Integration and Synthesis Summary for Amphibians

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined will “likely be adversely affected” by the proposed action. Our jeopardy analysis of the proposed action’s impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity.

Data and information used to determine each individual species’ rankings, including environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how rankings were assessed and combined are in Appendix E. Status of the species for each species can be found in Appendix B.

Ranges for all species in this assessment group are within the conterminous United States and the Commonwealth of Puerto Rico.

Vulnerability

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

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

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

Exposure

We anticipate amphibians can be exposed to methomyl through contact with contaminated water in their habitats or via dietary exposure, depending on if they are a terrestrial species with an aquatic phase, of a fully aquatic species. We assume all methomyl that is transported off-site, whether through spray drift or runoff, is likely to end up in local waterbodies, which may distribute methomyl residues throughout the entire watershed. Methomyl degrades quickly (i.e., within a few days) in aerobic aquatic habitats and as such is not likely to persist in waterbodies for long periods of time, be transported long distances in surface waters, or occur in groundwater sources. Thus, many amphibians may be exposed to methomyl via multiple routes.

We characterize the expected level of exposure using overlap data, past methomyl usage data, and any species-specific considerations such as life history information (e.g., habitat preferences, dispersal behavior) and existing protections or conservation actions. Species with greater than 10% overlap between their range and methomyl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps with methomyl use sites, we considered past methomyl usage data within a species' range to determine how much of a species' range we expect to be treated with methomyl each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the *Usage Analysis* section of this biological opinion. Species that data indicate will have a large portion of their range (>10%) treated with methomyl each year are assigned a high usage score. Species with 5-10% total usage are assigned a medium usage score, and species with less than 5% total usage are assigned a low usage score. Past methomyl usage data on Caribbean islands is unavailable. However, prior reporting data indicate that annual treatment with insecticides occurs on 20-70% of crops per municipality in Puerto Rico. We use these data broadly as confirmation that insecticide usage occurs on these islands, with methomyl presumably among these insecticides.

We determine the overall exposure ranking by qualitatively considering both the total overlap and total usage, as well as any additional exposure considerations that might modify the level of exposure likely to occur. When overlap and usage scores are the same, we assign the overall exposure ranking the same score (e.g., if both overlap and usage is high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions. (As usage is a subset of overlap, the overlap score will always be greater than the usage score). In cases where overlap is high, but usage is low, we anticipate a large portion of the range may be treated over the duration of the proposed action even if only a small portion of the range is treated in any given year (particularly if the areas treated occur in different locations each year), leading to an overall exposure ranking of medium. Past usage data for methomyl is not available for species located on Caribbean islands, including Puerto Rico, thus, in the absence of any additional exposure considerations for these species, our ranking is based on total overlap of methomyl use sites for species that occur in these areas. For all species, where there are additional exposure considerations, we adjust the overall exposure ranking to reflect this additional information, as appropriate.

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[1] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed to methomyl at levels estimated by EPA's environmental exposure modeling and is focused on determining the level of adverse effect expected to occur once exposure has taken place. Direct effects are based on the anticipated level of mortality and sublethal effects (e.g., reduced growth) likely to occur in exposed individuals. Indirect effects are based on the impact a listed species is likely to experience when the organisms they rely on, such as those that act as food or habitat resources, are exposed to methomyl and experience adverse effects.

We consider estimated concentrations of methomyl on the landscape or within the environment and effects reported in available toxicity studies to determine the level of direct and indirect adverse effects to listed species or critical habitat. Concentrations of methomyl can vary greatly among different regions and aquatic habitat types (e.g., low flow or low water volume habitats accumulate high levels of methomyl whereas fast flowing or large water volume habitats accumulate only low levels of methomyl). Based on available toxicity data for birds for the terrestrial phase and based on toxicity data for fish during the aquatic phase (as applicable), we anticipate amphibians are sensitive to methomyl and can experience high levels of mortality, even in habitats that only accumulate low levels. While sublethal effects, such as reduced growth or reproduction, are also possible with methomyl exposure, we do not anticipate sublethal effects are likely to occur before the onset of mortality for amphibians.

We anticipate species that rely on plant-based resources, such as algae and detritus for food or emergent aquatic vegetation as habitat, are not likely to experience any indirect adverse effects, as available toxicity data in plants indicate no reductions in plant survival or growth are likely to occur with methomyl exposure. In contrast, species that may rely exclusively on other arthropods for food resources may experience high levels of indirect adverse effects as methomyl exposure will likely reduce the abundance and availability of prey.

We determine the overall toxicity ranking for amphibians by qualitatively assessing both the expected levels of direct adverse effects (i.e., mortality) and indirect effects (i.e., prey loss). Given that mortality is the most adverse of direct effects to species, we assign a high toxicity score for direct adverse effects resulting in mortality of a species. As mentioned previously, available toxicity data indicate amphibians are sensitive to methomyl and may be exposed during the terrestrial phase via dietary exposure or via water during the aquatic phase as applicable to the species and are thus likely to die, even in habitats that only accumulate low levels.

[1] While our Opinion considers all consequences of the proposed action (per the definition of effects of the action at 50 CFR Part 402.02), the terms "direct" and "indirect" effects were used in EPA's BE, and are used in environmental risk assessment terminology in general, and do not have the same meaning as used in ESA regulations. As used in the effects analysis section, direct effects to species are those caused by the pesticide itself through dietary, dermal, or inhalation routes of exposure. Indirect effects occur when the pesticide acts on elements of the ecosystem that are required by the species, such as alterations to prey or shelter. Thus, in the effects analysis section, we may sometimes continue to use these terms to link back to the analysis in EPA's BE.

Summary of Amphibian Conclusions

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of methomyl, and the cumulative effects, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the 38 amphibian species/listed entities in this Appendix.

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

Species proposed for delisting

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

Table 1. Amphibian species proposed for delisting

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Change in listing status	Draft Determination
Eleutherodactylus jasperi	Golden coquí	-	Low	High	recommended delist - extinction	No Jeopardy

The golden coquí is endemic to Puerto Rico and its distribution was restricted to a small area south of the municipality of Cayey. The species was listed with low recovery potential and has a threatened status at present. However, the golden coquí has been recently recommended for delisting due to extinction based on findings in the most recent 5-Year Review (2022). When listed, the species was reported to occupy a total area of approximately 24 hectares on mountain tops, from 700 to 850 meters in elevation, at Cerro Avispa, Monte el Gato, and Sierra de Cayey. All known specimens were collected from bromeliads. They inhabited water-filled leaf axils of dense clusters of bromeliads growing on trees, rock edges, and on the ground. Most known habitat and critical habitat is found on private lands. There are no known extant populations of the golden coquí which were easily detected in the past. The easy detection should have led to high detection probabilities during visual surveys since the species' listing, but it has not been seen in 40 years. A significant effort has been invested in searching for the golden coquí since it was listed in 1977. All researchers that have searched for the golden coquí after 1981 have used adequate and proven techniques for detection. However, their efforts have not yielded any observation of the species in its historical locations, neighboring locations, or new locations identified through habitat suitability models, strongly suggesting the golden coquí is extinct. Furthermore, much of the species' habitat has been modified. We did not assess risk and usage quantitatively for the golden coquí. Our analysis of this species is qualitative as we anticipate that exposure to methomyl is not reasonably certain to occur given the species' known distribution, the prior ease of detection when present, and the likelihood of extinction.

After reviewing the current status of the listed species, the environmental baseline for the action area, the effects of the action, it is our biological opinion that the registration of methomyl is not likely to jeopardize the continued existence of the golden coqui. As noted above, there are no known extant populations of the golden coqui as the species has not been found since the 1980s and is likely extinct. We did not assess risk and usage quantitatively for the golden coqui; however, we anticipate that exposure to methomyl is very unlikely to occur given methomyl's largely agricultural uses, the species' preferred forested mountain habitat and known distribution, and the likelihood of extinction.

Species with low concern of adverse effects

The species in Table 2 are grouped together as they have low concern of adverse effects due to either 1) low exposure and low toxicity with high vulnerability or 2) low exposure with low or medium vulnerability and variable toxicity. While we present some specific information about the species in Table 2 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 2. Amphibian species with low exposure, medium/high vulnerability, and low/high toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Draft Determination
Ambystoma mavortium stebbinsi	Sonoran tiger salamander	Medium	Low	High	No Jeopardy
Anaxyrus californicus	Arroyo (arroyo southwestern) toad	Medium	Low	High	No Jeopardy
Anaxyrus canorus	Yosemite toad	Medium	Low	High	No Jeopardy
Cryptobranchus alleganiensis	Eastern hellbender Missouri DPS	Medium	Low	Low	No Jeopardy
Necturus alabamensis	Black warrior (Sipsey Fork) waterdog	High	Low	Low	No Jeopardy
Phaeognathus hubrichti	Red Hills salamander	Medium	Low	High	No Jeopardy
Plethodon nettingi	Cheat Mountain salamander	Medium	Low	High	No Jeopardy
Rana chiricahuensis	Chiricahua leopard frog	Medium	Low	High	No Jeopardy
Rana draytonii	California red-legged frog	Medium	Low	High	No Jeopardy
Rana pretiosa	Oregon spotted frog	Medium	Low	High	No Jeopardy

The following species have medium vulnerability, low exposure, and high toxicity rankings: Arroyo (arroyo southwestern) toad, California red-legged frog, Chiricahua leopard frog, Yosemite toad, and Oregon spotted frog. These species may be less robust in response to adverse effects from methomyl than other species with low vulnerability. Mortality and some loss of prey abundance is likely if exposed to methomyl. However, the Census of Agriculture indicated that little insecticide usage occurs within the ranges of these species (<5% of the range treated with any insecticide). The species' ranges for the Yosemite toad, California red-legged frog, and Arroyo toad are primarily on protected or federal lands where we expect pesticide usage to be low (i.e., National Parks, National Forests, state lands), in addition to their ranges overlapping small areas of agricultural lands. Available data indicate that a small percentage of the ranges for California red-legged frog and Arroyo toad have been treated annually with any insecticide (<1% and 2.1%, respectively, based on the Census of Agriculture) or methomyl (0.7% and 0.1% respectively, based on CalPUR data). Thus, we anticipate very few individuals of these species are likely to experience these adverse effects.

The Red Hills salamander, Cheat Mountain salamander, and Sonoran tiger salamander also have medium vulnerability, low exposure, and high toxicity rankings. These species spend significant portions of their life buried underground, in remote mountainous habitats, or in deep cave systems. For example, the Red Hills salamander is typically found in subterranean burrows. They fulfill much of their lifecycle near their burrows, prey on invertebrates and land snails inside the burrow and near burrow entrances, and do not inhabit agricultural areas (USFWS 2024). For these species, exposure to methomyl is expected to be very low based on overlap with agriculture (<5%) and the species' reliances on habitats where we do not anticipate individuals are likely to be exposed to pesticide applications, and thus we do not anticipate adverse effects for these species.

The black warrior (Sipsey Fork) waterdog and eastern hellbender (Missouri DPS) have high vulnerability, low exposure, and low toxicity rankings. While these species may be less robust to adverse effects given their high vulnerability, we anticipate only a small number of individuals will experience exposure or prey losses as these species have low exposure rankings, and any individuals exposed are not likely to experience more than low levels of adverse effects. The Census of Agriculture data indicates a low level of insecticide usage overall (1.6% and 0.76% of the ranges of the waterdog and hellbender, respectively, treated annually), and as such we have high confidence that there is a low likelihood of exposure for these species. Furthermore, the toxicity ranking of these species is low as we expect minimal levels of mortality (0.16% and 0.45% of exposed individuals of the waterdog and hellbender, respectively, are likely to die) due to their habitats of high flowing, larger waterbodies. This low level of adverse effect, coupled with the low exposure potential, indicate that only a very small number of individuals of these species are likely to experience any adverse effects from methomyl use.

In summary, while the vulnerability and toxicity rankings vary across the species in Table 2, we expect these species and their prey are not likely to experience more than low levels of exposure to methomyl. This low level of exposure is either coupled with a low or medium vulnerability, which makes the species more robust against any adverse effects that exposed individuals will experience, or a low toxicity ranking, indicating that exposure will not result in more than low levels of adverse effects to the species. Therefore, we determine the overall risk of adverse effects these species is low and that the proposed action will not appreciably reduce the survival and recovery of these amphibian species in the wild. Additionally, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of these amphibian species in the wild.

References:

U.S. Fish and Wildlife Service. 2024. Red Hills Salamander (*Phaeognathus hubrichti*) 5-Year Review: Summary and Evaluation. Daphne, Alabama. 26 pp.

Species with low exposure (informed by low overlap with agriculture), high vulnerability, and medium/high toxicity

The species in Table 3 are grouped together as they all have low exposure informed by low overlap with agricultural sites where methomyl is registered for use. While we present some specific information about the species in Table 3 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 3. Amphibian species with low baseline exposure (informed by low overlap with agriculture), high vulnerability, and medium/high toxicity

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap	Draft Determination
Batrachoseps aridus	Desert slender salamander	High	Low	High	0.0	No Jeopardy
Batrachoseps relictus	Relictual slender salamander	High	Low	Low	2.3	No Jeopardy
Batrachoseps simatus	Kern Canyon slender salamander	High	Low	Low	2.1	No Jeopardy
Cryptobranchus alleganiensis bishop	Ozark hellbender	High	Low	Medium	3.6	No Jeopardy
Eurycea nana	San Marcos salamander	High	Low	High	1.7	No Jeopardy
Eurycea naufragia	Georgetown salamander	High	Low	High	2.9	No Jeopardy
Eurycea sosorum	Barton Springs salamander	High	Low	High	0.3	No Jeopardy
Eurycea waterlooensis	Austin blind salamander	High	Low	High	0.3	No Jeopardy
Plethodon neomexicanus	Jemez Mountains salamander	High	Low	High	1.3	No Jeopardy
Rana muscosa	Mountain yellow-legged frog (Northern California DPS)	High	Low	High	0.0	No Jeopardy

All species in Table 4 have a high vulnerability ranking, indicating that the species may be sensitive to any adverse effects that occur to individuals within the species. The San Marcos salamander, Barton Springs salamander, Georgetown salamander, Austin blind salamander, and Jemez Mountains salamander have pesticides listed as a specific threat. These species have medium or high toxicity rankings. Based on the predicted level of methomyl expected to be consumed based on the aquatic habitats in which they are found and/or the dietary item exposure, we expect up to 97% of exposed individuals are likely to die. This number represents an upper bound of mortality if these amphibians consume only prey from a field treated with methomyl or, if fully aquatic, spend most of their time in small, low flow aquatic systems. We know from the life history of these species that the level of mortality will depend on the extent to which the species will consume the specific dietary items contaminated with methomyl, which we expect to occur at some point over the course of the proposed action.

While most of these species are likely to experience high levels of toxicity and are highly vulnerable, we anticipate, at most, a very small number of individuals are likely to be exposed to methomyl or experience losses of prey that leads to mortality. All the species in Table 3 have a low extent of overlap between the action area and their ranges (total overlaps with agricultural land uses range from 0-3.6%). Furthermore, the total overlap metric we use is a conservative estimate of exposure as it does not fully account for redundancy between use site layers, assumes exposure is occurring in all possible overlapping areas, and does not consider information on past methomyl usage. As such, we expect that exposure of these species to methomyl will occur in an even smaller portion of the species' ranges. Where available, habitat preferences confirm this expectation.

The San Marcos salamander, Barton Springs salamander, Austin blind salamander, and Georgetown salamander are found in spring flows of the Edwards Aquifer. While recharge of these aquifer systems makes them susceptible to contaminants due to the porous nature of these karst systems, methomyl is not able to reach these springs because of its low persistence in water and the flow rates in the high flow waters where these salamanders are found is sufficient enough to dilute methomyl to result in minimal exposure to individuals or their prey, leading to mortality of a very small number of individuals. We do not expect methomyl to concentrate in the low flow/low volume waterbodies associated with these springs. In addition, there are several conservation activities that take place for the Edwards Aquifer including land acquisitions and conservation easements, water quality protection recommendations, regional water planning, the City of Austin's habitat conservation plan covering operation and maintenance of Barton Springs Pool and adjacent springs, as well as captive breeding (for the Barton Springs salamander) and water quality monitoring (USFWS 2016).

The species' ranges for the mountain yellow-legged frog (northern DPS), desert slender salamander, relictual slender salamander, and Kern Canyon slender salamander are primarily on protected or federal lands where we expect pesticide usage to be low (i.e., National Forests, National Monument), in addition to their ranges overlapping small areas of agricultural lands. The relictual slender salamander and Kern Canyon slender salamander primarily occur in high elevation montane habitats (USFWS 2022) that we expect will not be affected by methomyl exposure. We anticipate mortality of a very small number of desert slender salamanders and mountain yellow-legged frogs from exposure of individuals and their prey.

After reviewing the current status of the species, environmental baseline for the action area, effects of the proposed registration of methomyl, and cumulative effects for the species in Table 3, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of these species. As discussed, all the species listed in Table 3 have a low extent of overlap between the action area and their ranges (up to 3.6%). As such, we expect, at most, only a very small number of individuals of these species are likely to experience exposure to methomyl that would lead to adverse effects, as discussed above. Therefore, we determine the overall risk of adverse effects these species is low and that the proposed action will not appreciably reduce the survival and recovery of the amphibian species in Table 3 in the wild.

References:

U.S. Fish and Wildlife Service. 2022. Species Status Assessment for the Relictual Slender Salamander (*Batrachoseps relictus*), Kern Canyon Slender Salamander (*Batrachoseps simatus*), and Kern Plateau Salamander (*Batrachoseps robustus*). Sacramento, California. 91 pp.

U.S. Fish and Wildlife Service. 2016. Barton Springs Salamander (*Eurycea sosorum*) Recovery Plan Amended to include Austin Blind Salamander (*Eurycea waterlooensis*). Albuquerque, New Mexico. 148 pp.

Species with low exposure (confirmed by low past usage from USDA Census of Agriculture), high vulnerability, and high toxicity

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

Table 5. Amphibian species with low past usage - Census of Agriculture

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Draft Determination
Eurycea rathbuni	Texas blind salamander	High	Low	High	2.3	No Jeopardy
Eurycea tonkawae	Jollyville Plateau salamander	High	Low	High	2.5	No Jeopardy
Rana sevosa	Dusky gopher frog	High	Low	High	1.0	No Jeopardy

The species in Table 4 have high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including mortality of individuals from methomyl exposure. These species have high toxicity rankings as we expect up to 97% of exposed individuals are likely to die. This number represents an upper bound of mortality if these amphibians consume only prey from a field treated with methomyl or spend some of their lifecycle in small, low flowing waterbodies. We know from the life history of these species, the level of mortality will depend on the extent to which the species will consume contaminated dietary items. We also anticipate reductions in the abundance of invertebrate prey species in low flow/low volume habitats, but reductions are not likely to occur throughout the entire species' range. Aquatic invertebrate prey is likely to be replenished from upstream sources for low flow/low volume waters.

While species in Table 4 are highly vulnerable and individuals are likely to die if exposed, we anticipate only a small number of individuals and their prey are likely to be exposed to methomyl given the low insecticide usage in the past across their ranges (only up to 2.5% of their ranges treated annually). Low CoA usage indicates that very little insecticide usage (of any type) occurred in the past in the counties where these species' ranges occur. Given that this reporting broadly includes all insecticide usage, we consider CoA data to be conservative estimates of methomyl usage that indicate very little of the species' ranges are likely to be treated. Additional exposure considerations confirm this low level of exposure as described below.

The Texas blind salamander and Jollyville Plateau salamander are found in spring flows of the Edwards Aquifer. While recharge of these systems makes them susceptible to contaminants due to the porous nature of these karst systems, methomyl is not able to reach these springs because of its low persistence in water and because high flow rate waters where these salamanders are found dilute methomyl to minimal concentrations. We do not expect methomyl to concentrate in the low flow/low volume waterbodies associated with these springs. In addition, there are several conservation activities that take place for the Edwards Aquifer including land acquisitions and conservation easements, water quality protection recommendations, regional water planning, and habitat conservation plans (USFWS 2024). Thus, we do not anticipate exposure that would lead to adverse effects for these species.

For the dusky gopher frog, the Service, private, and other federal partners that own property occupied by this species are vigilant in the approval and use of any pesticides. The Desoto National Forest implemented conservation actions to create, enhance, and restore aquatic and upland habitat for the dusky gopher frog for future translocations, and the Nature Conservancy implemented restoration activities on their property (USFWS 2021).

In summary, we have high confidence that there is a low extent of exposure for these species and no more than a very small number of individuals of the dusky gopher frog are anticipated to be affected from exposure or prey losses that result in mortality. We do not anticipate exposure that will lead to adverse effects to the Texas blind salamander or Jollyville Plateau salamander. After reviewing the current status of the species, environmental baseline for the action area, effects of the proposed registration of methomyl, and cumulative effects for the species in Table 4, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of these species. As discussed, while individuals are likely to die when exposed, we determine the overall risk of adverse effects of methomyl to these species is low and losses of small numbers of individuals from the proposed action will not likely appreciably reduce the survival and recovery of these amphibian species in the wild.

References:

U.S. Fish and Wildlife Service. 2024. Species Biological Report for Southern Edwards Aquifer Springs and Associated Aquatic Ecosystems. Albuquerque, New Mexico. 117 pp.

U.S. Fish and Wildlife Service. 2021. Dusky gopher frog (*Rana sevosa*) 5-Year Review: Summary and Evaluation. Jackson, Mississippi. 16 pp.

Species with low exposure (informed by low past usage from California Department of Pesticide Regulation data), high vulnerability, and high toxicity

The species in Table 5 are grouped together because they all occur completely within California and have low exposure confirmed by low levels of past methomyl usage within their ranges (% range treated), as informed by the California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data. While we present some specific information about the species in Table 5 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 6. Amphibian species with low exposure (informed by low past usage from the California Department of Pesticide Regulation, Pesticide Use Reporting Data), high vulnerability, and high toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Draft Determination
Ambystoma californiense	California tiger salamander (Sonoma County DPS)	High	Low	High	0.0	No Jeopardy
Ambystoma californiense	California tiger salamander (Central California DPS)	High	Low	High	1.0	No Jeopardy
Ambystoma californiense	California tiger salamander (Santa Barbara County DPS)	High	Low	High	2.3	No Jeopardy

These species' ranges may overlap more agricultural use sites than those in previous tables, but mandatory pesticide usage reporting data collected by the state of California indicates very little methomyl has been used in the agricultural sections where these species' ranges occur. Given that this usage data is mandated by the state of California and that this data is reported with relatively high spatial resolution, we have high confidence that these species are likely to experience no more than low levels of exposure from the proposed action.

All three DPS units of the California tiger salamander (Sonoma County DPS, Santa Barbara DPS, and Central California DPS) have high vulnerability rankings and high toxicity rankings. All three DPS units of the California tiger salamander inhabit vernal pools which makes them most susceptible to contaminants in run-off. Each metapopulation uses an array of vernal pools and swales, created ponds, and uplands, separated from one another by distance, topography, or anthropogenic barriers. Fragmentation of these water features is one of the primary threats to each DPS unit of the California tiger salamander (USFWS 2021, 2022, 2023). We expect up to 97% of exposed individuals are likely to die. This number represents an upper bound of mortality if these amphibians consume only prey from a field treated with methomyl or spend some of their lifecycle in small, low flowing waterbodies. We know from the life history of these species that level of mortality will depend on the extent to which the species consumes contaminated dietary items, which we expect to occur at some point over the course of the proposed action. We anticipate reductions in the abundance of invertebrate prey species in low flow/low volume habitats, but reductions are not likely to occur throughout the entire species' range. Aquatic invertebrate prey is likely to be replenished from upstream sources for low flow waters.

However, we anticipate, at most, a very small number of individuals are likely to be exposed to methomyl given that CalPUR data indicate low past usage within their ranges. This mandatory pesticide usage reporting data collected by the state of California indicates very little methomyl has been used in the agricultural areas where these species' ranges occur (Sonoma County: 0%, Santa Barbara: 2.3%, and Central California: 1% of the range treated annually). Given that the CalPUR data are specific to the counties or sections within the species' range, we have high confidence that there is a low likelihood of exposure for the different DPS units for this species. In addition, each DPS has conservation plans (i.e., Santa Rosa Plain Conservation Strategy), habitat improvement projects, mitigation and conservation banks, and other cooperative conservation efforts aimed at protecting the DPSs and their habitats.

Given the low level of methomyl usage within the ranges of the California tiger salamander (Sonoma County DPS, Santa Barbara DPS, and Central California DPS), we expect, at most, only a very small number of individuals within each DPS are likely to experience exposure or prey losses that lead to mortality. It is our biological opinion that the proposed registration of methomyl, is not likely to jeopardize the continued existence of these species. We determine the overall risk of adverse effects to the California tiger salamander (Sonoma County DPS, Santa Barbara DPS, and Central California DPS) is low and that the proposed action will not appreciably reduce the survival and recovery of the California tiger salamander (Sonoma County DPS, Santa Barbara DPS, and Central California DPS) in the wild.

References:

U.S. Fish and Wildlife Service. 2023. 5-Year Review California Tiger Salamander Central California Distinct Population Segment (*Ambystoma californiense*). Sacramento, California. 24 pp.

U.S. Fish and Wildlife Service. 2022. California Tiger Salamander (*Ambystoma californiense*) Santa Barbara County Distinct Population Segment. Ventura, California. 31 pp.

U.S. Fish and Wildlife Service. 2021. 5-Year Review California Tiger Salamander Sonoma County Distinct Population Segment (*Ambystoma californiense*). Sacramento, California. 13 pp.

Species with low exposure (based on habitat characteristics)

The species in Table 6 occurs in the Edwards Aquifer system, where we expect no more than low levels of methomyl will accumulate and we expect exposure to the species will be low. While we present some specific information about the species in Table 6 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 7. Amphibian species with low exposure (based on the characteristics of their preferred habitat)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Draft Determination
Eurycea chisholmensis	Salado salamander	High	Low	High	1.4	No Jeopardy

The Salado salamander in Table 6 has a high vulnerability ranking, indicating that it may be especially susceptible to species-level impacts from additional stressors in its environment, such as adverse effects to individuals from methomyl exposure. Additionally, pesticides are noted as a threat. Available toxicity data indicate that the species would experience mortality in low flow/volume waterbodies and indirect effects through loss of prey if exposed.

Despite having high vulnerability and toxicity rankings, we anticipate only a small number of individuals, at most, are likely to be exposed to methomyl based on the unique characteristics of the habitat it occupies. The Salado salamander occurs in the Northern Segment of the Edwards Aquifer, in portions of Travis, Williamson, and Bell Counties, Texas. Methomyl is not able to reach the springs associated with this aquifer system because of its low persistence in water. In addition, high flow rate waters where these salamanders are found dilute methomyl to minimal concentrations. As such, we anticipate only a small number of individuals, if any, are likely to be exposed to methomyl.

