Integration and Synthesis Summary for Reptiles

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 individual species' rankings and a template worksheet to show how rankings were assessed and combined are in Appendix E. Ranges for all species in this assessment group may fall within the conterminous United States or U.S. territories and the appropriate use and usage data has been applied (see the Exposure Section in the main body of the Opinion).

Vulnerability

For the reptile species that we or EPA determined are "likely to be adversely affected" by the proposed action, we considered several factors 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 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 s 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 reptiles will primarily be exposed to methomyl through dietary exposure by consuming contaminated food items in their habitats. Methomyl degrades quickly (i.e., within a few days) in natural environments and is not likely to persist for long periods of time or be transported long distances.

We characterize the expected level of exposure using overlap data (including on- and off-field overlap), 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 that will have a medium portion of their range (5-10%) treated with methomyl each year are assigned a medium usage score, and species that data indicate will have a low portion of their range (<5%) treated with methomyl each year are assigned a low usage score.

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 moderate 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. 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 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 on food items can vary greatly depending on the particular item and whether exposure to methomyl occurs on- or off-field. Based on available toxicity data, we anticipate reptiles exposed to methomyl may die depending on the species and dosage. 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 reptiles exposed at concentration estimated to occur on dietary items because of this action.

We anticipate species that rely on plant-based resources, such as grass, leaves, and fruit for food or vegetation as habitat, are not likely to experience any indirect adverse effects, as available toxicity data in plants indicate no reductions in plant survival or growth are likely to occur with methomyl exposure. In contrast, species that rely on arthropods for food resources may experience high levels of indirect adverse effects as methomyl exposure will likely reduce the abundance and availability of arthropod prey. Species that rely on other vertebrates for food resources can experience a range of adverse indirect effects depending on the prey items they consume and whether prey items are exposed to methomyl on- or off-field.

We determine the overall toxicity ranking for reptiles by qualitatively assessing both the expected levels of direct adverse effects (e,g., mortality) and indirect effects (e,g., prey loss). Given that mortality is the most adverse of direct effects to an individual of a species, we assign the most weight to direct adverse effects resulting in mortality when determining the toxicity ranking. As mentioned previously, available toxicity data indicate reptiles are sensitive to methomyl and are likely to die, depending on their size and the dietary items they consume.

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[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 use these terms to link back to the analysis in EPA's BE.

Thus, most reptiles will have a high toxicity ranking, with few exceptions: the Plymouth redbelly turtle, eastern indigo snake, copperbelly water snake, and eastern massasauga rattlesnake.

Vulnerability, exposure, and toxicity rankings are summarized in Appendix E.

Summary of Reptile 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 35 reptile species in this Appendix.

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

Species proposed for delisting

The reptile species in Table 1 have been proposed for delisting. 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. Species proposed for delisting due to recovery.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Change in listing status	Determination
Neoseps reynoldsi	Sand skink	Low	Low	High	recommended delist – due to recovery	No Jeopardy

The sand skink has low vulnerability, low exposure, and high toxicity rankings. Based on the toxicity of methomyl, we expect sand skink mortality to occur following consumption of certain dietary resources. Methomyl exposure will also cause prey loss (i.e., invertebrates) for the sand skink. Total overlap of the species' range with methomyl use sites is 3.0% and usage data indicate that only up 1.3% of the species' range has been treated annually in the past. As this species has a low total overlap and low annual usage within its range, we anticipate only a small number of individuals, at most, are likely to experience exposure to methomyl. Thus, despite the high level of toxicity if exposed, no more than a small number of individuals are likely to be exposed and thereby adversely affected.

In addition, we recommended the species for delisting in the most recent 5-year review because a large portion of its habitat is protected from development and managed for conservation (USFWS 2023, p. 53) and the sand skink is not likely to go extinct within the next 50 years. Modeling predictions indicate that it is unlikely that conditions between 50-100 years in the future will change in such a way that the species becomes at high risk of extinction (USFWS 2023, Ch 5.).

In summary the sand skink has a low vulnerability ranking and a high toxicity ranking. We expect this species is likely to experience low levels of exposure to methomyl. In addition, the sand skink has been recommended for delisting based on recovery goals and is likely to persist for many years into the future based on habitat protections, modeling projections, and resiliency trends. Therefore, we determine the overall risk of adverse effects to the sand skink is low and that the proposed action is not expected to appreciably reduce the survival and recovery of the sand skink in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the sand skink.

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References

U.S. Fish and Wildlife Service. 2023. Species Status Assessment Report for the Sand skink (*Neoseps reynoldsi*) Version 1.0. Atlanta, Georgia. 102 pp.

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

The reptile species listed here are grouped together because they have low exposure informed by low overlap with agricultural sites where methomyl is registered for use (Table 2). While we present some specific information about the species in Table 2 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 2. Species with low baseline exposure as informed by low overlap between the species' range and agricultural land uses, medium vulnerability, and high toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
Chilabothrus inornatus	Puerto Rican boa	Medium	Low	High	No Jeopardy
Cyclura stejnegeri	Mona ground Iguana	Medium	Low	High	No Jeopardy
Nerodia clarkii taeniata	Atlantic salt marsh snake	Medium	Low	High	No Jeopardy

These species have medium vulnerability rankings, indicating that these species may be less robust in response to adverse effects from methomyl than other species. They have a high toxicity ranking, indicating that mortality is likely. Sublethal effects to growth and reproduction are not expected, but some loss of prey resources is likely with exposure to methomyl.

The species listed in Table 2 have a high toxicity ranking, indicating that mortality, and/or loss of food items are likely when exposure occurs. However, we anticipate adverse effects are only likely to occur for individuals that primarily forage on methomyl use sites or on prey items that have recently been exposed to methomyl applications on use sites. We expect this is unlikely to occur with any regular frequency given that either methomyl use sites do not represent preferred foraging habitat or agriculture makes up a very small portion of these species' ranges. EPA's exposure modeling indicates that foraging in areas off-field is not likely to result in more than low levels of methomyl exposure, resulting in low mortality. Thus, we anticipate few individuals are likely to experience high levels of adverse effects as expected exposure scenarios are likely to result in low direct or indirect adverse effects to these species.

Furthermore, all species in this group have a low exposure ranking, specifically based on the low level of total overlap between their ranges and the action area. The range of the Mona ground iguana in the U.S. Virgin Islands does not overlap with agricultural areas, so we do not expect the species will be exposed to methomyl. For the Atlantic salt marsh snake and Puerto Rican boa, only small portions of their ranges overlap with the action area (1.7-3.3%) and they occur in habitats where we expect impacts from methomyl to be minimal (e.g., brackish coastal wetlands (USFWS 2019) and wooded areas, open pastures, shrubs, and cave entrances and interiors). In

addition, the Puerto Rican boa was proposed for delisting due to recovery in 2022 (USFWS 2022b). For both the Puerto Rican boa and the Atlantic salt marsh snake, we anticipate, at most, a very small number of individuals are likely to be exposed to methomyl, resulting in the loss of a very small number of individuals and prey loss that would lead to low levels of sublethal take (i.e., reductions in growth and reproduction) for each species. 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 have high confidence that these species will experience low levels of exposure to methomyl.

In summary, while the vulnerability is medium for these species and toxicity rankings are high for all species listed in Table 2, we expect that these species will experience at most, low levels of exposure to methomyl. This low level of exposure is coupled with a medium vulnerability, which makes the species more robust against any adverse effects that exposed individuals will experience. Therefore, we determine the overall risk of adverse effects these species is low and that the proposed action is not expected to appreciably reduce the survival and recovery of these reptile species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.

References

U.S. Fish and Wildlife Service. 2019. Atlantic salt marsh snake (*Nerodia clarkii taeniata*) 5-Year Review: Summary and Evaluation. Jacksonville, Florida. 19 pp.

U.S. Fish and Wildlife Service. 2022a. Mona Ground Iguana (*Cyclura stejnegeri*) 5-Year Review: Summary and Evaluation. Boquerón, Puerto Rico. 11 pp.

U.S. Fish and Wildlife Service. 2022b. Puerto Rican Boa (*Chilabothrus inornatus*) Species Status Assessment. Atlanta, Georgia. 86 pp.

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

The reptile species in Table 3 have high vulnerability rankings, low exposure rankings (informed by low overlap of the species' range with agriculture), and high toxicity rankings. While we present some specific information about the species in Table 3 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 3. Species with low baseline exposure (informed by low overlap of the species' range with agriculture), high vulnerability, and high toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap	Determination
Ameiva polops	St. Croix ground lizard	High	Low	High	0.0	No Jeopardy
Chilabothrus granti	Virgin Islands tree boa	High	Low	High	1.3	No Jeopardy
Crotalus willardi obscurus	New Mexico ridge-nosed rattlesnake	High	Low	High	4.1	No Jeopardy
Diadophis punctatus acricus	Key ring-necked snake	High	Low	Low	0	No Jeopardy
Emoia slevini	Slevin's skink	High	Low	High	1.9	No Jeopardy
Epicrates monensis monensis	Mona boa	High	Low	High	0.0	No Jeopardy
Eumeces egregius lividus	Blue-tailed mole skink	High	Low	High	2.4	No Jeopardy
Graptemys pearlensis	Pearl River map turtle	Medium	Low	Low	0	No Jeopardy
Masticophis lateralis euryxanthus	Alameda whipsnake (striped racer)	High	Low	High	0.5	No Jeopardy
Pituophis ruthveni	Louisiana pine snake	High	Low	High	1.7	No Jeopardy
Plestiodon egregius egregius	Florida Keys mole skink	High	Low	Low	0	No Jeopardy
Tantilla oolitica	Rim rock crowned snake	Medium	Low	Low	0	No Jeopardy

All the species listed in Table 3 have a high or medium vulnerability ranking, indicating that they may not be able to withstand additional stressors in their environment, including mortality of individuals from methomyl exposure. The species listed in Table 3 have a high or low toxicity ranking, indicating that mortality, sublethal effects to growth or reproduction, and/or loss of food items are likely when exposure occurs. However, we anticipate adverse effects are only likely to occur for individuals that primarily forage on methomyl use sites or forage on prey items that have recently been exposed to methomyl applications on use sites. We expect this is unlikely to occur with any regular frequency given that methomyl use sites do not represent preferred foraging habitat or that agriculture makes up a very small portion of these species' ranges. EPA's exposure modeling indicates that foraging in areas off-field or consuming prey that have only been exposed through spray drift or runoff are not likely to result in more than low levels of methomyl exposure that are not likely to result in any mortality and no more than low levels of sublethal effects. Thus, we anticipate few individuals are likely to experience high levels of adverse effects as expected exposure scenarios are not likely to result in direct or indirect adverse effects to these species.

Furthermore, all species in this group have a low exposure ranking, specifically based on the low level of total overlap between their ranges and the action area (total overlap ranges from 0 - 4.1%). 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. Given that we anticipate only a small portion of the range is likely exposed under these conservative assumptions, we have high confidence that only small numbers of individuals of each of these species are likely to experience exposure to methomyl. Additional information is provided for each species below.

The Mona boa, St. Croix ground lizard, Virgin Islands tree boa, and Slevin's skink are found in the U.S. Virgin Islands, Puerto Rico, or Guam. All four species occur in habitats where we do not expect methomyl usage to occur (i.e., tropical deciduous forests (USFWS 2019a), designated critical habitat (USFWS 2020a), subtropical forest (USFWS 2022a), complex forests (USFWS 2020b)), and we do not expect them to occur on or near agricultural fields. The species' ranges for the Mona boa and St. Croix ground lizard do not overlap with the action area, therefore we expect exposure will not occur. Only 1.3% of the Virgin Islands tree boa's range and 1.9% of the Slevin's skink's range overlaps with the action area, but we expect the species will not occur on agricultural fields. Because prey for the Virgin Islands tree boa and Slevin's skink could be on nearby agricultural lands, we anticipate that small losses of prey could result in reduction in fitness supporting reproductive capacity or growth in a small number of individuals.

The New Mexican ridge-nosed rattlesnake and blue-tailed mole skink occur in habitats where we expect little to no agriculture to occur (i.e., mountains in New Mexico and Arizona (USFWS 2019b), and Lake Wales Ridge region of Florida (USFWS 2021), respectively). Agricultural areas overlap small portions of the species' ranges (4.1% for New Mexican ridge-nosed rattlesnake and 2.4% for the blue-tailed mole skink). Methomyl has been used on even smaller areas of the ranges in the past (up to 0.5% of the rattlesnake's range and 1% of the skink's range treated annually). In addition, the skink is semi-fossorial and over half of its occupied sites are

protected. Thus, we expect very little methomyl will be used near either species, resulting in the loss of a very small number of individuals and prey loss that would lead to low levels of sublethal take (i.e., reductions in growth and reproduction) for each species.

