lose the ability to use a substantial portion (95.9%) of critical habitat for recovery. As a result, we expect the proposed action will result in substantial reductions in the pollinator PBF, to the extent that it would affect the conservation value of the designated critical habitat as a whole. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Florida brickell-bush's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Kincaid's lupine by >95% for terrestrial habitat. 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.*

2) *Applicators within the PULA are prohibited from applying methomyl from two hours after sunrise until two hours before sunset on cucurbits, tomatoes, and peppers. Applicators cannot apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on lima beans and snap beans and all registered crops in the "other orchards" UDL.*

The PULA for the Florida brickell-bush's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Florida brickell-bush's critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Florida brickell-bush's.

References

U.S. Fish and Wildlife Service. 2015. Designation of Critical Habitat for *Brickellia mosieri* (Florida Brickell-bush) and *Linum carteri* var. *carteri* (Carter's Small-flowered Flax). Final Rule. Federal Register 80: 49846-49886.

U.S. Fish and Wildlife Service. 2013. Proposed Designation of Critical Habitat for *Brickellia mosieri* (Florida Brickell-bush) and *Linum carteri* var. *carteri* (Carter's Small-flowered Flax). Proposed Rule. Federal Register 78 61293-61320.

White Bluffs bladderpod (*Physaria douglasii* ssp. *tuplashensis*)

Conclusion: not likely to adversely modify or destroy designated critical habitat

Physical & Biological Features.

(i) Weathered alkaline paleosols and mixed soils overlying the Ringold Formation. These soils occur within and around the exposed caliche-like cap deposits associated with the White Bluffs of the Ringold Formation, which contain a high percentage of calcium carbonate. These features occur between 210–275 m (700–900 ft) in elevation.

(ii) Sparsely vegetated habitat (less than 10–15 percent total cover), containing low amounts of nonnative or invasive plant species (less than 1 percent cover).

(iii) The presence of insect pollinator species.

(iv) The presence of native shrub steppe habitat within the effective pollinator distance (300 m (approximately 980 ft)).

(v) The presence of stable bluff formations with minimal landslide occurrence.

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that is essential for the conservation of the species. Little information is available on the White Bluffs bladderpod's specific pollinators, though they are insects, and the species likely uses outcrossing similar to many other species in the genus *Physaria*. Given the lack of information, we assume the species is an insect pollinator specialist that can only rely on a small number of species for successful pollination.

There is a high extent of overlap between the action area and the critical habitat (44% total overlap) (Table 131). There is also a high level of past methomyl usage (up to 44% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action, though most exposure is anticipated to be through spray drift (from off-field overlap).

Table 131. Overlap and past usage data for the critical habitat of the White Bluffs bladderpod.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
4	40	44	4	40	44

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. The White Bluffs bladderpod requires insect pollinators as a component of its critical habitat. Available toxicity data show that insect species are sensitive to methomyl exposure and are likely to die when exposed to methomyl. As such, we anticipate there will be a large reduction in the abundance of insect pollinators within critical habitat areas if they are exposed to methomyl.

Table 132. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
arthropods (as prey or pollinators)	X	Insect pollination	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, since there is a large portion of critical habitat that has the potential to be exposed to methomyl over the duration of the proposed action, and since arthropod species are highly sensitive to methomyl, we anticipate there will be an overall high level of adverse effects to the arthropod pollinator PBF (Table 132).

Rationale for Conclusion

In summary, while we anticipate a large portion of critical habitat has the potential to be exposed to methomyl over the duration of the proposed action, we anticipate low adverse effects to the pollinator PBF for the following reasons. First, the species is known to produce abundant seed, indicating that pollinators are available in the range and there is no pre-existing pollinator deficit. Second, almost all individuals occur within designated critical habitat and within the Hanford Reach National Monument where exposure to pollinators from agricultural uses of methomyl are not expected to occur (USFWS 2022). In addition, the final listing rule determined pesticide use on agricultural fields adjacent to the range of the species is not a threat to the species or its pollinators (USFWS 2013). Lastly, when critical habitat was designated, a built-in 300-350m ‘buffer’ was added to the designated area, so drift of methomyl from adjacent agricultural fields is unlikely. As such, we do not anticipate an appreciable reduction in the pollinator PBF and the species will continue to be able to use all portions of the critical habitat for recovery, such that methomyl exposure to pollinators will not affect the conservation value of the designated critical habitat as a whole. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the White Bluffs bladderpod.