In summary, we anticipate the Edwards Aquifer where Salado salamanders are found is not likely to accumulate more than low levels of methomyl as we expect the majority of methomyl residues will degrade before entering the aquifer. Thus, we anticipate exposure and prey losses will result in mortality of a very small number of individuals. After reviewing the current status of the Salado salamander, environmental baseline for the action area, effects of the proposed registration of methomyl, and cumulative effects for the Salado salamander it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of these species. While individuals are likely to die when exposed and pesticides are noted as a threat to the species, we anticipate few, if any, individuals are likely to experience exposure. We therefore determine the overall risk of adverse effects of methomyl to the Salado salamander is low and losses of small numbers of individuals from the proposed action will not likely appreciably reduce the survival and recovery of this amphibian species in the wild.

Species with Individual Integration and Synthesis summaries

For the species in Table 7, our preliminary exposure and toxicity rankings indicate that the proposed action may result in moderate to high adverse effects. As such, we discuss each species in more detail in individual Integration and Synthesis summaries below. In some cases, we modified initial exposure and toxicity rankings due to additional information regarding exposure and effects for individual species, as described below.

Table 8. Amphibians with moderate to high adverse effects anticipated from the proposed action. We addressed each species in individual Integration and Synthesis summaries.

Scientific Name	Common Name	Draft Determination
Ambystoma macrodactylum croceum	Santa Cruz long-toed salamander	No Jeopardy
Bufo houstonensis	Houston toad	No Jeopardy
Peltophryne lemur	Puerto Rican crested toad	No Jeopardy
Eleutherodactylus cooki	Guajón	No Jeopardy
Ambystoma cingulatum	Frosted flatwoods salamander	No Jeopardy
Rana muscosa	Mountain yellow-legged frog (Southern CA DPS)	No Jeopardy
Necturus lewisi	Neuse River waterdog	No Jeopardy
Ambystoma bishopi	Reticulated flatwoods salamander	No Jeopardy
Rana sierrae	Sierra Nevada yellow-legged frog	No Jeopardy
Anaxyrus williamsi	Dixie Valley toad	No Jeopardy
Eleutherodactylus juanariveroi	Llanero coqui	No Jeopardy

Integration and Synthesis Summary: Santa Cruz long-toed salamander

Scientific Name:	Common Name:	Entity ID:
Ambystoma macrodactylum croceum	Santa Cruz long-toed salamander	188

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our preliminary evaluation of the effects of the proposed action to the species (presented below), we determined there is high overlap of the action area with the species' range, and high past usage of methomyl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die and are likely to experience high levels of indirect effects resulting from loss of arthropod prey species. Given that exposure is high, and the level of indirect effects is high, we determined the risk of adverse effects to the species is likewise high. As such, we expected a large number of individuals were likely to experience reduced feeding success from the proposed action.

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

Species range

Based on range map dated: 1/31/2022; Wherever found; *States within the range:* CA. Figure 1 depicts the species' range.

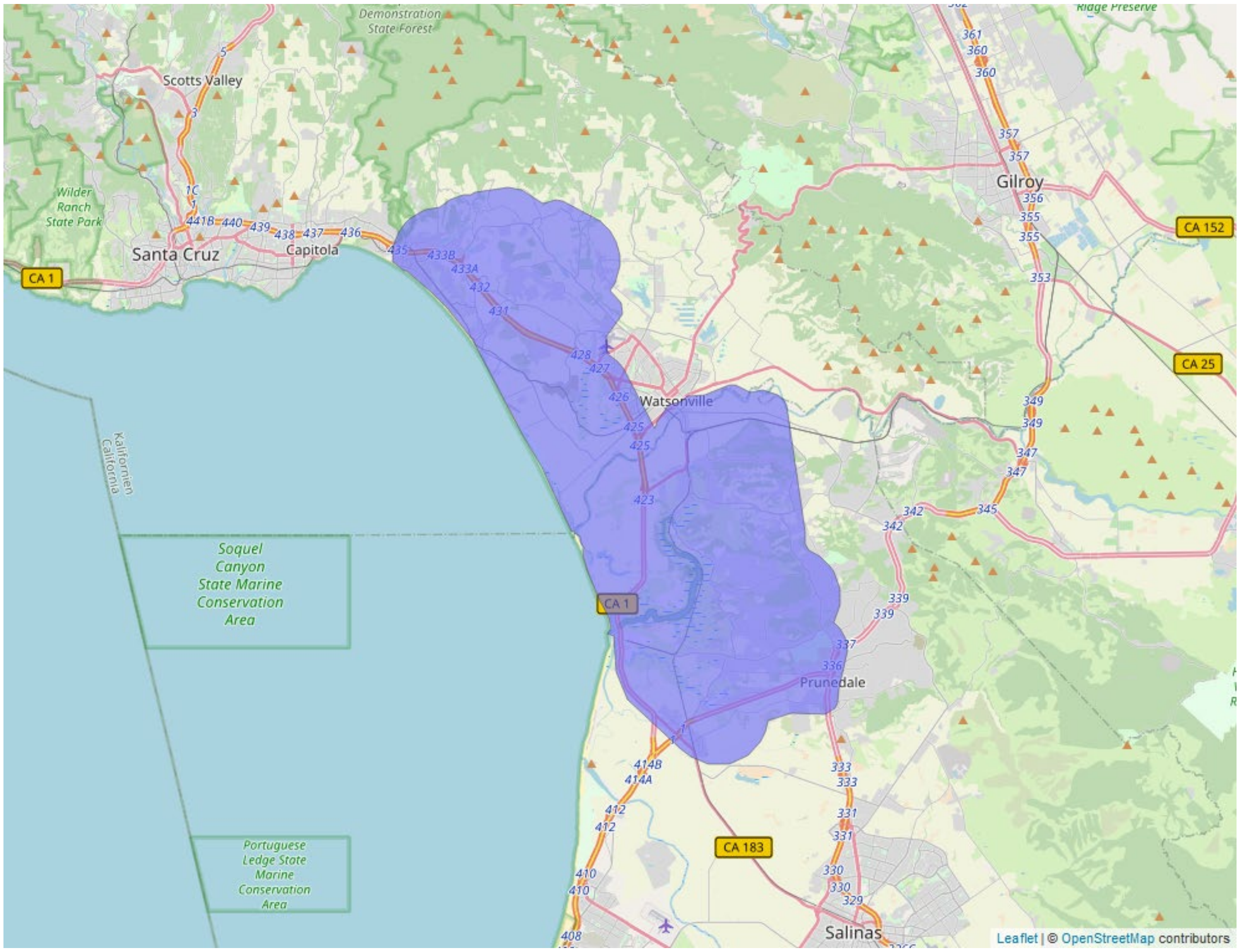

Figure 1. Range map of Santa Cruz long-toed salamander (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7405.

Vulnerability

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

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Review: 10/8/2019

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The primary factors that continue to endanger populations of the Santa Cruz long-toed salamander throughout its range include degradation, fragmentation, and loss of aquatic and upland habitats through agriculture, road construction, and urbanization. Roads, highways, buildings, walls, and fences may form complete barriers to dispersing Santa Cruz long-toed salamanders. Additionally, vehicular traffic frequently kills Santa Cruz long-toed salamanders attempting to cross roads and highways. Together, these factors result in genetically isolated subpopulations and mortality of Santa Cruz long-toed salamanders. The loss of upland habitat through urbanization reduces or eliminates terrestrial retreats such as viable root systems and small mammal burrows that are necessary for the subspecies during the non-breeding season. Santa Cruz long-toed salamanders are vulnerable to several predators. Eggs and larvae may be preyed upon by mosquitofish (*Gambusia* spp.) and crayfish. Other native and non-native predators feed on Santa Cruz long-toed salamander adults, metamorphs, larvae and eggs. Trematode infestations naturally occur in the subspecies, but their rate of incidence may be increased due to human-related factors such as reduced water quality. Chytrid fungus has been found to infect a number of amphibian populations that are declining and has been confirmed in Santa Cruz long-toed salamanders in both Santa Cruz and Monterey Counties. Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007). While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to the Santa Cruz long-toed salamander at this time.

Degraded water quality through chemical contamination (e.g., pesticides, herbicides, petroleum products) and sedimentation via runoff reduces the growth or survival of salamander larvae (Semlitsch 2002). Methoprene, an insect growth regulator and larvicide, has been used at Valencia Lagoon and other ponds to control mosquito populations. Data on its effects on Santa Cruz long-toed salamanders are not available, but effects on other amphibians have been observed. The survival of many amphibians relies on an abundance of invertebrates, and any delay in insect growth could reduce the numbers and density of prey available to Santa Cruz long-toed salamanders. Efforts to protect the subspecies habitat have resulted in the protection of important aquatic and upland habitat areas, scattered throughout its range; however, urbanization and intensive agriculture have resulted in the fragmentation of protected habitats, likely preventing dispersal and migration of the Santa Cruz long-toed salamander within and between populations.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 29.2% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area. Up to 6.8% of the species' range overlaps with methomyl use sites while 22.4% of the range occurs off-field (but may still be exposed to spray drift or runoff). Table 8 summarizes the overlap of use sites and the species range.

Table 9. Overlap of methomyl use sites with Santa Cruz long-toed salamander range.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0.7	3.9	4.7
Citrus	<0.1	<0.1	<0.1
Corn[2]	0.2	1.7	1.8
Cotton	<0.1	0.3	0.4
Other Grains	0.8	5.7	6.5
Other Orchards[3]	1.4	3	4.4
Other Row Crops	<0.1	<0.1	<0.1
Soybeans	<0.1	<0.1	<0.1
Vegetables and Ground Fruit	3.6	7.7	11.4
Wheat	NA	NA	NA
Total	**6.8**	**22.4**	**29.2**

Usage

Mandatory reporting data from the state of California indicate that, between 2012 - 2021, the maximum percent of the species' range treated with any pesticide was 47.8% (Table 8). Up to 46.1% of the range was treated with any insecticide and up to12.1% of the range was treated with methomyl.

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

Table 10. Annual percent of the Santa Cruz long-toed salamander's range treated with pesticides, insecticides or methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl	average # of growers reporting within the species' range
47.8	46.1	12.1	529.3

Additional Exposure Considerations

Adults spend much of their lives underground, often utilizing the tunnels of burrowing mammals such as moles and ground squirrels.

Transformed adults are rarely found outside of the breeding season. They are mostly found under wood, logs, rocks, bark, and other objects near breeding sites, or when they are breeding in the water. At other times of the year, they stay in rotten logs or moist places underground such as animal burrows.

Adults migrate to breeding sites, then return to terrestrial habitats.

Exposure Summary

There is a high extent of overlap between the action area and the species' range. Based on past usage data from CalPUR, we expect a high level of methomyl usage within the species' range. Given that the extent of overlap is high and that expected usage is high we expect a large number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: High

General Conservation Measures:

Rain restriction:
The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. Thus, we provide in Table 10 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting

concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure. However, despite the incorporation of the rain restriction mitigation, exposure remains high for this species.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The methomyl label has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

Effects of the Action: Toxicity

Direct Effects

We expect the Santa Cruz long-toed salamander will primarily experience direct adverse effects (i.e., mortality) from dietary exposure. The adult Santa Cruz long-toed salamander feeds on small invertebrates, such as worms, snails, insects, and spiders. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field or edge of field exposure can result in dosages up to 4.3 mg/kg-bw, which can occur when individuals exclusively consume soil invertebrates. This level of exposure on-field can cause mortality in up to 99.7% of exposed individuals. This will more likely impact adults of the population as juveniles and metamorphs are aquatic. While adults do spend much of their time burrowed underground, there is a likelihood they will feed adjacent to fields on arthropods or soil invertebrates which can result in mortality.

We expect dietary dosages from consuming contaminated food items off-field will result in lower levels of direct adverse effects as we expect lower levels of methomyl will occur in these food items.

Aquatic phase:

EPA's aquatic exposure modeling indicates that the maximum methomyl EECs within the region and aquatic habitats that the Santa Cruz long-toed salamander occupies will likely be as high as 106 to 2338 μg/L, depending on the type of habitat (Table 10). Mortality is not expected in large volume waterbodies but may occur in up to 91.5% of exposed individuals in low flow/low volume waterbodies. We anticipate this mortality may impact larvae or metamorphs disproportionately as they are fully aquatic and feed on small aquatic organisms, such as algae and invertebrates and adults only return to aquatic habitats to reproduce.

Table 11. Predicted environmental concentrations of methomyl within the Santa Cruz long-toed salamander's habitat and the associated level of mortality expected to occur with exposure.

Aquatic Habitat	HUC 2 Region	Max EEC (µg/L)	Percent amphibian mortality
Large volume waterbodies	HUC_18a	105.7	<0.01
Low flow/low volume waterbodies	HUC_18a	2338.2	91.5

Based on available toxicity data on sublethal effects of methomyl exposure in aquatic/ terrestrial vertebrates and the predicted environmental concentration of methomyl in the habitat of the Santa Cruz long-toed salamander, we do not anticipate adverse effects to growth and/or reproduction.

Indirect Effects

The Santa Cruz long-toed salamander relies on soil invertebrates and arthropods for food resources. Based on available toxicity data, we expect individuals of these prey species will likely experience high levels of mortality with exposure to methomyl, both on- and off-field. As such, we expect there may be substantial reductions in the abundance of soil invertebrates or other arthropods, indicating a high level of indirect adverse effects are likely to occur.

Toxicity Summary

We expect a high level of direct adverse effects will occur on-field and in low flow/low volume habitats as exposed individuals will likely die. We expect a low level of direct adverse effects will occur off-field. We do not expect sublethal effects (e.g., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a high level of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause a high level of mortality to organisms that act as food resources for the species such as arthropods and other soil invertebrates. As such, we determine the Santa Cruz long-toed salamander has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Santa Cruz long-toed salamander has a high exposure ranking. Based on past methomyl usage data, we expect up to 12.1.% of the range may be treated annually but may potentially cover up to 29.2% of the range over the duration of the proposed action depending how usage patterns change over time. This indicates that a large portion of the species' range is likely to be treated overall. As such, we expect a large number of individuals are likely to be exposed to methomyl.

The Santa Cruz long-toed salamander has a high toxicity ranking. We expect a high level of mortality will occur on-field or at the field edge as a result of dietary exposure through the consumption of contaminated food items for adults. We expect a high level of mortality to juveniles and metamorphs during the aquatic phase of their lifecycle in low flow/low volume habitats despite to the rain restriction and aquatic habitat spray drift buffer conservation measures. We expect a low level of mortality will occur off-field. We expect a high level of indirect adverse effects are likely to occur as we expect prey species such as soil invertebrates and arthropods will experience a high level of mortality with exposure to predicted concentrations of methomyl.

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

Preliminary Conclusion (with General Conservation Measures)

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of methomyl, and the cumulative effects, it is our biological opinion that the registration of methomyl, as proposed, is likely to jeopardize the continued existence of the Santa Cruz long-toed salamander. Vulnerability, likelihood of exposure, and toxicity are high for this species. Thus, we anticipate that large numbers of individuals will be affected over the duration of the proposed action, and we expect species-level effects to occur.

The Santa Cruz long-toed salamander has a high vulnerability ranking due to its endangered status, limited distribution, small population size, low juvenile survival rates, susceptibility to stochastic events, and anthropogenic threats to the species (e.g., continued degradation, fragmentation, and loss of suitable aquatic and upland habitats from urbanization, invasive species, and agricultural impacts to habitat). Similarly, the species has a high exposure ranking due to labeled uses across the range and estimated methomyl usage affecting 12.1% of the species range annually. Effects to prey items from use sites, reducing prey abundance and availability, and mortality of Santa Cruz long-toed salamanders from ingestion of contaminated soil-based prey are anticipated consequences of the proposed action. The species is generally at high risk as amphibians, given their aquatic life histories and susceptibility to environmental contaminants (e.g., pesticides, degraded water quality), can be subject to exposure through multiple pathways (e.g., dermal exposure, ingestion of contaminated arthropod prey) and at various life stages (egg, larval, juvenile, and adult). Estimated usage within the species' range, based upon more refined CalPUR data (in which we have higher confidence) is high at 12.1% and we therefore anticipate that exposure of the Santa Cruz long-toed salamander will be high.

For aquatic life stages of the Santa Cruz long-toed salamander exposed to methomyl we anticipate mortality will range up to 95% of exposed individuals and will disproportionately affect larval and metamorph life stages as they are fully aquatic and feed on small aquatic organisms, such as algae and invertebrates. The aquatic life stage vulnerability of this species is high, and the exposure is variable but high for this species based on the type of aquatic habitat. Thus, we anticipate that the usage of methomyl will lead to the high level of exposure to aquatic life stages identified above.

Insecticide usage is specifically mentioned in the species 2009 and 2019 5-Year Reviews, although methomyl is not named among the examples of insecticides. While mosquito abatement activities are mentioned as a significant threat stemming from insecticides, so are agricultural activities and across most of the species' extant complexes and many of its breeding sites. Based on the CalPUR usage data, we anticipate a large extent of methomyl usage and that large numbers of individual salamanders and their prey will be exposed to methomyl over the duration of the proposed action. The Santa Cruz long-toed salamander breeds in ephemeral ponds and spends most of its life history in coastal live oak forest. However, this does not preclude methomyl exposure, through runoff in particular.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Santa Cruz long-toed salamander:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Santa Cruz long-toed salamander by >95% for terrestrial habitat and between 74 and 99% for aquatic habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*
2) *Applicators need 6 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the habitat of the Santa Cruz long-toed salamander by an order of magnitude (i.e., a 10-fold reduction).*

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

After incorporating the specific conservation measure above, we expect exposure for the Santa Cruz long-toed salamander and its prey to be low with mortality to a very small number of individuals. After reviewing the current status of the species, environmental baseline for the action area, effects of the proposed action, and species-specific conservation measures, we do not anticipate the registration of methomyl will appreciably reduce the survival and recovery of the Santa Cruz-long-toed salamander in the wild. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Santa Cruz-long-toed salamander.

References

U.S. Fish and Wildlife Service. 2019. Santa Cruz Long-toed Salamander (*Ambystoma macrodactylum croceum*), 5-Year Review: Summary and Evaluation. Ventura, California.

U.S. Fish and Wildlife Service. 2009. Santa Cruz Long-toed Salamander (*Ambystoma macrodactylum croceum*), 5-Year Review: Summary and Evaluation. Ventura, California.

U.S. Fish and Wildlife Service. 1999. Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) draft revised recovery plan. Portland, Oregon. vi. + 82 pp.

Integration and Synthesis Summary: Houston toad

Scientific Name:	Common Name:	Entity ID:
Bufo houstonensis	Houston toad	190

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our preliminary evaluation of the effects of the proposed action to the species (presented below), we determined there is high overlap of the action area with the species' range, and low past usage of methomyl within the species' range, indicating a medium extent of exposure. Most exposed individuals are likely to die and are likely to experience high levels of indirect effects resulting from loss of affected arthropod prey. Given that exposure is medium, and the level of indirect effects is high, we determined the risk of adverse effects to the species is high. As such, we expected a moderate number of individuals were likely to experience reduced availability of uncontaminated prey from the proposed action.

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

Species range

Based on range map dated: 1/26/2018; Wherever found; *States within the range:* TX. Figure 2 depicts the species' range.

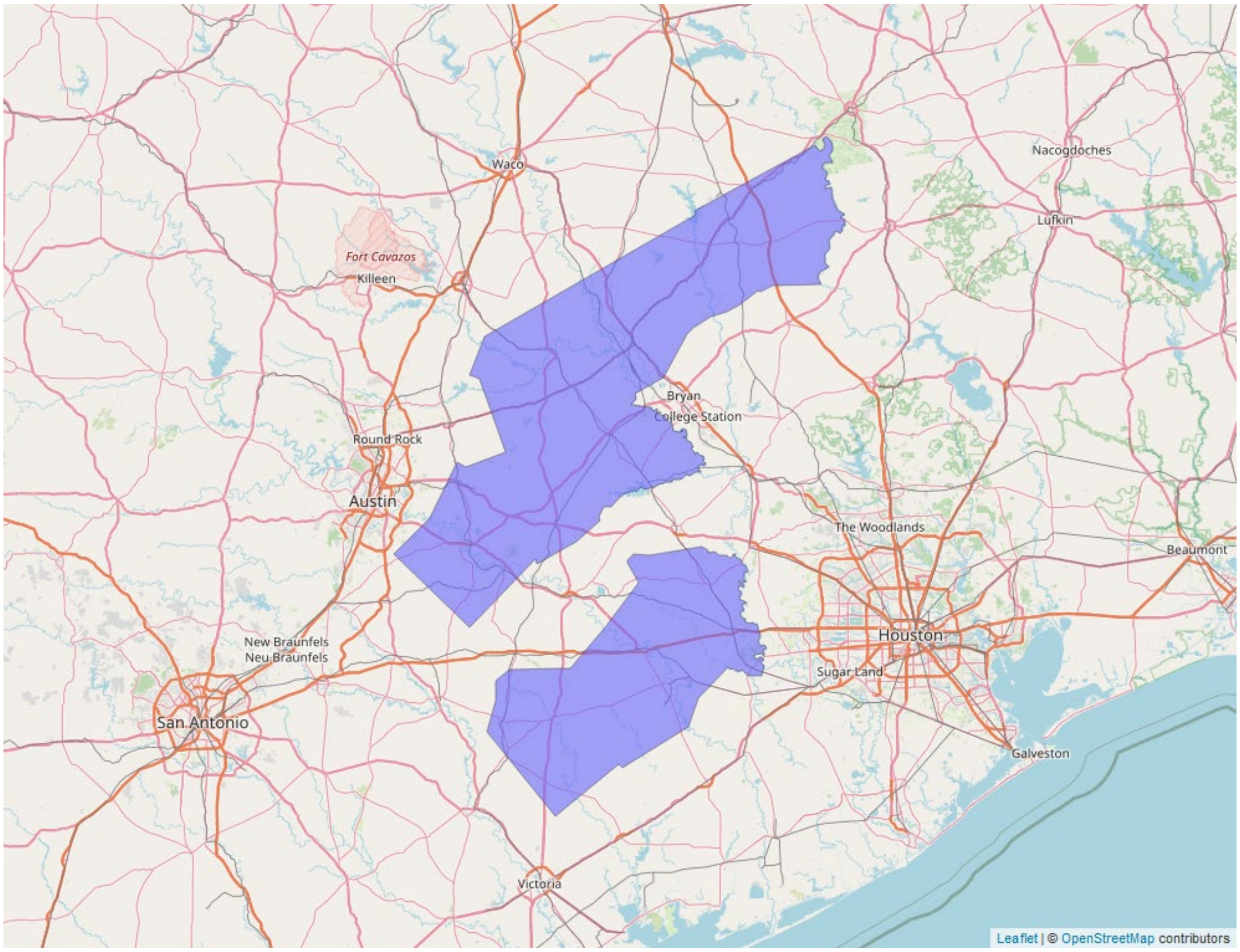

Figure 2. Range map of Houston toad (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/2206.

Vulnerability

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

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Review: 7/6/2018

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Historically, Houston toads ranged across the central coastal region of Texas with verified county reports in Austin, Bastrop, Brazos, Burleson, Colorado, Fort Bend, Harris, Lavaca, Lee, Leon, Liberty, Milam, and Robertson (Forstner and Dixon 2011, MacLaren and Forstner 2017). Houston toads disappeared from the Houston area (Harris, Fort Bend and Liberty counties) during the 1960-70s following an extended drought and the rapid urban expansion of the City of Houston. Overall trends for Houston toad abundance are declining across its range (McHenry and Forstner 2009; Forstner and Dixon 2011). Species authorities have provided a wide range of estimates for Houston toad subpopulation and census sizes throughout the years. Only the Bastrop County population has been surveyed consistently from year to year since the 1970s (Forstner and Dixon 2011). In the 1980s, surveyors reported observing 30 to 1,000 Houston toads per breeding pond in Bastrop County (Jacobsen 1983; Hillis et al. 1984). Thereafter, estimates of 2,000 Houston toads in all of Bastrop County were reported (Seal 1994). By 2003, Forstner (2003) estimated the number of Houston toads in Bastrop County to be between 100 and 200 individuals. During the 2011 Houston toad breeding/survey season, only 12 Houston toads were detected from extensive surveys in Austin, Bastrop, Burleson, Colorado, Lavaca, Lee, and Milam counties, as well as limited survey attempts in Leon and Robertson counties (Forstner and Dixon 2011; Dr. Michael Forstner, Texas State University, pers. comm. 2011). It is expected that Houston toads will soon be extirpated from Lee County, given population trends and habitat loss observed there since 2000 (Forstner and Dixon 2011).

Habitat loss and fragmentation continues to occur throughout the species' range. Fire suppression, conversion to agricultural pastures, residential development, and artificial impoundments have contributed to a very different ecosystem and landscape than when the Houston toad was first described in 1953. Early descriptions of Houston toad habitat (Kennedy 1962) differ from current survey and population monitoring results. Drought has been an additional stressor for the Houston toad for many years. Direct effects of drought on this species include desiccation, loss of breeding sites, and loss of eggs or tadpoles resulting from pond evaporation. These effects may be exacerbated due to other threats (e.g., habitat fragmentation and degradation) (Forstner and Dixon 2011). Predation by red imported fire ants (*Solenopsis invicta*) is an ongoing threat to the species. The distribution of the Houston toad appears to be naturally restricted as the result of specific habitat requirements for breeding and development. Small, sedentary species with restricted distributions, specialized habitat niches, and narrow climatic tolerances are especially sensitive to changes in habitat conditions (Welsh 1990, deMaynadier and Hunter 1998). These natural restrictions make them particularly vulnerable to the negative effects of human-induced changes that result in habitat loss, degradation, and fragmentation (Hillis et al. 1984). The 1984 recovery plan mentions the herbicide atrazine as a potential threat to the species.

Conservation efforts have included development of Habitat Conservation Plans, Safe Harbor Agreements, and the purchase of land by Texas Parks and Wildlife Department for the conservation of the Houston toad. A captive assurance colony was begun in 2007 and has maintained several hundred adult Houston toads in captivity at the Houston Zoo since that time (HZI 2010-2019). In addition, captive propagation and headstarting since 2013 have resulted in population supplementation of Houston toads, principally at the Griffith League Ranch (GLR) in Bastrop County, on the order of a million eggs per year since the program gained full efficiency in 2016. Results have been promising, as captures of adult Houston toad at the GLR increased from 40 in 2016 and 63 in 2017, to 130 in 2018 and 126 in 2019 (Forstner 2016, 2017, 2018, 2019). However, these results are still short-term, subject to frequent stochastic events (e.g., multiple catastrophic wildfires within designated critical habitat within the last 10 years) and do not address losses of habitat and the species' representation in other parts of the range.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 37.9% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 11). Up to 14.1% of the species' range overlaps with methomyl use sites while 23.7% of the range occurs off-field (but may still be exposed to spray drift or runoff).

