

APPENDIX L-A

ANIMALS: Critical Habitat Determinations and Rationales

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A. 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)¹ 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 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 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 malathion, specifically, those that related to: (1) water quality and habitat function, (2) arthropod as prey, (3) non-arthropods, including prey, pollinators/seed dispersers and host fish, and (4) arthropod pollinators/seed dispersers. 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 proposed and designated critical habitats into three groups:

Category 1. Critical habitats that have no specific PBFs listed in the rules.

Category 2. Critical habitats that have specified PBFs, but none related to the four relevant types of PBFs that we anticipate would be affected by pesticides (e.g., rocky stream bottom, sufficient space to move, etc.).

Category 3. Critical habitats that have one or more of the four relevant types of PBFs.

For critical habitats in Category 1, we reviewed information about the species biology and habitat requirements in the critical habitat rule to determine if any of the types of PBFs shown above would likely pertain to the critical habitat. In cases where no relevant PBFs were identified, the critical habitat was treated the same as those in Category 2. Critical habitats in Category 2 have specific PBFs in the rules, but none relevant to the effects of the Action. In these cases (a subset of Category 1s and all Category 2s), no link could be made to consequences of the Action on the PBFs of the critical habitat, including elements of the habitat that require

¹ We are using this term as a standardized way to cover the various terms used in critical habitat designations that equate to PBFs, such as primary constituent elements (PCEs) or "essential features" in critical habitat rules prior to 2016.

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 Action, we determined that the Action was not likely to destroy or adversely modify critical habitats that fell into these Categories.

In cases where we identified habitat elements comparable to relevant PBFs for Category 1 critical habitats, the critical habitats were further analyzed using the same method as those in Category 3. In these cases (a subset of Category 1s and all Category 3s), we continued our assessment of the consequences of the Action by evaluating the extent to which the critical habitat overlaps with malathion use sites, the degree of anticipated usage within the critical habitat, the associated risk to the PBF(s), and anticipated effects on the critical habitat as a whole.

Critical habitats with none of the identified relevant PBFs, but with host plant PBFs, are an exception to these categorizations. We anticipate the Action would have low level effects, at most, on plants that are exposed to malathion, as described further in the “*General Effects of Plants*” section in the Opinion. Critical habitats in this group are listed in section C below, along with our effects analysis related to their host plant PBFs.

A dichotomous key was developed and used to facilitate our assessment of the effects of the Action on critical habitats with one or more of the relevant PBFs in categories 1 and 3 (see Appendix L-C for the dichotomous key). The key served two purposes. First, it was used to screen out those critical habitats that fit into either of two groups where we anticipate the likelihood of exposure of critical habitat PBFs to malathion would be extremely low: (1) those critical habitats that have no overlap with use sites, and (2) those critical habitats that have 95% or higher overlap with Federal lands, where we anticipate only low levels of usage (see the Federal Lands section under *Approach to Usage Analysis* in the Opinion). Our assessment of critical habitats that fit the criteria for these groups are discussed below in sections D and E. Second, for critical habitats that did not fall into one of the two initial groups with low likelihood of exposure, the dichotomous key was used to frame our analysis by determining preliminary levels of concern (high or low) for the relevant PBFs in each critical habitat based on the anticipated risk to the PBF(s).

We organized our analysis based on similarity of anticipated effects to the various types of PBFs, using the following PBF categories (reorganized slightly from the initial list provided above for ease of analysis):

- Arthropods (as prey or pollinators/seed dispersers, as appropriate)
- Non-arthropods (as prey or pollinators/seed dispersers, as appropriate)
- Water quality
- Host fish
- Habitat function (pollutant levels related to habitat suitability)

In determining our preliminary level of concern, we considered information that informed our considerations of risk, such as: the degree to which PBFs would be susceptible to adverse effects from malathion based on combinations of the specific PBF(s); anticipated annual malathion usage in the critical habitat; and overlapping malathion uses. For example, malathion generally

poses high risks to arthropod and some non-arthropod prey species (i.e., sensitive taxa include fish, birds, amphibians and reptiles, with some exceptions), which could result in effects to arthropod or non-arthropod PBFs, thus diminishing the functionality of the critical habitat (e.g., decreasing the abundance of food resources may negatively impact growth and/or reproduction of the listed species). Similarly, water quality PBFs involving low flow, low volume and moderate volume aquatic habitats (i.e., Bins 2, 5 and 6, as shown in Table 1 in the dichotomous key in Appendix L-C) may also be more at risk to degradation from pollutants such as malathion due to higher environmental concentrations that would occur from malathion entering water bodies with less capacity for dilution.

We assigned a preliminary high concern level to PBFs involving taxa with a high sensitivity to malathion (i.e., arthropods, birds, fish, amphibians and reptiles), water quality PBFs involving low flow, low volume or moderate volume aquatic habitats, and habitat function affected by pesticides for critical habitats with over 5% usage anticipated annually (with some exceptions for usage only anticipated for mosquito control, as indicated in the dichotomous key and explained in the individual critical habitat rationales). Those PBFs that fit this scenario in critical habitats with 5% or less anticipated usage were assigned a preliminary low concern level. We also assigned a preliminary low concern level to non-arthropod prey PBFs involving taxa that are less sensitive to malathion (i.e., mammals, snails, clams, crustaceans and certain other taxa that would be exposed only from mosquito control usage), and water quality PBFs involving moderate flow, high flow or high volume aquatic habitats (i.e., Bins 3, 4 and 7) as outlined in the dichotomous key (Appendix L-C) and described further in the *Critical Habitat Approach to the Assessment* section in the main Opinion.

Once the preliminary level of concern was determined for each relevant PBF in each proposed or designated critical habitat, we then considered any additional relevant information that would influence our conclusion as to whether the Action is likely to destroy or adversely modify critical habitat. For example, we considered any label changes that include conservation measures intended to reduce impacts to listed species and their critical habitats (see *Description of the Action* section of Opinion). The following sections present our conclusion and supporting arguments for each proposed or designated critical habitat, organized by taxa group.

B. Conclusion

It is the FWS's biological opinion that the Action is not likely to result in the destruction or adverse modification (NDAM) of the proposed and designated critical habitats analyzed in this Opinion, based on the rationales provided in the sections below. Table 1 below indicates the section of this appendix where further information is provided for each animal critical habitat included in our assessment. Tables at the beginning of each taxa section include the critical habitats for that taxa group with their associated categories and our conclusions. Rationales for conclusions that apply to critical habitats with no relevant PBFs (a subset of Category 1s and all Category 2s) are provided in the discussion about those categories above (see *Introduction* above). Assessments of critical habitats with one or more relevant PBFs (a subset of Category 1s and all Category 3s) are provided in the applicable taxa sections following the tables listing the critical habitats associated with the taxa group. Exceptions are those that have host plant PBFs but none of the other relevant PBFs listed in their critical habitat designation, no overlap with

malathion use sites, or high (95% or greater) overlap with Federal lands, in which case the rationale is described in further detail in sections C, D, and E, respectively. Each critical habitat analyzed in the taxa sections includes a description of the critical habitat PBFs, relevant excerpts from the critical habitat rule (if applicable), inputs and outputs from the dichotomous key (presented in table format), and the rationale and conclusion for the critical habitat. More details about the critical habitat designations and any associated PBFs are in the Status of the Species and Critical Habitat (SOS) documents in Appendix C.

Table 1. Summary of where each animal critical habitat is located in Appendix L-A

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Amphibians	<i>Ambystoma bishopi</i>	Reticulated flatwoods salamander	3	G - Amphibians
Amphibians	<i>Ambystoma californiense</i>	California tiger salamander (Sonoma DPS)	2	G - Amphibians
Amphibians	<i>Ambystoma californiense</i>	California tiger salamander (Central CA DPS)	3	G - Amphibians
Amphibians	<i>Ambystoma californiense</i>	California tiger salamander (Santa Barbara DPS)	3	G - Amphibians
Amphibians	<i>Ambystoma cingulatum</i>	Frosted Flatwoods salamander	3	G - Amphibians
Amphibians	<i>Anaxyrus californicus</i>	Arroyo toad	3	G - Amphibians
Amphibians	<i>Anaxyrus canorus</i>	Yosemite toad	3	E - Federal Lands
Amphibians	<i>Bufo houstonensis</i>	Houston toad	1	G - Amphibians
Amphibians	<i>Eleutherodactylus cooki</i>	Guajón	3	D - No Overlap
Amphibians	<i>Eleutherodactylus jasperii</i>	Golden coqui	1	D - No Overlap
Amphibians	<i>Eleutherodactylus juanariveroi</i>	Llanero coqui	3	D - No Overlap
Amphibians	<i>Eurycea chisholmensis</i>	Salado salamander	3	G - Amphibians
Amphibians	<i>Eurycea nana</i>	San Marcos salamander	1	G - Amphibians
Amphibians	<i>Eurycea naufragia</i>	Georgetown salamander	3	G - Amphibians
Amphibians	<i>Eurycea tonkawae</i>	Jollyville Plateau salamander	3	G - Amphibians
Amphibians	<i>Eurycea waterlooensis</i>	Austin blind salamander	3	G - Amphibians
Amphibians	<i>Lithobates chiricahuensis</i>	Chiricahua leopard frog	3	E - Federal Lands
Amphibians	<i>Necturus alabamensis</i>	Black warrior waterdog	3	G - Amphibians
Amphibians	<i>Necturus lewisi</i>	Neuse River waterdog	3	D - No Overlap
Amphibians	<i>Plethodon neomexicanus</i>	Jemez Mountains salamander	2	G - Amphibians
Amphibians	<i>Rana draytonii</i>	California red-legged frog	3	G - Amphibians
Amphibians	<i>Rana muscosa</i>	Mountain yellow-legged frog (S CA DPS)	2	G - Amphibians
Amphibians	<i>Rana muscosa</i>	Mountain yellow-legged frog (N CA DPS)	3	G - Amphibians
Amphibians	<i>Rana pretiosa</i>	Oregon spotted frog	3	G - Amphibians
Amphibians	<i>Rana sevosa</i>	Dusky gopher frog	3	G - Amphibians

² 1 – PBFs are not specified in critical habitat rules; biological information was reviewed to determine if habitat elements comparable to the relevant PBFs would be applicable; 2 – Specified PBFs are not anticipated to be affected by pesticides; 3 – Specified PBFs may be affected by pesticides, as described in rationales for determinations in the subsequent sections.

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Amphibians	<i>Rana sierra</i>	Sierra Nevada yellow-legged frog	3	E - Federal Lands
Arachnids	<i>Adelocosa anops</i>	Kauai cave wolf or pe'e pe'e maka 'ole spider	3	H - Arachnids
Arachnids	<i>Cicurina baronia</i>	Robber Baron Cave meshweaver	3	H - Arachnids
Arachnids	<i>Cicurina madla</i>	Madla's Cave meshweaver	3	H - Arachnids
Arachnids	<i>Cicurina venii</i>	Braken Bat Cave meshweaver	3	H - Arachnids
Arachnids	<i>Cicurina vespera</i>	Government Canyon Bat Cave meshweaver	3	H - Arachnids
Arachnids	<i>Microhexura montivaga</i>	Spruce-fir moss spider	3	E - Federal Lands
Arachnids	<i>Neoleptoneta microps</i>	Government Canyon Bat Cave spider	3	H - Arachnids
Arachnids	<i>Texella cokendolpheri</i>	Cokendolpher Cave harvestman	3	H - Arachnids
Birds	<i>Agelaius xanthomus</i>	Yellow-shouldered blackbird	1	D - No Overlap
Birds	<i>Ammodramus maritimus mirabilis</i>	Cape Sable seaside sparrow	3	I - Birds
Birds	<i>Brachyramphus marmoratus</i>	Marbled murrelet	2	I - Birds
Birds	<i>Centrocercus minimus</i>	Gunnison sage-grouse	3	I - Birds
Birds	<i>Charadrius melodus</i>	Piping plover - Entire population (except Great Lakes Watershed)	3	I - Birds
Birds	<i>Charadrius melodus</i>	Piping plover - Great Lakes Watershed	2	I - Birds
Birds	<i>Charadrius nivosus nivosus</i>	Western snowy plover	3	I - Birds
Birds	<i>Chasiempis ibidis</i>	Oahu Elepaio	3	D - No Overlap
Birds	<i>Coccyzus americanus</i>	Yellow-billed cuckoo (Western U. S. DPS)	3	I - Birds
Birds	<i>Corvus kubaryi</i>	Mariana (=aga) crow	3	D - No Overlap
Birds	<i>Empidonax traillii extimus</i>	Southwestern willow flycatcher	3	I - Birds
Birds	<i>Eremophila alpestris strigata</i>	Streaked Horned lark	2	I - Birds
Birds	<i>Grus americana</i>	Whooping crane	3	I - Birds
Birds	<i>Grus canadensis pulla</i>	Mississippi sandhill crane	1	I - Birds
Birds	<i>Gymnogyps californianus</i>	California condor	1	I - Birds
Birds	<i>Loxioides bailleui</i>	Palila (honeycreeper)	2	I - Birds
Birds	<i>Loxops caeruleirostris</i>	Akekee	3	D - No Overlap
Birds	<i>Oreomystis bairdi</i>	Akikiki	3	D - No Overlap
Birds	<i>Palmeria dolei (batched)</i>	Crested honeycreeper	2	I - Birds
Birds	<i>Pipilo crissalis eremophilus</i>	Inyo California towhee	2	I - Birds
Birds	<i>Polioptila californica californica</i>	Coastal California gnatcatcher	2	I - Birds
Birds	<i>Polysticta stelleri</i>	Steller's eider	3	D - No Overlap
Birds	<i>Pseudonestor xanthophrys (batched)</i>	Maui parrotbill (honeycreeper)	2	I - Birds

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Birds	<i>Rostrhamus sociabilis plumbeus</i>	Everglade snail kite	1	I - Birds
Birds	<i>Setophaga angelae</i>	Elfin-woods warbler	3	D - No Overlap
Birds	<i>Somateria fischeri</i>	Spectacled eider	3	D - No Overlap
Birds	<i>Strix occidentalis caurina</i>	Northern spotted owl	2	I - Birds
Birds	<i>Strix occidentalis lucida</i>	Mexican spotted owl	2	I - Birds
Birds	<i>Todiramphus cinnamominus</i>	Guam Micronesian kingfisher	3	-D - No Overlap
Birds	<i>Vireo bellii pusillus</i>	Least Bell's vireo	2	I - Birds
Birds	<i>Zosterops rotensis</i>	Rota bridled white-eye	2	I - Birds
Clams	<i>Alasmidonta atropurpurea</i>	Cumberland elktoe	3	J - Clams
Clams	<i>Alasmidonta raveneliana</i>	Appalachian elktoe	3	J - Clams
Clams	<i>Amblema neislerii</i>	Fat three-ridge (mussel)	3	J - Clams
Clams	<i>Cyclonaias necki</i>	Guadalupe orb	3	J - Clams
Clams	<i>Cyclonaias (=Quadrula) petrina</i>	Texas pimpleback	3	J - Clams
Clams	<i>Elliptio chipolaensis</i>	Chipola slabshell	3	J - Clams
Clams	<i>Elliptio lanceolata</i>	Yellow lance	3	D - No Overlap
Clams	<i>Elliptio spinosa</i>	Altamaha spinymussel	3	J - Clams
Clams	<i>Elliptoideus sloatianus</i>	Purple bankclimber (mussel)	3	J - Clams
Clams	<i>Epioblasma brevidens</i>	Cumberlandian combshell	3	J - Clams
Clams	<i>Epioblasma capsaeformis</i>	Oyster mussel	3	J - Clams
Clams	<i>Epioblasma metastrata</i>	Upland combshell	3	J - Clams
Clams	<i>Epioblasma othcaloogensis</i>	Southern acornshell	3	J - Clams
Clams	<i>Fusconaia burkei</i>	Tapered pigtoe	3	J - Clams
Clams	<i>Fusconaia escambia</i>	Narrow pigtoe	3	J - Clams
Clams	<i>Fusconaia masoni</i>	Atlantic pigtoe	3	D - No Overlap
Clams	<i>Fusconaia mitchelli</i>	False spike	3	J - Clams
Clams	<i>Fusconaia rotulata</i>	Round ebonyshell	3	J - Clams
Clams	<i>Hamiota australis</i>	Southern sandshell	3	J - Clams
Clams	<i>Lampsilis altilis</i>	Finelined pocketbook	3	J - Clams
Clams	<i>Lampsilis bergmanni</i>	Guadalupe fatmucket	3	J - Clams
Clams	<i>Lampsilis bracteata</i>	Texas fatmucket	3	J - Clams
Clams	<i>Lampsilis perovalis</i>	Orangenacre mucket	3	J - Clams
Clams	<i>Lampsilis rafinesqueana</i>	Neosho Mucket	3	J - Clams
Clams	<i>Lampsilis subangulata</i>	Shinyrayed pocketbook	3	J - Clams
Clams	<i>Lasmigona decorata</i>	Carolina heelsplitter	3	J - Clams
Clams	<i>Margaritifera marrianae</i>	Alabama pearlshell	3	J - Clams
Clams	<i>Medionidus acutissimus</i>	Alabama moccasinshell	3	J - Clams
Clams	<i>Medionidus parvulus</i>	Coosa moccasinshell	3	J - Clams
Clams	<i>Medionidus penicillatus</i>	Gulf moccasinshell	3	J - Clams
Clams	<i>Medionidus simpsonianus</i>	Ochlockonee moccasinshell	3	J - Clams
Clams	<i>Medionidus walkeri</i>	Suwannee moccasinshell	3	J - Clams
Clams	<i>Pleurobema decisum</i>	Southern clubshell	3	J - Clams
Clams	<i>Pleurobema furvum</i>	Dark pigtoe	3	J - Clams
Clams	<i>Pleurobema georgianum</i>	Southern pigtoe	3	J - Clams
Clams	<i>Pleurobema hanleyianum</i>	Georgia pigtoe	3	J - Clams
Clams	<i>Pleurobema perovatum</i>	Ovate clubshell	3	J - Clams
Clams	<i>Pleurobema pyriforme</i>	Oval pigtoe	3	J - Clams

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Clams	<i>Pleurobema strodeanum</i>	Fuzzy pigtoe	3	J - Clams
Clams	<i>Pleurobema dolabelloides</i>	Slabside pearlymussel	3	J - Clams
Clams	<i>Popenaias popeii</i>	Texas hornshell	3	J - Clams
Clams	<i>Ptychobranhus greenii</i>	Triangular kidneyshell	3	J - Clams
Clams	<i>Ptychobranhus jonesi</i>	Southern kidneyshell	3	J - Clams
Clams	<i>Ptychobranhus subtentum</i>	Fluted kidneyshell	3	J - Clams
Clams	<i>Quadrula cylindrica cylindrica</i>	Rabbitsfoot	3	J - Clams
Clams	<i>Quadrula cylindrica strigillata</i>	Rough rabbitsfoot	3	J - Clams
Clams	<i>Truncilla macrodon</i>	Texas fawnsfoot	3	J - Clams
Clams	<i>Villosa choctawensis</i>	Choctaw bean	3	J - Clams
Clams	<i>Villosa perpurpurea</i>	Purple bean	3	J - Clams
Clams	<i>Pleurobema athearni</i>	Canoe Creek clubshell	3	J - Clams
Clams	<i>Obovaria subrotunda</i>	Round hickorynut	3	J - Clams
Clams	<i>Fusconaia subrotunda</i>	Longsolid	3	J - Clams
Crustaceans	<i>Branchinecta conservatio</i>	Conservancy fairy shrimp	3	K - Crustaceans
Crustaceans	<i>Branchinecta longiantenna</i>	Longhorn fairy shrimp	3	K - Crustaceans
Crustaceans	<i>Branchinecta lynchi</i>	Vernal pool fairy shrimp	3	K - Crustaceans
Crustaceans	<i>Branchinecta sandiegonensis</i>	San Diego fairy shrimp	3	K - Crustaceans
Crustaceans	<i>Cambarus cracens</i>	Slenderclaw Crayfish	3	D - No Overlap
Crustaceans	<i>Gammarus desperatus</i>	Noel's amphipod	3	E - Federal Lands
Crustaceans	<i>Gammarus hyalleloides</i>	Diminutive amphipod	3	K - Crustaceans
Crustaceans	<i>Gammarus pecos</i>	Pecos amphipod	3	K - Crustaceans
Crustaceans	<i>Lepidurus packardi</i>	Vernal pool tadpole shrimp	3	K - Crustaceans
Crustaceans	<i>Palaemonias ganteri</i>	Kentucky cave shrimp	2	K - Crustaceans
Crustaceans	<i>Procambarus econfinae</i>	Panama City crayfish	3	K - Crustacean
Crustaceans	<i>Spelaeorchestia koloana</i>	Kauai cave amphipod	3	K - Crustaceans
Crustaceans	<i>Streptocephalus woottoni</i>	Riverside fairy shrimp	3	K - Crustaceans
Crustaceans	<i>Stygobromus (=Stygonectes) pecki</i>	Peck's cave amphipod	3	K - Crustaceans
Crustaceans	<i>Faxonius peruncus</i>	Big Creek crayfish	3	K - Crustaceans
Crustaceans	<i>Faxonius quadruncus</i>	St. Francis River crayfish	3	K - Crustaceans
Fishes	<i>Acipenser oxyrinchus (=oxyrhynchus) desotoi</i>	Atlantic sturgeon (Gulf subspecies)	3	L - Fishes
Fishes	<i>Acipenser transmontanus</i>	White Sturgeon (Kootenai River population)	2	L - Fishes
Fishes	<i>Catostomus discobolus yarrowi</i>	Zuni bluehead Sucker	3	L - Fishes
Fishes	<i>Catostomus santaanae</i>	Santa Ana sucker	3	L - Fishes
Fishes	<i>Catostomus warnerensis</i>	Warner sucker	3	L - Fishes
Fishes	<i>Chasmistes brevirostris</i>	Shortnose sucker	3	L - Fishes
Fishes	<i>Chasmistes liorus</i>	June sucker	3	L - Fishes
Fishes	<i>Chrosomus saylari</i>	Laurel dace	3	L - Fishes
Fishes	<i>Crenichthys baileyi baileyi</i>	White River springfish	3	L - Fishes
Fishes	<i>Crenichthys baileyi grandis</i>	Hiko White River springfish	3	L - Fishes
Fishes	<i>Crenichthys nevadae</i>	Railroad Valley springfish	3	L - Fishes

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Fishes	<i>Crystallaria cincotta</i>	Diamond darter	3	L - Fishes
Fishes	<i>Cyprinella formosa</i>	Beautiful shiner	3	L - Fishes
Fishes	<i>Cyprinodon bovinus</i>	Leon Springs pupfish	1	L - Fishes
Fishes	<i>Cyprinodon macularius</i>	Desert pupfish	3	E - Federal Lands
Fishes	<i>Cyprinodon nevadensis mionectes</i>	Ash Meadows Amargosa pupfish	3	E - Federal Lands
Fishes	<i>Deltistes luxatus</i>	Lost River sucker	3	L - Fishes
Fishes	<i>Dionda diaboli</i>	Devils River minnow	3	L - Fishes
Fishes	<i>Elassoma alabamae</i>	Spring pygmy sunfish	3	L - Fishes
Fishes	<i>Eremichthys acros</i>	Desert dace	3	E - Federal Lands
Fishes	<i>Erimonax monachus</i>	Spotfin chub	1	L - Fishes
Fishes	<i>Erimystax cahni</i>	Slender chub	1	L - Fishes
Fishes	<i>Etheostoma boschungii</i>	Slackwater darter	1	L - Fishes
Fishes	<i>Etheostoma chermocki</i>	Vermilion darter	3	L - Fishes
Fishes	<i>Etheostoma fonticola</i>	Fountain darter	1	L - Fishes
Fishes	<i>Etheostoma moorei</i>	Yellowcheek darter	3	L - Fishes
Fishes	<i>Etheostoma nianguae</i>	Niangua darter	2	L - Fishes
Fishes	<i>Etheostoma osburni</i>	Candy darter	3	L - Fishes
Fishes	<i>Etheostoma phytophilum</i>	Rush darter	3	L - Fishes
Fishes	<i>Etheostoma spilotum</i>	Kentucky arrow darter	3	D - No Overlap
Fishes	<i>Etheostoma susanae</i>	Cumberland darter	3	L - Fishes
Fishes	<i>Etheostoma trisella</i>	Trispot darter	3	L - Fishes
Fishes	<i>Eucyclogobius newberryi</i>	Tidewater goby	3	L - Fishes
Fishes	<i>Gambusia georgei</i>	San Marcos gambusia	1	L - Fishes
Fishes	<i>Gila bicolor ssp. snyderi</i>	Owens tui chub	3	L - Fishes
Fishes	<i>Gila cypha</i>	Humpback chub	3	L - Fishes
Fishes	<i>Gila ditaenia</i>	Sonora chub	3	E - Federal Lands
Fishes	<i>Gila elegans</i>	Bonytail chub	3	E - Federal Lands
Fishes	<i>Gila intermedia</i>	Gila chub	3	L - Fishes
Fishes	<i>Gila purpurea</i>	Yaqui chub	3	L - Fishes
Fishes	<i>Gila seminuda (=robusta)</i>	Virgin River chub	3	L - Fishes
Fishes	<i>Hybognathus amarus</i>	Rio Grande silvery minnow	3	L - Fishes
Fishes	<i>Hypomesus transpacificus</i>	Delta smelt	3	L - Fishes
Fishes	<i>Ictalurus pricei</i>	Yaqui catfish	3	L - Fishes
Fishes	<i>Lepidomeda albvallis</i>	White River spinedace	3	L - Fishes
Fishes	<i>Lepidomeda mollispinis pratensis</i>	Big Spring spinedace	3	L - Fishes
Fishes	<i>Lepidomeda vittata</i>	Little Colorado spinedace	3	L - Fishes
Fishes	<i>Meda fulgida</i>	Spikedace	3	L - Fishes
Fishes	<i>Menidia extensa</i>	Waccamaw silverside	3	L - Fishes
Fishes	<i>Notropis buccula</i>	Smalleye Shiner	3	L - Fishes
Fishes	<i>Notropis girardi</i>	Arkansas River shiner	3	L - Fishes
Fishes	<i>Notropis mekistocholas</i>	Cape Fear shiner	1	L - Fishes
Fishes	<i>Notropis oxyrhynchus</i>	Sharpnose Shiner	3	L - Fishes
Fishes	<i>Notropis simus pecosensis</i>	Pecos bluntnose shiner	3	L - Fishes
Fishes	<i>Notropis topeka=tristis</i>	Topeka shiner	3	L - Fishes
Fishes	<i>Noturus baileyi</i>	Smoky madtom	3	E - Federal Lands
Fishes	<i>Noturus crypticus</i>	Chucky madtom	3	L - Fishes
Fishes	<i>Noturus flavipinnis</i>	Yellowfin madtom	1	L - Fishes
Fishes	<i>Noturus furiosus</i>	Carolina madtom	3	D - No Overlap
Fishes	<i>Oncorhynchus aguabonita whitei</i>	Little Kern golden trout	1	E - Federal Lands

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Fishes	<i>Percina antesella</i>	Amber darter	3	L - Fishes
Fishes	<i>Percina jenkinsi</i>	Conasauga logperch	3	L - Fishes
Fishes	<i>Percina pantherina</i>	Leopard darter	1	L - Fishes
Fishes	<i>Plagopterus argentissimus</i>	Woundfin	3	L - Fishes
Fishes	<i>Ptychocheilus lucius</i>	Colorado pikeminnow (=squawfish)	3	L - Fishes
Fishes	<i>Rhinichthys osculus nevadensis</i>	Ash Meadows speckled dace	3	E - Federal Lands
Fishes	<i>Salmo salar</i>	Atlantic salmon (Gulf of Maine DPS)	3	L - Fishes
Fishes	<i>Salvelinus confluentus</i>	Bull Trout	3	L - Fishes
Fishes	<i>Scaphirhynchus suttkusi</i>	Alabama sturgeon	3	L - Fishes
Fishes	<i>Speoplatyrhinus poulsoni</i>	Alabama cavefish	1	L - Fishes
Fishes	<i>Tiaroga cobitis</i>	Loach minnow	3	L - Fishes
Fishes	<i>Xyrauchen texanus</i>	Razorback sucker	3	L - Fishes
Fishes	<i>Noturus munitus</i>	Frecklebelly madtom	3	L - Fishes
Insects	<i>Ambrysus amargosus</i>	Ash Meadows naucorid	2	M - Insects
Insects	<i>Anaea troglodyta floridalis</i>	Florida leafwing butterfly	3	M - Insects
Insects	<i>Batrisesodes venyivi</i>	Helotes mold beetle	3	M - Insects
Insects	<i>Cicindela nevadica lincolniiana</i>	Salt Creek tiger beetle	3	M - Insects
Insects	<i>Desmocerus californicus dimorphus</i>	Valley elderberry longhorn beetle	3	C - Host Plant PBFs
Insects	<i>Dinacoma caseyi</i>	Casey's June beetle	2	M - Insects
Insects	<i>Drosophila Aglaia</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila differens</i>	Hawaiian picture-wing fly	3	C - Host Plant PBFs
Insects	<i>Drosophila hemipeza</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila heteroneura</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila montgomeryi</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila mulli</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila musaphilia</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila neoclavisetae</i>	Hawaiian picture-wing fly	3	C - Host Plant PBFs
Insects	<i>Drosophila obatai</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila ochrobasis</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila sharpi</i>	Hawaiian picture-wing fly	3	C - Host Plant PBFs
Insects	<i>Drosophila substenoptera</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Drosophila tarphytrichia</i>	[Unnamed] pomace fly	3	C - Host Plant PBFs
Insects	<i>Elaphrus viridis</i>	Delta green ground beetle	2	M - Insects
Insects	<i>Euchloe ausonides insulanus</i>	Island marble Butterfly	3	C - Host Plant PBFs
Insects	<i>Euphydryas editha bayensis</i>	Bay checkerspot butterfly	3	M - Insects
Insects	<i>Euphydryas editha quino</i>	Quino checkerspot butterfly	3	C - Host Plant PBFs
Insects	<i>Euphydryas editha taylori</i>	Taylor's (=whulge) Checkerspot Butterfly	3	C - Host Plant PBFs
Insects	<i>Glaucopsyche lygdamus palosverdesensis</i>	Palos Verdes blue butterfly	1	C - Host Plant PBFs
Insects	<i>Hesperia dacotae</i>	Dakota Skipper	3	C - Host Plant PBFs
Insects	<i>Heterelmis comalensis</i>	Comal Springs riffle beetle	3	M - Insects

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Insects	<i>Icaricia (Plebejus) shasta charlestonensis</i>	Mount Charleston blue butterfly	3	C - Host Plant PBFs
Insects	<i>Icaricia icarioides fenderi</i>	Fender's blue butterfly	3	C - Host Plant PBFs
Insects	<i>Lycaena hermes</i>	Hermes copper butterfly	3	C - Host Plant PBFs
Insects	<i>Manduca blackburni</i>	Blackburn's sphinx moth	3	C - Host Plant PBFs
Insects	<i>Megalagrion leptodemas</i>	Crimson Hawaiian damselfly	3	D - No Overlap
Insects	<i>Megalagrion nigrohamatum nigrolineatum</i>	Blackline Hawaiian damselfly	3	D - No Overlap
Insects	<i>Megalagrion oceanicum</i>	Oceanic Hawaiian damselfly	3	D - No Overlap
Insects	<i>Oarisma poweshiek</i>	Poweshiek skipperling	3	M - Insects
Insects	<i>Pyrgus ruralis lagunae</i>	Laguna Mountains skipper	3	C - Host Plant PBFs
Insects	<i>Rhadine exilis</i>	[Unnamed] ground beetle	3	M - Insects
Insects	<i>Rhadine infernalis</i>	[Unnamed] ground beetle	3	M - Insects
Insects	<i>Somatochlora hineana</i>	Hine's emerald dragonfly	3	M - Insects
Insects	<i>Speyeria zerene hippolyta</i>	Oregon silverspot butterfly	3	C - Host Plant PBFs
Insects	<i>Strymon acis bartrami</i>	Bartram's hairstreak butterfly	3	M - Insects
Insects	<i>Stygoparnus comalensis</i>	Comal Springs dryopid beetle	3	M - Insects
Insects	<i>Trimerotropis infantilis</i>	Zayante band-winged grasshopper	2	M - Insects
Mammals	<i>Corynorhinus (=Plecotus) townsendii virginianus</i>	Virginia big-eared bat	1	N - Mammals
Mammals	<i>Dipodomys heermanni morroensis</i>	Morro Bay kangaroo rat	1	N - Mammals
Mammals	<i>Dipodomys merriami parvus</i>	San Bernardino Merriam's kangaroo rat	2	N - Mammals
Mammals	<i>Dipodomys nitratooides exilis</i>	Fresno kangaroo rat	2	N - Mammals
Mammals	<i>Eumops floridanus</i>	Florida bonneted bat	3	N - Mammals
Mammals	<i>Lynx canadensis</i>	Canada lynx	2	N - Mammals
Mammals	<i>Martes caurina</i>	Pacific marten	3	N - Mammals
Mammals	<i>Microtus californicus scirpensis</i>	Amargosa vole	2	N - Mammals
Mammals	<i>Myotis sodalis</i>	Indiana bat	1	N - Mammals
Mammals	<i>Oryzomys palustris natator</i>	Rice rat	2	N - Mammals
Mammals	<i>Ovis canadensis nelsoni</i>	Peninsular bighorn sheep	2	N - Mammals
Mammals	<i>Ovis canadensis sierrae</i>	Sierra Nevada bighorn sheep	2	N - Mammals
Mammals	<i>Panthera onca</i>	Jaguar	2	N - Mammals
Mammals	<i>Pekania pennanti</i>	Fisher (Southern Sierra Nevada DPS)	3	E - Federal Lands
Mammals	<i>Peromyscus polionotus allopheys</i>	Choctawhatchee beach mouse	2	N - Mammals
Mammals	<i>Peromyscus polionotus ammobates</i>	Alabama beach mouse	2	N - Mammals
Mammals	<i>Peromyscus polionotus peninsularis</i>	St. Andrew beach mouse	2	N - Mammals

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Mammals	<i>Peromyscus polionotus trissyllepsis</i>	Perdido Key beach mouse	2	N - Mammals
Mammals	<i>Pteropus mariannus mariannus</i>	Mariana fruit bat (=Mariana flying fox)	3	D - No Overlap
Mammals	<i>Rangifer tarandus caribou</i>	Woodland caribou	2	N - Mammals
Mammals	<i>Sorex ornatus relictus</i>	Buena Vista Lake ornate shrew	3	N - Mammals
Mammals	<i>Tamiasciurus hudsonicus grahamensis</i>	Mount Graham red squirrel	2	N - Mammals
Mammals	<i>Thomomys mazama pugetensis</i>	Olympia pocket gopher	2	N - Mammals
Mammals	<i>Thomomys mazama tumuli</i>	Tenino pocket gopher	2	N - Mammals
Mammals	<i>Thomomys mazama yelmensis</i>	Yelm pocket gopher	2	N - Mammals
Mammals	<i>Trichechus manatus</i>	West Indian Manatee	1	N - Mammals
Mammals	<i>Ursus maritimus</i>	Polar bear	2	N - Mammals
Mammals	<i>Zapus hudsonius luteus</i>	New Mexico meadow jumping mouse	3	N - Mammals
Mammals	<i>Zapus hudsonius preblei</i>	Preble's meadow jumping mouse	2	N - Mammals
Reptiles	<i>Ameiva polops</i>	St. Croix ground lizard	1	D - No Overlap
Reptiles	<i>Anolis roosevelti</i>	Culebra Island giant anole	1	D - No Overlap
Reptiles	<i>Caretta caretta</i>	Loggerhead sea turtle	2	O - Reptiles
Reptiles	<i>Crocodylus acutus</i>	American crocodile	1	O - Reptiles
Reptiles	<i>Crotalus willardi obscurus</i>	New Mexican ridge-nosed rattlesnake	1	O - Reptiles
Reptiles	<i>Cyclura stejnegeri</i>	Mona ground Iguana	1	D - No Overlap
Reptiles	<i>Dermochelys coriacea</i>	Leatherback sea turtle	1	D - No Overlap
Reptiles	<i>Epicrates monensis monensis</i>	Mona boa	1	D - No Overlap
Reptiles	<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	1	D - No Overlap
Reptiles	<i>Gopherus agassizii</i>	Desert tortoise	2	O - Reptiles
Reptiles	<i>Kinosternon sonoriense longifemorale</i>	Sonoyta Mud Turtle	3	O - Reptiles
Reptiles	<i>Masticophis lateralis euryxanthus</i>	Alameda whipsnake (=striped racer)	3	O - Reptiles
Reptiles	<i>Pituophis melanoleucus lodingi</i>	Black Pinesnake	3	O - Reptiles
Reptiles	<i>Pseudemys rubriventris bangsi</i>	Plymouth red-bellied turtle	3	O - Reptiles
Reptiles	<i>Thamnophis eques megalops</i>	Northern Mexican gartersnake	3	O - Reptiles
Reptiles	<i>Thamnophis rufipunctatus</i>	Narrow-headed garter snake	3	O - Reptiles
Reptiles	<i>Uma inornata</i>	Coachella Valley fringe-toed lizard	2	O - Reptiles
Snails	<i>Antrobia culveri</i>	Tumbling Creek cavesnail	3	P - Snails
Snails	<i>Assiminea pecos</i>	Pecos assiminea snail	3	P - Snails
Snails	<i>Erinna newcombi</i>	Newcomb's snail	3	D - No Overlap
Snails	<i>Helminthoglypta walkeriana</i>	Morro shoulderband (=Banded dune) snail	3	P - Snails

Taxa	Scientific Name	Common Name	Category ²	Conclusion Section
Snails	<i>Juturnia kosteri</i>	Koster's springsnail	3	E - Federal Lands
Snails	<i>Leptoxis foremani</i>	Interrupted (=Georgia) Rocksnailed	3	P - Snails
Snails	<i>Newcombia cumingi</i>	Newcomb's Tree snail	2	P - Snails
Snails	<i>Pleurocera foremani</i>	Rough hornsnailed	3	P - Snails
Snails	<i>Pseudotryonia adamantina</i>	Diamond tryonia (formerly Diamond Y Spring Snail)	3	P - Snails
Snails	<i>Pyrgulopsis bernardina</i>	San Bernardino springsnailed	3	P - Snails
Snails	<i>Pyrgulopsis chupaderae</i>	Chupadera springsnailed	3	P - Snails
Snails	<i>Pyrgulopsis roswellensis</i>	Roswell springsnailed	3	E - Federal Lands
Snails	<i>Pyrgulopsis texana</i>	Phantom Springsnailed (formerly Phantom Cave Snail)	3	P - Snails
Snails	<i>Pyrgulopsis trivialis</i>	Three Forks springsnailed	3	E - Federal Lands
Snails	<i>Tryonia cheatumi</i>	Phantom tyronia (formerly Phantom Springsnailed (=Tryonia))	3	P - Snails
Snails	<i>Tryonia circumstriata</i>	Gonzales tryonia (formerly Gonzales springsnailed)	3	P - Snails

C. Critical Habitats with only Host Plant PBFs

For a number of insect species (as shown in Table 2), we found that critical habitat rules referenced one or more host plants that are essential for the conservation of the species, but did not describe or refer to any of the other PBFs that we found to be relevant to our analysis. The potential broad-scale use of this pesticide for all allowable uses within the ecosystem could affect pollinators of the host plant species. However, while mortality is generally expected for insect pollinators exposed to malathion on use sites, terrestrial invertebrates exhibit a range of sensitivities to malathion. We expect that there will be a reduction in pollinator abundance with malathion use, although based on field studies, we expect reductions following pesticide exposure would be temporary with recovery likely over a short period of time. Thus, we do not anticipate the host plants will likely be affected by loss of pollinators to the degree that would appreciably reduce the availability or functional roles of the host plants needed by the species. In addition, while malathion can affect native vegetation by reducing plant size or vigor if the foliage or ground is directly sprayed, the magnitude of this impact is anticipated to be small (less than 12% reduction in biomass), and would only occur on a limited number of use sites where the threshold for direct impacts to plants could be exceeded. These use types include orchards and vineyard, residential, Christmas trees, and nurseries. (see General Effects to Plants in the Opinion for detailed information). Furthermore, conservation measures will be implemented that include new restrictions to the method and frequency of application for residential uses, and reduced application number and rate for the orchards and vineyards use sites (see *Effects of the Action* section). These measures are anticipated to further limit the exposure of host plants and their pollinators in proximity to these use sites. As such, we do not anticipate these effects will appreciably reduce the host plant functions, or the value of critical habitat as a whole for the conservation of the species. Thus, we have determined the Action is not likely to result in the destruction or adverse modification of the designated and proposed critical habitats in Table 2 below.

Table 2. Summary of insect species with host plant PBFs mentioned in their critical habitat rule.

Scientific Name	Common Name
<i>Desmocerus californicus dimorphus</i>	Valley elderberry longhorn beetle
<i>Drosophila aglaia</i>	[Unnamed] pomace fly
<i>Drosophila differens</i>	Hawaiian picture-wing fly
<i>Drosophila hemipeza</i>	[Unnamed] pomace fly
<i>Drosophila heteroneura</i>	[Unnamed] pomace fly
<i>Drosophila montgomeryi</i>	[Unnamed] pomace fly
<i>Drosophila mulli</i>	[Unnamed] pomace fly
<i>Drosophila musaphilia</i>	[Unnamed] pomace fly
<i>Drosophila neoclavisetae</i>	Hawaiian picture-wing fly
<i>Drosophila obatai</i>	[Unnamed] pomace fly
<i>Drosophila ochrobasis</i>	[Unnamed] pomace fly
<i>Drosophila sharpi</i>	Hawaiian picture-wing fly
<i>Drosophila substenoptera</i>	[Unnamed] pomace fly
<i>Drosophila tarphytrichia</i>	[Unnamed] pomace fly
<i>Euchloe ausonides insulanus</i>	Island marble Butterfly
<i>Euphydryas editha quino</i>	Quino checkerspot butterfly
<i>Euphydryas editha taylori</i>	Taylor's (=whulge) Checkerspot Butterfly
<i>Glaucopsyche lygdamus palosverdesensis</i>	Palos Verdes blue butterfly
<i>Hesperia dacotae</i>	Dakota Skipper
<i>Icaricia (Plebejus) shasta charlestonensis</i>	Mount Charleston blue butterfly
<i>Icaricia icarioides fenderi</i>	Fender's blue butterfly
<i>Lycaena hermes</i>	Hermes copper butterfly
<i>Manduca blackburni</i>	Blackburn's sphinx moth
<i>Pyrgus ruralis lagunae</i>	Laguna Mountains skipper
<i>Speyeria zerene hippolyta</i>	Oregon silverspot butterfly

D. Critical Habitats Having No Overlap with Malathion Uses

A subset of critical habitats are not expected to be affected by the use of malathion to an appreciable degree, as we do not anticipate applications within the critical habitat itself due to lack of overlap with malathion use sites. Additional, qualitative review of these critical habitats confirmed that the habitats listed in Table 3 are not expected to be appreciably contaminated by malathion. While applications could occur near the species' critical habitat and transport of malathion could reach the critical habitat through runoff or spray drift, any exposure is expected to be low and limited to areas fairly close to application sites. General conservation measures for malathion are designed to minimize transport from spray drift and runoff, and minimize non-target site exposure and environmental concentrations (see the Influence of Conservation Measures on Exposure and Effects section in the Opinion). In addition, malathion does not tend to persist in the environment. It has a half-life of approximately 0.3-7 days in soil and 0.5 to 6 days in water under most natural conditions, although it can persist longer under uncommon conditions such as in waters that are highly acidic (see Chapter 3 of EPA's BE for malathion for a more detailed discussion). Based on the conservation measures in place to reduce the risk of exposure, the typical short-term persistence of malathion in the environment, and limited anticipated transport of malathion that would enter critical habitats from nearby use sites at concentrations that would be of concern to critical habitat PBFs, we expect only low level effects to the critical habitats in this group. The Action is not anticipated to appreciably diminish the value of any of the critical habitats as a whole in this group, and thus the critical habitats in Table 3 were each given a NDAM determination.

Table 3. Summary of species with no overlapping malathion uses in their designated critical habitat.

Taxa	Scientific Name	Common Name
Amphibians	<i>Eleutherodactylus cooki</i>	Guajón
Amphibians	<i>Eleutherodactylus jasperi</i>	Golden coqui
Amphibians	<i>Eleutherodactylus juanariveroi</i>	Llanero coqui
Amphibians	<i>Necturus lewisi</i>	Neuse River waterdog
Birds	<i>Agelaius xanthomus</i>	Yellow-shouldered blackbird
Birds	<i>Chasiempis ibidis</i>	Oahu Elepaio
Birds	<i>Corvus kubaryi</i>	Mariana (=aga) crow
Birds	<i>Loxops caeruleirostris</i>	Akekee
Birds	<i>Oreomystis bairdi</i>	Akikiki
Birds	<i>Polysticta stelleri</i>	Steller's eider
Birds	<i>Setophaga angelae</i>	Elfin-woods warbler
Birds	<i>Somateria fischeri</i>	Spectacled eider
Birds	<i>Todiramphus cinnamominus</i>	Guam Micronesian kingfisher
Clams	<i>Elliptio lanceolata</i>	Yellow lance
Clams	<i>Fusconaia masoni</i>	Atlantic pigtoe
Crustaceans	<i>Cambarus cracens</i>	Slenderclaw Crayfish
Fishes	<i>Etheostoma spilotum</i>	Kentucky arrow darter
Fishes	<i>Noturus furiosus</i>	Carolina madtom
Insects	<i>Megalagrion leptodemas</i>	Crimson Hawaiian damselfly
Insects	<i>Megalagrion nigrohamatum</i> <i>nigrolineatum</i>	Blackline Hawaiian damselfly

Taxa	Scientific Name	Common Name
Insects	<i>Megalagrion oceanicum</i>	Oceanic Hawaiian damselfly
Mammals	<i>Pteropus mariannus mariannus</i>	Mariana fruit bat (=Mariana flying fox)
Reptiles	<i>Ameiva polops</i>	St. Croix ground lizard
Reptiles	<i>Anolis roosevelti</i>	Culebra Island giant anole
Reptiles	<i>Cyclura stejnegeri</i>	Mona ground Iguana
Reptiles	<i>Dermochelys coriacea</i>	Leatherback sea turtle
Reptiles	<i>Epicrates monensis monensis</i>	Mona boa
Reptiles	<i>Eretmochelys imbricata</i>	Hawksbill sea turtle
Snails	<i>Erinna newcombi</i>	Newcomb's snail
Amphibians	<i>Eleutherodactylus jasper</i>	Golden coqui

E. Critical Habitat Predominantly Overlapping Federal Lands

The critical habitats in Table 4 were given NDAM determinations based on their large degree of overlap with existing Federal lands ($\geq 95\%$ overlap). Based on the available data, we anticipate that malathion usage is likely to occur on Federal lands over the duration of the Action, but only in very localized areas and on a limited basis, as it has in the past (see Federal Lands section under *Approach to Usage Analysis* in the Opinion). We do not have any information suggesting that future usage on Federal lands is expected to increase over current levels. We assessed information in the critical habitat rules to determine if it would be likely for the small percentage ($<5\%$) of critical habitat on non-federal lands to be disproportionately more important for the conservation and recovery of the species than areas on Federal lands, such that the usage on non-Federal lands would likely affect the value of the critical habitat as a whole for the conservation of the associated species. However, we did not find any situations where this would likely be the case. We expect any adverse effects to listed resources will be minimal, considering the small scale and low levels of past usage and in light of Federal agency programs that are designed to understand, avoid, and minimize the effects to listed species and their designated critical habitat, and the general conservation measures related to label changes for residential and agricultural uses that are expected to further reduce the likelihood of exposure and effects from these uses on non-target species and habitats (as described in Appendix A-2 and in the *Influence of Conservation Measures on Exposure on Effects* section in the Opinion). For these reasons, we made NDAM determinations for critical habitats primarily located on Federal lands (i.e. $\geq 95\%$ of the designated critical habitat acres are found on Federal lands).

Table 4. Summary of species with critical habitats overlapping with Federal lands by 95% or more.

Taxonomic Group	Scientific Name	Common Name	Critical Habitat Overlap with Federal Lands (% area)
Amphibians	<i>Lithobates chiricahuensis</i>	Chiricahua leopard frog	98.94
Amphibians	<i>Anaxyrus canorus</i>	Yosemite toad	99.93
Amphibians	<i>Rana sierra</i>	Sierra Nevada yellow-legged frog	98.79
Arachnids	<i>Microhexura montivaga</i>	Spruce-fir moss spider	100.00
Crustaceans	<i>Gammarus desperatus</i>	Noel's amphipod	96.89
Fishes	<i>Oncorhynchus aguabonita whitei</i>	Little Kern golden trout	100.00
Fishes	<i>Gila elegans</i>	Bonytail chub	95.66
Fishes	<i>Gila ditaenia</i>	Sonora chub	100.00
Fishes	<i>Noturus baileyi</i>	Smoky madtom	100.00

Taxonomic Group	Scientific Name	Common Name	Critical Habitat Overlap with Federal Lands (% area)
Fishes	<i>Rhinichthys osculus nevadensis</i>	Ash Meadows speckled dace	100.00
Fishes	<i>Eremichthys acros</i>	Desert dace	100.00
Fishes	<i>Cyprinodon nevadensis mionectes</i>	Ash Meadows Amargosa pupfish	100.00
Fishes	<i>Cyprinodon macularius</i>	Desert pupfish	100.00
Mammals	<i>Pekania pennanti</i>	Fisher (Southern Sierra Nevada DPS)	96.12
Snails	<i>Pyrgulopsis roswellensis</i>	Roswell springsnail	96.63
Snails	<i>Juturnia kosteri</i>	Koster's springsnail	96.65
Snails	<i>Pyrgulopsis trivialis</i>	Three Forks springsnail	100.00

F. Critical Habitats – Remaining Critical Habitat Categories and Rationales

The following sections describe our rationales for the remaining designated and proposed critical habitats organized by taxa group. Although some proposed and designated critical habitats have been addressed in the preceding sections, these have been included again in the taxa tables below to aid in crosswalking all of the proposed and designated critical habitats for each taxa group, with each entry indicating the location of the rationale. References to general conservation measures in the rationales below relate to label changes that will be implemented as described in the *Description of the Action* section and Appendix A-2 of this Opinion.