References

U.S. Fish and Wildlife Service. 2022. Recovery Plan for White Bluffs bladderpod (*Physaria douglasii* subsp. *Tuplashensis*). Portland, Oregon. 31 pp.

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Threatened Status for *Eriogonum codium* (Umtanum Desert Buckwheat) and *Physaria douglasii* subsp. *tuplashensis* (White Bluffs Bladderpod) and Designation of Critical Habitat. Final Rule. Federal Register 78: 76995-77005.

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Threatened Status for *Eriogonum codium* (Umtanum Desert Buckwheat) and *Physaria douglasii* subsp. *tuplashensis* (White Bluffs Bladderpod) and Designation of Critical Habitat. Final Rule. Federal Register 78: 24008-24032.

Carters small-flowered flax (*Linum carteri carteri*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Areas of pine rockland habitat that contain:
    - Open canopy, semi-open subcanopy, and understory;
    - Substrate of oolitic limestone rock; and
    - A plant community of predominately native vegetation
- A disturbance regime that naturally or artificially duplicates natural ecological processes (*e.g.,* fire, hurricanes, or other weather events) and that maintains the pine rockland habitat
- Habitats that are connected and of sufficient area to sustain viable populations of *Brickellia mosieri* and *Linum carteri* var. *carteri* in the pine rockland habitat

Additionally, the critical habitat designation emphasizes that sufficient connectivity of pine rockland habitat will contribute to the availability of pollinators of appropriate type and sufficient numbers to allow the species to reproduce and ensure sustainable populations, and to allow for population expansion through seed dispersal. As such, we include the presence of arthropod pollinators as a relevant PBF for this critical habitat.

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that are essential for the conservation of the species. The Carter's small-flowered flax is an insect pollinator generalist that can use a variety of insect species for successful pollination.

There is a high extent of overlap between the action area and the critical habitat (94.6% total overlap) (Table 133). There is a high level of past methomyl usage (up to 94.6% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 133. Overlap and past usage data for the critical habitat of the Carter's small-flowered flax.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
17.3	77.3	94.6	17.3	77.3	94.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate there will likely be some pollinators available within critical habitat after methomyl exposure. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in almost the entire critical habitat (94.6%).

Table 134. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBFs
arthropods (as prey or pollinators)	X	Insect pollination	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we expect high levels of adverse effects to the most sensitive species of the pollinator community within a large portion of the critical habitat. While we anticipate the pollinator community will recover after methomyl residues degrade, we expect critical habitat will repeatedly experience these adverse effects given the high level of past usage. As Carter's small-flowered flax requires insect pollinators for successful reproduction, we expect the proposed action will result in substantial reductions in the pollinator PBF (Table 134).

Rationale for Preliminary Conclusion

While Carter's small-flowered flax can use a variety of insect species for pollination, outcrossing by insect pollinators is essential to its reproductive success. As such, we anticipate individual plants will experience an appreciable decrease in their reproductive output due to methomyl-caused insect pollinator mortality and will lose the ability to use a substantial portion (94.6%) of critical habitat for recovery. In summary, we expect temporary, but episodic losses of a substantial portion of the most sensitive species of the pollinator community within a large portion of the critical habitat. We expect the proposed action will result in substantial reductions in the pollinator PBF, to the extent that it would affect the conservation value of the designated critical habitat as a whole. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Carter's small-flowered flax's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Carter's small-flowered flax by >95% for terrestrial habitat. 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.*
2) *Applicators within the PULA are prohibited from applying methomyl from two hours after sunrise until two hours before sunset on cucurbits, tomatoes, and peppers. Applicators cannot apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on lima beans and snap beans and all registered crops in the "other orchards" UDL.*

The PULA for the Carter's small-flowered flax's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Carter's small-flowered flax's critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Carter's small-flowered flax.

References

U.S. Fish and Wildlife Service. 2015. Designation of Critical Habitat for *Brickellia mosieri* (Florida Brickell-bush) and *Linum carteri* var. *carteri* (Carter's Small-flowered Flax). Final Rule. Federal Register 80: 49846-49886.

U.S. Fish and Wildlife Service. 2013. Proposed Designation of Critical Habitat for *Brickellia mosieri* (Florida Brickell-bush) and *Linum carteri* var. *carteri* (Carter's Small-flowered Flax). Proposed Rule. Federal Register 78: 61293 - 61320.

Vandenberg monkeyflower (*Mimulus fremontii* var. *vandenbergensis*)

Conclusion: Not likely to Adversely Modify or Destroy Designated Critical Habitat

Physical & Biological Features.