Usage

Based on past usage data, we anticipate up to 3.5% of the species' range will be treated with methomyl annually.

Table 12. Overlap of methomyl use sites with Houston toad range.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Alfalfa	<0.1	0.1	0.1	<0.1	<0.1	<0.1
Citrus	NA	NA	NA	NA	NA	NA
Corn[4]	6.1	8.6	14.6	0.3	0.4	0.7
Cotton	3.4	4.6	8	0.2	0.2	0.4
Other Grains	4.2	9.1	13.4	0.2	0.5	0.7
Other Orchards	0.3	1	1.3	0.3	1	1.3

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

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	0.6	2.2	2.8	<0.1	<0.1	0.1
Vegetables and Ground Fruit	<0.1	0.3	0.4	<0.1	0.3	0.4
Wheat	NA	NA	NA	NA	NA	NA
Total	**14.1**	**23.7**	**37.9**	**1.1**	**2.4**	**3.5**

Exposure Summary

There is a high extent of overlap between the action area and the species' range. Based on past usage data, we expect a low level of usage within the species' range. Given that the extent of overlap is high, and that expected usage is low we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Medium

General Conservation Measures:

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk to the Houston toad directly when in the aquatic phase as eggs or early metamorphs. Thus, we provide in Table 12 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure. However, despite the incorporation of the rain restriction mitigation, indirect effects to dietary items remain high for this species.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The methomyl label has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states “Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds”.

Effects of the Action: Toxicity

Direct Effects

We expect the Houston toad will primarily experience direct adverse effects (i.e., mortality) from dietary exposure. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 2.5 mg/kg-bw, which can occur when individuals exclusively consume amphibians. This level of exposure on-field can cause mortality in up to 95.5% of exposed individuals. We know that adult Houston toads feed on a variety of insects and other invertebrates. Bragg (1960) reported that captive Houston toads favored many small to medium-sized carabids (ground beetles), several small beetles of unknown families, several dipteral (flies), green lacewings, and many types of small moths. Thus, if feeding on-field (which is anticipated to be very limited) or adjacent to fields, we anticipate mortality but most likely less than predicted when exclusively feeding on amphibians on-field.

We do not expect dietary dosages from consuming contaminated food items off-field will result in direct adverse effects as we expect lower levels of methomyl (dosages up to 0.1 mg/kg-bw) will occur in these food items.

Aquatic phase:

EPA’s aquatic exposure modeling indicates that EECs within the regions and aquatic habitats that the Houston toad occupies will likely be exposed to maximum methomyl concentrations ranging from 23.1 to 387 µg/L, depending on the type of habitat (Table 12). Mortality is not expected in large volume waterbodies but may occur in up to 1.6% of exposed individuals in low flow/low volume waterbodies where tadpoles and early metamorphs are found. We do not expect any direct adverse effects from the consumption of algae and pollen by Houston toad tadpoles. Once they leave the pond after metamorphosis, juvenile Houston toads feed on small invertebrates found on the forest floor.

Table 13. Predicted environmental concentrations of methomyl within the Houston toad habitat and the associated level of mortality expected to occur with exposure.

Aquatic Habitat	HUC 2 Region	Max EEC (µg/L)	Percent amphibian mortality
Large volume waterbodies	HUC_12a	23.1	<0.01
Low flow/low volume waterbodies	HUC_12a	387.9	1.6

We anticipate adverse effects to growth and/or reproduction are unlikely.

Indirect Effects

Based on available life history information, we expect the Houston toad relies primarily on arthropods (particularly insects) for food resources. Based on available toxicity data, we expect individuals of these prey species will likely experience high levels of mortality with exposure to methomyl, with very limited amounts on- and increasingly likely off-field due to the species habitat preferences. As such, we expect there may be substantial reductions in the abundance of invertebrate prey species throughout the species' range where use sites abut preferred habitats, indicating a high level of indirect adverse effects are likely to occur.

Toxicity Summary

We expect a low level of direct adverse effects will occur to the Houston toad during the aquatic phase as eggs and early metamorphs. We expect a high level of effects on-field as individuals foraging on treated fields will likely die during the adult phase. We expect a low level of direct adverse effects will occur off-field of exposed individuals. We do not expect sublethal effects (e.g., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a high level of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause a high level of mortality to invertebrate organisms that act as the primary food resource for the species. As such, we determine the Houston toad has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Houston toad has a medium exposure ranking. Based on past methomyl usage data, we expect up to 3.5% of the range may be treated annually but may cover up to 37.9% of the range over the duration of the proposed action depending how usage patterns change over time. This indicates that a moderate portion of the species' range is likely to be treated overall. As such, we expect a moderate number of individuals are likely to be exposed to methomyl.

The Houston toad has a high toxicity ranking. We expect a high level of mortality will occur on-field as a result of dietary exposure through the consumption of contaminated invertebrate food items. We expect a low level of mortality will occur off-field, which is also a result of dietary exposure from the consumption of contaminated food items. We expect a low level of mortality during the aquatic phase to tadpoles and early metamorphs in smaller, low flowing aquatic habitats, which comprises a large amount of the reproductive habitat of this species. We expect a high level of indirect adverse effects are likely to occur as we expect invertebrate prey species will experience a high level of mortality with exposure to predicted concentrations of methomyl.

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

Preliminary Conclusion (with General Conservation Measures)

The Houston toad has a high vulnerability ranking due to its endangered status, limited distribution, small population size, low juvenile survival rates, susceptibility to stochastic events, and anthropogenic threats to the species (e.g., continued degradation, fragmentation, and loss of suitable aquatic and upland habitats from urbanization, invasive species, and agricultural impacts to habitat). Populations have continued to decline since at least the 1990s, and the isolated populations remaining are at risk from continued agricultural and development impacts. The species has a medium likelihood of exposure ranking due to labeled uses across the range and anticipated low levels of methomyl usage. While pesticides were specifically mentioned in the species' environmental baseline and cumulative effects discussion above, the estimated methomyl usage within the species range is low (<5%). However, we anticipate the low levels of usage are still a stressor for this highly imperiled species, given its aquatic life history component and susceptibility to environmental contaminants (e.g., pesticides, degraded water quality), and that individuals can be subject to exposure through multiple pathways (e.g., dermal exposure, ingestion of contaminated arthropod prey) and at various life stages (egg, larval, juvenile, and adult). Similarly, the high overlap with the action area (37.9% of the range and 23.7% of the off-field portion of the range) suggests that over the duration of the proposed action, a significant portion of the range will be subject to methomyl exposure.

It appears that agricultural conversion has limited the availability of suitable habitat (through both structural change and chemical contamination). While Houston toads are primarily found as a forest dwelling species today, research demonstrates that the species can persist in a mosaic of landscapes, particularly in more arthropod-rich grasslands (Brown and Thomas 1982, Marsh 2016, Sirsi et al. 2020, Lamberts 2021). Houston toads are also highly mobile, particularly in the juvenile life stage (Vandewege et al. 2012), which increases the risk of exposure to the species (i.e., seasonally, most Houston toads exist as highly mobile juveniles). We anticipate that applications of methomyl will result in reductions of the Houston toad's prey base and to a lesser extent mortality through direct and indirect adverse effects.

In addition to terrestrial exposure, we anticipate exposure to aquatic phases (e.g., egg and larval life stages) from runoff and spray drift and mortality of individuals at natal ponds across portions of the range where reproductive sites exist adjacent to agricultural use sites. Vulnerability of the aquatic life stage is low as we anticipate concentrations of methomyl in the aquatic environment to be low, with only low levels of mortality predicted in smaller, low flowing habitats where tadpoles and early metamorphs are found. Once they leave the pond after metamorphosis, juvenile Houston toads feed on small invertebrates found on the forest floor and will be susceptible to consumption of contaminated prey.

We anticipate a moderate number of individuals of this species will die (i.e., through direct exposure or through ingestion of contaminated prey) and experience reductions in invertebrate prey over the duration of the proposed action.

Final Conclusion (with Species-Specific Conservation Measures)

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

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Houston toad by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

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

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

After incorporating the specific conservation measure above, we expect exposure for the Houston toad to be low. As such we anticipate low numbers of individuals of this species will be adversely impacted. We anticipate loss of prey on agricultural fields adjacent to Houston toad habitat will incrementally reduce prey availability but at much reduced levels. Similarly, while direct exposure from consumption of contaminated prey and aquatic exposure through spray drift into breeding sites at the periphery of forested habitats is possible, we anticipate that with the measures described above that these pathways of exposure will be greatly limited and result in exposure of very low numbers of individuals or their prey over the course of the action, leading to mortality of a very small number of individuals. After reviewing the current status of the species, environmental baseline for the action area, effects of the proposed action, and species-specific conservation measures, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the Houston toad. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Houston toad.

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Integration and Synthesis Summary: Puerto Rican crested toad

Scientific Name:	Common Name:	Entity ID:
Peltophryne lemur	Puerto Rican crested toad	195

Species Overview

In reviewing the status of the species, the environmental baseline and cumulative effects for the action area, the Service determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is medium overlap of the action area with the species' range, and likely but unknown levels of past usage of methomyl within the species' range, indicating a medium extent of exposure. Most exposed individuals are likely to die or are likely to experience high levels of indirect effects resulting from loss of arthropod prey species. Given that exposure is medium, and the level of indirect effects is high, we determined the risk of adverse effects to the species is high. As such, we expected a moderate number of individuals were likely to experience reduced availability of arthropod prey and reduced feeding success from the proposed action.

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

Species range

Based on range map dated: 8/23/2021; Wherever found; *States within the range:* PR. Figure 3 depicts the species' range.

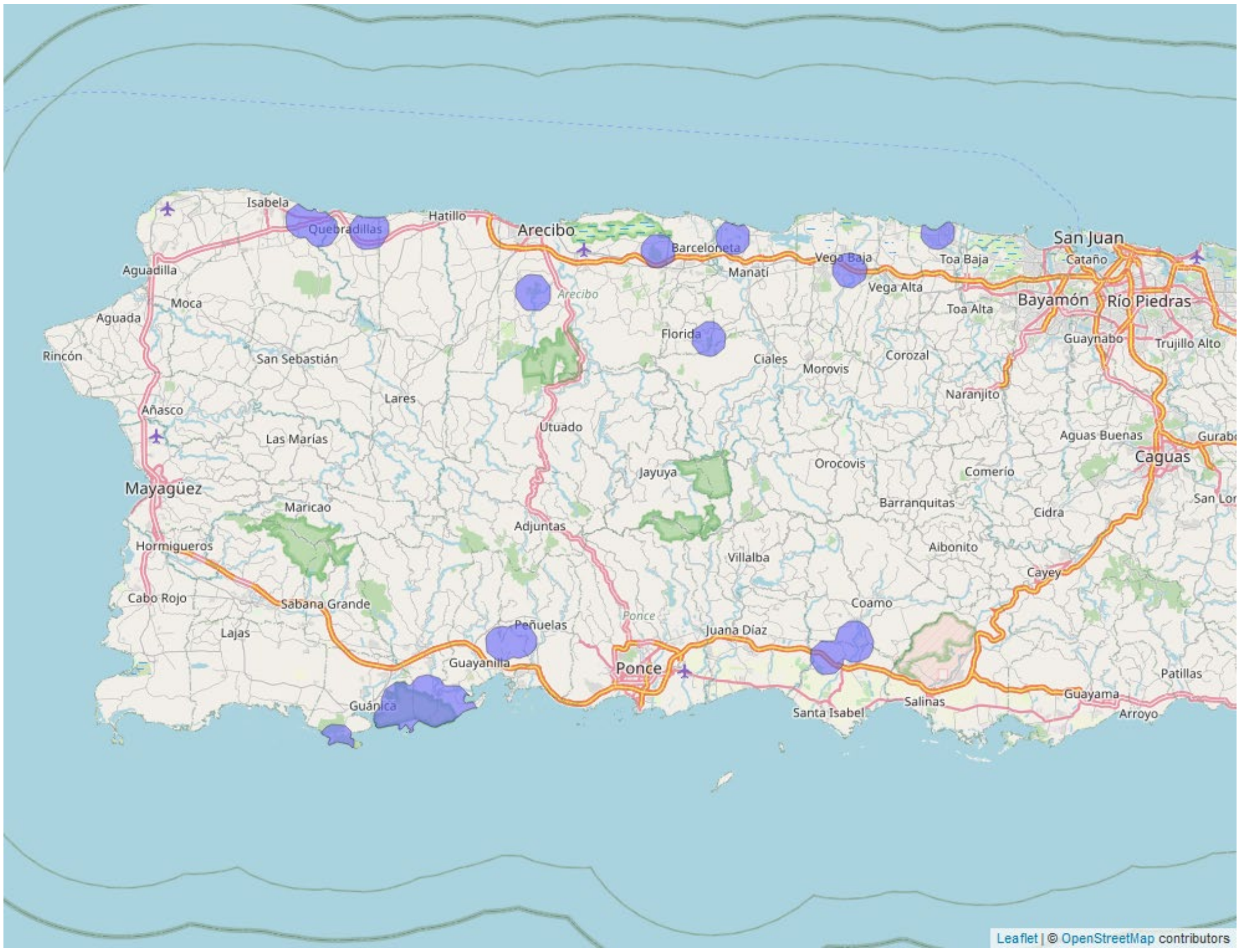

Figure 3. Range map of Puerto Rican crested toad (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3958.

Vulnerability

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

Summary of status

Listing status: Threatened

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

Most recently completed 5-Year Review: 8/4/2022

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

Number of populations: Multiple populations (few)

Species trends: Stable

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

At the time the recovery plan was approved (USFWS 1992) there were two known, isolated populations. The Guanica population, although small, is relatively stable and consists of approximately 2,000 individuals (Miguel Canals, Puerto Rico Department of Natural Resources, pers. Comm., 1991). The Quebradillas population consisted of approximately 25 to 50 individuals. However, no standardized quantitative population estimates have been obtained. Genetic research indicated that the two populations were distinct and should be managed separately. The latter population is currently believed to have been extirpated. Since 1992 active re-introduction efforts have resulted in more than 310,000 eggs and toadlets being released into six re-introduction sites (Manglillo Grande, El Tallonal. Gabia Farm, Rio Encantado, Cueva el Convento, and La Esperanza). The Puerto Rican crested toad populations are vulnerable to demographic and environmental catastrophe. These isolated populations may be reduced to levels beyond which they could not recover if a natural disaster (hurricane, fire, flood, tidal wave) or a prolonged drought were to occur, especially since reproduction in this species appears to rely on climatic events. When compounded with the reduced availability of breeding sites, these factors increase the likelihood of whole populations being eliminated.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 5.9% of the species' range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 13). Up to 3.8% of the species' range occurs on methomyl use sites while 2.1% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 14. Overlap of methomyl use sites with the Puerto Rican crested toad range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	3.8	2.1	5.9

Usage

Past methomyl usage data in Puerto Rico is unavailable. However, Census of Agriculture data in Puerto Rico indicate that insecticide usage occurs on 20-70% of crops annually per municipality, with methomyl presumably being among those insecticides. We broadly use this data as confirmation that methomyl usage likely occurs within the species' range.

Additional Exposure Considerations

While there are many populations of the Puerto Rican crested toad that are protected under conservation ownership (USFWS 2022), there are a few populations where breeding ponds are within close proximity to agricultural areas (Punta Ventana, Gabia Farm, Ciénaga).

Exposure Summary

There is a medium extent of overlap between the action area and the species' range. As such, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Medium

General Conservation Measures:

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.
However, despite the incorporation of the rain restriction mitigation, indirect effects remain high for this species.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds". We anticipate that, in many cases, these buffers will reduce exposure to the Puerto Rican crested toad and subsequent risk of direct effects and indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

We expect the Puerto Rican crested toad will primarily experience direct adverse effects (i.e., mortality) from dietary exposure. The Puerto Rican crested toad is known to prey on ants, beetles, crickets, and spiders. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 2.4 mg/kg-bw, which can occur when individuals exclusively consume soil invertebrates. This level of exposure on-field can cause mortality in up to 94.7% of exposed individuals.

Breeding ponds (e.g., the Punta Ventana natura breeding pond) that are located near agriculture and use of agrochemicals (i.e., pesticides, herbicides, and chemical fertilizers) may adversely affect the suitability of nearby breeding ponds (USFWS 2022). We anticipate the Puerto Rican crested toad will forage close to the agricultural areas near to the breeding ponds, particularly at this location (Punta Ventana) as well as populations in the Gabia Sector near Gabia Farm, within their range due to its vicinity to the agricultural areas where their prey items are found.

We expect dietary dosages from consuming contaminated food items off-field will result in lower levels of direct adverse effects as we expect lower levels of methomyl will occur in these food items further from an applied field.

We also anticipate the tadpoles, juvenile metamorphs, or breeding adults will be adversely impacted by methomyl from concentrations in breeding ponds, most likely in areas close to agricultural lands and after storm events as the Puerto Rican crested toad is known to emerge prior to storm events and will remain until the waters subside. Thus, methomyl that may have been applied to these agricultural lands, may move off of the fields and settle in these small static waters where several life-stages could be exposed.

Indirect Effects

The Puerto Rican crested toad relies on soil invertebrates and other arthropods for food resources, as mentioned above. Based on available toxicity data, we expect individuals of these prey species will likely experience high levels of mortality with exposure to methomyl, both on- and off-field. As such, we expect there may be substantial reductions in the abundance of invertebrate prey species upon which the Puerto Rican crested toad relies exclusively, thus, indicating a high level of indirect adverse effects are likely to occur.

Toxicity Summary

We expect a high level of direct adverse effects will occur on-field as up to 94.7% of individuals foraging on-field will likely die, in particular the individuals in the locations at Gabia Farm, Punta Ventana breeding ponds, or Ciénaga breeding ponds outside of Guánica Commonwealth Forest. We expect a low level of direct adverse effects off-field. We do not expect sublethal effects (e.g., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a high level of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause a high level of mortality to organisms that act as food resources for the species (insects and spiders). As such, we determine the Puerto Rican crested toad has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Puerto Rican crested toad has a medium exposure ranking. Based on past methomyl usage data, we expect up to 3.5% of the range may be treated annually but may potentially cover up to 5.9% of the range over the duration of the proposed action depending how usage patterns change over time. This indicates that a moderate portion of the species' range is likely to be treated overall. As such, we expect a moderate number of individuals are likely to be exposed to methomyl.

The Puerto Rican crested toad has a high toxicity ranking. We expect a high level of mortality will occur on-field as a result of dietary exposure through the consumption of contaminated food items. We expect a low level of mortality will occur off-field. We expect a high level of indirect adverse effects are likely to occur as we expect prey species will experience a high level of mortality with exposure to predicted concentrations of methomyl.

In addition, we also anticipate the tadpoles, juvenile metamorphs, or breeding adults will be adversely impacted by methomyl from concentrations in breeding ponds, most likely in areas close to agricultural lands and after storm events as the Puerto Rican toad is known to emerge prior to storm events and will remain until the waters subside. Thus, methomyl that may have been applied to these agricultural lands, may move off of the fields and settle in these small static waters where several life-stages could be exposed.

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

Preliminary Conclusion (with General Conservation Measures)

The Puerto Rican crested toad has a high vulnerability ranking due to its limited distribution, small population size, susceptibility to stochastic events, and anthropogenic threats to the species (e.g., continued degradation, fragmentation, and loss of suitable aquatic and upland habitats from urbanization, invasive species, and agricultural impacts to habitat). The species has a high toxicity ranking due to direct effects from ingestion of contaminated arthropod prey and indirect effects from loss of arthropod prey, and generally as amphibians, given their aquatic life histories and susceptibility to environmental contaminants (e.g., pesticides, degraded water quality), can be subject to exposure through multiple pathways (e.g., dermal exposure, ingestion of contaminated arthropod prey) and at various life stages (egg, larval, juvenile and adult). While we have estimated usage broadly for the Caribbean species and we acknowledge the Puerto Rican crested toad resides in forest associations of arid or semiarid, rocky areas with an abundance of limestone fissures and cavities in well-drained soil, the species ranks as medium for likelihood of exposure, primarily from runoff, and particularly for larval stages in breeding sites adjacent to agricultural uses, and due to its limited distribution.

As we anticipate that moderate numbers of individuals will be affected over the duration of the action and given the status of the species and the small population size, we expect species-level effects to occur. Therefore, we anticipate that the proposed action will appreciably reduce the survival and recovery of the Puerto Rican crested toad. After reviewing the current status of the listed species, the environmental baseline for the action area, the effects of the proposed action, it is our biological opinion that the registration of methomyl is likely to jeopardize the continued existence of the Puerto Rican crested toad.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Puerto Rican crested toad:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Puerto Rican crested toad by >95% for terrestrial habitat and between 74 and 99% for aquatic habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2) *Applicators need 6 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the habitat of the Puerto Rican crested toad by an order of magnitude (i.e., a 10-fold reduction).*

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

After incorporating the specific conservation measure above, we expect exposure for the Puerto Rican crested toad to be low. As such we anticipate low numbers of individuals of this species will be adversely impacted. We anticipate loss of prey on agricultural fields adjacent to Puerto Rican crested toad habitat will incrementally reduce prey availability but at much reduced levels. Similarly, while direct exposure from consumption of contaminated prey and aquatic exposure through spray drift into breeding sites at Gabia Farm, Punta Ventana breeding ponds, and Ciénaga wetland breeding ponds outside of Guánica Commonwealth Forest habitats, and other Puerto Rican crested toad population locations is possible, we anticipate that with the measures described above that these pathways of exposure will be greatly limited and result in exposure of very low numbers of individuals and prey losses over the course of the action that will lead to mortality of a very small number of individuals. After reviewing the current status of the species, environmental baseline for the action area, effects of the proposed action, and species-specific conservation measures, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the Puerto Rican crested toad. Thus, , it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Puerto Rican crested toad.

References

U.S. Fish and Wildlife Service. 2022. 5-Year Review: Summary and Evaluation, Puerto Rican Crested Toad (*Peltophryne lemur*). Boquerón, Puerto Rico. 52 pp.

U.S. Fish and Wildlife Service. 2016. 5-Year Review: Summary and Evaluation, Puerto Rican Crested Toad (*Peltophryne lemur*). Boquerón, Puerto Rico. 52 pp.

U.S. Fish and Wildlife Service. 1992. Recovery Plan for the Puerto Rican crested toad (*Peltophryne lemur*). Atlanta, Georgia. 19 pp.

Integration and Synthesis Summary: Guajón

Scientific Name:	Common Name:	Entity ID:
Eleutherodactylus cooki	Guajón	196

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is medium overlap of the action area with the species' range, and likely but unknown levels of past usage of methomyl within the species' range, indicating a medium extent of exposure. Most exposed individuals are likely to die and are likely to experience high levels of indirect effects resulting from loss of arthropod prey species. Given that exposure is medium, and the level of indirect effects is high, we determine the risk of adverse effects to the species is high. As such, we expected a moderate number of individuals were likely to experience reduced availability of arthropod prey and therefore reduced feeding success from the proposed action.

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

Species range

Based on range map dated: 11/12/2020; Wherever found; *States within the range:* PR. Figure 4 depicts the species' range.

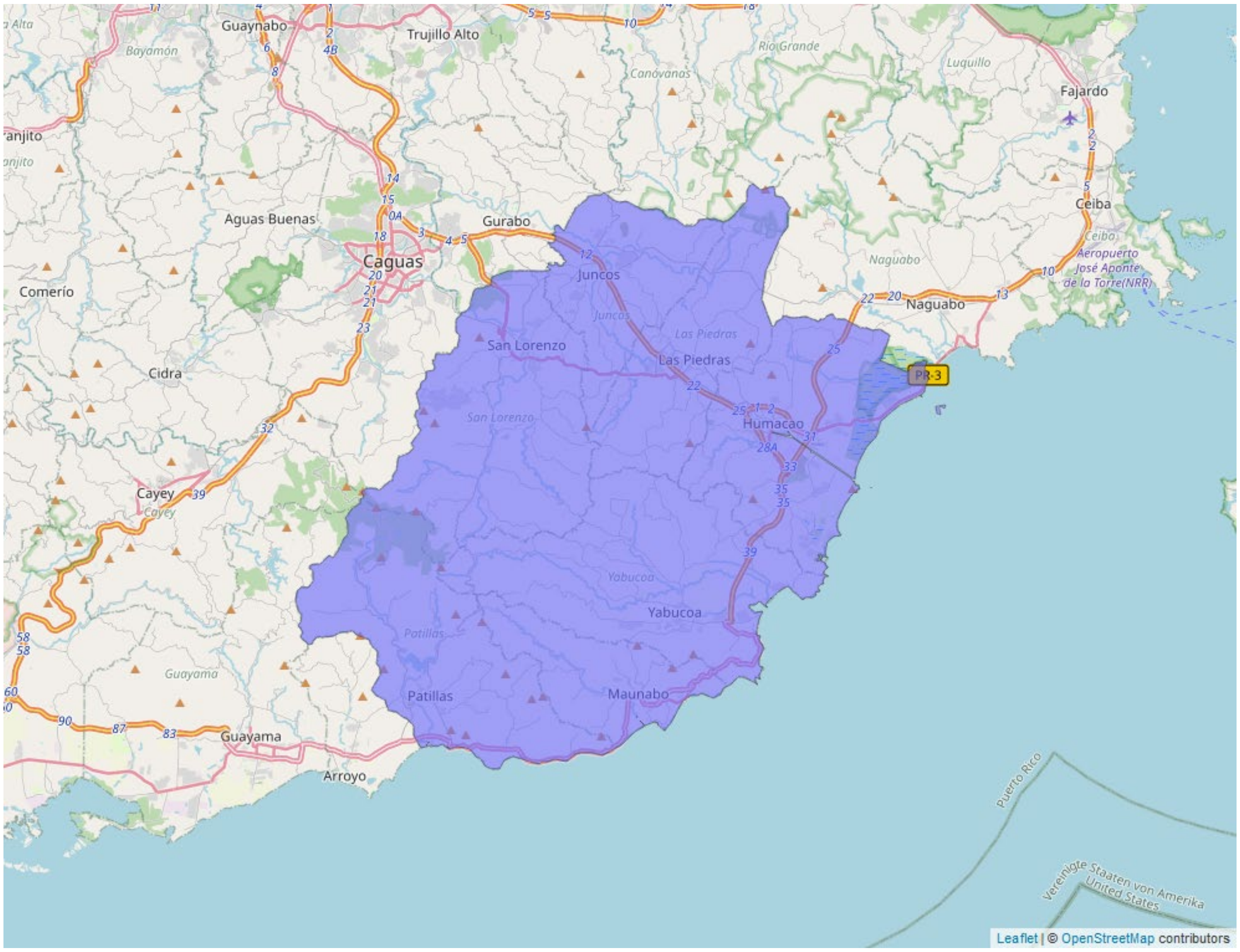

Figure 4. Range map of Guajón (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6963

Vulnerability

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

Summary of status

Listing status: Threatened

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

Most recently completed 5-Year Review: 8/31/2022

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

Number of populations: Multiple populations (numerous)

Species trends: Stable

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The guajón is known to occur in the Cuchilla de Panduras Mountain range in Puerto Rico, and Arroyo, Patillas, Maunabo, Yabucoa, San Lorenzo, Las Piedras, Humacao Municipalities. The population is thought to be stable. Threats to this species include loss of habitat, urban development, and recreational stream use. There is no information indicating that the species status has either improved or declined. Known guajón populations in the Sierra de Panduras should remain stable. Populations in Las Piedras must be closely monitored to prevent impacts from residential developments in private properties. Burrowes (1997) studied the guajón at a cave system in the Cuchilla de Panduras, where a total of 130 individuals were marked at the site, resulting in a mean population size estimate of 96 individuals, and a mean of 20 new individuals entering the population every six months. Another mark-recapture study conducted by Vega-Castillo (2000) showed mean population size of 436 individuals in a rocky stream in Humacao, and 390 individuals for a rocky stream at Las Piedras. Burrowes (2000b and 1997) assessed the genetic variation within and among populations of the guajón, in separate cave systems within the historic geographic range of the species and found a high degree of genetic variation and lack of population differentiation in the species. These studies also documented that genetic flow among populations of "guajones" is necessary to maintain the high genetic variability observed in the species. This genetic variability depends on inter-connection between caves, and the availability of clean subterranean waterways as indirect dispersal routes necessary for out-crossing (Burrowes 2000b and 1997). This study also suggested that the species is perfectly adapted to the existing environmental conditions in the caves, and that clean waterways must be maintained between the guajonales (i.e., rock formations in the species habitat consisting of caves and cavities made of plutonic, granitic, or sedimentary rocks) to maintain a high degree of genetic variation among the guajón population.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 4.8% of the species' range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 14). Up to 3.1% of the species' range occurs on methomyl use sites while 1.6% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 15. Overlap of methomyl use sites with the guajón range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	3.1	1.6	4.8

Usage

Past methomyl usage data in Puerto Rico is unavailable. However, Census of Agriculture data in Puerto Rico indicate that insecticide usage occurs on 20-70% of crops annually per municipality, with methomyl presumably being among those insecticides. We broadly use this data as confirmation that methomyl usage likely occurs within the species' range.