The Louisiana pinesnake primarily occurs on public lands (Department of Defense lands at Fort Polk and Peason Ridge, Louisiana and the Kisatchie and Angelina National Forests) and privately-owned industrial timberlands in Louisiana and Texas. They are semi-fossorial and may spend up to 59% of their time underground, further reducing their potential exposure to agricultural pesticides (USFWS 2022b). Overlap and usage are low for this species (1.7% overlap of the action area with the species range and up to 0.8% of the range treated annually with methomyl), making the likelihood of methomyl exposure low. The Alameda whipsnake uses atypical habitats such as trails for sunning and olive orchards. However, olives are not a methomyl use and the likelihood of exposure is low based on overlap and past methomyl usage (based on CalPUR data) in the range of this species (1.4% overlap of the action area with the species' range and up to 0.3% of the range has been treated annually with methomyl). In the most recent 5-year review (USFWS 2020c), there is a discussion on the threats to the Alameda whipsnake from pesticides, but this is in reference specifically to rodenticide use or aluminum and magnesium phosphide-based fumigants within its range. Therefore, for both species, we expect very little methomyl will be used near their habitat, resulting in the loss of a very small number of individuals and prey loss that would lead to low levels of sublethal take (i.e., reductions in growth and reproduction).

The Florida Keys mole skink species' range does not overlap the action area (0% overlap). Though the Key ring-necked snake, Pearl River map turtle, and rim rock crowned snake do not have range maps available, we do not expect overlap with the action area. These four species occur in areas where we do not expect agriculture to occur (e.g., Florida Key beaches, pine rockland, rivers, or large creeks; USFWS 2020d, 2021b, 2022c, 2023). The rim rock crowned snake also occurs in Miami-Dade County, Florida in protected areas (e.g., Barnacle Historic State Park, Zoo Miami pineland preserve). We do not expect these species will be exposed to methomyl.

In summary, all species in this group have a low exposure ranking based on the low level of total overlap between their ranges and the action area. For this reason, and the additional information for each species discussed above, we anticipate exposure is minimal. As such, we expect, at most, only a small number of individuals are likely to experience exposure. Therefore, we determine the overall risk of adverse effects for these species is low and that the proposed action is not expected to appreciably reduce the survival and recovery of these reptile species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 3 in the wild.

References

U.S. Fish and Wildlife Service. 2023. Species status assessment report for the Pearl River map turtle (*Graptemys pearlensis*). April 2023. Atlanta, Georgia. 141 pp.

U.S. Fish and Wildlife Service. 2022a. Virgin Islands tree boa (*Chilabothrus granti*) Species Status Assessment version 1.1. Atlanta, Georgia. 46 pp.

U.S. Fish and Wildlife Service. 2022b. Species Status Assessment Report for the Louisiana pine snake (*Pituophis ruthveni*) version 1.0. Atlanta, Georgia. 86 pp.

U.S. Fish and Wildlife Service. 2022c. Species status assessment report for the Florida Keys mole skink (*Plestiodon egregius egregius*). Version 2.0. April 2022. Atlanta, Georgia.

U.S. Fish and Wildlife Service. 2021a. Blue-tailed Mole Skink (*Eumeces egregius lividus*) 5-Year Review. Vero Beach, Florida. 20 pp.

U.S. Fish and Wildlife Service. 2021b. Species status assessment report for the Key ring-necked snake (*Diadophis punctatus acricus*). February 11, 2021. Vero Beach, Florida. 39 pp.

U.S. Fish and Wildlife Service. 2020a. Mona boa (*Epicrates monensis monensis*) 5-Year Review. Boquerón, Puerto Rico. 21 pp

U.S. Fish and Wildlife Service. 2020b. Slevin's skinkor or gualiik halumtanu (*Emoia slevini*) 5-Year Review: Summary and Evaluation. Honolulu, Hawai‘i. 20 pp.

U.S. Fish and Wildlife Service. 2020c. Alameda whipsnake (*Masticophis lateralis euryxanthus*) 5-Year Review. Sacramento, California. 17 pp

U.S. Fish and Wildlife Service. 2020d. Species status assessment report for the Rim rock crowned snake (*Tantilla oolitica*). February 11, 2020. Vero Beach, Florida.

U.S. Fish and Wildlife Service. 2019a. St. Croix Ground Lizard (*Ameiva polops*) 5-Year Review: Summary and Evaluation. Boquerón, Puerto Rico. 30 pp.

U.S. Fish and Wildlife Service. 2019b. New Mexico ridge-nosed rattlesnake 5-Year Reivew: Summary and Evaluation. Albuquerque, New Mexico. 23 pp.

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

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

Table 4. Species with low exposure (confirmed by low past usage from U.S. Department of Agriculture's Census of Agriculture (CoA)), medium/high vulnerability, and low/high toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Crocodylus acutus	American crocodile	Medium	Low	Low	1.0	No Jeopardy
Gopherus agassizii	Desert tortoise	Medium	Low	High	2.6	No Jeopardy
Gopherus polyphemus	Gopher tortoise (western DPS)	Medium	Low	High	1.0	No Jeopardy
Graptemys flavimaculata	Yellow-blotched map turtle	High	Low	High	1.0	No Jeopardy
Graptemys oculifera	Ringed map turtle	Medium	Low	High	1.1	No Jeopardy
Pituophis melanoleucus lodingi	Black pine snake	High	Low	High	1.2	No Jeopardy
Pseudemys rubriventris bangsi	Plymouth redbelly turtle	High	Low	Low	3.4	No Jeopardy
Sternotherus depressus	Flattened musk turtle	High	Low	High	1.2	No Jeopardy
Thamnophis eques megalops	Northern Mexican gartersnake	High	Low	High	0.4	No Jeopardy
Thamnophis rufipunctatus	Narrow-headed gartersnake	High	Low	High	0.5	No Jeopardy
Thamnophis sirtalis tetrataenia	San Francisco garter snake	High	Low	High	3.1	No Jeopardy

All the species listed in Table 4 have high medium or 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 also have a high toxicity ranking, indicating that mortality, sublethal effects to growth or reproduction, and/or loss of food items are likely when exposure occurs. However, we anticipate direct adverse effects are only likely to occur for individuals that primarily forage on methomyl use sites or forage on prey items that have recently been exposed to methomyl applications on use sites. We expect this is unlikely to occur with any regular frequency given that methomyl use sites do not represent preferred foraging habitat or that agriculture makes up a very small portion of these species' ranges. EPA's exposure modeling indicates that foraging in areas off-field or consuming prey that have only been exposed through spray drift or runoff are not likely to result in more than low levels of methomyl exposure that are not likely to result in any mortality and no more than low levels of sublethal effects. Thus, we anticipate few individuals are likely to experience adverse effects as expected exposure scenarios are not likely to result in direct adverse effects to these species.

While these species have relatively high percent overlap between the action area and their ranges, we anticipate only a small number of individuals are likely to be exposed to methomyl. Low usage according to the USDA's Census of Agriculture (CoA) 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 include conservative estimates of methomyl usage that indicate very little of the species' ranges have been treated in the past and are likely to be treated in the future.

The gopher tortoise (western DPS), desert tortoise, San Francisco garter snake, flattened musk turtle, ringed map turtle, yellow-blotched map turtle, and northern Mexican gartersnake feed on a variety of prey items that may be affected by methomyl exposure. Even though the overlap of the species' ranges with methomyl use sites are medium (5.3%-9.6%), CoA all-insecticide data indicate methomyl usage is low (up to 3.1% of each range has been treated with any insecticide annually). Due to habitat preferences (e.g., longleaf pine, desert, or aquatic habitats [USFWS 2014a, 2020a, 2021a, 2022c] where we do not expect methomyl to persist) and low past usage in the species' ranges, we expect, at most, a small number of individuals of western gopher tortoise, desert tortoise, San Francisco garter snakes, flattened musk turtles, and northern Mexican gartersnakes will be exposed to methomyl. In addition, 58% of the northern Mexican gartersnake's range is on federal lands (i.e., Coronado National Forest and Buenos Aires National Wildlife Refuge; USFWS 2014b) where we expect methomyl use to be minimal. Ringed map turtles and yellow-blotched map turtles may forage near agricultural use sites, but we expect low exposure because of low past methomyl usage and their reliance on both aquatic and soil invertebrates as prey (USFWS 2020b, 2023). We expect the loss of a very small number of individual San Francisco garter snakes, ringed map turtles, gopher tortoises, desert tortoises, and Northern Mexican gartersnakes from methomyl exposure. For the species that rely on animal prey (i.e., San Francisco garter snake, flattened musk turtle, ringed map turtle, yellow-blotched map turtle, and northern Mexican gartersnake), we expect prey loss that would lead to low levels of sublethal take (i.e., reductions in growth and reproduction).

Similarly, the Plymouth redbelly turtle is an aquatic turtle that feeds on plants, crayfish, and invertebrates (USFWS 2021b). We do not expect effects to their plant food items, nor do we expect mortality from loss of crayfish and invertebrate prey. CoA data indicates a low level of usage (up to 3.4% has been treated with any insecticide annually) within the range of this species. Low exposure and low toxicity indicate that a small number of Plymouth redbelly turtles are likely to experience indirect adverse effects from loss of prey, and we do not expect species-level effects to occur.

Even though overlap between the species' range and methomyl use sites is medium (9.7%), black pinesnakes avoid agricultural areas because they lack the vegetative cover and underground refugia that the species needs (USFWS 2022a). Further, low CoA data corroborates the low insecticide usage within their range overall (up to 1.2% has been treated annually). Therefore, we anticipate a very small number of black pinesnakes will be impacted by methomyl exposure through losses of prey that lead to reduced reproductive success.

Much of the species' ranges and/or occupied habitat for the narrow-headed gartersnake and American crocodile is found on federal or protected lands where we expect methomyl usage to be minimal. Most current localities for the narrow-headed gartersnake in New Mexico and Arizona are found on U.S. Forest Service lands (i.e., Apache and Gila National Forests; 67%). Overlap between the narrow-headed gartersnake's range and methomyl use sites is medium (6.2%), but CoA insecticide data indicate there is very little past annual insecticide usage (up to 0.5%) within the species' range. American crocodile habitat is primarily found on public conservation lands within the Ten Thousand Islands National Wildlife Refuge, Everglades National Park, and Crocodile Lake National Wildlife Refuge, and privately owned conservation land within the Everglades Mitigation Bank (USFWS 2022b). American crocodiles may experience some exposure if they eat prey near agricultural fields; overlap with methomyl use sites is medium (8.0%), but only up to 1.0% of the range has been treated with any insecticide annually according to CoA. Therefore, we expect methomyl exposure will only impact a small number of individual narrow-headed gartersnakes and American crocodiles through mortality and reduced reproduction from prey loss.

In summary, while species in Table 4 are highly vulnerable and could experience high levels of toxicity if exposed to methomyl, we anticipate only a small number of individuals of these species are likely to experience exposure. In particular, these species all have a low level of past usage within their range, informed by the CoA, which indicates that very little insecticides (of any type) have been used in the past in the counties where these species' ranges occur. Thus, we determine the overall risk of adverse effects these species is low and that the proposed action is not expected to appreciably reduce the survival and recovery of these reptile species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 4 in the wild.

References

U.S. Fish and Wildlife Service. 2023. Yellow-blotched map turtle (*Graptemys flavimaculata*) 5-Year Review: Summary and Evaluation. Jackson, Mississippi.18 pp.

U.S. Fish and Wildlife Service. 2022a. Species Status Assessment for the black pinesnake (*Pituophis melanoleucus lodingi*). Jackson, Mississippi. 37 pp.

U.S. Fish and Wildlife Service. 2022b. American crocodile (*Crocodylus acutus*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 35 pp.

U.S. Fish and Wildlife Service. 2022c. Desert tortoise (*Gopherus agasizii*) 5-Year Review: Summary and Evaluation. Las Vegas, Nevada. 55 pp.

U.S. Fish and Wildlife Service. 2021a. Species Status Assessment for the gopher tortoise (*Gopherus polyphemus*) version 0.4. Atlanta, Georgia. 288 pp.

U.S. Fish and Wildlife Service. 2021b. Species Status Assessment for the Massachusetts population of the northern red-bellied cooter (*Pseudemys rubriventris*) version 1.0. Hadley, Massachusetts. 109 pp.

U.S. Fish and Wildlife Service. 2020a. Species Status Assessment for the San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) version 1.0. Sacramento, California. 105 pp.

U.S. Fish and Wildlife Service. 2020b. Ringed map turtle (*Graptemys oculifera*) 5-Year Review: Summary and Evaluation. Jackson, Mississippi. 33 pp.

U.S. Fish and Wildlife Service. 2014a. Flattened musk turtle (*Sternotherus depressus*) 5-Year Review: Summary and Evaluation. Jackson, Mississippi. 30 pp.

U.S. Fish and Wildlife Service. 2014b. Endangered and Threatened Wildlife and Plants; Threatened Status for the Northern Mexican Gartersnake and Narrow-Headed Gartersnake. Final Rule. Federal Register 79(130):38678-38746.

U.S. Fish and Wildlife Service. 2007. Narrow-headed garter snake (*Thamnophis rufipunctatus*) Recovery Plan. Santa Fe, New Mexico. 22 pp.