- Native maritime chaparral communities of Burton Mesa comprising maritime chaparral and maritime chaparral mixed with coastal scrub, oak woodland, and small patches of native grasslands.
- Loose sandy soils: Arnold Sand, Marina Sand, Narlon Sand, Tangair Sand, Botella Loam, Terrace Escarpments, and Gullied Land.

In the critical habitat final rule (see *Application of the "Adverse Modification" Standard*), "reduction of pollinators" is listed as an action that "would lead to the destruction or alteration of Vandenberg monkeyflower habitat" and "may affect critical habitat."

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that are essential for the conservation of the species. The pollinators of the Vandenberg monkeyflower are unknown but assumed to be insects based on similar species in the genus.

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum yearly overlap between the critical habitat and agricultural areas reporting any pesticide usage was 15.3% (Table 135). Of those areas reporting pesticide usage, up to 14.3 % reported use of any insecticide. Based on this reporting data, we expect 0.2% of the critical habitat is likely to be treated with methomyl. However, these pesticide usage statistics are based on a small sample size of pesticide users (an average of 13.1 users per year), indicating that there are high levels of uncertainty regarding the level of methomyl usage. Thus, despite very little methomyl use reported in the 10-year period, we expect the all-insecticide usage overlap is a more appropriate estimate of potential exposure. As such, we anticipate a large portion of critical habitat (14.3%) is likely to be exposed.

Table 135. Overlap and past usage data for the critical habitat of the Vandenberg monkeyflower.

% overlap with all pesticide usage areas	% overlap with all insecticide usage areas	% overlap with methomyl usage areas
15.3	14.3	0.2

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate there will likely still be some pollinators available within critical habitat after methomyl exposure. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in a large portion of critical habitat (14.3%).

Table 136. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	X	Presence of insect pollinators	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we expect a high level of adverse effects to the most sensitive species of the pollinator community within a large portion of the critical habitat. While we anticipate adverse effects to pollinators will be temporary and that the pollinator community will recover after methomyl residues degrade, we anticipate adverse effects are likely to occur repeatedly over the duration of the proposed action based on the high level of past usage. As the Vandenberg monkeyflower requires insect pollinators for successful reproduction, we expect the proposed action will result in substantial reductions in the pollinator PBF (Table 136), to the extent that it would affect the conservation value of the designated critical habitat as a whole.

Rationale for Preliminary Conclusion

The insect pollinators of the Vandenberg monkeyflower are unknown, and while it may be able to use a variety of pollinator species, it needs a robust pollinator community within critical habitat to reproduce and maintain genetic diversity and viable populations over time. As such, we anticipate individual plants will experience an appreciable decrease in their reproductive output due to methomyl- caused insect pollinator mortality and will lose the ability to use a substantial portion (14.3%) of critical habitat for recovery. In summary, we expect temporary, but episodic losses of a substantial portion of the most sensitive species of the pollinator community within a large portion of the critical habitat. We expect the proposed action will result in substantial reductions in the pollinator PBF, to the extent that it would affect the conservation value of the designated critical habitat as a whole. Thus, we anticipated application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Vandenberg monkeyflower's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the Vandenberg monkeyflower by >95% for terrestrial habitat. 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 Vandenberg monkeyflower's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the Vandenburg monkeyflower's critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Vandenburg monkeyflower.

References

U.S. Fish and Wildlife Service. 2015. Designation of Critical Habitat for *Mimulus fremontii* var. *vandenbergensis* (Vandenberg monkeyflower). Final Rule. Federal Register 80: 48142-48170.

Robust spineflower (*Chorizanthe robusta* var. *robusta*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Sandy soils associated with active coastal dunes and inland sites with sandy soils.
- Plant communities that support associated species, including coastal dune, coastal scrub, grassland, maritime chaparral, and oak woodland communities.
- Plant communities that contain little or no cover by nonnative species which would compete for resources.
- Physical processes (occasional soil disturbance) that support natural dune dynamics along coastal areas.

As stated in the *Special Management Considerations or Protections* section of the critical habitat final rule, "use of pesticides should be limited or restricted so that viable populations of pollinators are present to facilitate reproduction. The associated plant communities must be maintained to ensure that the habitat needs of pollinators and dispersal agents are maintained."

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that are essential for the conservation of the species. The robust spineflower is an insect pollinator generalist that can be pollinated by a wide variety of insect species, in addition it may be able to self-pollinate in the absence of insect pollinators.