Additional Exposure Considerations

This species is considered a habitat specialist and populations only exist within guajonales or caves formed from large boulders of granite rock formations and/or streams from these formations (USFWS 2004). The guajón is also known to occur in disturbed habitat areas such as adjacent to rural roads, culverts, and aqueduct pump stations (USFWS 2017).

Eleutherodactylus frogs are known as direct developers because they do not go through the usual tadpole stage thus, they do not have an aquatic phase. Guajón females lay eggs on the rocks surface and males are in charge of guarding the eggs. Embryonic development occurs inside the eggs that later hatch into miniature copies of the adults.

Exposure Summary

There is a medium extent of overlap between the action area and the species' range. As such, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Medium

General Conservation Measures:

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.
However, indirect effects remain high following exposure in terrestrial habitats.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds". We anticipate that, in many cases, these buffers will significantly reduce exposure to the guajón when associated with waterbodies and subsequent risk of direct effects and indirect effects to prey items. However, toxicity remains high following exposure in terrestrial habitats.

Effects of the Action: Toxicity

Direct Effects

We expect the guajón will primarily experience direct adverse effects (i.e., mortality) from dietary exposure. The guajón is an important primary consumer of invertebrates. They can eat a large variety of insects like cockroaches and crickets, as well as other invertebrates like spiders. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 1.6 mg/kg-bw, which can occur when individuals exclusively consume arthropods. This level of exposure on-field can cause mortality in up to 79.5% of exposed individuals. It is likely the guajón will forage near agricultural fields (edge of field and thus the same level as on-field exposure) as the streams near the guajonales in many instances are in close proximity to agricultural areas throughout their range.

We do not expect dietary dosages (up to 0.1 mg/kg-bw) from consuming contaminated food items off-field will result in mortality of exposed individuals.

Indirect Effects

Based on available life history information, we know the guajón relies on several different insect species for food resources. Based on available toxicity data, we expect individuals of these prey species have a within Class range of sensitivity to methomyl exposure and thus mortality may vary, both on- and edge of field. As such, we expect there could be substantial reductions in the abundance of prey species, depending on the insect Order being preyed upon, throughout the species' range. This indicates a high level of indirect adverse effects are likely to occur, but we anticipate that prey will be available after exposure and any losses will likely only be temporary.

Toxicity Summary

We expect a high level of direct adverse effects will occur on-field as up to 79.5% of individuals foraging on treated fields will likely die. We do not expect mortality to result from foraging off-field. We do not expect sublethal effects (i.e., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a medium level of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause mortality to organisms (insects) that are food resources for the species. As such, we determine the guajón has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The guajón has a medium exposure ranking. Based on past methomyl usage data, we expect up to 3.5% of the range may be treated with methomyl annually but may potentially cover up to 4.8% of the range over the duration of the proposed action depending how usage patterns change over time. This indicates that a moderate portion of the species' range is likely to be treated overall. As such, we expect a moderate number of individuals are likely to be exposed to methomyl.

The guajón has a high toxicity ranking. We expect a high level of mortality will occur on-field or near edges of fields as a result of dietary exposure through the consumption of contaminated food items. It is likely the guajón will forage near agricultural fields as the streams near the guajonales in many instances are in close proximity to agricultural areas throughout their range. We do not expect mortality will occur from foraging off-field. We expect a medium level of indirect adverse effects are likely to occur as we expect some prey species will experience mortality with exposure to predicted concentrations of methomyl.

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

Preliminary Conclusion (with General Conservation Measures)

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the registration of methomyl is likely to jeopardize the continued existence of the guajón. As discussed below, the vulnerability and toxicity from methomyl are high for this species and we anticipate the likelihood of exposure to methomyl is medium. Thus, we anticipate that moderate numbers of individuals will be affected over the duration of the proposed action, and we expect species-level effects to occur.

The guajón has a high vulnerability ranking due to its limited distribution, small population size, susceptibility to stochastic events, and anthropogenic threats to the species (e.g., continued degradation, fragmentation, and loss of suitable aquatic and upland habitats from urbanization, invasive species, and agricultural impacts to habitat). The species has a high toxicity ranking due to direct effects from ingestion of contaminated arthropod prey and indirect effects from loss of arthropod prey and generally as amphibians, given their aquatic habitat preferences and susceptibility to environmental contaminants (e.g., pesticides, degraded water quality), can be subject to exposure through multiple pathways (e.g., dermal exposure, ingestion of contaminated arthropod prey) and at various life stages (juvenile and adult). While we have estimated usage broadly for the Caribbean species and we acknowledge the guajón resides in terrestrial freshwater, subtropical moist forest, subtropical wet forest, cave, and streams, the species ranks as medium for likelihood of exposure from runoff, and particularly for breeding sites adjacent to agricultural uses, and due to its limited distribution.

Final Conclusion (with Species-Specific Conservation Measures)

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

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for guajón by >95% for terrestrial habitat and between 74 and 99% for aquatic habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2) *Applicators need 6 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the habitat of the guajón by an order of magnitude (i.e., a 10-fold reduction).*

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

After incorporating the specific conservation measure above, we expect exposure for the guajón to be low. As such we anticipate low numbers of individuals of this species will be adversely impacted. We anticipate loss of prey on agricultural fields adjacent to guajón habitat will incrementally reduce prey availability but at much reduced levels. Similarly, while direct exposure from consumption of contaminated prey and aquatic exposure through spray drift into breeding sites at within the guajonales habitats is possible, we anticipate that with the measures described above that these pathways of exposure will be greatly limited and result in exposure of very low numbers of individuals and its prey over the course of the action, leading to mortality of a very small number of individuals. After reviewing the current status of the species, environmental baseline for the action area, effects of the proposed action, and species-specific conservation measures, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the guajón. Thus, it is our biological opinion that the registration of methomyl is not likely to jeopardize the continued existence of the guajón.

References

U.S. Fish and Wildlife Service. 2022. Guajón or Puerto Rican Demon (*Eleutherodactylus cooki*) 5-Year Review: Summary and Evaluation. Boquerón, Puerto Rico. 26pp.

U.S. Fish and Wildlife Service. 2011. Guajón or Puerto Rican Demon (*Eleutherodactylus cooki*) 5-Year Review: Summary and Evaluation. Boquerón, Puerto Rico.

U.S. Fish and Wildlife Service. 2004. Recovery Plan for the Guajón or Puerto Rican Demon (*Eleutherodactylus cooki*). Atlanta, Georgia. 31 pp.

Integration and Synthesis Summary: Frosted flatwoods salamander

Scientific Name:	Common Name:	Entity ID:
Ambystoma cingulatum	Frosted flatwoods salamander	199

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, while the EPA's BE identified high levels of overlap based on past use and usage, we determined there is low overlap of the action area with the species' range, and low past usage of methomyl within the species' range, indicating a low extent of exposure. In addition, most of the known occurrences of the frosted flatwoods salamander exist on federal lands (22 of 25 known populations), which leads us to conclude that the overlap and usage estimates are overestimated and that the likelihood of exposure for this species is actually low. Most exposed aquatic larval individuals are unlikely to die or any levels of indirect effects resulting from loss of prey species, but we anticipate high levels of mortality of terrestrial juvenile and adults through ingestion of contaminated prey when exposed. However, given the likelihood of limited exposure on the majority of extant sites, we anticipate that exposure is low, and the level of indirect effects is low, we determined the risk of adverse effects to the species is low. As such, we expect only a small number of individuals are likely to experience reduced feeding success from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the frosted flatwoods salamander. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the frosted flatwoods salamander. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 2/28/2023; Wherever found; *States within the range:* FL, GA, SC. Figure 5 depicts the species' range.

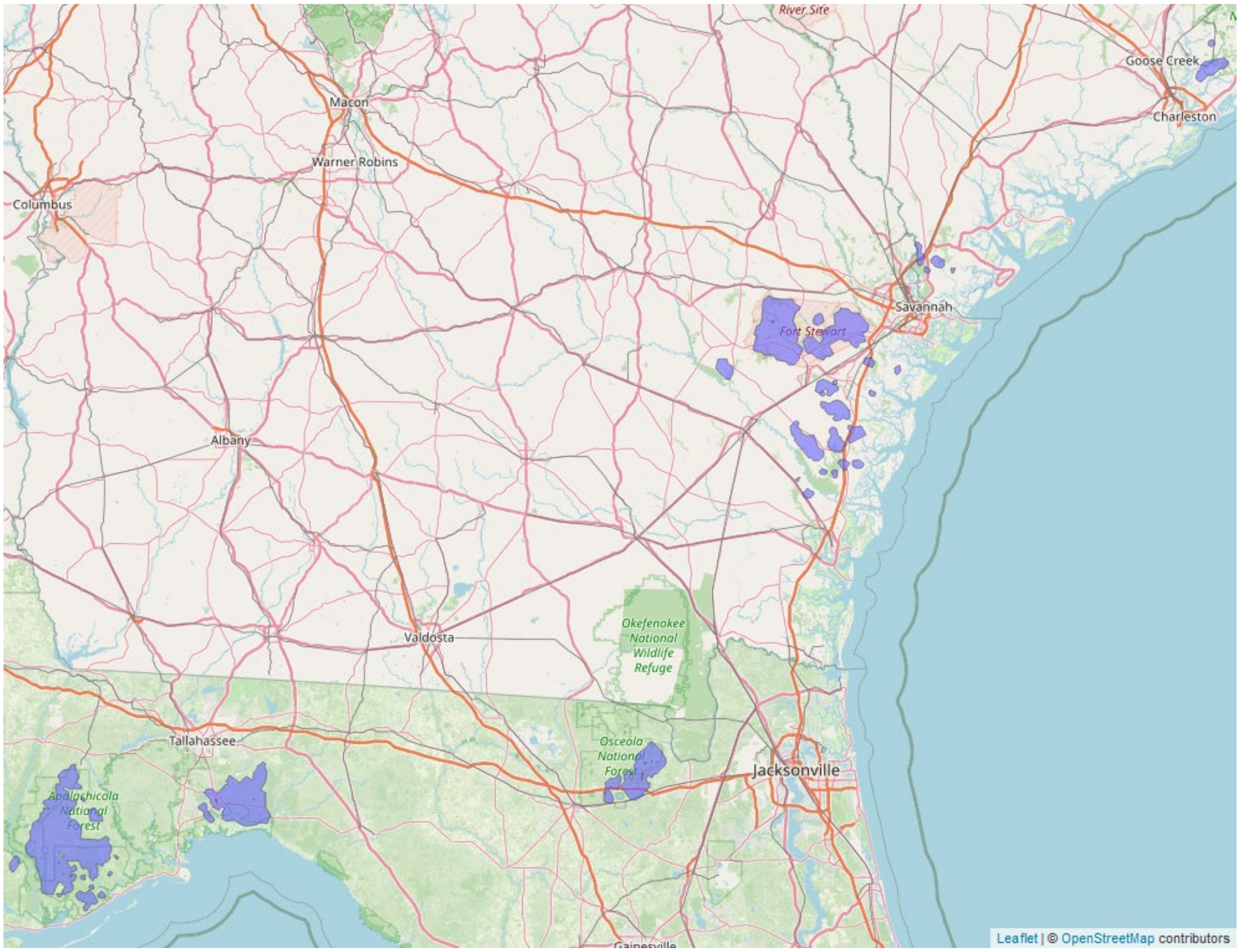

Figure 5. Range map of frosted flatwoods salamander (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4981.

Vulnerability

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

Summary of status

Listing status: Threatened

Most recent 5-Year Review recommendation: Uplist to Endangered

Most recently completed 5-Year Review: 9/13/2019

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

Number of populations: Multiple populations (numerous)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The frosted flatwoods salamander is a pond-breeding amphibian with a complex life cycle (i.e., aquatic egg and larval stages, terrestrial metamorphosed juvenile, and adult stages). Flatwood salamander adults migrate to ephemeral (seasonally-flooded) wetlands to breed in the fall. Juveniles and adults are highly fossorial, spending much of their time in crayfish burrows or root channels until they reach sexual maturity at 1-2 years old. Of the original 25 populations described in the final rule, nine were believed to potentially exist in 2019 based on surveys conducted in 2014-2015. Five populations occur in Apalachicola National Forest (Florida), two occur at St. Marks National Wildlife Refuge (Florida), and one occurs at Fort Stewart (Georgia). A ninth population may occur at Francis Marion National Forest in SC but has not been observed since 2010. There are no estimates of abundance for the species and their populations are believed to be declining; breeding did not occur for several years due to drought (i.e., ponds with little to no water and ponds filling too late in the season). Because they rely on ephemeral wetlands, flatwoods salamanders experience dramatic fluctuations in abundance across years. In 2014, frosted flatwoods salamanders were brought into captivity for breeding studies with hopes that they will be used for reintroductions someday (USFWS 2020).

The main threat to the frosted flatwoods salamander is loss of both its longleaf pine/slash pine flatwoods terrestrial habitat and its isolated, seasonally inundated breeding habitat. The combined pine flatwoods (longleaf pine-wiregrass and slash pine flatwoods) historical acreage was approximately 32 million ac. Flatwoods acreage was reduced to 5.6 million ac or approximately 18% of its original extent by conversions to urban development and agriculture. Remaining pine flatwoods (non-plantation forests) are typically fragmented and degraded by roads and pine plantations, with second-growth forests resulting from fire suppression. Most flatwoods salamander populations are widely separated from each other by unsuitable habitat. Flatwoods salamander breeding sites have been degraded or altered through alterations in hydrology, agricultural and urban development, road construction, incompatible silvicultural practices, shrub encroachment, dumping in or filling of ponds, conversion of wetlands to fish ponds, domestic animal grazing, and soil disturbance. Nonindigenous feral swine can significantly impact flatwoods salamander breeding sites through rooting. Invasive plant species such as cogongrass (*Imperata cylindrica*) threaten to further degrade existing habitat. Direct threats to flatwoods salamanders include disease and predation (i.e., fish and red imported fire ants [*Solenopsis invicta*]). Disease is currently unknown in natural populations of flatwoods salamanders, though a parasitic nematode (*Hedruris siredonis*) was found in South Carolina and Florida in larval flatwoods salamanders, and they may be susceptible to ranaviruses and chytrid fungus. Exposure to increased predation by fish is a potential threat to flatwoods salamanders when isolated, seasonally ponded wetland breeding sites are changed to, or connected to, more permanent wetlands inhabited by fishes that are not typically found in temporary wetlands. Climate change, especially in combination with other stressors, is a daunting challenge for the persistence of amphibians. Sea level rise is becoming and will likely continue to increase as a threat to the extant populations of the frosted flatwoods salamanders. Most of the remaining populations occur in very low-lying areas within a short distance of the coast. Small population sizes, especially concentrated in small areas, are more susceptible to stochastic events that could negatively impact the entire population. In 2018, Hurricane Michael inundated many flatwood salamander ponds with salt water and the 2019 breeding season was believed to be near complete failure at St. Marks. Pesticides and herbicides may pose a threat to amphibians such as the flatwoods salamanders because their permeable eggs and skin readily absorb substances from the surrounding aquatic or terrestrial environment (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 54.8% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 15). Up to 16.4% of the species' range overlaps with methomyl use sites while 38.9% of the range occurs off-field (but may still be exposed to spray drift or runoff).

Table 16. Overlap of methomyl use sites and methomyl usage (% range treated) within the frosted flatwoods salamander range.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Alfalfa	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Citrus	NA	NA	NA	NA	NA	NA
Corn[5]	2.6	6.8	9.5	0.1	0.4	0.5
Cotton	6.6	8.1	14.8	0.3	0.4	0.7
Other Grains	0.8	5.2	6	<0.1	0.3	0.3
Other Orchards	1.2	8.3	9.4	1.2	8.2	9.4
Other Row Crops	4.5	6.9	11.4	2	3.1	5.1
Soybeans	1.7	7.3	9.1	<0.1	0.4	0.5
Vegetables and Ground Fruit	0.6	3.2	3.7	0.6	3.1	3.7
Wheat	NA	NA	NA	NA	NA	NA

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

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Total	**16.4**	**38.9**	**54.8**	**4.3**	**15.5**	**19.7**

Usage

Based on past usage data, we anticipate up to 19.7% of the species' range will be treated with methomyl.

Additional Exposure Considerations

Frosted flatwoods salamanders are pond-breeding amphibians with complex life cycles (i.e., there is an aquatic larval life history stage, as well as a terrestrial juvenile and adult stage). As adults, flatwoods salamanders return to seasonally flooded wetlands to breed in the fall, where females lay eggs singly or in small clusters usually at the base of plants, in dry areas that will later fill with water provided by winter rainfall (USFWS 2021). Well-developed embryos hatch into larvae after inundation and metamorphose between March and May after an 11-to-18-week larval period (USFWS 2021). Juveniles normally disperse from ponds shortly after metamorphosis but may stay in or near ponds during seasonal droughts. Juveniles and adults are highly fossorial and spend much of their time in crayfish burrows or root channels until they reach sexual maturity (1 year for males; 2 years for females) and most return to their natal pond to breed during the fall months (USFWS 2021).

The Service revised the species' range map in February of 2023 (after the submittal of the final BE), removing many areas that may have historically been habitat, but are no longer capable of supporting the species due to land use changes. Thus, we anticipate the use and usage information significantly overestimate overlap. While the species' habitat (a mosaic of pine dominated flatwoods and seasonal wetlands) sometime exist adjacent to agricultural sites, it is not anticipated to overlap them.

Exposure Summary

Given the species' habitat preferences, the revised range mapping, and removing areas of historical habitat, we anticipate there is a low extent of overlap between the action area and the species' range. Similarly, we anticipate the past usage data overestimates the overlap of the action with agricultural sites and we expect a low level of usage within the species' range. Given that the extent of overlap is low, and that expected usage is low we expect a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Low

General Conservation Measures:

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. Thus, we provide in Table 16 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The methomyl label has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

We anticipate that, in many cases, these buffers will significantly reduce exposure to the frosted flatwoods salamander and subsequent risk of direct effects and indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

Because of its complex life cycle, the diet of the frosted flatwoods salamander consists of aquatic prey consumed by larvae as well as terrestrial prey consumed by adults and juveniles.

We expect the frosted flatwoods salamander will primarily experience direct adverse effects (i.e., mortality) from terrestrial dietary exposure. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 4.1 mg/kg-bw, which can occur when individuals exclusively consume soil invertebrates. This level of exposure on-field can cause mortality in up to 99.6% of exposed individuals. This level of mortality will also strictly be applicable to terrestrial juvenile or adult frosted flatwood salamanders that may not be feeding on-field as their habitat preferences do not favor agricultural areas. However, given its prevalence, agricultural sites frequently exist proximate to the species' preferred habitats and exposure from edge of field will be similar to on-field exposures.

Terrestrial juvenile and adult flatwoods salamanders are primarily fossorial and spend much of their time in crayfish burrows and root channels, where they are known to consume earthworms (Goin, 1950). Although it has not been documented, it is likely that juveniles and adults also feed opportunistically on other terrestrial invertebrates (larval and adult insects, spiders, centipedes, isopods, and snails), as has been documented for other species of *Ambystoma* (Petranka, 1998).

We expect dietary dosages from off-field exposure (0.2 mg/kg-bw) from exclusively consuming contaminated soil invertebrates will result in lower levels of direct adverse effects as we expect lower levels of methomyl will occur in these food items. This level of off-field exposure can cause mortality in up to <1% of exposed individuals.

Aquatic phase:

EPA's aquatic exposure modeling indicates that EECs within the region(s) and aquatic habitat(s) that the frosted flatwoods salamander occupies will likely be exposed to methomyl at maximum concentrations ranging from 140 to 1,715 µg/L, depending on the type of habitat and region (Table 16). Based on this range of potential exposures, we expect, on average, 0.1% of individuals will die. Mortality is not expected in large volume waterbodies but may occur in up to 37.8% of exposed individuals in low flow/low volume waterbodies.

Table 17. Predicted environmental concentrations of methomyl within the frosted flatwoods salamander habitat and the associated level of mortality expected to occur with exposure.

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Aquatic Habitat	HUC 2 Region	Max EEC (µg/L)	Percent amphibian mortality
Large volume waterbodies	HUC_3	139.8	0
Low flow/Low volume waterbodies	HUC_3	1,715	37.8

Based on available toxicity data on sublethal effects of methomyl exposure in aquatic vertebrates and the predicted environmental concentration of methomyl in the habitat of the frosted flatwoods salamander, we do not anticipate adverse effects to growth and/or reproduction.

Indirect Effects

Based on available life history information, we expect the frosted flatwoods salamander larvae rely on freshwater crustaceans. Whiles (2004) documented that freshwater crustaceans comprise 96% of all invertebrates consumed by larval frosted flatwoods salamanders. Therefore, while we expect some reductions in freshwater crustaceans (isopods and amphipods) from methomyl exposure, based on methomyl's low persistence in water, we anticipate any reductions in zooplankton as a food source will be localized and dependent on the size and volume of the water body. As such, we do not anticipate any indirect adverse effects to aquatic based prey items are likely to occur.

Adult and juvenile frosted flatwoods salamanders spend most of their time in crayfish burrows within intermediate moisture- pine dominated flatwoods/savanna communities, and feed on soil invertebrates which are likely to experience adverse effects from methomyl exposure. However, as most flatwood salamander habitat occurs proximate to agricultural areas, dietary items are anticipated to be exposed to methomyl. Therefore, indirect effects to their soil invertebrate food base is anticipated.

Toxicity Summary

We expect a high level of direct adverse effects will occur on-field as up to 99.6% of individuals foraging on-field will likely die. We expect a low level of direct adverse effects will occur off-field as <1% of exposed individuals foraging off-field will likely die. We do not expect sublethal effects (e.g., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a low level of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause some mortality to the aquatic isopods and amphipods that make up the diet for larval frosted flatwoods salamanders, but these reductions will be temporary and localized. For adults and juveniles, we anticipate some reductions in their soil invertebrate prey from methomyl exposure. Overall, we determine the frosted flatwoods salamander has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The frosted flatwoods salamander has a high exposure ranking. Based on past methomyl usage data, we expect up to 19.7% of the range may be treated annually but may potentially cover up to 54.8% of the range over the duration of the proposed action depending how usage patterns may or may not change over time. This indicates that a large portion of the species' range is likely to be treated overall. As such, we expect a large number of individuals are likely to be exposed to methomyl.

The frosted flatwoods salamander has a high toxicity ranking. We expect a high level of mortality will occur on-field or edge of field as a result of dietary exposure through the consumption of contaminated food items to adults and juveniles during the terrestrial phase of the life cycle. We expect a low level of mortality will occur off-field, which is also a result of dietary exposure from the consumption of contaminated food items. We expect a low level of indirect adverse effects are likely to occur as we expect prey species in the aquatic waterbodies where the larvae feed will experience some mortality with exposure to predicted concentrations of methomyl however, this will not reduce the prey items for the frosted flatwoods salamander larvae extensively as these prey items can be replenished in a short amount of time from upstream sources.

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

Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of methomyl, and the cumulative effects, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the frosted flatwoods salamander. Vulnerability, and toxicity are high for this species. However, exposure is anticipated to be low. Thus, we anticipate that only very small numbers of individuals will be affected over the duration of the action, and we do not expect species-level effects to occur.