G. Amphibians

The categories and rationales for NDAM determinations for critical habitats of amphibian species are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the *Introduction* section of this appendix. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 5. Summary of Amphibian Critical Habitat Categories and Rationales.

Scientific Name	Common Name	Category	Rationale
<i>Ambystoma bishopi</i>	Reticulated flatwoods salamander	3	see below
<i>Ambystoma californiense</i>	California tiger salamander (Sonoma DPS)	2	no relevant PBFs
<i>Ambystoma californiense</i>	California tiger salamander (Central CA DPS)	3	see below
<i>Ambystoma californiense</i>	California tiger salamander (Santa Barbara DPS)	3	see below
<i>Ambystoma cingulatum</i>	Frosted Flatwoods salamander	3	see below
<i>Anaxyrus californicus</i>	Arroyo toad	3	see below
<i>Anaxyrus canorus</i>	Yosemite toad	3	≥95% Federal lands overlap
<i>Bufo houstonensis</i>	Houston toad	1	see below
<i>Eleutherodactylus cooki</i>	Guajón	3	no overlap
<i>Eleutherodactylus jasperii</i>	Golden coqui	1	no overlap
<i>Eleutherodactylus juanariveroi</i>	Llanero coqui	3	no overlap
<i>Eurycea chisholmensis</i>	Salado salamander	3	see below
<i>Eurycea nana</i>	San Marcos salamander	1	see below
<i>Eurycea naufragia</i>	Georgetown salamander	3	see below
<i>Eurycea tonkawae</i>	Jollyville Plateau salamander	3	see below
<i>Eurycea waterlooensis</i>	Austin blind salamander	3	see below
<i>Lithobates chiricahuensis</i>	Chiricahua leopard frog	3	≥95% Federal lands overlap
<i>Necturus alabamensis</i>	Black warrior waterdog	3	see below
<i>Necturus lewisi</i>	Neuse River waterdog	3	no overlap

Scientific Name	Common Name	Category	Rationale
<i>Plethodon neomexicanus</i>	Jemez Mountains salamander	2	no relevant PBFs
<i>Rana draytonii</i>	California red-legged frog	3	see below
<i>Rana muscosa</i>	Mountain yellow-legged frog (S CA DPS)	2	no relevant PBFs
<i>Rana muscosa</i>	Mountain yellow-legged frog (N CA DPS)	3	see below
<i>Rana pretiosa</i>	Oregon spotted frog	3	see below
<i>Rana sevosia</i>	Dusky gopher frog	3	see below
<i>Rana sierra</i>	Sierra Nevada yellow-legged frog	3	≥95% Federal lands overlap

Reticulated Flatwoods Salamander (*Ambystoma bishopi*)

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

Physical and 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 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
82.41	57.23	3.38	1.57	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 4.95 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the reticulated flatwoods salamander.

Malathion use sites overlap with 100% of the critical habitat, with 82.41% and 57.23% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 4.95% of critical habitat annually, with usage on 3.38% of the critical habitat from mosquito control activities and usage on 1.57% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures will further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the reticulated flatwoods salamander. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the reticulated flatwoods salamander.

Reference(s):

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 Final Rule. Federal Register 74:6700-6774.

California Tiger Salamander (*Ambystoma californiense*) – Central California DPS

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

Physical and Biological Features:

- Standing bodies of fresh water that remain for a minimum of 12 consecutive months to support breeding
- Upland habitat adjacent and accessible to and from breeding ponds that contain small mammal burrows or other underground habitat
- Upland dispersal habitat between occupied locations that allow for movement between such sites

The California tiger salamander spends most of its life underground in forested habitat. However, during breeding season, the species migrates to standing bodies of freshwater ponds, vernal pools, and other ephemeral or permanent water bodies. In the Final Rule, (*see* Criteria Used to Identify Critical Habitat), conservation of the Central California DPS of the California tiger salamander relies on “protecting the water quality of breeding pools and ponds” ... “by minimizing the entry of sediments and other contaminants to the known occupied habitat.” “Activities that impair the water quality of aquatic breeding habitat” is also listed under ‘Special Management Considerations or Protections’, which includes use of pesticides. Pesticide use would reduce the water quality of breeding habitats and reduce food in upland habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
91.29	78.73	1.23	0.79	0.04
Total % Use Overlap = 100 ²		Total % Usage Overlap = 2.02 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
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¹Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the California tiger salamander (Central CA DPS).

Malathion use sites overlap with 100% of the critical habitat, with 91.29% and 78.73% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.02% of critical habitat annually, with usage on 1.23% of the critical habitat from mosquito control activities and usage on 0.79% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and conservation measures are expected to further reduce effects to the water quality PBF. We do not anticipate that malathion will directly or indirectly alter water quality to an extent that it will appreciably diminish the value of critical habitat as a whole for the conservation of the California tiger salamander (Central CA DPS). Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the California tiger salamander (Central CA DPS).

Reference(s):

U. S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Tiger Salamander, Central Population. Final Rule. Federal Register 70:49380-49458.

California Tiger Salamander (*Ambystoma californiense*) – Santa Barbara DPS

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

Physical and Biological Features:

- Standing bodies of fresh water that remain for a minimum of 12 consecutive months to support breeding
- Barrier-free uplands adjacent to breeding ponds that contain small mammal burrows.
- Upland areas between breeding locations and areas with small mammal burrows that allow for dispersal.

The California tiger salamander spends most of its life underground in forested habitat. However, during breeding season, the species migrates to standing bodies of freshwater ponds, vernal pools, and other ephemeral or permanent water bodies. Small mammals are essential in creating the underground habitat that adult California tiger salamanders depend upon for food, shelter, and protection. In the Final Rule, (*see* Criteria Used to Identify Critical Habitat), conservation of the Central California DPS of the California tiger salamander relies on “protecting the water quality of breeding pools and ponds” ... “by minimizing the entry of sediments and other contaminants to the known occupied habitat.” The Final Rule (*see* Special Management Considerations or Protections) also states “[c]ontamination by chemicals such as those used for agricultural purposes” may require special management considerations, which includes use of pesticides. Pesticide use would reduce the water quality of breeding habitats and reduce food in upland habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
90.71	69.13	0.19	1.85	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 2.04 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to

appreciably diminish the value of the critical habitat as a whole for the California tiger salamander (Santa Barbara DPS).

Malathion use sites overlap with 100% of the critical habitat, with 90.71% and 69.13% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.04% of critical habitat annually, with usage on 0.19% of the critical habitat from mosquito control activities and usage on 1.85% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce effects to the PBFs. We do not anticipate that malathion will adversely affect water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the California tiger salamander (Santa Barbara DPS).

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California tiger salamander (*Ambystoma californiense*) in Santa Barbara County. Final Rule. Federal Register 69:68568-68609.

Frosted Flatwoods Salamander (*Ambystoma cingulatum*)

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

Physical and Biological Features:

- Small (generally less than 1 – 10 acres), isolated ponds that:
 - Are typically acidic, tannin-stained, ephemeral, and located within mesic to intermediate-mesic flatwoods
 - Are seasonally flooded by rainfall in late fall or early winter and dry in late spring or early summer
 - Have relatively open canopy to maintain herbaceous layers
 - Have burrowing crayfish fauna
 - Lack large, predatory fish due to period drying
- Upland pine flatwoods-savanna habitat that:
 - Is open, mesic woodland maintained by frequent fires

- Contains crayfish burrows or other underground habitat
- Are dominated by wiregrasses in abundant herbaceous ground cover to support the flatwoods salamander's prey
- Upland areas that facilitate movement between breeding and non-breeding areas, characterized by subsurface structures like those created by deep litter cover or crayfish burrows.

The 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, crustacean and other aquatic invertebrate) upon which larva and adult frosted flatwoods salamanders rely for food.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
92.04	15.29	2.6	0.54	83.71
Total % Use Overlap = 100 ²		Total % Usage Overlap = 3.14 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action would appreciably diminish the value of the critical habitat as a whole for the frosted flatwoods salamander.

Malathion use sites overlap with 100% of the critical habitat, with 92.04% and 15.29% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.14% of critical habitat annually, with usage on 2.6% of

the critical habitat from mosquito control activities and usage on 0.54% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (83.71%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the *Effects of the Action* section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod and water quality PBFs.

We anticipate malathion usage on use sites that overlap with the critical habitat will be low, and conservation measures are expected to further reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the frosted flatwoods salamander.

Reference(s):

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 Final Rule. Federal Register 74:6700-6774.

Arroyo (=Arroyo Southwestern) Toad (*Anaxyrus californicus*)

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

Physical and Biological Features:

- Rivers, streams, and pools that sustain eggs, tadpoles, metamorphosing juveniles, and adult breeding frogs
- Riparian and adjacent upland habitats that provide protection
- A natural flooding regime that creates conditions suitable for breeding

- Stream channels and uplands that connect breeding areas and adjacent upland habitats

The PBFs focus on habitat characteristics and impacts to the habitat and species are defined (e.g., water depths, velocity, riverbed composition, ephemeral water bodies, duration of inundation). In the “Application of the ‘Adverse Modification’ Standard” section, the Final Rule states “[a]ctivities that ... may adversely affect critical habitat ... include but are not limited to...: (1) Actions that alter water chemistry or temperature. Such activities include, but are not limited to: Release of chemicals, biological pollutants, or heated effluents into the surface water or into connected groundwater at a point source or by dispersed release (non-point source).”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	43.24	0	low	39.33
Total % Use Overlap = 100 ²		Total % Usage Overlap = low ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was unavailable for this species, however a qualitative assessment indicated that usage within the species range and critical habitat is anticipated to be low (see *Description of Critical Habitat Analysis* in the Opinion for more information regarding critical habitat analysis and the usage information below for more information regarding usage in the Arroyo toad's species range).

Usage:

Prior to finalizing this Opinion, we discovered that the overlap of malathion use sites with the species range was calculated based on an inaccurate range map for this species. As a result, we did not carry forward the overlap values from the draft Opinion into this final Opinion. Instead, we qualitatively estimated the types and extent of malathion use sites occurring within the range by visually examining mapped crop use data layers in proximity to the species range and critical habitat using GIS.

A visual inspection of cropland data layers indicates that developed and open space developed use sites have the most overlap with the range and critical habitat of this species. A smaller percentage of the toad's range overlaps with agricultural areas, particularly crops within the vegetables and ground fruit UDL.

For an estimation of usage, we considered county-level CalPUR data for agriculture, county-level sales and usage data for mosquito adulticide, and national-level developed and open space developed usage (which is consistent with our overall estimates for listed species for these use types). Information from CalPUR indicates that malathion usage has occurred on crops within

the range and critical habitat of the Arroyo toad within the vegetables and ground fruit categories in the non-federal portion of the species' range. We estimate that up to 5% of developed and open space developed use sites within the species range could undergo some level of treatment with malathion, and we anticipate similar levels of usage for the species' critical habitat. Neither CalPUR nor sales data for the past 5 years indicate previous malathion usage for mosquito adulticide within the counties that comprise the Arroyo toad's range and critical habitat. We do not anticipate mosquito adulticide applications would likely occur in the future as the Arroyo toad typically occupies areas not conducive for treatment (e.g., wooded areas, chaparral, and grasslands). Therefore, we do not anticipate mosquito adulticide usage overlap with critical habitat.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the water quality PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the arroyo toad.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 43.24% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data shows no mosquito adulticide usage is expected in the counties containing critical habitat areas. Usage information from the species range for non-mosquito adulticide uses was not available at the time of analysis, as noted above, but a qualitative analysis of the species range indicates little usage is expected from non-mosquito adulticide use. Given that critical habitat is found entirely within the species' range, we also anticipate low overall usage will occur in critical habitat.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Additionally, new restrictions on residential use labels, which will address both developed and open space developed applications, include limiting use to spot treatments only, reducing maximum number of treatments to 2-4 per year (depending on the specific use), and increasing retreatment intervals to 7-10 days, are also expected to substantially reduce contamination of critical habitat. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate malathion usage on use sites that overlap with the critical habitat will be low, and conservation measures will further reduce effects to the water quality PBF. We do not anticipate that malathion will adversely affect water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the arroyo toad.

Reference(s):

U. S. Fish and Wildlife Service. 2011. Designation of Critical Habitat for the Arroyo Toad. Final Rule. Federal Register 76:7246-7467.

Houston Toad (*Bufo houstonensis*)

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. However, adult and juvenile Houston toads feed on a variety of insects and other invertebrates, and the toad uses aquatic habitats during the breeding season (between February and June). 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, water quality and habitat function as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	29.57	0	3.25	0
Total % Use Overlap = 29.57 ²		Total % Usage Overlap = 3.25 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to each of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Houston toad.

Malathion use sites overlap with 29.57% of the critical habitat, with 0% and 29.57% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.25% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 3.25% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, water quality, and habitat function PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and conservation measures are expected to further reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly adversely affect arthropod prey, water quality and habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Houston toad.

Reference(s):

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

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

Salado Salamander (*Eurycea chisholmensis*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- High-quality surface and subsurface water with temperatures between 61 and-84°F 16 and 29 °C), dissolved oxygen concentrations between 5.0 and 13 mg L⁻¹, and conductivity between 317 and 814 μS cm⁻¹
- Rocky substrate with interstitial spaces (surface habitat) and voids between rocks underground (subsurface habitat) with minimal sedimentation that provide cover, shelter, and foraging habitat
- Diverse aquatic invertebrate populations in surface and subsurface habitats, including crustaceans, aquatic snails and insects
- Subterranean aquifer that provides shelter, protection and space for reproduction

The Salado salamander is a strictly aquatic species that spends its entire life submersed in water. The salamander inhabits water of high quality with a narrow range of conditions. Pesticide use would reduce the water quality of habitat and aquatic invertebrates as defined in the PBFs. In the Final Rule, “[m]anagement activities that could ameliorate threats include...: “[p]rotecting the quality of cave and spring water by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution.” In the “Application of the Destruction or Adverse Modification Standard” section of the final rule, the list of activities that may be considered likely to destroy or adversely modify critical habitat includes, “Actions that would increase the concentration of sediment or contaminants in the surface or subsurface habitat. Such activities could include... release of pollutants into the surface water or connected groundwater at a point source or by dispersed release (non-point source). These activities could alter water conditions to levels that are harmful to the Georgetown and Salado salamanders or their prey and result in direct, indirect, or cumulative adverse effects to these salamander individuals and their life cycles.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	X	snails	low concern
water quality	X	aquatic bins 2 and 3	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0.19	71.24	0	9.02	8.91
Total % Use Overlap = 71.43 ²		Total % Usage Overlap = 9.02 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information). A portion (approximately 58%) of the critical habitat designated for this species occurs outside of the species' range. However, additional review and analysis of the critical habitat areas occurring outside the species' range indicate the usage data from the species range is still a suitable data source for this analysis.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the dichotomous key, there is preliminary high level of concern for impacts to arthropod prey and water quality. While there may also be impacts to the non-arthropod prey base, the concern for this PBF is low given to low sensitivity of snail prey species to malathion. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 71.43% of the critical habitat, with 0.19% and 71.24% overlapping with mosquito control and non-mosquito control use sites, respectively. Available

data indicates that usage will occur on 9.02% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 9.02% of the critical habitat from non-mosquito control activities. Our analysis indicated that a large portion (approximately 58%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate that the portion of critical habitat found outside of the species' range is adjacent to and within counties that are included in the range. We confirmed that these areas of critical habitat are expected to have the same (or at least very similar) usage rates as areas within the species' range, as the applicable usage data is State-wide, and all critical habitat areas are within the State. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

Arthropods are known to be sensitive to malathion exposure and loss of prey base is a concern for this critical habitat and usage in critical habitat is high enough to have warranted a preliminary high level of concern. However, conservation measures, as described below, are expected to reduce environmental concentrations of malathion in critical habitat and mitigate the effects to the arthropod prey PBF. Non-arthropod prey are less sensitive to malathion, and warranted a preliminary low level of concern due to low levels of anticipated effects. The effects are expected to be further reduced by the conservation measures.

There was a preliminary high level of concern for the water quality PBF due to the high level of expected usage. We anticipate that low flow, low volume, small, and localized bodies of water will accumulate high concentrations of malathion. This species heavily relies on these vulnerable habitats and it follows that the critical habitat would not be able to support the listed species in areas with malathion exposure. Thus, the Action would significantly decrease the conservation value of the critical habitat for the listed species. However, conservation measures that are to be implemented, as described below, are expected to reduce environmental concentrations of malathion in critical habitats and mitigate the effects to the water quality PBF.

Aquatic buffers, which specify on the label distances from water bodies where pesticides cannot be applied, are designed to reduce the fraction of spray drift entering aquatic habitats, with low flow and low volume habitats (the most sensitive areas) receiving the most protection from these buffers. Rain restrictions prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event, providing time for the malathion to degrade before runoff events can occur, which also significantly reduces contamination of critical habitat. New restrictions on residential use labels, including limiting use to spot treatments only, reducing maximum number of treatments to 2-4 per year (depending on the specific use), increasing retreatment intervals to 7-10 days, and setting aquatic habitat buffers and rain restrictions are also expected to substantially reduce contamination of critical habitat. With these conservation measures in place, we anticipate only small effects to arthropod prey, non-arthropod prey and water quality PBFs.

Although we anticipate usage on use sites that overlap with critical habitat will be high, the required conservation measures are expected to reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey, non-arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole.

for the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Salado salamander.

Reference(s):

U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Georgetown and Salado Salamanders. Final Rule. Federal Register 86:46536-46578.

San Marcos salamander (*Eurycea nana*)

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. However, the salamander requires clean and clear water free of pesticides, herbicides, and other chemicals that potentially exist in their water sources. They feed on amphipods, young brine shrimp, nudge flies, other small insect pupae, and small aquatic snails. Therefore, we have identified arthropod prey, non-arthropod prey, and water quality as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	snails and crustaceans	low concern
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	13.97	0	2.04	0
Total % Use Overlap = 13.97 ²		Total % Usage Overlap = 2.04 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to each of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the

effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the San Marcos salamander.

Malathion use sites overlap with 13.97% of the critical habitat, with 0% and 13.97% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.04% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 2.04% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, non-arthropod prey, and water quality PBFs.

We anticipate malathion usage on use sites that overlap with the critical habitat will be low, and conservation measures are expected to further reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey, non-arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the San Marcos salamander.

Reference(s):

U.S. Fish and Wildlife Service. 1996. San Marcos & Comal Springs & Associated Aquatic Ecosystems (Revised) Recovery Plan. Austin Ecological Services Office, Texas. 134 pp.

U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Listing of the San Marcos Salamander as Threatened, the San Marcos Gambusia as Endangered, and the Listing of Critical Habitat for Texas Wild Rice, San Marcos Salamander, San Marcos Gambusia, and Fountain Darter. Federal Register 45:47355-47364.

Georgetown Salamander (*Eurycea naufragia*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- High-quality surface and subsurface water with temperatures between 61 and 84°F (16 and 29 °C), dissolved oxygen concentrations between 5.0 and 13mg L⁻¹, and conductivity between 317 and 814 µS cm⁻¹
- Rocky substrate with interstitial spaces (surface habitat) and voids between rocks underground (subsurface habitat) with minimal sedimentation that provide cover, shelter, and foraging habitat

- Diverse aquatic invertebrate populations, including crustaceans, aquatic snails and insects
- Subterranean aquifer that provides shelter and-protection and space for reproduction

The Georgetown salamander is a strictly aquatic species that spends its entire life submersed in water. The salamander inhabits water of high quality with a narrow range of conditions. Pesticide use would reduce the water quality of habitat and aquatic invertebrates as defined in the PBFs. In the Final Rule (*see* Special Management Considerations or Protection), “[m]anagement activities that could ameliorate threats include...: “[p]rotecting the quality of cave and spring water by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution.” The Proposed Rule also states “macroinvertebrates...that aquatic salamanders feed on are especially sensitive to water pollution.” In the “Application of the “Destruction or Adverse Modification Standard” section of the final rule, the list of activities that may be considered likely to destroy or adversely modify critical habitat includes, “Actions that would increase the concentration of sediment or contaminants in the surface or subsurface habitat. Such activities could include... release of pollutants into the surface water or connected groundwater at a point source or by dispersed release (non-point source). These activities could alter water conditions to levels that are harmful to the Georgetown and Salado salamanders or their prey and result in direct, indirect, or cumulative adverse effects to these salamander individuals and their life cycles.” In the rule, the FWS acknowledges water quality benefits of the existing Georgetown water quality ordinance that heavily restricts certain activities in a tiered structure within 262-ft (80-m) and 984-ft (300-m) of salamander occupied springs, while finding that additional protections from designating the critical habitat are needed to more fully address threats to water quality.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	X	snails and crustaceans	low concern
water quality	X	aquatic bins 2 and 3	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
97.85	31.73	3.41	6.54	0.09
Total % Use Overlap = 100 ²		Total % Usage Overlap = 9.95 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the

results of the dichotomous key, there is a preliminary high level of concern for impacts to arthropod prey and water quality. There may also be impacts to non-arthropod prey, however these impacts are expected to be small and are of low concern. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 97.85% and 31.73% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 9.95% of critical habitat annually, with usage on 3.41% of the critical habitat from mosquito control activities and usage on 6.54% of the critical habitat from non-mosquito control activities.

Arthropods are known to be sensitive to malathion exposure and loss of prey base is a concern for this critical habitat and usage in critical habitat is high enough to be of concern. However, conservation measures, as described below, are expected to reduce environmental concentrations of malathion in critical habitat and mitigate the effects to the PBF.

There is high concern for water quality PBF due to the high level of expected usage. We anticipate that low flow, low volume, small, and localized bodies of water will accumulate high concentrations of malathion. This species heavily relies on these vulnerable habitats and it follows that the critical habitat would not be able to support the listed species. Thus, the Action would significantly decrease the conservation value of the critical habitat for the listed species. However, conservation measures that are to be implemented, as described below, are expected to reduce environmental concentrations of malathion in critical habitats and mitigate the effects to the PBF.

Aquatic buffers, which specify on the label distances from water bodies where pesticides cannot be applied, are designed to reduce the fraction of spray drift entering aquatic habitats, with low flow and low volume habitats (the most sensitive areas) receiving the most protection from these buffers. Rain restrictions prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event, providing time for the malathion to degrade before runoff events can occur, which also significantly reduces contamination of critical habitat. New restrictions on residential use labels, including limiting use to spot treatments only, reducing maximum number of treatments to 2-4 per year (depending on the specific use), increasing retreatment intervals to 7-10 days, and setting aquatic habitat buffers and rain restrictions are also expected to substantially reduce contamination of critical habitat. With these conservation measures in mind, we anticipate only small effects to arthropod prey, non-arthropod prey, and water quality PBFs.

Although we anticipate malathion usage on use sites that overlap with critical habitat will be high, the required conservation measures are expected to reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey, non-arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Georgetown salamander.

Reference(s):

U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Georgetown and Salado Salamanders. Final Rule. Federal Register 86:46536-46578.

Jollyville Plateau Salamander (*Eurycea tonkawae*)

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

Physical and Biological Features:

- High-quality water with temperatures between 65.3 and 67.3°F (18.5 and 19.6 °C), dissolved oxygen concentrations between 5.6 and 7.1 mg L⁻¹, and conductivity between 550 and 625 µS cm⁻¹
- Rocky substrate with interstitial spaces that provide cover, shelter, and foraging habitat
- Diverse aquatic invertebrate populations, including crustaceans and insects
- Subterranean aquifer that provides shelter and protection in times of drought

The Jollyville Plateau salamander is a strictly aquatic species that spend its entire life submersed in water. The salamander inhabits water of high quality with a narrow range of conditions. Pesticide use would reduce the water quality of habitat as defined in the PBFs. As stated in the Final Rule (*see* Special Management Considerations and Protection), “water quality degradation from contaminants, alteration to natural flow regimes, and physical habitat modification” may require special management consideration.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	37.83	2.14	5.09	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 7.23 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary high level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 37.83% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 7.23% of critical habitat annually, with usage on 2.14% of the critical habitat from mosquito control activities and usage on 5.09% of the critical habitat from non-mosquito control activities.

Arthropods are known to be sensitive to malathion exposure and loss of prey base is a concern for this critical habitat and usage in critical habitat is high enough to be of concern. Conservation measures, as described below, are expected to reduce environmental concentrations of malathion in critical habitat and mitigate the effects to the PBF.

There is high concern for water quality PBF due to the high level of expected usage. We anticipate that low flow, low volume, small, and localized bodies of water will accumulate high concentrations of malathion. This species heavily relies on these vulnerable habitats and it follows that the critical habitat would not be able to support the listed species. Thus, the Action would significantly decrease the conservation value of the critical habitat for the listed species. However, conservation measures that are to be implemented, as described below, are expected to reduce environmental concentrations of malathion in critical habitats and mitigate the effects to the PBF.

Aquatic buffers, which specify on the label distances from water bodies where pesticides cannot be applied, are designed to reduce the fraction of spray drift entering aquatic habitats, with low flow and low volume habitats (the most sensitive areas) receiving the most protection from these buffers. Rain restrictions prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event, providing time for the malathion to degrade before runoff events can occur, which also significantly reduces contamination of critical habitat. New restrictions on residential use labels, including limiting use to spot treatments only, reducing maximum number of treatments to 2-4 per year (depending on the specific use), increasing retreatment intervals to 7-10 days, and setting aquatic habitat buffers and rain restrictions are also expected to substantially reduce contamination of critical habitat. With these conservation measures in mind, we anticipate only small effects to arthropod prey and water quality PBFs.

Although we anticipate that malathion usage on use sites that overlap with the critical habitat will be high, the required conservation measures are expected to reduce impacts to PBFs. We do not anticipate that that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Action is not likely to result in the destruction or adverse modification of Jollyville Plateau salamander.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Designation of Critical Habitat for the Austin Blind and Jollyville Plateau Salamanders. Final Rule. Federal Register 78:51328-51379.

Austin Blind Salamander (*Eurycea waterlooensis*)

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

Physical and Biological Features:

- High-quality water with temperatures between 67.8 and 72.3 °F (19.9 and 22.4 °C), dissolved oxygen concentrations between 5 and 7 mg L⁻¹, and conductivity between 605 and 740 µS cm⁻¹
- Rocky substrate with interstitial spaces that provide cover, shelter, and foraging habitat
- Diverse aquatic invertebrate populations, including crustaceans and insects
- Subterranean aquifer that provides shelter and protection in times of drought

The Austin blind salamander is a strictly aquatic species that spend its entire life submersed in water. The salamander inhabits water of high quality with a narrow range of conditions. Pesticide use would reduce the water quality of habitat as defined in the PBFs. As stated in the Final Rule (*see* Special Management Considerations and Protection), “water quality degradation from contaminants, alteration to natural flow regimes, and physical habitat modification” may require special management consideration.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	85.55	0	1.2	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.2 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed

below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Austin blind salamander.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 85.55% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.2% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.2% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to arthropod prey and water quality PBFs.

We anticipate malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Austin blind salamander.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Designation of Critical Habitat for the Austin Blind and Jollyville Plateau Salamanders. Final Rule. Federal Register 78:51328-51379.

Black Warrior Waterdog (*Necturus alabamensis*)

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

Physical and Biological Features:

- Geomorphically stable, medium to large streams (typically 4 m (13 ft) wide or greater) with:
 - Substrate consisting of clay or bedrock with little sand, and containing abundant rock crevices, rock slabs, and leaf packs
 - Medium water velocity
 - Aquatic macroinvertebrates and small fish (prey)
 - Water temperature not exceeding 85°F
 - Dissolved oxygen 5.5 mg/L or greater
 - Turbidity of an average monthly reading of 15 NTUs above background readings
 - 115 mg/L of total suspended solids or less
 - Conductance of no greater than 225 mS per centimeter at 80°F
- Water that lacks harmful levels of pollutants, including specifically pesticides

- Appropriate water quality parameters to support black warrior waterdog and primary prey base, including:
 - Water temperature not exceeding 85°F
 - Dissolved oxygen 5.5 mg/L or greater
 - Turbidity of an average monthly reading of 15 NTUs above background readings
 - 115 g/L of total suspended solids or less
 - A specific conductance of no greater than 225 μ S per cm at 80°F

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	clams, crustaceans and fish	low concern
water quality	X	aquatic bins 3 and 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
15.64	0	0.41	0	10.45
Total % Use Overlap = 15.64 ²		Total % Usage Overlap = 0.41 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to each of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Black Warrior waterdog.

Malathion use sites overlap with 15.64% of the critical habitat, with 15.64% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.41% of critical habitat annually, with usage on 0.41% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

While the critical habitat does not overlap with agricultural use sites, general conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, are expected to reduce environmental concentrations of malathion from areas upstream or adjacent to the critical habitat. Buffers, which specify on the label a distance from water bodies

where pesticides are not to be applied, are expected to reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to arthropod prey, non-arthropod prey, and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey, non-arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Black Warrior waterdog.

Reference(s):

U. S. Fish and Wildlife Service. 2018. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Black Warrior Waterdog and Designation of Critical Habitat. Final Rule. Federal Register 83:257-284.

California Red-legged Frog (*Rana draytonii*)

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

Physical and Biological Features:

- Aquatic breeding habitat
- Aquatic non-breeding habitat
- Upland habitat that maintains the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the aquatic, wetland, or riparian habitat.
- Dispersal habitat that supports movement between different habitats
- Low water salinity (below 4.5 parts per thousand (ppt) for eggs, up to 7.0 ppt for tadpoles) and water temperatures below about 73°F (23°C)

In the Final Rule (*see* Special Management Considerations or Protections), “water chemistry or temperature alterations” and “pesticide application” are listed as threats that require special management considerations or protections. Pesticide use would reduce the water quality of habitat as defined in the PBFs, and could reduce the species’ prey populations (i.e., invertebrates).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5, 6 and 7	low concern
host fish	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
89.78	34.28	0.5	0.4	24.09
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.9 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the California red-legged frog.

Malathion use sites overlap with 100% of the critical habitat, with 89.78% and 34.28% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.9% of critical habitat annually, with usage on 0.5% of the critical habitat from mosquito control activities and usage on 0.4% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will directly or indirectly alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the California red-legged frog.

Reference(s):

U. S. Fish and Wildlife Service. 2010. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the California Red Legged Frog. Final Rule. Federal Register 75:12816-12959.

Mountain Yellow-legged Frog – Northern DPS (*Rana muscosa*)

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

Physical and Biological Features:

- Water bodies that are sufficiently deep that they do not dry out in summer or freeze through in winter for the entire tadpole growth phase (up to 2 years)
 - Including streams, rivers, perennial creeks (or permanent plunge pools within intermittent creeks), pools (i.e., a body of impounded water that is contained above a natural dam) and other forms
- Upland habitat adjacent to or surrounding breeding and nonbreeding aquatic habitat
- Water quality (e.g., pH, temperature, nutrients, lack of contaminants) and moisture availability necessary to sustain the frogs throughout their life stages

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
30.54	3.75	0	0	92.29
Total % Use Overlap = 34.29 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to

appreciably diminish the value of the critical habitat as a whole for the mountain yellow-legged frog (N CA DPS).

Malathion use sites overlap with 34.29% of the critical habitat, with 30.54% and 3.75% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (92.29%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

While usage data indicates no malathion use occurred recently within critical habitat, general conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will reduce environmental concentrations of any potential future uses of malathion in or near critical habitat. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We do not anticipate that malathion usage will occur on use sites that overlap with the critical habitat. For any usage that occur on or near the critical habitat, the required conservation measures are expected to reduce effects to the water quality PBF. We do not anticipate that malathion will directly or indirectly alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the critical habitat for the mountain yellow-legged frog (N CA DPS).

Reference(s):

U. S. Fish and Wildlife Service. 2016. Designation of Critical Habitat for the Sierra Nevada Yellow-Legged Frog, the Northern DPS of the Mountain Yellow-Legged Frog, and the Yosemite Toad. Final Rule. Federal Register 81:59046-59119.

Oregon Spotted Frog (*Rana pretiosa*)

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

Physical and Biological Features:

- Ephemeral or permanent bodies of fresh water, including but not limited to natural or manmade ponds, springs, lakes, slow-moving streams, or pools within or oxbows adjacent to streams, canals, and ditches.
 - Water characteristics, such as pH, dissolved oxygen, temperature, nutrients, and uncontaminated water, are needed to be maintained to ensure sufficient water quality.
- Aquatic movement corridors

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
3.58	8.89	low ³	low ³	74.78
Total % Use Overlap = 12.47 ²		Total % Usage Overlap = low ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was unavailable for this species, however a qualitative assessment indicated that usage within the species range and critical habitat is anticipated to be low (see *Description of Critical Habitat Analysis* in the Opinion for more information regarding critical habitat analysis and the usage information below for more information regarding usage in the range of the Oregon spotted frog.)

Usage:

Prior to finalizing this Opinion, we discovered that the overlap of malathion use sites with the species range was calculated based on an inaccurate range map for this species. As a result, we did not carry forward the overlap values from the draft Opinion into this final Opinion. Instead, we qualitatively estimated the types and extent of malathion use sites occurring within the range and critical habitat by visually examining mapped crop use data layers in proximity to the species range using GIS.

For an estimation of usage, we considered state-level agricultural information described in EPA's SUUM (Appendix G), county level sales and usage data for mosquito adulticide, and national level developed and open space developed usage (which is consistent with our overall estimates for listed species for these use types).

Information regarding past usage of malathion for corn, wheat, other grains, and pasture indicates that a low percentage (less than or equal to 3.3%) of these crops were treated with malathion in Oregon and Washington, which contain the majority of the Oregon spotted frog's

range and all of its critical habitat. It is unknown how much of this usage occurs within or near the range of the Oregon spotted frog, and could be higher or lower than these statewide averages. We estimate that up to 5% of developed and open space developed within the species range could undergo some level of treatment with malathion, and we anticipate similar levels of usage for the species' critical habitat.

For mosquito adulticide, available data from the past five years indicated past usage of malathion in 2 of the 21 counties in California, Oregon, and Washington that contain areas of the Oregon spotted frog's range. Only a small fraction of the species range and critical habitat occurs in one of the counties with previous mosquito adulticide usage, generally in forested areas and open range, and the only other county with previous mosquito adulticide usage that overlaps with the species' range and critical habitat only recorded one instance of usage in the last five years.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Oregon spotted frog.

Malathion use sites overlap with 12.47% of the critical habitat, with 3.58% and 8.89% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that low usage will occur in the critical habitat from mosquito control activities, and low usage will occur from non-mosquito control activities based on anticipated usage in the species range, as discussed above. Given that the critical habitat is found entirely within the species' range, we anticipate usage levels will be similar in the critical habitat.

A fairly large portion of the species' critical habitat (74.78%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use site overlap is high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use. An additional review of the critical habitat areas on non-Federal lands did not indicate these areas are disproportionately important for the species (e.g., critical breeding areas).

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing

environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to reduce those effects to the water quality PBFs. We do not anticipate that malathion will directly or indirectly alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Oregon spotted frog.

Reference(s):

U. S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Oregon Spotted Frog. Final Rule. Federal Register 81:29336-29396.

Dusky Gopher Frog (*Rana sevos*)

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

Physical and Biological Features:

- Ephemeral wetland habitat, including ponds, that are geographically isolated from other waterbodies and embedded in forests historically dominated by longleaf pine communities, that are small (generally <0.4 to 4.0 ha (<1 to 10 ac)), ephemeral, and acidic.
 - Water quality such that frogs, their eggs, or larvae are not exposed to pesticides or chemicals and sediment associated with road runoff.
- Upland forested nonbreeding habitat
- Upland connectivity habitat that provides access between wetland and forest habitats

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
85.15	32.02	0	0.68	51.44
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.68 ³		

¹Mosquito control use and usage may overlap with other usages.

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
--	--	--	--	---

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to this PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the dusky gopher frog.

Malathion use sites overlap with 100% of the critical habitat, with 85.15% and 32.02% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.68% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.68% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (51.44%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the critical habitat for the dusky gopher frog.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Dusky Gopher Frog (Previously Mississippi Gopher Frog). Federal Register 77:35118-35161.

H. Arachnids

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 6. Summary of Arachnids Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Adelocosa anops</i>	Kauai cave wolf or pe'e pe'e maka 'ole spider	3	see below
<i>Cicurina baronia</i>	Robber Baron Cave meshweaver	3	see below
<i>Cicurina madla</i>	Madla's Cave meshweaver	3	see below
<i>Cicurina venii</i>	Braken Bat Cave meshweaver	3	see below
<i>Cicurina vespera</i>	Government Canyon Bat Cave meshweaver	3	see below
<i>Microhexura montivaga</i>	Spruce-fir moss spider	3	≥95% Federal lands overlap
<i>Neoleptoneta microps</i>	Government Canyon Bat Cave spider	3	see below
<i>Texella cokendolpheri</i>	Cokendolpher Cave harvestman	3	see below

Kauai Cave Wolf or Pe'e Pe'e Maka 'ole Spider (*Adelocosa anops*)

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

Physical and Biological Features

- The presence of subterranean spaces from 5 to 25 cm (0.2 in to 10 in) at the narrowest dimension (collectively termed “mesocaverns”), or caves or passages (spaces greater than 25 cm (10 in))
- Dark and/or stagnant air zones that maintain microclimates with humidity at saturation levels
- The presence of roots from living, non-toxic plants such as, but not limited to, ohia (*Metrosideros polymorpha*), maiapilo (*Capparis sandwichiana*), and aalii (*Dodonea viscosa*) in these types of mesocaverns or caves.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6, and 7	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors. Usage was considered to be low, as described below.

Critical habitat exposure to malathion - use and usage data

Information regarding past use site overlap and usage of malathion in Hawaii is not available. However, we anticipate residential (developed and open space developed) and agricultural uses occur in and near designated critical habitat for this species. Prior survey data has indicated that 4.8% of agricultural crops were treated with insecticides every year, with malathion only being a subset of this use. Based on information collected for CONUS species, we estimate that 5% of developed and open space developed could undergo some level of treatment with malathion annually. At present, information indicates that malathion is not used as a mosquito control agent in Hawaii. Future use cannot be ruled out, but is not expected to increase significantly. Due to the high degree of uncertainty associated with this data, as discussed in the “*Approach to Usage Analysis*” section in the Opinion, we consider this quantitative usage data broadly and assess exposure from malathion usage qualitatively by considering the likelihood that critical habitat will occur in the areas where insecticide usage will take place. Usage is not expected to be over 5% on any given use site, and therefore usage is considered to be low across the critical habitat.

Critical Habitat Rationale for Conclusion:

The broad-scale use of this pesticide for all allowable uses within the ecosystem could reduce the conservation value of the critical habitat by affecting arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Due to the vulnerabilities of the species and its critical habitat, as well as known general agricultural practices in the area of critical habitat, a preliminary high level of concern was indicated for affects to the critical habitat of the Kauai cave wolf spider. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

General conservation measures are expected to substantially decrease the environmental concentrations of malathion entering critical habitat, reducing the risk to critical habitat PBFs. Aquatic habitat buffers, which specify a distance from waterbodies where malathion cannot be applied, is expected to change application patterns to reduce the amount of spray drift accumulating in the streams and creeks that feed into the cave systems the Kauai cave wolf spider occupies. Similarly, rain restrictions, which prohibit the application of malathion within 48 hours of a forecasted rain event or when the soil is saturated, provides time for malathion to degrade before runoff events can occur, which reduces the concentration of malathion in waterbodies that feed the cave systems the species occupies.

Additionally, a species-specific conservation measure was developed to further mitigate effects from agricultural malathion uses and protect the critical habitat of the Kauai cave wolf spider. General agricultural buffer distances will be extended from 25 and 50 feet to 50 and 200 feet around cave openings and sinkholes for ground and aerial applications, respectively. AgDRIFT modeling results show that these extended buffer zones can reduce spray drift into off-target areas by up to 73% and 97% for aerial and ground applications, respectively. This measure would substantially reduce the amount of malathion entering critical habitat through spray drift, reducing the likelihood of impacts to the PBFs. Furthermore, in addition to a 48-hour rain restriction on malathion application, at least a 24-hour period between irrigation and malathion applications is required. These restrictions are expected to allow time for malathion degradation,

and reduce runoff and seepage of malathion so it is much less likely to enter cave systems in the critical habitat. With these conservation measures in place, we expect the impacts to the arthropod prey, water quality and habitat function PBFs to be low.

Thus, based on the anticipated low usage and the required general and species-specific conservation measures, we expect the likelihood of exposure and impacts to arthropod prey, water quality and habitat function PBFs, will be extremely limited. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to destroy or adversely modify critical habitat for the Kauai cave wolf or pe'e pe'e maka 'ole spider.

Reference(s):

U. S. Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Kauai Cave Wolf Spider and Kauai Cave Amphipod. Final Rule. Federal Register 68:17430-17470.

Robber Baron Cave Meshweaver (*Cicurina baronia*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidity (near saturation), and suitable substrates (spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Clean surface water that flows into the karst features, including runoff that flows into the caves' entrances or associated features through sinkholes or fractures, and through-ground flows via fractures, conduits, and passages; and
- A healthy surface community of plants (i.e., juniper-oak woodland) and animals (i.e., cave crickets) living in and near the karst feature that provides nutrient input and protects the karst ecosystem from adverse effects (nonnative species invasions, contaminants, and fluctuations in temperature and humidity).

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of Critical Habitat Designation*), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that [that] may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this species.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	99.4	0	1.84	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.84 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to each of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 99.4% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.84% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.84% of the critical habitat from non-mosquito control activities.

While we do not anticipate high usage on malathion use sites that overlap with the critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments

from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

To expand further upon these broadly applied general label changes, a species-specific conservation measure was developed for the critical habitat of the Robber Baron Cave meshweaver. Applicators are to avoid application within 100 feet around designated critical habitat. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important prey item for this species. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to greatly minimize the likelihood of exposure and effectively protect the arthropod prey base, water quality, and habitat function PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey, water quality and habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Robber Baron Cave meshweaver.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

Madla's Cave Meshweaver (*Cicurina madla*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidity (near saturation), and suitable substrates (spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Clean surface water that flows into the karst features, including runoff that flows into the caves' entrances or associated features through sinkholes or fractures, and through-ground flows via fractures, conduits, and passages; and
- A healthy surface community of plants (i.e., juniper-oak woodland) and animals (i.e., cave crickets) living in and near the karst feature that provides nutrient input and protects the karst ecosystem from adverse effects (nonnative species invasions, contaminants, and fluctuations in temperature and humidity).

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of*

Critical Habitat Designation), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this and 8 other species covered by this Final Rule.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	6.36	0	1.84	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.84 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to each of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 6.36% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.84% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.84% of the critical habitat from non-mosquito control activities.

While we do not anticipate high usage on malathion use sites that overlap with critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce

environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific measure was developed to further protect the critical habitat of the Madla's Cave meshweaver. Applicators are to avoid applying malathion within 100 feet around designated critical habitat where malathion cannot be applied. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important prey item for this species. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to greatly minimize the likelihood of exposure and effectively protect the arthropod prey base, water quality, and habitat function PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey, water quality or habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Madla's Cave meshweaver.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

Braken Bat Cave Meshweaver (*Cicurina venii*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidity (near saturation), and suitable substrates (spaces between and underneath rocks for foraging and sheltering) that are free of contaminants

- Clean surface water that flows into the karst features, including runoff that flows into the caves' entrances or associated features through sinkholes or fractures, and through-ground flows via fractures, conduits, and passages; and
- A healthy surface community of plants (i.e., juniper-oak woodland) and animals (i.e., cave crickets) living in and near the karst feature that provides nutrient input and protects the karst ecosystem from adverse effects (nonnative species invasions, contaminants, and fluctuations in temperature and humidity).

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of Critical Habitat Designation*), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this and 8 other species covered by this Final Rule.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	high concern
host fish	--	--	--
habitat function	X	--	high concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	49.81	0	5.77	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 5.77 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to each of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 49.81% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.77% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 5.77% of the critical habitat from non-mosquito control activities.

In addition to the anticipated high usage and high overlap with malathion use sites, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems where the species occurs. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure was developed to provide additional protection for the critical habitat of the Braken Bat Cave meshweaver. Applicators are not to apply malathion within 100 feet of designated critical habitat. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important prey item for the species. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the amount of malathion entering critical habitat and impacting the prey base. This species-specific conservation measure, in combination with the general conservation measures described above, is expected to greatly minimize the likelihood of exposure and effectively protect the arthropod prey base, water quality, and habitat function PBFs.

Although we anticipate usage on use sites that overlap with critical habitat will be high, the required conservation measures are expected to reduce effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter the arthropod prey base, water quality or habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Braken Bat Cave meshweaver.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

Government Canyon Bat Cave Meshweaver (*Cicurina vespera*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidity (near saturation), and suitable substrates (spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Clean surface water that flows into the karst features, including runoff that flows into the caves' entrances or associated features through sinkholes or fractures, and through-ground flows via fractures, conduits, and passages; and
- A healthy surface community of plants (i.e., juniper-oak woodland) and animals (i.e., cave crickets) living in and near the karst feature that provides nutrient input and protects the karst ecosystem from adverse effects (nonnative species invasions, contaminants, and fluctuations in temperature and humidity).

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of Critical Habitat Designation*), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this and 8 other species covered by this Final Rule.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	0	0	0	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to each of these PBFs. As discussed below, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that no usage will occur the critical habitat annually from either mosquito control or non-mosquito control activities.

While we do not anticipate usage on malathion use sites that overlap with the critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure was developed to provide additional protections for the critical habitat of the Government Canyon Bat Cave meshweaver. Applicators are not to apply malathion within 100 feet around designated critical habitat where malathion cannot be applied. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important prey item for this species. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to greatly minimize the likelihood of exposure and effectively protect the arthropod prey base, water quality, and habitat function PBFs.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey, water quality and habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Government Canyon Bat Cave meshweaver.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

Government Canyon Bat Cave Spider (*Neoleptoneta microps*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidity (near saturation), and suitable substrates (spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Clean surface water that flows into the karst features, including runoff that flows into the caves' entrances or associated features through sinkholes or fractures, and through-ground flows via fractures, conduits, and passages; and
- A healthy surface community of plants (i.e., juniper-oak woodland) and animals (i.e., cave crickets) living in and near the karst feature that provides nutrient input and protects the karst ecosystem from adverse effects (nonnative species invasions, contaminants, and fluctuations in temperature and humidity).

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of Critical Habitat Designation*), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this and 8 other species covered by this Final Rule.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	0	0.01	0	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.01 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to each of these PBFs. As discussed below, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.01% of critical habitat annually, with usage on 0.01% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

While we do not anticipate high usage with malathion use sites that overlap with critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measures was developed to provide additional protections for the critical habitat of the Government Canyon Bat Cave spider. Applicators are not to apply malathion within 100 feet around designated critical habitat. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important prey item for this species. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to greatly

minimize the likelihood of exposure and effectively protect the arthropod prey base, water quality, and habitat function PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be very low, and the required conservation measures are expected to further reduce those effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey, water quality and habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Government Canyon Bat Cave spider.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

Cokendolpher Cave Harvestman (*Texella cokendolpheri*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidity (near saturation), and suitable substrates (spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Clean surface water that flows into the karst features, including runoff that flows into the caves' entrances or associated features through sinkholes or fractures, and through-ground flows via fractures, conduits, and passages; and
- A healthy surface community of plants (i.e., juniper-oak woodland) and animals (i.e., cave crickets) living in and near the karst feature that provides nutrient input and protects the karst ecosystem from adverse effects (nonnative species invasions, contaminants, and fluctuations in temperature and humidity).

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of Critical Habitat Designation*), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this and 8 other species covered by this Final Rule.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	99.83	0	1.84	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.84 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to each of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 99.83% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.84% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.84% of the critical habitat from non-mosquito control activities.

While we do not anticipate high usage on malathion use sites that overlap with critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an

as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure was developed to provide additional protections for the critical habitat of the Cokendolpher Cave harvestman. Applicators are not to apply malathion within 100 feet around designated critical habitat. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important prey item for this species. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to greatly minimize the likelihood of exposure and effectively protect the arthropod prey base, water quality, and habitat function PBFs.