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

The reptile 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. These species have high vulnerability and high toxicity rankings. 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 5. Reptiles with low exposure (confirmed by low last usage from California Department of Pesticide Regulation (CalPUR) data), high vulnerability, and high toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Gambelia silus	Blunt-nosed leopard lizard	High	Low	High	1.8	No Jeopardy
Thamnophis gigas	Giant garter snake	High	Low	High	1.5	No Jeopardy
Uma inornata	Coachella Valley fringe-toed lizard	High	Low	High	0.3	No Jeopardy

The blunt-nosed leopard lizard, giant garter snake, and Coachella Valley fringe-toed lizard 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. All three have high toxicity rankings due to expected levels of direct mortality if they are exposed to methomyl on-field. However, we expect exposure for the species in Table 5 will be low due to past methomyl usage according to CalPUR data. The blunt-nosed leopard lizard occurs in alkali sink scrub, saltbush scrub, and native and nonnative grasslands on the San Joaquin Valley floor, in the surrounding foothills areas of Tulare and Kern Counties, and up the eastern portions of the Coast Range foothills in Fresno, Kern, Madera, Merced, San Luis Obispo, and Tulare Counties in California (USFWS 2020). The giant garter snake primarily occurs in perennial wetlands, but it may use rice lands with interconnected water conveyance structures that serve as an alternative habitat in the absence of the higher-quality wetlands it prefers (USFWS 2017). Both of these species occur in close proximity to agricultural areas, but only 1.5-1.8% of their ranges have been treated with methomyl in the past according to CalPUR data. The blunt-nosed leopard lizard is not expected to be on field as it does not prefer agricutural areas, and conversion of their

habitat to agriculture led to their listing status (USFWS 2020). Methomyl is not used on rice lands, thus will not impact the giant garter snake from on-field exposure. Even though overlap between the Coachella Valley fringe-toed lizard's range and methomyl use sites is medium (7.7%), up to 80% of the range is on federal lands (i.e., Bureau of Land Management, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, and U.S. Forest Service; USFWS 2023b). In addition, up to 0.3% of the range has been treated annually based on CalPUR data.

While these species could experience high levels of toxicity if exposed on-field and they are highly vulnerable, we anticipate, at most, a very small number of individuals are likely to experience exposure. While these species have high percent overlaps between the action area and their ranges, 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 (up to 1.8% and 1.5% of the blunt-nosed leopard lizard and giant garter snake ranges have been treated with methomyl according to CalPUR usage data, respectively). Given that this usage data is mandated by the state of California and is reported with relatively high spatial resolution, we have high confidence that only a small portion of the species' ranges are likely to be exposed to methomyl. Therefore, we expect all three of these species will experience low levels of sublethal take (e.g., reduced reproductive success) from loss of prey.

Given the low level of methomyl usage within the species' ranges, we expect, at most, only a small number of individuals are likely to experience exposure. Therefore, we determine the overall risk of adverse effects to these species are low and that the proposed action is not expected to appreciably reduce the survival and recovery of blunt-nosed leopard lizards or giant garter snakes. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 5 in the wild.

References

U.S. Fish and Wildlife Service. 2023. Coachella Valley fringe-toed lizard (*Uma inornata*) 5-Year Review: Summary and Evaluation. Carlsbad, California. 40 pp.

U.S. Fish and Wildlife Service. 2020. Species Status Assessment for the Blunt-nosed leopard lizard (*Gambelia sila*) Version 1.0. Sacramento, California. 106 pp.

U.S. Fish and Wildlife Service. 2017. Recovery Plan for the giant garter snake (*Thamnophis gigas*) 5-Year Review: Summary and Evaluation. Sacramento, California. 79 pp.

Species with Individual Integration and Synthesis summaries

For species in Table 6, our preliminary exposure and toxicity rankings indicate that the proposed action may result in 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 6. Reptiles 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
Drymarchon couperi	Eastern indigo snake	No Jeopardy
Nerodia erythrogaster neglecta	Copperbelly water snake	No Jeopardy
Glyptemys muhlenbergii	Bog turtle	No Jeopardy
Sistrurus catenatus	Eastern massasauga (rattlesnake)	No Jeopardy
Macrochelys suwanniensis	Suwannee alligator snapping turtle	No Jeopardy

Integration and Synthesis Summary: Eastern indigo snake

Scientific Name:	Common Name:	Entity ID:
Drymarchon couperi	Eastern indigo snake	173

Species Overview

In reviewing the status of the species, the environmental baseline and cumulative effects for the action area, we have 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, and high past usage of methomyl within the species' range, indicating a high extent of exposure. Most exposed individuals are unlikely to die but are likely to experience medium levels of indirect effects resulting from loss of available prey species. Given that exposure is high and the level of indirect effects is medium, we determine the risk of adverse effects to the species is medium. As such, we expect a moderate number of individuals are likely to experience loss of available prey 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 expected to appreciably reduce the survival and recovery of the eastern indigo snake in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the eastern indigo snake. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 2/3/2022; Wherever found; *States within the range:* AL, FL, GA, MS. Figure 1 depicts the species' range.

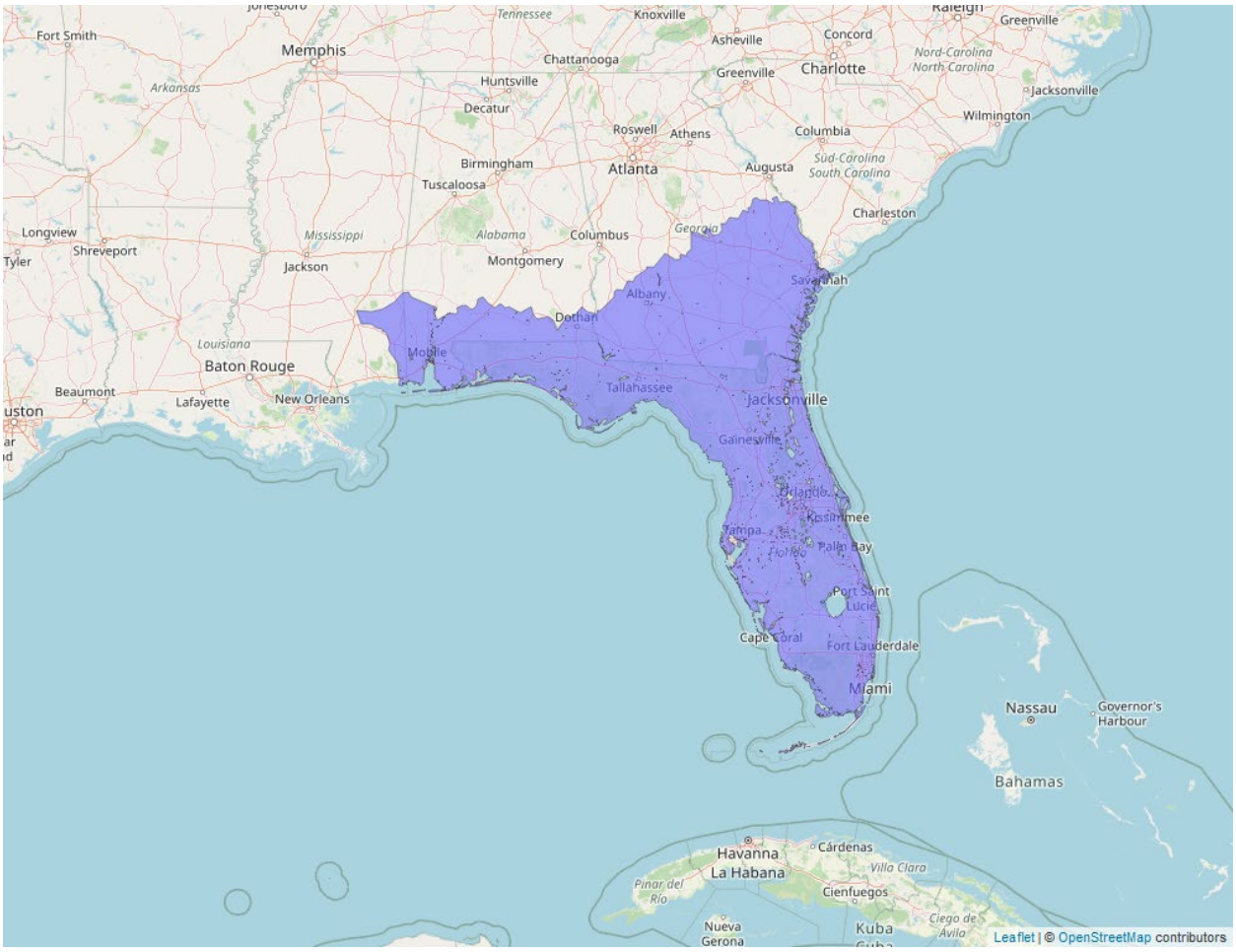

Figure 1. Range map of eastern indigo snake (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7253.

Vulnerability

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

Summary of status

Listing status: Threatened

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

Most recently completed 5-Year Review: 8/30/2019

C-A8. Reptiles: Integration and Synthesis Summaries

Distribution: Population size/Location(s) unknown

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Historically, the eastern indigo snake occurred throughout Florida and in the coastal plain of Georgia, Alabama, and Mississippi. The eastern indigo snake has been extirpated in Alabama and Mississippi and, and its distribution has further contracted in other areas, particularly in the Florida Panhandle, due to the decline of gopher tortoise populations. Wild collection of eastern indigo snakes for the pet trade and gassing of gopher tortoise burrows are no longer considered to be substantial threats although they still occur to some extent. Habitat destruction, modification, and curtailment, however, remain significant threats to the species' recovery and long-term viability. Since the last review (USFWS 2008), significant progress has been made in our understanding of the species' distribution, life history and habitat requirements which has supported development and implementation of conservation strategies for the species. This new information was summarized and assessed in the eastern indigo snake's recent species status assessment. Fifty-three (53) potential populations were estimated in the SSA (USFWS 2019). Of these populations, resilience was classified based primarily on habitat conditions as follows: eight very low, 28 low to medium-low, 13 medium to medium-high, and four high. The overall current population resiliency is medium to low. Population growth rates are unknown due to the lack of data on this cryptic species. The contemporary distribution of the eastern indigo snake represents the species' known ecological and genetic diversity, but the redundancy of populations has decreased. Most notable are the loss of populations in the Panhandle region (includes parts of Alabama, Florida, Georgia, and Mississippi) and a contraction of the distribution in the southern extent of the Peninsular Florida region, including the Florida Keys. The Panhandle and North Florida regions have zero (0) highly resilient populations, thus limiting overall redundancy (USFWS 2019a, 2019b).

Today, the primary threats to the long-term viability of the species are from habitat fragmentation and loss due to land use changes, especially urbanization. Urbanization includes a variety of negative impacts that remove or alter available habitat or impact snakes directly including residential and commercial development, road construction and expansion, direct mortality (e.g., road mortality, human persecution, domestic pets), invasive species, predation and inadequate fire management. Habitat loss for coastal populations due to sea level rise is also an increasing risk. Snake fungal disease has emerged as an additional negative factor, but impacts to long-term viability remains uncertain, and research is on-going. Pesticides, especially those that bioaccumulate through the food chain, may present a hazard to eastern indigo snakes, but there have been no documented cases of mortality from pesticide use (USFWS 2019a).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 51.1% 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 7). Up to 16.9% of the species' range overlaps with methomyl use sites while 34.4% of the range occurs off-field and may be exposed to spray drift or runoff.

Usage

Based on past usage data, we anticipate up to 18% of the species' range will be treated with methomyl (Table 7).

Table 7. Overlaps and usage data for the Eastern indigo snake.

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[2]	2.3	5.2	7.6	0.1	0.3	0.4
Cotton	5.5	6.5	12	0.3	0.3	0.6
Other Grains	2.3	6.4	8.7	0.1	0.3	0.4
Other Orchards	1.1	6.6	7.7	1.1	6.6	7.7
Other Row Crops	4.8	6.6	11.4	2.2	2.9	5.1
Soybeans	1.4	5.4	6.8	<0.1	0.2	0.3
Vegetables and Ground Fruit	0.9	2.9	3.8	0.9	2.9	3.8
Wheat	NA	NA	NA	NA	NA	NA
Total	**16.9**	**34.4**	**51.1**	**4.7**	**13.3**	**18**

[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.

Additional Exposure Considerations

Throughout their range, eastern indigo snakes may also use below-ground shelter sites for refuge, breeding, feeding, and nesting. Reliance on xeric sandhill habitats throughout the northern portion of the eastern indigo snake's range in Georgia and northern Florida is due to the dependence on gopher tortoise burrows for shelter during winter. Eastern indigo snakes are also known to utilize human-altered habitats. In Florida, agricultural sites, such as sugar cane fields, improved pasture sites, citrus groves, and canal banks created in drained wetland areas are sometimes occupied by eastern indigo snakes (USFWS 2019).

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 high level of usage within the species' range. While gopher tortoise burrows are used to escape the cold of winter as well as for breeding, feeding, and nesting, we expect some reduced direct exposure based on this life history trait however, because the eastern indigo snake is known to occupy agricultural areas and may not spend its entire lifecycle underground, some exposure cannot be completely discounted for this species. 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.

Aquatic habitat buffers: 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 Eastern indigo snake 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 1.1 mg/kg-bw, which can occur when individuals exclusively consume amphibians. This level of exposure on-field can cause mortality in up to 53.6% of exposed individuals. However, this value represents the mortality upper bound if the eastern indigo snake consumes only prey from a field treated with methomyl.

We know that the diet of the eastern indigo snake reflects the species' large home range and movement between uplands, lowlands, and other landscapes in which it occurs. The eastern indigo snake is an active forager (USFWS 2019b) seeking out its prey rather than sitting and waiting on its prey. Therefore, it is likely that the eastern indigo snake will not forage exclusively on field or at the field edge and thus mortality related to consuming methomyl from contaminated prey will be low.