The frosted flatwoods salamander has a high vulnerability ranking due to its threatened status (with a 5-year review recommendation to uplist to endangered), limited distribution, small population size, low juvenile survival rates, susceptibility to stochastic events, and anthropogenic threats to the species (e.g., continued degradation, fragmentation, and loss of suitable aquatic and upland habitats from urbanization, invasive species, and agricultural impacts to habitat). Similarly, the species has a high exposure ranking due to labeled uses across the range and estimated methomyl usage affecting 19.7% of the species range annually and up to 54.8% of the species range over the course of the proposed action. Effects to prey items from use sites and mortality of frosted flatwoods salamanders from ingestion of contaminated soil-based prey are anticipated. The species is generally at high risk as amphibians, given their aquatic life histories and susceptibility to environmental contaminants (e.g., pesticides, degraded water quality), can be subject to exposure through multiple pathways (e.g., dermal exposure, ingestion of contaminated arthropod prey) and at various life stages (egg, larval, juvenile, and adult). However, as most of the known occurrences of the frosted flatwoods salamander exist on federal lands (22 of 25 known populations), we anticipate that the overlap of use sites and the usage data is an overestimate and that the anticipated effects from such exposure will be far less than the species' range overlap and usage estimates above. Similarly, we revised the species' range map in February of 2023 (after the submittal of the final BE), removing many areas that may have historically been habitat, but are no longer capable of supporting the species due to land use changes. Thus, we anticipate the use and usage information significantly overestimate overlap. Lastly, while the species' habitat (a mosaic of pine dominated flatwoods and seasonal wetlands) sometime exists adjacent to agricultural sites, it is not anticipated to overlap them. Therefore, we anticipate that exposure of the frosted flatwoods salamander will be low.

For aquatic life stages of the frosted flatwoods salamander exposed to methomyl we anticipate mortality will range from 0% of individuals to 37.8% but with generally fewer effects to larval and metamorph life stages as they are fully aquatic and feed on small planktonic organisms, such as algae and invertebrates that will be less affected given methomyl's low persistence in water. The aquatic life stage vulnerability of this species is low, but exposure is variable but high for this species based on aquatic habitats. Thus, we anticipate that the concentration of methomyl will lead to low levels of exposure for the larval life stages.

Insecticide usage is specifically mentioned in the species 2019 5-Year Review, although methomyl is not named specifically. Based on the usage data, we will anticipate high levels of methomyl exposure, however, as above, we anticipate the use and usage numbers are overestimates based on revision of the range map, the species' habitat preferences, and that the frosted flatwoods salamander is largely confined to sites on federal lands where methomyl use and exposure is anticipated to be very low to non-existent. Thus, the likelihood of exposure is anticipated to be low. We anticipate the general conservation measures above, including rain restrictions and aquatic habitat buffers, will further reduce the likelihood of exposure of the species, their prey, and their habitat.

We anticipate small numbers of individuals of this species will die from consumption of invertebrate prey or prey losses over the duration of the proposed action. We anticipate the loss of small numbers of individuals, mostly terrestrial juveniles and adults feeding on contaminated soil invertebrate prey, will not result in species-level effects. Likewise, we anticipate that the proposed action will not appreciably reduce the survival and recovery of the frosted flatwoods salamander. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the frosted flatwoods salamander.

References

U.S. Fish and Wildlife Service. 2021. Recovery Plan for the Frosted Flatwoods Salamander (*Ambystoma cingulatum*). Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2019. Frosted flatwoods salamander (*Ambystoma cingulatum*), 5-Year Review: Summary and Evaluation. Panama City, Florida.

Integration and Synthesis Summary: Mountain yellow-legged frog (Southern DPS)

Scientific Name:	Common Name:	Entity ID:
Rana muscosa	Mountain yellow-legged frog (Southern DPS)	207

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our preliminary evaluation of the effects of the proposed action to the species (presented below), we determined there is low overlap of the action area with the species' range, and low past usage of methomyl within the species' range, indicating a low extent of exposure. The risk to the species is medium. As such, we expected a small number of individuals were likely to die from the proposed action. Any mortality for this species could be detrimental to its recovery.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. After incorporating these conservation measures, we expect exposure to be unlikely to occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the mountain yellow-legged frog (southern DPS). We discuss our rationale for this conclusion for the species in the sections below.

Species range

Last updated: 2/17/2018; U.S.A., southern California; *States within the range:* CA. Figure 6 depicts the species' range.

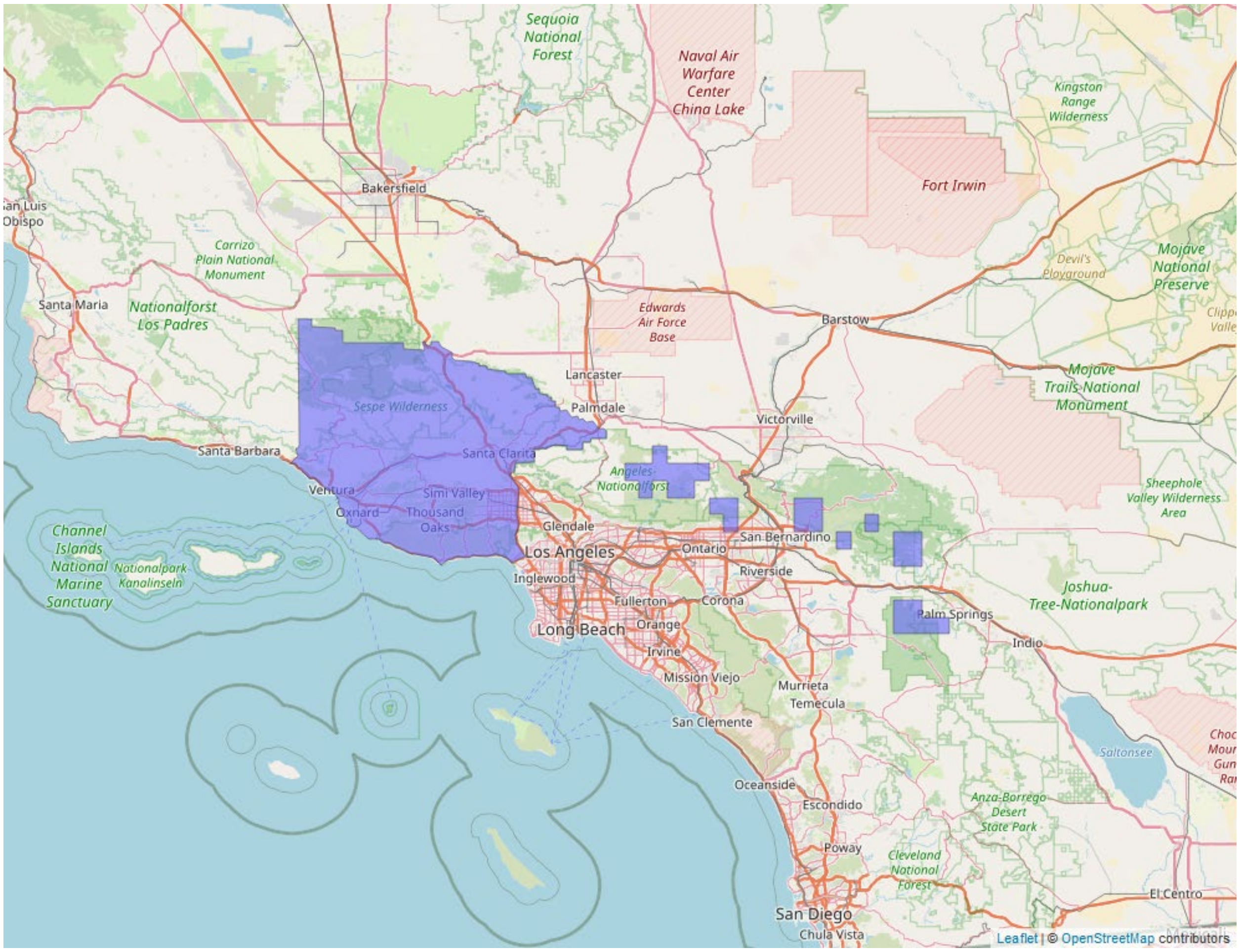

Figure 6. Range map of Mountain yellow-legged frog southern DPS (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8037.

Vulnerability

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

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Review: 5/6/2019

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

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Mountain yellow-legged frogs (Southern DPS) are most often found in creeks with permanent (perennial) water in at least some portion of the reach (USFWS 2018), particularly in rocky and shaded streams on desert and coastal slopes from 370-2,290 m in elevation. The southern population of mountain yellow-legged frogs was historically widely distributed in at least 166 known populations from creeks and drainages in San Gabriel, San Bernardino, San Jacinto, and Palomar Mountains of Los Angeles, San Bernardino, Riverside, and San Diego counties in southern CA. By 1997, southern mountain yellow-legged frogs were believed to be extirpated from more than 99% of its previously documented range. Southern mountain yellow-legged frogs were thought to be extirpated from the San Bernardino Mountains until a single small population was rediscovered in 1998 at East Fork City Creek (a tributary of the Santa Ana River). In 2002, they were known from only 7 of the 166 historical localities in southern California (all of which were owned or partially owned by the US Forest Service), including 5 small streams in the San Gabriel Mountains (Bear Gulch, Vincent Gulch, South Fork Big Rock Creek, Little Rock Creek, and Devil's Canyon), 1 stream in the San Bernardino Mountains (East Fork City Creek), and 1 stream in the upper reaches of the San Jacinto River system in the San Jacinto Mountains (Fuller Mill Creek) (USFWS 2012). As of 2019, there were 10 extant small populations distributed disproportionately across southern California. Determining accurate population estimates has been a challenge due to exceedingly low numbers at most extant localities. Three populations (including two of the larger ones at the time of listing) may have fewer than five adults remaining: Bear Gulch, East Fork City Creek, and Tahquitz-Willow Creek. Three additional populations may have 15 or fewer adults (Vincent Gulch, Fuller Mill Creek, and Dark Canyon). At Dark Canyon, threat abatement including increased restrictions on recreation and trout removal may have reversed the decline of this population as evidenced by a recent increase in abundance. South Fork Big Rock Creek appears to be stable at a low abundance of fewer than 30 adults. Since 2001, only Little Rock Creek experienced a substantial increase, which resulted from trout removal efforts and a creek closure enforced at this location. The status of the Devil's Canyon is unclear although it also persists at a very low abundance (USFWS 2012). Southern mountain yellow-legged frogs are successfully reared at the San Diego Zoo Institute for Conservation Research, Los Angeles Zoo, and Henry Doorly Zoo. One translocation effort in 2013 is believed to have been unsuccessful after surveys in 2014, 2015, and 2017 found no southern mountain yellow-legged frogs at the release site (USFWS 2018).

The most significant stressors to southern mountain yellow-legged frogs are related to the constraints on recruitment by predation (bullfrogs and crayfish) and disease (chytrid fungus or Bd). Where adults reproduce in trout-occupied waters, or where tadpoles disperse downstream into trout-occupied waters, those tadpoles are likely to be preyed upon by trout. Most populations are isolated in headwaters of streams or tributaries due to predatory nonnative trout (USFWS 2019). Additionally, all populations are positive for Bd, and although infection rates are low, the juvenile life stage, which experiences the highest mortality from Bd, is usually undetected during annual population surveys. Each southern mountain yellow-legged frog population is highly susceptible to stochastic events, especially wildfire. Measures have been taken to reduce the impact of certain threats since listing, including recreation. However, threats to the habitat remain, including marijuana cultivation, suction dredge mining, recreational and fire management activities, and roadwork construction. Other threats to southern mountain yellow-legged frogs include potential impacts from climate change, exposure to UV-B radiation, acid precipitation, and contaminants (e.g., pesticides, heavy metals, and nitrogen-based fertilizers). Evidence of the effects of wind-borne pesticides deposited from upwind agricultural sources are suggested as a cause of measured sublethal effects to amphibians in the nearby Sierra Nevada (USFWS 2012), but no specific effects to mountain yellow-legged frogs have been identified as of 2019. Small population sizes and a fragmented metapopulation structure are a great impetus for threat abatement, including trout removal and recreational closures adjacent to extant populations. As of 2019, two populations have responded positively to restoration efforts (nonnative trout removal and recreational closures) (USFWS 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 2.8% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 17). Up to 0.2% of the species' range overlaps with methomyl use sites while 2.6% of the range occurs off-field (but may still be exposed to spray drift or runoff).

Table 18. Overlap of methomyl use sites with the mountain yellow-legged frog (southern DPS) range.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0	0.6	0.6
Citrus	<0.1	0.2	0.3
Corn[6]	0	0.1	0.1
Cotton	0	<0.1	<0.1
Other Grains	0	0.6	0.6
Other Orchards[7]	0.2	0.4	0.6
Other Row Crops	0	<0.1	<0.1
Soybeans	0	0	0
Vegetables and Ground Fruit	0	0.8	0.8
Wheat	0	0	0

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

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

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Total	**0.2**	**2.6**	**2.8**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-20121 the maximum percent of the species' range treated with any pesticide was 6.3% (Table 17). Within the range of the species, up to 5.3% of the range was treated with any insecticide, and 0.1% of the range had been treated with methomyl.

Table 19. Annual percent of the mountain yellow-legged frog's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulation.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
6.3	5.3	0.1

Additional Exposure Considerations

For the mountain yellow-legged frog (southern DPS), habitat preferences are rocky and shaded streams on desert and coastal slopes from 370-2,290 meters in elevation in San Gabriel, San Bernardino, San Jacinto, and Palomar Mountains of Los Angeles, San Bernardino, Riverside, and San Diego counties in southern CA. Pesticides are noted as a threat to this species as there is specific mention of evidence of the effects of wind-borne pesticides deposited from upwind agricultural sources as a suggested cause of measured sublethal effects to amphibians in the nearby Sierra Nevada (USFWS 2012), but no specific effects to mountain yellow-legged frogs have been identified as of 2019 and there is no indication these effects are from methomyl specifically. In addition, the majority of their habitat is protected and managed in two national forests, the Inyo National Forest, and the Los Padres National Forest.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. Based on past usage data, we expect a low level of usage within the species' range. The past usage data comes from the California Department of Pesticide Regulation, which mandates reporting and presents usage data at fine spatial scales, which gives us high confidence in the usage assessment for this species. Given that the extent of overlap is low, and that expected usage is low, we expect a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Low

General Conservation Measures:

Rain restriction:
The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be

treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. Thus, we provide in Table 19 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure. However, despite the incorporation of the rain restriction mitigation, mortality remains high for this species.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

We anticipate that, in many cases, these buffers will reduce exposure to the mountain yellow-legged frog (southern DPS) and subsequent risk of direct effects and indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

Because of its complex life cycle, the diet of the mountain yellow-legged frog (southern DPS) consists of terrestrial and aquatic insects and other amphibians consumed by adults and juveniles. Tadpoles feed on algae.

We expect the mountain yellow-legged frog (southern DPS) will primarily experience direct adverse effects (i.e., mortality) from terrestrial dietary exposure. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 1.5 mg/kg-bw, which can occur when individuals exclusively consume arthropod prey. This level of exposure on-field can cause mortality in up to 75.7% of exposed individuals. This level of mortality will strictly be applicable to terrestrial juvenile or adult mountain yellow-legged frogs. However, mountain yellow-legged frogs (southern DPS) are not anticipated to feed on field.

We expect dietary dosages from off-field exposure (0.1 mg/kb-bw) from exclusively consuming contaminated arthropods will result in lower levels of direct adverse effects as we expect lower levels of methomyl will occur in these food items. This level of off-field exposure can cause mortality in up to <1% of exposed individuals.

Aquatic phase:

EPA's aquatic exposure modeling indicates that EECs within the region(s) and aquatic habitat(s) that the mountain yellow-legged frog (southern DPS) occupies will likely be exposed to maximum methomyl concentrations from 175 to 2,759 µg/L, depending on the type of habitat and region (Table 19). Mortality is not expected in large volume waterbodies but may occur in up to 95.5% of exposed individuals in low flow/low volume waterbodies.

Table 20. Predicted environmental concentrations of methomyl within the mountain yellow-legged frog (Southern DPS) habitat and the associated level of mortality expected to occur with exposure.

Aquatic Habitat	HUC 2 Region	Max EEC (µg/L)	Percent amphibian mortality
Large volume waterbodies	HUC_18a	179	0.01
Low flow/low volume waterbodies	HUC_18a	2,338	91.5
Large volume waterbodies	HUC_18b	175	0.01
Low flow/low volume waterbodies	HUC_18b	2,759	95.5

Based on available toxicity data on sublethal effects of methomyl exposure in aquatic vertebrates and the predicted environmental concentration of methomyl in the habitat of the mountain yellow-legged frog (southern DPS), we do not anticipate adverse effects to growth and/or reproduction.

Indirect Effects

Based on available life history information, we expect the mountain yellow-legged frog (southern DPS) is an opportunistic forager that can consume plant matter (e.g., algae, plankton) during the tadpole phase, terrestrial insects, aquatic insects, benthic macroinvertebrates, and even other amphibians (including conspecifics) during the adult and juvenile phase. Therefore, while we expect some reductions in the abundances of aquatic and terrestrial insects from methomyl exposure, based on methomyl's low persistence, we anticipate any reductions in sensitive prey species will be localized and dependent on the habitat type (e.g., low flow/low volume waterbodies will experience greater reductions of prey and longer recovery times as these habitats accumulate more methomyl). Furthermore, given the breadth of dietary items individuals can use, we anticipate in situations where methomyl use reduces the abundance of sensitive prey species individuals can switch to more abundant food resources. As such, we do not anticipate any indirect adverse effects are likely to occur. We do not anticipate any indirect effects from dietary exposure during the tadpole phase as available toxicity data in aquatic plants indicate no reductions in plant survival or growth are likely to occur with methomyl exposure.

Toxicity Summary

We do not expect direct adverse effects will occur on-field as mountain yellow frogs do not prefer this type of habitat and the majority of areas where they are found are located in two national forests, thus mountain yellow-legged frogs (southern DPS) are not anticipated to feed on field.

We expect a low level of direct adverse effects will occur in terrestrial off-field habitats as <1% of exposed individuals foraging off-field will likely die. However, we expect mortality to occur for those individuals in low flow/ static waterbodies. We do not expect sublethal effects (i.e., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a low level of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause some mortality to sensitive insect species that make up part of the diet of mountain yellow-legged frogs (southern DPS). But these reductions will be temporary and localized. Overall, we determine the mountain yellow-legged frog (southern DPS) has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The mountain yellow-legged frog (southern DPS) has a low exposure ranking. There is a low extent of overlap between the action area and the species range (2.8% total overlap) and a low level of past methomyl usage (up to 0.1% of the range treated annually) based on mandatory pesticide use reporting from the state of California. As such, we expect a small number of individuals are likely to experience exposure.

The mountain yellow-legged frog (southern DPS) has a medium toxicity ranking. Frogs will not forage on field or edge of field, however, tadpoles occupying low flow/low volume waterbodies are likely to be exposed to high levels of methomyl and will experience high levels of mortality (up to 95.5% of exposed individuals). However, juveniles and adults that forage off-field and tadpoles in larger volume waterbodies are not likely to experience any mortality. While there will likely be reductions in the abundance of sensitive insect species that individuals feed on, we anticipate that individuals, as opportunistic foragers, will likely be able to switch food items in situations where insect abundances are adversely affected by methomyl exposure, indicating only low levels of indirect effects are likely.

While the mountain yellow-legged frog (southern DPS) habitat preferences are rocky and shaded streams on desert and coastal slopes from 370-2,290 m in elevation in San Gabriel, San Bernardino, San Jacinto, and Palomar Mountains of Los Angeles, San Bernardino, Riverside, and San Diego counties in southern California, pesticides are noted as a threat to this species. There is specific mention of evidence of the effects of wind-borne pesticides deposited from upwind agricultural sources as a suggested cause of measured sublethal effects to amphibians in the nearby Sierra Nevada (USFWS 2012), but no specific effects to mountain yellow-legged frogs (southern DPS) have been identified as of 2019 and there is no indication these effects are from methomyl specifically. In addition, as of 2019, there were 10 extant small populations distributed disproportionately across southern California and three populations (including two of the larger ones at the time of listing) may have fewer than five adults remaining: Bear Gulch, East Fork City Creek, and Tahquitz-Willow Creek. Three additional populations may have 15 or fewer adults (Vincent Gulch, Fuller Mill Creek, and Dark Canyon). Given that we expect only a small number of individuals are likely to be exposed, but exposed individuals can experience medium levels of adverse effects, including mortality, we expect the overall risk of adverse effects to the species is medium due to very few individuals that we are aware of in the population at present.

Preliminary Conclusion (with General Conservation Measures)

Vulnerability and toxicity are high for this species. Likelihood of exposure is low, but with the caveat that even at low anticipated levels, given the status and distribution of this species, any losses due to methomyl exposure are likely species-level consequences of the proposed action. Thus, we anticipate that moderate numbers of individuals will be affected over the duration of the proposed action and we expect species-level effects to occur.

We acknowledge there is a low extent of overlap between the action area and the species range (2.8% total overlap) and a low level of past methomyl usage (up to 0.1% of the range treated annually) based on mandatory pesticide use reporting from the state of California and that we have a higher confidence in this source of information. However, this species has experienced substantial declines, and we anticipate an exposure pathway for direct exposure of aquatic larval stages in low flow/low volume waterbodies. This exposure will impact a large percentage (>79%) of those exposed. While a small number of individuals are likely to be exposed over the duration of the action, the species' is critically imperiled, and loss of a few individuals will result in species level effects. Southern *Rana muscosa*, which historically was widely distributed in at least 166 known populations across four mountain ranges in southern California, are currently considered to be extant, as of 2019, in 10 small populations distributed disproportionately across southern California and three populations (including two of the larger ones at the time of listing) may have fewer than five adults remaining: Bear Gulch, East Fork City Creek, and Tahquitz-Willow Creek. Three additional populations may have 15 or fewer adults (Vincent Gulch, Fuller Mill Creek, and Dark Canyon).

Thus, we anticipate small numbers of individuals of this species will die (i.e., through direct exposure of larval stages) over the duration of the action. However. we anticipate the loss of small numbers of individuals from such exposure will result in species-level effects and given the species' critically low numbers, any resulting loss of individuals from the proposed action is anticipated to appreciably reduce the survival and recovery of the mountain yellow-legged frog (Southern DPS). After reviewing the current status of the listed species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the registration of methomyl, as proposed, is likely to jeopardize the continued existence of the mountain yellow-legged frog (Southern DPS).

Final Conclusion (with Species-Specific Conservation Measures)

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

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for mountain yellow-legged frog by >95% for terrestrial habitat and between 74 and 99% for aquatic habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2) *Applicators need 6 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the habitat of the mountain yellow-legged frog by an order of magnitude (i.e., a 10-fold reduction).*

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

After incorporating the specific conservation measure above, we expect exposure for the mountain yellow-legged frog (southern DPS) to be low. As such, we anticipate low numbers of individuals of this species will be adversely impacted. We anticipate loss of prey on agricultural fields adjacent to mountain yellow-legged frog (southern DPS) habitat will incrementally reduce prey availability but at much reduced levels. Similarly, while direct exposure from consumption of contaminated prey and aquatic exposure through spray drift into breeding sites is possible, we anticipate that with the measures described above that these pathways of exposure will be greatly limited and result in exposure of very low numbers of individuals over the course of the action. Thus, we anticipate mortality of a very small number of individuals. After reviewing the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the mountain yellow-legged frog (southern DPS).

References

U.S. Fish and Wildlife Service. 2019. Mountain yellow-legged frog (*Rana muscosa*) southern California distinct population segment 5-year review: summary and evaluation. 14 pp.

U.S. Fish and Wildlife Service. 2018. Recovery Plan for the southern California distinct population segment of the mountain yellow-legged frog. Sacramento, California. iv + 24 pp.

U.S. Fish and Wildlife Service. 2012. Mountain yellow-legged frog (*Rana muscosa*) southern California distinct population segment 5-year review: summary and evaluation. 78 pp.

Integration and Synthesis Summary: Neuse River waterdog

Scientific Name:	Common Name:	Entity ID:
Necturus lewisi	Neuse River waterdog	2932

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is high overlap of the action area with the species' range (Figure 7), and medium past usage of methomyl within the species' range, indicating a medium extent of exposure. Most exposed individuals are unlikely to die or experience sublethal effects. We expect low levels of indirect effects resulting from loss of invertebrate prey species in some low flow/volume waterbodies. Given that exposure is medium, and the level of indirect effects is low, we determined the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to experience adverse effects from the proposed action, and we do not expect species-level effects to occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action, including the conservation measures, is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Neuse River waterdog. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 10/10/2018; Wherever found; *States within the range:* NC. Figure 7 depicts the species' range.

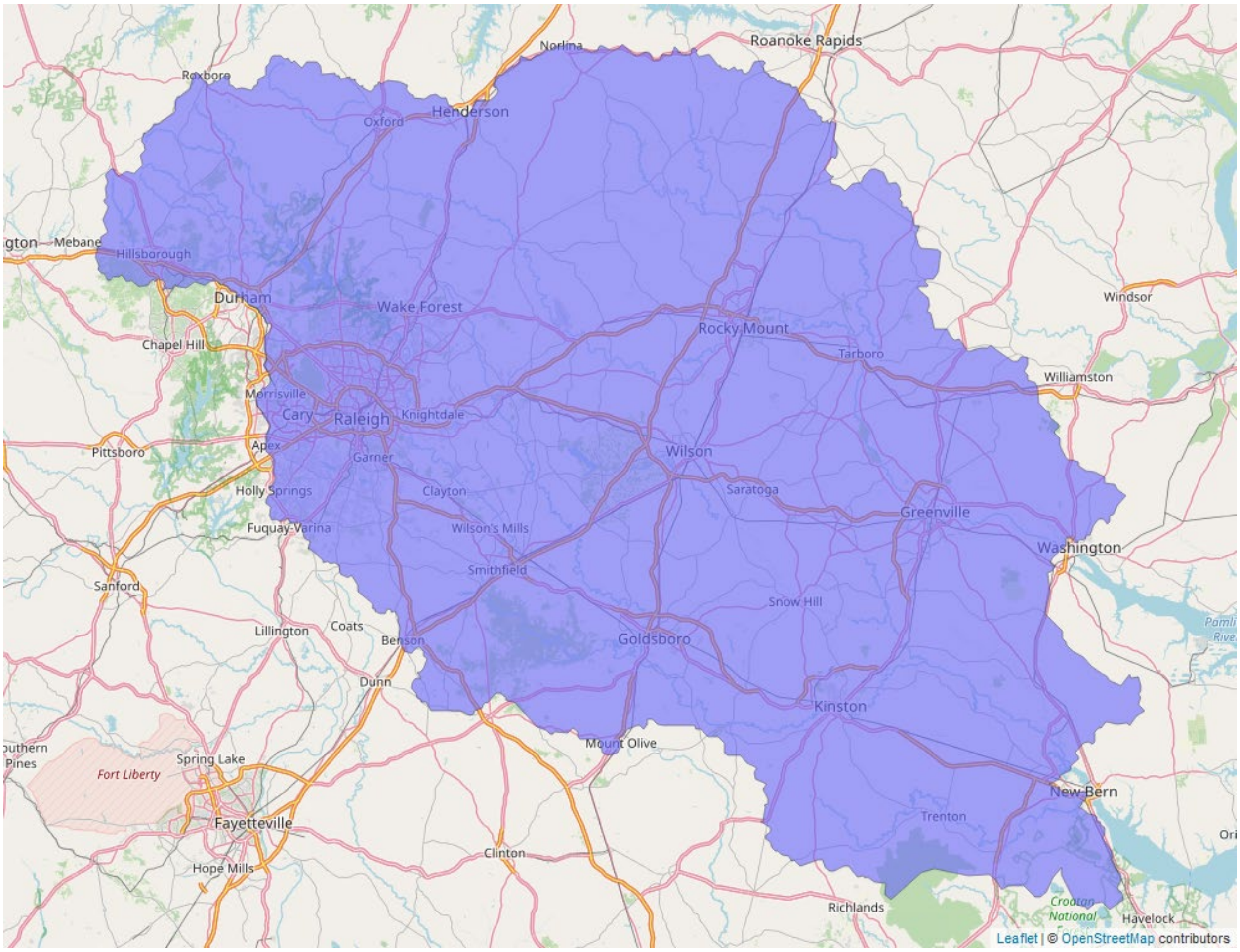

Figure 7. Range map of Neuse River waterdog (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6772.