Based on the low anticipated malathion usage on use sites that overlap with the critical habitat and low level of effects expected to the PBFs with the conservation measures in place, we do not anticipate that malathion will directly or indirectly alter arthropod prey, water quality and habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Cokendolpher Cave harvestman.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

I. Birds

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 7. Summary of Birds Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Agelaius xanthomus</i>	Yellow-shouldered blackbird	1	no overlap
<i>Ammodramus maritimus mirabilis</i>	Cape Sable seaside sparrow	3	see below
<i>Brachyramphus marmoratus</i>	Marbled murrelet	2	no relevant PBFs
<i>Centrocercus minimus</i>	Gunnison sage-grouse	3	see below
<i>Charadrius melodus</i>	Piping plover - Entire population (except Great Lakes Watershed)	3	see below
<i>Charadrius melodus</i>	Piping plover - Great Lakes Watershed	2	no relevant PBFs
<i>Charadrius nivosus nivosus</i>	Western snowy plover	3	see below
<i>Chasiempis ibidis</i>	Oahu Elepaio	3	no overlap
<i>Coccyzus americanus</i>	Yellow-billed cuckoo (Western U. S. DPS)	3	see below
<i>Corvus kubaryi</i>	Mariana (=aga) crow	3	no overlap
<i>Empidonax traillii eximius</i>	Southwestern willow flycatcher	3	see below
<i>Eremophila alpestris strigata</i>	Streaked Horned lark	2	no relevant PBFs
<i>Grus americana</i>	Whooping crane	3	see below
<i>Grus canadensis pulla</i>	Mississippi sandhill crane	1	see below
<i>Gymnogyps californianus</i>	California condor	1	no relevant PBFs
<i>Loxioides bailleui</i>	Palila (honeycreeper)	2	no relevant PBFs
<i>Loxops caeruleirostris</i>	Akekee	3	no overlap
<i>Oreomystis bairdi</i>	Akikiki	3	no overlap
<i>Palmeria dolei (batched)</i>	Crested honeycreeper	2	no relevant PBFs
<i>Pipilo crissalis eremophilus</i>	Inyo California towhee	2	no relevant PBFs
<i>Polioptila californica californica</i>	Coastal California gnatcatcher	2	no relevant PBFs
<i>Polysticta stelleri</i>	Steller's eider	3	no overlap
<i>Pseudonestor xanthophrys (batched)</i>	Maui parrotbill (honeycreeper)	2	no relevant PBFs
<i>Rostrhamus sociabilis plumbeus</i>	Everglade snail kite	1	see below

Scientific Name	Common Name	Category	Rationale
<i>Setophaga angelae</i>	Elfin-woods warbler	3	no overlap
<i>Somateria fischeri</i>	Spectacled eider	3	no overlap
<i>Strix occidentalis caurina</i>	Northern spotted owl	2	no relevant PBFs
<i>Strix occidentalis lucida</i>	Mexican spotted owl	2	no relevant PBFs
<i>Todiramphus cinnamominus</i>	Guam Micronesian kingfisher	3	no overlap
<i>Vireo bellii pusillus</i>	Least Bell's vireo	2	no relevant PBFs
<i>Zosterops rotensis</i>	Rota bridled white-eye	2	no relevant PBFs

Cape Sable Seaside Sparrow (*Ammodramus maritimus mirabilis*)

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

Physical and Biological Features:

- Calcitic marl soils characteristic of short-hydroperiod marshes of the Everglades
- Vegetation communities that support foraging and nesting
- Contiguous open habitat
- Hydrologic conditions to support and maintain the vegetation composition and nesting habitat.

The PBFs focus on soils that support a unique vegetation community, habitat structure and hydrological conditions that maintain nesting and foraging habitats. The Final Rule (*see* Adverse Modification Standard) identifies “[a]ctions that would significantly and detrimentally alter water quality that may lead to detrimental changes in vegetation species composition and structure or productivity of prey organisms and may have direct detrimental effects on sparrows. These activities could reduce population sizes and the likelihood of persistence within one or more sparrow subpopulations and reduce the suitability of habitat for breeding for extended periods.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	0.62	0	1.56	88.32
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.56 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Cape Sable seaside sparrow.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 0.62% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.56% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.56% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (88.32%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures involving changes to agricultural use labels, such as implementing aquatic habitat buffers, a 48-hour rain restriction, and reduced application rate and frequencies for specific crops, will decrease environmental concentrations of malathion. Changes to residential label uses, which reduce the maximum number of applications allowed per year and limit use to spot treatments only, among other changes, will also decrease environmental concentrations of malathion in the species' critical habitat. Day time restrictions on mosquito adulticide applications, which limits applications to 2 hours of dusk or dawn, would protect insect prey that are active during the day, mitigating impacts to the arthropod prey base PBF.

We anticipate malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Cape Sable seaside sparrow.

Reference(s):

U. S. Fish and Wildlife Service. 2007. Critical Habitat Revised Designation for the Cape Sable Seaside Sparrow. Final Rule. Federal Register 72:62736-62766.

Gunnison Sage-Grouse (*Centrocercus minimus*)

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

Physical and Biological Features:**Critical Habitat Rationale:**

- 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, in the Final Rule (*see* Application of the “Adverse Modification Standard”), identified 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
59.68	19.29	4.1	1.82	55.61
Total % Use Overlap = 78.97 ²		Total % Usage Overlap = 5.93 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which are associated with vegetation-related critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to arthropod prey. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 78.97% of the critical habitat, with 59.68% and 19.29% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.93% of critical habitat annually, with usage on 4.1% of the critical habitat from mosquito control activities and usage on 1.82% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (55.61%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use and usage may be high outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

Terrestrial invertebrates are a secondary food item of the grouse. Alternative and perhaps other preferable food resources are likely to remain available during periods when invertebrates are reduced due to exposure to malathion, although a reduction in invertebrate abundance could be problematic during the breeding season when the grouse are congregating at lek sites or needing to feed their young. We do not anticipate impacts to the sagebrush plant community described in the PBFs from malathion, or its function in supporting associated arthropod prey.

General conservation measures involving changes to agricultural use labels, such as reducing the application rate and frequencies for specific crops, will substantially decrease environmental concentrations of malathion. Changes to residential label uses, which reduce the maximum number of applications allowed per year and limit use to spot treatments only, among other changes, will also decrease environmental concentrations of malathion in the species' critical habitat. While exposure is expected to reduce the abundance where exposed, we do not expect complete elimination of the arthropod prey base given the range of sensitivities these species

have towards malathion and we do not expect exposure will result in community level effects that will negatively affect the PBF.

We anticipate usage on use sites that overlap with critical habitat will be high. However, based on the information above, including conservation measures, the extent of critical habitat on Federal land and consideration of additional relevant information regarding likelihood of exposure and impacts to arthropod prey associated with the PBFs, we do not anticipate the effects of the Action would appreciably diminish the value of the critical habitat as a whole for the Gunnison sage-grouse. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Gunnison sage-grouse.

Reference(s):

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 79:69312-69363.

Piping Plover: Entire Population except the Great Lakes DPS (*Charadrius melodus*)

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

Physical and Biological Features:

- Sand and/or mud flats with no or very sparse emergent vegetation. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.
- Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide with debris, detritus (decaying organic matter), or microtopographic relief (less than 50 cm above substrate surface) offering refuge from high winds and cold weather.
- Presence of surf-cast algae for feeding of prey, sparsely vegetated backbeach for roosting and refuge during storms, spits for feeding and roosting, salterns, and washover areas for feeding and roosting.
- For breeding northern Great Plains piping plovers:
 - Alkali lakes and wetlands with:
 - Shallow, seasonally to permanently flooded, mixosaline to hypersaline wetlands with sandy to gravelly, sparsely vegetated beaches, salt-encrusted mud flats, and/or gravelly salt flats;
 - springs and fens along edges of alkali lakes and wetlands; and
 - adjacent uplands 200 ft (61 m) above the high water mark of the alkali lake or wetland
 - Rivers with sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, and the interface with the river
 - Reservoirs with sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies
 - Inland lakes with sparsely vegetated and windswept sandy to gravelly islands, beaches, and peninsulas, and their interface with the water body

- Dynamic hydrological system of wet-to-dry cycles to support habitat area, abundance and availability of insect foods, brood and nesting cover, and lack of vegetation
- For wintering piping plovers in North Carolina and Texas:
 - Intertidal sand beaches (including sand flats) or mud flats (between annual low tide and annual high tide) with no or very sparse emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.
 - Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 in (50 cm) above substrate surface) offering refuge from high winds and cold weather.
 - Surf-cast algae for feeding.
 - Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.
 - Spits, especially sand, running into water for foraging and roosting.
 - Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water.
 - Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.
 - Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites).

These PBFs focus on space, cover, habitat structure, and habitat availability with specific elements including an abundance and availability of insect foods. In the Wintering Piping Plovers Final Rule (*see Effects of Critical Habitat Designation*), “[s]ignificantly and detrimentally altering water quality that may lead to decreased diversity or productivity of prey organisms or may have direct detrimental effects on piping plovers” is listed as an “activit[y] that may destroy or adversely modify critical habitat.” A nearly identical threat is described in the Final Rule for the Breeding Population: “[a]ny activity that significantly and detrimentally alters water quality in the unit” ...“may destroy or adversely modify critical habitat.” Pesticide use would reduce the water quality and survival of arthropod prey in piping plover habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
11.24	6.87	0	1.1	17.89
Total % Use Overlap = 18.11 ²		Total % Usage Overlap = 1.1 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information). A portion (approximately 18%) of the critical habitat designated for this species occurs outside of the species' range. However, additional review and analysis of the critical habitat areas occurring outside the species' range indicate the usage data from the species range is still a suitable data source for this analysis.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the piping plover - entire population (except Great Lakes Watershed).

Malathion use sites overlap with 18.11% of the critical habitat, with 11.24% and 6.87% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.1% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.1% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 18%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate that critical habitat areas found outside of the species' range are contiguous with the range. We confirmed that these areas of critical habitat are expected to experience the same (or at least very similar) usage rates as areas within the species' range, as the applicable agricultural and mosquito adulticide usage data is State- and county-wide, respectively, and all the critical habitat areas are within the same State and counties. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

General conservation measures involving changes to agricultural use labels, such as reducing the application rate and frequencies for specific crops, will substantially decrease environmental concentrations of malathion. Changes to residential label uses, which reduce the maximum number of applications allowed per year and limit use to spot treatments only, among other changes, will also decrease environmental concentrations of malathion in the species' critical habitat.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction

or adverse modification of critical habitat for the piping plover - entire population (except Great Lakes Watershed).

Reference(s):

U. S. Fish and Wildlife Service. 2002. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northern Great Plains Breeding Population of the Piping Plover. Final Rule. Federal Register 67:57637-57717.

U. S. Fish and Wildlife Service. 2001. Endangered and Threatened Wildlife and Plants; Final Determinations of Critical Habitat for Wintering Piping Plovers. Final Rule. Federal Register 66:36038-36143.

Western Snowy Plover (*Charadrius nivosus nivosus*)

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

Physical and 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 arthropod prey of the western snowy plover.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
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¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
61.77	21.11	0.14	0.29	23.91
Total % Use Overlap = 82.88 ²		Total % Usage Overlap = 0.43 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information). A portion (approximately 14%) of the critical habitat designated for this species occurs outside of the species' range. However, additional review and analysis of the critical habitat areas occurring outside the species' range indicate the usage data from the species range is still a suitable data source for this analysis.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the western snowy plover.

Malathion use sites overlap with 82.88% of the critical habitat, with 61.77% and 21.11% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.43% of critical habitat annually, with usage on 0.14% of the critical habitat from mosquito control activities and usage on 0.29% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 14%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate that the portion of critical habitat found outside of the species' range is contiguous with the range. We confirmed that these areas of critical habitat are expected to have the same (or at least very similar) usage rates as areas within the species' range, as the applicable agricultural and mosquito adulticide usage data is State- and county-wide, respectively, and all the critical habitat units are within the same States and counties. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

General conservation measures involving changes to agricultural use labels, such as reducing the application rate and frequencies for specific crops, will substantially decrease environmental concentrations of malathion. Changes to residential label uses, which reduce the maximum number of applications allowed per year and limit use to spot treatments only, among other changes, will also decrease environmental concentrations of malathion in the species' critical habitat.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the

arthropod PBF. We do not anticipate that malathion will directly or indirectly alter arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the western snowy plover.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Revised designation of Critical Habitat for the Pacific Coast Population of the Western snowy plover. Final Rule. Federal Register 77:36728-36869.

Yellow-Billed Cuckoo: Western U. S. DPS (*Coccyzus americanus*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- Riparian woodlands: Riparian woodlands with mixed willow cottonwood vegetation, mesquite-thornforest vegetation, or a combination of these that contain habitat for nesting and foraging.
- Adequate prey: Presence of prey consisting of large insect fauna (i.e., cicadas, caterpillars, katydids, grasshoppers, large beetles, dragonflies) and tree frogs for adults and young in breeding areas during the nesting season and in post-breeding dispersal areas.
- Dynamic riverine processes: River systems that are dynamic and provide hydrologic processes that encourage sediment movement and deposits that allow seedling germination and promote plant growth, maintenance, health, and vigor.

These habitat features can be summarized as riparian woodlands with dynamic riverine processes that support adequate arthropod prey. As stated in the Proposed 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
52.39	16.75	0.71	0.04	47.07
Total % Use Overlap = 69.14 ²		Total % Usage Overlap = 0.75 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and habitat function, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the yellow-billed cuckoo (western U.S. DPS).

Malathion use sites overlap with 69.14% of the critical habitat, with 52.39% and 16.75% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.75% of critical habitat annually, with usage on 0.71% of the critical habitat from mosquito control activities and usage on 0.04% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural use labels, such as reducing the application rate and frequencies for specific crops, will substantially decrease environmental concentrations of malathion. Changes to residential label uses, which reduce the maximum number of applications allowed per year and limit use to spot treatments only, among other changes, will also decrease environmental concentrations of malathion in the species' critical habitat.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey and habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the yellow-billed cuckoo (western U. S. DPS).

Reference(s):

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Western Distinct Population Segment of the Yellow-Billed Cuckoo. Proposed Rule. Federal Register 85:11458-11594.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

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

Physical and 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. Use of pesticides would likely kill the arthropod prey of the southwestern willow flycatcher.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
68.35	12.7	0.71	0.09	34.88
Total % Use Overlap = 81.05 ²		Total % Usage Overlap = 0.8 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the southwestern willow flycatcher.

Malathion use sites overlap with 81.05% of the critical habitat, with 68.35% and 12.7% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.8% of critical habitat annually, with usage on 0.71% of the critical habitat from mosquito control activities and usage on 0.09% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural use labels, such as reduced application rate and frequencies for specific crops, and changes to residential label uses, which reduce the maximum number of applications allowed per year and limit use to spot treatments only (among other changes), together will decrease environmental concentrations of malathion in the species' critical habitat, further reducing risk to the arthropod prey PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod prey PBF. We do not anticipate that malathion will directly or indirectly alter arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the southwestern willow flycatcher.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Designation of Critical Habitat for the Southwestern Willow Flycatcher. Final Rule. Federal Register 78:344-534.

Whooping Crane (*Grus americana*)

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

Physical and 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 molluscs (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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	mammals, snails, clams, crustaceans, birds, amphibians, reptiles and fish	low concern
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
36.69	29.31	1.15	0.83	31.14
Total % Use Overlap = 66 ²		Total % Usage Overlap = 1.98 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of

the Action are likely to appreciably diminish the value of the critical habitat as a whole for the whooping crane.

Malathion use sites overlap with 66% of the critical habitat, with 36.69% and 29.31% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.98% of critical habitat annually, with usage on 1.15% of the critical habitat from mosquito control activities and usage on 0.83% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural use labels, such as implementing aquatic habitat buffers, a 48-hour rain restriction, and reduced application rate and frequencies for specific crops, will substantially decrease environmental concentrations of malathion in the waterbodies that the species forages in. Changes to residential label uses, which reduce the maximum number of applications allowed per year and limit use to spot treatments only, among other changes, will also decrease environmental concentrations of malathion in the species' critical habitat, reducing risk to the PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod and non-arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the whooping crane.

Reference(s):

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

Mississippi Sandhill Crane (*Grus canadensis pulla*)

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. Cranes primarily feed on plant matter, adult and larval insects, earthworms, crayfish, small reptiles, amphibians (frogs), and possibly small birds and mammals. They also eat grasshoppers, crickets, snails, and bird eggs. Therefore, we have identified arthropods and non-arthropod prey as relevant PBFs.

The final critical habitat rule does not describe PBFs for the critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	X	mammals, crustaceans, birds, amphibians, reptiles and fish	high concern
water quality	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	33.76	5.24	1.24	69.49
Total % Use Overlap = 100 ²		Total % Usage Overlap = 6.48 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to arthropod prey and non-arthropod prey. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 33.76% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 6.48% of critical habitat annually, with usage on 5.24% of the critical habitat from mosquito control activities and usage on 1.24% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (69.49%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use and usage may be high outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

Malathion use is expected to impact prey species availability, which can decrease the critical habitat's conservation value to the listed species. However, based on the information available, we do not anticipate malathion will affect all prey species uniformly. We anticipate that malathion would disproportionately impact arthropods, fish, as well as bird and amphibian prey in certain scenarios (depending on application rates on use sites). While this species is known to consume these high-risk non-arthropod prey, it has a varied diet that includes a number of taxa

that are not sensitive to malathion exposure. Thus, while malathion usage is expected to be high in critical habitat, we do not anticipate significant effects to food resources and impacts to the availability of suitable non-arthropod prey PBF would be small.

General conservation measures are expected to substantially reduce environmental concentrations of malathion and help protect critical habitat. Aquatic habitat buffers are in place that specify distances from waterbodies where malathion cannot be applied. The buffers are anticipated to reduce malathion from entering critical habitat through runoff and spray drift, reducing risk of negative impacts to the PBFs. Additionally, rain restrictions, which prohibit application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provide time for malathion to degrade before runoff events can occur. This measure would reduce malathion concentrations in critical habitat via runoff, and further protect critical habitat PBFs. Other general restrictions in place for residential uses, such as limiting applications to spot treatments and limiting the number of applications to two per year, will also reduce environmental concentrations of malathion within critical habitat.

Thus, while the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high, based on the information above, including the proportion of Federal lands, conservation measures, and consideration of additional relevant information regarding likelihood of exposure and impacts to arthropod prey and non-arthropod prey PBFs, we anticipate that the Action poses a low risk to critical habitat. We do not anticipate that malathion will directly or indirectly alter PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Mississippi sandhill crane.

Reference(s):

U. S. Fish and Wildlife Service. 2019. Mississippi Sandhill Crane (*Grus canadensis pulla*) 5-Year Review: Summary and Evaluation. Mississippi Ecological Services Field Office, Jackson. 46 pp.

U. S. Fish and Wildlife Service. 1991. Recovery Plan Mississippi Sandhill Crane. 3rd Revision. Atlanta, Georgia. 48 pp.

U. S. Fish and Wildlife Service. 1977. Determination of Critical Habitat for Mississippi Sandhill Crane. Final Rule. Federal Register 42:39985-39988.

Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*)

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 primary food source is the Florida apple snail. Water quality is also important to this species, and degradation was identified as a threat, as were contaminant residues from DDT, DDD, DDE,

dieldrin, PCBs, mercury, lead, and arsenic to both Everglade snail kites and apple snails. Therefore, we have identified non-arthropod prey and water quality as relevant PBFs.

The final critical habitat rule does not describe PBFs for the critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	X	snails	low concern
water quality	X	aquatic bins 7	low concern
host fish	--	--	--
habitat function	X	--	high concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.98	0.53	6.44	2.16	19.1
Total % Use Overlap = 100 ²		Total % Usage Overlap = 8.59 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect non-arthropod prey, water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to habitat function. There may also be impacts to non-arthropod prey and water quality, however these impacts are expected to be small and are of low concern. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 99.98% and 0.53% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 8.59% of critical habitat annually, with usage on 6.44% of the critical habitat from mosquito control activities and usage on 2.16% of the critical habitat from non-mosquito control activities.

Given that both the Everglade snail kite itself, as well as its main prey species, snails, are tolerant to both direct and indirect effects of malathion, we do not anticipate the Action to negatively impact habitat function PBF to a degree that reduces the conservation value of the critical habitat as a whole. Additionally, general label changes and conservation measures that are widely applied to all species, such as aquatic habitat buffers, a 48-hour rain restriction, and changes to residential use labels, would decrease environmental concentrations of malathion, protecting the critical habitat PBFs.

Thus, while the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, based on the information above, including conservation measures and consideration of additional relevant information regarding the tolerance of the snail kite's main prey base to malathion, we anticipate that the Action poses a low risk to critical habitat. We do not anticipate that malathion will directly or indirectly alter PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Everglade snail kite.

Reference(s):

- U. S. Fish and Wildlife Service. 2019. Recovery Plan for the Endangered Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*). South Florida Ecological Services Office, Vero Beach. 10 pp.
- U. S. Fish and Wildlife Service. 2007. Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*) 5-Year Review: Summary and Evaluation. South Florida Ecological Services Office, Vero Beach. 23 pp.
- U.S. Fish and Wildlife Service. 1977. Final Rule: Correction and Augmentation of Published Rulemaking. Federal Register 42:47840-47845.
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J. Clams (Bivalves/Mussels)

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 8. Summary of Bivalves/Clams Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Alasmidonta atropurpurea</i>	Cumberland elktoe	3	see below
<i>Alasmidonta raveneliana</i>	Appalachian elktoe	3	see below
<i>Amblema neislerii</i>	Fat three-ridge (mussel)	3	see below
<i>Cyclonaias necki</i>	Guadalupe orb	3	see below
<i>Cyclonaias (=Quadrula) petrina</i>	Texas pimpleback	3	see below
<i>Elliptio chipolaensis</i>	Chipola slabshell	3	see below
<i>Elliptio lanceolata</i>	Yellow lance	3	no overlap
<i>Elliptio spinosa</i>	Altamaha spinymussel	3	see below
<i>Elliptoideus sloatianus</i>	Purple bankclimber (mussel)	3	see below
<i>Epioblasma brevidens</i>	Cumberlandian combshell	3	see below
<i>Epioblasma capsaeformis</i>	Oyster mussel	3	see below
<i>Epioblasma metastriata</i>	Upland combshell	3	see below
<i>Epioblasma othcaloogensis</i>	Southern acornshell	3	see below
<i>Fusconaia burkei</i>	Tapered pigtoe	3	see below
<i>Fusconaia escambia</i>	Narrow pigtoe	3	see below
<i>Fusconaia masoni</i>	Atlantic pigtoe	3	no overlap
<i>Fusconaia mitchelli</i>	False spike	3	see below
<i>Fusconaia rotulata</i>	Round ebonyshell	3	see below
<i>Fusconaia subrotunda</i>	Longsolid	3	see below
<i>Hamiota australis</i>	Southern sandshell	3	see below
<i>Lampsilis altilis</i>	Finelined pocketbook	3	see below
<i>Lampsilis bergmanni</i>	Guadalupe fatmucket	3	see below
<i>Lampsilis bracteata</i>	Texas fatmucket	3	see below
<i>Lampsilis perovalis</i>	Orangenacre mucket	3	see below
<i>Lampsilis rafinesqueana</i>	Neosho Mucket	3	see below
<i>Lampsilis subangulata</i>	Shinyrayed pocketbook	3	see below
<i>Lasmigona decorata</i>	Carolina heelsplitter	3	see below
<i>Margaritifera marrianae</i>	Alabama pearlshell	3	see below
<i>Medionidus acutissimus</i>	Alabama moccasinshell	3	see below
<i>Medionidus parvulus</i>	Coosa moccasinshell	3	see below
<i>Medionidus penicillatus</i>	Gulf moccasinshell	3	see below
<i>Medionidus simpsonianus</i>	Ochlockonee moccasinshell	3	see below
<i>Medionidus walkeri</i>	Suwannee moccasinshell	3	see below
<i>Obovaria subrotunda</i>	Round hickorynut	3	see below
<i>Pleurobema athearni</i>	Canoe Creek clubshell	3	see below
<i>Pleurobema decisum</i>	Southern clubshell	3	see below
<i>Pleurobema furvum</i>	Dark pigtoe	3	see below

Scientific Name	Common Name	Category	Rationale
<i>Pleurobema georgianum</i>	Southern pigtoe	3	see below
<i>Pleurobema hanleyianum</i>	Georgia pigtoe	3	see below
<i>Pleurobema perovatum</i>	Ovate clubshell	3	see below
<i>Pleurobema pyriforme</i>	Oval pigtoe	3	see below
<i>Pleurobema strodeanum</i>	Fuzzy pigtoe	3	see below
<i>Pleuonaia dolabelloides</i>	Slabside pearlymussel	3	see below
<i>Popenaias popeii</i>	Texas hornshell	3	see below
<i>Ptychobranhus greenii</i>	Triangular kidneyshell	3	see below
<i>Ptychobranhus jonesi</i>	Southern kidneyshell	3	see below
<i>Ptychobranhus subtentum</i>	Fluted kidneyshell	3	see below
<i>Quadrula cylindrica cylindrica</i>	Rabbitsfoot	3	see below
<i>Quadrula cylindrica strigillata</i>	Rough rabbitsfoot	3	see below
<i>Truncilla macrodon</i>	Texas fawnsfoot	3	see below
<i>Villosa choctawensis</i>	Choctaw bean	3	see below
<i>Villosa perpurpurea</i>	Purple bean	3	see below

Cumberland Elktoe (*Alasmidonta atropurpurea*)

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

Physical and Biological Features:

- Water quality, including temperature, turbidity, oxygen content, and other characteristics, necessary for the normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae (juveniles)

In general, this species lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Effects of Critical Habitat Designation), “release of chemicals, biological pollutants, or heated effluents into the surface water or connected groundwater as a point source or by dispersed release” is listed as an activity that “could alter water conditions that are beyond the tolerances of the mussels or their fish host and result in direct or cumulative adverse effects to these individuals and their life cycles.” In the Special Management Considerations and Protection section, “pollution that results in contamination, nitrification, or sedimentation” is listed as a threat that may require special management considerations due to its effects on water quality and/or presence of fish hosts.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
1.51	20.7	0	0.42	68.52
Total % Use Overlap = 22.21 ²		Total % Usage Overlap = 0.42 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Cumberland elktoe.

Malathion use sites overlap with 22.21% of the critical habitat, with 1.51% and 20.7% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.42% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.42% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (68.52%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, usually from multiple families. Due to this flexible host requirement, along with the conservation measures that are to be implemented, as well as the low usage expected in critical habitat, we expect the fish host community would experience, at most, low level effects from malathion use. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Cumberland elktoe.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered Mussels in the Tennessee and Cumberland River Basins. Final Rule. Federal Register 69:53136-53180.

Appalachian Elktoe (*Alasmidonta raveneliana*)

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

Physical and Biological Features:

- Permanent, flowing, cool, clean, water
- Geomorphically stable stream channels and banks
- Pool, riffle, and run sequences within the channel
- Stable sand, gravel, cobble, and boulder or bedrock substrates
- Medium to high stream gradient
- Periodic natural flooding
- Fish hosts with adequate living, foraging, and spawning areas for them

The Final Rule identifies “sedimentation and other pollutants (i.e., fertilizers, pesticides, heavy metals, oil, salts, organic wastes, etc.)” as the most immediate threats to the remaining populations of the species. The Final Rule also states that the “life cycle of native mussels makes the reproductive stages especially vulnerable to pesticides and other pollutants.” In the Effects of Critical Habitat Designation section, “pesticide/herbicide applications” is listed as an “activity that could result in the significant discharge or deposition of sediment, excessive nutrients, or other organic or chemical pollutants” in Appalachian elktoe critical habitat units.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	15.22	0	0.08	65.64
Total % Use Overlap = 15.22 ²		Total % Usage Overlap = 0.08 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Appalachian elktoe.

Malathion use sites overlap with 15.22% of the critical habitat, with 0% and 15.22% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.08% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.08% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (65.64%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects will occur to host fish given the low level of expected usage in critical habitat, as well as

conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects will occur. We anticipate adequate availability of fish hosts would remain available and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Appalachian elktoe.

Reference(s):

U. S. Fish and Wildlife Service. 2002. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Appalachian Elktoe. Final Rule. Federal Register 67:61016-61040.

Guadalupe Orb (*Cyclonaias necki*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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, 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 Central Texas mussels
 - Channel catfish, flathead catfish, tadpole madtom

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
21.16	11.25	2.07	2.63	0
Total % Use Overlap = 32.42 ³		Total % Usage Overlap = 0.72		

¹The species' critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Guadalupe orb.

Malathion use sites overlap with 32.42% of the critical habitat, with 21.16% and 11.25% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.72% of critical habitat annually, with usage on 2.07% of the critical habitat from mosquito control activities and usage on 2.63% of the critical habitat from non-mosquito control activities.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects will occur to host fish given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food

base for host fish, we do not anticipate mortality or sublethal effects will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Guadalupe orb.

Reference(s):

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Endangered Species Status with Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike, and Threatened Species Status with Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Proposed rule. Federal Register 86:47916-48011.

Texas pimpleback (*Cyclonaias*(=*Quadrula*) *petrina*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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, 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 Central Texas mussels
 - Channel catfish, flathead catfish, tadpole madtom

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6, and 7	high concern
host fish	X	fish host specialist	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
20.21	16.44	3.79	2.12	0
Total % Use Overlap = 36.64 ³		Total % Usage Overlap = 5.9		

¹The species' critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to water quality and host fish. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 36.64% of the critical habitat, with 20.21% and 16.44% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.9% of critical habitat annually, with usage on 3.79% of the critical habitat from mosquito control activities and usage on 2.12% of the critical habitat from non-mosquito control activities.

While there was initially high concern for water quality PBF due to the high level of expected usage, this species uses a variety of aquatic habitat types, which we anticipate would mitigate exposure to malathion. We expect that impacts to the water quality PBF would be limited to only those that are low flow, low volume, small, and localized bodies of water. While this species

does occupy these high-risk aquatic habitats, they also use faster flowing areas, which do not accumulate pesticides at high enough concentrations that would affect the value of the critical habitat for the conservation of the species. Conservation measures, described below, are anticipated to further reduce environmental concentrations of malathion in critical habitat, decreasing the risk to the PBF.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. This narrow requirement for reproduction may make the species more vulnerable to temporary losses of host fish. While the high expected usage in critical habitat, without the conservation measures described below, would lead to high levels of effects to fish hosts, which would decrease the species' reproductive capacity, we do not expect substantial effects will occur to host fish given the variety of aquatic habitats they occupy and the general conservation measures that are to be implemented. As described in the "Approach to the Effects Analysis" section of the main body of the opinion, specific considerations were made for species that occur in bin 3 and 4 aquatic habitats as they were initially modeled in such a way that likely results in overestimation of environmental concentrations of malathion, thus overestimating potential exposure in these bins (e.g., by up to an order of magnitude). We expect the host fishes of the Texas pimpleback that occupy areas with higher flow rates (i.e., bin 3 and 4 habitats) would experience substantially lower exposures to malathion and would have decreased risk of adverse effects. Additionally, the general conservation measures (described below) would further reduce the likelihood of exposure to fish hosts. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

Additionally, a species-specific conservation measure was developed to further mitigate exposure to critical habitat that might result from agricultural uses. For all non-ultra low volume aerial applications for wheat, other grains, and cotton, applicators must use a 100 foot buffer from vulnerable habitats (i.e., low flow and low volume aquatic habitats as defined and informed by input from the local FWS field offices), or use a 50-foot buffer in addition to a full swath displacement. AgDRIFT modeling indicates that this extended buffer can reduce spray drift entering critical habitat by up to 58%. In combination with the general conservation measures, we expect there to be low to no impacts to water quality of host fish PBFs.

Although we anticipate usage on use sites that overlap with critical habitat will be high, we expect the likelihood of exposure and impacts to the water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We

do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Texas pimpleback.

Reference(s):

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Endangered Species Status with Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike, and Threatened Species Status with Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Proposed rule. Federal Register 86:47916-48011.

Fat Three-Ridge Mussel (*Amblema neislerii*)

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

Physical and 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 Final Rule, the narrative for the water quality PCE 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 [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 Principle Constituent Elements section).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	high concern

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
host fish	X	fish host generalist	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
73.51	52.19	7.79	2.72	4.94
Total % Use Overlap = 100 ²		Total % Usage Overlap = 10.52 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to water quality and host fish. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 73.51% and 52.19% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 10.52% of critical habitat annually, with usage on 7.79% of the critical habitat from mosquito control activities and usage on 2.72% of the critical habitat from non-mosquito control activities.

While there was initially high concern for the water quality PBF due to the high level of expected usage, this species uses a variety of aquatic habitat types, which we anticipate would partially mitigate exposure to malathion. We expect that impacts to the water quality PBF would be limited to only those that are low flow, low volume, small, and localized bodies of water. While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides at high enough concentrations that would appreciably affect the water quality PBF and overall value of the critical habitat for the conservation of the species in these areas. Conservation measures, described below, are anticipated to further reduce environmental concentrations of malathion in critical habitat, decreasing the risk to the water quality PBF across all aquatic habitat types.

This clam species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, typically from multiple families. However, while this flexibility should confer some resilience to temporary losses of host fish, without the conservation measures described below, expected usage in critical habitat is high and would be anticipated to reduce fish host abundance to a degree that would pose significant risk to the species' reproductive capacity. However, due

to the variety of aquatic habitats the species occupies and the conservation measures described below, we do not expect substantial effects will occur to host fish.

As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in bin 3 and 4 aquatic habitats as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations of malathion, thus overestimating potential exposure (e.g., by up to an order of magnitude). We expect the host fishes of the fat three-ridge mussel that occupy areas with higher flow rates (i.e., bin 3 and 4 habitats) would experience substantially lower exposures to malathion and would have decreased risk of adverse effects. Additionally, the conservation measures that are to be implemented to protect critical habitat would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels will reduce environmental concentrations of malathion to a level that would induce only low levels of effects to water quality and host fish. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. This measure is expected to benefit all aquatic habitats, including low flow and low volume habitats that are at higher risk due to less capacity for dilution. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure has been developed to mitigate the impact that mosquito adulticide use will have on critical habitat. Where feasible, mosquito control applicators are to avoid applications on or near vulnerable areas (i.e., low flow and low volume aquatic habitats, as defined with input from the local FWS field offices). If avoidance is not feasible or impairs the ability for mosquito control districts or agencies to protect public health, applicators are to reach out to the local FWS field offices to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. Discussions at the local level allow for flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors such as PBFs of the critical habitat. Applicators subject to this conservation measures will be required to retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented.

Thus, while the extent of malathion use sites overlapping with critical habitat is high, and past usage data indicates usage will be high as well, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required

general and species-specific conservation measures. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the fat three-ridge (mussel).

Reference(s):

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 72:34215-34224.

Chipola Slabshell (*Elliptio chipolaensis*)

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

Physical and 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 Final Rule, the narrative for the water quality PCE 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 [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).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	high concern
host fish	X	fish host specialist	high concern
habitat function	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
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¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
98.03	52.44	6.65	3.07	0.03
Total % Use Overlap = 100 ²		Total % Usage Overlap = 9.72 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to water quality and host fish. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 98.03% and 52.44% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 9.72% of critical habitat annually, with usage on 6.65% of the critical habitat from mosquito control activities and usage on 3.07% of the critical habitat from non-mosquito control activities.

While there was initially high concern for the water quality PBF due to the high level of expected usage, this species uses a variety of aquatic habitat types, which we anticipate would partially mitigate exposure to malathion. We expect that impacts to the water quality PBF would be limited to only those that are low flow, low volume, small, and localized bodies of water. While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides at high enough concentrations that would appreciably affect the PBFs and overall value of the critical habitat for the conservation of the species in these areas. Conservation measures, described below, are anticipated to further reduce environmental concentrations of malathion in critical habitat, decreasing the risk to the water quality PBF across all aquatic habitat types.

This clam species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species. This narrow requirement for reproduction would make the species more vulnerable to temporary losses of host fish if the particular host fish were to become unavailable or insufficient in abundance for the clams and no suitable alternative hosts were available. Due to the high expected usage in critical habitat, without the conservation measures described below, we would expect fish hosts would experience high levels of effects from malathion use, which would decrease the species' reproductive capacity. However, considering the dilution anticipated in several of the aquatic habitat types needed in the critical habitat (i.e., bin types shown in the

table above) and conservation measures that are to be implemented (described below), we do not expect substantial effects will occur to host fish. As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in bin 3 and 4 aquatic habitats as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations of malathion, thus overestimating potential exposure (e.g., by up to an order of magnitude). We expect the host fishes of the Chipola slabshell that occupy areas with higher flow rates (i.e., bin 3 and 4 habitats) would experience substantially lower exposures to malathion and would have decreased risk of adverse effects. Additionally, the conservation measures that are to be implemented to protect critical habitat would further reduce the likelihood of exposure to fish hosts. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented, such as aquatic habitat buffers, rain restrictions and changes to residential use labels will reduce environmental concentrations of malathion to a level that would induce only low levels of effects to water quality and host fish. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. This measure is expected to benefit all aquatic habitats, including low flow and low volume habitats that are at higher risk due to less natural capacity for dilution. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure has been developed to mitigate the impact that mosquito adulticide use will have on critical habitat. Where feasible, mosquito control applicators are to avoid applications on or near vulnerable areas (i.e., low flow and low volume aquatic habitats, as defined with input from the local FWS field offices). If avoidance is not feasible or impairs the ability for mosquito control districts or agencies to protect public health, applicators are to reach out to the local FWS field offices to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. Discussions at the local level allow for flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors such as PBFs of the critical habitat. Applicators subject to this conservation measures will be required to retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented. With these conservation measures in place, we expect the impacts to water quality and fish host PBFs to be low.

Thus, while the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in the critical habitat, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We do not anticipate that

malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Chipola slabshell.

Reference(s):

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 72:34215-34224.

Altamaha Spinymussel (*Elliptio spinosa*)

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

Physical and Biological Features:

- Water quality, including specifically:
 - Temperature (less than 32.6 °C (90.68 °) 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)
 - Ammonia level not exceeding 1.5 mg N/L, 0.22 mg N/L (normalized to pH 8 and 25 °C (77 °F))

In the Final Rule, the narrative for the water quality PCE states that pesticides are one of the factors that can alter water quality. The Final Rule states “[m]alathion, one of the most important pesticides used in cotton farming, inhibits physiological activities of mussels (Kabeer et al. 1979, pp.71-72).”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 4	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
41.33	37.05	0.51	2.21	0
Total % Use Overlap = 78.38 ²		Total % Usage Overlap = 2.72 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
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¹Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Altamaha spiny mussel.

Malathion use sites overlap with 78.38% of the critical habitat, with 41.33% and 37.05% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.72% of critical habitat annually, with usage on 0.51% of the critical habitat from mosquito control activities and usage on 2.21% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects will occur to host fish given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Altamaha spiny mussel.

Reference(s):

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

Purple Bankclimber (*Elliptoideus sloatianus*)

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

Physical and 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 Final Rule, the narrative for the water quality PCE 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 [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).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
58.36	43.86	3.15	1.58	6.31
Total % Use Overlap = 100 ²		Total % Usage Overlap = 4.73 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the purple bankclimber.

Malathion use sites overlap with 100% of the critical habitat, with 58.36% and 43.86% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 4.73% of critical habitat annually, with usage on 3.15% of the critical habitat from mosquito control activities and usage on 1.58% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. Due to this flexible host requirement, along with the conservation measures that are to be implemented, as well as the low usage expected in critical habitat, we do not expect substantial effects will occur to the fish host community. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the purple bankclimber.

Reference(s):

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 72:34215-34224.

Cumberlandian Combshell (*Epioblasma brevidens*)

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

Physical and Biological Features:

- Water quality, including temperature, turbidity, oxygen content, and other characteristics, necessary for the normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae (juveniles)

In general, this species lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. Use of pesticides could affect water quality, which would affect the Cumberlandian combshell and their prey. In the Final Rule (*see* Effects of Critical Habitat Designation), “release of chemicals, biological pollutants, or heated effluents into the surface water or connected groundwater as a point source or by dispersed release” is listed as an activity that “could alter water conditions that are beyond the tolerances of the mussels or their fish host and result in direct or cumulative adverse affects to these individuals and their life cycles.” In the Special Management Considerations and Protection section, “pollution that results in contamination, nitrification, or sedimentation” is listed as a threat that may require special management considerations due to its effects on water quality and/or presence of fish hosts.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
4.96	34.03	0.49	0.59	15.13
Total % Use Overlap = 38.99 ²		Total % Usage Overlap = 1.08 ³		

¹Mosquito control use and usage may overlap with other usages.

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
--	--	--	--	---

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Cumberlandian combshell.

Malathion use sites overlap with 38.99% of the critical habitat, with 4.96% and 34.03% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.08% of critical habitat annually, with usage on 0.49% of the critical habitat from mosquito control activities and usage on 0.59% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. Due to this flexible host requirement, along with the conservation measures that are to be implemented, as well as the low usage expected in critical habitat, we do not expect substantial effects will occur to the fish host community. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Cumberlandian combshell.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered Mussels in the Tennessee and Cumberland River Basins. Final Rule. Federal Register 69:53136-53180.

Oyster Mussel (*Epioblasma capsaeformis*)

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

Physical and Biological Features:

- Water quality, including temperature, turbidity, oxygen content, and other characteristics, necessary for the normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae (juveniles)

In general, this species lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Effects of Critical Habitat Designation), “release of chemicals, biological pollutants, or heated effluents into the surface water or connected groundwater as a point source of by dispersed release” is listed as an activity that “could alter water conditions that are beyond the tolerances of the mussels or their fish host and result in direct or cumulative adverse affects to these individuals and their life cycles.” In the Special Management Considerations and Protection section, “pollution that results in contamination, nitrification, or sedimentation” is listed as a threat that may require special management considerations due to its effects on water quality and/or presence of fish hosts.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
4.96	34.03	2.58	0.55	15.13
Total % Use Overlap = 38.99 ²		Total % Usage Overlap = 3.13 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the oyster mussel.

Malathion use sites overlap with 38.99% of the critical habitat, with 4.96% and 34.03% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.13% of critical habitat annually, with usage on 2.58% of the critical habitat from mosquito control activities and usage on 0.55% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. Due to this flexible host requirement, along with the conservation measures that are to be implemented, as well as the low usage expected in critical habitat, we do not expect substantial effects will occur to the fish host community. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the oyster mussel.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered Mussels in the Tennessee and Cumberland River Basins. Final Rule. Federal Register 69:53136-53180.

Upland Combshell (*Epioblasma metastrata*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
39.59	28.08	0	0	5
Total % Use Overlap = 67.67 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the upland combshell.

Malathion use sites overlap with 67.67% of the critical habitat, with 39.59% and 28.08% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects will occur to host fish given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We do not anticipate malathion usage on use sites that overlap with the critical habitat, and the required conservation measures are expected to further reduce the likelihood of exposure and effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the upland combshell.

Reference(s):

- U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.
- U. S. Fish and Wildlife Service. 2008. Upland combshell (*Epioblasma metastriata*) 5-Year Review: Summary and Evaluation. Southeast Region, Jackson, Mississippi. 37 pp.

Southern Acornshell (*Epioblasma othcaloogensis*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae

- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
38.88	27.41	0	0	5.75
Total % Use Overlap = 66.29 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the southern acornshell.

Malathion use sites overlap with 66.29% of the critical habitat, with 38.88% and 27.41% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects will occur to host fish given the low level of expected usage in critical habitat,

as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the southern acornshell.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

U. S. Fish and Wildlife Service. 2008. Upland combshell (*Epioblasma metastriata*) 5-Year Review: Summary and Evaluation. Southeast Region, Jackson, Mississippi. 37 pp.

Tapered Pigtoe (*Fusconaia burkei*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
60.64	38.61	1.21	1.58	5.67
Total % Use Overlap = 99.25 ²		Total % Usage Overlap = 2.79 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the tapered pigtoe.

Malathion use sites overlap with 99.25% of the critical habitat, with 60.64% and 38.61% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.79% of critical habitat annually, with usage on 1.21% of the critical habitat from mosquito control activities and usage on 1.58% of the critical habitat from non-mosquito control activities.

This species is a fish host specialist. Its glochidia can metamorphose only on a single or a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects will occur to host fish given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to host fish. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied,

are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the tapered pigtoe.

Reference(s):

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 77:61664-61719.

Narrow Pigtoe (*Fusconaia escambia*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 7	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
60.29	27.65	0.83	1.17	8.51
Total % Use Overlap = 87.94 ²		Total % Usage Overlap = 2 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the narrow pigtoe.

Malathion use sites overlap with 87.94% of the critical habitat, with 60.29% and 27.65% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2% of critical habitat annually, with usage on 0.83% of the critical habitat from mosquito control activities and usage on 1.17% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole

for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the narrow pigtoe.

Reference(s):

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 77:61664-61719.

False spike (*Fusconaia mitchelli*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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, 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 Central Texas mussels
 - Blacktail shiner and red shiner

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	high concern
host fish	X	fish host specialist	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat)²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
1.03 - 11.17	6.17 - 15.88	0 - 3.07	0.72 - 7.71	0
Total % Use Overlap = 7.19 - 27.05 ³		Total % Usage Overlap = 0.72 - 8.68		

¹The species' critical habitat shapefile was unavailable at the time of analysis. The range of values shown for use, usage, total % use and total % usage overlap are from species range overlaps and usage anticipated for 4 other central Texas mussel species with similar ranges and critical habitat areas. Data for the 4 other mussel species serves as an approximation for use and usage in the proposed false spike critical habitat as this group of mussels occurs in the same vicinity and shares some of the same critical habitat areas with the false spike.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary high level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the false spike.

Malathion use and usage overlap with false spike critical habitat was unavailable at the time of analysis; thus, we are assessing effects to critical habitat qualitatively. A visual examination of the designated critical habitat areas using GIS layers indicate likely overlap with at least some agricultural, developed/open space developed, and mosquito adulticide use sites. Based on similarities in the ranges and critical habitat areas of 4 other species of mussels found in the same vicinity and that share the same proposed critical habitat rule (the Guadalupe fatmucket, the Guadalupe orb, Texas fatmucket, Texas pimpleback, and the Texas fawnsfoot), we expect that malathion use sites will likely overlap with 7.19 to 27.05% of the critical habitat, with 1.03 to 11.17% overlapping with mosquito control and 6.17 to 15.88% overlapping with non-mosquito control use sites (using estimates from these other species' ranges and critical habitats). Available data indicates that usage will likely occur on approximately 0.72 to 8.68% of critical habitat annually, with usage on 0 to 3.07% of the critical habitat from mosquito control activities and usage on 0.72 to 7.71% of the critical habitat from non-mosquito control activities.

While there was initially high concern for water quality PBF due to expected usage that could range up to a high level, this species uses a variety of aquatic habitat types, most of which should mitigate exposure to malathion through dilution. We expect that impacts to the water quality PBF would be limited to only those habitats that are low flow, low volume, small, and localized bodies of water. While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides including malathion at high enough concentrations that would affect the value of the critical habitat for the conservation of the species. Additionally, conservation measures that are to be implemented would further decrease malathion concentrations in all aquatic habitats, further decreasing the risk to the PBF, even with slight variations in the use and usage estimates described above. Thus, we expect only low impacts to the water quality PBF.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the

species more vulnerable to temporary losses of fish host species, we do not expect substantial effects will occur to host fish given the variety of aquatic habitats they occupy and the general conservation measures that are to be implemented. As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in bin 3 and 4 aquatic habitats as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations of malathion, thus overestimating potential exposure (e.g., by up to an order of magnitude). We expect the host fishes of the false spike that occupy areas with higher flow rates (i.e., bin 3 and 4 habitats) would experience substantially lower exposures to malathion and would have decreased risk of adverse effects. Additionally, the conservation measures that are to be implemented to protect critical habitat would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers, rain restrictions, reductions in the number of allowable applications a year, and changes to developed/open space developed use labels, are expected to substantially reduce environmental concentrations of malathion entering critical habitat. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Additionally, we expect that changes to agricultural labels that limit the allowable number of applications per year to crops such as wheat, cotton, corn, and a variety of fruits and vegetables, as well as changes to developed/open space developed use labels, such as limiting use to spot treatments only and setting the maximum number of applications to 2 per year (where previously there was no limit), will also reduce environmental concentrations of malathion. These general conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

Additionally, a species-specific conservation measure was developed to further mitigate exposure to critical habitat for one of the other species with similar ranges and critical habitats, the Texas pimpleback, from agricultural uses. The false spike shares two of its four critical habitat units with the Texas pimpleback, so these measures will apply to both species’ critical habitats in these areas (false spike critical habitat units 2 and 3). This measure specifies that, for all non-ultra low volume aerial applications for wheat, other grains, and cotton, applicators must use a 100 foot buffer from vulnerable habitats (i.e., low flow and low volume aquatic habitats as defined and informed by input from the local FWS field offices), or use a 50-foot buffer in addition to a full swath displacement. AgDRIFT modeling indicates that this extended buffer can reduce spray drift entering critical habitat by up to 58%. In combination with the general conservation measures, we expect no, or only low impacts to water quality and host fish PBFs in these areas.

Although malathion usage on use sites that overlap with the critical habitat were initially estimated to be high, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected level of dilution that will occur in the

species' habitat as well as the the required conservation measures. Thus, we do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, we expect that the Action is not likely to result in the destruction or adverse modification of critical habitat for the false spike.

Reference(s):

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Endangered Species Status with Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike, and Threatened Species Status with Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Proposed rule. Federal Register 86:47916-48011.

Round Ebonyshell (*Fusconaia rotulata*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 4	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
57.62	26.17	0.27	1.66	4.52
Total % Use Overlap = 83.79 ²		Total % Usage Overlap = 1.94 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
--	--	--	--	---

¹Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the round ebonyshell.