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum yearly overlap between the critical habitat and agricultural areas reporting any pesticide usage was 24% (Table 137). Of those areas reporting pesticide usage, up to 21.3% reported use on any insecticide. Based on this reporting data, we expect 0% of the critical habitat is likely to be treated with methomyl. However, these pesticide usage statistics are based on a small sample size of pesticide users (an average of 14.7 users per year), indicating that there are high levels of uncertainty regarding the level of methomyl usage. Thus, despite no methomyl use reported in the 10-year period, we expect the all-insecticide usage overlap is a more appropriate estimate of potential exposure. As such, we anticipate a large portion of critical habitat (21.3%) is likely to be exposed.

Table 137. Overlap and past usage data for the critical habitat of the robust spineflower.

% overlap with all pesticide usage areas	% overlap with all insecticide usage areas	% overlap with methomyl usage areas
24	21.3	0

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate some pollinators are likely to still be available within critical habitat after methomyl exposure. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recovery over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in a large portion of critical habitat (21.3%).

Table 138. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impacts to PBF
arthropods (as prey or pollinators)	X	Presence of insect pollinators	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we expect a high level of adverse effects to the most sensitive species of the pollinator community within a large portion of the critical habitat. While we anticipate adverse effects to pollinators will be temporary and that the pollinator community will recover after methomyl residues degrade, we anticipate adverse effects are likely to occur repeatedly over the duration of the proposed action based on the high level of past insecticide usage (which we use instead of the low methomyl usage given the low sample size of growers reporting within the sections containing critical habitat). As the robust spineflower requires insect pollinators for successful reproduction, we expect the proposed action will result in moderate reductions in the pollinator PBF (Table 138) in a large portion of the critical habitat, to the extent that it would affect the conservation value of the designated critical habitat as a whole.

Rationale for Preliminary Conclusion

While the robust spineflower may be able to use a variety of insect pollinator species, and may be able to self-fertilize, it needs a robust pollinator community within critical habitat to reproduce and maintain genetic diversity and viable populations over time. As such, we anticipate individual plants will experience a moderate decrease in their reproductive output due to methomyl-caused insect pollinator mortality and will lose the ability to use a substantial portion (21.3%) of critical habitat for recovery. In summary, we expect temporary, but episodic losses of a moderate portion of the most sensitive species of the pollinator community within a large portion of the critical habitat. We expect the proposed action will result in moderate reductions in the pollinator PBF in a large portion of the critical habitat, to the extent that it would affect the conservation value of the designated critical habitat as a whole. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is likely to result in the destruction or adverse modification of the designated critical habitat for the robust spineflower.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the robust spineflower's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the robust spineflower by >95% for terrestrial habitat. 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 robust spineflower's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the robust spineflower's critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the robust spineflower.

References

U.S. Fish and Wildlife Service. 2002. Designation of Critical Habitat for *Chorizanthe robusta var. robusta* (robust spineflower). Final Rule. Federal Register 67: 36822-36845.

Prostrate milkweed (*Asclepias prostrata*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Well-drained sandy soil overlying strata of sandstone or indurated caliche;
- High soil gypsum concentration;
- Open savannas and grasslands of the Tamaulipan shrubland ecological region;
- Vegetation composition that includes abundant, diverse pollen and nectar plants and healthy populations of native bee and wasp species; and
- Less than 20 percent cover of buffelgrass.

Effects of the Action

We expect methomyl use will impact arthropod pollinators, which is a critical habitat PBF that is essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (11.8% total overlap) (Table 139). There is a high level of past methomyl usage (up to 11.8% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 139. Overlap and past usage data for the critical habitat of the prostrate milkweed.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
1.0	10.8	11.8	1.0	10.8	11.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate some pollinators are likely to still be available within critical habitat after methomyl exposure. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recovery over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species in a large portion of critical habitat (11.8%).

Table 140. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Presence of insect pollinators	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we expect a high level of adverse effects to the most sensitive species of the pollinator community within a large portion of the critical habitat. While we anticipate adverse effects to pollinators will be temporary and that the pollinator community will recover after methomyl residues degrade, we anticipate adverse effects are likely to occur repeatedly over the duration of the proposed action based on the high level of past insecticide usage (which we use instead of the low methomyl usage given the low sample size of growers reporting within the sections containing critical habitat). As the prostrate milkweed requires insect pollinators for successful reproduction, we expect the proposed action will result in moderate reductions in the pollinator PBF (Table 140) in a large portion of the critical habitat, to the extent that it would affect the conservation value of the designated critical habitat as a whole.