Vulnerability

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

Summary of status

Listing status: Threatened

Most recent 5-Year Review recommendation: N/A

Most recently completed 5-Year Review: N/A

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Neuse River waterdog is a permanently aquatic salamander species endemic to the Tar-Pamlico and Neuse River drainages in North Carolina. The species occurs in riffles, runs, and pools in medium to large streams and rivers with moderate gradient in both the Piedmont and Coastal Plain physiographic regions. Waterdogs prefer clean water with permanent flow and are not tolerant of siltation and turbidity. Benthic critters such as the waterdog have disproportionate rates of imperilment and extirpation because stream bottoms are often the first habitats affected by pollution. The Neuse River waterdog has declined in abundance and distribution and many remaining populations are fragmented (USFWS 2021a). Since the 2018 SSA analyses (USFWS 2021a), survey and research efforts have led to documentation of Neuse River waterdogs in places they were believed to be extirpated. The species was found in 37 HUC-10s between 2011-2022; 338 of 430 were added since 2018. As of 2023, the Neuse River waterdog has 3 populations: Trent, Neuse (8 subpopulations), and Tar-Pamlico (5 subpopulations) (USFWS 2023). The one population predicted to remain extant (Tar) is expected to be characterized by low occupancy and abundance in the future (USFWS 2021a).

The Neuse River waterdog faces a variety of risks from declines in water quality, loss of stream flow, riparian and instream fragmentation, deterioration of instream habitats, invasive species (i.e., red swamp crayfish (*Procambarus clarkii*), flathead catfish (*Pylodictis olivaris*), and hydrilla (*Hydrilla verticillata*)). These risks, which are expected to be exacerbated by urbanization and climate change, were important factors in our assessment of the future viability of the Neuse River waterdog. Streams with urbanized or agriculturally dominated riparian corridors are subject to increased sediment-loading from unstable banks and/or impervious surface run-off, resulting in less suitable in-stream habitat for waterdogs as compared to habitat with forested corridors. Agricultural pesticide use can have detrimental effects, and studies have shown the species to have low to moderate levels of pesticide contamination from a variety of sources, including insect control. The human population in the southeast has increased annually by 37.6% since 2000 and we expect additional growth in the future. With human population growth, we also expect additional urban development that could result in mortality or habitat loss for the Neuse River waterdog. Climate change has already begun to affect the watersheds where Neuse River Waterdog occurs, resulting in higher air temperatures, increased evaporation, and altered precipitation patterns such that water levels range-wide have reached historic lows, which put the populations at elevated risk for habitat loss, especially in the headwater areas. We expect other threats to the waterdog, including water quality issues, loss of stream flow, fragmentation, and general habitat loss to be exacerbates by increased development and climate change (USFWS 2021a).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We do not expect listed aquatic species will occur on-field, and thus expect exposure will only result from off-field transport via spray drift or runoff. Given that the ranges for listed aquatic species are generally delineated using the relevant HUC 12 watersheds, we anticipate that all residues that leave use sites will be collected in the waterbodies within the species range where individuals occur regardless of how residues leave treated sites or where in the range they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that listed aquatic species are likely to experience. We expect up to 38.4% of the species range will contain use sites.

Usage

Past usage data indicate that up to 6.6 % of the species' range has been treated with methomyl annually. Use layers with the highest anticipated usage include vegetables and ground fruit and other row crops at annual rates of 2.6% and 2.4%, respectively.

Table 21. Overlap of methomyl use sites with Neuse River waterdog.

Use Layer	Use Site Overlap (% range)	% Range Treated (On-field)
Alfalfa	<0.1	<0.1
Citrus	NA	NA
Corn	10	0.5
Cotton	7.9	0.4
Other Grains	1.2	0.1
Other Orchards	<0.1	<0.1
Other Row Crops	5.3	2.4
Soybeans[8]	21.3	1.1
Vegetables and Ground Fruit	2.6	2.6
Wheat	NA	NA
Total	**38.4**	**6.6**

Exposure Summary

There is a high extent of overlap between the action area and the species' range. Based on past usage data, we expect a medium level of usage within the species' range. Given that the extent of overlap is high, and that expected usage is medium we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Medium

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

General Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. Thus, we provide in Table 21 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

We anticipate that, in many cases, these buffers will significantly reduce exposure to the Neuse River waterdog and subsequent risk of direct effects and indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

EPA's aquatic exposure modeling indicates that EECs within the region and aquatic habitats that the Neuse River waterdog occupies will likely be exposed to maximum methomyl concentrations ranging from 35 to 171 µg/L, depending on the type of habitat (Table 21). Mortality is not expected in high flow waterbodies but may occur in up to 0.009% of exposed individuals in low flow/low volume waterbodies. The Neuse River waterdog prefers riffles, runs, and pools in medium to large streams and rivers with moderate gradient such as streams wider than 15m, although some have been observed in smaller creeks deeper than 100 cm, and with a main channel flow rate greater than 10cm/sec (USFWS 2021) so it may be found in both high flow waterbodies and low flow /low volume waterbodies.

We do not anticipate any sublethal effects (e.g., growth, reproduction) at any of the expected EECs within the range of the Neuse River waterdog.

Table 22. Predicted environmental concentrations of methomyl within the Neuse River waterdog's habitat and the associated level of mortality expected to occur with exposure.

Aquatic Habitat	HUC 2 Region	Max EEC (µg/L)	Percent amphibian mortality
High flow waterbodies	HUC_3	35	< 0.01
Low flow/low volume waterbodies	HUC_3	171	< 0.01

Indirect Effects

The Neuse River waterdog can consume invertebrate species as a food resources. Available toxicity data indicate that invertebrate species, particularly arthropods, are sensitive to methomyl and are likely to die with exposure to methomyl at the predicted environmental concentrations. As such, we anticipate indirect effects to the species through the loss of prey resources is likely. However, we do not expect all invertebrate species will be equally sensitive to methomyl exposure. As such, we anticipate the abundance of only some invertebrate species may be reduced while other species may not exhibit as large of a reduction in abundance. In addition, we expect some reductions in zooplankton from methomyl exposure, based on methomyl's low persistence in water and planktonic drift. We anticipate any localized reductions in zooplankton as a food source will be quickly replenished by upstream sources. Given that available life history information available for the Neuse River waterdog indicates it is an invertebrate prey generalist, we anticipate individuals are likely more robust to temporary losses of certain invertebrate prey species as they can likely switch to use other species whose abundance is not as greatly reduced as they may have less inherent sensitivity to methomyl. As such, we anticipate a temporary loss of certain invertebrate prey species will result in no more than low levels of adverse indirect effect to the Neuse River waterdog.

Toxicity Summary

Based on the predicted environmental concentrations of methomyl within the aquatic habitats that the Neuse River waterdog is found in, we expect there will be a low level of direct effects as the likelihood of mortality is low and we do not expect sublethal effects to growth and reproduction are likely. We also anticipate a low level of indirect effects to invertebrate prey. As such, we anticipate the species will has a medium toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The Neuse River waterdog has a medium exposure ranking. There is a large presence of methomyl use sites within the species range (38.4% total overlap) and a medium level of anticipated usage rate within the range (up to 6.6% of the range treated annually). As such, we expect a moderate number of individuals are likely to experience exposure. The Neuse River waterdog has a low toxicity ranking. Based on predicted environmental concentrations of methomyl within the species' habitat of low flow/low volume habitats, we expect there will be a low likelihood of direct effects, including mortality (up to 0.009 % of individuals likely to die) and a low level of indirect effects through the loss of prey resources. We anticipate this level of direct and indirect effects, coupled with the medium exposure potential, will result in low levels of adverse effects to a moderate number of individuals. Therefore, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Neuse River waterdog is a fully aquatic salamander that utilizes low to moderate-gradient streams with low current velocities but prefers riffles, runs, and pools in medium to large streams and rivers with moderate gradient. The species requires uncontaminated sites and is intolerant of degraded water quality as from siltation or turbidity so that, in general, stream channels with forested and stable banks where erosion is limited are more likely to support the species than site where vegetation and stream banks have been altered (e.g., where agriculture or development activities exist). The Neuse River waterdog has a high vulnerability based on its status, distribution, and trends. The labeled uses across the range are estimated to be high at 38.4 % and usage is medium with up to 6.6% of the ranged treated annually. Effects to the species prey are likely pursuant to labeled uses, but we anticipate prey resources will be affected variably such that only a low level of indirect effects through the loss of prey resources occurs over the duration of the action. We do not anticipate individuals will necessarily be found in the affected areas of the waterbodies near application sites when methomyl is applied (e.g., lower quality stream sites), although moderate numbers of individuals are expected to occur in these areas (i.e., low flow/low volume streams) and be exposed over the duration of the proposed action. We expect very low levels of mortality in low flow/volume waterbodies and no mortality in high flow/volume waterbodies. We do not expect sublethal effects in any waterbodies. Where localized effects (e.g., reductions in prey) occur as a result of applications of methomyl, we anticipate additional food resources from upstream sources will quickly recolonize, or individuals will seek out other areas of available prey.

Therefore, we expect low numbers of individuals of this species will experience adverse effects, leading to morality of a very small number of individuals after incorporating the general conservation measures listed above. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action with inclusion of conservation measures, is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Neuse River waterdog.

References

U.S. Fish and Wildlife Service. 2023. Draft Recovery Plan for the Neuse River Waterdog (*Necturus lewisi*). Raleigh, North Carolina. 17 pp.

U.S. Fish and Wildlife Service. 2021a. Species Status Assessment Report for the Neuse River Waterdog (*Necturus lewisi*). Version 1.2. February 2021. Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2021b. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Neuse River Waterdog, Endangered

Species Status for Carolina Madtom, and Designations of Critical Habitat. Final Rule. Federal Register 86(109): 30688-30751.

Integration and Synthesis Summary: Reticulated flatwoods salamander

Scientific Name:	Common Name:	Entity ID:
Ambystoma bishopi	Reticulated flatwoods salamander	9943

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. While the EPA's BE identified high levels of overlap based on past use and usage, in our evaluation of the effects of the proposed action to the species, we determined there is low overlap of the action area with the species' range (Figure 8), and low past usage of methomyl within the species' range, indicating a low extent of exposure. Most exposed aquatic larval individuals are unlikely to die or any levels of indirect effects resulting from loss of prey species, but we anticipate high levels of mortality of terrestrial juvenile and adults through ingestion of contaminated prey, when infrequently exposed. However, given that exposure is low, and the level of indirect effects is low, we determined the risk of adverse effects to the species is low. As such, we expect a small number of individuals, primarily but infrequently, terrestrial juveniles and adults, are likely to die and reduced feeding success from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action, including conservation measures, is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the reticulated flatwoods salamander. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/28/2022; Wherever found; *States within the range:* FL, GA. Figure 8 depicts the species' range.

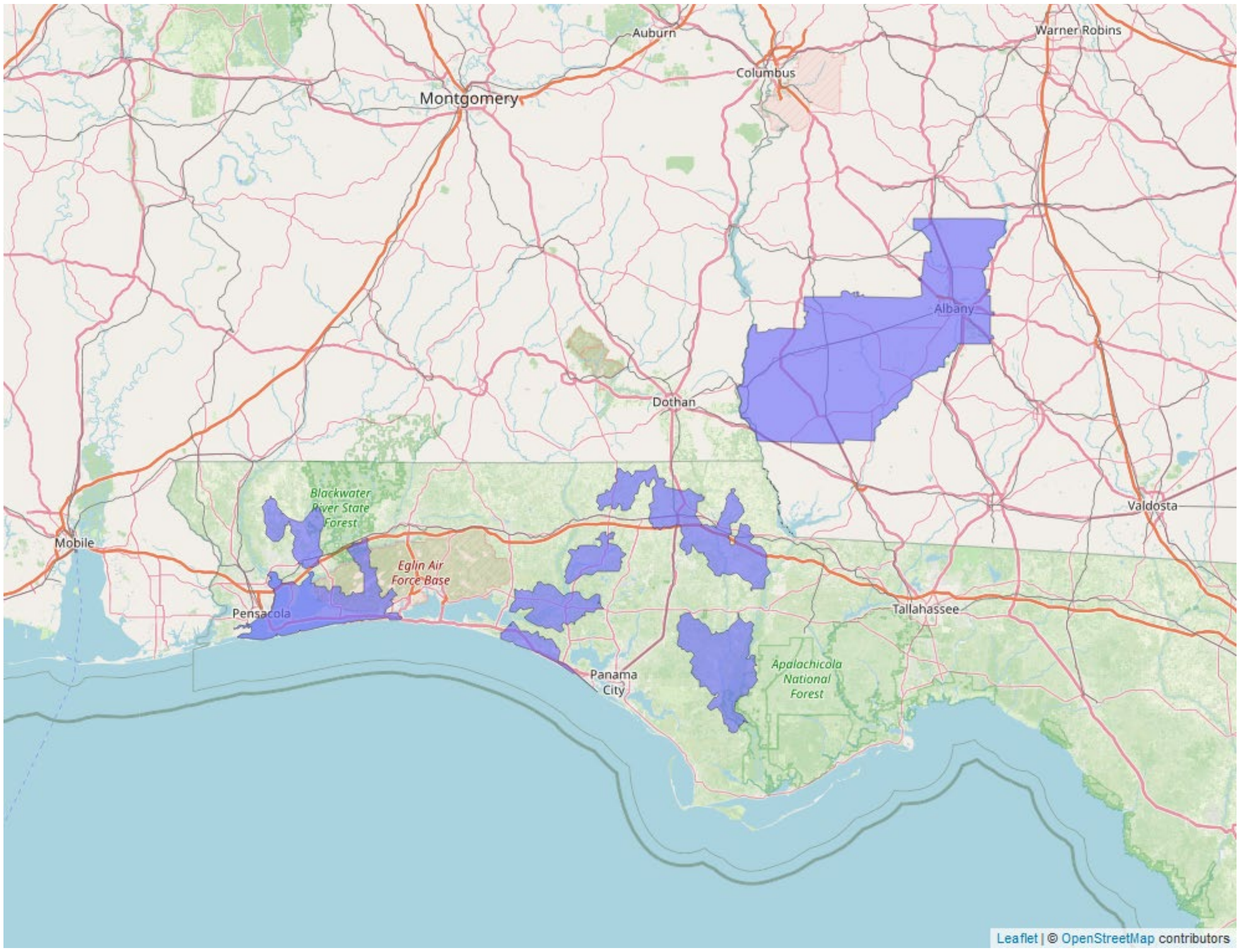

Figure 8. Range map of the reticulated flatwoods salamander (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8939.

Vulnerability

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

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Review: 8/5/2015

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The reticulated flatwoods salamander is an ephemeral wetland-breeding amphibian with a complex life cycle (i.e., aquatic egg and larval stages, terrestrial metamorphosed juvenile, and adult stages). Flatwoods salamander adults migrate to ephemeral (seasonally flooded) wetlands to breed in the fall. Juveniles usually disperse from ponds shortly after metamorphosing but may remain nearby during drought periods. Juveniles and adults are highly fossorial, spending much of their time in crayfish burrows or root channels until they reach sexual maturity at 1-2 years old. The reticulated flatwoods salamander was historically found in four southern counties of Alabama, but it has not been observed there since 1981. In Georgia, the reticulated flatwoods salamander was discovered in two wetlands on the Mayhaw Wildlife Management Area in Miller County. In Florida, the reticulated flatwoods salamander has been observed in Santa Rosa and Okaloosa Counties (17 breeding wetlands and 4 larvae detections). At the end of the 2014/2015 breeding season, there were six known and currently occupied populations across these wetlands in FL and GA (USFWS 2020).

The main threat to the reticulated flatwoods salamander is loss of both its longleaf pine/slash pine flatwoods terrestrial habitat and its isolated, seasonally inundated breeding habitat. The combined pine flatwoods (longleaf pine-wiregrass and slash pine flatwoods) historical acreage was approximately 32 million acres. Flatwoods acreage was reduced to 5.6 million ac or approximately 18% of its original extent by conversions to urban development and agriculture. Remaining pine flatwoods (non-plantation forests) are typically fragmented and degraded by roads and pine plantations, with second-growth forests resulting from fire suppression. Most flatwoods salamander populations are widely separated from each other by unsuitable habitat. Flatwoods salamander breeding sites have been degraded or altered through alterations in hydrology, agricultural and urban development, road construction, incompatible silvicultural practices, shrub encroachment, dumping in or filling of ponds, conversion of wetlands to fish ponds, domestic animal grazing, and soil disturbance. Nonindigenous feral swine can significantly impact flatwoods salamander breeding sites through rooting. Invasive plant species such as cogongrass (*Imperata cylindrica*) threaten to further degrade existing habitat. Direct threats to flatwoods salamanders include disease and predation (i.e., fish and red imported fire ants [*Solenopsis invicta*]). Disease is currently unknown in natural populations of flatwoods salamanders, though a parasitic nematode (*Hedruris siredonis*) was found in South Carolina and Florida in larval flatwoods salamanders, and they may be susceptible to ranaviruses and chytrid fungus. Exposure to increased predation by fish is a potential threat to flatwoods salamanders when isolated, seasonally ponded wetland breeding sites are changed to, or connected to, more permanent wetlands inhabited by fishes that are not typically found in temporary wetlands. Climate change, especially in combination with other stressors, is a daunting challenge for the persistence of amphibians. Sea level rise is becoming and will likely continue to increase as a threat to the extant populations of the frosted flatwoods salamanders. Most of the remaining populations occur in very low-lying areas within a short distance of the coast. Small population sizes, especially concentrated in small areas, are more susceptible to stochastic events that could negatively impact the entire population. Hurricane Michael in 2018 inundated many flatwood salamander ponds with salt water and the 2019 breeding season was believed to be near complete failure at St. Marks. Pesticides and herbicides may pose a threat to amphibians such as the flatwoods salamanders because their permeable eggs and skin readily absorb substances from the surrounding aquatic or terrestrial environment (USFWS 2015, 2020, 2023).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 95.9% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area. Up to 37.1% of the species' range overlaps with methomyl use sites while 59.7% of the range occurs off-field (but may still be exposed to spray drift or runoff).

Table 23. Overlap of methomyl use sites and usage (% range treated) within the reticulated flatwoods salamander range.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Alfalfa	<0.1	0.2	0.2	<0.1	<0.1	<0.1
Citrus	NA	NA	NA	NA	NA	NA
Corn[9]	6.1	8.6	14.8	0.3	0.4	0.7
Cotton	12.5	13.1	25.6	0.6	0.7	1.3
Other Grains	2	11.1	13.1	0.1	0.6	0.7
Other Orchards	2.8	12.1	14.9	2.8	12.1	14.9
Other Row Crops	13.2	12.3	25.5	6	5.5	11.5
Soybeans	2.3	9.5	11.8	0.1	0.5	0.6
Vegetables and Ground Fruit	0.4	1.3	1.7	0.4	1.3	1.7
Wheat	NA	NA	NA	NA	NA	NA
Total	**37.1**	**59.7**	**95.9**	**10.2**	**20.7**	**30.8**

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

Usage

Based on past usage data, we anticipate up to 30.8% of the species' range will be treated annually with methomyl.

Additional Exposure Considerations

Reticulated flatwoods salamanders are ephemeral wetland-breeding amphibians with complex life cycles (i.e., there is a terrestrial egg stage, an aquatic larval life history stage, as well as a terrestrial metamorphosed juvenile and adult stage). As adults, flatwoods salamanders migrate to ephemeral (seasonally flooded) wetlands to breed in the fall, where females lay eggs singly or in small clusters on litter, vegetation, or soil, usually in small depressions near the base of plants, in dry areas that will later fill with water provided by winter rainfall. Well-developed embryos hatch into larvae in the winter and metamorphose between March and May after an 11- to 18-week larval period. Juveniles normally disperse from wetlands shortly after metamorphosing but may stay near wetlands during seasonal droughts. Juveniles and adults are highly fossorial and spend much of their time in crayfish burrows or root channels until they reach sexual maturity (1 year for males; 1-2 years for females) and most return to their natal wetland to breed during the fall months (USFWS 2020).

The Service revised the species' range map in February of 2022 (after the submittal of the final BE), removing many areas that may have historically been habitat, but are no longer capable of supporting the species due to land use changes. Thus, we anticipate the use and usage information significantly overestimate overlap. While the species' habitat (a mosaic of pine dominated flatwoods and seasonal wetlands) sometimes exists adjacent to agricultural sites, it is not anticipated to overlap them.

Exposure Summary

Given the species' habitat preferences and revised range mapping, removing areas of historical habitat, we anticipate there is a low extent of overlap between the action area and the species' range. Similarly, we anticipate the past usage data overestimates the overlap of the action with agricultural sites and we expect a low level of usage within the species' range. Given that the extent of overlap is low, and that expected usage is low we expect a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Low

General Conservation Measures:

Rain restriction:
The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at:

www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. Thus, we provide in Table 23 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The methomyl label has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

We anticipate that, in many cases, these buffers will reduce exposure to the reticulated flatwoods salamander and subsequent risk of direct effects and indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

Because of its complex life cycle, the diet of the reticulated flatwoods salamander consists of aquatic prey consumed by larvae as well as terrestrial prey consumed by adults and juveniles.

We expect the reticulated flatwoods salamander will primarily experience direct adverse effects (i.e., mortality) from terrestrial dietary exposure. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 4 mg/kg-bw, which can occur when individuals exclusively consume soil invertebrates. This level of exposure on-field can cause mortality in up to 99.6% of exposed individuals. This level of mortality will also strictly be applicable to terrestrial juvenile or adult reticulated flatwood salamanders. However, because the reticulated flatwoods salamander has such specific habitat requirements for feeding and breeding, as well as sheltering (mostly fossorial) and do not travel far from these areas to forage, it is unlikely they will forage on field. It is still likely they will forage near agricultural areas as their habitat is surrounded by large tracts of agricultural land and thus could still die from spray drift from methomyl but the level of mortality to juvenile and adults is likely less than what is stated above.

We expect dietary dosages from consuming contaminated food items off-field will result in lower levels of direct adverse effects as we expect lower levels of methomyl will occur in these food items. Off-field exposure can result in dosages up to 0.1 mg/kg-bw, which can occur when individuals exclusively consume soil invertebrates. This level of off-field exposure can cause mortality in up to <1% of exposed individuals.

Aquatic phase:

EPA's aquatic exposure modeling indicates that EECs within the region and aquatic habitats that the reticulated flatwoods salamander occupies will likely be exposed to methomyl at maximum concentrations from 139.8 to 1,715 µg/L, depending on the type of habitat and region (Table 23). Based on this range of potential exposures, we expect, on average, 0.1% of individuals will die. However, mortality is not expected in large volume waterbodies but may occur in up to 37.8% of exposed individuals in low flow/low volume waterbodies.

Table 24. Predicted environmental concentrations of methomyl within the reticulated flatwoods salamander habitat and the associated level of mortality expected to occur with exposure

Aquatic Habitat	HUC 2 Region	Max EEC (µg/L)	Percent amphibian mortality
Large volume waterbodies	HUC_3	139.8	0
Low flow/low volume waterbodies	HUC_3	1,715	37.8

Based on available toxicity data on sublethal effects of methomyl exposure in aquatic vertebrates and the predicted environmental concentration of methomyl in the habitat of the reticulated flatwoods salamander, we do not anticipate adverse effects to growth and/or reproduction.

Indirect Effects

Based on available life history information, we expect the reticulated flatwoods salamander larvae rely on freshwater crustaceans as their main dietary item. Whiles (2004) documented that freshwater crustaceans comprise 96% of all invertebrates consumed by larval reticulated flatwoods salamanders. Therefore, while we expect some reductions in freshwater crustaceans (isopods and amphipods) from methomyl exposure, based on methomyl's low persistence in water, they will be temporary. We also anticipate any localized reductions in zooplankton as a food source will be temporary. As such, we do not anticipate any indirect adverse effects are likely to occur for larvae or metamorph dietary items.

Adult and juvenile reticulated flatwoods salamanders while spending most of their time in crayfish burrows within intermediate moisture-pine dominated flatwoods/savanna communities, feed on soil invertebrates, which are likely to experience adverse effects from methomyl exposure. The reticulated flatwoods salamander will also feed on other amphibians and invertebrate species as well, therefore indirect effects to their food base overall are not anticipated as they have a variety of dietary items on which to forage.

Toxicity Summary

We expect a medium level of direct adverse effects will occur on-field as reticulated flatwoods salamanders will not likely forage on field directly. We expect a low level of direct adverse effects will occur off-field as <1% of exposed individuals foraging off-field will likely die. For larvae, we do expect high mortality based on their feeding and presence in low flow aquatic habitats. We do not expect sublethal effects (i.e., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a low level of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause some mortality to the aquatic isopods and amphipods that make up the diet for larval reticulated flatwoods salamanders but these reductions will be temporary and prey items will be replenished soon after from upstream sources. For adults and juveniles that feed on soil invertebrates as well as other terrestrial dietary items we anticipate some reductions in particular to the soil invertebrates however, this will not impact the salamander overall as they have a variety of dietary items on which to forage. Overall, we determine the reticulated flatwoods salamander has a high toxicity ranking.