Malathion use sites overlap with 83.79% of the critical habitat, with 57.62% and 26.17% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.94% of critical habitat annually, with usage on 0.27% of the critical habitat from mosquito control activities and usage on 1.66% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure to fish hosts. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the round ebonyshell.

Reference(s):

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 77:61664-61719.

Longsolid (*Fusconaia subrotunda*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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

In the Proposed Rule (*see*) Application of the “Destruction or Adverse Modification” Standard) activities that the FWS may find are likely to destroy or adversely modify critical habitat include “significantly alter water chemistry or water quality (e.g., ... 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).”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat)²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
16.56	10.72	0.98	0.92	Information not available
Total % Use Overlap = 27.27 ³		Total % Usage Overlap = 1.9		

¹Critical habitat data was unavailable - species range use usage data used as a surrogate for critical habitat use and usage.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the longsolid.

Malathion use sites overlap with 27.27% of the critical habitat, with 16.56% and 10.72% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.9% of critical habitat annually, with usage on 0.98% of the critical habitat from mosquito control activities and usage on 0.92% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole

for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the longsolid.

Reference(s):

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.

Southern Sandshell (*Hamiota australis*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
64.97	32.94	1.73	0.96	9.01
Total % Use Overlap = 97.91 ²		Total % Usage Overlap = 2.69 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the southern sandshell.

Malathion use sites overlap with 97.91% of the critical habitat, with 64.97% and 32.94% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.69% of critical habitat annually, with usage on 1.73% of the critical habitat from mosquito control activities and usage on 0.96% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to host fish will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented, which would further reduce the likelihood of exposure. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the southern sandshell.

Reference(s):

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 77:61664-61719.

Finelined Pocketbook (*Lampsilis altilis*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
31.14	26.44	1.05	0.72	8.31
Total % Use Overlap = 57.58 ²		Total % Usage Overlap = 1.77 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the finelined pocketbook.

Malathion use sites overlap with 57.58% of the critical habitat, with 31.14% and 26.44% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.77% of critical habitat annually, with usage on 1.05% of the critical habitat from mosquito control activities and usage on 0.72% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to fish hosts will occur given this flexible host requirement, along with the conservation measures that are to be implemented (described below), as well as the low usage expected in critical habitat. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the finelined pocketbook.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Guadalupe fatmucket (*Lampsilis bergmanni*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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, 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 Central Texas mussels
 - Green sunfish, bluegill, largemouth bass, and Guadalupe bass

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
7.14	6.17	0	0.72	0
Total % Use Overlap = 13.36 ³		Total % Usage Overlap = 0.72		

¹The species' critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Guadalupe fatmucket.

Malathion use sites overlap with 13.36% of the critical habitat, with 7.14% and 6.17% overlapping with mosquito control and non-mosquito control use sites, respectively. Available

data indicates that usage will occur on 0.72% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.72% of the critical habitat from non-mosquito control activities.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Guadalupe fatmucket.

Reference(s):

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Endangered Species Status with Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike, and Threatened Species Status with Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Proposed rule. Federal Register 86:47916-48011.

Texas fatmucket (*Lampsilis bracteata*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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, 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 Central Texas mussels
 - Green sunfish, bluegill, largemouth bass, and Guadalupe bass

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6, and 7	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
9.82	10.92	0.08	2.87	0.03
Total % Use Overlap = 20.76 ³		Total % Usage Overlap = 2.95		

¹The species' critical habitat shapeful was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat. Our analysis indicated that a portion (approximately 11%) of the species' critical habitat is located outside of the species' range, which may cause deviations from the usage data listed above. However, additional review and analyses indicate that the portion of critical habitat found outside of the species' range is adjacent to or close to the range. Therefore, usage in the species range is still expected to be similar to and serves as a suitable approximation for usage in the critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Texas fatmucket.

Malathion use sites overlap with 20.76% of the critical habitat, with 9.82% and 10.92% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.95% of critical habitat annually, with usage on 0.08% of the critical habitat from mosquito control activities and usage on 2.87% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 11%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate that the portion of critical habitat found outside of the species' range is contiguous with and includes sections of the same river systems that are in the range. We confirmed that these areas of critical habitat are expected to have the same (or at least very similar) usage rates, as the applicable agricultural and mosquito adulticide usage data are at State- and county-wide levels, respectively, and all the critical habitat units are within the same State and counties. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further decrease the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to agricultural labels, such as reducing the maximum number of allowable applications per year for a variety of crops, is also expected to reduce the environmental concentrations of malathion entering critical habitat. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Texas fatmucket.

Reference(s):

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Endangered Species Status with Critical Habitat for Guadalupe Fatmucket, Texas

Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike, and Threatened Species Status with Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Proposed rule. Federal Register 86:47916-48011.

Orangenacre Mucket (*Lampsilis perovalis*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
23.02	21.63	1.84	0.64	14.02
Total % Use Overlap = 44.65 ²		Total % Usage Overlap = 2.47 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key

indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the orangenacre mucket.

Malathion use sites overlap with 44.65% of the critical habitat, with 23.02% and 21.63% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.47% of critical habitat annually, with usage on 1.84% of the critical habitat from mosquito control activities and usage on 0.64% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to fish hosts will occur given this flexible host requirement, the low usage expected in critical habitat, and the conservation measures that are to be implemented, which would further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the orangenacre mucket.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Neosho Mucket (*Lampsilis rafinesqueana*)

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

Physical and 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.

In the Final 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. In the Special Management Considerations or Protection section, chemical contaminants, including pesticides, was listed as a primary threat to critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
4.57	63.34	0	1.57	1.6
Total % Use Overlap = 67.91 ²		Total % Usage Overlap = 1.57 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Neosho mucket.

Malathion use sites overlap with 67.91% of the critical habitat, with 4.57% and 63.34% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.57% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.57% of the critical habitat from non-mosquito control activities.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial

effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further decrease the likelihood of exposure. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Neosho mucket.

Reference(s):

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 80:24692-24774.

Shinyrayed Pocketbook (*Lampsilis subangulata*)

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

Physical and 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 Final Rule, the narrative for the water quality PCE 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).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	high concern
host fish	X	fish host generalist	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
59.3	48.31	3.62	1.76	7.1
Total % Use Overlap = 100 ²		Total % Usage Overlap = 5.38 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary high level of concern for impacts to both of these PBFs. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to water quality and host fish.

Malathion use sites overlap with 100% of the critical habitat, with 59.3% and 48.31% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.38% of critical habitat annually, with usage on 3.62% of the critical habitat from mosquito control activities and usage on 1.76% of the critical habitat from non-mosquito control activities.

While there was initially high concern for the water quality PBF due to the high level of expected usage, this species uses a variety of aquatic habitat types, which we anticipate would partially mitigate exposure to malathion. We expect that impacts to the water quality PBF would be limited to only those that are low flow, low volume, small, and localized bodies of water.

While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides at high enough concentrations that would appreciably affect the water quality PBF and value of the critical habitat for the conservation of the species in these areas. Conservation measures, described below, are anticipated to further reduce environmental concentrations of malathion in critical habitat, decreasing the risk to the water quality PBF across all aquatic habitat types.

This clam species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes from multiple families. However, while this flexibility should confer some resilience to temporary losses of host fish, without the conservation measures described below, expected usage in critical habitat is high and would be anticipated to reduce fish host abundance to a degree that would pose significantly risk to the species' reproductive capacity. However, we do not expect substantial effects to host fish will occur given the variety of aquatic habitats they occupy and the conservation measures described below that are to be implemented. As described in the "Approach to the Effects Analysis" section of the main body of the Opinion, specific considerations were made for species that occur in bin 3 and 4 aquatic habitats as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations of malathion, thus overestimating potential exposure (e.g., by up to an order of magnitude). We expect the host fishes of the shiner rayed pocketbook that occupy areas with higher flow rates (i.e., bin 3 and 4 habitats) would experience substantially lower exposures to malathion and would have decreased risk of adverse effects. Additionally, the conservation measures that are to be implemented to protect critical habitat would further reduce the likelihood of exposure to fish hosts. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels will reduce environmental concentrations of malathion to a level that would induce only low levels of effects to water quality and host fish. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. This measure is expected to benefit all aquatic habitats, including low flow and low volume habitats that are at higher risk due to less natural capacity for dilution. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure has been developed to mitigate the impact that mosquito adulticide use will have on critical habitat. Where feasible, mosquito control applicators are to avoid applications on or near vulnerable areas (i.e., low flow and low volume aquatic habitats, as defined with input from the local FWS field offices). If avoidance is not feasible or impairs the ability for mosquito control districts or agencies to protect public health, applicators are to reach out to the local FWS field offices to determine appropriate measures to

ensure the proposed application is likely to have no more than minor effects on the species. Discussions at the local level allow for flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors such as PBFs of the critical habitat. Applicators subject to this conservation measures will be required to retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented. With the general and species-specific conservation measures in mind, we do not anticipate major impacts to water quality and fish host PBFs.

Thus, while the extent of malathion use sites overlapping with critical habitat is high, and past usage data indicates usage will be high in the critical habitat, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the shinyrayed pocketbook.

Reference(s):

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 72:34215-34224.

Carolina Heelsplitter (*Lasmigona decorate*)

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

Physical and Biological Features:

- Permanent, flowing, cool, clean water

While the Final Rule does not clearly define “clean water”, it states that the life cycle of native mussels, such as the Carolina heelsplitter, makes the reproductive stages particularly vulnerable (i.e., due to suffocation and/or poisoning) to pesticides and other pollutants. The Final Rule also identifies the runoff of pesticides to be one of several factors that has contributed to the decline and loss of populations of Carolina heelsplitter. In the Effects of Critical Habitat Designation section, “pesticide/herbicide application” is listed as an “[a]ctivit[y] that may destroy or adversely modify critical habitat” for this species.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	X	fish host unknown	low concern

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
2.69	30.04	1.01	1.03	29.33
Total % Use Overlap = 32.73 ²		Total % Usage Overlap = 2.04 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Carolina heelsplitter.

Malathion use sites overlap with 32.73% of the critical habitat, with 2.69% and 30.04% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.04% of critical habitat annually, with usage on 1.01% of the critical habitat from mosquito control activities and usage on 1.03% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing

environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Carolina heelsplitter.

Reference(s):

U. S. Fish and Wildlife Service. 2002. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Carolina Heelsplitter. Final Rule. Federal Register 67:44502-44522.

Alabama Pearlshell (*Margaritifera marrianae*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4 and 7	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
47.36	20	1.29	1.74	0
Total % Use Overlap = 67.36 ²		Total % Usage Overlap = 3.03 ³		

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
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¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Alabama pearlshell.

Malathion use sites overlap with 67.36% of the critical habitat, with 47.36% and 20% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.03% of critical habitat annually, with usage on 1.29% of the critical habitat from mosquito control activities and usage on 1.74% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which would further reduce the likelihood of exposure. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Alabama pearlshell.

Reference(s):

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 77:61664-61719.

Alabama Moccasinshell (*Medionidus acutissimus*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
22.46	22.69	3.63	0.71	13.19
Total % Use Overlap = 45.15 ²		Total % Usage Overlap = 4.34 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Alabama moccasinshell.

Malathion use sites overlap with 45.15% of the critical habitat, with 22.46% and 22.69% overlapping with mosquito control and non-mosquito control use sites, respectively. Available

data indicates that usage will occur on 4.34% of critical habitat annually, with usage on 3.63% of the critical habitat from mosquito control activities and usage on 0.71% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur given this flexible host requirement, the low usage expected in critical habitat, and the conservation measures to be implemented, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Alabama moccasinshell.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Coosa Moccasinshell (*Medionidus parvulus*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
40.53	26.57	2.18	0.83	11.64
Total % Use Overlap = 67.1 ²		Total % Usage Overlap = 3.01 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Coosa moccasinshell.

Malathion use sites overlap with 67.1% of the critical habitat, with 40.53% and 26.57% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.01% of critical habitat annually, with usage on 2.18% of the critical habitat from mosquito control activities and usage on 0.83% of the critical habitat from non-mosquito control activities.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to host fish will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which are anticipated to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur.

We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Coosa moccasinshell.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Gulf Moccasinshell (*Medionidus penicillatus*)

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

Physical and 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 Final Rule, the narrative for the water quality PCE 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).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4 and 5	high concern
host fish	X	fish host generalist	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
56.83	49.86	4.99	1.85	2.93
Total % Use Overlap = 100 ²		Total % Usage Overlap = 6.84 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary high level of concern for impacts to both of these PBFs. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to water quality and host fish.

Malathion use sites overlap with 100% of the critical habitat, with 56.83% and 49.86% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 6.84% of critical habitat annually, with usage on 4.99% of the critical habitat from mosquito control activities and usage on 1.85% of the critical habitat from non-mosquito control activities.

While there was initially high concern for the water quality PBF due to the high level of expected usage, this species uses a variety of aquatic habitat types, which we anticipate would partially mitigate exposure to malathion. We expect that impacts to the water quality PBF would be limited to only those that are low flow, low volume, small, and localized bodies of water. While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides at high enough concentrations that would appreciably affect the water quality PBF and overall value of the critical habitat for the

conservation of the species in these areas. Additionally, the conservation measures described below that are to be implemented would further decrease malathion concentrations in all aquatic habitats, further decreasing the risk to the PBF. Thus, we think there is low concern for impacts to the water quality PBF.

This clam species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes from multiple families. However, while this flexibility should confer some resilience to temporary losses of host fish, without the conservation measures described below, expected usage in critical habitat is high and would be anticipated to reduce fish host abundance to a degree that would pose significantly risk to the species' reproductive capacity. However, we do not expect substantial effects to fish hosts will occur given the variety of aquatic habitats they occupy and the conservation measures described below. As described in the "Approach to the Effects Analysis" section of the main body of the Opinion, specific considerations were made for species that occur in bin 3 and 4 aquatic habitats as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations of malathion, thus overestimating potential exposure (e.g., by up to an order of magnitude). We expect the host fishes of the Gulf moccasinshell that occupy areas with higher flow rates (i.e., bin 3 and 4 habitats) would experience substantially lower exposures to malathion and would have decreased risk of adverse effects. Additionally, the conservation measures that are to be implemented to protect critical habitat would further reduce the likelihood of exposure to fish hosts. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will further reduce environmental concentrations of malathion to a level that would induce only low levels of effects to water quality and host fish. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, species-specific conservation measures have been developed to further protect critical habitat from malathion use. For cotton applications, which was a crop type that was driving much of the anticipated usage, applicators are to use a 100 foot buffer for aerial applications or use a 50 foot buffer and one full swatch displacement near vulnerable area (i.e., low flow and low volume areas as defined with input from the local FWS field offices). Based on AgDRIFT modeling, this extended buffer is expected to reduce aerial application spray drift by up to 58%. For mosquito adulticide, applicators are to avoid applying on or near vulnerable areas (i.e., low flow and low volume aquatic habitats, as defined with input from the local FWS field offices). If avoidance is not feasible or impairs the ability for mosquito control districts or agencies to protect public health, applicators are directed to reach out to the local FWS field offices to determine appropriate measures to ensure the proposed application is likely to have no

more than minor effects on the species. Discussions at the local level allow for flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors such as PBFs of the critical habitat. Applicators subject to this conservation measures will be required to retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented. With these general and species-specific conservation measures in mind, we do not anticipate major impacts to water quality and fish host PBFs.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Gulf moccasinshell.

Reference(s):

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 72:34215-34224.

Ochlockonee Moccasinshell (*Medionidus simpsonianus*)

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

Physical and 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 Final Rule, the narrative for the water quality PCE 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 [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).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 4	low concern
host fish	X	fish host unknown	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
81.03	40.84	7.53	4.78	4.55
Total % Use Overlap = 100 ²		Total % Usage Overlap = 12.32 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to host fish and a preliminary low level of concern for impacts to water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 81.03% and 40.84% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 12.32% of critical habitat annually, with usage on 7.53% of the critical habitat from mosquito control activities and usage on 4.78% of the critical habitat from non-mosquito control activities.

As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in Bins 3 and 4 as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations, thus overestimating potential exposure (e.g., by up to an order of magnitude). Further investigation by EPA into estimated environmental concentrations for Bins 3 and 4 indicated that the flow rates in these aquatic habitats are sufficient to dilute malathion concentrations to levels that will result in low impacts to water quality and fish host species. Thus, the level of contamination expected to occur in this critical habitat (that only includes Bins 3 and 4) is substantially less than what was initially indicated in EPA’s modeling, and concentrations are anticipated to cause only low levels of effects to water quality or fish hosts.

This species' fish host is currently unknown, and we therefore erred on the side of caution and treated this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. This narrow requirement for reproduction may make the species more vulnerable to temporary losses of host fish. While usage is expected to be high, we do not expect substantial effects to fish hosts will occur given the levels of dilution expected to occur in the habitat of the species (as described above) as well as the conservation measures that are to be implemented (described below), which would further reduce the likelihood of exposure to host fish. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Ochlockonee moccasinshell.

Reference(s):

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 72:34215-34224.

Suwannee Moccasinshell (*Medionidus walkeri*)

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

Physical and 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 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).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 4	low concern
host fish	X	fish host specialist	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
62.63	15.78	6.82	2.14	5.03

Mosquito Adulticide Use (% overlap with critical habitat)²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
Total % Use Overlap = 78.41 ²		Total % Usage Overlap = 8.96		

¹The species' critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to host fish and a preliminary low level of concern for impacts to water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 78.41% of the critical habitat, with 62.63% and 15.78% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 8.96% of critical habitat annually, with usage on 6.82% of the critical habitat from mosquito control activities and usage on 2.14% of the critical habitat from non-mosquito control activities.

As described in the "Approach to the Effects Analysis" section of the main body of the Opinion, specific considerations were made for species that occur in Bins 3 and 4 as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations, thus overestimating potential exposure (e.g., by up to an order of magnitude). Further investigation by EPA into estimated environmental concentrations for Bin 3s and 4 indicated that the flow rates in these aquatic habitats are sufficient to dilute malathion concentrations to levels that will result in low impacts to water quality and fish host species. Thus, the level of contamination expected to occur in this critical habitat (that only includes Bins 3 and 4) is substantially less than what was initially indicated in EPA's modeling, and concentrations are anticipated to cause only low levels of effects to water quality or fish hosts.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species within a single family. This narrow requirement for reproduction would make the species more vulnerable to temporary losses of host fish if the particular host fish were to become unavailable or insufficient in abundance for the clams and no suitable alternative hosts were available. However, despite the high level of usage expected, we do not expect substantial effects to host fish will occur considering the dilution anticipated in the aquatic habitat types needed in the critical habitat (as described above) and conservation measures that are to be implemented (described below), which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied,

are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in the critical habitat, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Suwannee moccasinshell.

Reference(s):

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.

Round hickorynut (*Obvaria subrotunda*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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

In the Proposed Rule (*see*) Application of the “Destruction or Adverse Modification” Standard) activities that the FWS may find are likely to destroy or adversely modify critical habitat include

“significantly alter water chemistry or water quality (e.g., ... 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).”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
19.11	15.38	0.41	1.27	Information not available
Total % Use Overlap = 34.48 ³		Total % Usage Overlap = 1.68		

¹Critical habitat data was unavailable - species range use usage data used as a surrogate for critical habitat use and usage.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the round hickorynut.

Malathion use sites overlap with 34.48% of the critical habitat, with 19.11% and 15.38% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.68% of critical habitat annually, with usage on 0.41% of the critical habitat from mosquito control activities and usage on 1.27% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur given this flexible host requirement, low usage expected in critical habitat, and the implementation of conservation measures (described below), which are expected to further decrease the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the round hickorynut.

Reference(s):

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.

Canoe Creek clubshell (*Pleurobema athearni*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- Stable instream substrate for attaching and sheltering
- clean, flowing water to keep substrates free from excess sedimentation and to facilitate host fish interactions and feeding
- appropriate water quality and temperatures to meet physiological needs for survival, growth, and reproduction; food and nutrients to survive and grow
- host fish for reproduction and dispersal

Fish host may include- tricolor shiner (*Cyprinella trichroistia*), Alabama shiner (*C. callistia*), and striped shiner (*Luxilus chrysocephalus*).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, and 4	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
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¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
37.5	12.07	3.0	0.65	0
Total % Use Overlap = 49.57 ³		Total % Usage Overlap = 3.65		

¹Critical habitat data was unavailable - species range use and usage data used as a surrogate for critical habitat use and usage.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Canoe Creek clubshell.

Malathion use sites overlap with 49.57% of the critical habitat, with 37.5% and 12.07% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.65% of critical habitat annually, with usage on 3.0% of the critical habitat from mosquito control activities and usage on 0.65% of the critical habitat from non-mosquito control activities.

This species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to fish hosts will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Canoe Creek clubshell.

Reference(s):

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Canoe Creek Clubshell and Designation of Critical Habitat. Proposed Rule. Federal Register 85 FR 69540 69563.

Southern Clubshell (*Pleurobema decisum*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
29.82	24.37	1.9	0.55	3.78

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
Total % Use Overlap = 54.19 ²		Total % Usage Overlap = 2.45 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the southern clubshell.

Malathion use sites overlap with 54.19% of the critical habitat, with 29.82% and 24.37% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.45% of critical habitat annually, with usage on 1.9% of the critical habitat from mosquito control activities and usage on 0.55% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantially effects to host fish will occur given this flexible host requirement, the low usage expected in critical habitat, and the conservation measures to be implemented (described below), which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the southern clubshell.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Dark Pigtoe (*Pleurobema furvum*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
14.35	19.14	0.64	0.59	47.96
Total % Use Overlap = 33.49 ²		Total % Usage Overlap = 1.23 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key

indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the dark pigtoe.

Malathion use sites overlap with 33.49% of the critical habitat, with 14.35% and 19.14% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.23% of critical habitat annually, with usage on 0.64% of the critical habitat from mosquito control activities and usage on 0.59% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur given this flexible host requirement, the low usage expected in critical habitat, and the conservation measures to be implemented (described below), which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain, and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the dark pigtoe.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Southern Pigtoe (*Pleurobema georgianum*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
40.53	26.57	1.49	0.85	11.64
Total % Use Overlap = 67.1 ²		Total % Usage Overlap = 2.34 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the southern pigtoe.

Malathion use sites overlap with 67.1% of the critical habitat, with 40.53% and 26.57% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.34% of critical habitat annually, with usage on 1.49% of the critical habitat from mosquito control activities and usage on 0.85% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to fish hosts given this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures to be implemented, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the southern pigtoe.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Georgia Pigtoe (*Pleurobema hanleyianum*)

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

Physical and Biological Features:

- Geomorphically stable stream and river channels and banks
- A hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species is found
- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and chemical constituents
- Sand, gravel, cobble, boulder, or bedrock substrates with low to medium amounts of fine sediment and attached filamentous algae
- The presence of fish host(s) for the Georgia pigtoe (species currently unknown). Diverse assemblages of native chubs, minnows, stonerollers, and other stream-adapted fish species will serve as a potential indication of presence of host fish.

In the 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. In the critical habitat final rule, “a lack of specific information on the sensitivity of the Georgia pigtoe...and their host fish to common industrial and municipal pollutants” limited the application of regulatory mechanisms to protect this species.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3	low concern
host fish	X	fish host unknown	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
17.66	22.33	4.81	1.13	11.62
Total % Use Overlap = 39.99 ²		Total % Usage Overlap = 5.94 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to host fish and a preliminary low level of concern for impacts to water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 39.99% of the critical habitat, with 17.66% and 22.33% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.94% of critical habitat annually, with usage on 4.81% of the critical habitat from mosquito control activities and usage on 1.13% of the critical habitat from non-mosquito control activities.

As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in Bins 3 and 4 as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations, thus overestimating potential exposure (e.g., by up to an order of magnitude). Further investigation by EPA into estimated environmental concentrations for Bins 3 and 4 indicated that

the flow rates in these aquatic habitats are sufficient to dilute malathion concentrations to levels that will result in low impacts to water quality and fish host species. Thus, the level of contamination expected to occur in this critical habitat (that only includes Bin 3) is substantially less than what was initially indicated in EPA's modeling, and concentrations are anticipated to cause only low levels of effects to water quality or fish hosts.

This species' fish host is currently unknown, and we therefore erred on the side of caution and treated this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. This narrow requirement for reproduction may make the species more vulnerable to temporary losses of host fish. Due to the high expected usage in critical habitat, without the conservation measures described below, we would generally expect fish hosts would experience high levels of effects from malathion use, which would decrease the species' reproductive capacity. However, we do not expect substantial effects to fish hosts will occur considering the dilution anticipated in the aquatic habitat types needed in the critical habitat (i.e., bin 3 as shown in the table above and described above) and conservation measures that are to be implemented, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Georgia pigtoe.

Reference(s):

U. S. Fish and Wildlife Service. 2010. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Georgia Pigtoe Mussel, Interrupted Rocksnail, and Rough Hornsnail and Designation of Critical Habitat. Final Rule. Federal Register 75:67512-67550.

Ovate Clubshell (*Pleurobema perovatum*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
22.32	22.64	1.81	0.6	12.66
Total % Use Overlap = 44.96 ²		Total % Usage Overlap = 2.41 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the ovate clubshell.

Malathion use sites overlap with 44.96% of the critical habitat, with 22.32% and 22.64% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.41% of critical habitat annually, with usage on 1.81% of the critical habitat from mosquito control activities and usage on 0.6% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to host fish will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the ovate clubshell.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Oval Pigtoe (*Pleurobema pyriforme*)

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

Physical and 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 Final Rule, the narrative for the water quality PCE 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 [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).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
55.25	49.39	2.42	1.4	1.16
Total % Use Overlap = 100 ²		Total % Usage Overlap = 3.82 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the oval pigtoe.

Malathion use sites overlap with 100% of the critical habitat, with 55.25% and 49.39% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.82% of critical habitat annually, with usage on 2.42% of the critical habitat from mosquito control activities and usage on 1.4% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures to be implemented (described below), which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the oval pigtoe.

Reference(s):

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 72:34215-34224.

Fuzzy Pigtoe (*Pleurobema strodeanum*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
51.5	32.94	1.71	0.95	6.75
Total % Use Overlap = 84.44 ²		Total % Usage Overlap = 2.66 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the fuzzy pigtoe.

Malathion use sites overlap with 84.44% of the critical habitat, with 51.5% and 32.94% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.66% of critical habitat annually, with usage on 1.71% of the critical habitat from mosquito control activities and usage on 0.95% of the critical habitat from non-mosquito control activities.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to host fish will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We

anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the fuzzy pigtoe.

Reference(s):

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 77:61664-61719.

Slabside Pearlymussel (*Pleuroaia dolabelloides*)

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

Physical and Biological Features:

- Water quality with low levels of pollutants and including a natural temperature regime, pH (6.0-8.5), oxygen content (not less than 5.0 milligrams/liter), hardness, and turbidity necessary for normal behavior, growth, and viability of all life stages.

In the Final Rule (*see* Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirements), 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 slabside pearlymussel.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
7.58	35.8	0.9	0.55	2.71
Total % Use Overlap = 43.38 ²		Total % Usage Overlap = 1.45 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the slabside pearlymussel.

Malathion use sites overlap with 43.38% of the critical habitat, with 7.58% and 35.8% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.45% of critical habitat annually, with usage on 0.9% of the critical habitat from mosquito control activities and usage on 0.55% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and general conservation measures to be implemented (described below), which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing

environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the slabside pearl mussel.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Fluted Kidneyshell and Slabside Pearlymussel. Final Rule. Federal Register 78:59556-59620.

Texas hornshell (*Popenaias popeii*)

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

Physical and Biological Features:

- Flowing water at rates high enough to support clean-swept substrate but not so high as to dislodge individuals
- Crevices beneath boulders, shelves, and within undercut banks with seams of fine sediment
- River carpsucker, red shiner, and gray redhorse present
- Water quality parameters within the following ranges
 - Salinity below 0.9 ppt
 - Ammonia below 0.7 mg/L
 - Low levels of contaminants
 - Dissolved oxygen levels within substrate greater than 1.3 mg/L

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 4, 5, 6, and 7	low concern
host fish	X	fish host specialist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat)²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
23.44	1.94	0.93	0.2	25.3
Total % Use Overlap = 25.39 ³		Total % Usage Overlap = 1.16		

¹The species' critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as proxies for critical habitat. Our analysis indicated that a portion (approximately 44%) of the species' critical habitat is located outside of the species' range, which may cause deviations from the usage data listed above. However, additional review and analyses indicate that the portion of critical habitat found outside of the species' range is adjacent to or close to the range. Therefore, usage in the species range is still expected to be similar to and serves as a suitable approximation for usage in the critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Texas hornshell.

Malathion use sites overlap with 25.39% of the critical habitat, with 23.44% and 1.94% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.16% of critical habitat annually, with usage on 0.93% of the critical habitat from mosquito control activities and usage on 0.2% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 44%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses show that critical habitat areas found outside of the species' range are contiguous with and include sections of the same river systems and are found within the same State and counties as the species' range. We confirmed that these areas of critical habitat are expected to have the same (or at least very similar) usage rates as areas within the species' range, as the applicable agricultural and mosquito adulticide usage data is State- and county-wide, respectively, and all critical habitat areas are within the same State and counties. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures that are to be implemented (described below), which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, which prohibit malathion

application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Texas hornshell.

Reference(s):

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designating Texas Hornshell Critical Habitat. Proposed Rule. Federal Register 86:30888-30909.

Triangular Kidneyshell (*Ptychobranchus greenii*)

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

Physical and Biological Features:

- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae
- Correct flow and water quality to continue to develop

This mussel, in general, lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Need for Special Management Consideration or Protection), “point and/or nonpoint source pollution that results in contamination” is listed as an action that requires “special management considerations or protection to maintain ... water quantity or quality, substrates, presence of fish hosts.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
32.53	24.8	1.16	0.7	21.13
Total % Use Overlap = 57.33 ²		Total % Usage Overlap = 1.87 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the triangular kidneyshell.

Malathion use sites overlap with 57.33% of the critical habitat, with 32.53% and 24.8% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.87% of critical habitat annually, with usage on 1.16% of the critical habitat from mosquito control activities and usage on 0.7% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures that are to be implemented (described below), which are expected to further reduce the likelihood of exposure. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole

for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the triangular kidneyshell.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Three Threatened Mussels and Eight Endangered Mussels in the Mobile River Basin. Final Rule. Federal Register 69:40084-40171.

Southern Kidneyshell (*Ptychobranchus jonesi*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
59.19	32.16	0.93	1.04	4.95
Total % Use Overlap = 91.35 ²		Total % Usage Overlap = 1.97 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key

indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the southern kidneyshell.

Malathion use sites overlap with 91.35% of the critical habitat, with 59.19% and 32.16% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.97% of critical habitat annually, with usage on 0.93% of the critical habitat from mosquito control activities and usage on 1.04% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to host fish will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the southern kidneyshell.

Reference(s):

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 77:61664-61719.

Fluted Kidneyshell (*Ptychobranhus subtentum*)

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

Physical and Biological Features:

- Water quality with low levels of pollutants and including a natural temperature regime, pH (between 6.0 to 8.5), oxygen content (not less than 5.0 milligrams/liter), hardness, and turbidity necessary for normal behavior, growth, and viability of all life stages.

In the Final Rule (*see* Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirements), 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 fluted kidneyshell.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
5.91	36.65	0.09	0.51	14.99
Total % Use Overlap = 42.56 ²		Total % Usage Overlap = 0.61 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the fluted kidneyshell.

Malathion use sites overlap with 42.56% of the critical habitat, with 5.91% and 36.65% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.61% of critical habitat annually, with usage on 0.09% of

the critical habitat from mosquito control activities and usage on 0.51% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures that are to be implemented, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the fluted kidneyshell.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Fluted Kidneyshell and Slabside Pearlymussel. Final Rule. Federal Register 78:59556-59620.

Rabbitsfoot (*Quadrula cylindrica cylindrica*)

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

Physical and 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.

In the Final 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. In the Special Management Considerations or

Protection section, chemical contaminants, including pesticides, was listed as a primary threat to critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
20.5	32.52	0.9	0.86	11.89
Total % Use Overlap = 53.02 ²		Total % Usage Overlap = 1.76 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the rabbitsfoot.

Malathion use sites overlap with 53.02% of the critical habitat, with 20.5% and 32.52% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.76% of critical habitat annually, with usage on 0.9% of the critical habitat from mosquito control activities and usage on 0.86% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures that are to be implemented (described below), which are expected to further reduce the likelihood of exposure. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied,

are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the rabbitsfoot.

Reference(s):

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 80:24692-24774.

Rough Rabbitsfoot (*Quadrula cylindrica strigillata*)

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

Physical and Biological Features:

- Water quality, including temperature, turbidity, oxygen content, and other characteristics, necessary for the normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae (juveniles)

In general, this species lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Effects of Critical Habitat Designation), “release of chemicals, biological pollutants, or heated effluents into the surface water or connected groundwater as a point source of by dispersed release” is listed as an activity that “could alter water conditions that are beyond the tolerances of the mussels or their fish host and result in direct or cumulative adverse affects to these individuals and their life cycles.” In the Special Management Considerations and Protection section, “pollution that results in contamination, nitrification, or sedimentation” is listed as a threat that may require special management considerations due to its effects on water quality and/or presence of fish hosts.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
water quality	X	aquatic bins 2, 3, 4 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	33.43	0	0.53	1.61
Total % Use Overlap = 33.43 ²		Total % Usage Overlap = 0.53 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the rough rabbitsfoot.

Malathion use sites overlap with 33.43% of the critical habitat, with 0% and 33.43% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.53% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.53% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures that are to be implemented, which are expected to further decrease the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing

environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the rough rabbitsfoot.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered Mussels in the Tennessee and Cumberland River Basins. Final Rule. Federal Register 69:53136-53180.

Texas fawnsfoot (*Truncilla macrodon*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and 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, 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 Central Texas mussels

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
water quality	X	aquatic bins 2, 3, 4, 5, 6, 7	high concern
host fish	X	fish host specialist	high concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
33.53	20.62	9.52	2.93	0
Total % Use Overlap = 54.15 ³		Total % Usage Overlap = 12.45		

¹The species' critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat. Our analysis indicated that a portion (approximately 22%) of the species' critical habitat is located outside of the species' range, which may cause deviations from the usage data listed above. However, additional review and analyses indicate that the portion of critical habitat found outside of the species' range is adjacent to or close to the range. Therefore, usage in the species range is still expected to be similar to and serves as a suitable approximation for usage in the critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to water quality and host fish. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 33.53% of the critical habitat, with 33.53% and 20.62% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 12.45% of critical habitat annually, with usage on 9.52% of the critical habitat from mosquito control activities and usage on 2.93% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 22%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate critical habitat areas found outside of the species' range are contiguous with and include sections of the same river systems that are in the range. We confirmed that these areas of critical habitat would have the same (or at least very similar) usage rates as areas within the species' range, as the applicable agricultural and mosquito adulticide usage data is State- and county-wide, respectively, and the critical habitat units are all within the same State and counties as the species' range. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

While there was initially high concern for water quality PBF due to the high level of expected usage, this species uses a variety of aquatic habitat types, which we anticipate would mitigate exposure to malathion. We expect that impacts to the water quality PBF would be limited to only

those that are low flow, low volume, small, and localized bodies of water. While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides at high enough concentrations that would affect the value of the critical habitat for the conservation of the species. Conservation measures, described below, are anticipated to further reduce environmental concentrations of malathion in critical habitat, decreasing the risk to the PBF.

This species is a fish host specialist. Its glochidia can metamorphose only on a select few fish species, usually within a single family. This narrow requirement for reproduction may make the species more vulnerable to temporary losses of host fish. Due to the high expected usage in critical habitat, without the conservation measures described below, we would expect fish hosts would experience high levels of effects from malathion use, which would decrease the species' reproductive capacity. However, we do not expect substantial effects to host fish will occur considering the dilution anticipated in the aquatic habitat types needed in the critical habitat (i.e., bin types shown in the table above and described above) and conservation measures that are to be implemented (described below), which are expected to further decrease the likelihood of exposure. While some small reductions in numbers of host fish may occur, we anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to agricultural labels, such as reducing the maximum number of allowable applications per year for a variety of crops, is also expected to reduce the environmental concentrations of malathion entering critical habitat. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

In addition to these general measures, the registrants have agreed to additional conservation measures to mitigate exposures for vulnerable, low flow reaches of critical habitat for both agricultural and mosquito adulticide uses. Where feasible, applicators will either use a 100 ft buffer around stretches of vulnerable habitat (as defined and informed by FWS species experts) or use a 50-foot buffer in addition to one full swath displacement when applying malathion aerially for grain, wheat, and cotton applications. Similarly, where feasible, applicators will not apply mosquito adulticide within vulnerable stretches of critical habitat (as defined and informed by FWS species experts) and will coordinate with the local FWS Field Office staff to determine alternative measures to reduce exposure if avoidance is not possible. Discussions at the local level allow for greater flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors. Applicators subject to this conservation measures will be required to maintain records of their interactions with FWS offices, allowing us to better track this coordination and its outcomes moving forward. With these general and species-specific conservation measures in mind, we do not anticipate major impacts to water quality and fish host PBFs. Together, these general and species-specific

measures will reduce exposure to critical habitat to a degree that there is only low concern regarding impacts to the water quality and host fish PBFs.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in the critical habitat, we expect the likelihood of exposure and impacts to water quality and fish host PBFs will be extremely limited due to the expected levels of dilution that will occur within aquatic habitats the species occupies as well as the required general and species-specific conservation measures. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Texas fawnsfoot.

Reference(s):

U. S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Endangered Species Status with Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike, and Threatened Species Status with Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot. Proposed rule. Federal Register 86:47916-48011.

Choctaw Bean (*Villosa choctawensis*)

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

Physical and 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.

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 4	low concern
host fish	X	fish host unknown	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
53.53	32.94	1.59	0.89	7.32
Total % Use Overlap = 86.47 ²		Total % Usage Overlap = 2.49 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Choctaw bean.

Malathion use sites overlap with 86.47% of the critical habitat, with 53.53% and 32.94% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.49% of critical habitat annually, with usage on 1.59% of the critical habitat from mosquito control activities and usage on 0.89% of the critical habitat from non-mosquito control activities.

This species' fish host is currently unknown. Therefore, we will err on the side of caution and treat this species as a fish host specialist with glochidia that can metamorphose only on a select few fish species, usually within a single family. While this narrow fish host requirement can make the species more vulnerable to temporary losses of fish host species, we do not expect substantial effects to host fish will occur given the low level of expected usage in critical habitat, as well as conservation measures that are to be implemented to protect critical habitat, which are expected to further reduce the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole

for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Choctaw bean.

Reference(s):

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 77:61664-61719.

Purple Bean (*Villosa perpurpurea*)

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

Physical and Biological Features:

- Water quality, including temperature, turbidity, oxygen content, and other characteristics, necessary for the normal behavior, growth, and survival of all life stages of the five mussels and their host fish.
- Stable substrates with low to medium amounts of sediment and low amounts of filamentous algae (juveniles)

In general, this species lives embedded in the bottom sand, gravel, and/or cobble substrates of rivers and streams. In the Final Rule (*see* Effects of Critical Habitat Designation), “release of chemicals, biological pollutants, or heated effluents into the surface water or connected groundwater as a point source of by dispersed release” is listed as an activity that “could alter water conditions that are beyond the tolerances of the mussels or their fish host and result in direct or cumulative adverse affects to these individuals and their life cycles.” In the Special Management Considerations and Protection section, “pollution that results in contamination, nitrification, or sedimentation” is listed as a threat that may require special management considerations due to its effects on water quality and/or presence of fish hosts.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	X	fish host generalist	low concern
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	31.34	0	0.41	2.64
Total % Use Overlap = 31.34 ²		Total % Usage Overlap = 0.41 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and host fish, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the purple bean.

Malathion use sites overlap with 31.34% of the critical habitat, with 0% and 31.34% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.41% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.41% of the critical habitat from non-mosquito control activities.

This species is a fish host generalist. Its glochidia can metamorphose on a wide variety of fishes, often from multiple families. We do not expect substantial effects to host fish will occur due to this flexible host requirement, the low usage expected in critical habitat, and the general conservation measures that are to be implemented (described below), which are expected to further decrease the likelihood of exposure. While we expect small reductions in the food base for host fish, we do not anticipate mortality or sublethal effects to host fish will occur. We anticipate adequate availability of fish hosts would remain and impacts to the PBF would be minor.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to water quality and host fish PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce the likelihood of effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and host fish to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the purple bean.

Reference(s):

U. S. Fish and Wildlife Service. 2004. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Five Endangered Mussels in the Tennessee and Cumberland River Basins. Final Rule. Federal Register 69:53136-53180.

K. Crustaceans

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 9. Summary of Crustacean Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Branchinecta conservatio</i>	Conservancy fairy shrimp	3	see below
<i>Branchinecta longiantenna</i>	Longhorn fairy shrimp	3	see below
<i>Branchinecta lynchi</i>	Vernal pool fairy shrimp	3	see below
<i>Branchinecta sandiegonensis</i>	San Diego fairy shrimp	3	see below
<i>Cambarus cracens</i>	Slenderclaw Crayfish	3	no overlap
<i>Gammarus desperatus</i>	Noel's amphipod	3	≥95% Federal lands overlap
<i>Gammarus hyalleloides</i>	Diminutive amphipod	3	see below
<i>Gammarus pecos</i>	Pecos amphipod	3	see below
<i>Lepidurus packardii</i>	Vernal pool tadpole shrimp	3	see below
<i>Palaemonias ganteri</i>	Kentucky cave shrimp	2	no relevant PBFs
<i>Procambarus econfinae</i>	Panama City crayfish	3	see below
<i>Spelaeorchestia koloana</i>	Kauai cave amphipod	3	see below
<i>Streptocephalus woottoni</i>	Riverside fairy shrimp	3	see below
<i>Stygobromus (=Stygonectes) pecki</i>	Peck's cave amphipod	3	see below
<i>Faxonius peruncus</i>	Big Creek crayfish	3	see below
<i>Faxonius quadruncus</i>	St. Francis River crayfish	3	see below

Conservancy Fairy Shrimp (*Branchinecta conservatio*)

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

Physical and 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 Final Rule does not specifically mention pesticides, however, sedimentation or chemical pollution from roadway or other urban runoff is identified 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.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
89.49	71.6	1.62	0.83	33.52
Total % Use Overlap = 100 ²		Total % Usage Overlap = 2.45 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the conservancy fairy shrimp.

Malathion use sites overlap with 100% of the critical habitat, with 89.49% and 71.6% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.45% of critical habitat annually, with usage on 1.62% of

the critical habitat from mosquito control activities and usage on 0.83% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the conservancy fairy shrimp.

Reference(s):

U. S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon: Evaluation of Economic Exclusions from 2003 Final Designation. Final Rule. Federal Register 70:46924-46999.

Longhorn Fairy Shrimp (*Branchinecta longiantenna*)

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

Physical and 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 longhorn fairy shrimp. The 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."

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	93.91	4.3	0.22	14.25
Total % Use Overlap = 100 ²		Total % Usage Overlap = 4.52 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information). A portion (approximately 29%) of the critical habitat designated for this species occurs outside of the species' range. However, additional review and analysis of the critical habitat areas occurring outside the species' range indicate the usage data from the species range is still a suitable data source for this analysis.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the longhorn fairy shrimp.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 93.91% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 4.52% of critical habitat annually, with usage on 4.3% of the critical habitat from mosquito control activities and usage on 0.22% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 29%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate that most of the critical habitat units found outside of the species' range are adjacent to the range

or in nearby areas where we would expect similar usage rates. We found that critical habitat units that were found further away from the species' range (i.e., in a different county) were within the range of a related species (the conservancy fairy shrimp). Thus, we determined that usage information for this species would likely provide a suitable approximation for our estimates for the longhorn fairy shrimp's critical habitat. We compared the usage rates expected to occur within the range of the conservancy fairy shrimp and confirmed that they are largely similar to usage rates within the range of the longhorn fairy shrimp. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the longhorn fairy shrimp.

Reference(s):

U. S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon: Evaluation of Economic Exclusions from 2003 Final Designation. Final Rule. Federal Register 70:46924-46999.

Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)

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

Physical and 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 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."

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
89.27	80.49	0.76	0.66	11.64
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.42 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the vernal pool fairy shrimp.

Malathion use sites overlap with 100% of the critical habitat, with 89.27% and 80.49% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.42% of critical habitat annually, with usage on 0.76% of the critical habitat from mosquito control activities and usage on 0.66% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the vernal pool fairy shrimp.

Reference(s):

U. S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon: Evaluation of Economic Exclusions from 2003 Final Designation. Final Rule. Federal Register 70:46924-46999.

San Diego Fairy Shrimp (*Branchinecta sandiegonensis*)

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

Physical and Biological Features:

- Vernal pools with shallow to medium depths (2 in (5 cm) to 12 in (30 cm)) that hold water for sufficient lengths of time (7 to 60 days) necessary for incubation, maturation, and reproduction of the San Diego fairy shrimp, in all but the driest years
- Topographic features characterized by mounds and swales and depressions within a matrix of surrounding uplands that result in complexes of continuously, or intermittently, flowing surface water in the swales connecting the pools described in PCE 1, providing for dispersal and promoting hydroperiods of adequate length in the pools (i.e., the vernal pool watershed)
- Flat to gently sloping topography, and any soil type with a clay component and/or an impermeable surface or subsurface layer known to support vernal pool habitat

(including Carlsbad, Chesterton, Diablo, Huerhuero, Linne, Olivenhain, Placentia, Redding, and Stockpen soils)

These PBFs focus on habitat structure such as pool depth, topographic features, and soil types. In the Final Rule (*see* Application of the ‘Adverse Modification’ Standard), “introduction of water, other liquids, or chemicals (including herbicides and pesticides” is listed as an action that “may affect critical habitat” and “would permanently alter the features of the vernal pool basin.” The Special Management Considerations and Protection section states “[o]nce a vernal pool complex has been protected from loss from habitat conversion or development, it is still necessary to ensure that the habitat is not degraded as a result of altered hydrology, contamination, nonnative species invasions, or other incompatible land uses.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.89	60.18	0	0.02	73.22
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.02 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the San Diego fairy shrimp.

Malathion use sites overlap with 100% of the critical habitat, with 99.89% and 60.18% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.02% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.02% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species’ critical habitat (73.22%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and

minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the San Diego fairy shrimp.

Reference(s):

USFWS. 2007. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the San Diego Fairy Shrimp (*Branchinecta sandiegonensis*). Final Rule. Federal Register 72:70648-70714.

Diminutive Amphipod (*Gammarus hyalleloides*)

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

Physical and 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	12.88	0	0.03	0
Total % Use Overlap = 12.88 ²		Total % Usage Overlap = 0.03 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the diminutive amphipod.

Malathion use sites overlap with 12.88% of the critical habitat, with 0% and 12.88% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.03% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.03% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the diminutive amphipod.

Reference(s):

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.

Pecos Amphipod (*Gammarus pecos*)

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

Physical and 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 Pecos amphipod is often found in beds of submerged aquatic plants and is considered an omnivore, feeding on algae, submergent vegetation, and decaying organic matter.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	6.48	0	0.15	0
Total % Use Overlap = 6.48 ²		Total % Usage Overlap = 0.15 ³		

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
--	---	--	---	--

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Pecos amphipod.

Malathion use sites overlap with 6.48% of the critical habitat, with 0% and 6.48% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.15% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.15% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Pecos amphipod.

Reference(s):

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.

Vernal Pool Tadpole Shrimp (*Lepidurus packardii*)

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

Physical and 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 sources. Detritus (both living and dead organic matter) is a primary food source for the conservancy fairy shrimp. The 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."

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
92.94	96.26	1.51	0.36	11.02
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.87 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the vernal pool tadpole shrimp.

Malathion use sites overlap with 100% of the critical habitat, with 92.94% and 96.26% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.87% of critical habitat annually, with usage on 1.51% of the critical habitat from mosquito control activities and usage on 0.36% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the vernal pool tadpole shrimp.

Reference(s):

U. S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants in California and Southern Oregon: Evaluation of Economic Exclusions from 2003 Final Designation. Final Rule. Federal Register 70:46924-46999.

Panama City Crayfish (*Procambarus econfinae*)

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

Physical and Biological Features:

- Undeveloped lands, including cropland, utilities rights-of-way, timberlands, or grazing lands, that support open wet pine flatwoods and wet prairie habitats that contain appropriate herbaceous groundcover vegetation; permanent or temporary pools of shallow (usually less

than 1 foot) freshwater locations; and gently sloped ground level swales with a 3:1 or shallower slope ratio along ecotonal or transitional areas.

- Soil types within undeveloped lands that provide sediment structure needed for burrow construction and that support some native herbaceous vegetation and the likelihood of native seed bank that with management will provide vegetation needed for additional food and cover, and where the ground water is always within 3 feet of the ground surface and surface waters occur on occasion (as specified in the proposed rule).
- Undeveloped lands that contain surface and groundwater of sufficient quality to support all life stages of the Panama City crayfish and the herbaceous vegetation on which they rely. This includes surface waters with oxygen levels, pH levels and temperatures within specific ranges (as specified in the proposed rule).

In the Proposed Rule (*see* Application of the “Destruction or Adverse Modification” Standard), activities that the FWS may find are likely to destroy or adversely modify critical habitat include “Actions that would significantly alter water quality parameters including... chemical composition. Such activities could include, but are not limited to, release of chemicals, excess nutrients, pesticides, and biological or other pollutants into the surface water or connected groundwater at a point source or by dispersed release (nonpoint source). These activities could alter water conditions to levels that are beyond the tolerances of the crayfish and result in direct or cumulative adverse effects to these individuals and their life cycles.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
95.55	15.08	0.02	2.33	0
Total % Use Overlap = 100 ²		Total % Usage = 2.35		

¹The species' critical habitat shapefile was unavailable at the time of analysis - both species range overlap and usage were used as surrogates for critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Panama City crayfish.