Rationale for Preliminary Conclusion

While the prostrate milkweed may be able to use a variety of insect pollinator species, it needs a robust pollinator community within critical habitat to reproduce and maintain genetic diversity and viable populations over time. As such, we anticipate individual plants will experience a moderate decrease in their reproductive output due to methomyl-caused insect pollinator mortality and will lose the ability to use a substantial portion (11.8%) of critical habitat for recovery. In summary, we expect temporary, but episodic losses of a large portion of the most sensitive species of the pollinator community within a large portion of the critical habitat. We expect the proposed action will result in moderate reductions in the pollinator PBF in a large portion of the critical habitat, to the extent that it would affect the conservation value of the designated critical habitat as a whole. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is likely to result in the destruction or adverse modification of the designated critical habitat for the prostrate milkweed.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the prostrate milkweed's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the prostrate milkweed by >95% for terrestrial habitat. 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 prostrate milkweed's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the prostrate milkweed critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the prostrate milkweed.

References

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Prostrate Milkweed and Designation of Critical Habitat. Final Rule. Federal Register: 88

Wright's marsh thistle (*Cirsium wrightii*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Water-saturated soils with surface or subsurface water flow that allows permanent root saturation and seed germination;
- Alkaline soils;
- Full sunlight; and
- Diverse floral communities to attract pollinators.

Effects of the Action

We expect methomyl use will impact insect pollinators, which is a critical habitat PBF that is essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (81.8% total overlap) (Table 141). There is a high level of past methomyl usage (up to 81.8% critical habitat treated annually). However, over two thirds of designated critical habitat (~66%) occurs on public land managed federal, state, or city government where we do not anticipate agricultural activity (and methomyl usage) is likely to occur. A visual assessment of the eight designated critical habitat units using satellite imagery confirms that the designated critical habitat does not appear to be located on or adjacent to any potential methomyl use sites and that the high overlaps calculated in Table 141 are likely erroneous and not representative of the exposure that is reasonably certain to occur. Given that we anticipate the majority of critical habitat occurs in publicly managed land that is not registered for methomyl use and our qualitative assessment of the locations of critical habitat units, we expect the overall exposure to the Wright's marsh thistle's critical habitat is low.

Table 141. Overlap and past usage data for the critical habitat of the Wright's marsh thistle.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
9.7	72.1	81.8	9.7	82.1	81.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate some pollinators are likely to still be available within critical habitat after methomyl exposure. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recovery over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species should exposure to methomyl occur.

Table 142. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Presence of insect pollinators	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

While we expect a high level of impact to arthropod pollinators should methomyl exposure occur, given the low level of expected exposure, we do not anticipate more than low levels of adverse effects to the arthropod pollinator PBF are likely to occur. Thus, we do not anticipate the proposed action will negatively affect the conservation value of the designated critical habitat as a whole.

Rationale for Conclusion

While the Wright's marsh thistle relies on insect pollinators that are highly sensitive and susceptible to methomyl exposure, we do not anticipate more than low levels of adverse effects are likely to occur as we anticipate a low level of exposure to critical habitat is reasonably certain to occur. Two-thirds of critical habitat is located on publicly managed lands that are not likely to contain land uses registered for methomyl use. This low level of exposure is corroborated by our qualitatively visual assessment of designated critical habitat units, which do not appear to be located on or near agricultural use sites. Thus, we anticipate application of methomyl, as proposed, will not appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the prostrate milkweed.

References

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Wright's Marsh Thistle With a Section 4(d) Rule and Designation of Critical Habitat. Final Rule. Federal Register: 88

Sand dune phacelia (*Phacelia argentea*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Sandy coastal dune habitat above the high tide line that provides a high light environment, room for growth, and adequate moisture; and,
- A sufficiently abundant pollinator community (which may include leafcutter bees and bumble bees) for pollination and reproduction.

Effects of the Action

We expect methomyl use will impact arthropod pollinators, which is a critical habitat PBF that is essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (14.7% total overlap) (Table 143). There is a high level of past methomyl usage (up to 10.8% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 143. Overlap and past usage data for the critical habitat of the [species name].