We do not expect that eastern indigo snakes will accumulate measurable dosages from consumption of contaminated food items off-field.

Indirect Effects:

The eastern indigo snake relies on amphibians, reptiles, small mammals, arthropods, birds, and fish 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, on-field and lower levels of mortality off-field. As such, we expect there may be moderate reductions in the abundance of prey species throughout the species' range, indicating a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

We expect a low level of direct adverse effects will occur on-field. While up to 53.6% of individuals foraging on-field could die, we expect eastern indigo snakes are more likely to forage off-field, resulting in a low level of direct adverse effects because they are known to forage widely within their large home ranges. We do not expect any sublethal effects (e.g., reduced growth or reproduction) are likely to occur at predicted exposure levels. We expect of indirect effects are likely to occur to individuals as we anticipate methomyl exposure will cause a moderate level of mortality to organisms that act as food resources for the species. As such and combined with the low direct effects to the eastern indigo snake and the ability of the eastern indigo snake to forage widely such that they will not experience a substantial loss in prey exposed to methomyl, we determine the eastern indigo snake has a medium toxicity ranking.

Overall Toxicity Ranking: Medium

Effects of the Action Summary

The eastern indigo snake has a high exposure ranking. Based on past methomyl usage data, we expect up to 18% of the range may be treated annually but may potentially cover up to 51.1% 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 eastern indigo snake has a low toxicity ranking. We expect a low level of mortality based on the low likelihood the eastern indigo snake will preferentially consume prey from a field treated with methomyl. We do not expect mortality will occur from consumption of contaminated food off-field. We expect a medium level of indirect adverse effects are likely to occur as we expect prey species will experience a medium level of mortality with exposure to predicted concentrations of methomyl.

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

Conclusion

The eastern indigo snake is a threatened species found in four regions of the southeast: southeast Georgia, the Panhandle (includes portions of Alabama, Florida, and Georgia), north Florida, and peninsular Florida. Thirty (30) of the historical 51 populations are extirpated (59%). Population extent has declined in all regions, with a 48% decline across the species' historical range. The primary threats to the long-term viability of the species are from habitat fragmentation and loss due to land use changes, especially urbanization. Urbanization includes a variety of negative impacts that remove or alter available habitat or impact snakes directly including residential and commercial development, road construction and expansion, direct mortality (e.g., road mortality, human persecution, domestic pets), invasive species, predation, and inadequate fire management. Habitat loss for coastal populations due to sea level rise is also an increasing risk. Snake fungal disease has emerged as an additional negative factor, but impacts to long-term viability remains uncertain, and research is on-going. Thus, we have determined that the species has a high vulnerability.

The eastern indigo snake is a diurnal species and prefers upland habitat types (e.g., longleaf pine sandhills, scrub, pine flatwoods, tropical hardwood hammocks, and coastal dunes), but it also uses a variety of lowland (e.g., freshwater and saltwater marshes and swamps) and human-altered habitats (e.g., agricultural lands). Eastern indigo snakes may move seasonally between upland and lowland habitats, especially in northern portions of their range. Throughout their range, eastern indigo snakes use below-ground shelter sites for refuge, breeding, feeding, and

nesting. Adult eastern indigo snakes move long distances and have very large home ranges from about a hundred to several thousand acres (tens to over a thousand hectares). They consume a wide variety of animals, including other snakes.

There is large overlap (51.1%) between the species range and the action area, with (16.9%) of the species range overlapping with use sites, and 34.4% susceptible to off-site exposure through spray drift and runoff. Usage data indicates that a high amount of the range (18%) will be treated with methomyl annually. We expect the eastern indigo snake will primarily experience direct adverse effects (i.e., mortality) from dietary exposure. On-field exposure can result in dosages up to 1.1 mg/kg-bw, which can occur when individuals exclusively consume amphibians exposed to methomyl. This level of exposure on-field can cause mortality in up to 53.6% of exposed individuals. However, this value represents the mortality upper bound if the eastern indigo snake consumes only prey, in sufficient quantity, from a field treated with methomyl. Mortality is not anticipated when foraging off-field. High levels of mortality to prey items are expected on field, while medium levels of mortality are expected off-field, where exposure to methomyl occurs. Use of burrows and preference for native habitat will generally protect the eastern indigo snake from exposure to methomyl, however, we cannot rule out that snakes will traverse agricultural fields and consume contaminated prey during that time. The eastern indigo snake is an active forager (USFWS 2019b) seeking out its prey rather than sitting and waiting on its prey. While eating contaminated prey cannot be ruled out, the snake is unlikely to consume enough contaminated prey items in a single feeding (e.g., agricultural field) to induce mortality. In addition, wild snakes typically consume live prey. Most prey items exposed to methomyl are likely to be killed and not an attractive prey item to eastern indigo snakes. While prey items for the snake may be reduced across the range of the species, prey items are likely more abundant outside of agricultural areas where methomyl is applied, and thus, we do not anticipate significant reductions in available prey for the eastern indigo snake throughout its range.

Therefore, we expect impacts to the eastern indigo snake to be low and a small number of individuals will be adversely affected due 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 expected to appreciably reduce the survival and recovery of the eastern indigo snake. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the eastern indigo snake in the wild.

References

U.S. Fish and Wildlife Service. 2019a. Eastern Indigo Snake (*Drymarchon corais couperi*) 5-Year Review: Summary and Evaluation. Athens, Georgia. 51 pp.

U.S. Fish and Wildlife Service. 2019b. Species Status Assessment (SSA) Report for the Eastern Indigo Snake (*Drymarchon couperi*). Version 1.1. Athens, Georgia. 160 pp.

Integration and Synthesis Summary: Copperbelly water snake

Scientific Name:	Common Name:	Entity ID:
Nerodia erythrogaster neglecta	Copperbelly water snake	180

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 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, and high past usage of methomyl within the species' range, indicating a high extent of exposure. Primary exposure pathways are through dietary exposure of contaminated prey off-field, and we expect low levels of mortality from this exposure. We do not expect sublethal effects. This species' primary prey is amphibians, and we anticipate low levels of indirect effects from loss of prey are likely in terrestrial areas. We do not expect indirect effects in aquatic areas because of conservation measures and label buffers. Even though exposure is high, the level of direct and indirect effects is low and 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. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the copperbelly water snake in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the copperbelly water snake. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 12/13/2021; Indiana north of 40 degrees north latitude, Michigan, Ohio; *States within the range:* IN, MI, OH. Figure 2 depicts the species' range.

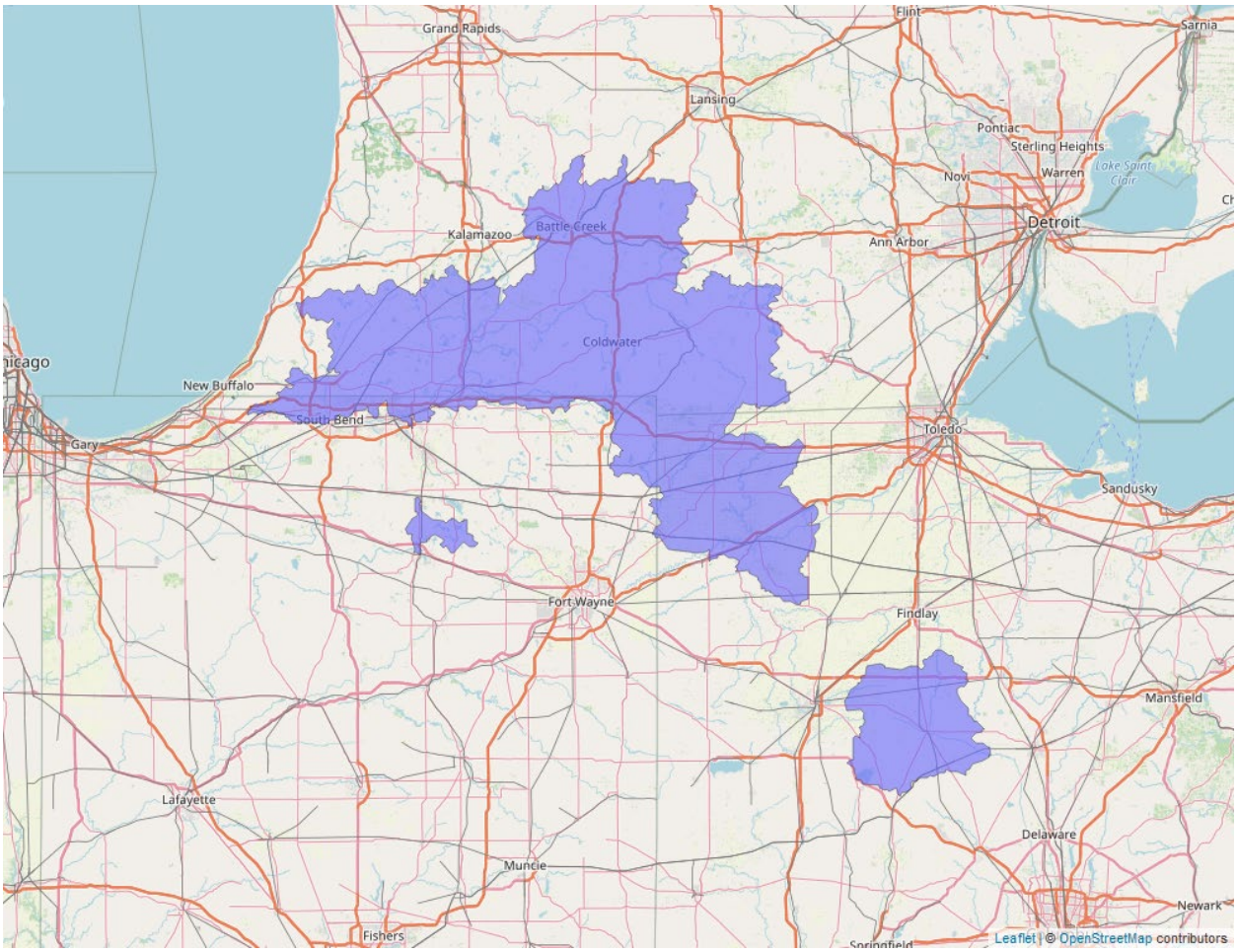

Figure 2. Range map of copperbelly water snake (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7253.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of status

Listing status: Threatened

Most recent 5-Year Review recommendation: Uplist to Endangered

Most recently completed 5-Year Review: 9/27/2023

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The copperbelly water snake is the northern Midwest representative of the plain-bellied water snake. Their diet includes mostly amphibians and fish. Their historical distribution likely included south central Michigan and northwestern Ohio, southwestward through Indiana to extreme southeastern Illinois and Kentucky (USFWS 2008). Genetic studies suggest that the subspecies is found in a single, freely interbreeding population. Subpopulations span from western Kentucky and southern Illinois to northern Indiana and Ohio and southern Michigan. Northern copperbelly water snakes (*Nerodia erythrogaster neglecta*) are listed as a threatened Distinct Population Segment (DPS). The DPS consists of populations north of the 40th parallel, in Indiana, Michigan, and Ohio. Surveys over the last twenty years have documented an ongoing decline in these populations. Many populations are now extirpated, and the five that remain are very small. Even the largest population, located in Ohio, is in decline with adults likely numbering in the low hundreds, or less. Copperbelly water snakes have both wetland and terrestrial habitat requirements but are associated most often with wetland complexes characterized by a preponderance of shallow wetlands, many of which draw down seasonally. Thus, the species needs habitat complexes of isolated wetlands distributed in a forested upland matrix. Many subpopulations are now extirpated, and the few that remain are very small. The species was believed to be declining after the 2018 5-Year Review, in which we stated that the DPS may have had fewer than 100 individuals (USFWS 2018). Further population declines were evidenced by survey results in Indiana, Ohio, and Michigan in 2020 and 2021. They are known to occur in one wetland cluster in Ohio and Michigan; many wetlands previously occupied do not seem to be occupied anymore. In 2022 and 2023, all but one individual observed during surveys (n=10 total) were captured and placed in captivity following the species Captive Rearing Plan. They adapted well to captivity and breeding has been successful (USFWS 2023).

The principal limiting factor for copperbelly water snakes is the availability of wetland/upland habitat complexes of sufficient size. They require many hundreds of hectares of contiguous habitat to persist. Additional threats are disease (e.g., snake fungal disease), human persecution, inadequate habitat management, road crossings, increased sedimentation, and contamination caused by fertilizer runoff. Sedimentation, usually resulting from agricultural activities, but also caused by construction, may change hydrological characteristics, alter plant succession, and reduce the numbers of amphibians and fish used by the snake as food. The species is threatened by climate change, particularly through anticipated changes to ephemeral wetlands and amphibian populations (USFWS 2023). In the 2018 and 2023 5-Year Reviews, the copperbelly

water snake was recommended for uplisting to endangered (USFWS 2018, 2023). The reasoning behind this recommendation is that the recovery criteria have not been met, the known threats have not significantly diminished, climate change represents a new and uncertain threat, and the copperbelly population has declined since listing to its current level (<100 individuals), which meets the criteria for reclassification.