Malathion use sites overlap with 100% of the critical habitat, with 95.55% and 15.08% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.35% of critical habitat annually, with usage on 0.02% of the critical habitat from mosquito control activities and usage on 2.33% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will reduce environmental concentrations of malathion. Buffers, which are specified on the label as a distance from water bodies where pesticides are not to be applied, substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, when malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, provides time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion away from the application area. These conservation measures reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Panama City crayfish.

Reference(s):

U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Threatened Species Status, Section 4(d) rule, and designation of critical habitat for the Panama City crayfish. Proposed rule; reopening of comment period and announcement of public hearing. Federal Register 86:19838-19863.

Kauai Cave Amphipod (*Spelaeorchestia koloana*)

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

Physical and Biological Features:

- The presence of subterranean spaces from 5 mm to 25 cm (0.2 in to 10 in) at their narrowest point (collectively termed “mesocaverns”) and/or cave passages greater than 25 cm (>10 in)
- Dark and/or stagnant air zones that maintain relative humidity at saturation levels (≥100 percent)
- Roots from living, nontoxic plants such as, but not limited to, ohia (*Metrosideros polymorpha*), maiapilo (*Capparis sandwichiana*), and aalii (*Dodonea viscosa*)

The Kauai cave amphipod occurs in caves in the Koloa area on Kauai. The Kauai cave amphipod is a detritivore and has been observed feeding on the roots of *Pithecellobium dulce* (*Manila tamarind*) and *Ficus* sp. (fig), rotting roots, sticks, branches, and other plant material washed into, or otherwise carried into, the caves, as well as the fecal material of other arthropods. In large cave passages, most individuals are found in association with roots or rotting plant debris.

The final rule (*see* Effects of Critical Habitat Designation) also states that “[a]ctivities that may result in the destruction or adverse modification of critical habitat include those that alter the primary constituent elements to an extent that the value of critical habitat for the conservation of the ... Kauai cave amphipod is appreciably reduced. (We note that such activities also may jeopardize the continued existence of the species, *see* Appendix K). Activities that may adversely affect critical habitat for this species include, but are not limited to: (3) Appreciably decreasing habitat value or quality through ... activities that could potentially alter water quality or quantity to an extent that vegetation structure is affected, cave humidity levels are reduced, habitat is flooded, or toxic materials (e.g., pesticides, fuel, solvents, or other household or industrial chemicals) are transported into habitat, and activities that increase the risk of fire within or outside habitats above the cave; (4) Application of pesticides, herbicides, insecticides, fungicides, or other such chemicals within, above, or adjacent to known habitat, that may directly or indirectly affect troglobitic organisms.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Information regarding past use site overlap and usage of malathion in Hawaii is not available. However, we anticipate residential (developed and open space developed) and agricultural uses occur in and near designated critical habitat for this species. Prior survey data has indicated that 4.8% of agricultural crops were treated with insecticides every year, with malathion only being a subset of this use. Based on information collected for CONUS species, we estimate that 5% of developed and open space developed could undergo some level of treatment with malathion annually. At present, information indicates that malathion is not used as a mosquito control agent in Hawaii. Future use cannot be ruled out, but is not expected to increase significantly. Due to the high degree of uncertainty associated with this data, as discussed in the “*Approach to Usage Analysis*” section in the Opinion, we consider this quantitative usage data broadly and assess exposure from malathion usage qualitatively by considering the likelihood that critical habitat will occur in the areas where insecticide usage will take place. Usage is not expected to be over 5% on any given use site, and therefore usage is considered to be low across the critical habitat.

Critical Habitat Rationale for Conclusion:

The broad-scale use of this pesticide for all allowable uses within the ecosystem could reduce the conservation value of the critical habitat by affecting water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Due to the vulnerabilities of the species and its critical habitat, as well as known general agricultural practices in the area of critical habitat, a preliminary high concern level was indicated for affects to the critical habitat of the Kauai cave amphipod. As discussed below, while we anticipate impacts to the PBFs, we do

not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

General conservation measures that will be implemented for malathion are expected to substantially decrease the environmental concentrations of malathion entering critical habitat, reducing the risk to critical habitat PBFs. Aquatic habitat buffers, which specify a distance from waterbodies where malathion cannot be applied, is expected to change application patterns to reduce the amount of spray drift accumulating in the streams and creeks that feed into the cave systems the Kauai cave amphipod occupies. Similarly, rain restrictions, which prohibit the application of malathion within 48 hours of a forecasted rain event or when the soil is saturated, provides time for malathion to degrade before runoff events can occur, which reduces the concentration of malathion in waterbodies that feed the cave systems the species occupies.

Additionally, a species-specific conservation measure was developed to further mitigate agricultural malathion uses and protect the critical habitat of the Kauai cave amphipod. General agricultural buffer distances will be extended from 25 and 50 feet to 50 and 200 feet around cave openings and sinkholes for ground and aerial applications, respectively. AgDRIFT modeling results show that these extended buffer zones can reduce spray drift into off-target areas by up to 73% and 97% for aerial and ground applications, respectively. This measure would substantially reduce the amount of malathion entering critical habitat through spray drift, reducing the likelihood of impacts to the PBFs. Furthermore, in addition to a 48-hour rain restriction on malathion application, at least a 24-hour period between irrigation and malathion applications is required. These restrictions are expected to allow time for malathion degradation, and reduce runoff and seepage of malathion so it is less likely to enter cave systems in the critical habitat. . With these conservation measures in place, we expect the impacts to water quality and habitat function PBFs to be low.

Past usage data indicates malathion usage will be low in critical habitat. Thus, based on the anticipated low usage and the required general and species-specific conservation measures, we expect the likelihood of exposure and impacts to water quality and habitat function PBFs will be extremely limited. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to result in the destruction or adverse modification of critical habitat for the Kauai cave amphipod.

Reference(s):

U. S. Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Kauai Cave Wolf Spider and Kauai Cave Amphipod. Final Rule. Federal Register 68:17430-17470.

Riverside Fairy Shrimp (*Streptocephalus woottoni*)

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

Physical and Biological Features:

- Ephemeral wetland habitat consisting of vernal pools and ephemeral habitat that have wet and dry periods appropriate for the incubation, maturation, and reproduction of the Riverside fairy shrimp in all but the driest of years, such that the pools... [p]rovide the suitable water chemistry characteristics to support the Riverside fairy shrimp.
 - Physiochemical factors such as alkalinity, pH, temperature, dissolved solutes, dissolved oxygen, which can vary depending on the amount of recent precipitation, evaporation, or oxygen saturation
- Type and depth of soil and subsurface layers

This species requires vernal pool habitat to grow and reproduce. The Final Rule (*see* Special Management Considerations or Protection) identified “altered water quality or quantity ... due to ... the introduction of water, other liquids, or chemicals (including herbicides and pesticides) into the vernal pool basin” as one of the threats to the physical or biological features in areas designated as critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	50.21	0	0.08	0.07
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.08 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Riverside fairy shrimp.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 50.21% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.08% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.08% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Riverside fairy shrimp.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Riverside Fairy Shrimp. Final Rule. Federal Register 77:72069-72140.

Peck's Cave Amphipod (*Stygobromus* (= *Stygonectes*) *pecki*)

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

Physical and 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. The Final Rule (*see* Special Management Considerations and Protection) identifies “pesticides and herbicides associated with pathogenic organisms or invasive species” as one of the threats to water quantity and quality.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2	low concern
host fish	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	51.91	0	2.91	0
Total % Use Overlap = 51.91 ²		Total % Usage Overlap = 2.91 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Peck's cave amphipod.

Malathion use sites overlap with 51.91% of the critical habitat, with 0% and 51.91% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.91% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 2.91% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Peck's cave amphipod.

Reference(s):

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.

Big Creek crayfish (*Faxonius peruncus*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- Stream flow velocity generally between 0 and 1.1 feet per second (ft/ s) (0 and 0.35 meters per second (m/s))
- Stream depths generally between 0.2 and 1.6 ft (0.06 and 0.49 m) for the Big Creek crayfish,
- Water temperatures between 34 and 84 degrees Fahrenheit (°F) (1.1 and 28.9 degrees Celsius (°C))
- Adequately low stream embeddedness so that spaces under rocks and cavities in gravel remain available to the Big Creek crayfish
- Spaces under rocks or shallow burrows in gravel that provide refugia
- An available forage and prey base consisting of invertebrates, periphyton, and plant detritus
- Connectivity among occupied stream reaches of the Big Creek crayfish.
- Ratios or densities of nonnative species low enough to allow for maintaining the populations of the Big Creek crayfish

In the Proposed Rule (*see* Application of the “Destruction or Adverse Modification” Standard) activities that the FWS may find are likely to destroy or adversely modify critical habitat include “Pesticide use.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	3.73	0	0.45	27.6
Total % Use Overlap = 3.73 ³		Total % Usage Overlap = 0.45		

¹Critical habitat data was unavailable - species range use usage data used as a surrogate for critical habitat use and usage.

²Mosquito control use and usage may overlap with other usages.

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
--	---	--	---	--

²Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Big Creek crayfish.

Malathion use sites overlap with 3.73% of the critical habitat, with 0% and 3.73% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.45% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.45% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod prey and water quality PBFs. We do not anticipate that malathion will directly or indirectly alter PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Big Creek crayfish.

Reference(s):

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Big Creek Crayfish and St. Francis River Crayfish and Designations of Critical Habitat. Proposed Rule. Federal Register 85 FR 58192-58222.

St. Francis River crayfish (*Faxonius quadruncus*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- Stream flow velocity generally between 0 and 1.1 feet per second (ft/ s) (0 and 0.35 meters per second (m/s))
- Stream depths generally between 0.2 and 1.7 ft (0.06 and 0.52 m) for the St. Francis River crayfish
- Water temperatures between 34 and 84 degrees Fahrenheit (°F) (1.1 and 28.9 degrees Celsius (°C))
- Adequately low stream embeddedness so that spaces under rocks and cavities in gravel remain available to the Big Creek crayfish and St. Francis River crayfish
- Spaces under rocks or shallow burrows in gravel that provide refugia
- An available forage and prey base consisting of invertebrates, periphyton, and plant detritus
- Connectivity among occupied stream reaches of the St. Francis River crayfish.
- Ratios or densities of nonnative species low enough to allow for maintaining the populations of the St. Francis River crayfish

In the Proposed Rule (*see* Application of the “Destruction or Adverse Modification” Standard) activities that the FWS may find are likely to destroy or adversely modify critical habitat include “Pesticide use.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	3.73	0	0.45	31.5
Total % Use Overlap = 3.73 ³		Total % Usage Overlap = 0.45		

¹Critical habitat data was unavailable - species range use usage data used as a surrogate for critical habitat use and usage.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and arthropod prey, which are critical habitat PBFs essential for the conservation of the species. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the St. Francis River crayfish.

Malathion use sites overlap with 3.73% of the critical habitat, with 0% and 3.73% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.45% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.45% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod prey and water quality PBFs. We do not anticipate that malathion will directly or indirectly alter PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the St. Francis River crayfish.

Reference(s):

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Big Creek Crayfish and St. Francis River Crayfish and Designations of Critical Habitat. Proposed Rule. Federal Register 85 FR 58192-58222.

L. Fishes

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 10. Summary of Fish Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Acipenser oxyrinchus</i> (= <i>oxyrhynchus</i>) <i>desotoi</i>	Atlantic sturgeon (Gulf subspecies)	3	see below
<i>Acipenser transmontanus</i>	White Sturgeon (Kootenai River population)	2	no relevant PBFs
<i>Catostomus discobolus</i> <i>yarrowi</i>	Zuni bluehead Sucker	3	see below
<i>Catostomus santaanae</i>	Santa Ana sucker	3	see below
<i>Catostomus warnerensis</i>	Warner sucker	3	see below
<i>Chasmistes brevirostris</i>	Shortnose sucker	3	see below
<i>Chasmistes liorus</i>	June sucker	3	see below
<i>Chrosomus saylari</i>	Laurel dace	3	see below
<i>Crenichthys baileyi baileyi</i>	White River springfish	3	see below
<i>Crenichthys baileyi grandis</i>	Hiko White River springfish	3	see below
<i>Crenichthys nevadae</i>	Railroad Valley springfish	3	see below
<i>Crystallaria cincotta</i>	Diamond darter	3	see below
<i>Cyprinella formosa</i>	Beautiful shiner	3	see below
<i>Cyprinodon bovinus</i>	Leon Springs pupfish	1	see below
<i>Cyprinodon macularius</i>	Desert pupfish	3	≥95% Federal lands overlap
<i>Cyprinodon nevadensis mionectes</i>	Ash Meadows Amargosa pupfish	3	≥95% Federal lands overlap
<i>Deltistes luxatus</i>	Lost River sucker	3	see below
<i>Dionda diaboli</i>	Devils River minnow	3	see below
<i>Elassoma alabamiae</i>	Spring pygmy sunfish	3	see below
<i>Eremichthys acros</i>	Desert dace	3	≥95% Federal lands overlap
<i>Erimonax monachus</i>	Spotfin chub	1	see below
<i>Erimystax cahni</i>	Slender chub	1	see below
<i>Etheostoma boschungii</i>	Slackwater darter	1	see below
<i>Etheostoma chermocki</i>	Vermilion darter	3	see below
<i>Etheostoma fonticola</i>	Fountain darter	1	see below
<i>Etheostoma moorei</i>	Yellowcheek darter	3	see below
<i>Etheostoma nianguae</i>	Niangua darter	2	no relevant PBFs
<i>Etheostoma osburni</i>	Candy darter	3	see below
<i>Etheostoma phytophilum</i>	Rush darter	3	see below
<i>Etheostoma sellare</i>	Maryland darter	3	see below
<i>Etheostoma spilotum</i>	Kentucky arrow darter	3	no overlap
<i>Etheostoma susanae</i>	Cumberland darter	3	see below

Scientific Name	Common Name	Category	Rationale
<i>Etheostoma trisella</i>	Trispot darter	3	see below
<i>Eucyclogobius newberryi</i>	Tidewater goby	3	see below
<i>Gambusia georgei</i>	San Marcos gambusia	1	see below
<i>Gila bicolor ssp. snyderi</i>	Owens tui chub	3	see below
<i>Gila cypha</i>	Humpback chub	3	see below
<i>Gila ditaenia</i>	Sonora chub	3	≥95% Federal lands overlap
<i>Gila elegans</i>	Bonytail chub	3	≥95% Federal lands overlap
<i>Gila intermedia</i>	Gila chub	3	see below
<i>Gila purpurea</i>	Yaqui chub	3	see below
<i>Gila seminuda (=robusta)</i>	Virgin River chub	3	see below
<i>Hybognathus amarus</i>	Rio Grande silvery minnow	3	see below
<i>Hypomesus transpacificus</i>	Delta smelt	3	see below
<i>Ictalurus pricei</i>	Yaqui catfish	3	see below
<i>Lepidomeda albivallis</i>	White River spinedace	3	see below
<i>Lepidomeda mollispinis pratenis</i>	Big Spring spinedace	3	see below
<i>Lepidomeda vittata</i>	Little Colorado spinedace	3	see below
<i>Meda fulgida</i>	Spikedace	3	see below
<i>Menidia extensa</i>	Waccamaw silverside	3	see below
<i>Notropis buccula</i>	Smalleye Shiner	3	see below
<i>Notropis girardi</i>	Arkansas River shiner	3	see below
<i>Notropis mekistocholas</i>	Cape Fear shiner	1	see below
<i>Notropis oxyrhynchus</i>	Sharpnose Shiner	3	see below
<i>Notropis simus pecosensis</i>	Pecos bluntnose shiner	3	see below
<i>Notropis topeka=tristis</i>	Topeka shiner	3	see below
<i>Noturus baileyi</i>	Smoky madtom	3	≥95% Federal lands overlap
<i>Noturus crypticus</i>	Chucky madtom	3	see below
<i>Noturus flavipinnis</i>	Yellowfin madtom	1	see below
<i>Noturus furiosus</i>	Carolina madtom	3	no overlap
<i>Oncorhynchus aguabonita whitei</i>	Little Kern golden trout	1	≥95% Federal lands overlap
<i>Percina antesella</i>	Amber darter	3	see below
<i>Percina jenkinsi</i>	Conasauga logperch	3	see below
<i>Percina pantherina</i>	Leopard darter	1	see below
<i>Plagopterus argentissimus</i>	Woundfin	3	see below
<i>Ptychocheilus lucius</i>	Colorado pikeminnow (=squawfish)	3	see below
<i>Rhinichthys osculus nevadensis</i>	Ash Meadows speckled dace	3	≥95% Federal lands overlap
<i>Salmo salar</i>	Atlantic salmon (Gulf of Maine DPS)	3	see below
<i>Salvelinus confluentus</i>	Bull Trout	3	see below
<i>Scaphirhynchus suttkusi</i>	Alabama sturgeon	3	see below
<i>Speoplatyrhinus poulsoni</i>	Alabama cavefish	1	see below
<i>Tiaroga cobitis</i>	Loach minnow	3	see below
<i>Xyrauchen texanus</i>	Razorback sucker	3	see below
<i>Noturus munitus</i>	Frecklebelly madtom	3	see below

Atlantic Sturgeon (*Acipenser oxyrinchus* (=oxyrhynchus) *desotoi*) – Gulf Subspecies

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

Physical and Biological Features:

- Detritus, aquatic insects, worms, or mollusks (or a combination of these items), within riverine habitats for larval and juvenile life stages
- Amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, molluscs, or crustaceans (or a combination of these items) within estuarine and marine habitats and substrates for subadult and adult life stages
- Riverine spawning sites with substrates suitable for egg deposition and development, such as limestone outcrops and cut limestone banks, bedrock, large gravel or cobble beds, marl, soapstone, or hard clay
- Riverine aggregation areas sometimes located in holes below normal riverbed depths, believed necessary for minimizing energy expenditures during fresh water residency and possibly for osmoregulatory functions
- A flow regime (magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) necessary for normal behavior, growth, and survival of all life stages in the riverine environment
- Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics
- Sediment quality, including texture and other chemical characteristics
- Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (i.e., an unobstructed river or a dammed river that still allows for passage)

In the Final Rule (*see* Activities That May Destroy or Adversely Modify Gulf Sturgeon Critical Habitat), “release of chemicals, biological pollutants, or heated effluents into surface water or connected groundwater via point sources or dispersed non-point sources” was listed as an “[action] that would alter water quality within a designated critical habitat unit.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	X	snails, clams, and crustaceans	low concern
water quality	X	aquatic bins 2, 3, 4, 6 and 7	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
27.98	0.31	4.94	0.46	6.6
Total % Use Overlap = 28.29 ²		Total % Usage Overlap = 5.4 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information). A portion (approximately 21%) of the critical habitat designated for this species occurs outside of the species' range. However, additional review and analysis of the critical habitat areas occurring outside the species' range indicate the usage data from the species range is still a suitable data source for this analysis.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey, and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to arthropod prey and water quality, and a preliminary low level of concern for impacts to non-arthropod prey. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 28.29% of the critical habitat, with 27.98% and 0.31% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.4% of critical habitat annually, with usage on 4.94% of the critical habitat from mosquito control activities and usage on 0.46% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 21%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate that critical habitat areas found outside of the species' range are contiguous with and include sections of the same aquatic systems that are in the range. We confirmed that these areas of critical habitat are expected to have the same (or at least very similar) usage rates as areas within the species' range, as the applicable agricultural and mosquito adulticide usage data are State- and county-wide, respectively, and all critical habitat areas are within the same State and counties. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs across all of the species' critical habitat.

While there was initially high concern for water quality PBF due to the high level of expected usage, this species uses a variety of aquatic habitat types, most of which should mitigate exposure to malathion through dilution. We expect that impacts to the water quality PBF would be limited to only those habitats that are low flow, low volume, small, and localized bodies of water. While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides at high enough concentrations that would affect the value of the critical habitat for the conservation of the species. Additionally, conservation measures that are to be implemented would further decrease malathion concentrations in all aquatic habitats, further decreasing the risk to the PBF. Thus, we expect only low impacts to the water quality PBF.

Malathion use is expected to impact prey species availability, which can decrease the critical habitat's conservation value to the listed species. However, based on the information available, we do not anticipate malathion will affect all prey species uniformly. We anticipate that malathion would disproportionately impact arthropod and fish prey, particularly in low flow and low volume habitat areas. While this species is known to consume these high-risk prey items, it has a varied diet that includes several taxa that are not sensitive to malathion exposure. Thus, while malathion usage is expected to be high in critical habitat, we do not anticipate significant effects to food resources and impacts to arthropod and non-arthropod prey PBFs would be small.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion transport through spray drift and runoff from entering aquatic habitats, and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, water quality, and non-arthropod prey PBFs within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we expect the conservation measures will be sufficient to protect arthropod prey, non-arthropod prey and water quality PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Atlantic sturgeon (Gulf subspecies).

Reference(s):

U. S. Fish and Wildlife Service. 2003. Designation of Critical Habitat for the Gulf Sturgeon. Final Rule. Federal Register 68:13370-13495.

Zuni Bluehead Sucker (*Catostomus discobolus yarrowi*)

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

Physical and Biological Features:

- A riverine system with habitat that includes:
 - Dynamic flows that allow for periodic changes in channel morphology and adequate river functions, such as channel reshaping and delivery of coarse sediments
 - Stream courses with perennial flows or intermittent flows that serve as connective corridors between occupied or seasonally occupied habitat through which the subspecies may disperse when the habitat is wetted

- Stream mesohabitat types including runs, riffles, and pools with substrate ranging from gravel, cobble, and bedrock substrates with low or medium amounts of fine sediment and substrate embeddedness
- Streams with depths generally less than 2 m (3.3 ft) and with slow to swift flow velocities less than 0.35 m/sec (1.15 ft/sec)
- Clear, cool water with low turbidity and temperatures in the general range of 2.0 to 23.0 °C (35.6 to 73.4 °F)
- No harmful levels of pollutants
- Adequate riparian shading to reduce water temperatures when ambient temperatures are high and provide protective cover from predators
- Abundant aquatic insect food consisting of fine particulate organic material, filamentous algae, midge larvae, caddisfly larvae, mayfly larvae, flatworms, and small terrestrial insects
- Areas devoid of nonnative aquatic species (or areas that are maintained to keep nonnatives at an adequate level for Zuni bluehead sucker survival and reproduction)

The Final Rule states “release of chemicals, biological pollutants, or other substances into the surface water or connected groundwater at a point source or by dispersed release (nonpoint source)” is an action that “can affect water chemistry and the prey base of the Zuni bluehead sucker.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.84	1.22	3.35	0.07	94.68
Total % Use Overlap = 100 ²		Total % Usage Overlap = 3.42 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Zuni bluehead Sucker.

Malathion use sites overlap with 100% of the critical habitat, with 99.84% and 1.22% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.42% of critical habitat annually, with usage on 3.35% of the critical habitat from mosquito control activities and usage on 0.07% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (94.68%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Zuni bluehead Sucker.

Reference(s):

U. S. Fish and Wildlife Service. 2016. Designation of Critical Habitat for the Zuni Bluehead Sucker. Final Rule. Federal Register 81:36762-36785.

Santa Ana Sucker (*Catostomus santaanae*)

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

Physical and Biological Features:

- A functioning hydrological system that experiences peaks and ebbs in the water volume (either naturally or regulated) that encompasses areas that provide or contain sources of water and coarse sediment in the riverine environment
- Stream channel substrate consisting of a mosaic of loose sand, gravel, cobble, and boulder substrates in a series of riffles, runs, pools, and shallow sandy stream margins necessary to maintain various life stages of the species, including adults, juveniles, larvae, and eggs, in the riverine environment
- Water depths greater than 1.2 in (3 cm) and bottom water velocities greater than 0.01 ft per second (0.03 m per second)
- Clear or only occasionally turbid water
- Water temperatures less than 86 °F (30 °C)
- Instream habitat that includes food sources (such as zooplankton, phytoplankton, and aquatic invertebrates), and associated vegetation such as aquatic emergent vegetation and adjacent riparian vegetation to provide:
 - Shading to reduce water temperature when ambient temperatures are high
 - Shelter during periods of high water velocity
 - Protective cover from predators
- Areas within perennial stream courses that may be periodically dewatered, but that serve as connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted

Suckers (Family Catostomidae) are primarily bottom feeders, sucking up algae, small invertebrates, and organic detritus from gravel, cobble, rock, and other hard surfaces.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.61	51.37	0	0.37	17.7
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.37 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Santa Ana sucker.

Malathion use sites overlap with 100% of the critical habitat, with 99.61% and 51.37% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.37% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.37% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Santa Ana sucker.

Reference(s):

U. S. Fish and Wildlife Service. 2010. Revised Critical Habitat for Santa Ana Sucker. Final Rule. Federal Register 75:77962-78027.

Warner Sucker (*Catostomus warnerensis*)

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

Physical and Biological Features:

- Streams 15 feet (4.5 m) to 60 feet (18 m) wide with gravel-bottom shoal and riffle areas with intervening pools and a stable riparian zone
- Clean, unpolluted flowing water
- Variety of aquatic insects, crustaceans, and other small invertebrates

In the Final Rule (*see* Critical Habitat section), “application of herbicide or insecticide along stream courses or lakes inhabited by the Warner sucker” is listed as an activity that may adversely modify critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	9.45	0	0	38.66
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Warner sucker.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 9.45% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of

malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Warner sucker.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Determination that the Warner Sucker is a Threatened Species and Designation of Its Critical Habitat. Final Rule. Federal Register 50:39117-39123.

Shortnose Sucker (*Chasmistes brevirostris*)

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

Physical and Biological Features:

- Areas with sufficient water quantity and depth within lakes, reservoirs, streams, marshes, springs, groundwater sources, and refugia habitats with minimal physical, biological, or chemical impediments to connectivity.
 - Shallow water (up to 3.28 ft (1.0 m)) for the larval stage
 - Deeper water (up to 14.8 ft (4.5 m)) for older life stages
 - Water quality characteristics, including water temperatures of less than 28.0 °Celsius (82.4 °F), pH less than 9.75, dissolved oxygen levels greater than 4.0 mg per L, low levels of microcystin, and un-ionized ammonia (less than 0.5 mg per L)
- Natural flow regimes that provide flows during the appropriate time of year or, if flows are controlled, minimal flow departure from a natural hydrograph
- Streams and shoreline springs with gravel and cobble substrate at depths typically less than 4.3 ft (1.3 m) with adequate stream velocity to allow spawning to occur.
- Areas containing emergent vegetation adjacent to open water for rearing, growth, and survival
- Abundant forage, including chironomidae, crustacea, and other aquatic macroinvertebrates

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
51.68	27.22	0	0	33.05
Total % Use Overlap = 78.9 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the shortnose sucker.

Malathion use sites overlap with 78.9% of the critical habitat, with 51.68% and 27.22% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the shortnose sucker.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Lost River Sucker and Shortnose Sucker. Final Rule. Federal Register 77:43796-43799.

June Sucker (*Chasmistes liorus*)

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

Physical and Biological Features:

- 1 ft (0.3 m) to 3 ft (1 m) of high quality water constantly flowing over a clean, unsilted gravel substrate
- For larval June suckers, shallow areas with low velocities connected to the main channel of the river

Critical habitat includes the lower section of the Provo River in Utah County, Utah.

Activities (public or private) identified in the final rule designating critical habitat that may adversely modify such habitat or may be affected by such designation include, “Any activities such as habitat alteration or increased water use from Utah Lake and the Provo River could be detrimental to the species and would need to be examined on a case-by-case basis.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bin 2,3,5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	8.15	0	1.2	0
Total % Use Overlap = 8.15 ²		Total % Usage Overlap = 1.2 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to water quality. As discussed below, while we

anticipate impacts to this PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 8.15% of the critical habitat, with 0% and 8.15% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.2% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.2% of the critical habitat from non-mosquito control activities.

This species uses a variety of aquatic habitat types, which we anticipate would partially mitigate exposure to malathion. We expect that impacts to the water quality PBF would be limited to only those that are low flow, low volume, small, and localized bodies of water. While this species does occupy these high-risk aquatic habitats, they also use larger volume, faster flowing areas, which do not accumulate pesticides at high enough concentrations to appreciably affect the water quality PBF or value of the critical habitat for the conservation of the species in these areas. Conservation measures, described below, are anticipated to further reduce environmental concentrations of malathion in critical habitat, decreasing the risk to the water quality PBF across all aquatic habitat types.

General conservation measures that are to be implemented, such as aquatic habitat buffers, rain restrictions and changes to residential use labels, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. This measure is expected to benefit all aquatic habitats, including low flow and low volume habitats that are at higher risk due to less natural capacity for dilution. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will directly or indirectly alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the June sucker.

Reference(s):

U. S. Fish and Wildlife Service. 1986. Final Rule Determining the June Sucker (*Chasmistes liorus*) to be an Endangered Species with Critical Habitat. Final Rule. Federal Register 51:10851-10857.

U. S. Fish and Wildlife Service. 2019. Endangered and Threatened Wildlife and Plants; Reclassification of the Endangered June Sucker to Threatened With a Section 4(d) Rule. Federal Register 84:65080-65098.

Laurel Dace (*Chrosomus saylari*)

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

Physical and Biological Features:

- Pool and run habitats of geomorphically stable, first- to second-order streams with riparian vegetation
- Cool, clean, flowing water with shallow depths
- Connectivity between spawning, foraging, and resting sites to promote gene flow throughout the species' range
- Stable bottom substrates composed of relatively silt-free gravel, cobble, and slab-rock boulder substrates with undercut banks and canopy cover
- 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, caddisfly larvae, and stonefly larvae

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	22.33	0	0.79	0
Total % Use Overlap = 22.33 ²		Total % Usage Overlap = 0.79 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the laurel dace.

Malathion use sites overlap with 22.33% of the critical habitat, with 0% and 22.33% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.79% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.79% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented, such as aquatic habitat buffers, rain restrictions and changes to residential use labels are expected to substantially reduce environmental concentrations of malathion within critical habitat. Aquatic habitat buffers, which specify a distance from waterbodies where malathion cannot be applied, are expected to change application patterns to reduce the amount of spray and spray drift that deposits in waterbodies, reducing the environmental concentration of malathion within critical habitat. AgDRIFT modeling results indicate that buffers ranging from 25 to 100 feet can reduce spray drift deposition in off-target sites by 40 to 90%. This measure is expected to substantially reduce the concentration of malathion entering critical habitat. Rain restrictions, which prohibit malathion application within 24 or 48 hours within a forecasted rain event for residential or agricultural uses, respectively, are expected to provide sufficient time for malathion to degrade before runoff events can occur. This restriction would decrease the amount of malathion found in runoff, thus decreasing the environmental concentrations in critical habitat. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. These measures would substantially reduce negative impacts to critical habitat PBFs.

While mosquito control is not expected to be a malathion use in critical habitat, it was found to be of concern in the species range. A species-specific measure was developed that applies across the species range, which includes critical habitat for the laurel dace. Where feasible, applicators will not apply malathion as a mosquito adulticide near vulnerable habitats (i.e., low flow or low volume aquatic habitats) within the range of the species (including critical habitat). If avoidance is not feasible or impairs the ability for mosquito control districts or agencies to protect public health, applicators are to reach out to the local FWS field offices to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. Discussions at the local level allow for flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors such as PBFs of the critical habitat. Applicators subject to this conservation measures will be required to retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented.

With the general and species-specific conservation measures in mind, we do not anticipate major impacts to the arthropod prey or water quality PBFs. As anticipated malathion usage on use sites that overlap with the critical habitat is low, and conservation measures are expected to further

reduce effects to the PBFs, we do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the laurel dace.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace. Final Rule. Federal Register 77:63604-63668.

White River Springfish (*Crenichthys baileyi baileyi*)

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

Physical and Biological Features:

- Warm-water springs and their outflows and surrounding land areas that provide vegetation for cover and habitat for insects and other invertebrates on which the species feeds.

The Final Rule states “[t]he most critical elements to survival of the springfishes are the consistent quality and quantity of springflows.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	4.15	0	0.02	4.38
Total % Use Overlap = 4.15 ²		Total % Usage Overlap = 0.02 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below,

while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the White River springfish.

Malathion use sites overlap with 4.15% of the critical habitat, with 0% and 4.15% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.02% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.02% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the White River springfish.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Final Rule to Determine Endangered status and Critical Habitat for the White River Springfish and the Hiko White River Springfish. Final Rule. Federal Register 50:39123-39128.

Hiko White River Springfish (*Crenichthys baileyi grandis*)

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

Physical and Biological Features:

- Warm-water springs and their outflows and surrounding land areas that provide vegetation for cover and habitat for insects and other invertebrates on which the species feeds.

The Final Rule states “[t]he most critical elements to survival of the springfishes are the consistent quality and quantity of springflows.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	3.71	0	0.08	0
Total % Use Overlap = 3.71 ²		Total % Usage Overlap = 0.08 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Hiko White River springfish.

Malathion use sites overlap with 3.71% of the critical habitat, with 0% and 3.71% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.08% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.08% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a

whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the Hiko White River springfish.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Final Rule to Determine Endangered status and Critical Habitat for the White River Springfish and the Hiko White River Springfish. Final Rule. Federal Register 50:39123-39128.

Railroad Valley Springfish (*Crenichthys nevadae*)

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

Physical and Biological Features:

- Clear, unpolluted thermal spring waters ranging in temperature from 29° to 36°C in pools
- Flowing channels
- Marshy areas with aquatic plants
- Insects and mollusks

In the Critical Habitat section of the Final Rule, “release of chemical or biological pollutants into the waters as a point source or by dispersed release” is listed as an “activity which would significantly alter the water chemistry” and “could adversely impact the critical habitat.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	crustaceans	low concern
water quality	X	aquatic bins 2, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	2.2	0	0.02	90.51
Total % Use Overlap = 2.2 ²		Total % Usage Overlap = 0.02 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Railroad Valley springfish.

Malathion use sites overlap with 2.2% of the critical habitat, with 0% and 2.2% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.02% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.02% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (90.51%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use and usage may be low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, non-arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality, arthropod prey and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Railroad Valley springfish.

Reference(s):

U. S. Fish and Wildlife Service. 1986. Determination of Threatened Status and Critical Habitat for the Railroad Valley Springfish. Final Rule. Federal Register 51:10857-10865.

Diamond Darter (*Crystallaria cincotta*)

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

Physical and Biological Features:

- A series of connected riffle-pool complexes with medium velocities in medium- to large-sized, geomorphically stable streams
- Stable, undisturbed sand and gravel stream substrates that are relatively free of and not embedded with silts and clays
- Instream flow regime (magnitude, frequency, duration, and seasonality of discharge over time) that is relatively unimpeded by impoundment or diversions such that there is minimal departure from a natural hydrograph
- Adequate water quality characterized by seasonally medium temperatures, high dissolved oxygen levels, and medium pH, and low levels of pollutants and siltation
- Other fish larvae and benthic invertebrates including midge, caddisfly, and mayfly larvae

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
22.92	37.79	0	0.26	8.33
Total % Use Overlap = 60.71 ²		Total % Usage Overlap = 0.26 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information). A portion (approximately 77% or more) of the critical habitat designated for this species occurs outside of the species' range. However, additional review and analysis of the critical habitat areas occurring outside the species' range indicate the usage data from the species range is still a suitable data source for this analysis.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the diamond darter.

Although the species range is limited to areas within West Virginia, critical habitat for the species occurs in areas within two States – West Virginia (within the species range) and Kentucky. Our analysis indicated that the largest portion (approximately 77%) of the species' critical habitat is located far outside of the species' range in the Green River watershed in

Kentucky. Malathion use sites overlap with 60.71% of the critical habitat (both units of the critical habitat), with 22.92% and 37.79% overlapping with mosquito control and non-mosquito control use sites, respectively. As described in the Opinion, we employed the usage information for the species range to serve as an approximation for the portion of the critical habitat in West Virginia, based on the expected uses within the critical habitat in that State. We used GIS analyses to confirm that similar uses were expected within the species' critical habitat in Kentucky. We then compared usage data for Kentucky and West Virginia to determine anticipated usage across the entirety of the critical habitat of the species. Based on the available usage data, we do not expect mosquito adulticide usage will occur within the critical habitat areas, and other usage will occur on 0.26% of critical habitat in West Virginia annually, with very similar usage estimated for Kentucky.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures will further reduce those effects to the water quality and arthropod prey PBFs. Additionally, the critical habitat unit in Kentucky has been designated by the state of Kentucky as an Outstanding State Resource Water (OSRW) and has water quality criteria specific to malathion, which sets allowable concentration limits within the river at a level that will likely reduce effects to affect arthropod prey or water quality PBFs for this. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the diamond darter.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Designation of Critical Habitat for the Diamond Darter (*Crystallaria cincotta*). Final Rule. Federal Register 78:52364-52387.

Beautiful Shiner (*Cyprinella formosa*)

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

Physical and Biological Features:

- Small permanent streams with riffles or intermittent creeks with pools and riffles
 - Clean, unpolluted water
 - Free of introduced exotic fishes

- Backwater areas of stream and springs with overgrown cut banks and accumulation of detritus (feeding, sheltering)

In the Final Rule (*see* Critical Habitat section), “release of chemical or biological pollutants into surface or underground waters at a point source or by dispersal release” is listed as an “activity which would significantly alter the water chemistry” and “could adversely impact the critical habitat.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0.01	0.39	0	0.25	44.72
Total % Use Overlap = 0.4 ²		Total % Usage Overlap = 0.25 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the beautiful shiner.

Malathion use sites overlap with 0.4% of the critical habitat, with 0.01% and 0.39% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.25% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.25% of the critical habitat from non-mosquito control activities.

While past usage data suggests that very little malathion has been used within critical habitat recently, general conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will reduce environmental concentrations resulting from any potential future use of malathion. Buffers, which specify on the label a distance from water

bodies where pesticides are not to be applied, are expected to reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the beautiful shiner.

Reference(s):

U. S. Fish and Wildlife Service. 1984. Final Rule to Determine the Yaqui Chub to be an Endangered Species with Critical Habitat, and To Determine the Beautiful Shiner and Yaqui Catfish to be Threatened Species with Critical Habitat. Final Rule. Federal Register 49:34490-34497.

Leon Springs pupfish (*Cyprinodon bovinus*)

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 primarily forages on diatoms, marl, algae, aquatic insects, amphipods, and gastropods. Therefore, we have identified arthropods and non-arthropod prey as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	snails and crustaceans	low concern
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	3.81	0	0.27	0

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
Total % Use Overlap = 3.81 ²		Total % Usage Overlap = 0.27 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Leon Springs pupfish.

Malathion use sites overlap with 3.81% of the critical habitat, with 0% and 3.81% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.27% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.27% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod and non-arthropod prey PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Leon Springs pupfish.

Reference(s):

- U.S. Fish and Wildlife Service. 2019. Supplemental Finding for the Leon Springs pupfish (*Cyprinodon bovinus*) Recovery Plan. Southwest Region, Albuquerque, New Mexico. 4 pp.
- U.S. Fish and Wildlife Service. 2013. Leon Springs pupfish (*Cyprinodon bovinus*) 5-Year Review: Summary and Evaluation. Austin Ecological Services Field Office, Texas. 29 pp.

U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Listing of Leon Springs Pupfish as Endangered with Critical Habitat. Federal Register 45:54678-54681.

Lost River Sucker (*Deltistes luxatus*)

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

Physical and Biological Features:

- Areas with sufficient water quantity and depth within lakes, reservoirs, streams, marshes, springs, groundwater sources, and refugia habitats with minimal physical, biological, or chemical impediments to connectivity.
 - Shallow water (up to 3.28 ft (1.0 m)) for the larval stage
 - Deeper water (up to 14.8 ft (4.5 m)) for older life stages
 - Water quality characteristics, including water temperatures of less than 28.0 °Celsius (82.4 °F), pH less than 9.75, dissolved oxygen levels greater than 4.0 mg per L, low levels of microcystin, and un-ionized ammonia (less than 0.5 mg per L)
- Natural flow regimes that provide flows during the appropriate time of year or, if flows are controlled, minimal flow departure from a natural hydrograph
- Streams and shoreline springs with gravel and cobble substrate at depths typically less than 4.3 ft (1.3 m) with adequate stream velocity to allow spawning to occur.
- Areas containing emergent vegetation adjacent to open water for rearing, growth, and survival
- Abundant forage, including chironomidae, crustacea, and other aquatic macroinvertebrates

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
34.24	27.61	0	0.01	52.82
Total % Use Overlap = 61.85 ²		Total % Usage Overlap = 0.01 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
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¹Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Lost River sucker.

Malathion use sites overlap with 61.85% of the critical habitat, with 34.24% and 27.61% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.01% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.01% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (52.82%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Lost River sucker.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Lost River Sucker and Shortnose Sucker. Final Rule. Federal Register 77:43796-43799.

Devils River Minnow (*Dionda diaboli*)

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

Physical and Biological Features:

- Streams characterized by:
 - Areas with slow to medium water velocities between 10 and 40 cm/second (4 and 16 in/second) in shallow to medium water depths between approximately 10 cm (4 in) and 1.5 m (4.9 ft)
 - Near vegetative structure, such as emergent or submerged vegetation or stream bank riparian vegetation that overhangs into the water column
 - Gravel and cobble substrates ranging in diameter between 2 and 10 cm (0.8 and 4 in) with low or medium amounts of fine sediment (less than 65 percent stream bottom coverage) and low or medium amounts of substrate embeddedness
 - Pool, riffle, run, and backwater components free of artificial instream structures that would prevent movement of fish upstream or downstream
- High-quality water provided by permanent, natural flows from groundwater springs and seeps characterized by:
 - Temperature ranging between 17 °C and 29 °C (63 °F and 84 °F)
 - Dissolved oxygen levels greater than 5.0 mg/l
 - Neutral pH ranging between 7.0 and 8.2
 - Conductivity less than 0.7 mS/cm and salinity less than 1 ppt
 - Ammonia levels less than 0.4 mg/ l
 - No or minimal pollutant levels for copper, arsenic, mercury, and cadmium; human and animal waste products; pesticides; fertilizers; suspended sediments; and petroleum compounds and gasoline or diesel fuels
- Abundant algae and other microorganisms associated with stream substrates
- Aquatic stream habitat either devoid of nonnative aquatic species (including fish, plants, and invertebrates) or in which such nonnative aquatic species are at levels that allow for healthy populations of Devils River minnows
- Areas within stream courses that may be periodically dewatered for short time periods, during seasonal droughts, but otherwise serve as connective corridors between occupied or seasonally occupied areas through which the species moves when the area is wetted

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
34.5	8.46	0.99	0.18	0
Total % Use Overlap = 42.96 ²		Total % Usage Overlap = 1.17 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Devils River minnow.

Malathion use sites overlap with 42.96% of the critical habitat, with 34.5% and 8.46% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.17% of critical habitat annually, with usage on 0.99% of the critical habitat from mosquito control activities and usage on 0.18% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Devils River minnow.

Reference(s):

U. S. Fish and Wildlife Service. 2008. Designation of Critical Habitat for the Devils River Minnow. Final Rule. Federal Register 73:46988-47026.

Spring Pygmy Sunfish (*Elassoma alabamae*)

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

Physical and 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.

The large majority of occupied habitat for this species remains on privately owned lands enrolled under three Candidate Conservation Agreements with Assurances (CCAAs). We determined that the benefits of excluding areas covered by these CCAA outweighed the benefits of including them in the critical habitat designation, thus the designated critical habitat does not include these areas. The total area designated as critical habitat is 538 ha (1,330 ac). Critical habitat in Unit 1, Subunit A is a small, narrow strip of wetlands in an area of 7.2 ha (17.9 ac) that has been acquired for protection of the species by the Land Trust of North Alabama. Site restrictions on this site include no use of pesticides or herbicides.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	X	snails and crustaceans	low concern
water quality	X	aquatic bins 2, 5 and 6	high concern
host fish	--	--	--
habitat function	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
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¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	0	9.25	0	17.98
Total % Use Overlap = 100 ²		Total % Usage Overlap = 9.25 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to arthropod prey and water quality, and a preliminary low level of concern for impacts to non-arthropod prey. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 9.25% of critical habitat annually, with usage on 9.25% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

There is high concern for water quality PBF due to the high level of expected usage. In particular, we anticipate that without the conservation measures described below, low flow, low volume, small, and localized bodies of water would exhibit high enough concentrations of malathion to affect the water quality PBF to a degree that would decrease the conservation value of the critical habitat for the listed species. However, conservation measures that are to be implemented would sufficiently reduce environmental concentrations of malathion in these vulnerable habitats to a level that would induce only low levels of effects in the critical habitat.

While we do not expect usage within critical habitat for uses other than mosquito control, general conservation measures, such as aquatic habitat buffers, rain restrictions and changes to residential use labels are expected to reduce the likelihood of contaminantion for any potential new uses occurring on or near critical habitat. Aquatic habitat buffers, which specify on the label an distance from waterbodies where malathion cannot be applied, is expected to alter application patterns to provide space between application areas and aquatic habitats, and areas for spray drift to dissipate before reaching aquatic habitats. AgDRIFT modeling results indicate that buffers from 25 to 100 feet can reduce spray drift deposition in off-target sites by up to 90%, depending on environmental conditions and the application method. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of

a forecasted rain event, are expected to provide sufficient time for malathion to degrade before runoff events can occur. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. These general conservation measures are expected to reduce the likelihood of contamination resulting from any potential new agricultural or residential uses that might occur in or near the critical habitat in the future.

Additionally, a species specific measure has been developed to protect critical habitat from mosquito adulticide use. Where feasible, applicators will not apply malathion as a mosquito adulticide on critical habitat. If avoidance is not feasible or impairs the ability for mosquito control districts or agencies to protect public health, applicators are to reach out to the local FWS field offices to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. Discussions at the local level allow for flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors such as PBFs of the critical habitat. Applicators subject to this conservation measures will be required to retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we expect the conservation measures will be sufficient to protect the arthropod prey, non-arthropod prey and water quality PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the spring pygmy sunfish.

Reference(s):

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.

Manson, M. 2020. Partnership Preserves 700 Acres for Habitat Protection. Alabama Land Trust Website: <https://www.landtrustnal.org/2020/06/22/beaverdam-swamp-protected>. Accessed on 1/25/2020

Spotfin chub (*Erimonax monachus*)

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 feeds on insects, including immature midges, blackfly larvae, caddisflies, and other insects. Therefore, we have identified arthropods as a relevant PBF.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	27.84	0	0.4	28.56
Total % Use Overlap = 27.84 ²		Total % Usage Overlap = 0.4 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the spotfin chub.

Malathion use sites overlap with 27.84% of the critical habitat, with 0% and 27.84% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.4% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.4% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod prey PBF. We do not anticipate that malathion will directly or indirectly alter arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a

whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the spotfin chub.

Reference(s):

U.S. Fish and Wildlife Service. 2019. Spotfin Chub (*Erimonax monachus*) 5-Year Review: Summary and Evaluation. North Carolina Field Office, Asheville. 41 pp.

U.S. Fish and Wildlife Service. 1983. Recovery Plan Spotfin Chub (*Hybopsis monachus*). Atlanta, Georgia. 60 pp.

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

Slender Chub (*Erimystax cahni*)

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 primarily forages on benthic insects and mollusks. Therefore, we have identified arthropods and non-arthropod prey as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	snails and clams	low concern
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	31.32	0	0.53	2.86
Total % Use Overlap = 31.32 ²		Total % Usage Overlap = 0.53 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod and non-arthropod, which are critical habitat PBFs essential for the conservation of the species. As discussed below, while we

anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the slender chub.

Malathion use sites overlap with 31.32% of the critical habitat, with 0% and 31.32% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.53% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.53% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and non-arthropod prey PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the slender chub.

Reference(s):

U.S. Fish and Wildlife Service. 2021. Slender Chub (*Erimystax (=Hybopsis) cahni*) 5-Year Review: Summary and Evaluation. Tennessee Ecological Services Field Office, Cookeville. 11 pp.

U.S. Fish and Wildlife Service. 2014. Slender Chub (*Erimystax (=Hybopsis) cahni*) 5-Year Review: Summary and Evaluation. Tennessee Ecological Services Field Office, Cookeville. 22 pp.

U.S. Fish and Wildlife Service. 1983. Recovery Plan Slender Chub (*Hybopsis cahni*). Atlanta, Georgia. 36 pp.

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

Slackwater Darter (*Etheostoma boschungii*)

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 primarily forages on crustaceans and insects. Pesticides are known to degrade surfacewater and ground water and are listed as threats to the species. Therefore, we have identified arthropods, non-arthropod prey, and water quality as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	crustaceans	low concern
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	43.45	0	1.35	0.83
Total % Use Overlap = 43.45 ²		Total % Usage Overlap = 1.35 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the slackwater darter.

Malathion use sites overlap with 43.45% of the critical habitat, with 0% and 43.45% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.35% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.35% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted

rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, non-arthropod prey, and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality, arthropod prey and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the slackwater darter.

Reference(s):

U.S. Fish and Wildlife Service. 2008. Slackwater Darter (*Etheostoma boschungii*) 5-Year Review: Summary and Evaluation. Mississippi Ecological Services Office, Jackson. 25 pp.

U.S. Fish and Wildlife Service. 1984. Slackwater Darter Recovery Plan. Atlanta, Georgia. 60 pp.