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
0.7	14.0	14.7	0.6	10.3	10.8

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. Available toxicity data indicate that insect species are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. However, we do not anticipate all insect species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. As such, we anticipate some pollinators are likely to still be available within critical habitat after methomyl exposure. Additionally, we anticipate impacted pollinator species, especially those that are less sensitive and more common, will recovery over time once methomyl residues have degraded (which should occur over days to weeks). As such, we anticipate temporary, episodic reductions of insect pollinator species should exposure to methomyl occur.

Table 144. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Presence of insect pollinators	High
non-arthropods (as prey or hosts)	--	--	--
water quality	--	--	--
habitat function	--	--	--

In summary, we expect a high level of adverse effects to the most sensitive species of the pollinator community within a large portion of the critical habitat. While we anticipate adverse effects to pollinators will be temporary and that the pollinator community will recover after methomyl residues degrade, we anticipate adverse effects are likely to occur repeatedly over the duration of the proposed action based on the high level of past insecticide usage (which we use instead of the low methomyl usage given the low sample size of growers reporting within the sections containing critical habitat). As the prostrate milkweed requires insect pollinators for successful reproduction, we expect the proposed action will result in moderate reductions in the pollinator PBF (Table 144) in a large portion of the critical habitat, to the extent that it would affect the conservation value of the designated critical habitat as a whole.

Rationale for Preliminary Conclusion

While the sand dune phacelia may be able to use a variety of insect pollinator species, it needs a robust pollinator community within critical habitat to reproduce and maintain genetic diversity and viable populations over time. As such, we anticipate individual plants will experience a moderate decrease in their reproductive output due to methomyl-caused insect pollinator mortality and will lose the ability to use a substantial portion (14.7%) of critical habitat for recovery. In summary, we expect temporary, but episodic losses of a large portion of the most sensitive species of the pollinator community within a large portion of the critical habitat. We expect the proposed action will result in moderate reductions in the pollinator PBF in a large portion of the critical habitat, to the extent that it would affect the conservation value of the designated critical habitat as a whole. Thus, we anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species.

Rationale for Final Conclusion

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the sand dune phacelia's critical habitat:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering critical habitat for the sand dune phacelia by >95% for terrestrial habitat. 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 sand dune phacelia's critical habitat will be the entirety of designated critical habitat. 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 methomyl.

After incorporating the above critical habitat-specific conservation measure, we expect exposure to the sand dune phacelia's critical habitat will be low. As such, we anticipate there will be sufficient arthropod pollinators available to support reproduction of individuals occupying critical habitat. Thus, we do not anticipate application of methomyl, as proposed, will appreciably diminish the value of critical habitat as a whole for the conservation of the species. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the sand dune phacelia.

References

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Sand Dune Phacelia and Designation of Critical Habitat. Final Rule. Federal Register: 88

Reptiles

Plymouth redbelly turtle (*Pseudemys rubriventris bangsi*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

Species-specific PBFs are not listed, but chemical changes to water quality that reduces or eliminates vegetation or aquatic prey items is listed as a threat that may adversely modify critical habitat. In the critical habitat rule, we state "[t]his species has an extremely limited range and is highly susceptible to changes in its habitat." We also state "[w]ith regard to the Plymouth redbellied turtle, a major threat to the continued existence of this species is the adverse modification of the water quality and levels of the ponds on which it depends. Any significant … reduction in water quality which would reduce or eliminate vegetation and aquatic prey items of this turtle could adversely modify critical habitat since aquatic vegetation serves as both food and shelter to the turtle."

Effects of the Action

The Plymouth redbelly turtle primarily consumes aquatic vegetation but can also consume snails, clams, fish, tadpoles, and crustaceans, indicating that arthropod and non-arthropod prey are essential components of its critical habitat.

There is a high extent of overlap between the action area and the critical habitat (38.4% total overlap) (Table 145). There is a high level of past methomyl usage (up to 38.4% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 145. Overlap and past usage data for the critical habitat of the Plymouth redbelly turtle.

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
7.3	31.1	38.4	7.3	31.1	38.4

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl 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. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. EPA's environmental fate modeling predicts methomyl concentrations within the Plymouth redbelly turtle's habitat will range from 12-1,715 μg/L depending on the specific habitat characteristics (e.g., flow rate, water volume).

Available toxicity data indicate that arthropods, such as the crustaceans the Plymouth redbelly turtle occasionally consumes, are highly sensitive to methomyl and are likely to experience high levels of mortality when exposed to predicted levels of methomyl within critical habitat, regardless of the exposure level. As such, we anticipate high levels of adverse effects to the arthropod prey PBF.