Overall Toxicity Ranking: High Effects of the Action Summary

The reticulated flatwoods salamander has a low exposure ranking. Based on the EPA's BE assessment of past methomyl usage data, we expect up to 30.8% of the range may be treated annually but may potentially cover up to 95.9% of the range over the duration of the proposed action depending how usage patterns may or may not change over time. However, the Service revised the species range map in February of 2022, removing many areas that may have historically included habitat, but no longer are capable of supporting the species. Thus, we anticipate the use and usage data represent significant overestimates given the species habitat preferences of a mosaic of pine dominated flatwoods and seasonal wetlands. We anticipate that that only a small portion of the species' range is likely to be treated overall. As such, we expect a small number of individuals are likely to be exposed to methomyl.

The reticulated flatwoods salamander has a high toxicity ranking. When infrequently exposed we expect a medium level of mortality will occur on-field as a result of dietary exposure through the consumption of contaminated food items to adults and juveniles during the terrestrial phase of the life cycle. We expect a low level of mortality will occur off-field, which is also a result of dietary exposure from the consumption of contaminated food items. We expect a low level of indirect adverse effects are likely to occur as we expect prey species in the aquatic waterbodies where the larvae feed will experience some mortality with exposure to predicted concentrations of methomyl however, this will not reduce the prey items for the reticulated flatwoods salamander larvae extensively as these prey items can be replenished in a short amount of time from upstream sources.

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

Conclusion (with General Conservation Measures)

The reticulated flatwoods salamander has a high vulnerability ranking due to its threatened status (with a 5-year review recommendation to uplist to endangered), limited distribution, small population size, low juvenile survival rates, susceptibility to stochastic events, and anthropogenic threats to the species (e.g., climate change, continued degradation, fragmentation and loss of suitable aquatic and upland habitats from urbanization, invasive species, fire suppression, and agricultural impacts to habitat). The species has a low exposure ranking because we anticipate the species will remain off-field due to its habitat preferences and limit exposure within the revised species' range for which we do not have accurate overlap information for methomyl use sites or past usage. While estimated past methomyl usage affected 30.8% of the former species' range annually and up to 95.9% of the former species' range overlaps methomyl use sites, we anticipate these estimates are significant overestimates. Effects to prey items from use sites and mortality of reticulated flatwoods salamanders from ingestion of contaminated soil-based prey are anticipated to be rare events. Based on the reclusive behavior and specialized habitat preferences of the species (i.e., fossorial lifestyle), we anticipate foraging (including exposed soil-based invertebrate prey), seasonal breeding, and dispersal activity for terrestrial life stages of the species will expose only small numbers of individual salamanders and their prey over the duration of the proposed action.

Amphibians in general are at high risk, given their aquatic life histories and susceptibility to environmental contaminants (e.g., pesticides, degraded water quality). They can be exposed through multiple pathways (e.g., dermal exposure, ingestion of contaminated arthropod prey) and at various life stages (e.g., egg, larval, juvenile, and adult). For aquatic life stages of the reticulated flatwoods salamander, we anticipate mortality will range from 0% to 37.8% of exposed individuals. Generally fewer effects to larval and metamorph life stages are anticipated as they are fully aquatic and feed on small planktonic organisms, such as invertebrates, that will be less affected given methomyl's low persistence in water. Indirect effects to these dietary items are also not anticipated as populations of these planktonic invertebrates can be replenished in smaller water bodies over a short period of time. The aquatic life stage vulnerability of this species is low, and exposure is variable but anticipated to be low for this species based on the revised range information. We anticipate that the concentration of methomyl will lead to only low levels of exposure for the larval life stages.

Thus, we anticipate a very small number of individuals of this species will die, both from terrestrial juveniles and adults ingesting contaminated prey and from infrequent reductions in the soil invertebrate prey and other terrestrial dietary items, primarily affecting terrestrial juveniles and adults, over the duration of the proposed action. We anticipate the 48-hour rain restriction measure and aquatic habitat buffers on the label will be sufficient to protect the reticulated flatwoods salamander throughout its lifecycle. We expect the loss of low numbers of individuals and reductions in the available prey base will not result in species-level effects. Therefore, we anticipate that the proposed action, with conservation measures, will not appreciably reduce the survival and recovery of the reticulated flatwoods salamander. Therefore, after reviewing the current status of the listed species, environmental baseline for the action area, effects of the action, and cumulative effects, it is our biological opinion that the registration of methomyl, as proposed with conservation measures, is not likely to jeopardize the continued existence of the reticulated flatwoods salamander.

References

U.S. Fish and Wildlife Service. 2023. Reticulated flatwoods salamander (*Ambystoma bishopi*), 5-Year Review: Summary and Evaluation. Gainesville, Florida.

U.S. Fish and Wildlife Service. 2020. Species Status Assessment for the Reticulated flatwoods salamander (*Ambystoma bishopi*). Version 1.0. Panama City, Florida.

U.S. Fish and Wildlife Service. 2015. Reticulated flatwoods salamander (*Ambystoma bishopi*), 5-Year Review: Summary and Evaluation. Panama City, Florida.

Integration and Synthesis Summary: Sierra Nevada yellow-legged frog

Scientific Name:	Common Name:	Entity ID:
Rana sierrae	Sierra Nevada yellow-legged frog	10517

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our preliminary evaluation of the effects of the proposed action to the species (presented below), we determined there is low overlap of the action area with the species' range, and low past usage of methomyl within the species' range, indicating a low extent of exposure. Most exposed individuals are likely to die and are likely to experience low levels of indirect effects resulting from loss of prey. Given that exposure is low, and the level of direct effects is high, we determined the risk of adverse effects to the species is high. As such, we expected a small number of individuals were likely to die from the proposed action. Any mortality for this species could be detrimental to its recovery.

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

Species range

Last updated: 7/7/2023; Wherever found; *States within the range:* CA, NV. Figure 9 depicts the species' range.

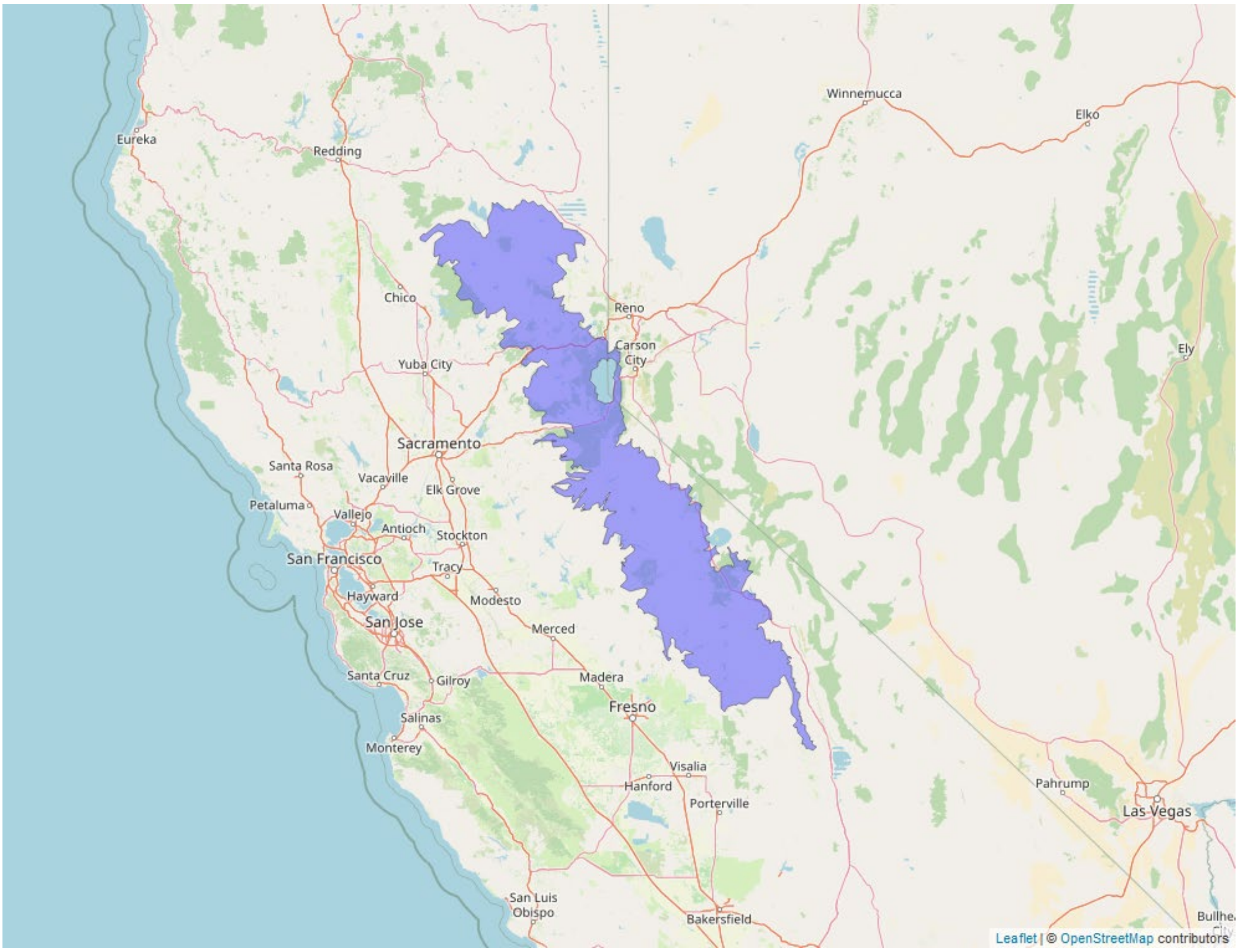

Figure 9. Range map of Sierra Nevada yellow-legged frog (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9529.

Vulnerability

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

Summary of status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Most recently completed 5-Year Review: N/A

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Sierra Nevada yellow-legged frogs historically inhabited lakes, ponds, marshes, meadows, and streams at elevations between 3,500-12,000 feet and ranged from north of the Feather River in Butte and Plumas counties south to the Monarch Divide on the west side of the Sierra Nevada crest in Fresno County. East of the Sierra Nevada crest in California, the historical range of the Sierra Nevada yellow-legged frog extended from areas north of Lake Tahoe, through Mono County (including the Glass Mountains) to Inyo County. Historical records indicate that the Sierra Nevada yellow-legged frog also occurred at locations within the Carson Range of Nevada, including Mount Rose in Washoe County, and in the vicinity of Lake Tahoe in Douglas County, Nevada. Pronounced declines in the Sierra Nevada yellow-legged frog populations occurred north of Lake Tahoe in the northernmost 78 mi portion of the Sierra Nevada yellow-legged frog's range. Vredenburg et al. (2007) compared survey records from 1995-2004 to museum records from 1899-1994 and reported that Sierra Nevada yellow-legged frogs were extirpated from 92.5% of their historical range. California Department of Fish and Wildlife expanded upon Vredenburg et al.'s study to include additional survey data from 1995–2010; the recent survey efforts failed to detect any extant Sierra Nevada yellow-legged frog populations at 220 of 318 historical localities. To summarize population trends over the available historical record, loss estimates range from 69 to 93% of the Sierra Nevada yellow-legged frog population (USFWS 2013).

Threats include habitat degradation and fragmentation, predation and disease, climate change, inadequate regulatory protections, and the interaction of these various stressors impacting small remnant populations. A range-wide reduction in abundance and geographic extent of surviving populations of frogs occurred following decades of fish stocking, habitat fragmentation, livestock trampling, and a disease epidemic (chytrid fungus). Surviving populations are smaller and more isolated, and recruitment in diseased populations is reduced relative to historic norms. This combination of population stressors makes persistence of this species precarious throughout the currently occupied range in the Sierra Nevada. Evidence of the effects of wind-borne pesticides deposited from upwind agricultural sources are suggested as a cause of measured sublethal effects to amphibians in the nearby Sierra Nevada (USFWS 2012), but no specific effects to Sierra Nevada yellow-legged frogs have been identified as of 2019 (USFWS 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 1.3% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area. Up to 0.4% of the species' range overlaps with methomyl use sites while 0.9% of the range occurs off-field (but may still be exposed to spray drift or runoff).

Table 25. Overlap and past annual usage data (percent range treated) for the Sierra Nevada yellow-legged frog.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Alfalfa	0.3	0.7	1	<0.1	0.1	0.2
Citrus	NA	NA	NA	NA	NA	NA
Corn[10]	<0.1	<0.1	<0.1	0	0	0.0
Cotton	<0.1	<0.1	<0.1	0	0	0.0
Other Grains	<0.1	0.1	0.2	0	0	0.0
Other Orchards	<0.1	<0.1	<0.1	0	0	0.0
Other Row Crops	<0.1	<0.1	<0.1	0	0	0.0
Soybeans	0	0	0	0	0	0.0
Vegetables and Ground Fruit	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Wheat	NA	NA	NA	NA	NA	NA
Total	**0.4**	**0.9**	**1.3**	**<0.1**	**0.2**	**0.3**

Usage

Based on past usage data, we anticipate up to 0.3% of the species' range will be treated annually with methomyl.

Additional Exposure Considerations

Sierra Nevada yellow-legged frogs inhabit lakes, ponds, marshes, meadows, and streams at elevations between 3,500-12,000 feet. Surviving populations are smaller and more isolated, and recruitment in diseased populations is reduced relative to historic norms. This combination of population stressors makes persistence of this species precarious throughout the currently occupied range in the Sierra Nevada. Evidence of the effects of wind-borne pesticides deposited from upwind agricultural sources are suggested as a cause of measured sublethal effects to amphibians in the nearby Sierra Nevada (USFWS 2012), but no specific effects to Sierra Nevada yellow-legged frogs have been identified as of 2019 (USFWS 2019) and there is no indication these effects are from methomyl specifically.

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

Exposure Summary

There is a low extent of overlap between the action area and the species' range (1.3% total overlap). Based on past usage data, we expect a low level of usage within the species' range (up to 0.3% range treated annually). Given that the extent of overlap is low, and that expected usage is low, we expect a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: Low

General Conservation Measures:

Rain restriction:
The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. Thus, we provide in Table 25 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure. However, despite the incorporation of the rain restriction mitigation, mortality remains high for this species.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

We anticipate that, in many cases, these buffers will reduce exposure to the Sierra Nevada yellow-legged frog and subsequent risk of direct effects and indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

Because of its complex life cycle, the diet of the Sierra Nevada yellow-legged frog consists of terrestrial and aquatic insects and other amphibians consumed by adults and juveniles. Tadpoles feed on algae.

We expect the Sierra Nevada yellow-legged frog will primarily experience direct adverse effects (i.e., mortality) from terrestrial dietary exposure. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 1.8 mg/kg-bw, which can occur when individuals exclusively consume arthropod prey. This level of exposure on-field can cause mortality in up to 85.4% of exposed individuals. This level of mortality will strictly be applicable to terrestrial juvenile or adult Sierra Nevada yellow-legged frogs.

We expect dietary dosages from consuming contaminated food items off-field will result in lower levels of direct adverse effects as we expect lower levels of methomyl will occur in these food items. Off-field exposure can result in dosages up to 0.1 mg/kg-bw, which can occur when individuals exclusively consume arthropods that have only been exposed to methomyl through spray drift. This level of off-field exposure can cause mortality in up to <1% of exposed individuals.

Aquatic phase:

EPA's aquatic exposure modeling indicates that EECs within the regions and aquatic habitat(s) that the Sierra Nevada yellow-legged frog occupies will likely be exposed to maximum methomyl concentrations ranging from 13 to 1,029 μg/L, depending on the type of habitat and region (Table 16). However, mortality is not expected in large volume waterbodies but may occur in up to 40.8% of exposed individuals in low flow/low volume waterbodies.

Table 26. Predicted environmental concentrations of methomyl within the Sierra Nevada yellow-legged frog habitat and the associated level of mortality expected to occur with exposure.

Aquatic Habitat	HUC 2 Region	Max EEC (μg/L)	Percent amphibian mortality
Large volume waterbodies	HUC_16a	13.6	< 0.01
Low flow/low volume waterbodies	HUC_16a	742.5	19.2
Large volume waterbodies	HUC_18a	15.8	< 0.01
Low flow/low volume waterbodies	HUC_18a	920.7	32.6
Large volume waterbodies	HUC_18b	22.6	< 0.01

Aquatic Habitat	HUC 2 Region	Max EEC (µg/L)	Percent amphibian mortality
Low flow/low volume waterbodies	HUC_18b	1029.6	40.8

Based on available toxicity data on sublethal effects of methomyl exposure in aquatic vertebrates and the predicted environmental concentration of methomyl in the habitat of the Sierra Nevada yellow-legged, we do not anticipate adverse effects to growth and/or reproduction.

Indirect Effects

Based on available life history information, we expect the Sierra Nevada yellow-legged frog is an opportunistic forager that can consume plant matter (e.g., algae, plankton) during the tadpole phase, terrestrial insects, aquatic insects, benthic macroinvertebrates, and even other amphibians (including conspecifics) during the adult and juvenile phase. Therefore, while we expect some reductions in the abundances of aquatic and terrestrial insects from methomyl exposure, based on methomyl's low persistence, we anticipate any reductions in sensitive prey species will be localized and dependent on the habitat type (e.g., low flow/low volume waterbodies will experience greater reductions of prey and longer recovery times as these habitats accumulate more methomyl). Furthermore, given the breadth of dietary items individuals can use, we anticipate in situations where methomyl use reduces the abundance of sensitive prey species individuals can switch to more abundant food resources. As such, we do not anticipate any indirect adverse effects are likely to occur. We do not anticipate any indirect effects from dietary exposure during the tadpole phase as available toxicity data in aquatic plants indicate no reductions in plant survival or growth are likely to occur with methomyl exposure.

Toxicity Summary

We expect a high level of direct adverse effects will occur on-field as up to 85.4% of individuals foraging on-field will likely die. We expect a low level of direct adverse effects will occur off-field as <1% of exposed individuals foraging off-field will likely die. We do not expect sublethal effects (i.e., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect a high level of direct effects in aquatic habitats as up to 40.8% of exposed individuals are likely to die. We expect a low level of indirect effects are likely to occur to individuals in aquatic habitats as we anticipate methomyl exposure will cause some mortality to sensitive insect species that make up part of the diet of Sierra Nevada yellow-legged frogs. But these reductions will be temporary and localized. Overall, we determine the Sierra Nevada yellow-legged frog has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Sierra Nevada yellow-legged frog has a low exposure ranking. There is a low extent of overlap between the action area and the species range (1.3% total overlap) and a low level of past methomyl usage (up to 0.3% of the range treated annually). As such, we expect a small number of individuals are likely to experience exposure.

The Sierra Nevada yellow-legged frog has a high toxicity ranking. Frogs that forage on-field are likely to experience high levels of mortality (up to 85.4% of exposed individuals). Similarly, tadpoles occupying low flow/low volume waterbodies are likely to be exposed to high levels of methomyl and will experience high levels of mortality (up to 79.5% of exposed individuals). However, juveniles and adults that forage off-field and tadpoles in larger volume waterbodies are not likely to experience any mortality. While there will likely be reductions in the abundance of sensitive insect species that individuals feed on, we anticipate that individuals, as opportunistic foragers, will likely be able to switch food items in situations where insect abundances are adversely affected by methomyl exposure, indicating only low levels of indirect effects are likely.

While the Sierra Nevada yellow-legged frog habitat preferences are lakes, ponds, marshes, meadows, and streams at elevations between 3,500-12,000 feet. Surviving populations are smaller and more isolated, and recruitment in diseased populations is reduced relative to historic norms. This combination of population stressors makes persistence of this species precarious throughout the currently occupied range in the Sierra Nevada. Evidence of the effects of wind-borne pesticides deposited from upwind agricultural sources are suggested as a cause of measured sublethal effects to amphibians in the nearby Sierra Nevada (USFWS 2012), but no specific effects to Sierra Nevada yellow-legged frogs have been identified as of 2019 (USFWS 2019) and there is no indication these effects are from methomyl specifically.

Given that we expect only a small number of individuals are likely to be exposed, but exposed individuals can experience high levels of adverse effects, including mortality, we expect the overall risk of adverse effects to the species is high due to very few, isolated individuals that we are aware of in the population at present.

Preliminary Conclusion (with General Conservation Measures)

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of methomyl, and the cumulative effects, it is our biological opinion that the registration of methomyl, as proposed, is likely to jeopardize the continued existence of the Sierra Nevada yellow-legged frog. Vulnerability and toxicity are high for this species. Likelihood of exposure is low, but with the caveat that even at low anticipated levels, given the status and distribution of this species, any losses due to methomyl exposure are likely species-level consequences of the proposed action. Thus, we anticipate that moderate numbers of individuals will be affected over the duration of the proposed action, and we expect species-level effects to occur.

We acknowledge there is a low extent of overlap between the action area and the species range (1.3% total overlap) and a low level of past methomyl usage (up to 0.3% of the range treated annually) based on mandatory pesticide use reporting from the state of California and that we have a higher confidence in this source of information. However, this species has experienced substantial declines and we anticipate an exposure pathway for direct exposure of adult (feeding on contaminated prey) and for aquatic larval stages in low flow/low volume waterbodies. This exposure will impact a small number of individuals of this critically imperiled species and result in species level effects. Monitoring efforts and research studies have documented substantial declines of Sierra Nevada yellow-legged frog populations in the Sierra Nevadas. The number of extant populations has declined greatly over the last few decades. Remaining populations are patchily scattered throughout the historical range (Jennings and Hayes 1994; Jennings 1995; Jennings 1996). In the northernmost portion of the range (Butte and Plumas Counties), only a few Sierra Nevada yellow-legged frog populations have been documented since 1970. Vredenburg et al. (2007) compared recent survey records (1995– 2004) with museum records from 1899– 1994 and reported that 92.5 percent of historical Sierra Nevada yellow-legged frog populations are now extirpated. Despite the low overlap and anticipated usage, we note the critical status of this species such that any losses of individuals of this species from exposure to methomyl are likely species-level consequences of the proposed action.

However, we anticipate the general conservation measures above, including rain restrictions and aquatic habitat buffers, will further reduce the likelihood of exposure of the species, their prey, and their habitat. Implementation of species-specific measures will reduce the likelihood of exposure as well.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Sierra Nevada yellow-legged frog:

1) *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Sierra Nevada yellow-legged frog by >95% for terrestrial habitat and between 74 and 99% for aquatic habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

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

After incorporating the species-specific conservation measure above, we expect exposure for the Sierra Nevada yellow-legged frog to be very low. We anticipate direct exposure in aquatic larval stages or through ingestion of contaminated prey as terrestrial adults could result in mortality, but after incorporating these conservation measures, we expect exposure to be unlikely to occur. We anticipate that with the measures described above that these pathways of exposure will be greatly limited and result in exposure of very low numbers of individuals and their prey over the course of the action, leading to mortality of a very small number of individuals. After reviewing the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Sierra Nevada yellow-legged frog.

References

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Sierra Nevada Yellow-Legged Frog and Northern Distinct Population Segment of the Mountain Yellow-Legged Frog, and Threatened Species Status for Yosemite Toad; Final Rule. Federal Register 79(82): 24256-24310.

U.S. Fish and Wildlife Service. 2012. Mountain Yellow-legged Frog [Southern California Distinct Population Segment] (*Rana muscosa*) 5-Year Review: Summary and Evaluation. Carlsbad, California. 14 pp.

Integration and Synthesis Summary: Dixie Valley toad

Scientific Name:	Common Name:	Entity ID:
Anaxyrus williamsi	Dixie Valley toad	11468

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is a low extent of exposure. In addition, the known occurrences of the Dixie Valley toad exist on federal lands, which leads us to conclude that the overlap and usage estimates are overestimated and that the likelihood of exposure for this species is actually low. Most exposed aquatic larval individuals are unlikely to die or any levels of indirect effects resulting from loss of prey species, but we anticipate high levels of mortality of terrestrial juvenile and adults through ingestion of contaminated prey when exposed or when in low flow or low volume habitats. However, given the likelihood of limited exposure on the majority of extant sites, we anticipate that exposure is low, and the level of indirect effects is low, we determined the risk of adverse effects to the species is low. As such, we expect only a small number of individuals are likely to experience reduced feeding success from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action, with the inclusion of conservation measures, is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Dixie Valley toad. We discuss our rationale for the species in the sections below.

Species range

Last updated: 4/28/2022; Wherever found; *States within the range:* NV. Figure 10 depicts the species' range.

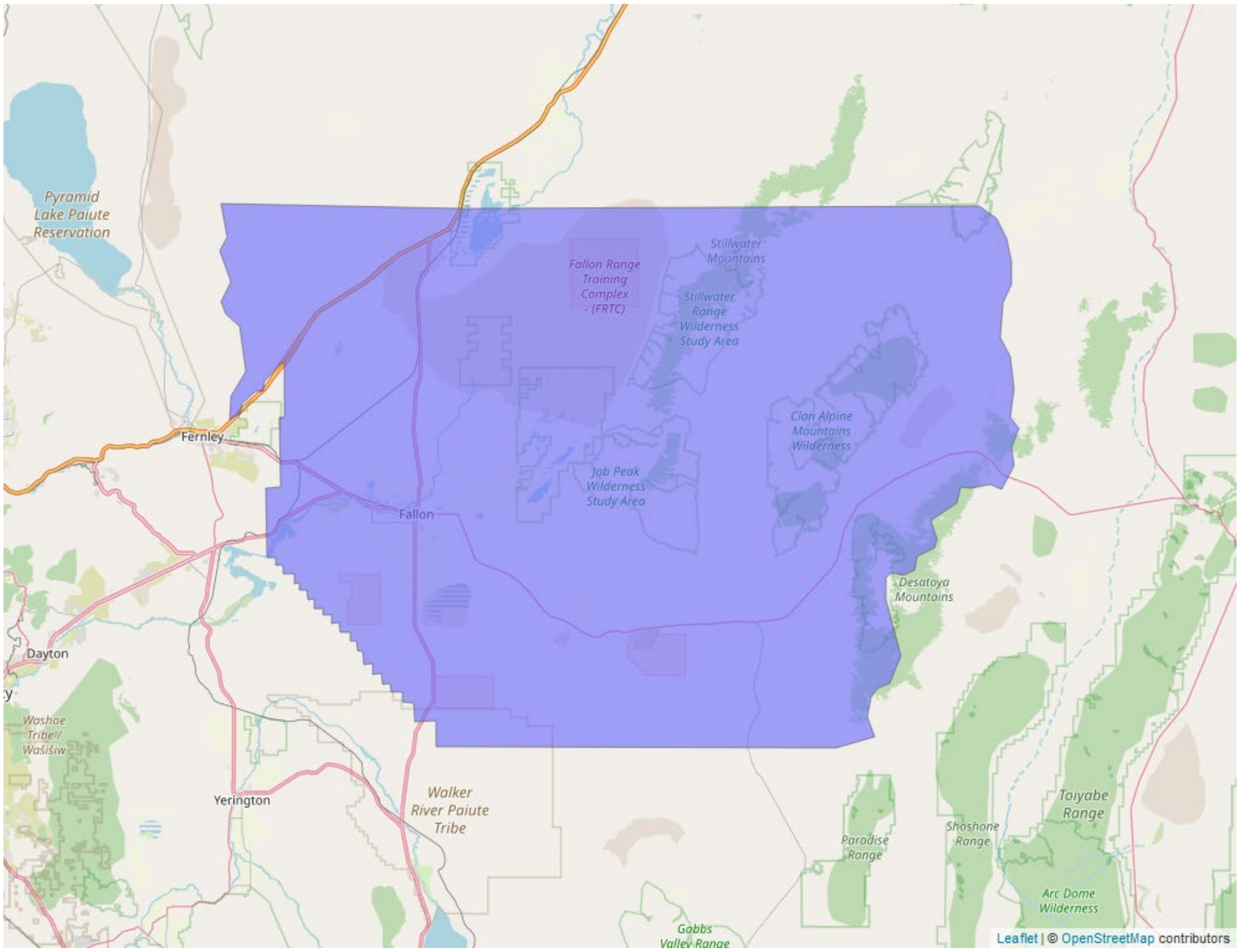

Figure 10. Range map of Dixie Valley toad (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/10635.