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

Vermilion Darter (*Etheostoma chermockii*)

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

Physical and Biological Features:

- Geomorphically stable stream bottoms and banks to maintain bottom features (riffles, runs, and pools) and transition zones between bottom features to promote connectivity and maintain gene flow
- Instream flow regime with an average daily discharge over 50 cubic feet per second, including surface runoff and groundwater sources (springs and seepages)
- Water quality with temperature not exceeding 26.7 °C (80 °F), dissolved oxygen 6.0 milligrams or greater per liter, turbidity of an average monthly reading of 10 NTUs and 15mg/l TSS or less; and a specific conductance of no greater than 225 micro Siemens per centimeter at 26.7 °C (80 °F)
- Stable bottom substrates consisting of fine gravel with coarse gravel or cobble, or bedrock with sand and gravel, with low amounts of fine sand and sediments within the interstitial spaces of the substrates along with adequate aquatic vegetation

These PBFs focus on habitat structural features, general water characteristics, and stream substrate composition. In the Final Rule (*see* Distribution and Habitat), “degradation of water quality and substrate components due to sedimentation and other pollutants” is listed as a primary threat to the vermilion darter and its habitat. Pesticides are specifically listed as pollutants in the same section. The Final Rule (*see* Water Quality section) also states that

“[h]armful levels of pollutants impair critical behavior functions in fish and are reflected in population-level responses (reduced population size, biomass, year class success, etc.)”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	33.31	0	0.92	0
Total % Use Overlap = 33.31 ²		Total % Usage Overlap = 0.92 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the vermilion darter.

Malathion use sites overlap with 33.31% of the critical habitat, with 0% and 33.31% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.92% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.92% of the critical habitat from non-mosquito control activities.

General conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, are expected to substantially reduce the environmental concentrations of malathion occurring in critical habitat from agricultural and residential sources. Aquatic habitat buffers, which specify on the label a distance from waterbodies where malathion cannot be applied, are expected to change malathion application patterns to reduce the amount of malathion from applications and associated spray drift that deposits in adjacent waterbodies, decreasing the amount of malathion entering aquatic habitat. Rain restrictions, which prohibit malathion application within 24 or 48 hours within a forecasted rain event for residential and agricultural uses, respectively, or when soil is saturated, is expected to provide time for malathion to degrade before runoff events can occur. This measure is expected to reduce the concentration of malathion entering aquatic habitats within critical habitat from runoff. Changes to residential

uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. The implementation of these general conservation measures is expected to substantially reduce the potential impact of malathion on critical habitat PBFs from non-mosquito adulticide uses.

Additionally, a species-specific conservation measure was developed to protect the species from mosquito adulticide use. While mosquito control is not expected to be a malathion use in critical habitat, it was found to be of concern in the species range. A species-specific measure is in place that applies across the species range, which includes critical habitat for the vermilion darter. Where feasible, applicators will not apply malathion as a mosquito adulticide near vulnerable habitats (i.e., low flow or low volume aquatic habitats) within the range of the species (including critical habitat). If avoidance is not feasible or impairs the ability for mosquito control districts or agencies to protect public health, applicators are to reach out to the local FWS field offices to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. Discussions at the local level allow for flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors such as PBFs of the critical habitat. Applicators subject to this conservation measures will be required to retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented.

With these general and species-specific conservation measures in place, we do not anticipate major impacts to water quality. As anticipated malathion usage on use sites that overlap with the critical habitat is low, and conservation measures further reduce the likelihood of exposure of aquatic habitats, we do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the vermilion darter.

Reference(s):

U. S. Fish and Wildlife Service. 2010. Designation of Critical Habitat for the Vermilion Darter. Final Rule. Federal Register 75:75913-75931.

Fountain Darter (*Etheostoma fonticola*)

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 is known to eat Copepoda, Cladocera, Amphipoda, Diptera, Ephemeroptera, and Ostracoda. A primary threat to fountain darters is degradation of water quality, specifically from pesticides and non-point pollutants. Therefore, we have identified arthropods, non-arthropod prey, and water quality as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	crustaceans	low concern
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	30.86	0	3.99	0
Total % Use Overlap = 30.86 ²		Total % Usage Overlap = 3.99 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the fountain darter.

Malathion use sites overlap with 30.86% of the critical habitat, with 0% and 30.86% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.99% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 3.99% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, non-arthropod prey, and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality, arthropod prey and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the

critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the fountain darter.

Reference(s):

U.S. Fish and Wildlife Service. 2021. Fountain Darter (*Etheostoma fonticola*) 5-Year Review: Summary and Evaluation. Austin Ecological Services Field Office. Texas. 47 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan Amendmends for Elevent Southwest Species. Southwest Region, Albuquerque, New Mexico. 19 pp.

U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Listing of the San Marcos Salamander as Threatened, the San Marcos Gambusia as Endangered, and the Listing of Critical Habitat for Texas Wild Rice, San Marcos Salamander, San Marcos Gambusia, and Fountain Darter. Federal Register 45:47355-47364.

Yellowcheek Darter (*Etheostoma moorei*)

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

Physical and Biological Features:

- Geomorphically stable, second- to fifth order streams with riffle habitats, and connectivity between spawning, foraging, and resting sites to promote gene flow within the species' range
- Stable bottom substrates composed of relatively silt-free medium to strong velocity riffles with gravel, cobble, and boulder substrates
- 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 blackfly larvae, stonefly larvae, mayfly nymphs, and caddisfly larvae

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	15.88	0	0.17	0
Total % Use Overlap = 15.88 ²		Total % Usage Overlap = 0.17 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the yellowcheek darter.

Malathion use sites overlap with 15.88% of the critical habitat, with 0% and 15.88% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.17% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.17% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the yellowcheek darter.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace. Final Rule. Federal Register 77:63604-63668.

Candy Darter (*Etheostoma osburni*)

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

Physical and Biological Features:

- Ratios or densities of nonnative species that allow for maintaining populations of candy darters (candy darters hybridize with closely-related species if in the same waterway)
- A blend of unembedded gravel and cobble that allows for normal breeding, feeding, and sheltering behavior
- Adequate water quality characterized by seasonally moderated temperatures and physical and chemical parameters (e.g., pH, dissolved oxygen levels, turbidity, etc.) that support normal behavior, growth, and viability of all life stages of the candy darter
- An abundant, diverse benthic macroinvertebrate community (e.g., mayfly nymphs, midge larvae, caddisfly larvae) that allows for normal feeding behavior
- Sufficient water quantity and velocities that support normal behavior, growth and viability of all life stages of the candy darter

In the Final Rule (*see* Application of the ‘Adverse Modification’ Standard), activities that may affect critical habitat include, “Actions that would significantly alter water chemistry. Such activities could include, but are not limited to, release of chemicals, biological pollutants, or heated effluents into the surface water or connected groundwater at a point source or by dispersed release (nonpoint source). These activities could alter water conditions to levels that are beyond the tolerances of the candy darter and result in direct or cumulative adverse effects to these individuals and their life cycles.” Adequate water quality is essential for normal behavior, growth, and viability during all life stages of the candy darter.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
20.58	5.81	0	0.35	30.95
Total % Use Overlap = 26.39 ³		Total % Usage Overlap = 0.35		

¹The species’ critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the candy darter.

Malathion use sites overlap with 26.39% of the critical habitat, with 20.58% and 5.81% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.35% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.35% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the candy darter.

Reference(s):

U. S. Fish and Wildlife Service. 2018. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Candy Darter. Proposed Rule. Federal Register 83:59232-59268.

Rush Darter (*Etheostoma phytophilum*)

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

Physical and Biological Features:

- Springs and spring-fed reaches of geomorphically stable, relatively low gradient, headwater streams with appropriate habitat (bottom substrates) to maintain essential riffles, runs, and pools
- Emergent vegetation in shallow water and on the margins of small streams and spring runs
- Cool, clean, flowing water

- Connectivity between spawning, foraging, and resting sites to promote gene flow throughout the species' range
- Stable bottom substrates composed of a combination of sand with silt, muck, gravel, or bedrock and adequate emergent vegetation in shallow water on the margins of small permanent and ephemeral streams and spring runs
- Instream flow with medium velocity and a continuous daily discharge that allows for a longitudinal connectivity regime inclusive of both surface runoff and groundwater sources (springs and seepages) and exclusive of flushing flows caused by stormwater runoff.
- 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, blackfly larvae, beetles, and microcrustaceans

In the Final Rule (see Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirements), optimal water quality for the rush darter “lacks harmful levels of pollutants, such as ...pesticides; nitrogen, potassium, and phosphorous fertilizers.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
42.94	31.75	0.71	0.78	0
Total % Use Overlap = 74.69 ²		Total % Usage Overlap = 1.49 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the rush darter.

Malathion use sites overlap with 74.69% of the critical habitat, with 42.94% and 31.75% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.49% of critical habitat annually, with usage on 0.71% of

the critical habitat from mosquito control activities and usage on 0.78% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the rush darter.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace. Final Rule. Federal Register 77:63604-63668.

Maryland Darter (*Etheostoma sellare*)³

Conclusion: ☐ Will ☒ Not likely to destroy or adversely modify designated critical habitat.

Physical and 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 Final Rule (*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.”

³ The Maryland darter was recommended for delisting due to extinction in the Service’s 2021 5-Year Review. However, we will continue to consider potential effects to this species’ critical habitat while the designation remains in effect.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	(Federal Lands (% area overlap))
100	46.19	3.61	4.9	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 8.52 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high concern for impacts to arthropod prey and water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 46.19% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 8.52 % of critical habitat annually, with usage on 3.61% of the critical habitat from mosquito control activities and usage on 4.9% of the critical habitat from non-mosquito control activities.

There was a preliminary high level of concern for the arthropod prey and water quality PBFs due to expected effects from the high level of expected usage. In particular, we anticipated that low flow, low volume, small, and localized bodies of water would exhibit high enough concentrations of malathion to affect the water quality and arthropod prey PBFs. However, general conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, would be expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we expect the conservation measures will reduce exposure to effects the arthropod prey and water quality PBFs. Thus, we do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, this Action is not likely to destroy or adversely modify critical habitat for the Maryland darter.

Reference(s):

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

U.S. Fish and Wildlife Service. 2021. Maryland darter (*Etheostoma sellare*), 5-year review: Summary and evaluation. Chesapeake Bay Field Office, Annapolis, MD. 16 pp. + Appendices.

Cumberland Darter (*Etheostoma susanae*)

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

Physical and Biological Features:

- Shallow pools and gently flowing runs of geomorphically stable streams
- Connectivity between spawning, foraging, and resting sites to promote gene flow throughout the species' range
- Stable bottom substrates composed of relatively silt-free sand and sand-covered bedrock, boulders, large cobble, woody debris, or other cover
- 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 microcrustaceans

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
21.37	16.8	0	0.21	85.2
Total % Use Overlap = 38.17 ²		Total % Usage Overlap = 0.21 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Cumberland darter.

Malathion use sites overlap with 38.17% of the critical habitat, with 21.37% and 16.8% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.21% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.21% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (85.2%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a

whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Cumberland darter.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace. Final Rule. Federal Register 77:63604-63668.

Trispot darter (*Etheostoma trisella*)

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

Physical and Biological Features:

- Geomorphically stable, small to medium streams with detritus, woody debris, and stands of water willow (*Justicia americana*) over stream substrate that consists of small cobble, pebbles, gravel, and fine layers of silt; and intact riparian cover to maintain stream morphology and reduce erosion and sediment inputs.
- Adequate seasonal water flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time) necessary to maintain appropriate benthic habitats and to maintain and create connectivity between permanently flowing streams with associated streams that hold water from November through April, providing connectivity between the darter's spawning and summer areas.
- Water and sediment quality (including, but not limited to, conductivity; hardness; turbidity; temperature; pH; ammonia; heavy metals; pesticides; animal waste products; and nitrogen, phosphorus, and potassium fertilizers) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- Prey base of aquatic macroinvertebrates.

In the Final Rule, "significant alteration of water quality" is listed as an activity that may need special management consideration or protection (*see* Special Management Considerations or Protection section of the rule). Activities listed in the Application of the 'Adverse Modification' Standard section that may be likely to destroy or adversely modify critical habitat include "Actions that would significantly alter water chemistry or quality," including the release of pesticides.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat)²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
65.53	12.79	2.49	1.94	1.17
Total % Use Overlap = 78.32 ³		Total % Usage Overlap = 4.43		

¹The species' critical habitat shapefile was unavailable at the time of analysis so both species range overlap and usage were used as surrogates for critical habitat. Our analysis indicated that a portion (approximately 29%) of the species' critical habitat is located outside of the species' range, which may cause deviations from the data listed above. However, additional review and analyses indicate that the portion of critical habitat found outside of the species' range is expected to have comparable use and usage overlap as areas within the range of the species.

Therefore, usage in the species range is still expected to be similar to and serves as a suitable approximation for usage in the critical habitat.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the trispot darter.

Critical habitat for the species is found in Alabama, Georgia, and Tennessee. Malathion use sites overlap with 79.32% of the critical habitat, with 65.53% and 12.79% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 4.43% of critical habitat annually, with usage on 2.49% of the critical habitat from mosquito control activities and usage on 1.94% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 29%) of the species' critical habitat is located outside of the species' range within these States, which indicates there may be deviations from the usage data listed above. However, additional qualitative review and analyses confirmed that areas found outside of the species' range are expected to have comparable levels of overlap and usage rates as areas within the species' range, as the applicable usage data is State-wide within each of the States in which critical habitat is found. We do not anticipate that any of the small differences we observed in use sites would substantially affect our assumptions about usage or likelihood of exposure of the PBFs to malathion applications across all of the species critical habitat.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the

arthropod prey and water quality PBFs. We do not anticipate that malathion will alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the trispot darter.

Reference(s):

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Trispot Darter. Final Rule. Federal Register 85:61619-61638.

Tidewater Goby (*Eucyclogobius newberryi*)

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

Physical and Biological Features:

- Persistent, shallow (~0.3 to 6.6 ft (0.1 to 2 m)), still-to-slow-moving lagoons, estuaries, and coastal streams with:
 - Salinity up to 12 ppt
 - Substrates (e.g., sand, silt, mud) suitable for the construction of burrows
 - Submerged and emergent aquatic vegetation, such as *Potamogeton pectinatus*, *Ruppia maritima*, *Typha latifolia*, and *Scirpus* spp.
 - Presence of a sandbar(s) across the mouth of a lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, thereby providing relatively stable water levels and salinity

These PBFs focus on habitat structural features, salinity, and substrate composition. In the Final Rule (*see* Application of the ‘Adverse Modification’ Standard), “pesticide application” is listed as an activity that “could degrade the water quality where tidewater goby live, introduce toxic substances that can poison individual fish, adversely affect fish immune systems, and decrease the amount of oxygen in aquatic habitats where the species occurs.” Tidewater goby predominantly eat macroinvertebrates including shrimp and aquatic insects, though these prey items are not listed as PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
85.2	27.5	0	0.93	17.74
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.93 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the tidewater goby.

Malathion use sites overlap with 100% of the critical habitat, with 85.2% and 27.5% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.93% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.93% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the tidewater goby.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Tidewater Goby. Final Rule. Federal Register 78:8746-8819.

San Marcos Gambusia (*Gambusia georgei*)

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. Though this species' feeding habits are largely unknown, they are believed to feed primarily on insect larvae and other invertebrates. San Marcos gambusia require clean and clear water and pesticides, herbicides, and other chemicals are known threats to water quality. Therefore, we have identified arthropods and water quality as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	30.86	0	0	0
Total % Use Overlap = 30.86 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the San Marcos gambusia.

Malathion use sites overlap with 30.86% of the critical habitat, with 0% and 30.86% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most

protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the San Marcos gambusia.

Reference(s):

U.S. Fish and Wildlife Service. 2018. San Marcos gambusia (*Gambusia georgei*) 5-Year Review: Summary and Evaluation. Austin Ecological Services Field Office. Texas. 6 pp.

U.S. Fish and Wildlife Service. 1996. San Marcos & Comal Springs & Associated Aquatic Ecosystems (Revised) Recovery Plan. Austin Ecological Services Office, Texas. 134 pp.

U.S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Listing of the San Marcos Salamander as Threatened, the San Marcos Gambusia as Endangered, and the Listing of Critical Habitat for Texas Wild Rice, San Marcos Salamander, San Marcos Gambusia, and Fountain Darter. Federal Register 45:47355-47364.

Owens Tui Chub (*Gila bicolor ssp. snyderi*)

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

Physical and Biological Features:

- High quality, cool water with adequate cover in the form of rocks, undercut banks, or aquatic vegetation
- Sufficient insect prey available

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
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¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	6.96	0	0	0
Total % Use Overlap = 6.96 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Owens tui chub.

Malathion use sites overlap with 6.96% of the critical habitat, with 0% and 6.96% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Owens tui chub.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Endangered Status and Critical Habitat Designation for the Owens Tui Chub. Final Rule. Federal Register 50:31592-31597.

Humpback Chub (*Gila cypha*)

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

Physical and Biological Features:

- Water of sufficient quality (temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.)
- River channels, bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year flood plain, of the Colorado River which when inundated provide spawning, nursery, feeding and rearing habitats, or access to these habitats
- Food supply, predation, and competition are considered constituent elements. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced non-native fish species in many areas.

In the Final Rule (*see* Examples of Proposed Actions), “actions that would contaminate the river” may disturb or remove the primary constituent elements within designated critical habitat for the Colorado River endangered fishes.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
95.6	1.15	2.39	0.15	74.48
Total % Use Overlap = 96.75 ²		Total % Usage Overlap = 2.54 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the humpback chub.

Malathion use sites overlap with 96.75% of the critical habitat, with 95.6% and 1.15% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.54% of critical habitat annually, with usage on 2.39% of the critical habitat from mosquito control activities and usage on 0.15% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (74.48%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the humpback chub.

Reference(s):

U. S. Fish and Wildlife Service. 1994. Determination of Critical Habitat for the Colorado River Endangered Fishes: Razorback Sucker, Colorado Squawfish, Humpback Chub, and Bonytail Chub. Final Rule. Federal Register 59:13374-13400.

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

Physical and Biological Features:

- Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies all found in headwaters, springs, and cienegas
- Water temperatures for spawning (17 to 24 °C (62.6 to 75.2 °F)) and seasonally appropriate temperatures for all life stages (~10 °C to 30 °C)
- Water quality with reduced levels of contaminants (including sedimentation), adequate levels of pH (6.5 to 9.5), dissolved oxygen (3.0 to 10.0 mg/l) and conductivity (100 to 1000 mmhos)
- Invertebrates (aquatic and terrestrial insects) and aquatic plants (diatoms and filamentous green algae)
- Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, a high degree of streambank stability, and a healthy, intact riparian vegetation community
- Habitat devoid of nonnative aquatic species detrimental to Gila chub or habitat in which detrimental nonnatives are kept at a level that allows Gila chub to continue to survive and reproduce
- Streams that maintain a natural flow pattern including periodic flooding

The Final Rule (*see* Special Management Considerations or Protections) states that “maintaining high quality and adequate quantities of water for all life stages of Gila chub may involve special management actions such as retaining an adequate buffer of riparian vegetation to help filter out sediment and contaminants.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
3.8	1.6	0	0.08	81.33
Total % Use Overlap = 5.4 ²		Total % Usage Overlap = 0.08 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
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¹Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Gila chub.

Malathion use sites overlap with 5.4% of the critical habitat, with 3.8% and 1.6% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.08% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.08% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (81.33%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Gila chub.

Reference(s):

U. S. Fish and Wildlife Service. 2005. Listing Gila Chub as Endangered With Critical Habitat. Final Rule. Federal Register 70:66664-66721.

Yaqui Chub (*Gila purpurea*)

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

Physical and Biological Features:

- Clean permanent water with deep pools and intermediate areas with riffles without any exotic fishes
- Backwater areas of stream and springs with overgrown cut banks and accumulation of detritus (feeding, sheltering)

In the Final Rule (*see* Critical Habitat section), “release of chemical or biological pollutants into surface or underground waters at a point source or by dispersal release” is listed as an “activity which would significantly alter the water chemistry” and “could adversely impact the critical habitat.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	0.39	0	0.87	13.96
Total % Use Overlap = 0.39 ²		Total % Usage Overlap = 0.87 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we

anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Yaqui chub.

Malathion use sites overlap with 0.39% of the critical habitat, with 0% and 0.39% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.87% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.87% of the critical habitat from non-mosquito control activities.

While overlap and usage data suggests there is a low risk of exposure within critical habitat, general conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will reduce environmental concentrations of malathion for any potential future uses that may occur in or near critical habitat. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Yaqui chub.

Reference(s):

U. S. Fish and Wildlife Service. 1984. Final Rule to Determine the Yaqui Chub to be an Endangered Species with Critical Habitat, and To Determine the Beautiful Shiner and Yaqui Catfish to be Threatened Species with Critical Habitat. Final Rule. Federal Register 49:34490-34497.

Virgin River Chub (*Gila seminuda* (=robusta))

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

Physical and Biological Features:

- Sufficient quantity and quality of water (temperature, dissolved oxygen, contaminants, nutrients, turbidity, etc.)
 - Natural seasonally variable temperature, turbidity, and conductivity
- Hydrologic regime characterized by the duration, magnitude, and frequency of flow events capable of forming and maintaining channel and instream habitat necessary for particular life stages at certain times of the year

- Flood events inundating the floodplain necessary to provide the organic matter that provides or supports the nutrient and food sources for the listed fishes
- River channels, side channels, secondary channels, backwaters, and springs, and other areas which provide access to these habitats
- Areas with slow to medium velocities, within deep runs or pools, with predominately sand substrates, particularly habitats which contain boulders or other instream cover.
- Food supply, predation, and competition are considered constituent elements. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced non-native fish species in many areas.
 - Seasonally flooded areas that produce allochthonous (humus, silt, organic detritus, colloidal matter, and plants and animals produced outside the river and brought into the river) organic matter which provides and supports much of the prey species
 - Few or no predatory or competitive nonnative species in occupied habitats or potential reestablishment sites

In the Final Rule (*see* Effects of Critical Habitat Designation), “actions that ... contaminate the river” may adversely modify critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.95	5.47	0.64	0.12	62.56
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.76 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Virgin River chub.

Malathion use sites overlap with 100% of the critical habitat, with 99.95% and 5.47% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.76% of critical habitat annually, with usage on 0.64% of the critical habitat from mosquito control activities and usage on 0.12% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (62.56%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Virgin River chub.

Reference(s):

U. S. Fish and Wildlife Service. 2000. Designation of Critical Habitat for the Woundfin and Virgin River Chub. Final Rule. Federal Register 65:4140-4156.

Rio Grande Silvery Minnow (*Hybognathus amarus*)

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

Physical and Biological Features:

- Hydrologic regime with sufficient flowing water with low to medium currents capable of forming and maintaining a diversity of aquatic habitats:

- Backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep with relatively little velocity compared to the rest of the channel), eddies (a pool with water moving opposite to that in the river channel), and runs (flowing water in the river channel without obstructions) of varying depth and velocity
- Low-velocity habitat (including eddies created by debris piles, pools, or backwaters, or other refuge habitat (e.g., connected oxbows or braided channels)) within unimpounded stretches of flowing water of sufficient length (river miles)
- Substrates of predominantly sand or silt
- Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of greater than 1 °C (35 °F) and less than 30 °C (85 °F) and reduce degraded water quality conditions (decreased dissolved oxygen, increased pH, etc.)

These PBFs of the Rio Grande silvery minnow habitat focus on water flow, river structural features, substrate composition, and general parameters of river water quality. The Final Rule (*see* Effects of the Critical Habitat Designation section) states that “significantly and detrimentally altering the water quality within the [critical habitat] designation”, specifically “the release of chemical or biological pollutants into the surface water or connected groundwater at a point source or by dispersed release (non-point)”, is an activity that is likely to require section 7 consultation for EPA permitting.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	16.82	0.42	0.14	8.42
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.56 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we

anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Rio Grande silvery minnow.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 16.82% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.56% of critical habitat annually, with usage on 0.42% of the critical habitat from mosquito control activities and usage on 0.14% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Rio Grande silvery minnow.

Reference(s):

U.S. Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants Designation of Critical Habitat for the Rio Grande Silvery Minnow. Final Rule. Federal Register 68:8088-8135.

Delta Smelt (*Hypomesus transpacificus*)

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

Physical and Biological Features:

- Shallow, fresh or slightly brackish backwater sloughs and edgewaters for spawning
- Suitable water quality (i.e., low concentrations of pollutants) and substrates for egg attachment (e.g., submerged tree roots and branches and emergent vegetation)
- Adequate river flow to transport larvae from upstream spawning areas to rearing habitat; 2 ppt isohaline must be located westward of the Sacramento-San Joaquin River confluence during the period when larvae or juveniles are being transported

- Unrestricted access to suitable spawning habitat in a period that may extend from December to July (adult migration). These areas also should be protected from physical disturbance and flow disruption during migratory periods.

Suitable water quality (low concentrations of pollutants) within the estuary is necessary to provide delta smelt larvae and juveniles a shallow, protective, food-rich environment in which to mature to adulthood.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 4, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
94.35	82.75	1.61	1.7	0.92
Total % Use Overlap = 100 ²		Total % Usage Overlap = 3.31 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Delta smelt.

Malathion use sites overlap with 100% of the critical habitat, with 94.35% and 82.75% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.31% of critical habitat annually, with usage on 1.61% of the critical habitat from mosquito control activities and usage on 1.7% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted

rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Delta smelt.

Reference(s):

U. S. Fish and Wildlife Service. 1994. Critical Habitat Determination for the Delta Smelt. Final Rule. Federal Register 59:65256-65279.

Yaqui Catfish (*Ictalurus pricei*)

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

Physical and Biological Features:

- Clean unpolluted permanent water in streams with medium current with clear pools and without exotic fishes

In the Final Rule (*see* Critical Habitat section), “release of chemical or biological pollutants into surface or underground waters at a point source or by dispersal release” is listed as an “activity which would significantly alter the water chemistry” and “could adversely impact the critical habitat.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	0.39	0	0.81	14.75
Total % Use Overlap = 0.39 ²		Total % Usage Overlap = 0.81 ³		

¹Mosquito control use and usage may overlap with other usages.

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
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²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Yaqui catfish.

Malathion use sites overlap with 0.39% of the critical habitat, with 0% and 0.39% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.81% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.81% of the critical habitat from non-mosquito control activities.

While use and usage data suggests there is low risk of exposure within critical habitat, general conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will reduce environmental concentrations of malathion from any potential new uses that may occur in the future in or near critical habitat. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Yaqui catfish.

Reference(s):

U. S. Fish and Wildlife Service. 1984. Final Rule to Determine the Yaqui Chub to be an Endangered Species with Critical Habitat, and To Determine the Beautiful Shiner and Yaqui Catfish to be Threatened Species with Critical Habitat. Final Rule. Federal register 49:34490-34497.

White River Spinedace (*Lepidomeda albivallis*)

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

Physical and Biological Features:

- Consistently high quality and quantity of cool springs and their outflows, and surrounding land area that provides vegetation for cover and habitat for insects and other invertebrates on which the species feeds

In the Final Rule (*see* Critical Habitat section), “pollution of the springwater” is listed as an activity that “may adversely affect the critical habitat of the White River spinedace.” The most critical element of the survival of the spinedace is a consistent quality and quantity of springflow, which provides habitat for the spinedace and its prey (e.g., insects and other invertebrates).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	11.53	0	0.04	0
Total % Use Overlap = 11.53 ²		Total % Usage Overlap = 0.04 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the White River spinedace.

Malathion use sites overlap with 11.53% of the critical habitat, with 0% and 11.53% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.04% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.04% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the White River spinedace.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Determination of Endangered Status and Designation of Critical Habitat for the White River Spinedace. Final Rule. Federal Register 50:37194-31198.

Big Spring Spinedace (*Lepidomeda mollispinis pratensis*)

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

Physical and Biological Features:

- Clean permanent flowing spring-fed stream with deep pool areas and shallow marshy areas along the shore and the absence of exotic fishes.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	5.54	0	0.02	80.38
Total % Use Overlap = 5.54 ²		Total % Usage Overlap = 0.02 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Big Spring spinedace.

Malathion use sites overlap with 5.54% of the critical habitat, with 0% and 5.54% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.02% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.02% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (80.38%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the

species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Big Spring spinedace.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Determination of Threatened Status and Critical Habitat for the Big Spring Spinedace. Final Rule. Federal Register 50:12298-12302.

Little Colorado Spinedace (*Lepidomeda vittata*)

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

Physical and Biological Features:

- Clean, permanent flowing water, with pools and a fine gravel or silt-mud substrate

In the Final Rule (*see* Critical Habitat section), “chemical or biological pollution at a point source or by dispersed release” is listed as an activity that “would extensively alter the water chemistry” and “could adversely affect the critical habitat.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
66.04	2.9	0	0.03	77.79
Total % Use Overlap = 68.94 ²		Total % Usage Overlap = 0.03 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Little Colorado spinedace.

Malathion use sites overlap with 68.94% of the critical habitat, with 66.04% and 2.9% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.03% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.03% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (77.79%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Little Colorado spinedace.

Reference(s):

U. S. Fish and Wildlife Service. 1987. Final Rule to Determine *Lepidomeda vittata* (Little Colorado Spinedace) to be a Threatened Species with Critical Habitat. Final Rule. Federal Register 52:35034-35041.

Spikedace (*Meda fulgida*)

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

Physical and Biological Features:

- Perennial flows with a stream depth generally less than 1 m (3.3 ft), with slow to swift flow velocities between 5 and 80 cm per second (1.9 and 31.5 in. per second), low levels of pollutants, and connectivity between occupied or seasonally occupied habitat
- Stream microhabitats including glides, runs, riffles, the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or medium amounts of fine sediment and substrate embeddedness
- Stream habitat with a low gradient of less than approximately 1.0 percent at elevations below 2,100 m (6,890 ft)
- Water temperatures ~8.0 to 28.0 °C (46.4 to 82.4 °F).
- Abundant aquatic insects consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies
- Levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace

In the Final Rule (*see Water in Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirement section*), “water quality is important to spikedace. Water with no or low levels of pollutants is essential for the survival of spikedace.” Pesticides are then listed as one of the pollutants that should not be present at high levels for this species. In the Special Management Considerations or Protection section, “poor water quality...for all life stages of spikedace...threaten[s] [this] fish and may require special management actions or protections.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
3.79	1.72	0	0.14	85.45
Total % Use Overlap = 5.51 ²		Total % Usage Overlap = 0.14 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous

key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the spikedace.

Malathion use sites overlap with 5.51% of the critical habitat, with 3.79% and 1.72% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.14% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.14% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (85.45%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the spikedace.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Endangered Status and Designations of Critical Habitat for Spikedace and Loach Minnow. Final Rule. Federal Register 77:10810-10932.

Waccamaw Silverside (*Menidia extensa*)

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

Physical and Biological Features:

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

In the Final 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	11.02	0	1.19	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.19 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Waccamaw silverside.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 11.02% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.19% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.19% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be

applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Waccamaw silverside.

Reference(s):

U. S. Fish and Wildlife Service. 1987. Determination of Threatened Status and Critical Habitat for the Waccamaw Silverside. Final Rule. Federal Register 67:11277-11286.

Smalleye Shiner (*Notropis buccula*)

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

Physical and Biological Features:

- Unobstructed, sandy-bottomed river segments greater than 275 km (171 mi) in length
- Flowing water of greater than $\sim 6.43 \text{ m}^3\text{s}^{-1}$ (227 cfs) averaged over the shiner spawning season (April through September)
- Water of sufficient quality to support survival and reproduction, characterized by:
 - Temperatures less than 40.6 °C (105.1 °F)
 - Dissolved oxygen concentrations greater than 2.11 mg/L
 - Salinities less than 30 mS/cm (18 ppt)
 - Sufficiently low petroleum and other pollutant concentrations such that mortality does not occur
- Native riparian vegetation capable of maintaining river water quality, supporting terrestrial prey populations, and maintaining a healthy riparian ecosystem

In the Final Rule (*see* Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirements), “[f]lowing water of sufficient quality” including “minimal pollution” is required for the survival of smalleye shiners. Special management considerations include “protecting water quality by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
water quality	X	aquatic bins 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
2.98	41.87	3.19	3.72	0
Total % Use Overlap = 44.85 ²		Total % Usage Overlap = 6.92 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to arthropod prey and a preliminary low level of concern for impacts to water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 44.85% of the critical habitat, with 2.98% and 41.87% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 6.92% of critical habitat annually, with usage on 3.19% of the critical habitat from mosquito control activities and usage on 3.72% of the critical habitat from non-mosquito control activities.

As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in Bins 3 and 4 as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations, thus overestimating potential exposure. Further investigation by EPA into estimated environmental concentrations for Bins 3 and 4 indicates that the flow rates in these aquatic habitats are sufficient to dilute malathion concentrations to levels that will result in low impacts to arthropod prey and water quality. Thus, the level of contamination expected to occur in critical habitat is substantially less than what was initially indicated in EPA’s modeling and concentrations are anticipated to cause only low levels of effects to arthropod prey or water quality.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. This measure is expected

to benefit all aquatic habitats, including low flow and low volume habitats that are at higher risk due to less natural capacity for dilution. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we expect the conservation measures will be sufficient to protect the arthropod prey and water quality PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the smallmouth shiner.

Reference(s):

U. S. Fish and Wildlife Service. 2014. Designation of Critical Habitat for Sharpnose Shiner and Smallmouth Shiner. Final Rule. Federal Register 79:45242-45271.

Arkansas River Shiner (*Notropis girardi*)

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

Physical and 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 stretch 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

In the Final Rule (*see* Effects of Critical Habitat Designation), “[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 or biological pollutants

into the surface water or connected groundwater as a point source or by dispersed release (non-point).”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0.33	79.9	0.33	3.61	0
Total % Use Overlap = 80.23 ²		Total % Usage Overlap = 3.94 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Arkansas River shiner.

Malathion use sites overlap with 80.23% of the critical habitat, with 0.33% and 79.9% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.94% of critical habitat annually, with usage on 0.33% of the critical habitat from mosquito control activities and usage on 3.61% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Arkansas River shiner.

Reference(s):

U. S. Fish and Wildlife Service. 2005. 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.

Cape Fear Shiner (*Notropis mekistocholas*)

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 is believed to be omnivorous, and water quality is considered very important for the species habitat. Therefore, we have identified water quality as a relevant PBF.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	27.77	0	1.35	0
Total % Use Overlap = 27.77 ²		Total % Usage Overlap = 1.35 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a

preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Cape Fear shiner.

Malathion use sites overlap with 27.77% of the critical habitat, with 0% and 27.77% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.35% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.35% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Cape Fear shiner.

Reference(s):

- U.S. Fish and Wildlife Service. 2017. Cape Fear Shiner (*Notropis mekistocholas*) 5-Year Review: Summary and Evaluation. Raleigh Ecological Services Field Office, North Carolina. 47 pp.
- U.S. Fish and Wildlife Service. 1988. Cape Fear Shiner Recovery Plan. Southeast Regionm Atlanta, Georgia. 23 pp.
- U.S. Fish and Wildlife Service. 1987. Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status and Designation of Critical Habitat for Cape Fear Shiner. Federal Register 52:36034-36034.

Sharpnose Shiner (*Notropis oxyrhynchus*)

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

Physical and Biological Features:

- Unobstructed, sandy-bottomed river segments greater than 275 km (171 mi) in length

- Flowing water of greater than approximately $2.61 \text{ m}^3\text{s}^{-1}$ (92 cfs) averaged over the shiner spawning season (April through September)
- Water of sufficient quality to support survival and reproduction, characterized by:
 - Temperatures less than 39.2°C (102.6°F)
 - Dissolved oxygen concentrations greater than 2.66 mg/L (2.66 ppm)
 - Salinities less than 25 mS/cm (15 ppt)
 - Sufficiently low petroleum and other pollutant concentrations such that mortality does not occur
- Native riparian vegetation capable of maintaining river water quality, supporting terrestrial prey, and maintaining a healthy riparian ecosystem

In the Final Rule (*see* Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirements), “[f]lowing water of sufficient quality” including “minimal pollution” is required for the survival of sharpnose shiners. Special management considerations include “protecting water quality by implementing comprehensive programs to control and reduce point sources and non-point sources of pollution.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
2.98	41.87	0.72	7.57	0
Total % Use Overlap = 44.85 ²		Total % Usage Overlap = 8.29 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to arthropod prey and a preliminary low level of concern for impacts to water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 44.85% of the critical habitat, with 2.98% and 41.87% overlapping with mosquito control and non-mosquito control use sites, respectively. Available

data indicates that usage will occur on 8.29% of critical habitat annually, with usage on 0.72% of the critical habitat from mosquito control activities and usage on 7.57% of the critical habitat from non-mosquito control activities.

As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in Bins 3 and 4 as they were initially modeled in such a way that likely resulted in overestimation of environmental concentrations, thus overestimating potential exposure. Further investigation by EPA into estimated environmental concentrations for Bins 3 and 4 indicated that the flow rates in these aquatic habitats are sufficient to dilute malathion concentrations to levels that will result in low impacts to arthropod prey and water quality. Thus, the level of contamination expected to occur in critical habitat is substantially less than what was initially indicated in EPA’s modeling and concentrations are anticipated to cause only low levels of effects to arthropod prey or water quality.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce malathion from applications and associated spray drift from entering aquatic habitats. This measure is expected to benefit all aquatic habitats, including low flow and low volume habitats that are at higher risk due to less natural capacity for dilution. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, we do not expect malathion to accumulate in concentrations high enough to cause appreciable impacts to arthropod prey and water quality PBFs, and general conservation measures to be implemented will further decrease exposure of PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the sharpnose shiner.

Reference(s):

U. S. Fish and Wildlife Service. 2014. Designation of Critical Habitat for Sharpnose Shiner and Smalleye Shiner. Final Rule. Federal Register 79:45242-45271.

Pecos Bluntnose Shiner (*Notropis simus pecosensis*)

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

Physical and Biological Features:

- Clean, permanent water
- Main river channel habitat with sandy substrate
- Low velocity flow

In the Final Rule (*see* Summary of Factors Affecting the Species), “contribution of pollutants to the river by agricultural operations” is listed as a factor that has adverse effects on the water quality in Pecos bluntnose shiner habitat. As stated in the Critical Habitat section, “[o]ther threats to the critical habitat include water pollution from municipal sewage, agriculture areas, and fish toxicants.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
55.57	25.12	0	0.42	9.66
Total % Use Overlap = 80.69 ²		Total % Usage Overlap = 0.42 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Pecos bluntnose shiner.

Malathion use sites overlap with 80.69% of the critical habitat, with 55.57% and 25.12% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.42% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.42% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers,

which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Pecos bluntnose shiner.

Reference(s):

U. S. Fish and Wildlife Service. 1987. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Pecos Bluntnose Shiner and Designation of its Critical Habitat. Final Rule. Federal Register 52:5295-5303.

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

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

Physical and 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 Final 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
5.76	61.83	0.13	1.87	0.28
Total % Use Overlap = 67.59 ²		Total % Usage Overlap = 2 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Topeka shiner.

Malathion use sites overlap with 67.59% of the critical habitat, with 5.76% and 61.83% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2% of critical habitat annually, with usage on 0.13% of the critical habitat from mosquito control activities and usage on 1.87% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of

malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Topeka shiner.

Reference(s):

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

Chucky Madtom (*Noturus crypticus*)

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

Physical and 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

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	62.98	0	1.79	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.79 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Chucky madtom.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 62.98% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.79% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.79% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Chucky madtom.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for the Cumberland Darter, Rush Darter, Yellowcheek Darter, Chucky Madtom, and Laurel Dace. Final Rule. Federal Register 77:63604-63668.

Yellowfin Madtom (*Noturus flavipinnis*)

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 a variety of aquatic insects (tiny midges to large burrowing mayfly larvae). Water quality is considered very important for the species habitat; non-point pollution, including runoff of pesticides, herbicides, and fertilizers, alter the chemistry of affected streams and negatively affect the species habitat and food sources. Therefore, we have identified arthropods and water quality as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	42.22	0	0.61	1.14
Total % Use Overlap = 42.22 ²		Total % Usage Overlap = 0.61 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the yellowfin madtom.

Malathion use sites overlap with 42.22% of the critical habitat, with 0% and 42.22% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.61% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.61% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied,

are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the yellowfin madtom.

Reference(s):

U.S. Fish and Wildlife Service. 2020. Yellowfin Madtom (*Noturus flavipinnis*) 5-Year Review: Summary and Evaluation. Tennessee Ecological Services Field Office, Cookeville. 23 pp.

U.S. Fish and Wildlife Service. 1983. Recovery Plan Yellowfin Madtom (*Noturus flavipinnis*) Taylor. Southeast Region, Atlanta, Georgia. 37 pp.

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

Amber Darter (*Percina antesella*)

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

Physical and Biological Features:

- High quality water, riffle areas (free of silt) composed of sand, gravel, and cobble, which becomes vegetated primarily with *Podostemum* during the summer

According to the Final Rule (*see* Background section), the amber darter requires unpolluted, clean water streams. As stated in the Critical Habitat section, activities that alter the watershed and “could degrade the water and substrate quality ... by increasing siltation, water temperatures, organic pollutants, and extremes in water flow” may affect critical habitat for the amber darter.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 4	low concern
host fish	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
58.69	34.44	0.42	0.78	0
Total % Use Overlap = 93.13 ²		Total % Usage Overlap = 1.2 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the amber darter.

Malathion use sites overlap with 93.13% of the critical habitat, with 58.69% and 34.44% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.2% of critical habitat annually, with usage on 0.42% of the critical habitat from mosquito control activities and usage on 0.78% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the amber darter.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Determination of Endangered Status and of Critical Habitat for the Amber Darter and the Conasauga Logperch. Final Rule. Federal Register 50:31597-31604.

Conasauga Logperch (*Percina jenkinsi*)

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

Physical and Biological Features:

- High quality water, riffle areas (free of silt) composed of sand, gravel, and cobble, which becomes vegetated primarily with *Podostemum* during the summer

According to the Final Rule (*see* Background section), the Conasauga logperch requires unpolluted, clean water streams. As stated in the Critical Habitat section, activities that alter the watershed and “could degrade the water and substrate quality ... by increasing siltation, water temperatures, organic pollutants, and extremes in water flow” may affect critical habitat for the Conasauga logperch.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
50.09	28.85	0	0.82	27.55
Total % Use Overlap = 78.94 ²		Total % Usage Overlap = 0.82 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Conasauga logperch.

Malathion use sites overlap with 78.94% of the critical habitat, with 50.09% and 28.85% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.82% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.82% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Conasauga logperch.

Reference(s):

U. S. Fish and Wildlife Service. 1985. Determination of Endangered Status and of Critical Habitat for the Amber Darter and the Conasauga Logperch. Final Rule. Federal Register 50:31597-31604.

Leopard Darter (*Percina pantherina*)

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 mostly on microcrustaceans and immature aquatic insects. Water quality is very important to this species and pesticides and fertilizers are mentioned as threats to water quality in its habitat. Therefore, we have identified arthropods, non-arthropod prey, and water quality as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	crustaceans	low concern
water quality	X	aquatic bins 3 and 4	low concern

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
host fish	--	--	--
habitat function		--	

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	16.47	0	0.21	0.02
Total % Use Overlap = 16.47 ²		Total % Usage Overlap = 0.21 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the leopard darter.

Malathion use sites overlap with 16.47% of the critical habitat, with 0% and 16.47% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.21% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.21% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, non-arthropod prey, and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality, arthropod prey and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the leopard darter.

Reference(s):

U.S. Fish and Wildlife Service. 2021. Leopard Darter (*Percina pantherina*) 5-Year Review: Summary and Evaluation. Oklahoma Ecological Services Field Office, Tulsa. 47 pp.

U.S. Fish and Wildlife Service. 1993. Leopard Darter *Percina pantherina* (Moore and Reeves) Revised Recovery Plan. Region 2, Albuquerque, New Mexico. 60 pp.

U.S. Fish and Wildlife Service. 1978. Final Threatened Status and Critical Habitat for the Leopard Darter. Federal Register 43:3711-3716.

Woundfin (*Plagopterus argentissimus*)

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

Physical and Biological Features:

- Sufficient quantity and quality of water (temperature, dissolved oxygen, contaminants, nutrients, turbidity, etc.)
 - Natural seasonally variable temperature, turbidity, and conductivity
- Hydrologic regime characterized by the duration, magnitude, and frequency of flow events capable of forming and maintaining channel and instream habitat necessary for particular life stages at certain times of the year
 - Flood events inundating the floodplain necessary to provide the organic matter that provides or supports the nutrient and food sources for the listed fishes
 - River channels, side channels, secondary channels, backwaters, and springs, and other areas which provide access to these habitats
 - Areas with slow to medium velocities, within deep runs or pools, with predominately sand substrates, particularly habitats which contain boulders or other instream cover.
 - Runs and pools adjacent to riffles that have sand, and sand and gravel substrates (adult and juvenile woundfin)
 - Shoreline margins and backwater habitats associated with growths of filamentous algae (woundfin larvae)
- Food supply, predation, and competition are considered constituent elements. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced non-native fish species in many areas.
 - Seasonally flooded areas that produce allochthonous (humus, silt, organic detritus, colloidal matter, and plants and animals produced outside the river and brought into the river) organic matter which provides and supports much of the prey species
 - Few or no predatory or competitive nonnative species in occupied habitats or potential reestablishment sites

In the Final Rule (*see* Effects of Critical Habitat Designation), “actions that ... contaminate the river” may adversely modify critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.95	5.47	2.15	0.2	62.56
Total % Use Overlap = 100 ²		Total % Usage Overlap = 2.34 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the woundfin.

Malathion use sites overlap with 100% of the critical habitat, with 99.95% and 5.47% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.34% of critical habitat annually, with usage on 2.15% of the critical habitat from mosquito control activities and usage on 0.2% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (62.56%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be

applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the woundfin.

Reference(s):

U. S. Fish and Wildlife Service. 2000. Designation of Critical Habitat for the Woundfin and Virgin River Chub. Final Rule. Federal Register 65:4140-4156.

Colorado Pikeminnow = Colorado Squawfish (*Ptychocheilus lucius*)

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

Physical and Biological Features:

- Water of sufficient quality (temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.)
- River channels, bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year flood plain, of the Colorado River which when inundated provide spawning, nursery, feeding and rearing habitats, or access to these habitats
- Food supply, predation, and competition are considered constituent elements. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced non-native fish species in many areas.

In the Final Rule (*see* Examples of Proposed Actions), “actions that would contaminate the river” may disturb or remove the primary constituent elements within designated critical habitat for the Colorado River endangered fishes.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
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¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
93.78	8.27	1.46	0	56.02
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.46 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Colorado pikeminnow (=squawfish).

Malathion use sites overlap with 100% of the critical habitat, with 93.78% and 8.27% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.46% of critical habitat annually, with usage on 1.46% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (56.02%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of

malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Colorado pikeminnow (=squawfish).

Reference(s):

U. S. Fish and Wildlife Service. 1994. Determination of Critical Habitat for the Colorado River Endangered Fishes: Razorback Sucker, Colorado Squawfish, Humpback Chub, and Bonytail Chub. Final Rule. Federal Register 59:13374-13400.

Atlantic Salmon (*Salmo salar*) – Gulf of Maine DPS

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

Physical and Biological Features:

- Deep, oxygenated pools and cover (boulders, woody debris, vegetation, etc.), near freshwater spawning sites
- Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with cool, oxygenated water, diverse substrate, and diverse food resources
- Combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and to maximize parr production
- Freshwater and estuary migratory sites:
 - Free from physical and biological barriers that delay or prevent access to spawning grounds or marine environments (smolts)
 - With abundant, diverse native fish communities to serve as a protective buffer against predation
 - With sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration
 - With water chemistry needed to support sea water adaptation of smolts

As stated in the PBFs of the Spawning and Rearing PCE section of the Final Rule, “[w]ater quantity and quality...are important for successful Atlantic salmon spawning.” Water quality is also listed as an essential PBF that allows Atlantic salmon to successfully use sites for spawning, rearing, and migrating (pg. 29333). Salmon require diverse invertebrate communities for forage, populations of which would be affected by pesticide use.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	8.35	0	0.19	0.44
Total % Use Overlap = 8.35 ²		Total % Usage Overlap = 0.19 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Atlantic salmon (Gulf of Maine DPS).

Malathion use sites overlap with 8.35% of the critical habitat, with 0% and 8.35% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.19% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.19% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly

alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Atlantic salmon (Gulf of Maine DPS).

Reference(s):

U. S. Fish and Wildlife Service. 2009. Designation of Critical Habitat for Atlantic Salmon (*Salmo salar*) Gulf of Maine Distinct Population Segment. Final Rule. Federal Register 74:29300-29341.

Bull Trout (*Salvelinus confluentus*)

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

Physical and Biological Features:

- Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia
- Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers
- Abundant prey, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish
- Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure
- Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range.
- In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment (silt to coarse sand) embedded in larger substrates.
- Peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph
- Low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, and smallmouth bass), interbreeding (e.g., brook trout), or competing (e.g., brown trout) species

In the Final Rule (*see* Special Management Considerations or Protection), “[d]ischarging pollutants such as nutrients, agricultural chemicals, animal waste, and sediment into spawning and rearing waters” is described as detrimental to PBFs. “[E]nvironmental contaminants” are listed as threats to water quality in bull trout habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	mammals, amphibians, reptiles and fish	low concern
water quality	X	aquatic bins 2, 3, 4, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
28	14.09	0.27	1.48	43.04
Total % Use Overlap = 42.09 ²		Total % Usage Overlap = 1.74 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the bull trout.