Available toxicity data indicate that aquatic plants and mollusks are not likely to experience any adverse effects to survival, growth, or reproduction at any predicted concentrations of methomyl within critical habitat. In contrast, fish and amphibian prey species are likely to experience high levels of mortality (up to 77% mortality) in shallow or low flow areas but are not likely to experience any mortality (or sublethal effects) in deeper/large volume areas of critical habitat. Given that we only anticipate low levels of adverse effects to mollusk prey and a range of low to high levels of adverse effects to fish prey, we anticipate there will be an overall moderate level of adverse effects to the non-arthropod prey PBF in general.

We do not anticipate Plymouth redbelly turtles are likely to accumulate high levels of methomyl from exposure to contaminated waters and are not likely to experience any adverse effects to survival or sublethal effects. As such, we do not anticipate the presence of methomyl will reduce the water quality within critical habitat to a level where individual turtles would not be able to occupy critical habitat.

Table 146. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impacts to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	presence of arthropod prey	High
non-arthropods (as prey or hosts)	X	presence of snail, fish, and amphibian prey	Low - High (depending on taxa)
water quality	X	Large volume waterbodies, Low flow/Low volume waterbodies	Low
habitat function	--	--	--

In summary, while there is a large portion of critical habitat that is likely to be exposed to methomyl over the duration of the proposed action, we expect there will be a range of adverse effects to the various relevant critical habitat PBFs (Table 146). Areas of critical habitat exposed to methomyl are likely to experience high mortality of arthropod prey, and some areas (e.g., shallow, low flow areas) are likely to experience high mortality of fish and amphibian prey as well. In contrast, we anticipate there will be no adverse effects to aquatic plants and no more than low levels of adverse effects to mollusk invertebrate prey that individuals also feed on. Similarly, we expect no more than low levels of adverse effects to the water quality PBF as individual turtles are not likely to accumulate high enough levels of methomyl through exposure to contaminated water to would reduce survival or cause reductions to growth or reproduction.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we do not anticipate impacts to the PBFs to occur at levels that would diminish the value of the critical habitat as a whole for the conservation of the species. The Plymouth redbelly turtle primarily consumes aquatic vegetation, but also consumes snails, clams, fish, tadpoles, and crustaceans, indicating that arthropod and non-arthropod prey are essential components of its critical habitat. Available toxicity data indicate that crustaceans are likely to experience high levels of mortality when exposed to predicted levels of methomyl, regardless of the exposure level. Similarly, fish and amphibians are likely to experience high levels of mortality in shallow or low flow areas but are not likely to experience any adverse effects in deeper/large volume areas of critical habitat. Aquatic plants and mollusks are not likely to experience any adverse effects to survival, growth, or reproduction at any predicted concentrations of methomyl in critical habitat. While we anticipate losses of non-arthropod and arthropod prey during temporary periods after methomyl exposures, we expect some prey items would remain available and aquatic vegetation, the primary food item for the Plymouth redbelly turtle, would not be affected by methomyl. The 2021 Species Status Assessment discusses how reduced water quality can adversely affect aquatic invertebrate and vegetation communities, which provide food and shelter for northern red-bellied cooters, although reductions in prey are not listed as a known threat to the species. Therefore, we do not expect the anticipated prey losses from methomyl exposure would have a significant impact on the availability of adequate food resources for turtles in the critical habitat. Additionally, we do not anticipate reductions in water quality at levels that would reduce survival or cause reductions to growth or reproduction of the turtles. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the Plymouth redbelly turtle.

References

U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Listing as Endangered With Critical Habitat for the Plymouth Red-Bellied Turtle In Massachusetts. Final Rule. Federal Register 45: 21828-21833.

U.S. Fish and Wildlife Service. 2021. Species Status Assessment Report for the Massachusetts Population of the Northern Red-bellied Cooter (Pseudemys rubriventris), Version 1.0. Hadley, Massachusetts.

Rim rock crowned snake (*Tantilla oolitica*)

Conclusion: Not likely to destroy or adversely modify designated critical habitat

Physical & Biological Features.

- Pine rocklands habitat that contains:
  - Refugia consisting of limestone rock substrate with holes, crevices, and shallow depressions; piles of rock rubble; and pockets of organic matter accumulating in solution holes;
  - Suitable prey;
  - Warm, moist microhabitats to maintain homeostasis; and
  - A natural or prescribed fire regime at 5- and 7-year intervals that maintains the pine rocklands habitat and associated plant community.
- Rockland hammock habitat that contains:
  - Refugia consisting of limestone rock substrate with holes, crevices, and shallow depressions; piles of rock rubble; and pockets of organic matter accumulating in solution holes;
  - Suitable prey;
  - Warm, moist microhabitats to maintain homeostasis; and
  - Little to no maintenance

Effects of the Action

We expect methomyl use will impact arthropod and non-arthropod prey, which are critical habitat PBFs that are essential for the conservation of the species.