The species continues to face a high degree of threat from loss or conversion of forest and wetland habitat, particularly because most of the land in the DPS' range is privately owned. Some restoration, conservation, research, and captive rearing projects continue and create high potential for recovery.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We do not expect the copperbelly water snake will occur on-field, and thus expect exposure will only result from off-field transport via spray drift or runoff. We expect 65.6% of the species range will overlap with areas that are likely to be exposed through off-site transport within the action area (Table 8).

Usage

Based on past usage data, we anticipate up to 14.5% of the species' range will be exposed to spray drift or runoff of methomyl (Table 8).

Table 8. Overlap and usage data for the copperbelly water snake.

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	6.5	22.2	28.6	1	3.3	4.3
Citrus	NA	NA	NA	NA	NA	NA
Corn[3]	49.3	27.2	76.5	2.4	1.4	3.8
Cotton	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Grains	0.9	6.9	7.8	<0.1	0.4	0.4

[3] 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 Orchards	0.7	3.3	4	0.7	3.3	4
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	50	26.3	76.3	2.5	1.3	3.8
Vegetables and Ground Fruit	2.3	6.1	8.4	2.3	6.1	8.4
Wheat	NA	NA	NA	NA	NA	NA
Total	**60.3**	**65.6**	**100**	**6.5**	**14.5**	**20.9**

Exposure Summary

There is a high extent of overlap between the action area (off-field methomyl overlap) and the species' range. Based on past usage data, we expect a high level of 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.

Aquatic habitat buffers: 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 copperbelly water snake 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. We do not expect the copperbelly water snake to forage on-field. We anticipate the dietary dosages from consuming contaminated food items off-field will result in low levels of direct adverse effects (i.e., mortality) and no sublethal effects.

Indirect Effects:

The copperbelly water snake relies on amphibians, and to a much lesser extent fish, for food resources. Based on available toxicity data, we expect prey species will experience a low level of mortality in areas off-field (i.e., there will be a low loss of off-field prey). As such, we expect there may be small reductions in the abundance of prey species throughout the species' range, indicating a low level of indirect adverse effects is likely to occur.

We do not expect aquatic indirect effects because of the rain restriction conservation measure (see below), and the existing buffer to waterbodies on product labels will also mitigate loss of fish and amphibian prey.

Toxicity Summary

We do not expect the copperbelly water snake to occur on-field. We expect they will experience low levels of mortality and no sublethal effects from foraging on contaminated food items off-field. We expect a low level of indirect effects is likely to occur in terrestrial areas from mortality to terrestrial amphibian prey for the species. We do not expect indirect effects to individuals in aquatic areas (i.e., prey loss of aquatic prey) because of the rain restriction and existing buffers to waterbodies on the product label. As such, we determine the copperbelly water snake has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The copperbelly water snake has a high exposure ranking. Based on past methomyl usage data and potential methomyl use sites (i.e., overlap), we expect between 14.5% and 65.6% of the range may be exposed to methomyl through spray drift or runoff over the duration of the proposed action depending how usage patterns change over time. Because of the high level of exposure, we expect a large portion of the species' range and a large number of individuals are likely to be exposed to methomyl.

The copperbelly water snake has a low toxicity ranking. Because the species does not occur on-field, we expect direct adverse effects will only occur from consuming contaminated prey off-field and will result in low levels of direct adverse effects (i.e., mortality). We do not expect sublethal effects from off-field exposure. We expect a low level of indirect adverse effects is likely to occur as we expect existing conservation measures, such as the rain restriction and application buffers to waterbodies, will minimize adverse effects to fish and amphibian prey in aquatic habitats. While there may be some loss of amphibian prey in terrestrial habitat off-field, we anticipate this will result in low levels of indirect adverse effects.

Even though overlap suggests a large number of individuals are likely to experience exposure, we expect only a low level of direct and indirect adverse effects is likely. Therefore, we determine the overall risk of adverse effects to the species is low.

Conclusion

The copperbelly water snake is a threatened subspecies (distinct population segment, DPS) that consists of populations north of the 40th parallel in Indiana, Michigan, and Ohio. Surveys over the last twenty years have documented an ongoing decline in these populations. Many populations are now extirpated, and the five that remain are very small. Abundance has declined since listing to its current level of less than 100 individuals and should be considered for uplisting to endangered. Restoration, conservation projects, research, and captive rearing continue to be implemented and create high potential for recovery. Although several projects (e.g., conservation easements, restoration grants) have resulted in either the protection or restoration of suitable habitat for the copperbelly water snake, the threat of forest and wetland habitat loss and fragmentation remains high. Most of the northern DPS' range is privately owned. The primary form of economic activity in conflict with the copperbelly is agriculture. Row crops do not provide suitable habitat and fragment remaining forest from wetland habitat. Residential development also removes and fragments habitat but is not widespread in the copperbelly range.

There is large overlap (65.6%) between the species' range and off-field portions of the action area, where the species is susceptible to off-site exposure through spray drift and runoff. Usage data indicates that a high amount of the range (14.5%) will be exposed to methomyl annually through spray drift or runoff. The copperbelly water snake is likely to be found primarily in native wetland and upland forest habitats where exposure may occur but is not likely to result in mortality from consuming contaminated prey. We expect low levels of mortality from consuming prey off-field and low levels of prey loss off-field from methomyl exposure. We do not expect sublethal effects from off-field exposure.

Even though overlap suggests a large number of individuals are likely to experience exposure, we expect low levels of direct adverse effects is likely. In addition, we do not expect indirect effects through loss of aquatic prey (i.e., fish and amphibians) because of the rain restriction conservation measure, and the existing buffer to waterbodies on product labels will mitigate

these losses. There will be low levels of indirect adverse effects to terrestrial prey because existing buffers only apply to waterbodies. We determine the overall risk of adverse effects to the species is low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the copperbelly water snake in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the copperbelly water snake.

References

U.S. Fish and Wildlife Service. 2018. Copperbelly Water Snake (Northern Population Segment) (*Nerodia erythrogaster neglecta*) 5-Year Review: Summary and Evaluation. East Lansing, Michigan. 22 pp .

U.S. Fish and Wildlife Service. 2010. Copperbelly Water Snake (Northern Population Segment) (*Nerodia erythrogaster neglecta*) 5-Year Review: Summary and Evaluation. East Lansing, Michigan. 16 pp .

U.S. Fish and Wildlife Service. 2008. Northern Population Segment of the Copperbelly Water Snake (*Nerodia erythrogaster neglecta*) Recovery Plan. Fort Snelling, Minnesota. ix + 79 pp.

Integration and Synthesis Summary: Bog turtle

Scientific Name:	Common Name:	Entity ID:
Glyptemys muhlenbergii	Bog turtle	182

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 evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range and medium 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 available 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 adverse effects 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 bog turtle 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 expected to appreciably reduce the survival and recovery of the bog turtle in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the bog turtle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 4/15/2022; Wherever found, except GA, NC, SC, TN, VA; *States within the range:* CT, DE, MA, MD, NJ, NY, PA. Figure 3 depicts the species' range.

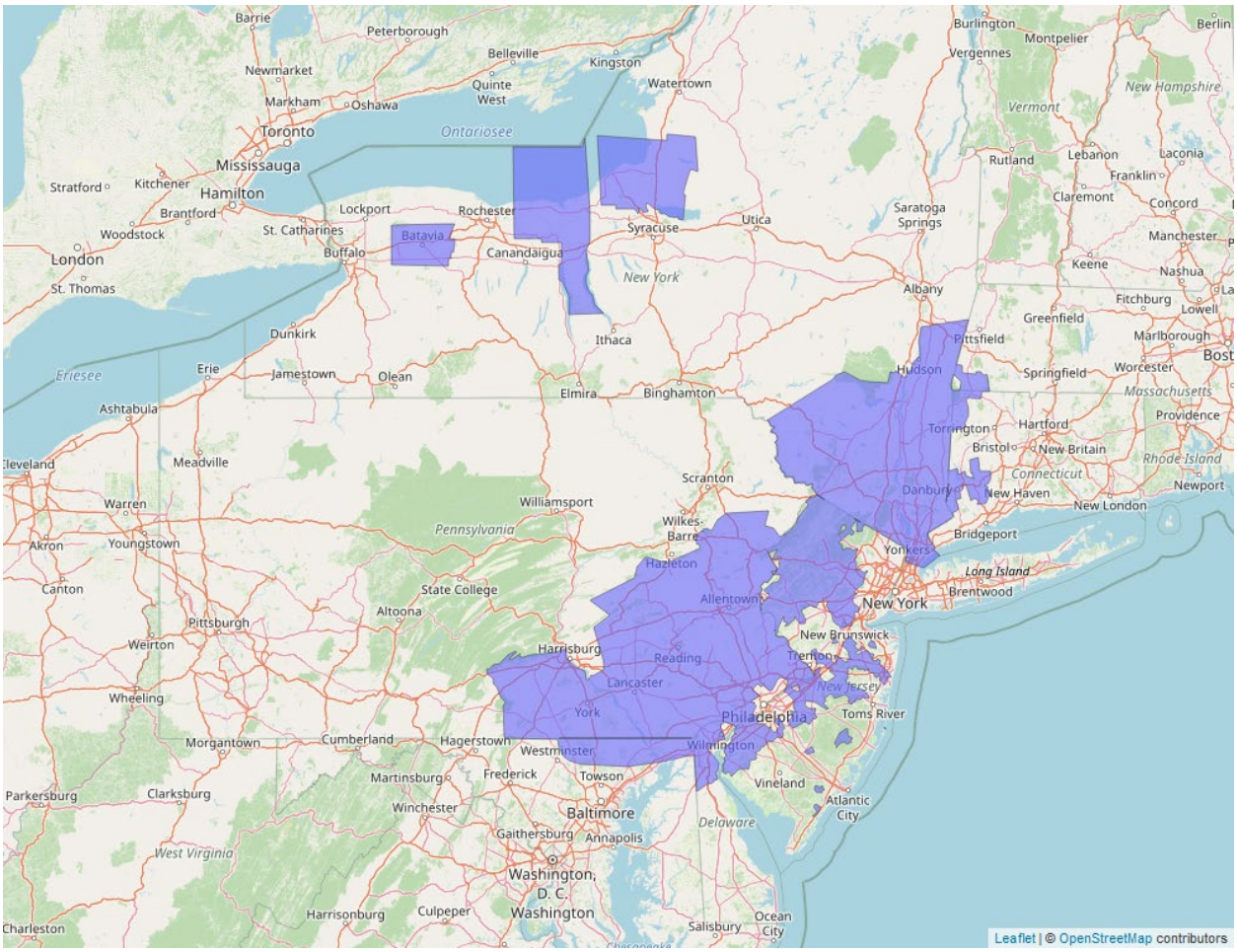

Figure 3. Range map of bog turtle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6962.

Vulnerability

Vulnerability of the species considers the status of the species, 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: 8/29/2022

Distribution: Species/Populations neither constrained nor widespread

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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: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Bog turtles occur in various wetlands, including shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, man-made structures (e.g., pipes, ditches), and pastures. These areas often have soft, muddy bottoms; clear, cool, soft-flowing water; open canopies; and form a network of rivulets. Pedestal vegetation, such as tussock sedge (*Carex stricta*) and sphagnum moss, is used for nesting and basking. They hibernate in winter in densely vegetated areas, under water in soft mud, in crevices between rocks, or between tangled roots. Hibernation areas need clean, cool, flowing water to avoid freezing. Bog turtles are able to disperse between habitat patches of changing vegetation within a long-term, stable, wetland complex. They eat slugs, earthworms, spiders, beetles, millipedes, flies, snails, ants, moths, dragonflies, caddisflies, other insects, and plants. We are now aware of 330 extant bog turtle metapopulations (508 individual populations), which includes both connected populations (n=106) and isolated individual populations (i.e., no connectivity to other populations currently, but likely were once part of a metapopulation; n=224). Pennsylvania is the only state in the northern range where new populations are regularly being discovered, and the distribution in the rest of the northern range is stable. There are 37 potentially extirpated populations and 40 confidently extirpated populations due to lack of suitable habitat (USFWS 2001, 2022). While the species also occurs in Georgia, North Carolina, South Carolina, Tennessee, and Virginia, those in the northern states are part of the threatened distinct population segment. The southern populations are listed as "Similarity of Appearance" under the Endangered Species Act (USFWS 2022).

Bog turtles have been found at elevations ranging from near sea level in the north to 1,500 meters in the south. They usually occur in small, discrete populations occupying suitable wetland habitat dispersed along a watershed. These wetlands are a mosaic of micro-habitats that include dry pockets, saturated areas, and areas that are periodically flooded. The turtles depend upon this diversity of micro-habitats for foraging, nesting, basking, hibernation, shelter, and other needs. Bog turtles can disperse between habitat patches of changing vegetation within a long-term, stable, wetland complex. Pedestal vegetation, such as tussock sedge (C. stricta) and sphagnum moss, is utilized for nesting and basking. Bog turtles become active in late March to late April, depending upon latitude, elevation, and seasonal weather conditions. Bog turtles generally retreat into more densely vegetated areas to hibernate but have also been found hibernating under water in soft mud, in crevices between rocks, or between tangled roots.