Malathion use sites overlap with 42.09% of the critical habitat, with 28% and 14.09% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.74% of critical habitat annually, with usage on 0.27% of the critical habitat from mosquito control activities and usage on 1.48% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, non-arthropod prey, and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality, arthropod prey and non-arthropod prey PBFs. We do not anticipate that malathion will

directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the bull trout.

Reference(s):

U. S. Fish and Wildlife Service. 2010. Revised Designation of Critical Habitat for Bull Trout in the Conterminous United States. Final Rule. Federal Register 75:2270-2431.

Alabama Sturgeon (*Scaphirhynchus suttkusi*)

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

Physical and Biological Features:

- A flow regime (the magnitude, frequency, duration, seasonality of discharge over time) necessary to maintain all life stages of the species in the riverine environment, including migration, breeding site selection, resting, larval development, and protection of cool water refuges (tributaries).
- River channel with stable sand and gravel river bottoms, and bedrock walls, including associated mussel beds.
- Limestone outcrops and cut limestone banks, large gravel or cobble such as that found around channel training devices, and bedrock channel walls that provide riverine spawning sites with substrates suitable for egg deposition and development.
- Long sections of free-flowing water to allow spawning migrations and development of embryos and larvae.
- Water temperature not exceeding 32 °C (90 °F); dissolved oxygen levels not less than 5 mg/L (5 ppm), except under extreme conditions due to natural causes or downstream of existing hydroelectric impoundments, where it can range from 5 mg/L to 4 mg/L (5 ppm to 4 ppm); and pH within the range of 6.0 to 8.5.

In the Water Quality section of the Final Rule, “pesticides” are listed as a factor that can “potentially alter water quality” and “adequate water quality, quantity, and flow are essential...during all life stages of the sturgeon.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 4	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
61.48	15.95	2.1	0.89	5.03
Total % Use Overlap = 77.43 ²		Total % Usage Overlap = 2.99 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Alabama sturgeon.

Malathion use sites overlap with 77.43% of the critical habitat, with 61.48% and 15.95% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.99% of critical habitat annually, with usage on 2.1% of the critical habitat from mosquito control activities and usage on 0.89% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the Alabama sturgeon.

Reference(s):

U. S. Fish and Wildlife Service. 2009. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Alabama Sturgeon (*Scaphirhynchus suttkusi*). Final Rule. Federal Register 74:26488-26510.

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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	X	crustaceans	low concern
water quality	X	aquatic bins 6	high concern
host fish	--	--	--
habitat function		--	

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	45.51	0	5.09	82.1
Total % Use Overlap = 45.51 ²		Total % Usage Overlap = 5.09 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to water quality and a preliminary low level of concern for impacts to non-arthropod prey. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 45.51% of the critical habitat, with 0% and 45.51% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.09% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 5.09% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (82.1%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the *Effects of the*

Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use and usage may be high outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

There is high concern for water quality PBF due to the high level of expected usage. We anticipate that without the conservation measures described below, low flow, low volume, small, and localized bodies of water would exhibit high enough concentrations of malathion to affect the water quality PBF to a degree that would decrease the conservation value of the critical habitat for the listed species. However, general conservation measures, such as aquatic habitat buffers, rain restrictions and changes to residential use labels would help mitigate exposure to critical habitat. Aquatic habitat buffers, which specify on the label a distance from waterbodies where malathion cannot be applied, are an effective means of altering pesticide application patterns to provide more space for malathion from applications and associated spray drift to dissipate before depositing in off-target areas. Rain restrictions, which prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event, are expected to provide sufficient time for malathion to degrade before runoff events can occur, decreasing the malathion concentration entering critical habitat from runoff. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat. These general conservation measures are expected to reduce impacts to the water quality and non-arthropod prey PBFs.

Additionally, a species-specific conservation measure has been developed to further mitigate the possible impacts of malathion use within the range of the species, including critical habitat. Aquatic habitat buffers are extended from 25 and 50 feet to 50 and 200 feet for ground and aerial applications, respectively. These additional buffers further decrease the amount of malathion from applications and associated spray drift that is likely to deposit in springs and sinkholes that feed the aquifer supporting the critical habitat. AgDRIFT modeling results indicate that spray drift entering the range and critical habitat may be decreased by up to 88-96% with this measure.

The conservation measures would sufficiently reduce environmental concentrations of malathion to a level that would induce only low levels of effects in the critical habitat. Thus, with the conservation measures in place, we anticipate only small effects to the non-arthropod prey and water quality PBFs.

While the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, based on the information above, including general and species-specific conservation measures and consideration of additional relevant information regarding likelihood of exposure and impacts to non-arthropod prey and water quality PBFs, we anticipate that the Action poses a low risk to critical habitat. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the

species. Therefore, this Action is not likely to destroy or adversely modify critical habitat for the Alabama cavefish.

Reference(s):

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

Loach Minnow (*Tiaroga cobitis*)

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

Physical and Biological Features:

- Perennial flows with a stream depth generally less than 1 m (3.3 ft), with slow to swift flow velocities between 0 and 80 cm per second (0.0 and 31.5 in. per second), low levels of pollutants, and connectivity between occupied or seasonally occupied habitat
- Stream microhabitats including glides, runs, riffles, the margins of pools and eddies, and backwater components over sand, gravel, and cobble substrates with low or medium amounts of fine sediment and substrate embeddedness
- Stream habitat with a low gradient of less than approximately 2.5 percent at elevations below 2,500 m (8,202 ft)
- Water temperatures ~8.0 to 25.0 °C (46.4 to 77 °F).
- Abundant aquatic insects consisting of mayflies, true flies, black flies, caddisflies, stoneflies, and dragonflies
- Levels of nonnative aquatic species that are sufficiently low as to allow persistence of spikedace

In the Final Rule (*see Water in Food, Water, Air, Light, Minerals, or Other Nutritional or Physiological Requirement section*), “water, with no or low pollutant levels, is important for the conservation of loach minnow.” Pesticides are listed as one of the pollutants that should be present in no more than low levels.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
3.91	2.48	0	0.14	82.4
Total % Use Overlap = 6.39 ²		Total % Usage Overlap = 0.14 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the loach minnow.

Malathion use sites overlap with 6.39% of the critical habitat, with 3.91% and 2.48% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.14% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.14% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (82.4%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a

whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the loach minnow.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Endangered Status and Designations of Critical Habitat for Spikedace and Loach Minnow. Final Rule. Federal Register 77:10810-10932.

Razorback Sucker (*Xyrauchen texanus*)

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

Physical and Biological Features:

- Water of sufficient quality (temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.)
- River channels, bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year flood plain, of the Colorado River which when inundated provide spawning, nursery, feeding and rearing habitats, or access to these habitats
- Food supply, predation, and competition are considered constituent elements. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced non-native fish species in many areas.

In the Final Rule (*see* Examples of Proposed Actions), “actions that would contaminate the river” may disturb or remove the primary constituent elements within designated critical habitat for the Colorado River endangered fishes.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 4 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
90.69	6.72	1.91	0	83.26
Total % Use Overlap = 97.41 ²		Total % Usage Overlap = 1.91 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
--	--	--	--	---

¹Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the razorback sucker.

Malathion use sites overlap with 97.41% of the critical habitat, with 90.69% and 6.72% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.91% of critical habitat annually, with usage on 1.91% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (83.26%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the razorback sucker.

Reference(s):

U. S. Fish and Wildlife Service. 1994. Determination of Critical Habitat for the Colorado River Endangered Fishes: Razorback Sucker, Colorado Squawfish, Humpback Chub, and Bonytail Chub. Final Rule. Federal Register 59:13374-13400.

Frecklebelly madtom – Upper Coosa River DPS (*Noturus munitus*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- Geomorphically stable, medium to large streams with:
 - (a) Stable stream channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation; and
 - (b) Banks with intact riparian cover to maintain stream morphology and reduce erosion and sediment inputs.
- Connected instream habitats that:
 - (a) Include stable riffle-run pool complexes
 - (b) Consist of silt-free gravel, coarse sand, cobble, boulders, woody structure, and river weed (*Podostemum* spp.); and
 - Have abundant cobble, boulders, woody structure, or other suitable 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 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
- Appropriate water and sediment quality (including, but not limited to, conductivity; hardness; turbidity; temperature; pH; ammonia; heavy metals; pesticides; animal waste products; and nitrogen, phosphorus, and potassium fertilizers) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
- Diversity and availability of aquatic macroinvertebrate prey items, which include larval midges, mayflies, caddisflies, dragonflies, and beetles.

In the Proposed Rule (*see* Application of the “Destruction or Adverse Modification” Standard) activities that the FWS may find are likely to destroy or adversely modify critical habitat include “actions that would significantly alter water chemistry or quality. Such activities could include, but are not limited to, release of chemicals or biological pollutants into the surface water or connected groundwater at a point source or by dispersed release (non-point source).”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3 and 4	low concern

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
45.64	14.5	5.08	0.57	4
Total % Use Overlap = 60.14 ³		Total % Usage Overlap = 5.56		

¹Critical habitat data was unavailable - species range use usage data used as a surrogate for critical habitat use and usage.

²Mosquito control use and usage may overlap with other usages.

³Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary high level of concern for impacts to the arthropod prey, and a preliminary low level of concern for impacts to water quality. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the frecklebelly madtom.

Malathion use sites overlap with 60.14% of the critical habitat, with 45.64% and 14.5% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 5.56% of critical habitat annually, with usage on 5.08% of the critical habitat from mosquito control activities and usage on 0.57% of the critical habitat from non-mosquito control activities.

As described in the “Approach to the Effects Analysis” section of the main body of the Opinion, specific considerations were made for species that occur in Bins 3 and 4 and they were modeled in such a way that likely resulted in overestimation of estimated environmental concentrations, thus overestimating potential exposure. Further investigation by EPA into Bin 3 and 4 estimated environmental concentrations indicate that the flow rates in these aquatic habitats are sufficient to dilute malathion concentrations to a level that will result in low impacts to arthropod prey and water quality.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to arthropod prey and water quality PBFs.

Although we anticipate usage on use sites that overlap with critical habitat will be high, the required conservation measures are expected to reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the frecklebelly madtom.

Reference(s):

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for the Upper Coosa River Distinct Population Segment of Frecklebelly Madtom and Designation of Critical Habitat. Proposed Rule. Federal Register 85:74050-7408859.

M. Insects

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with only host plant PBFs, no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 11. Summary of Insect Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Ambrysus amargosus</i>	Ash Meadows naucorid	2	no relevant PBFs
<i>Anaea troglodyta floridalis</i>	Florida leafwing butterfly	3	see below
<i>Batrises ventyvi</i>	Helotes mold beetle	3	see below
<i>Cicindelidia floridana</i>	Miami Tiger Beetle	3	see below
<i>Cicindela nevadica lincolniana</i>	Salt Creek tiger beetle	3	see below
<i>Desmocerus californicus dimorphus</i>	Valley elderberry longhorn beetle	3	host plant PBF only
<i>Dinacoma caseyi</i>	Casey's June beetle	2	no relevant PBF
<i>Drosophila Aglaia</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila differens</i>	Hawaiian picture-wing fly	3	host plant PBF only
<i>Drosophila hemipeza</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila heteroneura</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila montgomeryi</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila mulli</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila musaphilia</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila neoclavisetae</i>	Hawaiian picture-wing fly	3	host plant PBF only
<i>Drosophila obatai</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila ochrobasis</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila sharpi</i>	Hawaiian picture-wing fly	3	host plant PBF only
<i>Drosophila substenoptera</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Drosophila tarphytrichia</i>	[Unnamed] pomace fly	3	host plant PBF only
<i>Elaphrus viridis</i>	Delta green ground beetle	2	no relevant PBF
<i>Euchloe ausonides insulanus</i>	Island marble Butterfly	3	host plant PBF only
<i>Euphydryas editha bayensis</i>	Bay checkerspot butterfly	3	see below
<i>Euphydryas editha quino</i>	Quino checkerspot butterfly	3	host plant PBF only
<i>Euphydryas editha taylori</i>	Taylor's (=whulge) Checkerspot Butterfly	3	host plant PBF only
<i>Glaucopsyche lygdamus palosverdesensis</i>	Palos Verdes blue butterfly	1	host plant PBF only
<i>Hesperia dacotae</i>	Dakota Skipper	3	host plant PBF only
<i>Heterelmis comalensis</i>	Comal Springs riffle beetle	3	see below
<i>Icaricia (Plebejus) shasta charlestonensis</i>	Mount Charleston blue butterfly	3	host plant PBF only
<i>Icaricia icarioides fenderi</i>	Fender's blue butterfly	3	host plant PBF only
<i>Lycaena hermes</i>	Hermes copper butterfly	3	host plant PBF only

Scientific Name	Common Name	Category	Rationale
<i>Manduca blackburni</i>	Blackburn's sphinx moth	3	host plant PBF only
<i>Megalagrion leptodemas</i>	Crimson Hawaiian damselfly	3	no overlap
<i>Megalagrion nigrohamatum nigrolineatum</i>	Blackline Hawaiian damselfly	3	no overlap
<i>Megalagrion oceanicum</i>	Oceanic Hawaiian damselfly	3	no overlap
<i>Oarisma poweshiek</i>	Poweshiek skipperling	3	see below
<i>Pyrgus ruralis lagunae</i>	Laguna Mountains skipper	3	host plant PBF only
<i>Rhadine exilis</i>	[Unnamed] ground beetle	3	see below
<i>Rhadine infernalis</i>	[Unnamed] ground beetle	3	see below
<i>Somatochlora hineana</i>	Hine's emerald dragonfly	3	see below
<i>Speyeria zerene hippolyta</i>	Oregon silverspot butterfly	3	host plant PBF only
<i>Strymon acis bartrami</i>	Bartram's hairstreak butterfly	3	see below
<i>Stygoparnus comalensis</i>	Comal Springs dryopid beetle	3	see below
<i>Trimerotropis infantilis</i>	Zayante band-winged grasshopper	2	no relevant PBFs

Florida Leafwing Butterfly (*Anaea troglodyta floridalis*)

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

Physical and 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 described in the final rule, includes "Actions 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."

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	high concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	8.33	10.31	1.95	77
Total % Use Overlap = 100 ²		Total % Usage Overlap = 12.26 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect habitat function, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated is a preliminary high level of concern for impacts to habitat function. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 8.33% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 12.26% of critical habitat annually, with usage on 10.31% of the critical

habitat from mosquito control activities and usage on 1.95% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (77%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described for Federal lands under *Approach to Usage Analysis* in the Effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use and usage may be high outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

Based on overlap with use sites and past malathion usage, the dichotomous key indicated a preliminary high level of concern for potential impacts to habitat function. Characteristics of the critical habitat listed in the PBFs include "pesticide levels low enough to have minimal effect on survival of the butterfly or its ability to occupy the habitat." Florida leafwing butterfly mortality would be anticipated from malathion exposure on all use sites and in spray drift areas. However, conservation measures substantially reduce the risk of exposure for the Florida leafwing butterfly.

General conservation measures for agricultural, residential and mosquito control uses, such as reductions to the maximum allowable number of applications per year for a number of crops, application restrictions while crops are blooming to protect active pollinators (including the Florida leafwing butterfly) from exposure, and application restrictions for mosquito adulticide to only within two hours of dusk and dawn, are anticipated to substantially reduce the likelihood of exposure and environmental concentrations of malathion during times when pollinators such as the Florida leafwing butterfly are most active. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments a year from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in critical habitat.

Additionally, a species-specific measure has been put into place in order to further mitigate exposure to malathion from mosquito adulticide use, which is the use with the highest overlap and majority of the anticipated usage in the critical habitat. Specifically, the measure requires that, where feasible, applicators will not apply malathion as a mosquito adulticide within the designated critical habitat. If avoidance is not feasible or impairs the ability of the mosquito control district or agency to protect public health and welfare, the applicator must reach out to the local FWS Ecological Services field office(s) to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. The applicator must retain documentation of the technical assistance and the agreed upon species-specific measures that were implemented. This measure is expected to effectively reduce exposure of the Florida leafwing butterfly and contamination of critical habitat such that the habitat continues to function for the species.

Thus, while the extent of malathion use sites overlapping with critical habitat is high and past usage data indicates usage will be high in critical habitat, based on the information above,

including consideration of species-specific and general conservation measures, we anticipate that the Action poses a low risk to habitat function. We do not anticipate that malathion will directly or indirectly alter habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Florida leafwing butterfly.

Reference(s): 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 79:47180-47220.

Helotes Mold Beetle (*Batrisodes venyivi*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidities (near saturation), and suitable substrates (i.e., containing spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Surface and subsurface sources (e.g., plants and their roots, fruits, leaves, animal eggs, feces, and carcasses) that provide nutrient input into the karst ecosystem

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (*see* Effects of Critical Habitat Designation), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this species.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins	low concern
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	5.25	0	1.84	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.84 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 5.25% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.84% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.84% of the critical habitat from non-mosquito control activities.

While we do not anticipate high usage on malathion use sites that overlap with critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure was developed to provide additional protections for the critical habitat of the Helotes mold beetle. Applicators are not to apply malathion within 100 feet of designated critical habitat. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important source of nutrient input for karst ecosystems. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to

greatly minimize the likelihood of exposure and effectively protect the water quality and habitat function PBFs.

Anticipated malathion usage on use sites that overlap with the critical habitat is low, and both general label changes as well as species-specific conservation measures will further decrease the likelihood of exposure such that only low-level effects to the PBFs are expected. We do not anticipate that malathion will alter the PBFs to an extent that it will appreciably diminish the value of critical habitat as a whole for the conservation of the Helotes mold beetle. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Helotes mold beetle.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates. Final Rule. Federal Register 77:8450-8523.

Miami Tiger Beetle (*Cicindelidia Floridana*)

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

Physical and 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 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.”

The “Special Management Considerations or Protection” section of the proposed rule states, “Pesticides 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. Based on Miami-Dade Mosquito Control’s implementation of spray buffers around pine rocklands occupied by the Miami tiger beetle, mosquito control pesticides are not considered a current threat for the species. However, if these buffers were to change or Miami tiger beetles were found in habitat without restrictions of pesticide applications,

then the threat of exposure would need to be reevaluated.” 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.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	64.41	99.4	19.98	25
Total % Use Overlap = 100 ³		Total % Usage = 100		

¹ Use/usage data was not available for the species at the time of analysis. Use/usage data from the range of the Miami tiger beetle was used as a surrogate for this analysis

² Mosquito control use and usage may overlap with other usages.

³ Total use and usage overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary high level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Miami tiger beetle.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 64.41% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 100% of critical habitat annually, with usage on 99.4% of the critical habitat from mosquito control activities and usage on 19.98% of the critical habitat from non-mosquito control activities.

Conservation measures are expected to reduce the environmental concentrations of malathion entering critical habitat and affecting the arthropod prey base. Conservation measures for mosquito adulticide use will prohibit application during most daylight hours (restricting use to only occur two hours after sunrise and two hours before sunset), which is expected to reduce the concentration of malathion entering critical habitat during periods when the prey base is most active. Changes to residential use labels include limiting residential use to spot treatments only (greatly reducing offsite drift), reducing the extent of area which can be treated by as much as

75%, decreasing the number of allowable applications from “repeat as necessary” to a maximum of 2 to 4 applications per year, and requiring a 7-10 day retreatment interval, which is expected to reduce environmental concentrations by allowing initial residues to degrade before the next application. Additionally, changes to agricultural labels, such as reducing the number of allowable applications per year on a number of crops, which previously ranged from 3-13 applications per year, to 2-4 applications per year, is also expected to reduce environmental concentrations of malathion entering critical habitat. Furthermore, reductions to application rates, specifically for use on citrus, is expected to reduce environmental concentrations resulting from spray drift to one-third of modeled values. These general conservation measures are expected to substantially reduce the risk of exposure to the arthropod prey base of the Miami tiger beetle, reducing the impacts to the PBF.

In addition to general label changes, which apply to all uses specified on the label, additional species-specific measures are in place for both mosquito adulticide and agricultural uses. For mosquito control use, applicators, where feasible, must not apply malathion within the species range (which includes critical habitat), plus a 200-foot buffer. If not feasible, applicators are to coordinate with the local FWS field office to determine appropriate measures to ensure the proposed application is likely to have no more than minor effects on the species. For agricultural uses, applicators within 200 feet of the species range (which includes critical habitat) must apply malathion only when wind is blowing away from pine rockland habitat, or use a 50- to 200-foot application buffer (specific buffer sizes will vary depending on the application type and rate). Buffer sizes can be reduced if a full swath displacement upwind is used during aerial applications. These species-specific measures are expected to further reduce the risk of exposure and effects to the PBF.

While usage in and around critical habitat is anticipated to be high, the implementation of the general and species-specific conservation measures are expected to substantially reduce the environmental concentrations of malathion entering critical habitat, protecting the arthropod prey PBF and preserving critical habitat quality. Expanded buffers, between 50 to 200 feet for agricultural uses depending on the use and application type and 200 feet for mosquito adulticide, is anticipated to reduce spray drift from entering critical habitat by up to 82-90%, which would substantially reduce exposure to arthropod prey species. In cases where mosquito control applicators are not able to implement this extended buffer, they are directed to coordinate with the local FWS field office to determine appropriate alternative measures. Discussions at the local level allows for greater flexibility based on site- or species-specific considerations, such as timing, species life history, and geographic or habitat factors. Applicators subject to this conservation measures will be required to maintain records of their interactions with FWS offices, allowing us to better track this coordination and its outcomes moving forward. With these general and species-specific conservation measures in mind, we do not anticipate major impacts to the arthropod prey PBF.

While anticipated malathion usage on use sites that overlap with the critical habitat is high, conservation measures are expected to substantially reduce exposure and effects to arthropod prey. We do not anticipate that malathion will directly or indirectly alter this PBF to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Miami tiger beetle.

Reference(s):

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.

Salt Creek Tiger Beetle (*Cicindela nevadica lincolniana*)

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

Physical and 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
91.48	90.29	0	3.88	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 3.88 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
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¹Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Salt Creek tiger beetle.

Malathion use sites overlap with 100% of the critical habitat, with 91.48% and 90.29% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.88% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 3.88% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural and residential use labels, including implementation of aquatic habitat buffers, rain restrictions, and reduced maximum allowable applications per year, are expected to decrease environmental concentrations of malathion habitats such as the wetlands and mudflats the species occupies and further reduce risk to the PBF. Additional changes to mosquito adulticide labels, such as prohibitions on daytime applications, are expected to further reduce environmental concentrations of malathion and reduce risk to the PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod PBF. We do not anticipate that malathion will directly or indirectly alter arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Salt Creek tiger beetle.

Reference(s):

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 79:26014-26038.

Bay Checkerspot Butterfly (*Euphydryas editha bayensis*)

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

Physical and Biological Features:

- Annual or perennial grasslands with little to no overstory that provide north-south and east-west slopes with a tilt of more than 7 degrees for larval host plant survival during periods of atypical weather (e.g., drought). Common grassland species include wild oats (*Avena fatua*), soft chess (*Bromus hordeaceus*), California oatgrass (*Danthonia californica*), Italian ryegrass (*Lolium multiflorum*), purple needlegrass (*Nassella pulchra*), and Idaho fescue (*Festuca idahoensis*); less abundant in these grasslands are annual and perennial forbs such as filaree (*Erodium botrys*), true clovers (*Trifolium* sp.), and dwarf plantain (*Plantago erecta*). These species, with the exception of dwarf plantain, are not required by the Bay checkerspot butterfly, but merely are provided here as an example of species commonly found in California grasslands.
- The primary larval host plant, dwarf plantain (*Plantago erecta*), and at least one of the secondary host plants, purple owl's-clover (*Castilleja densiflora*) or exserted paintbrush (*Castilleja exserta*), are required for reproduction, feeding, and larval development.
- Adult nectar sources for feeding, including desert parsley (*Lomatium* spp.), California goldfields (*Lasthenia californica*), tidy-tips (*Layia platyglossa*), sea muilla (*Muilla maritima*), scytheleaf onion (*Allium falcifolium*), false babystars (*Linanthus androsaceus*), and intermediate fiddleneck (*Amsinckia intermedia*)
- Soils derived from serpentinite ultramafic rock (Montara, Climara, Henneke, Hentine, and Obispo soil series) or similar soils (Inks, Candlestick, Los Gatos, Fagan, and Barnabe soil series) that provide areas with fewer aggressive, nonnative plant species for larval host plant and adult nectar plant survival and reproduction
- Stable holes/cracks in the soil and surface rock outcrops

The PBFs focus on the presence of suitable habitats, including areas that provide host plants for feeding, breeding, and sheltering, as well as habitat structure and soil types that provide suitable habitat for the Bay checkerspot butterfly. In the Final Rule (*see* Special Management Considerations or Protection), “pesticide application (including drift)” is listed as a threat to PBFs. “Use of pesticides (for example, insecticides and herbicides) in or adjacent to critical habitat may affect populations of butterflies within these units. Populations adjacent to areas where there is intensive use of pesticides may be at risk as a result of drift and runoff.” In the Application of the “Adverse Modification” Standard section, “[d]irect application on, or drift onto, critical habitat of pesticides, herbicides, fertilizers, or other chemicals or biological agents” may affect critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	74.1	0.01	1.04	1.86
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.05 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect habitat function, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Bay checkerspot butterfly.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 74.1% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.05% of critical habitat annually, with usage on 0.01% of the critical habitat from mosquito control activities and usage on 1.04% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural and residential use labels, including reduced maximum allowable applications per year and restrictions on blooming crops are expected to protect pollinators and decrease environmental concentrations of malathion and further reduce risk to the PBF. Additional changes to mosquito adulticide labels, such as prohibitions on daytime applications, are expected to further reduce environmental concentrations of malathion and reduce risk to the habitat function PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the habitat function PBF. We do not anticipate that malathion will directly or indirectly alter habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Bay checkerspot butterfly.

Reference(s):

U. S. Fish and Wildlife Service. 2008. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bay Checkerspot Butterfly (*Euphydryas editha bayensis*). Final Rule. Federal Register 73:50406-50452.

Comal Springs Riffle Beetle (*Heterelmis comalensis*)

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

Physical and 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. The Final Rule identifies pesticides and herbicides associated with pathogenic organisms or invasive species as one of the threats to water quantity and quality.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	5.55	0	1.04	0
Total % Use Overlap = 5.55 ²		Total % Usage Overlap = 1.04 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Comal Springs riffle beetle.

Malathion use sites overlap with 5.55% of the critical habitat, with 0% and 5.55% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.04% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.04% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the Comal Springs riffle beetle.

Reference(s):

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.

[Unnamed] Ground Beetle (*Rhadine exilis*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidities (near saturation), and suitable substrates (i.e., containing spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Surface and subsurface sources (e.g., plants and their roots, fruits, leaves, animal eggs, feces, and carcasses) that provide nutrient input into the karst ecosystem

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of Critical Habitat Designation*), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this species.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	19.39	0	4.96	0.13
Total % Use Overlap = 100 ²		Total % Usage Overlap = 4.96 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 19.39% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 4.96% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 4.96% of the critical habitat from non-mosquito control activities.

However, while we do not anticipate high usage on malathion use sites that overlap with critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments

from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measure was developed to provide additional protections for the critical habitat of *Rhadine exilis*. Applicators are to avoid applying malathion within 100 feet around designated critical habitat. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important source of nutrient input for karst ecosystems. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to greatly minimize the likelihood of exposure and effectively protect the arthropod prey and habitat function PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for *Rhadine exilis*.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

[Unnamed] Ground Beetle (*Rhadine infernalis*)

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

Physical and Biological Features:

- Karst-forming rock containing subterranean spaces (caves and connected mesocaverns) with stable temperatures, high humidities (near saturation), and suitable substrates (i.e., containing spaces between and underneath rocks for foraging and sheltering) that are free of contaminants
- Surface and subsurface sources (e.g., plants and their roots, fruits, leaves, animal eggs, feces, and carcasses) that provide nutrient input into the karst ecosystem

The PBFs focus on maintaining the karst-forming rock formations and that they are free of contamination and sustain robust invertebrate populations. In the Final Rule (see *Effects of Critical Habitat Designation*), “[a]ctions that would introduce pollutants to the occupied features themselves, the surface or subsurface drainage basins, or the surrounding mesocaverns”, specifically including “pesticides or herbicides ... into or near critical habitat units that may affect surface plant and animal communities or that may affect the subsurface karst ecosystem or

degrade subsurface water quality”, are listed as “[a]ctions that may affect critical habitat” for this species.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	11.56	0	1.84	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 1.84 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and habitat function, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary low level of concern for impacts to both of these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 11.56% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.84% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.84% of the critical habitat from non-mosquito control activities.

While we do not anticipate high usage on malathion use sites that overlap with critical habitat, the interconnected nature of the karst systems that define this critical habitat create additional potential for contamination from nearby groundwater sources outside of the critical habitat that feed into cave systems within the critical habitat. However, general conservation measures, such as aquatic habitat buffers, rain restrictions, and changes to residential use labels, will reduce environmental concentrations of malathion entering the critical habitat. Aquatic habitat buffers for both agricultural and residential uses, which specify a distance from waterbodies (such as the springs and sinkholes that feed the cave systems the species occupies), will reduce environmental concentrations of malathion resulting from applications and associated spray drift. Rain restrictions, which prohibit the application of malathion within 24 or 48 hours of a forecasted

rain event for residential and agricultural uses, respectively, provides time for malathion to degrade before runoff events can occur, reducing the concentration of malathion in waters entering the cave systems that support the species. Changes to residential uses, such as limiting use to spot treatments only and reducing the maximum number of allowable treatments from an as needed basis to twice a year, are also expected to substantially reduce environmental concentrations of malathion in non-target areas, including critical habitat.

Additionally, a species-specific conservation measures was developed to provide additional protections for the critical habitat of *Rhadine infernalis*. The designated critical habitat area already includes a 344 foot buffer around cave entrances to protect the foraging area of cave crickets, an important source of nutrient input for karst ecosystems. This species-specific measure brings the total buffer distance from the critical habitat to 444 feet, which is anticipated to substantially reduce the likelihood of malathion entering critical habitat. This species-specific measure, in combination with the general conservation measures described above, is expected to greatly minimize the likelihood of exposure and effectively protect the arthropod prey and habitat function PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for *Rhadine infernalis*.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Designation of Critical Habitat for Nine Bexar County, TX, Invertebrates Final Rule and a 12-Month Finding On a Petition To Revise Critical Habitat Designation By Removing Unit 13 From Designation Under the Act - Not Warranted. Final Rule. Federal Register 77:8450-8523.

Poweshiek Skipperling (*Oarisma poweshiek*)

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

Physical and 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 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
35.69	45.65	0.31	3.91	4.08
Total % Use Overlap = 81.34 ²		Total % Usage Overlap = 4.22 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information). A portion (approximately 55%) of the critical habitat designated for this species occurs outside of the species' range. However, additional review and analysis of the critical habitat areas occurring outside the species' range indicate the usage data from the species range is still a suitable data source for this analysis.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect habitat function, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Poweshiek skipperling.

Malathion use sites overlap with 81.34% of the critical habitat, with 35.69% and 45.65% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 4.22% of critical habitat annually, with usage on 0.31% of the critical habitat from mosquito control activities and usage on 3.91% of the critical habitat from non-mosquito control activities. Our analysis indicated that a portion (approximately 55%) of the species' critical habitat is located outside of the species' range, which may indicate deviations from the usage data listed above. However, additional review and analyses indicate that most of the critical habitat areas outside of the species' range are in directly adjacent areas or nearby in areas within the same counties as the range. We confirmed that areas outside the species' range that occur in the same States are expected to have the same (or at least very similar) usage rates as areas within the species' range, as the applicable agricultural usage data is State-wide. For critical habitat units that were outside the species range and located in the same States but in different counties, we confirmed that these other counties did not have mosquito adulticide usage data available. Thus, we do not anticipate that any of the small differences we observed in critical habitat use site overlaps would substantially affect our assumptions about usage or likelihood of exposure of the PBFs.

General conservation measures involving changes to agricultural and residential use labels, including reduced maximum allowable applications per year for crops like vegetables and groundfruit, daytime restrictions on mosquito adulticide applications, and restrictions on blooming crops are expected to protect pollinators and decrease environmental concentrations of malathion and further reduce risk to habitat function. Additional changes to mosquito adulticide labels, such as prohibitions on daytime applications, are expected to further reduce environmental concentrations of malathion and reduce risk to the habitat function PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the habitat function PBF. We do not anticipate that malathion will directly or indirectly alter habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the specritical habitat for the Poweshiek skipperling.

Reference(s):

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 80:59248-59384.

Hine's Emerald Dragonfly (*Somatochlora hineana*)

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

Physical and 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 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
10.9	8.99	0.27	1.71	50.78
Total % Use Overlap = 19.89 ²		Total % Usage Overlap = 1.98 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Hine's emerald dragonfly.

Malathion use sites overlap with 19.89% of the critical habitat, with 10.9% and 8.99% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.98% of critical habitat annually, with usage on 0.27% of the critical habitat from mosquito control activities and usage on 1.71% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (50.78%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, day time restrictions on mosquito adulticide applications, and reductions in the number of allowable applications for a number of crops will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water

quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Hine's emerald dragonfly.

Reference(s):

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.

Bartram's Hairstreak Butterfly (*Strymon acis bartrami*)

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

Physical and 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 described in the final rule, includes “Actions 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.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	10.25	2.5	1.71	72.38
Total % Use Overlap = 100 ²		Total % Usage Overlap = 4.21 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect habitat function, is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Bartram’s hairstreak butterfly.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 10.25% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 4.21% of critical habitat annually, with usage on 2.5% of the critical habitat from mosquito control activities and usage on 1.71% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species’ critical habitat (72.38%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat,

and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures involving changes to agricultural and residential use labels, including reduced maximum allowable applications per year for a variety of crops, day time mosquito adulticide application restrictions, and restrictions on blooming crops are expected to protect pollinators and decrease environmental concentrations of malathion and further reduce risk to habitat function. Additional changes to mosquito adulticide labels, such as prohibitions on daytime applications, are expected to further reduce environmental concentrations of malathion and reduce risk to the habitat function PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the habitat function PBF. We do not anticipate that malathion will directly or indirectly alter habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Bartram's hairstreak butterfly.

Reference(s):

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 79:47180-47220.

Comal Springs Dryopid Beetle (*Stygoparnus comalensis*)

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

Physical and 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. The Final Rule identifies pesticides and herbicides associated with pathogenic organisms or invasive species as one of the threats to water quantity and quality.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	53.18	0	1.72	0
Total % Use Overlap = 53.18 ²		Total % Usage Overlap = 1.72 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Comal Springs dryopid beetle.

Malathion use sites overlap with 53.18% of the critical habitat, with 0% and 53.18% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.72% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 1.72% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the

species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the Comal Springs dryopid beetle.

Reference(s):

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.

N. Mammals

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 12. Summary of Mammal Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Canis lupus</i>	Gray wolf	1	see below
<i>Corynorhinus (=Plecotus) townsendii virginianus</i>	Virginia big-eared bat	1	see below
<i>Dipodomys heermanni morroensis</i>	Morro Bay kangaroo rat	1	see below
<i>Dipodomys merriami parvus</i>	San Bernardino Merriam's kangaroo rat	2	no relevant PBFs
<i>Dipodomys nitratooides exilis</i>	Fresno kangaroo rat	2	no relevant PBFs
<i>Eumops floridanus</i>	Florida bonneted bat	3	see below
<i>Lynx canadensis</i>	Canada lynx	2	no relevant PBFs
<i>Martes caurina</i>	Pacific marten	3	see below
<i>Microtus californicus scirpensis</i>	Amargosa vole	2	no relevant PBFs
<i>Myotis sodalis</i>	Indiana bat	1	see below
<i>Oryzomys palustris natator</i>	Rice rat	2	no relevant PBFs
<i>Ovis canadensis nelsoni</i>	Peninsular bighorn sheep	2	no relevant PBFs
<i>Ovis canadensis sierrae</i>	Sierra Nevada bighorn sheep	2	no relevant PBFs
<i>Panthera onca</i>	Jaguar	2	no relevant PBFs
<i>Pekania pennanti</i>	Fisher (Southern Sierra Nevada DPS)	3	≥95% Federal lands overlap
<i>Peromyscus polionotus allopshys</i>	Choctawhatchee beach mouse	2	no relevant PBFs
<i>Peromyscus polionotus ammobates</i>	Alabama beach mouse	2	no relevant PBFs
<i>Peromyscus polionotus peninsularis</i>	St. Andrew beach mouse	2	no relevant PBFs
<i>Peromyscus polionotus trissyllepsis</i>	Perdido Key beach mouse	2	no relevant PBFs
<i>Pteropus mariannus mariannus</i>	Mariana fruit bat (=Mariana flying fox)	3	no overlap
<i>Rangifer tarandus caribou</i>	Woodland caribou	2	no relevant PBFs
<i>Sorex ornatus relictus</i>	Buena Vista Lake ornate shrew	3	see below
<i>Tamiasciurus hudsonicus grahamensis</i>	Mount Graham red squirrel	2	no relevant PBFs

Scientific Name	Common Name	Category	Rationale
<i>Thomomys mazama pugetensis</i>	Olympia pocket gopher	2	no relevant PBFs
<i>Thomomys mazama tumuli</i>	Tenino pocket gopher	2	no relevant PBFs
<i>Thomomys mazama yelmensis</i>	Yelm pocket gopher	2	no relevant PBFs
<i>Trichechus manatus</i>	West Indian Manatee ⁴	2	no relevant PBFs
<i>Ursus maritimus</i>	Polar bear	2	no relevant PBFs
<i>Zapus hudsonius luteus</i>	New Mexico meadow jumping mouse	3	see below
<i>Zapus hudsonius preblei</i>	Preble's meadow jumping mouse	2	no relevant PBFs

Gray Wolf (*Canis lupus*)

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. Wolves primarily are predators of medium and large mammals, primarily: deer, moose, bison, elk, sheep, mountain goat, caribou, and antelope. This species will also prey on with small mammals, beavers, birds, and large invertebrates. Other dietary items include: domestic animals (dogs, sheep, and cattle), birds, fish, and plant items such as berries and fruits. The critical habitat rule notes a decline in deer, the wolf's main prey species, resulting primarily from forest maturation and severe winter weather as a threat. Therefore, we have identified non-arthropod prey as a relevant PBF.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect non-arthropod prey, which is a critical habitat PBF essential for the conservation of the species. However, as discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the gray wolf.

Following a February 10, 2022 court decision, critical habitat for gray wolves in Minnesota and Michigan was reinstated after a November 3, 2020 rule removed the critical habitat designation. Due to the timing for completion of this Opinion, we were unable to generate a use and usage overlap table for this critical habitat analysis. However, only low usage is anticipated based on a prior analysis of use and usage in the species range (see the species analysis in Appendix K). Additionally, only low level effects are anticipated for the non-arthropod prey PBF. We anticipate reduction in a small number of birds, fish and amphibians exposed to malathion. However, mammals, the preferred prey item of the gray wolf, are unlikely to experience effects. Based on the anticipated low usage and low effects to the non-arthropod prey PBF, we do not anticipate that malathion will alter the PDF to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the gray wolf.

⁴ The species' critical habitat designation did not contain relevant PBFs to insecticides and was not analyzed further for effects of the Action.

Reference(s):

U.S. Fish and Wildlife Service. 1978. Reclassification of the gray wolf in the United States and Mexico, with determination of critical habitat in Michigan and Minnesota. Federal Register 47:9607-9615.

Virginia Big-Eared Bat (*Corynorhinus* (=Plecotus) townsendii virginianus)

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 primary food source is moths (>80%). Therefore, we have identified arthropods as a relevant PBF.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
20.89	13.66	0	0.25	28.75
Total % Use Overlap = 34.55 ²		Total % Usage Overlap = 0.25 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Virginia big-eared bat.

Malathion use sites overlap with 34.55% of the critical habitat, with 20.89% and 13.66% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.25% of critical habitat annually, with usage on 0% of

the critical habitat from mosquito control activities and usage on 0.25% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural and residential use labels, including reduced maximum allowable yearly applications for a variety of specific uses, will reduce environmental concentrations of malathion. This decreased exposure to malathion will decrease potential effects to the arthropod PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod prey PBF. We do not anticipate that malathion will directly or indirectly alter arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Virginia big-eared bat.

Reference(s):

U.S. Fish and Wildlife Service. 2019. Virginia Big-Eared Bat (*Corynorhinus townsendii virginianus*) 5-Year Review: Summary and Evaluation. West Virginia Ecological Services Field Office, Elkins. 45 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for the Virginia Big-Eared Bat (*Corynorhinus townsendii virginianus*). Northeast Region, Hadley, Massachusetts. 18 pp.

U.S. Fish and Wildlife Service. 1984. A Recovery Plan for the Ozark Big-Eared Bat and the Virginia Big-Eared Bat. Region 3, Twin Cities, Minnesota. 119 pp.

U.S. Fish and Wildlife Service. 1979. Endangered and Threatened Wildlife and Plants; Listing of Virginia and Ozark Big-Eared Bats as Endangered Species, and Critical Habitat Determination. Federal Register 44:69206-69208.

Morro Bay Kangaroo Rat (*Dipodomys heermanni morroensis*)

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 feeds on substrate, seeds, foliage, flowers, fruits, insects, and land snails. Therefore, we have identified arthropods and non-arthropod prey as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	snails	low concern
water quality	--	--	--
host fish	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
94.65	41.48	0	0.06	0.43
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.06 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Morro Bay kangaroo rat.

Malathion use sites overlap with 100% of the critical habitat, with 94.65% and 41.48% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.06% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.06% of the critical habitat from non-mosquito control activities.

Changes to agricultural labels will reduce the maximum allowable yearly application number on a variety of crops that overlap with or are adjacent to the species' critical habitat, reducing exposure to malathion. Furthermore, changes in residential use labels, including reducing maximum allowable yearly applications, limiting application to spot treatments, and reducing the extent of area which can be treated are expected to further reduce environmental concentrations of malathion. With these conservation measures in mind, we anticipate effects to the arthropod and non-arthropod prey base PBFs will be small.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Morro Bay kangaroo rat.

Reference(s):

U.S. Fish and Wildlife Service. 2021. Morro Bay Kangaroo Rat (*Dipodomys heermanni morroensis*) 5-Year Review. Ventura Ecological Services Field Office, California. 6 pp.

U.S. Fish and Wildlife Service. 2000. Draft Revised Recovery Plan for the Morro Bay Kangaroo Rat (*Dipodomys heermanni morroensis*). Region 1, Portland, Oregon. 110 pp.

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

Florida bonneted bat (*Eumops floridanus*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

The following summarize the primary PBFs of the critical habitat. Further details about each one are provided in the proposed rule.

- Representative forest types (all age classes) that support the Florida bonneted bat by providing roosting and foraging habitat within its core areas
- Habitat that provides for roosting and rearing of offspring
- Habitat that provides for foraging, which may vary widely across the Florida bonneted bat's range, in accordance with ecological conditions, seasons, and disturbance regimes that influence vegetation structure and prey species distributions... Foraging habitat consists of:
 - Sources for drinking water and prey, including open fresh water and permanent or seasonal freshwater wetlands, in natural or rural areas (non-urban areas)
 - Wetland and upland forests, open freshwater wetlands, and wetland and upland shrub (which provide a prey base and suitable foraging conditions (i.e. open habitat structure))
 - Natural or semi-natural habitat patches in urban or residential areas that contribute to prey base and provide suitable foraging conditions (i.e. open habitat structure); and/or
 - The presence and abundance of the bat's prey (i.e. large flying insects) in sufficient quantity, availability, and diversity necessary for reproduction, development, growth, and survival
- A dynamic disturbance regime (natural or artificial) (e.g. fire, hurricanes) that maintains and regenerates forested habitat, including plant communities, open habitat structure, and temporary gaps, which is conducive to promoting a continual supply of roosting sites, prey items, and suitable foraging conditions
- Large patches (more than 40,470 ha (100,000 ac)) of forest and associated natural or semi-natural habitat types that represent functional ecosystems with a reduced influence from humans (i.e., areas that shield the bat from human disturbance, artificial lighting, habitat loss and degradation)
- Corridors, consisting of roosting and foraging habitat, that allow for population maintenance and expansion, dispersal, and connectivity among and between geographic areas for natural and adaptive movements, including those necessitated by climate change

- A subtropical climate that provides tolerable conditions for the species, such that normal behavior, successful reproduction, and rearing of offspring are possible

Activities described in the proposed rule (*see* Application of the “Adverse Modification” Standard) that the FWS may find would be considered likely to destroy or adversely modify critical habitat include, “Actions that would significantly... impact prey base (e.g., availability, abundance, density, diversity). In addition to altering habitat, vegetation, or structure (given above), this includes, but is not limited to: Widespread application of pesticides; exposure to contaminants (e.g., direct or through drinking water or food chain) ...” A section on pesticides and contaminants in the proposed rule states that areas with intensive pesticide activity may not support an adequate food base. Foraging habitat can be enhanced, in part, by limiting the use of pesticides, including agrochemicals (chemicals used in agriculture) and landowners and land managers can help reduce some risks of exposure and improve foraging conditions for the Florida bonneted bat by avoiding or limiting use of insecticides (e.g., mosquito control, agricultural).

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	--	--	--
water quality	X	Bins 3, 4, 6, 7	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
75.29	23.79	2.85	3.16	55.31
Total % Use Overlap = 99.08 ³		Total % Usage = 6.01		

¹ Use/usage data was not available for the species at the time of analysis. Use/usage data from the range of the Florida bonneted bat was used as a surrogate for this analysis

² Mosquito control use and usage may overlap with other usages.

³ Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the dichotomous key, there is preliminary high level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 99.08% of the critical habitat, with 75.29% and 23.79% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 6.01% of critical habitat annually, with usage on 2.85% of the critical habitat from mosquito control activities and usage on 3.16% of the critical habitat

from non-mosquito control activities. However, given that we are using species range use and usage data as a surrogate for critical habitat, and that there is a higher proportion of proposed critical habitat located on Federal lands as compared to the species range (55.31% as opposed to 16.69%), it is likely that the overlap and usage values overestimate exposure that would occur within the proposed critical habitat.

A fairly large portion of the species' critical habitat (55.31%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate only low levels of effects on the Federal portion. While expected use and usage may be high outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

While there was initially high concern for the water quality PBF due to the high level of expected usage, the bat uses open water habitats for drinking in flight, and therefore we expect it will generally use more sizable aquatic habitats. We expect impacts to the water quality PBF would be less likely in aquatic habitats with higher flows or volumes, as larger water bodies would not likely accumulate malathion at high enough concentrations that would affect the value of the critical habitat for the conservation of the species. Additionally, the conservation measures and label changes described below would further decrease malathion concentrations in all aquatic habitats, further decreasing the risk of the water quality PBF becoming unsuitable for the species.

Arthropods are known to be sensitive to malathion exposure, and loss of prey base is a concern for Florida bonneted bat's critical habitat and usage in critical habitat is high enough to be of concern. However, the conservation measures and label changes described below are expected to reduce environmental concentrations of malathion in critical habitat and mitigate effects to the arthropod PBF.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, substantially reduce spray drift from entering aquatic habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, provides time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and water quality PBFs.

General conservation measures involving changes to agricultural and residential use labels, including reduced maximum allowable yearly applications for a variety of specific uses, will reduce environmental concentrations of malathion. Additionally, changes to residential use labels, such as limiting residential use to spot treatments only, reducing the number of allowable applications per year, and reducing the extent of area which can be treated in developed and open space developed areas by as much as 75%, are expected to substantially reduce environmental

concentrations within the proposed critical habitat. This decreased exposure to malathion will decrease potential effects to the PBFs.

Although we anticipate usage on use sites that overlap with critical habitat will be high, the required conservation measures are expected to reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter water quality and arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the critical habitat for the Florida bonneted bat.

Reference(s):

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Florida Bonneted Bat. Proposed Rule. Federal Register 85:35510-35544.

Pacific marten, Coastal DPS (*Martes caurina*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

The following summarizes the primary PBFs of the critical habitat. Further details about each one are provided in the proposed rule.

- Habitat that supports a coastal marten home range by providing for breeding, denning, resting, or foraging. This habitat provides cover and shelter to facilitate thermoregulation and reduce predation risk, foraging sources for marten prey, and structures that provide resting and denning sites. To provide cover and support denning, resting, and foraging, coastal martens require a mature forest overstory, dense understory development, and biologically complex structure that contains snags, logs, other decay elements, or other structures that support denning, resting, or marten prey.
- Habitat that allows for movement within home ranges among stands that meet the PBF above, or supports individuals dispersing between home ranges.

Activities described in the proposed rule (*see* Application of the “Adverse Modification” Standard) that the FWS may find would be considered likely to destroy or adversely modify critical habitat include actions that may cause significant reductions in the amount, extent, or quality of habitat available to coastal martens for needs including feeding. Activities that could reach this magnitude of impact to PBFs could include noxious weed treatments, forest pest and disease management. Martens are dietary generalists. Small mammals dominate their diet year round, with some mammal species varying by season. Birds, insects and fruits are also seasonally important. Special management and protection considerations discussed in the rule include reducing direct or indirect threats from inadvertent poisoning from rodenticides.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	mammals, birds	low concern
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data¹

Mosquito Adulticide Use (% overlap with critical habitat) ²	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ²	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
29.5	3.37	0	1.39	91.47
Total % Use Overlap = 32.87 ³		Total % Usage = 1.39		

¹ Use/usage data was not available for the species at the time of analysis. Use/usage data from the range of Humboldt marten was used as a surrogate for this analysis. The Pacific marten (Coastal DPS) is a listable entity of the Humboldt marten subspecies (*M. c. humboldtensis*).