There is a high extent of overlap between the action area and the critical habitat (19.6% total overlap) (Table 147). There is a high level of past methomyl usage (up to 19.6% critical habitat treated annually), suggesting that a large portion of the critical habitat is likely to be exposed over the duration of the proposed action.

Table 147. Overlap and past usage data for the critical habitat of the [species name].

% Total On-Field Overlap	% Total Off-field Overlap	% Total Overlap	% On-field Treated Annually	% Off-field Treated Annually	% Treated Annually
5.2	14.4	19.6	5.2	14.4	19.6

Our analysis of potential impacts to critical habitat PBFs assumes critical habitats are exposed to methomyl and is focused on determining the level of adverse effect expected to occur once exposure has taken place. We integrate species' specific factors and considerations in the "Rationale for Conclusion" section below. The rim rock crowned snake's exact diet is unknown, but prey probably consists of centipedes, insects, and other small invertebrates such as earthworms, snails, cutworms, wireworms, and insect larvae. Available toxicity data indicate that arthropod species, such as the insect species the snake consumes, are generally sensitive to methomyl and are likely to experience high levels of mortality when exposed to methomyl within critical habitat, regardless of the exposure concentration. However, we do not anticipate all arthropod species will be equally sensitive to methomyl exposure as natural variations in species' physiologies and behaviors will result in different responses to methomyl exposure. Furthermore, the rim rock crowned snake is primarily fossorial and lives underground, where we expect its prey species are less likely to be exposed to methomyl. Thus, we anticipate there will still be some food resources available in critical habitat despite a reduction in the abundance of sensitive species. Additionally, we anticipate impacted prey species will recover over time once methomyl residues have degraded (which should occur over days to weeks). As such, while we expect arthropod prey will still be available after exposure and any losses will likely only be temporary, suggesting only low levels of adverse effects to the arthropod prey PBF.

In contrast to arthropod prey, available toxicity data indicate that the non-arthropod invertebrate species that the snake consumes, including snails, slugs, and worms, are not likely to experience more than low levels of adverse effects to survival, growth, or reproduction at concentrations of methomyl likely to occur in critical habitat. As such, we expect there will be no more than low levels of impacts to non-arthropod prey availability and no adverse effects to the non-arthropod PBF.

Table 148. Summary of relevant physical and biological features (PBFs), feature characteristics, and potential impact to each PBF.

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Potential Impact to PBF
arthropods (as prey or pollinators)	X	Insect prey	High
non-arthropods (as prey or hosts)	X	Mollusks, annelids	Low
water quality	--	--	--
habitat function	--	--	--

In summary, while there is a large portion of critical habitat that is likely to be exposed to methomyl over the duration of the proposed action, we expect there will only low levels of adverse effects to the relevant critical habitat PBFs (Table 148). While methomyl exposure will cause temporary decreases in the abundance of sensitive arthropod prey species, we anticipate the rim rock crowned snake will have sufficient food resources available in the form of other, less sensitive invertebrate species. As such, we anticipate the overall proposed critical habitat will not experience more than low levels of adverse effects.

Rationale for Conclusion

While there is a high extent of overlap between the action area and the critical habitat, and usage is anticipated to be high, we do not anticipate impacts to the PBFs to occur at levels that would diminish the value of the critical habitat as a whole for the conservation of the species. The rim rock crowned snake consumes a wide range of invertebrate prey. While available toxicity data indicate that arthropod species are likely to die with exposure to methomyl, other prey species like slugs, snails, and worms, are not likely to experience any adverse effects. While we anticipate temporary losses of arthropod prey after methomyl exposures, we expect some prey items would remain available. Therefore, we do not expect the anticipated prey losses from methomyl exposure would have a significant impact on the availability of adequate food resources for snakes in the critical habitat. Therefore, we have determined the proposed action is not likely to result in the destruction or adverse modification of the designated critical habitat for the rim rock crowned snake.

References

U.S. Fish and Wildlife Service. 2020. Species status assessment report for the Rim rock crowned snake (*Tantilla oolitica*). Vero Beach, Florida.