The species declined primarily due to loss and degradation of habitat. Current threats to the bog turtle include: habitat loss or alteration from altered hydrology due to development, roads, beavers, and agriculture and changes in vegetation (e.g., invasive species encroachment,

vegetation succession, incompatible or lack of management); collection for the illegal wildlife trade; predation; and inherent factors (e.g., specialized habitat requirements, limited dispersal ability, small population sizes, delayed sexual maturity, road mortality, contaminants). The greatest threat remains habitat loss or degradation from development. Roads are a source of mortality and barrier to species movement within and between populations. Pollution and contaminants, mainly from oil and gas pipeline projects, threaten the species and its habitat (USFWS 2022). Herbicides, pesticides, and fertilizers can degrade or destroy bog turtle habitat and we recommended avoiding them in bog turtle conservation zones in the recovery plan (USFWS 2001).

The primary threat of loss or alteration of habitat has continued, and we expect it to continue into the future, especially on private lands. The early successional vegetation required by bog turtles for successful nesting relies upon habitat management. While the Service, states, NRCS, and other partners have restored many individual wetlands or portions of wetlands, ongoing management is a challenge. The bog turtle is a long-lived species and can tolerate some degree of suboptimal habitat for several years. However, continued degradation results in reduced population size and resiliency, putting populations at greater risk of impacts from stochastic or catastrophic events, such as drought conditions, disease, predation, or illegal collection (USFWS 2022).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 58.2% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 9). Up to 18.3% of the species' range overlaps with methomyl use sites while 40% of the range occurs off-field and may be exposed to spray drift or runoff).

Usage

Based on past usage data, we anticipate up to 11.4% of the species' range will be treated with methomyl (3% on-field and 8.4% off-field) (Table 9).

Table 9. Overlap and usage data for the bog turtle.

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	2.8	11.6	14.4	0.4	1.8	2.2
Citrus	NA	NA	NA	NA	NA	NA

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Corn[4]	12.3	15.5	27.7	0.6	0.8	1.4
Cotton	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Grains	1.2	7.3	8.5	<0.1	0.3	0.4
Other Orchards	0.9	2.2	3.1	0.9	2.2	3.1
Other Row Crops	<0.1	0.2	0.3	<0.1	<0.1	0.1
Soybeans	9	14.3	23.2	0.5	0.7	1.2
Vegetables and Ground Fruit	1	3.2	4.2	1	3.2	4.2
Wheat	NA	NA	NA	NA	NA	NA
Total	**18.3**	**40**	**58.2**	**3**	**8.4**	**11.4**

Additional Exposure Considerations

Depending on latitude and weather conditions, bog turtles generally bruminate (i.e., burrow into soft soils and slow their activity) from October to March. Upon spring emergence, individuals begin traveling to their nesting grounds. Mating takes place between March and June, with females, on average, laying between 3-4 eggs in June to early July. Eggs hatch from August to October. Within a watershed, bog turtles inhabit a variety of wetland types that are generally small, spring/seepage-fed, open-canopy, herbaceous sedge meadows and fens bordered by more thickly vegetated and wooded areas. Aquatic areas are primarily used by bog turtles for nesting, basking, and foraging activities, and contain native sedges, grasses, forbs, scattered shrubs, saturated mud/muck-like soils, and shallow to deep rivulets/watery trails created by naturally flowing water or by wildlife. Bog turtles use more densely vegetated or sparsely forested areas for hibernation and will occasionally be found using upland habitat adjacent to wetland edges. Bog turtles are known to occasionally disperse through uplands or via streams and travel to adjacent wetlands to seek out other areas of suitable habitat. Based on these habitat descriptions, it is not likely that they will often use agricultural areas for feeding, breeding, or sheltering. However, bog turtles have been documented hibernating in agricultural and roadside ditches and dispersing through forests, agricultural lands, and developed areas (USFWS 2022).

[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.

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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 high level of usage within the species' range. Due to the bog turtle's propensity to travel through agricultural areas to reach areas of suitable habitat, it is possible that bog turtles will feed in off-field areas where dietary items can still be exposed to methomyl. Given that the extent of overlap is high, expected usage is medium (8.4%), and they may be exposed occasionally via their diet within these areas, 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, exposure remains high for this species.

Aquatic habitat buffers: 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".

These aquatic habitat buffers would not apply to agricultural ditches or wetlands, where bog turtles are found.

Effects of the Action: Toxicity

Direct Effects:

We expect the bog turtle will primarily experience direct adverse effects (i.e., mortality) from dietary exposure. The level of adverse effects 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 2.8 mg/kg-bw, which can occur when individuals exclusively consume

leaves on-field. This level of exposure can cause mortality in up to 97.2% of exposed individuals. This value represents the mortality upper bound if the bog turtle consumes only leaves from a field treated with methomyl, which we expect will be rare. Bog turtles consume a varied diet of leaves, seeds, berries, insects, slugs, worms, root material, moss, and carrion**.** The bog turtle occupies wetlands, including shallow, spring-fed fens, sphagnum bogs, swamps, marshy meadows, and pastures that have soft, muddy bottoms and clear, cool, slow-flowing water. They are not likely to be found on-field but may feed off-field and at edges of fields. As such, we still anticipate high mortality is likely.

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 amphibians, or leaves. This level of off-field exposure will cause mortality in very few exposed individuals.

Indirect Effects:

The bog turtle relies on benthic invertebrates, leaves, soil invertebrates, and arthropods for food resources. Based on available toxicity data, we expect individuals of prey species will likely experience high levels of mortality with exposure to methomyl, both on- and off-field. However, we expect the level of mortality will vary across insect species as a result of natural variability in physiology, exposure, and other factors. Furthermore, plant food resources are not likely to experience any mortality or sublethal adverse effects from methomyl exposure, indicating that bog turtles can use alternative food resources when sensitive insect prey species die from methomyl exposure. As such, we expect there may be reductions in the abundance of some dietary items throughout the species' range, indicating a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

Though we do not expect bog turtles to forage on-field, the few that do will likely experience a high level of direct adverse effects (97.2% of individuals foraging on-field will likely die) and we expect similar mortality for individuals foraging at field edges based on the bog turtle diet. Although the bog turtle diet is varied, it may consist of leaves, as well as arthropods and soil invertebrates that could be exposed to methomyl and cause adverse effects. We expect a low level of direct adverse effects will occur off-field as exposed individuals foraging off-field will not be exposed to methomyl at levels that will cause mortality. 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 a high level of mortality to food resources that are not plant-based. Given the potential for mortality to individuals, and a reduction in food resources, we determine the bog turtle has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The bog turtle has a medium exposure ranking. Based on past methomyl usage data, we expect up to 11.4% of the range may be treated annually but methomyl may be used on as much as 58.2% of the range over the duration of the proposed action depending how usage patterns change over time. A large portion of the species' range is likely to be treated overall. Because the bog turtle could be exposed as they travel through agricultural areas to reach more suitable habitat, they could consume dietary items from these areas on occasion. As such, we expect a moderate number of individuals are likely to be exposed to methomyl.

The bog turtle has a high toxicity ranking. We expect a high level of mortality will occur for turtles that forage on field edges as a result of dietary exposure through the consumption of contaminated arthropod and soil invertebrate food items. We expect a low level of direct mortality will occur off-field, which is also a result of dietary exposure from the consumption of contaminated food items. 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.

We still expect a high level of indirect adverse effects is likely to occur as existing conservation measures, such as the rain restriction and application buffers to waterbodies, will minimize but not eliminate adverse effects to prey in aquatic habitats or terrestrial areas adjacent to aquatic habitats. There will still be loss of prey in these habitats and anticipate this will result in high levels of indirect adverse effects.

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

Preliminary Conclusion (with General Conservation Measures)

The bog turtle has high vulnerability because of its declining trends and specific habitat requirements. It is listed as threatened and occurs across 508 populations (330 metapopulations) across seven states. They occur in various wetlands and require muddy ground, cool and flowing water, vegetation to burrow under and hibernate, and invertebrates (e.g., slugs, earthworms, spiders, beetles, millipedes, flies, snails, ants, moths, dragonflies, caddisflies, other insects) and plants to eat. Many historical populations are now extirpated, and habitat has been greatly reduced across the range. Bog turtles continue to face threats from habitat loss, altered hydrology, changes to vegetation, collection, predation, and contaminants.

Bog turtles occasionally use agricultural lands for hibernating (i.e., ditches) and dispersing, but we expect them to primarily use non-agricultural lands. Methomyl use sites overlap 58.2% of the

species range, 18.3% of which is on-field. A high portion (11.4%) of the range has been treated annually with methomyl in the past (3% on-field and 8.4% off-field), therefore the bog turtle has a high exposure ranking and we expect that a large number of individuals will be exposed throughout the duration of the action. Even though we primarily considered off-field exposure, overlap with methomyl use sites was high (40% off-field). Many bog turtle habitats and occupied areas are near agricultural lands. Bog turtles are known to disperse through agricultural lands between their preferred habitat, and they occur in primarily mosaic landscapes made up of wetlands, agricultural lands, and development due to past land use changes and fragmentation. Though we do not expect bog turtles to often occur on agricultural fields, they may feed off-field and on edges of fields, which will result in high levels of mortality. We also expect that methomyl exposure will cause indirect effects to the bog turtle through reductions in invertebrate prey. The label includes two conservation measures that would reduce the likelihood of methomyl exposure for this species (i.e., rain restrictions and aquatic habitat buffers), but additional species-specific measures are needed to further reduce exposure for the bog turtle. Without species-specific measures, we determined the species has a medium exposure ranking and we anticipate that a moderate number of individuals will experience exposure from the 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 bog turtle:

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 bog turtle 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 mitigations as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the habitat of the bog turtle by an order of magnitude (i.e., a 10-fold reduction).*

The PULA for the bog turtle 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 bog turtle to be very low. We initially anticipated direct exposure because they often occur on agricultural fields, and they may feed off-field and on edges of fields, which would result in high levels of mortality. We also expected that methomyl exposure would cause indirect effects to the bog turtle through reductions in invertebrate prey, 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 over the course of the action. After adding the effects of the action (including the species-specific conservation measures) and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the bog turtle 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 bog turtle.

References

U.S. Fish and Wildlife Service. 2022. Bog Turtle (*Glyptemys muhlenbergii*) 5-Year Review: Summary and Evaluation. Cortland, New York. 39 pp.

U.S. Fish and Wildlife Service. 2001. Bog Turtle (*Clemmys muhlenbergii*) Northern Population Recovery Plan. Hadley, Massachusetts. 109 pp.

Integration and Synthesis Summary: Eastern massasauga (rattlesnake)

Scientific Name:	Common Name:	Entity ID:
Sistrurus catenatus	Eastern massasauga (rattlesnake)	7800

Species Overview

In reviewing the status of the species, the environmental baseline and cumulative effects for the action area, we determined that the species' vulnerability is medium. In our evaluation of the effects of the proposed action to the species, we determine 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. Individuals are unlikely to forage exclusively on-field such that direct effects from consumption of contaminated prey is anticipated to be rare. While the species utilizes a variety of prey and non-agriculture habitats, given the extent of exposure, we anticipate moderate numbers of individuals will experience medium levels of indirect effects resulting from loss of available prey species. Given that exposure is high, the level of indirect effects is medium, and we expect on-field exposure to be rare, we determined the risk of adverse effects to the species is medium. As such, we expect a moderate number of individuals are likely to experience adverse effects 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 expected to appreciably reduce the survival and recovery of the eastern massasauga (=rattlesnake) in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the eastern massasauga (=rattlesnake). We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 4/18/2022; Wherever found; *States within the range:* IA, IL, IN, MI, MN, NY, OH, PA, WI. Figure 4 depicts the species' range.