² Mosquito control use and usage may overlap with other usages.

³ Total overlap is capped at 100%.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Pacific marten.

Malathion use sites overlap with 32.87% of the critical habitat, with 29.5% and 3.37% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.39% of critical habitat annually, with all usage coming from non-mosquito adulticide uses.

A fairly large portion of the species' critical habitat (91.47%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

Changes in residential use labels, which would reduce the maximum number of applications that can be made in a year, as well as limit residential use to spot treatments and reduce the extent of area which can be treated, would reduce environmental concentrations of malathion and further decrease risk of adverse effects to critical habitat. With these conservation measures in mind, we anticipate the impacts to the PBFs would be small.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Pacific marten.

Reference(s):

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Coastal Distinct Population Segment of the Pacific Marten. Final Rule. Federal Register 85:63806-63830.

Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Coastal Distinct Population Segment of the Pacific Marten. Proposed Rule. Federal Register 86:58831-58858.

Indiana Bat (*Myotis sodalis*)

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 feeds on flying insects and occasionally spiders. Therefore, we have identified arthropods and non-arthropod prey as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	--	low concern
water quality	--	--	--
host fish	--	--	--
habitat function		--	

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
23.34	0	0.31	0	7.34
Total % Use Overlap = 23.34 ²		Total % Usage Overlap = 0.31 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Indiana bat.

Malathion use sites overlap with 23.34% of the critical habitat, with 23.34% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.31% of critical habitat annually, with usage on 0.31% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be very low, and will have low effects to the arthropod and non-arthropod prey PBFs. While some reduction in prey is expected where applications occur, we anticipate sufficient alternative prey will remain and the bat will be able to utilize alternative foraging sites as needed. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Indiana bat.

Reference(s):

U.S. Fish and Wildlife Service. 2019. Indiana Bat (*Myotis sodalis*) 5-Year Review. Indiana Ecological Services Field Office, Bloomington. 91 pp.

U.S. Fish and Wildlife Service. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Great Lakes-Big Rivers Region 3, Fort Snelling, Minnesota. 258 pp.

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

Buena Vista Lake Ornate Shrew (*Sorex ornatus relictus*)

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

Physical and 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 Final Rule (*see* Application of the ‘Adverse Modification’ Standard), activities “that could affect water quality within critical habitat” may adversely modify critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	X	snails	low concern
water quality	X	aquatic bins 2 and 5	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
83.74	95.71	0 ³	Medium ³	13.32
Total % Use Overlap = 100 ²		Total % Usage Overlap = Medium ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was unavailable for this species, however a qualitative assessment indicated that usage within the species range and critical habitat is anticipated to be low (*see Description of Critical Habitat Analysis* in the Opinion for more information regarding critical habitat analysis and the usage information below for more information regarding usage in the range of the Buena Vista Lake ornate shrew).

Usage:

Prior to finalizing this Opinion, we discovered that the overlap of malathion use sites with the species range was calculated based on an inaccurate range map for this species. As a result, we did not carry forward the overlap values from the draft Opinion into this final Opinion. Instead, we qualitatively estimated the types and extent of malathion use sites occurring within the range by visually examining mapped crop use data layers in proximity to the species range and critical habitat using GIS.

For an estimation of usage in the species range and critical habitat, we considered county-level CalPUR data for agriculture, county level sales and usage data for mosquito adulticide, and national-level developed and open space developed usage (which is consistent with our overall estimates for listed species for these use types).

Information from CalPUR indicates that malathion usage has occurred on crops within the range and critical habitat of the Buena Vista Lake ornate shrew within the pasture, vegetables and ground fruit, orchards and vineyards, cotton, and wheat UDLs. Because known locations of shrews within the range occur in relatively small fragmented units (including designated critical habitat areas) that are often adjacent to or surrounded by agricultural fields, any usage in these areas could correspond to disproportionately large percentage of occupied habitat and designated critical habitat.

We estimate that up to 5% of developed and open space developed use sites within the species range and critical habitat would undergo some level of treatment with malathion. However, given the habitat preferences of the Buena Vista Lake ornate shrew and the likely limited applications within of the portions of the critical habitat (riparian and wetland areas) in which the relevant PBFs are most likely found within these use sites, this usage is unlikely to be of significance to the shrew's designated critical habitat.

For mosquito adulticide, neither CalPUR nor sales data for the last five years indicate past usage of malathion within the counties where the shrew's range (including critical habitat) is located, and we expect similar lack of usage in the future. Therefore, we do not anticipate mosquito adulticide usage overlap with critical habitat.

For non-mosquito adulticide uses, primarily agricultural uses, we estimate that usage will be medium in and adjacent to critical habitat based on land uses in the vicinity of designated areas.

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary high level of concern for impacts to the water quality and arthropod prey PBFs, and low concern for the non-arthropod prey PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Buena Vista Lake ornate shrew.

Malathion use sites overlap with 100% of the critical habitat, with 83.74% and 95.71% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will not occur in the critical habitat from mosquito control activities, but we do anticipate medium usage on the critical habitat from non-mosquito control activities (especially agriculture uses) based on anticipated usage in the species range, as discussed above. Given that the critical habitat is found entirely within the species' range, and based on a visual assessment of uses that overlap the critical habitat, we anticipate usage levels will be similar in the critical habitat.

Arthropods are known to be sensitive to malathion exposure and loss of prey base is a concern for this critical habitat. We anticipate that usage in critical habitat will be high enough to have warranted a preliminary high level of concern. However, conservation measures, as described below, are expected to reduce environmental concentrations of malathion in critical habitat and mitigate the effects to the arthropod prey PBF. Non-arthropod prey are less sensitive to malathion, and warranted a preliminary low level of concern due to low levels of anticipated effects. The effects are expected to be further reduced by the conservation measures.

There was a preliminary high level of concern for the water quality PBF due to the high level of expected usage. We anticipate that low flow, low volume, small, and localized bodies of water would accumulate high concentrations of malathion in the absence of effective conservation measures. This species heavily relies on these vulnerable habitats, and it follows that the critical habitat would not be able to support the listed species in areas with high levels of malathion exposure. However, we expect that both general and species-specific conservation measures that

will be implemented, as described below, will reduce environmental concentrations of malathion in critical habitat areas and effectively mitigate the effects to the water quality PBF.

We anticipate that several general conservation measures will substantially reduce the exposure of PBFs from malathion applications. Aquatic buffers, which specify on the label distances from water bodies where pesticides cannot be applied, are designed to reduce the fraction of spray drift entering aquatic habitats, with low flow and low volume habitats (the most sensitive areas, which are relevant to both the species and its critical habitat) receiving the most protection from these buffers. Rain restrictions prohibit malathion application within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event, providing time for the malathion to degrade before runoff events can occur, which also significantly reduces contamination of critical habitat. New restrictions on residential use labels, including limiting use to spot treatments only, reducing maximum number of treatments to 2-4 per year (depending on the specific use), increasing retreatment intervals to 7-10 days, and setting aquatic habitat buffers and rain restrictions that apply to developed and open space developed areas, are also expected to substantially reduce contamination of critical habitat. With these conservation measures in place, we anticipate only small effects to arthropod prey, non-arthropod prey and water quality PBFs.

To expand further upon these broadly applied general label changes, the following species-specific conservation measure was developed for the Buena Vista Lake ornate shrew: Apply by ground application only within 100 feet from occupied sites (as described in the 2020 Species Status Assessment). Designated critical habitat is comprised of seven critical habitat units; all of the units are considered to be occupied based on the 2020 Species Status Assessment. This species-specific measure, in combination with the general conservation measures described above, is expected to further minimize the likelihood of exposure and effectively protect the arthropod and non-arthropod prey base and water quality PBFs.

Although we anticipate usage on use sites that overlap with critical habitat will be medium, the required conservation measures are expected to substantially reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey, non-arthropod prey, and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the Buena Vista Lake ornate shrew.

Reference(s):

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 78:39835-39867.

U.S. Fish and Wildlife Service. 2020. Buena Vista Lake Ornate Shrew Species Status Assessment. U.S. Fish and Wildlife Service, Sacramento, CA. 97 pp.

New Mexico Meadow Jumping Mouse (*Zapus hudsonius luteus*)

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

Physical and Biological Features:

- Riparian communities along rivers and streams, springs and wetlands, or canals and ditches that contain:
 - Persistent emergent herbaceous wetlands especially characterized by presence of primarily forbs and sedges (*Carex* spp. or *Schoenoplectus pungens*)
 - Scrub-shrub riparian areas that are dominated by willows (*Salix* spp.) or alders (*Alnus* spp.) with an understory of primarily forbs and sedges
 - Flowing water that provides saturated soils that supports tall (average stubble height of herbaceous vegetation of at least 61 cm (24 in)) and dense herbaceous riparian vegetation composed primarily of sedges (*Carex* spp. or *Schoenoplectus pungens*) and forbs, including: Spikerush (*Eleocharis macrostachya*), beaked sedge (*Carex rostrata*), rushes (*Juncus* spp., *Scirpus* spp.), and numerous species of grasses such as bluegrass (*Poa* spp.), slender wheatgrass (*Elymus trachycaulus*), brome (*Bromus* spp.), or foxtail barley (*Hordeum jubatum*), and forbs such as water hemlock (*Circuta douglasii*), field mint (*Mentha arvensis*), asters (*Aster* spp.), or cutleaf coneflower (*Rudbeckia laciniata*)
 - Sufficient areas of 9 to 24 kilometers (5.6 to 15 miles) along a stream, ditch, or canal that contain suitable or restorable habitat to support movements
 - Adjacent floodplain and upland areas extending approximately 100 m (330 ft) outward from the boundary between the active water channel and the floodplain

These PBFs focus on habitat type and structure. The PBF section of the Final Rule discusses the reliance of the jumping mouse on tall and dense vegetation as described in the PBFs above, and states, “[t]his vegetation is an important resource need for the jumping mouse because it provides vital food sources (insects and seeds), as well as the structural material for building day nests that are used for shelter from predators. It is imperative that the jumping mouse have rich abundant food sources during the summer so that it can accumulate sufficient fat reserves to survive the long hibernation period because the subspecies does not cache food for the winter.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
42.71	18.56	1.27	0.23	38.25
Total % Use Overlap = 61.27 ²		Total % Usage Overlap = 1.5 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the New Mexico meadow jumping mouse.

Malathion use sites overlap with 61.27% of the critical habitat, with 42.71% and 18.56% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.5% of critical habitat annually, with usage on 1.27% of the critical habitat from mosquito control activities and usage on 0.23% of the critical habitat from non-mosquito control activities.

Changes to agricultural use labels, including reductions in the allowable maximum number of applications that can be made in a year for crops that overlap with or are adjacent to the species' critical habitat, would reduce environmental concentrations of malathion. Additionally, changes in residential use labels, which also reduce the maximum number of applications that can be made in a year, as well as limit the residential use to spot treatments and reduce the extent of area which can be treated, are expected to further reduce environmental concentrations of malathion. With these conservation measures in mind, we anticipate the impacts to the PBFs would be small.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod prey PBF. We do not anticipate that malathion will directly or indirectly alter arthropod prey to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the New Mexico meadow jumping mouse.

Reference(s):

U. S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the New Mexico Meadow Jumping Mouse. Final Rule. Federal Register 81:14264-14325.

O. Reptiles

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 13. Summary of Reptile Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Ameiva polops</i>	St. Croix ground lizard	1	no overlap
<i>Anolis roosevelti</i>	Culebra Island giant anole	1	no overlap
<i>Caretta caretta</i>	Loggerhead sea turtle	2	no relevant PBFs
<i>Crocodylus acutus</i>	American crocodile	1	see below
<i>Crotalus willardi obscurus</i>	New Mexican ridge-nosed rattlesnake	1	see below
<i>Cyclura stejnegeri</i>	Mona ground Iguana	1	no overlap
<i>Dermochelys coriacea</i>	Leatherback sea turtle	1	no overlap
<i>Epicrates monensis monensis</i>	Mona boa	1	no overlap
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	1	no overlap
<i>Gopherus agassizii</i>	Desert tortoise	2	no relevant PBFs
<i>Kinosternon sonoriense longifemorale</i>	Sonoyta Mud Turtle	3	see below
<i>Masticophis lateralis euryxanthus</i>	Alameda whipsnake (=striped racer)	3	see below
<i>Pituophis melanoleucus lodingi</i>	Black Pinesnake	3	see below
<i>Pseudemys rubriventris bangsi</i>	Plymouth red-bellied turtle	3	see below
<i>Thamnophis eques megalops</i>	Northern Mexican gartersnake	3	see below
<i>Thamnophis rufipunctatus</i>	Narrow-headed garter snake	3	see below
<i>Uma inornata</i>	Coachella Valley fringe-toed lizard	2	no relevant PBFs

American Crocodile (*Crocodylus acutus*)

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. American crocodile habitats include mangrove swamps, exposed shorelines and low-energy fresh and brackish-water inland swamps, creeks and bays. The species forages opportunistically and eats fish, crabs, snakes, small invertebrates, turtles, birds and small mammals. Water quality is a concern for the species and contaminants (including pesticides and PCBs) are known to occur in American crocodiles. Therefore, we have identified arthropod prey, non-arthropod prey, and water quality as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	high concern
non-arthropod prey	X	mammals, crustaceans, birds, reptiles and fish	high concern
water quality	X	aquatic bins 2,3,4,5,6,7	high concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
47.04	1.17	8.58	0.78	77.88
Total % Use Overlap = 48.21 ²		Total % Usage Overlap = 9.36 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. Based on the results of the dichotomous key, there is a preliminary high level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the species.

Malathion use sites overlap with 48.21% of the critical habitat, with 47.04% and 1.17% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 9.36% of critical habitat annually, with usage on 8.58% of

the critical habitat from mosquito control activities and usage on 0.78% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (77.88%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use and usage may be high outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

Malathion use is expected to impact prey species availability, which can decrease the critical habitat's conservation value to the listed species. However, based on the information available, we do not anticipate malathion will affect all prey species uniformly. We anticipate that malathion would disproportionately impact fish and bird prey in certain scenarios (primarily in systems where mosquito adulticide is the predominant source of malathion). While this species is known to consume these high-risk non-arthropod prey, it has a varied diet that includes a number of taxa that are not sensitive to malathion exposure. Thus, while malathion usage is expected to be high in critical habitat, we do not anticipate significant effects to food resources and impacts to non-arthropod prey PBF would be small.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, water quality, and non-arthropod prey PBFs.

Although we anticipate usage on use sites that overlap with critical habitat will be high, the required conservation measures are expected to reduce effects to the PBFs. We do not anticipate that malathion will directly or indirectly alter arthropod prey, non-arthropod prey and water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to result in the destruction or adverse modification of critical habitat for the critical habitat for the American crocodile.

Reference(s):

U.S. Fish and Wildlife Service. 2019. Recovery Plan for the Distinct Population Segment of the American Crocodile (*Crocodylus acutus*) in Florida. South Florida Ecological Services Field Office, Vero Beach. 9 pp.

U.S. Fish and Wildlife Service. 1999. American crocodile, *Crocodylus acutus*, species account in South Florida multi-species recovery plan. Atlanta, Georgia. 2172 pp.

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

New Mexican Ridge-nosed Rattlesnake (*Crotalus willardi obscurus*)

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 is known to eat lizards, centipedes, small mammals, and passerine birds. Therefore, we have identified arthropods and non-arthropod prey as relevant PBFs.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	mammals, birds and reptiles	low concern
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	1.52	0	0.3	0
Total % Use Overlap = 1.52 ²		Total % Usage Overlap = 0.3 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the New Mexican ridge-nosed rattlesnake.

Malathion use sites overlap with 1.52% of the critical habitat, with 0% and 1.52% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates

that usage will occur on 0.3% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.3% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural use labels, including reducing the maximum allowable number of applications made in a year for crops that overlap with the species' critical habitat, would reduce environmental concentrations of malathion and reduce the risk to the PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the New Mexican ridge-nosed rattlesnake.

Reference(s):

- U.S. Fish and Wildlife Service. 2019. New Mexican Ridge-Nosed Rattlesnake (*Crotalus willardi obscurus*) 5-Year Review: Summary and Evaluation. New Mexico Ecological Services Field Office, Albuquerque. 23 pp.
- U.S. Fish and Wildlife Service. 2019. Supplemental Finding for New Mexico Ridgenose Rattlesnake Recovery Plan. Southwest Region 2, Albuquerque, New Mexico. 9 pp.
- U.S. Fish and Wildlife Service. 1985. New Mexico Ridgenose Rattlesnake Recovery Plan. Region 2, Albuquerque, New Mexico. 64 pp.
- U.S. Fish and Wildlife Service. 1978. Listing of the New Mexican Ridge-Nosed Rattlesnake as a Threatened Species With Critical Habitat. Federal Register 43:34476-34480.

Sonoyta Mud Turtle (*Kinosternon sonoriense longifemorale*)

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

Physical and Biological Features:

- Aquatic habitat (i.e., streams, natural/man-made ponds) with perennial or near-perennial sources of water, containing or including:
 - Surface water up to 2m (7 ft) deep with a rocky, muddy, or sandy substrate and emergent or submergent vegetation
 - Surface water free of nonnative predators and competitors, including crayfish, American bullfrogs, and large sunfish
 - Shallow water areas with dense emergent vegetation (e.g., cattail, spikerush, travelling spikerush)
 - Access to deeper open water in ponds and submerged vegetation
 - Areas with complex structure, including protective shelter sites (i.e., root masses, rock features, undercut banks)

- Aquatic invertebrates (e.g., Anisoptera, Trichoptera, Diptera, Coleoptera, aquatic snail species) and their corresponding habitat, including submergent or emergent vegetation and a variety of forage, and prey such as algae, diatoms, other microorganisms
- Terrestrial, riparian habitat, adjacent to suitable aquatic habitat, containing or including:
 - Accessible shoreline without insurmountable rock or artificial vertical barriers to allow movement between wetted sites, aquatic habitats and terrestrial nest sites
 - Riparian areas that maintain soil moisture to prevent desiccation of eggs and provide estivation sites, located along the banks of ponds and streams with riparian vegetation
 - Estivation and nesting sites, including depressions under vegetation, soil, organic matter, rock crevices, soil burrows

Sonoyta mud turtles are “opportunistic carnivores, feeding primarily on aquatic invertebrates that live on emergent and submergent vegetation or the substrate of ponds and streams.” Sonoyta mud turtle hatchlings and juveniles feed on littoral invertebrate fauna, while subadults and adults prefer benthic and plant-crawling invertebrates. In habitats with poor aquatic invertebrate faunas, Sonoyta mud turtles will shift to omnivorous feeding, including plants and vertebrates (e.g., fish). Pesticide use would affect arthropod prey and supplemental prey (e.g., fish) on which sonoyta mud turtles predominantly rely. Prey are identified in the PBFs above.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	snails, crustaceans, amphibians and fish	low concern
water quality	--	--	--
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0.05	0	0.01	0	30.16
Total % Use Overlap = 0.05 ²		Total % Usage Overlap = 0.01 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and non-arthropod prey, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Sonoyta Mud Turtle.

Malathion use sites overlap with 0.05% of the critical habitat, with 0.05% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.01% of critical habitat annually, with usage on 0.01% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey and non-arthropod prey PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the arthropod and non-arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Sonoyta Mud Turtle.

Reference(s):

U. S. Fish and Wildlife Service. 2018. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Sonoyta Mud Turtle. Proposed Rule. Federal Register 83:62778-62794.

Alameda Whipsnake (=Striped Racer) (*Masticophis lateralis euryxanthus*)

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

Physical and Biological Features:

- Scrub/shrub vegetation dominated by low to medium stature woody shrubs with a mosaic of open and closed canopy as characterized by the chamise, chamise-eastwood manzanita, chaparral whitethorn, and interior live oak shrub vegetation series occurring at elevations from sea level to approximately 3,850 ft (1,170 m).
 - These habitats form a pattern of open and closed canopy used by the Alameda whipsnake for shelter from predators, temperature regulation, prey-viewing opportunities, and nesting habitat and substrate.
 - These features contribute to support a prey base consisting of western fence lizards and other prey species such as skinks, frogs, snakes, and birds.
- Woodland or annual grassland vegetation series comprised of one or more of the following:

- Blue oak, coast live oak, California bay, California buckeye, and California annual grassland vegetation series.
- This mosaic of vegetation is essential to prey species, including western fence lizards, skinks, frogs, snakes, and birds, and provides opportunities for:
 - Foraging by allowing snakes to come in contact with and visualize, track, and capture prey
 - Short and long distance dispersal within, between, or to adjacent areas containing essential features
 - Contact with other Alameda whipsnakes for mating and reproduction.
- Rock outcrops, talus, and small mammal burrows within or adjacent to scrub/shrub vegetation and woodlands that are used for retreats (shelter), hibernacula, foraging, and dispersal, and provide additional prey population support functions.

In the Final Rule (*see* Adverse Modification Standard), “application of rodenticide or other chemicals” is listed as an action that “would significantly alter or modify the functioning of rock lands, talus, or small mammal burrows as Alameda whipsnake refugium or prey production.” As stated in the Final Rule, Alameda whipsnake prey includes lizards (e.g., the western fence lizard), rattlesnakes, western skinks, frogs, and nesting birds. Activities including application of chemicals could result in “direct losses of, or cumulative adverse effects to, individual Alameda whipsnakes, their life cycles, their populations, and their prey base.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	42.09	2	0.02	1.8
Total % Use Overlap = 100 ²		Total % Usage Overlap = 2.03 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect habitat function, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to

appreciably diminish the value of the critical habitat as a whole for the Alameda whipsnake (=striped racer).

Malathion use sites overlap with 100% of the critical habitat, with 100% and 42.09% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.03% of critical habitat annually, with usage on 2% of the critical habitat from mosquito control activities and usage on 0.02% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural use labels, including reducing the maximum allowable number of applications made in a year for crops that overlap with the species' critical habitat, would reduce environmental concentrations of malathion occurring in critical habitat. Additional changes in residential use labels, including limiting use to spot treatments, reducing the extent of area that is treatable, and reducing the maximum allowable number of yearly applications, would further decrease malathion exposure to critical habitat. With these conservation measures in mind, we anticipate the effects to the habitat function PBF would be small.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the habitat function PBF. We do not anticipate that malathion will directly or indirectly alter habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Alameda whipsnake (=striped racer).

Reference(s):

U. S. Fish and Wildlife Service. 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Alameda Whipsnake. Final Rule. Federal Register 71: 58176-58231.

Black Pinesnake (*Pituophis melanoleucus lodingi*)

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

Physical and Biological Features:

- Pine forest, historically dominated by longleaf pine and maintained by frequent fire
 - Open canopy that sustains a reduced woody mid-story (<10% cover) and abundant, diverse, native herbaceous groundcover (at least 40% cover)
 - Minimum 5,000 ac (2,023 ha) of mostly unfragmented habitat
- Naturally burnt-out or rotted-out pine stumps and their associated root system tunnels
- Deep, sandy, well-drained soils characteristic of longleaf pine forests
 - No flooding or ponding
 - <15% medium and coarse gravel fragments
 - >60 in (152 cm) depth to seasonal; high water table
 - >60 in (152 cm) depth to the hardpan
 - Textural components equaling >30% sand and <35% clay

- Slope <15%

In the Final Rule (*see* Application of the ‘Adverse Modification’ Standard), “chemical applications (pesticides or herbicides)” are listed as activities that “may affect critical habitat.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey			
non-arthropod prey	X	mammals and birds	low concern
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
55.63	0	2.19	0	11.64
Total % Use Overlap = 55.63 ²		Total % Usage Overlap = 2.19 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey and habitat function, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the black pinesnake.

Malathion use sites overlap with 55.63% of the critical habitat, with 55.63% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 2.19% of critical habitat annually, with usage on 2.19% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and will only occur for mosquito adulticide use. Low-level effects to habitat function are anticipated. No mortality is anticipated from black pine snakes exposed to malathion used for mosquito control within the critical habitat. Low-level effects to reproduction are anticipated for individual black pine snakes that ingest exposed birds, although the most common prey type used by the snake is mammals (birds are only taken opportunistically). No non-arthropod prey losses are anticipated from mosquito adulticide usage. Given the low anticipated usage and low level of expected effects, we do not anticipate that malathion will directly or indirectly alter the

non-arthropod prey and habitat function PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the black pinesnake.

Reference(s):

U. S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Black Pinesnake. Final Rule. Federal Register 85:11238-11270.

Plymouth Red-Bellied Turtle (*Pseudemys rubriventris bangsi*)

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

Physical and 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. The Final Rule states “[t]his species has an extremely limited range and is highly susceptible to changes in its habitat.” The Rule also states “[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.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	X	sensitive to insecticides	low concern
non-arthropod prey	X	crustaceans and fish	low concern
water quality	X	aquatic bins 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	19.15	0	0	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect arthropod prey, non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Plymouth red-bellied turtle.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 19.15% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the arthropod prey, water quality, and non-arthropod prey PBFs.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the the water quality, arthropod prey and non-arthropod prey PBFs from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Plymouth red-bellied turtle.

Reference(s):

U. S. Fish and Wildlife Service. 1980. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Plymouth Red-Bellied Turtle. Final Rule. Federal Register 45:21828-21833.

Northern Mexican Gartersnake (*Thamnophis eques megalops*)

Conclusion: Not likely to destroy or adversely modify proposed critical habitat.

Physical and Biological Features:

- Aquatic or riparian habitat including:
 - Perennial or spatially intermittent streams of low to medium gradient that possess appropriate amounts of in-channel pools, off-channel pools, or backwater habitat, and that possess a natural, unregulated flow regime that allows for periodic flooding or, if

- flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of processing sediment loads
- Lentic wetlands such as livestock tanks, springs, and cienegas
 - Shoreline habitat with adequate organic and inorganic structural complexity to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities (e.g., boulders, rocks, organic debris such as downed trees or logs, debris jams, small mammal burrows, or leaf litter)
 - Aquatic habitat with characteristics that support a native amphibian prey base, such as salinities less than 5 parts per thousand, pH greater than or equal to 5.6, and pollutants absent or minimally present at levels that do not affect survival of any age class of the northern Mexican gartersnake or the maintenance of prey populations
- Adequate terrestrial space (600 ft (182.9 m) lateral extent to either side of bankfull stage) adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation (extended inactivity)
 - Prey consisting of viable populations of native amphibian and native fish species
 - Absence of nonnative fish species of the families Centrarchidae and Ictaluridae, bullfrogs (*Lithobates catesbeianus*), and/or crayfish (*Orconectes virilis*, *Procambarus clarki*, etc.), or occurrence of these nonnative species at low enough levels such that recruitment of northern Mexican gartersnakes and maintenance of viable native fish or soft-rayed, nonnative fish populations (prey) is still occurring

These PBFs include aquatic habitat with “pollutants absent or minimally present” and “viable populations of native amphibian and native fish species.” In the Proposed Rule (see Application of the ‘Adverse Modification’ Standard), “[r]elease of chemicals, biological pollutants, or effluents into the surface water or into connected groundwater at a point source or by dispersed release” and “aerial pesticide overspray” are listed as actions that could “adversely affect the ability of the habitat to support survival and reproduction of gartersnake prey species.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	X	mammals, amphibians, reptiles and fish	low concern
water quality	X	aquatic bins 2, 3, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
33.02	2.15	0.84	0.21	40.62
Total % Use Overlap = 35.17 ²		Total % Usage Overlap = 1.05 ³		

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
--	---	--	---	--

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Northern Mexican gartersnake.

Malathion use sites overlap with 35.17% of the critical habitat, with 33.02% and 2.15% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 1.05% of critical habitat annually, with usage on 0.84% of the critical habitat from mosquito control activities and usage on 0.21% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality and non-arthropod prey PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Northern Mexican gartersnake.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northern Mexican Gartersnake and Narrow-Headed Gartersnake. Proposed Rule. Federal Register 78:39756-39854.

Narrow-Headed Gartersnake (*Thamnophis rufipunctatus*)

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

Physical and Biological Features:

- Stream habitat, including:
 - Perennial or spatially intermittent streams with sand, cobble, and boulder substrate and low or medium amounts of fine sediment and substrate embeddedness, and that possess appropriate amounts of pool, riffle, and run habitat to sustain native fish populations
 - Natural, unregulated flow regime that allows for periodic flooding or, if flows are modified or regulated, a flow regime that allows for adequate river functions, such as flows capable of processing sediment loads
 - Shoreline habitat with adequate organic and inorganic structural complexity (e.g., boulders, cobble bars, vegetation, and organic debris such as downed trees or logs, debris jams), with appropriate amounts of shrub- and sapling-sized plants to allow for thermoregulation, gestation, shelter, protection from predators, and foraging opportunities
 - Aquatic habitat with no pollutants or, if pollutants are present, levels that do not affect survival of any age class of the narrow-headed gartersnake or the maintenance of prey populations.
- Adequate terrestrial space (600 ft (182.9 m) lateral extent to either side of bankfull stage) adjacent to designated stream systems with sufficient structural characteristics to support life-history functions such as gestation, immigration, emigration, and brumation.
- Prey base consisting of viable populations of native fish species or soft-rayed, nonnative fish species
- Absence of nonnative fish species of the families Centrarchidae and Ictaluridae, bullfrogs (*Lithobates catesbeianus*), and/or crayfish (*Orconectes virilis*, *Procambarus clarki*, etc.), or occurrence of these nonnative species at low enough levels such that recruitment of narrow-headed gartersnakes and maintenance of viable native fish or soft-rayed, nonnative fish populations (prey) is still occurring.

These PBFs include aquatic habitat with “no pollutants or, if pollutants are present, levels that do not affect survival of any age class of the narrow-headed gartersnake of the maintenance of prey species” In the Proposed Rule (*see* Application of the ‘Adverse Modification’ Standard), “[r]elease of chemicals, biological pollutants, or effluents into the surface water or into connected groundwater at a point source or by dispersed release” and “aerial pesticide overspray” are listed as actions that could “adversely affect the ability of the habitat to support survival and reproduction of gartersnake prey species.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	X	amphibians and fish	low concern
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat)¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap)¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
22.8	3.35	0.4	0.09	56.12
Total % Use Overlap = 26.15 ²		Total % Usage Overlap = 0.49 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect non-arthropod prey and water quality, which are critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to these PBFs. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the narrow-headed garter snake.

Malathion use sites overlap with 26.15% of the critical habitat, with 22.8% and 3.35% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.49% of critical habitat annually, with usage on 0.4% of the critical habitat from mosquito control activities and usage on 0.09% of the critical habitat from non-mosquito control activities.

A fairly large portion of the species' critical habitat (56.12%) is on Federal lands, where malathion usage is expected to be extremely low and carried out with avoidance and minimization measures for listed species and critical habitats (as described in the effects of the Action section of the Opinion). Thus, while usage may occur anywhere within the overlapping use sites, we are primarily concerned about the effects of malathion on the non-Federal portion of the critical habitat, as we anticipate no more than low level effects on the Federal portion. While expected use may be high and usage low outside of the Federal portion of critical habitat, and while this usage may change in amount over time, the large portion of critical habitat contained on Federal lands is likely to remain of consistent quality with no or low impacts from malathion use.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality, and non-arthropod prey PBFs.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality and arthropod prey PBFs. We do not anticipate that malathion will directly or indirectly alter the PBFs to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the narrow-headed garter snake.

Reference(s):

U. S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northern Mexican Gartersnake and Narrow-Headed Gartersnake. Proposed Rule. Federal Register 78:39756-39854.

P. Snails

The categories and rationales for NDAM determinations for critical habitats of species in this taxa group are summarized in the Table below. Analyses of critical habitats with relevant PBFs follow the table as indicated by the rationale notation “see below.” Further analysis was not necessary for those with no relevant PBFs, as discussed in the Introduction section. See coinciding sections of this appendix for discussions of those with no overlap with malathion use sites or 95% or greater Federal lands overlap with critical habitat.

Table 14. Summary of Snail Critical Habitat Categories and Rationales

Scientific Name	Common Name	Category	Rationale
<i>Antrobia culveri</i>	Tumbling Creek cavesnail	3	see below
<i>Assiminea pecos</i>	Pecos assiminea snail	3	see below
<i>Erinna newcombi</i>	Newcomb's snail	3	no overlap
<i>Helminthoglypta walkeriana</i>	Morro shoulderband (=Banded dune) snail	3	see below
<i>Juturnia kosteri</i>	Koster's springsnail	3	≥95% Federal lands overlap
<i>Leptoxis foremani</i>	Interrupted (=Georgia) Rocksnail	3	see below
<i>Newcombia cumingi</i>	Newcomb's Tree snail	2	no relevant PBFs
<i>Pleurocera foremani</i>	Rough hornsnail	3	see below
<i>Pseudotryonia adamantina</i>	Diamond tryonia (formerly Diamond Y Spring Snail)	3	see below
<i>Pyrgulopsis bernardina</i>	San Bernardino springsnail	3	see below
<i>Pyrgulopsis chupaderae</i>	Chupadera springsnail	3	see below
<i>Pyrgulopsis roswellensis</i>	Roswell springsnail	3	≥95% Federal lands overlap
<i>Pyrgulopsis texana</i>	Phantom Springsnail (formerly Phantom Cave Snail)	3	see below
<i>Pyrgulopsis trivialis</i>	Three Forks springsnail	3	≥95% Federal lands overlap
<i>Tryonia cheatumi</i>	Phantom tyronia (formerly Phantom Springsnail (=Tryonia))	3	see below
<i>Tryonia circumstriata</i>	Gonzales tryonia (formerly Gonzales springsnail)	3	see below

Tumbling Creek Cavesnail (*Antrobia culveri*)

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

Physical and Biological Features:

- Instream flow regime with an average daily discharge between 0.07 and 150 cubic feet per second (cfs), inclusive of both surface runoff and groundwater sources (springs and

seepages), and water quality with temperature 55–62 °F (12.78–16.67 °C), dissolved oxygen 4.5 mg/L or greater, and turbidity of an average monthly reading of no more than 200 NTUs for a duration not to exceed 4 hours

- Biofilm, the organic coating and bacterial layer associated with the underside of rocks or a bare rock stream bottom. Biofilm is directly connected to energy input from the guano of a large colony of roosting bats in Tumbling Creek Cave.
- Stable stream bottoms and banks (stable horizontal dimension and vertical profile) that maintain bottom features (riffles, runs, and pools) and transition zones between bottom features, with bottom substrates consisting of fine gravel with coarse gravel or cobble, or bedrock with sand and gravel, with low amounts of fine sand and sediments within the interstitial spaces of the substrates.

In the Final Rule (*see* Application of the ‘Adverse Modification’ Standard), “release of chemicals, biological pollutants, or heated effluents” that are introduced to Tumbling Creek, its tributaries, or the associated spring would “significantly alter water chemistry or water quality (for example, changes to temperature or pH, introduced contaminants, excess nutrients)” in critical habitat.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	57.7	0	0	0
Total % Use Overlap = 57.7 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Tumbling Creek cavesnail.

Malathion use sites overlap with 57.7% of the critical habitat, with 0% and 57.7% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the water quality PBF from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Tumbling Creek cavesnail.

Reference(s):

U. S. Fish and Wildlife Service. 2011. Designation of Critical Habitat for Tumbling Creek Cavesnail. Final Rule. Federal Register 76:37663-37677.

Pecos Assiminea Snail (*Assiminea pecos*)

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

Physical and Biological Features:

- Moist or saturated soil at stream or spring run margins
 - Consisting of wet mud or occurs beneath mats of vegetation
 - Within 1 in (2 to 3 cm) of flowing water
 - Native wetland plant species, such as salt grass or sedges, that provide leaf litter, shade, cover, and appropriate microhabitat
 - Wetland vegetation adjacent to spring complexes that supports the algae, detritus, and bacteria needed for foraging
 - Adjacent to spring complexes with:
 - Permanent, flowing, fresh to moderately saline water with no or no more than low levels of pollutants
 - Stable water levels with natural diurnal and seasonal variations.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2,3,4,5,6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
10.16	6.57	0	0.24	9.68
Total % Use Overlap = 16.73 ²		Total % Usage Overlap = 0.24 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Pecos assimineia snail.

Malathion use sites overlap with 16.73% of the critical habitat, with 10.16% and 6.57% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.24% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.24% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water

quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the critical habitat for the Pecos assiminea snail.

Reference(s):

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

Morro Shoulderband (=Banded Dune) Snail (*Helminthoglypta walkeriana*)

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

Physical and Biological Features:

- Sand or sandy soils needed for reproduction
- Slope not greater than 10 percent to facilitate movement of individuals
- Presence of native coastal dune scrub vegetation

These PBFs focus on habitat structure, including soil structure, slope and coastal dune vegetation. In the Final Rule (*see* Critical Habitat Designation), “controlling pesticides in snail areas” is listed as a “[s]pecial management need.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	--	--	--
host fish	--	--	--
habitat function	X	--	low concern

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.35	36.08	0	0.06	0.79
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0.06 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect habitat function, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Morro shoulderband (=Banded dune) snail.

Malathion use sites overlap with 100% of the critical habitat, with 99.35% and 36.08% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.06% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.06% of the critical habitat from non-mosquito control activities.

General conservation measures involving changes to agricultural use labels, including implementation of aquatic habitat buffers, rain restrictions, and reduced maximum allowable applications per year, are expected to decrease environmental concentrations of malathion in the species' designated critical habitat. Additional changes to residential use labels, including limiting use to spot treatments, reducing the extent of area which can be treated, and reducing the maximum allowable number of applications per year, further decrease environmental concentrations of malathion in the species' critical habitat. With these conservation measures in mind, we anticipate the effects to the PBF will be low.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the habitat function PBF. We do not anticipate that malathion will directly or indirectly alter habitat function to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Morro shoulderband (=Banded dune) snail.

Reference(s):

U.S. Fish and Wildlife Service. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Morro Shoulderband Snail (*Helminthoglypta walkeriana*). Final Rule. Federal Register 66:9233-9246.

Interrupted (=Georgia) Rocksnail (*Leptoxis foremani*)

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

Physical and Biological Features:

- Geomorphically stable stream and river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation)
- A hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found
- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and chemical characteristics necessary for normal behavior, growth, and viability of all life stages

- Sand, gravel, cobble, boulder, bedrock, or mud substrates with low to medium amounts of fine sediment and attached filamentous algae

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3, 4 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
19.58	37.77	1.48	1.69	0
Total % Use Overlap = 57.35 ²		Total % Usage Overlap = 3.17 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the interrupted (=Georgia) rocksnail.

Malathion use sites overlap with 57.35% of the critical habitat, with 19.58% and 37.77% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.17% of critical habitat annually, with usage on 1.48% of the critical habitat from mosquito control activities and usage on 1.69% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted

rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the interrupted (=Georgia) rocksnail.

Reference(s):

U. S. Fish and Wildlife Service. 2010. Determination of Endangered Status for the Georgia Pigtoe Mussel, Interrupted Rocksnail, and Rough Hornsnail and Designation of Critical Habitat; Final Rule. Federal Register 75:67512-67550.

Rough Hornsnail (*Pleurocera foremani*)

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

Physical and Biological Features:

- Geomorphically stable stream and river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation)
- A hydrologic flow regime (the magnitude, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found
- Water quality, including temperature, pH, hardness, turbidity, oxygen content, and chemical characteristics necessary for normal behavior, growth, and viability of all life stages
- Sand, gravel, cobble, boulder, bedrock, or mud substrates with low to medium amounts of fine sediment and attached filamentous algae

In the 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.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 3	low concern
host fish	--	--	--
habitat function	--	--	--

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
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¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
99.77	31.15	1.75	1.51	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 3.27 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the rough hornsnail.

Malathion use sites overlap with 100% of the critical habitat, with 99.77% and 31.15% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 3.27% of critical habitat annually, with usage on 1.75% of the critical habitat from mosquito control activities and usage on 1.51% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the rough hornsnail.

Reference(s):

U. S. Fish and Wildlife Service. 2010. Determination of Endangered Status for the Georgia Pigtoe Mussel, Interrupted Rocksnail, and Rough Hornsnail and Designation of Critical Habitat; Final Rule. Federal Register 75:67512-67550.

Diamond Tryonia (*Pseudotryonia adamantina*)

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

Physical and Biological Features:

- Permanent, flowing, unpolluted water (free from contamination) within natural temperature variations, emerging from the ground and flowing on the surface
 - Water temperatures between 11to 27°C (52 to 81°F) with natural seasonal and diurnal variations slightly above and below that range
- 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
- Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation, for breeding, egg laying, maturing, feeding, and escape from predators
- Either an absence of nonnative predators and competitors or nonnative predators and competitors at low population levels.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 5	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	6.44	0	0.26	0
Total % Use Overlap = 6.44 ²		Total % Usage Overlap = 0.26 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBFs essential for the conservation of the species. The results of the dichotomous key indicated a

preliminary low level of concern for impacts to the PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the diamond tryonia (formerly Diamond Y Spring Snail).

Malathion use sites overlap with 6.44% of the critical habitat, with 0% and 6.44% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.26% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.26% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. We expect that the use of buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, will substantially reduce spray drift from entering aquatic habitats and will be most protective of low flow and low volume habitats. The use of rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, will likely provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the diamond tryonia (formerly Diamond Y Spring Snail).

Reference(s):

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

San Bernardino Springsnail (*Pyrgulopsis bernardina*)

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

Physical and Biological Features:

- Free-flowing springs, spring runs, spring seeps, and shallow pond water, with appropriate water chemistry, substrate, and flow characteristics
 - Adequately clean spring water (free from contamination) emerging from the ground and flowing on the surface
- Periphyton (attached algae), bacteria, and decaying organic material for food
- Substrates with cobble, gravel, pebble, sand, silt, and aquatic vegetation, for egg laying, maturing, feeding, and escape from predators

- Either an absence of nonnative predators (crayfish) and competitors (snails) or their presence at low population levels

In the Final Rule (*see* Criteria Used to Identify Critical Habitat), the springsnail requirements listed include “unpolluted spring water.” Springsnails are “sensitive to shifts in water quality”, including those caused by contamination. In the Pesticides section, glyphosphate (and other pesticides) is said to contaminate the food base for the springsnail, though the Final Rule also states “we do not consider the proper use of the pesticide [glyphosphate] to threaten the San Bernardino springsnail’s continued existence.”

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	17.35	0	0.01	39.76
Total % Use Overlap = 17.35 ²		Total % Usage Overlap = 0.01 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (*see Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBF, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the San Bernardino springsnail.

Malathion use sites overlap with 17.35% of the critical habitat, with 0% and 17.35% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.01% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.01% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied,

are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the San Bernardino springsnail.

Reference(s):

U. S. Fish and Wildlife Service. 2012. Determination of Endangered Status for Three Forks Springsnail and Threatened Status for San Bernardino Springsnail Throughout Their Ranges and Designation of Critical Habitat for Both Species. Final Rule. Federal Register 77:23060-23092.

Chupadera Springsnail (*Pyrgulopsis chupaderae*)

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

Physical and Biological Features:

- Springheads, springbrooks, seeps, ponds, and seasonally wetted meadows containing:
 - Unpolluted spring water (free from contamination) emerging from the ground and flowing on the surface
 - Periphyton (an assemblage of algae, bacteria, and microbes) and decaying organic material for food
 - Substrates including cobble, gravel, pebble, sand, silt, and aquatic vegetation, for egg laying, maturing, feeding, and escape from predators
 - Nonnative species either absent or present at low population levels

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
100	0	0	0	0
Total % Use Overlap = 100 ²		Total % Usage Overlap = 0 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Chupadera springsnail.

Malathion use sites overlap with 100% of the critical habitat, with 100% and 0% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

No malathion usage is anticipated on use sites that overlap with the critical habitat, and the conservation measures are expected to further reduce the likelihood of exposure and effects to the water quality PBF from any future applications on or near the critical habitat. We do not anticipate that malathion will directly or indirectly alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Chupadera springsnail.

Reference(s):

U. S. Fish and Wildlife Service. 2011. Determination of Endangered Status for the Chupadera Springsnail and Designation of Critical Habitat. Final Rule. Federal Register 77:41088-41106.

Phantom Springsnail (*Pyrgulopsis texana*)

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

Physical and Biological Features:

- Permanent, flowing, unpolluted water (free from contamination) within natural temperature variations, emerging from the ground and flowing on the surface
 - Water temperatures between 11 to 27°C (52 to 81°F) with natural seasonal and diurnal variations slightly above and below that range
- 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
- Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation, for breeding, egg laying, maturing, feeding, and escape from predators
- Either an absence of nonnative predators and competitors or nonnative predators and competitors at low population levels.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5 and 6	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	21.35	0	0.1	0
Total % Use Overlap = 21.35 ²		Total % Usage Overlap = 0.1 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Phantom Springsnail (formerly Phantom Cave Snail).

Malathion use sites overlap with 21.35% of the critical habitat, with 0% and 21.35% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.1% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.1% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Phantom springsnail.

Reference(s):

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

Phantom Tyronia (*Tryonia cheatumi*)

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

Physical and Biological Features:

- Permanent, flowing, unpolluted water (free from contamination) within natural temperature variations, emerging from the ground and flowing on the surface
 - Water temperatures between 11 to 27°C (52 to 81°F) with natural seasonal and diurnal variations slightly above and below that range
- 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
- Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation, for breeding, egg laying, maturing, feeding, and escape from predators
- Either an absence of nonnative predators and competitors or nonnative predators and competitors at low population levels.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2, 3, 5, 6 and 7	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	21.35	0	0.1	0
Total % Use Overlap = 21.35 ²		Total % Usage Overlap = 0.1 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Phantom tyronia (formerly Phantom Springsnail (=Tryonia)).

Malathion use sites overlap with 21.35% of the critical habitat, with 0% and 21.35% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.1% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.1% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will

appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Phantom tyronia.

Reference(s):

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

Gonzales Tyronia (*Tryonia circumstriata*)

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

Physical and Biological Features:

- Permanent, flowing, unpolluted water (free from contamination) within natural temperature variations, emerging from the ground and flowing on the surface
 - Water temperatures between 11 to 27°C (52 to 81°F) with natural seasonal and diurnal variations slightly above and below that range
- 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
- Substrates that include cobble, gravel, pebble, sand, silt, and aquatic vegetation, for breeding, egg laying, maturing, feeding, and escape from predators
- Either an absence of nonnative predators and competitors or nonnative predators and competitors at low population levels.

Physical and Biological Features (PBF) impacts summary

Physical/Biological Feature Category	Feature of Critical Habitat	Feature Characteristics	Preliminary Concern Level ¹
arthropod prey	--	--	--
non-arthropod prey	--	--	--
water quality	X	aquatic bins 2 and 3	low concern
host fish	--	--	--
habitat function	--	--	--

¹Preliminary concern levels for relevant PBFs were determined using a standardized dichotomous key that incorporates multiple factors.

Critical habitat exposure to malathion - use and usage data

Mosquito Adulticide Use (% overlap with critical habitat) ¹	Non-Mosquito Adulticide Use (% overlap with critical habitat)	Mosquito Adulticide Usage (% usage overlap) ¹	Non-Mosquito Adulticide Usage (% usage overlap)	Federal Lands (% area overlap with critical habitat)
0	6.44	0	0.26	0
Total % Use Overlap = 6.44 ²		Total % Usage Overlap = 0.26 ³		

¹Mosquito control use and usage may overlap with other usages.

²Total overlap is capped at 100%.

³Species range usage data was used as an approximation for usage on use sites overlapping with critical habitat (see *Description of Critical Habitat Analysis* in the Opinion for more information).

Critical Habitat Rationale for Conclusion:

Labeled uses of malathion are expected to affect water quality, which is a critical habitat PBF essential for the conservation of the species. The results of the dichotomous key indicated a preliminary low level of concern for impacts to this PBF. As discussed below, while we anticipate impacts to the PBFs, we do not anticipate the effects of the Action are likely to appreciably diminish the value of the critical habitat as a whole for the Gonzales tryonia (formerly Gonzales springsnail).

Malathion use sites overlap with 6.44% of the critical habitat, with 0% and 6.44% overlapping with mosquito control and non-mosquito control use sites, respectively. Available data indicates that usage will occur on 0.26% of critical habitat annually, with usage on 0% of the critical habitat from mosquito control activities and usage on 0.26% of the critical habitat from non-mosquito control activities.

General conservation measures that are to be implemented widely, such as aquatic habitat buffers and rain restrictions, will further reduce environmental concentrations of malathion. Buffers, which specify on the label a distance from water bodies where pesticides are not to be applied, are expected to substantially reduce spray drift from entering aquatic habitats and are most protective of low flow and low volume habitats. Rain restrictions, where malathion is not to be applied within 24-hours (for residential uses) or 48-hours (for agricultural uses) of a forecasted rain event or when the soil is saturated, are expected to provide time for the pesticide to degrade before runoff events can occur, substantially decreasing environmental concentrations of malathion as well. These conservation measures will further reduce the risk of impacts to the water quality PBF.

We anticipate that malathion usage on use sites that overlap with the critical habitat will be low, and the required conservation measures are expected to further reduce those effects to the water quality PBF. We do not anticipate that malathion will alter water quality to an extent that it will appreciably diminish the value of the critical habitat as a whole for the conservation of the species. Therefore, the Action is not likely to destroy or adversely modify critical habitat for the Gonzales tryonia (formerly Gonzales springsnail).

Reference(s):

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