Vulnerability

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

Summary of status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Most recently completed 5-Year Review: N/A

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

Number of populations: Single population

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Dixie Valley toads are a narrow endemic toad found in a single metapopulation at Dixie Meadows, approximately 69 kilometers northeast of the City of Fallon in Nevada. Dixie Meadows consists of six wetlands connected by upland habitat. The numerous springs and spring provinces in the Dixie Meadows discharge area represent a unique feature in Dixie Valley. Outside of the Dixie Meadows wetland, the surrounding landscape is characterized by expansive xeric habitats nearly devoid of surface water. Surface water flowing from Dixie Meadows springs are formed from a combination of shallow basin-fill aquifer, mainly recharged from atmospheric contributions which fall on the Stillwater Range, and a deep geothermal reservoir. Toads are rarely found farther than 14 m from aquatic habitats. They require sufficient wetted areas, adequate water temperature, wetland vegetation, and adequate water quality. Due to lack of specific information, we assume they are opportunistic feeders like other toads, primarily eating aquatic and terrestrial invertebrates as adults and algae and detritus as aquatic larvae. Dixie Meadows is managed by federal entities (i.e., Department of Defense and Bureau of Land Management), including all areas occupied by the Dixie Valley toad. Population estimates are unavailable for Dixie Valley toads, but consistent reproduction has been documented (USFWS 2023).

Threats to the species include geothermal development (i.e., changes in water temperature and flow, habitat loss), predation, disease, livestock grazing, spring modifications, groundwater pumping, and altered precipitation and temperature from climate change. Negative impacts are expected to occur to toads and their habitats from geothermal development, but the extent of these impacts is unknown. Heavy livestock grazing has been shown to negatively influence amphibian populations and their habitat. Dixie Meadows is grazed by livestock, but there is no indication of habitat loss due to the effects of heavy grazing. Spring modifications may include surface water diversion, impoundment, or channel modification, including dredging. These spring modifications affect Dixie Valley toad needs by changing how water is distributed throughout the wetland, and open water needed for plant productivity, which provides food and shelter. The most extreme effects of groundwater withdrawal on Dixie Valley toads are desiccation and extirpation or extinction. If groundwater withdrawal occurs but does not cause a spring to dry, there can still be adverse effects to Dixie Valley toads or their habitat (USFWS 2023). Dixie Valley toads have low redundancy because they are a narrow endemic with a projected occupancy of only 155.9 hectares (385.2 acres), have limited dispersal opportunities due to the harsh, arid nature of the surrounding landscape, and consist of one population. Subsequently, the species' future viability depends critically on maintaining resilience within Dixie Meadows.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 6.6% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area. Up to 3.1% of the species' range overlaps with methomyl use sites while 3.5% of the range occurs off-field (but may still be exposed to spray drift or runoff).

Table 27. Overlap and past annual usage data (percent range treated) for the Dixie Valley toad.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Alfalfa	2.3	1.8	4.1	0.3	0.2	0.5
Citrus	0	0	0	0	0	0
Corn[11]	0.4	0.7	1.1	<0.1	0.1	0.1
Cotton	0	0	0	0	0	0
Other Grains	0.3	1	1.3	<0.1	0.1	0.1
Other Orchards	0	0	0	0	0	0
Other Row Crops	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	<0.1	0.1	0.1	<0.1	0.1	0.1
Wheat	0	0	0	0	0	0
Total	**3.1**	**3.5**	**6.6**	**0.3**	**0.5**	**0.8**

Usage

Based on past usage data, we anticipate up to 0.8% of the species' range will be treated annually with methomyl.

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

Additional Exposure Considerations

Dixie Valley toads are endemic to Dixie Meadows, Churchill County, Nevada. Dixie Meadows is a ground water dependent ecosystem consisting of at least 122 springs and seeps located on the east side of the Stillwater Range. Approximately 90 percent of all occupied habitat is located on Department of Defense lands and the remaining is on public lands managed by the Bureau of Land Management.

Exposure Summary

There is a moderate extent of overlap between the species' range and the action area. However, given that the species is highly restricted to a single area (Dixie Meadows), which is entirely located on Department of Defense and Bureau of Land Management land (where we do not anticipate any agricultural pesticides like methomyl will be used), we do not expect any individuals are likely to be exposed to methomyl. As such, the species' exposure ranking is low.

Overall Exposure Ranking: Low

General Conservation Measures:

Rain restriction:
The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. Thus, we provide in Table 27 the maximum predicted EEC from the highest overlap use site within the species range to illustrate the resulting concentrations of methomyl in the aquatic habitats where this species is found as a result of this rain restriction measure.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

We anticipate that, in many cases, these buffers will reduce exposure to the Dixie Valley toad and subsequent risk of direct effects and indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

There is no published information on the feeding habits of Dixie Valley toads. It is assumed that adult Dixie Valley toads are opportunistic feeders, similar to other toad species (USFWS 2023), and their diet most likely consists of the available aquatic and terrestrial invertebrates found in Dixie Meadows. Aquatic larvae are assumed to feed on algae and detritus.

We expect the Dixie Valley toad will primarily experience direct adverse effects (i.e., mortality) from terrestrial dietary exposure. The level of adverse effect will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. On-field exposure can result in dosages up to 1.8 mg/kg-bw, which can occur when individuals exclusively consume arthropod prey. This level of exposure on-field can cause mortality in up to 85.4% of exposed individuals. We expect dietary dosages from consuming contaminated food items off-field will result in lower levels of direct adverse effects as we expect lower levels of methomyl will occur in these food items. Off-field exposure can result in dosages up to 0.1 mg/kg-bw, which can occur when individuals exclusively consume arthropods that have only been exposed to methomyl through spray drift. This level of off-field exposure can cause mortality in up to <1% of exposed individuals. Given that methomyl use sites are not likely to occur within the species' range, we do not anticipate any individuals will be exposed to on-field levels of methomyl. As such, we do not expect more than low levels of mortality are likely to occur.

Aquatic phase:

EPA's aquatic exposure modeling indicates that methomyl can occur within the Dixie Valley toad's habitat at maximum concentrations ranging from 8 to 743μg/L, depending on the type of habitat and region (Table 27). We expect, at high end estimates, that up to 19% of exposed individuals are likely to die. This mortality would likely be limited to only tadpoles as juveniles and adults are semi aquatic and can avoid aquatic exposure by leaving contaminated waters. In contrast, at lower end estimates, we do not anticipate any exposed individuals are likely to die.

Table 28. Predicted environmental concentrations of methomyl within the Dixie Valley toad's habitat and the associated level of mortality expected to occur with exposure.

Aquatic Habitat	HUC 2 Region	Max EEC (μg/L)	Percent amphibian mortality
Low flow/low volume waterbodies	HUC 16a	742.5	19.2
Low flow/low volume waterbodies	HUC 16b	633.6	11.9
Large volume waterbodies	HUC 16a	13.6	<0.01
Large volume waterbodies	HUC 16b	8.2	<0.01

Indirect Effects

Based on available life history information, we expect the Dixie Valley toad is an opportunistic forager that can consume plant matter (e.g., algae, plankton) during the tadpole phase and both terrestrial and aquatic invertebrates during the adult and juvenile phase. Therefore, while we expect some reductions in the abundances of aquatic and terrestrial insects from methomyl exposure, based on methomyl's low persistence, we anticipate any reductions in sensitive prey species will be localized and dependent on the habitat type (e.g., low flow/low volume waterbodies will experience greater reductions of prey and longer recovery times as these habitats accumulate more methomyl). Furthermore, given the breadth of dietary items individuals can use, we anticipate in situations where methomyl use reduces the abundance of sensitive prey species individuals can switch to more abundant food resources. As such, we do not anticipate any indirect adverse effects are likely to occur. We do not anticipate any indirect effects from dietary exposure during the tadpole phase as available toxicity data in aquatic plants indicate no reductions in plant survival or growth are likely to occur with methomyl exposure.

Toxicity Summary

The Dixie Valley toad can be exposed through contact with dissolved methomyl residues as tadpoles or through its diet as juveniles or adults. We do not anticipate juveniles or adults are likely to forage on invertebrate prey directly on methomyl use sites given that the range is entirely on Department of Defense and Bureau of Land Management lands. As such, juveniles and adults are not likely to accumulate more than low levels of methomyl and are not likely to experience any direct adverse effects. Tadpoles occupying low flow or low volume waterbodies can experience high levels of mortality as estimated methomyl concentrations can reach high levels in these habitats. However, we do not anticipate any mortality or sublethal adverse effects are likely to occur to tadpoles occupying deeper or larger bodies of water where estimated concentrations of methomyl are much lower. While juvenile and adult toads are not likely to experience adverse effect, given the potential high mortality rate of tadpoles, we assign the species a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Dixie Valley toad has a low exposure ranking. The species' range is entirely located on Department of Defense and Bureau of Land Management land. Given that methomyl is only registered for agricultural use and given that we do not anticipate any agriculture is likely occurring on these federal lands, we do not anticipate methomyl will be used within the species' range. While individuals may be exposed to methomyl residues from spray drift or runoff from nearby areas, we anticipate only a small number of individuals, at most, will be exposed to methomyl. The Dixie Valley toad has a high toxicity ranking. While we do not anticipate juvenile or adult toads are likely to experience more than low levels of adverse effects, tadpoles occupying low flow or low volume waterbodies are likely to be exposed to high levels of methomyl, resulting in high levels of mortality.

While there is a high level of toxicity associated with exposure, particularly for tadpoles, we expect very few individuals are likely to be exposed given the location of the species' range on federal lands. As such, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Dixie Valley toad has a high vulnerability ranking due to its endangered status, limited distribution, small population size, and anthropogenic threats to the species (e.g., geothermal development (i.e., changes in water temperature and flow, habitat loss), predation, disease, livestock grazing, spring modifications, groundwater pumping, and altered precipitation and temperature from climate change). Population estimates are not available and based on the data we have, it is difficult to infer temporal trends or population size. In addition to adult toads, surveys recorded eggs, tadpoles, and juveniles in all survey years, suggesting consistent reproduction is occurring.

Dixie Valley toads are primarily a wetted area species that rely on springs and spring provinces in the Dixie Meadows discharge area of Dixie Valley. Outside of the Dixie Meadows wetland, the surrounding landscape is characterized by expansive xeric habitats nearly devoid of surface water. Dixie Valley toads are restricted to spring areas and because toads are rarely encountered more than 14 meters from aquatic habitat, we have high confidence they do not disperse far. We anticipate the likelihood of exposure to methomyl is low, stemming mostly from the presence of their very specialized habitat on Department of Defense and Bureau of Land Management lands where very little use of methomyl is likely. While there are likely to be some reductions of available invertebrate prey adjacent to agricultural use sites, we do not anticipate this will impact the species as a whole because they are algae feeders during the larval and juvenile metamorph phases. Any aquatic invertebrate prey they consume will decline in abundance in low flow or low volume waters and will be quickly replenished over time.

We anticipate exposure to aquatic phases (e.g., egg and larval life stages) from runoff and spray drift and mortality of individuals at natal ponds across portions of the range where reproductive sites exist adjacent to agriculture use sites. Vulnerability of the aquatic life stage is also high and we anticipate toxic concentrations of methomyl in the aquatic environment, particularly in smaller, low flowing habitats where tadpoles and early metamorphs are found.

We anticipate the inclusion of general conservation measures above, including rain restrictions and aquatic habitat buffers, will further reduce the likelihood of exposure of the species, their prey, and their habitat. Therefore, we anticipate a small number of individual Dixie Valley toads will die through direct exposure, ingestion of contaminated prey, or reductions in invertebrate prey over the duration of the proposed action. We anticipate the loss of a small number of individuals from such exposure and reductions in the food base will not result in species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Dixie Valley toad.

References

U.S. Fish and Wildlife Service. 2023. Species Status Assessment for Dixie Valley Toad (*Anaxyrus williamsi*). Churchill County, Nevada. Reno Fish and Wildlife Office. Interior Region 10 California-Great Basin.

Integration and Synthesis Summary: Llanero coquí

Scientific Name:	**Common Name:**	**Entity ID:**
Eleutherodactylus juanariveroi	Llanero coquí	9378

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is a low extent of exposure. A moderate portion of the range overlaps with agricultural areas, and a very small portion of the range overlaps with areas subject to spray drift from agricultural areas. We expect an even smaller portion of the range has been exposed to insecticides in the past based on Census of Agriculture data for Puerto Rico. We do not expect the species to occur or forage on-field, and we do not expect mortality off-field from dietary exposure. Some insect prey species may die from methomyl exposure on-field and off-field, but we do not expect more than low levels of indirect effects to coquís from loss of prey. We determined the risk of adverse effects to the species is low. As such, we expect only a small number of individuals are likely to experience reduced feeding success from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action, with the inclusion of conservation measures, is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the llanero coquí. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 08/20/2021; Wherever found; *States within the range:* PR. Figure 11 depicts the species' range.

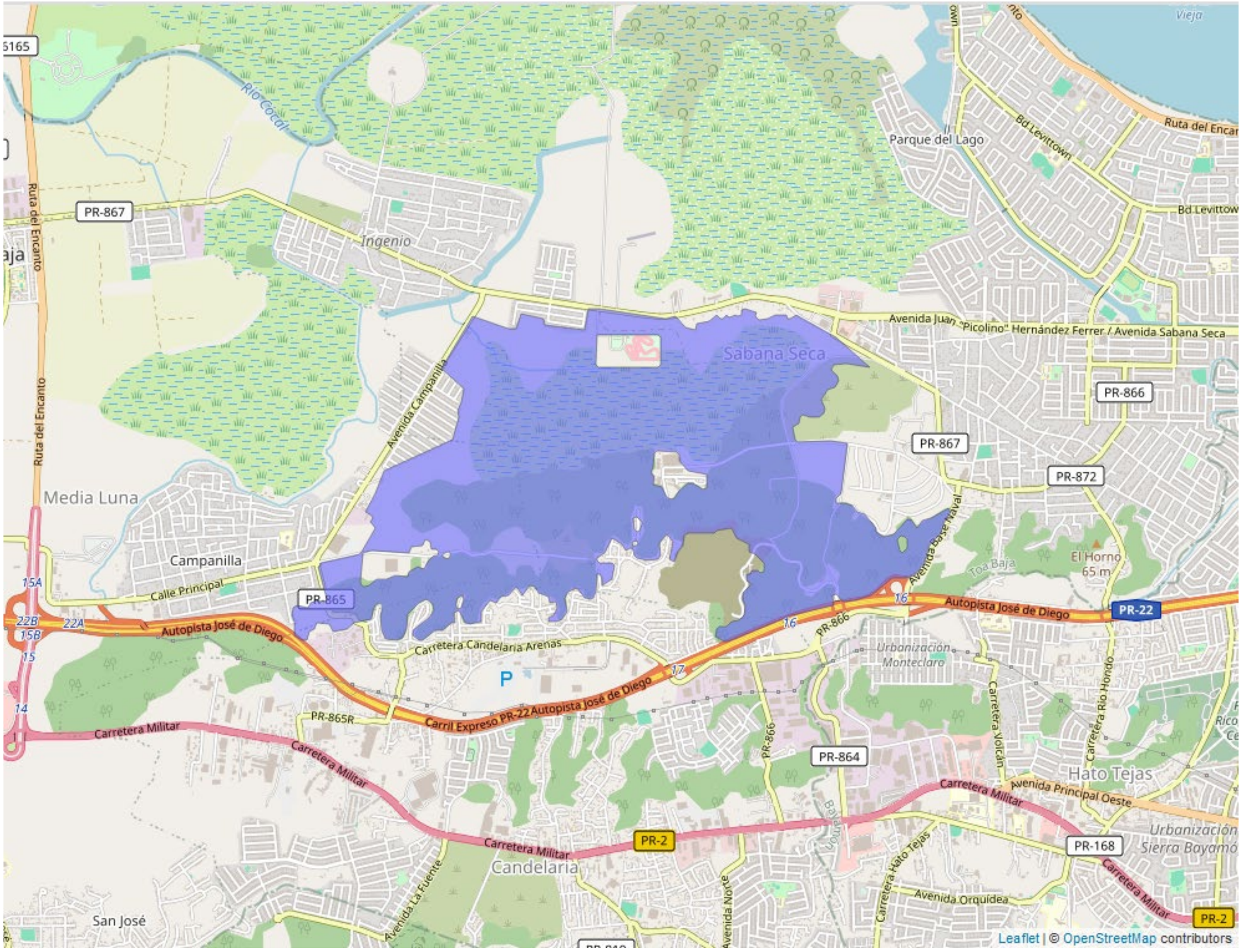

Figure 11. Range map of llanero coquí (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/D03V.

Vulnerability

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

Summary of status

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 6/17/2024

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

Number of populations: Single population

Species trends: Unknown population trends

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The llanero coqui is the smallest coquí species in Puerto Rico, about the size of a dime when fully grown. By the time the previous 5-Year Review was published (August 2019; Service 2019), only one llanero coquí population was known in the Sabana Seca wetland area in Toa Baja with an estimated population of 473.3 ± 186.8 individuals per hectare or 192 per acre from surveys conducted in 2005-2006. Since then, two new populations have been described further west and east from the type locality in Sabana Seca. In 2018, a second breeding population of llanero coquí was found and confirmed in the Caño Tiburones area in Arecibo. This population is approximately 45 kilometers (30 miles) west from Sabana Seca. In 2023, a third breeding population was found and confirmed in Carolina, approximately 28 kilometers (17 miles) east from Sabana Seca. The extent of these two new populations is being investigated. Visits to other nearby suitable wetland locations further east yielded no records for the species but still warrant further exploration (USFWS 2024).

Due to the species restricted range, stochastic events such as fire are a major concern for this species. Additionally, contaminants, such as herbicide runoff and landfill leachate pollution, are a major concern that could impact the aquatic environment in which this species depends. The llanero coquí is highly restricted in its range and the threats occur throughout its range.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 5.5% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 28). Up to 4.6% of the species' range occurs on methomyl use sites while 0.96% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 29. Overlap of methomyl use sites with the llanero coquí range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	4.6	0.96	5.5

Usage

Past methomyl usage data in Puerto Rico is unavailable. However, Census of Agriculture data in Puerto Rico indicate that insecticide usage occurs on 20-70% of crops annually per municipality (muncipio), with methomyl presumably being among those insecticides. We broadly use this data as confirmation that methomyl usage likely occurs within the species' range.

Additional Exposure Considerations

The llanero coquí is an herbaceous wetland specialist found only on a palustrine herbaceous wetland at Sabana Seca Ward previously managed by the U.S. Naval Security Group Activity Sabana Seca and areas owned by the Commonwealth of Puerto Rico (i.e., University of Puerto Rico and Puerto Rico Land Authority). The Service estimated the palustrine herbaceous wetland area where the llanero coquí is now found to be about 615 acres (249 hectares). The species appears to be an obligate marsh dweller and has been found only in freshwater, herbaceous wetland habitat at an elevation of 55.8 feet (17 meters).

The llanero coquí exhibits direct development by laying eggs outside of the water (such as other *Eleutherodactylus*) and does not have an aquatic, free swimming larval stage (tadpole) as most frogs do. The egg masses of the llanero coquí are enclosed on a thick jelly coat and placed on the plant *Sagittaria lancifolia* (bulltongue arrowhead) in leaf axils or leaf surfaces. Contrary to most species in the same genus, the llanero coquí does not provide parental care to the egg mass. The jelly coat is unique among Puerto Rican *Eleutherodactylus* species and is an important adaptation in the absence of parental care because it may protect eggs from dehydration, predation, and from microbial/fungi overgrow (USFWS 2019). Once eggs have developed, a tiny froglet hatches and has the same appearance as an adult.

The life history of other frogs in the genus *Eleutherodactylus* indicates they are opportunistic feeders where diets reflect the availability of food of appropriate size (USFWS 2019). The wetland appears to provide a variety of food sources for the species, mostly small insects and other invertebrates.

Exposure Summary

There is a low extent of off-field overlap with any cultivated land use sites where insecticides have been used and the species' range (0.96%). Individuals may occur near but not within agricultural use sites as this species is a palustrine wetland obligate. However, usage data for Puerto Rico (20-70% crops treated annually with any insecticide) is general and we cannot determine exactly where within the range of the llanero coquí methomyl is likely to be applied. We do not anticipate methomyl use will be concentrated within the agricultural areas adjacent to the wetland habitats of the llanero coquí. The area susceptible to spray drift of any insecticide is expected to account for only 0.96% of the species' range and overlap values may overestimate the extent of methomyl use sites within the species' range because usage data is for all of Puerto Rico. Therefore, we anticipate a low level of exposure from methomyl for the llanero coquí. Given that the expected level of usage in the species' range is low, we expect a small number of individuals are likely to be exposed to methomyl.

Overall Exposure Ranking: Low

General Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites which is the following: "Do not apply during rain. Do not apply when soil in the area to be treated is saturated (if there is standing water on the field or if water can be squeezed from soil) or if NOAA/National Weather Service predicts a total rainfall of 1 inch or greater over the 48 hours following the day of application, only considering a 48-hour period when, at any point during the 48-hour period, the precipitation potential is 50% or greater. Detailed National Weather Service forecasts for local weather conditions should be obtained on-line at: www.weather.gov or by contacting your local National Weather Service Forecasting Office." This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk to the llanero coquí directly in their wetland habitat.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions with the spray drift mitigation practices already in place on the label. The methomyl label has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

We anticipate that, in many cases, these buffers will significantly reduce exposure to the llanero coquí and subsequent indirect effects to prey items.

Effects of the Action: Toxicity

Direct Effects

We expect terrestrial phase amphibians will be directly exposed to methomyl through dietary exposure. The llanero coquí is primarily an opportunistic feeder and consumes mostly insects and small arthropods. We know the llanero coquí is unlikely to feed on-field, and we do not anticipate mortality from feeding on invertebrates off-field in their wetland habitat.

Indirect Effects

Based on available toxicity data, we expect prey individuals will likely experience high levels of mortality with exposure to methomyl, with greater mortality expected on-field than off-field. As such, we expect there may be substantial reductions in the abundance of invertebrate prey species where use sites abut preferred habitats, but invertebrate prey mortality is not likely to eliminate the species' entire prey base. Because the llanero coqui is able to eat a variety of invertebrate dietary items and not all their range is near agricultural areas, we expect the species to still have prey items available.

Toxicity Summary

We do not expect on-field exposure or resultant mortality because we do not expect the species to forage on-field nor do we anticipate mortality to individuals feeding off-field as the llanero coquí has a varied diet and not all its habitat is near agricultural areas that may impact their prey resources. We anticipate indirect effects are likely to occur to invertebrate prey but only in areas that are adjacent to agricultural areas and not throughout the species' range. As such, we determine the llanero coquí has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The llanero coquí has a low exposure ranking. There is a medium extent of overlap (5.5%) between agricultural use sites and the species' range. Because the species does not occur on-field, we expect 0.96% of the range overlaps with any areas that could be treated with insecticides, including methomyl, in the future. Because this usage estimate includes all insecticides, it likely overestimates the amount of methomyl actually used within the species' range. As such, we expect a small number of individuals are likely to be exposed to methomyl. With the two label restrictions above, we anticipate that the palustrine wetland habitats of the llanero coquí will receive less runoff and spray drift from nearby agricultural applications of methomyl.

The llanero coquí has a low toxicity ranking. We do not expect the species to forage on-field. We do not anticipate llanero coquí will die or experience other direct adverse effects from consuming contaminated food items off-field. We expect a low level of indirect adverse effects are likely. Even though terrestrial arthropod mortality is anticipated, it is likely to occur in wetland habitat near agricultural areas and not throughout the llanero coquí's entire range.

Given that we expect a small number of individuals are likely to be exposed from agricultural uses (through spray drift) and adverse effects will be low, we determine the overall risk of adverse effects to the species is low.

Conclusion

The llanero coquí has a high vulnerability ranking due to its endangered status, limited distribution, small population size, and threats to the species and its habitat (e.g., contaminants, fire). Llanero coquís are wetland obligates that occur where there is herbaceous vegetation and marshy, freshwater conditions. They are found on lands previously managed by the U.S. Navy and Commonwealth of Puerto Rico. The species' range is highly restricted and surrounded by anthropogenic land uses, including agriculture.

The species' range overlaps with a moderate portion of the action area (up to 5.5%), and we do not expect coquís to occur on-field. The species' habitat occurs near agricultural areas where methomyl may be used, so we only considered off-field exposure from runoff or spray drift. We do not have methomyl usage data for Puerto Rico, but we expect methomyl has been used in Puerto Rico and 0.96% of the range could be treated with insecticides. In addition, across Puerto

Rico, 20-70% of crops have been treated annually with any insecticide, suggesting the 0.96% overlap may be an overestimate as some of this area may not be treated with insecticides. Because of expected low usage of any insecticides in the range and the species' obligate relationship with wetlands (i.e., unlikelihood that it will occur on-field), we expect a small number of individuals and their prey will be exposed to methomyl. We do not expect llanero coquís to die from dietary exposure off-field, and we expect low indirect effects from prey loss because the coqui feeds on diverse insect prey that occur across the range and not only on-field where mortality is expected to be high.

We anticipate the inclusion of the general conservation measures above, including rain restrictions and aquatic habitat buffers, will further reduce the likelihood of exposure of the species, their prey, and their habitat. Therefore, we anticipate a very small number of individual llanero coquís will experience exposure or reductions in invertebrate prey over the duration of the proposed action that would lead to mortality. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the llanero coquí.

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