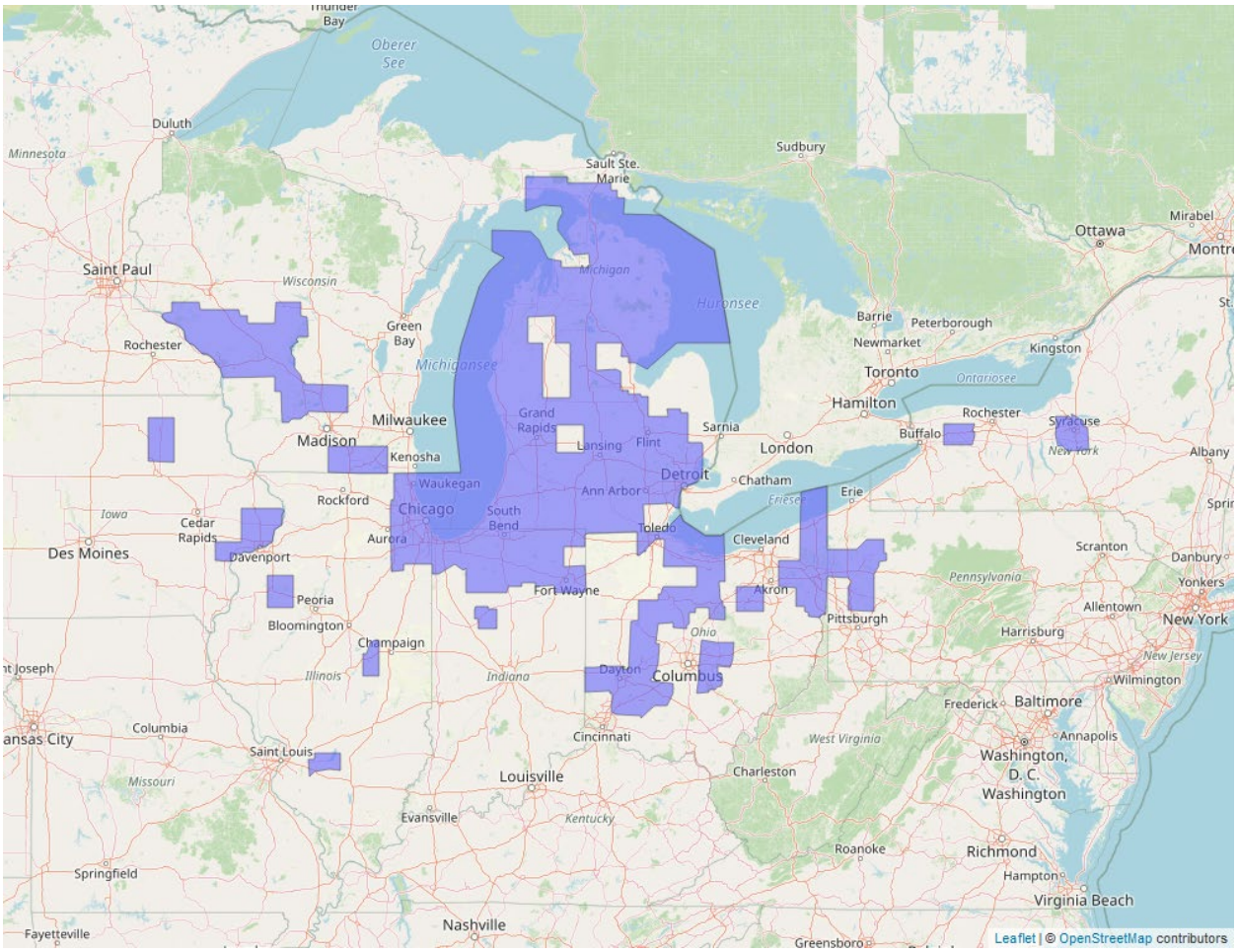

Figure 4. Range map of eastern massasauga (rattlesnake) (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/2202.

Vulnerability

Vulnerability of the species considers the status of the species, 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: 8/23/2021

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: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The documented historical range of the eastern massasauga rattlesnake included sections of western New York, western Pennsylvania, southeastern Ontario, the upper and lower peninsulas of Michigan, the northern two thirds of Ohio and Indiana, the northern three quarters of Illinois, the southern half of Wisconsin, extreme southeast Minnesota, east central Missouri, and the eastern third of Iowa. The limits of the current range of the eastern Massasauga resemble the boundaries of its historical range. However, the geographic distribution of extant localities has been restricted by the loss of the populations from much of the area within the boundaries of that range. Range-wide, there are 558 known historical eastern massasauga rattlesnake populations, of which 263 are known to still be extant, 211 are likely extirpated or known extirpated, and 84 are of unknown status. According to the 2021 5-year review, the eastern massasauga rattlesnake is still extant in the states of Indiana, Illinois, Iowa, Michigan, New York, Ohio, Pennsylvania, and Wisconsin. One new population was discovered in Indiana, nine new element occurrences were discovered in Michigan, two populations in Wisconsin that were presumed extirpated were found to be extant, and one population considered extant in 2016 is now considered extirpated due to lack of suitable habitat. Eastern massasaugas are considered extirpated from Missouri and Minnesota. They use high, dry habitats, open canopy wetlands, and nearby upland areas during the active season (i.e., spring, summer, fall). They are found in old fields, bogs and fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, sedge meadows, peatlands, forest edge, scrub shrub forest, floodplain forest, and coniferous forests. They use crayfish burrows, rock crevices, rodent holes, hummocks, old stumps, rotten logs, and root systems as hibernacula in the winter. They primarily eat small mammals and other snakes (USFWS 2016).

The most prominent stressors affecting the eastern massasauga rattlesnake include habitat loss and fragmentation, especially through development and vegetative succession; hydrologic alteration (hydrologic drawdown) resulting in drought or artificial flooding; persecution; collection; and mortality of individuals from habitat management that includes post-emergent (after hibernation) prescribed fire and mowing for habitat management. The emergence of Snake Fungal Disease has proven fatal for the eastern massasauga (USFWS 2016). The largest sources of direct mortality for eastern massasaugas are vehicle mortality and predation by birds of prey, coyotes, feral cats, and other snakes (USFWS 2021). The species faces a moderate degree of threat, meaning there are many threats acting upon the species that are anticipated to continue in the future. They are well understood and can be managed. They also have high recovery potential, if habitat conservation and expansion is used to reduce impacts of habitat loss.

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

We expect 95.1% 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 10). Up to 40.5% of the species' range overlaps with methomyl use sites while 54.6% of the range occurs off-field and may be exposed to spray drift or runoff).

Usage

Based on past usage data, we anticipate up to 18.6% of the species' range will be treated with methomyl (5.3% on-field and 13.3% off-field) (Table 10).

Table 10. Overlap and usage data for the eastern massasauga (rattlesnake).

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	6.3	18.7	25	0.9	2.8	3.7
Citrus	NA	NA	NA	NA	NA	NA
Corn[5]	30.3	19.8	50.1	1.5	1	2.5
Cotton	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Grains	1	6.3	7.2	<0.1	0.3	0.4
Other Orchards	0.8	3.1	3.8	0.8	3	3.8
Other Row Crops	0.4	1	1.4	0.2	0.4	0.6
Soybeans	27.6	19.2	46.9	1.4	0.9	2.3
Vegetables and Ground Fruit	1.8	5.7	7.6	1.8	5.8	7.6
Wheat	NA	NA	NA	NA	NA	NA
Total	**40.5**	**54.6**	**95.1**	**5.3**	**13.3**	**18.6**

[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.

C-A8. Reptiles: Integration and Synthesis Summaries

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 high level of 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. However, despite the incorporation of the rain restriction mitigation, exposure remains high for this species.

Aquatic habitat buffers: 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 eastern massasauga rattlesnake will primarily experience direct adverse effects (i.e., mortality) from dietary exposure. The level of adverse effects will vary depending on the expected dosage, which is determined by the dietary item and the location where foraging occurs. The diet or prey of the eastern massasauga rattlesnake varies across the species' range but may consist primarily of small mammals (*Microtus, Peromyscus,* and *Blarina* spp.) and other snakes. On-field exposure can result in dosages up to 1.4 mg/kg-bw, which can occur when individuals exclusively consume amphibians. Eastern massasauga rattlesnakes are not known to consume amphibians, so we expect a lower level of methomyl contamination in their prey (i.e., mammals and snakes).

Foraging habitat for eastern massasauga rattlesnakes includes floodplains, riparian, lowland, and upland forests, or any area that provides an adequate abundance of suitable prey. Foraging habitat usually has an open canopy and a sedge or grass ground cover (USFWS 2016). Thus, we do not anticipate the eastern massasauga rattlesnake forages on-field and likely forages within the habitats the snakes and their prey prefer. Therefore, it is likely that the eastern massasauga rattlesnake will not forage exclusively on-field or at the field edge, and thus mortality related to consuming methomyl from contaminated prey will be low. 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 and this level of off-field exposure can cause mortality in very few exposed individuals.

Indirect Effects:

The eastern massasauga rattlesnake relies on reptiles and small mammals for food resources. Based on available toxicity data, we expect individual prey species will likely experience medium levels of mortality with exposure to methomyl, both on- and off-field. As such, we expect there may be reductions in the abundance of prey species throughout the species' range, indicating a medium level of indirect adverse effects are likely to occur.

Toxicity Summary

We expect a low level of direct adverse effects will occur because the eastern massasauga rattlesnake is likely to forage off-field in a variety of habitats. We expect a low level of direct adverse effects will occur off-field as well as up to 0.1% 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 medium level of mortality to organisms that act as food resources for the species. As such, we determine the eastern massasauga rattlesnake has a low toxicity ranking from the combination of low direct effects and medium indirect effects.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The eastern massasauga rattlesnake has a high exposure ranking. Based on past methomyl usage data, we expect up to 18.6% of the range may be treated annually but may potentially cover up to 95.1% of the range over the duration of the proposed action depending on how usage patterns change over time. A large portion of the species' range is likely to be treated overall, and we expect a large number of individuals are likely to be exposed to methomyl.

The eastern massasauga rattlesnake has a low toxicity ranking. We expect a low 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, which is also a result of dietary exposure from the consumption of contaminated food items. We expect a medium level of indirect adverse effects are likely to occur as we expect prey species will experience a medium 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 low levels of direct and indirect adverse effects are likely, we determine the overall risk of adverse effects to the species is medium.

Conclusion

The eastern massasauga rattlesnake has medium vulnerability because of its limited distribution, declining trends, and specific habitat requirements. It is listed as threatened and occurs across 263 extant populations (an additional 211 are likely or known to be extirpated) in Indiana, Illinois, Iowa, Michigan, New York, Ohio, Pennsylvania, and Wisconsin. They use high, dry habitats, open canopy wetlands, and nearby upland areas during the active season (i.e., spring, summer, fall). They are found in old fields, bogs and fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, sedge meadows, peatlands, forest edge, scrub shrub forest, floodplain forest, and coniferous forests. They use crayfish burrows, rock crevices, rodent holes, hummocks, old stumps, rotten logs, and root systems as hibernacula in the winter. Eastern massasauga rattlesnakes primarily eat small mammals and other snakes. They are threatened by habitat loss and fragmentation, road mortality, altered hydrology, collection, and some habitat management activities (i.e., prescribed burns and mowing).

Methomyl use sites overlap 95.1% of the species range, 40.5% of which is on-field. A high portion (18.6%) of the range has been treated annually with methomyl in the past (5.3% on-field and 13.3% off-field), therefore the eastern massasauga rattlesnake has a high exposure ranking and we expect that a large number of individuals will be exposed throughout the duration of the action. Because of the species' habitat requirements described above, we do not anticipate the eastern massasauga forages on-field or close to the field edge, therefore, we expect mortality related to consuming prey recently contaminated with methomyl on-field or off-field will be low. We expect medium indirect effects to occur for the eastern massasauga rattlesnake from reductions in small mammal and reptile prey.

Even though we expect a large number of eastern massasauga rattlesnakes will be exposed to methomyl, we expect a low level of direct and indirect effects will occur through mortality and impacts to prey sources. We expect that the overall risk to the species is medium. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the eastern massasauga (=rattlesnake) in the wild. Thus, it is our biological opinion that the action is not likely to jeopardize the continued existence of the eastern massasauga (=rattlesnake).

References

U.S. Fish and Wildlife Service. 2021. Eastern Massasauga Rattlesnake (*Sistruurs catenatus*) 5-Year Review: Summary and Evaluation. Chicago, Illinois. 13 pp.

U.S. Fish and Wildlife Service. 2016. Species Status Assessment for the Eastern Massasauga rattlesnake (*Sistruurs catenatus*). Version 2.

Integration and Synthesis Summary: Suwannee alligator snapping turtle

Scientific Name:	Common Name:	Entity ID:
Macrochelys suwanniensis	Suwannee alligator snapping turtle	11657

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 determine 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. Individuals are unlikely to forage on-field such that direct effects from consumption of contaminated prey is anticipated to be rare. The species primarily consumes aquatic prey, and we anticipate large numbers of individuals will experience low levels of indirect effects resulting from loss of available prey species. Given that exposure is high, the level of indirect effects is low, and we expect on-field exposure to be rare, we determined the risk of adverse effects to the species is medium. As such, we expect a large number of individuals are likely to experience low levels of adverse effects 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 expected to appreciably reduce the survival and recovery of the Suwannee alligator snapping turtle in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Suwannee alligator snapping turtle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 02/04/2022; Wherever found; *States within the range:* FL, GA. Figure 5 depicts the species' range.

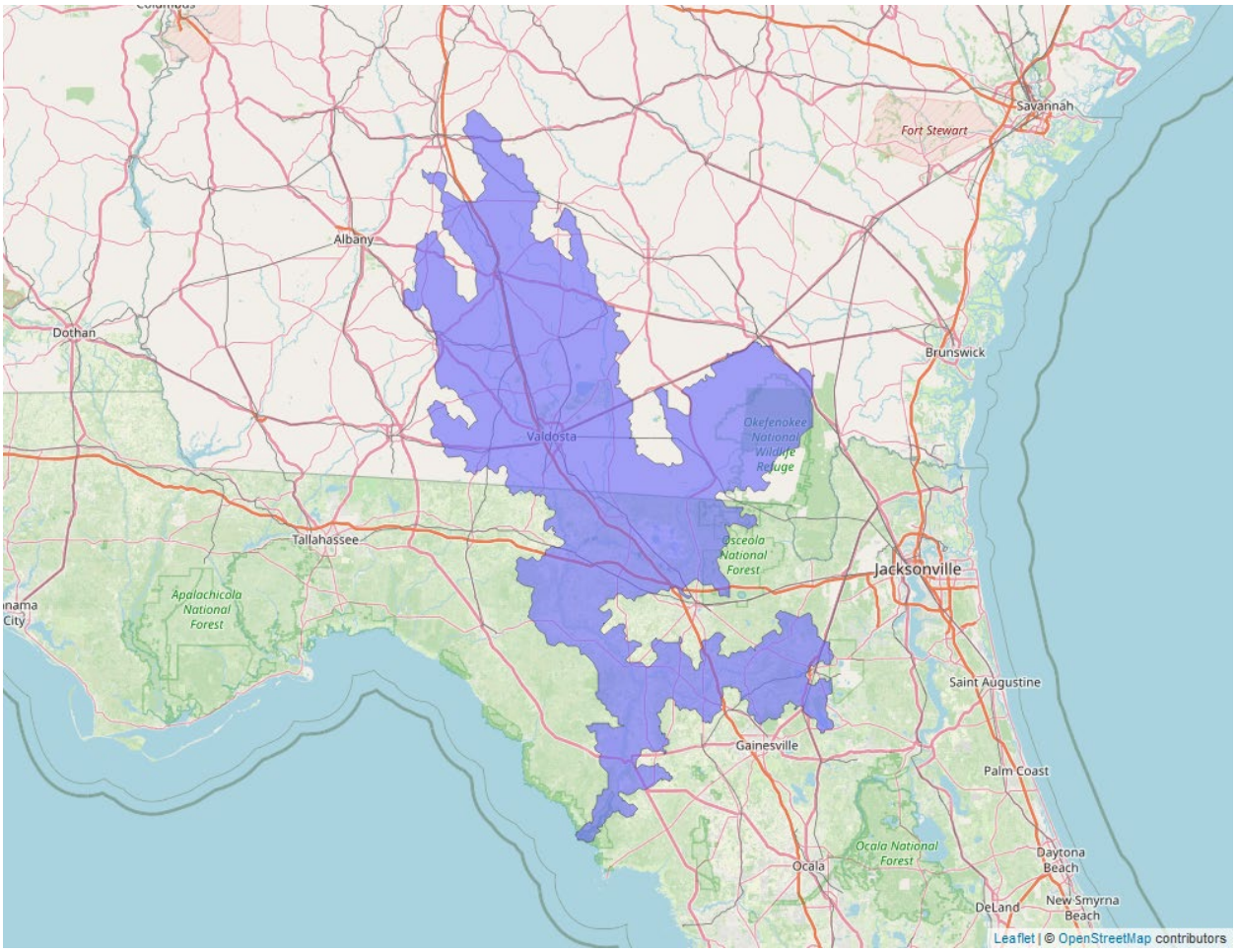

Figure 5. Range map of Suwannee alligator snapping turtle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/10891.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. In making our jeopardy determination, vulnerability of the species is a function only of its status, but also the environmental baseline and cumulative effects. These are summarized below for this species.

Summary of status

Listing status: Threatened

Most recent 5-Year Review recommendation: N/A

Most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated populations

Number of populations: Single population

Species trends: Declining populations – one or more populations declining

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Suwannee alligator snapping turtles are primarily freshwater turtles endemic to the Suwannee River basin and found more abundantly in the middle reaches of the Suwannee River where freshwater springs contribute to an increase in productivity of the aquatic system. The Suwannee River basin encompasses parts of southern Georgia and northern Florida. Main water bodies that currently or historically supported Suwannee alligator snapping turtle include the Suwannee River, Santa Fe River, New River, Alapaha River, Little River, and Withlacoochee River. Individuals occupy main river channels and tributaries when habitat is present. Overland movements are expected to be limited, primarily nesting females and juveniles, and their diet consists of fish, crustaceans, mollusks, birds, smaller turtles, snakes, insects, and plant material. The species currently encompasses a single population with an estimated abundance of 2,000 turtles across most of its historical range in Georgia and Florida (USFWS 2021).

Current and past threats to the species include illegal harvest, bycatch, habitat alteration, nest predation, climate change, disease, parasitic insects, and contaminants. Commercial and recreational turtle harvesting practices in the last century resulted in a decline of the Suwannee alligator snapping turtle across its range. Commercial harvest of the species reached its peak in the late 1960s and 1970s. Both Florida and Georgia have since prohibited the commercial and recreational harvest, but the effect of historical large-scale removal of large turtles and illegal harvest is ongoing. Suwannee alligator snapping turtles can be killed or harmed incidentally during fishing and other recreational activities. Some of these threats include fish hook ingestion, drowning when hooked on trotlines (a fishing line strung across a stream with multiple hooks set at intervals) and limb lines, or bush hooks (single hooks hung from branches) and jug lines (line with a hook affixed to a floating jug), along with injuries and drowning when entangled in various types of fishing line. Boats and boat propeller strikes may also injure or kill Suwannee alligator snapping turtles. Suwannee alligator snapping turtle aquatic and nesting habitats have been altered by anthropogenic disturbances. Activities and processes that can alter habitat include dredging, deadhead logging (removal of submerged or partially submerged snags, woody debris and other large vegetation for wood salvage), removal of riparian cover, channelization, stream bank erosion, siltation, and land use adjacent to rivers (e.g., clearing land for agriculture). Suwannee alligator snapping turtle habitat is also influenced by water availability, quantity, and quality across its range. Ground water withdrawals for irrigation and contaminants from runoff (both residential and agricultural) have been identified as stressors to the species' habitat. Nest predation rates for *Macrochelys* spp. are high. Raccoons (*Procyon lotor*) are common nest

predators, but ninebanded armadillos (*Dasypus novemcinctus*), Virginia opossums (*Didelphis virginiana*), bobcats (*Lynx rufus*), and river otters (*Lontra canadensis*) may also depredate nests. Additional nonnative species found within the species' range that may depredate nests include feral pigs (*Sus scrofa*) and invasive red imported fire ants (*Solenopsis invicta*). Climate change may also affect Suwannee alligator snapping turtle to varying degrees, but the extent of impact is influenced by certain geographical factors, including proximity to the coast and latitudinal thermogradients. Other stressors that may affect Suwannee alligator snapping turtles include disease, nest parasites, contaminants from urban and agricultural runoff, and historical recreational harvest, but none of these stressors rise to the level of a threat. These stressors may act on individuals or have highly localized impacts, and while each is relatively uncommon, they may exacerbate the effects of other ongoing threats (USFWS 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 100% 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 32.8% of the species' range overlaps with methomyl use sites while 79% of the range occurs off-field and may be exposed to spray drift or runoff.

Usage

Based on past usage data, we anticipate up to 55.2% of the species' range will be treated with methomyl (16.5% on-field and 38.7% off-field) (Table 11).

Table 11. Overlap and usage data for the Suwannee alligator snapping turtle.

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	0	0	0	0	0	0
Corn[6]	5.1	15.5	20.6	1.1	3.3	4.4
Cotton	11.3	14.1	25.4	1.6	2.3	3.9
Other Grains	1.5	10.1	11.6	0.1	1.1	1.1

[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.

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 Orchards	1.9	12.4	14.3	0.4	3.0	3.4
Other Row Crops	11.4	18.8	30.2	11.4	18.8	30.2
Soybeans	0.8	5.8	6.6	0.3	2.2	2.5
Vegetables and Ground Fruit	1.6	8.1	9.7	1.6	8.1	9.7
Wheat	0	0	0	0	0	0
Total	**32.8**	**79.0**	**100**[7]	**16.5**	**38.7**	**55.2**

Additional Exposure Considerations

The Suwannee alligator snapping turtle is a largely aquatic turtle generally found in deeper water of large rivers and their major tributaries. Individuals can also be found in a wide variety of habitats, including small streams, springs, bayous, canals, swamps, lakes, reservoirs, ponds, floodplains during flooding, and oxbows. While the species is largely aquatic, individuals can occur in nearby terrestrial areas (up to 200 meters from water) to nest (adults) and travel to the water from the nest (juveniles) (USFWS 2022). As such, while there is overlap between the species' range and agricultural use sites, we do not anticipate any individuals are likely to be exposed to methomyl directly on agricultural use sites. To account for this difference in exposure potential, we only consider off-site exposure in our assessment, indicating that total overlap with off-field agricultural areas is 79% and up to 38.7% of the range is likely to be exposed through runoff or drift annually.

Exposure Summary

There is a high extent of overlap between areas exposed to runoff and drift and the species' range. Based on past usage data, we expect a high level of usage within off-field areas as well. Given that the extent of overlap is high and expected usage is high, we expect a large number of individuals are likely to experience exposure from the proposed action.

Overall Exposure Ranking: High

[7] Total overlap is capped at 100%.

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.

Aquatic habitat buffers: 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 do not anticipate any direct effects to the Suwannee alligator snapping turtle when foraging in aquatic waterbodies. Because of the rain restriction conservation measure and the existing buffer to waterbodies on product labels (see above), concentrations will not reach the level that would cause adverse effects to the Suwannee alligator snapping turtle, even in lower flow or lower volume aquatic habitats.

The Suwannee alligator snapping turtle consumes a wide variety of food, but its diet primarily consists of fish. The species can also consume crustaceans, mollusks, smaller turtles, insects, snakes, birds, and vegetation (like acorns). We expect dietary items foraged on methomyl use sites in terrestrial areas will contain the highest concentrations of methomyl residues and result in the highest exposures to the snapping turtle. In contrast, dietary items off-field are not likely to contain more than low levels of methomyl. Furthermore, we expect the consumption of aquatic prey will result in lower levels of methomyl exposure than consumption of terrestrial prey as we do not anticipate methomyl will accumulate in aquatic prey given its low bioaccumulation potential. Because the Suwannee alligator snapping turtle primarily consumes aquatic prey (which do not accumulate methomyl) and does not forage on methomyl use sites (where dietary exposures are highest), we do not anticipate individuals will experience more than low levels of methomyl exposure and are not likely to experience any direct adverse effects.

Indirect Effects:

The Suwannee alligator snapping turtle consumes a wide variety of food items spanning a diverse array of taxa, from fish, to invertebrates, to plant matter. While we expect some prey species are sensitive to insecticides (such as aquatic invertebrates) and may decrease in availability in response to methomyl exposure, we anticipate the Suwannee alligator snapping turtle can rely on other food resources that are less sensitive to methomyl, such as fish or plant matter. As such, we do not anticipate the species will experience more than low levels of indirect adverse effects.

Toxicity Summary

Given that the Suwannee alligator snapping turtle is an aquatic species that primarily consumes aquatic prey species in areas away from methomyl use sites, we anticipate individuals are not likely to experience more than low levels of dietary exposure, which will not result in any direct adverse effects. While there may be some decreases in the abundance of prey species sensitive to methomyl, we anticipate the Suwannee alligator snapping turtle will have sufficient alternative food resources available as the species is an opportunistic forager that consumes a wide range of dietary items.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The Suwannee alligator snapping turtle has a high exposure ranking. The high extent of overlap and high level of past methomyl usage within the species' range suggests that a large number of individuals are likely to be exposed over the duration of the proposed action. We do not expect individuals to occur on-field. We do not anticipate exposed individuals are likely to experience direct adverse effects because we anticipate individuals are not likely to be exposed to more than low levels of methomyl through dietary exposure. We expect a reduction in the abundance of some prey species following methomyl exposure but that the Suwannee alligator snapping turtle will be able to find alternate sources of food as an opportunistic feeder.

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

Conclusion

The Suwannee alligator snapping turtle is listed as threatened. It is a freshwater turtle endemic to the Suwannee River basin in southern Georgia and northern Florida. They eat mostly fish but also crustaceans, mollusks, smaller turtles, snakes, birds, insects, and plant material. Overland movements are expected to be limited, primarily nesting females and juveniles. The species

occurs in a single population with an overall estimated abundance of 2,000 turtles. Population numbers historically decreased due to recreational and commercial take primarily, and these threats have been greatly reduced. Current threats include habitat loss and degradation, bycatch, effects of climate change, and urban and agricultural contaminants.

We do not expect the species to forage or occur on agricultural areas where methomyl is used because of their reliance on aquatic habitats, so we only considered off-field areas in our analysis. Areas subject to runoff or drift from methomyl use sites overlap 79% of the species' range, and 38.7% of the species' range has been exposed to methomyl from spray drift or runoff annually in the past. After incorporating general conservation measures, we do not expect direct adverse effects (i.e., death or sublethal effects) to the species when exposed. The rain restriction will reduce the amount of methomyl reaching the species' habitat from runoff, and the aquatic habitat buffer limits the amount of spray drift that will reach the species' habitat from applications on nearby methomyl use sites. Suwannee alligator snapping turtles eat primarily aquatic prey (e.g., fish, crustaceans, mollusks), most of which we do not expect to accumulate more than low levels of methomyl after exposure. In addition, we expect low indirect effects through loss of prey (i.e., primarily crustaceans) from methomyl exposure due to the species' reliance on diverse prey, most of which is expected to experience little to no effects from methomyl exposure (e.g., fish, mollusks, plants).

While we expect a large number of Suwannee alligator snapping turtles will be exposed to methomyl through spray drift or runoff, we expect concentrations to be low by the time methomyl reaches the species' habitat and very low levels of adverse effects will occur to individuals. We do not expect mortality or sub-lethal effects from dietary exposure, and we expect no more than low levels of indirect effects through loss of prey. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the Suwannee alligator snapping turtle in the wild. Thus, it is our biological opinion that the action is not likely to jeopardize the continued existence of the Suwannee alligator snapping turtle.

References

U.S. Fish and Wildlife Service. 2022. Species status assessment report for the Suwannee alligator snapping turtle (*Macrochelys suwanniensis*), Version 1.2. Atlanta, Georgia.