Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Gambelia silus	Blunt-nosed leopard lizard	151

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Endangered
Distribution: Small, endemic, constrained, and/or isolated population(s)
Number of Populations: Population size/location(s) unknown
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
Historically, blunt-nosed leopard lizards occurred in arid lands throughout much of the San Joaquin Valley and adjacent foothills, ranging from San Joaquin County in the north, to the Tehachapi Mountains in the south, as well as in the Carrizo Plain and Cuyama Valley (Montanucci 1965; Germano and Williams 1992a; McGuire 1996). At the time of listing, the blunt-nosed leopard lizard was found in scattered locations in San Joaquin Valley, in the foothills of Tulare and Kern Counties and up the eastern portions of the Coast Range foothills; Fresno, Kern, Madera, Merced, San Luis Obispo and Tulare Counties (Stebbins 1954, and California Department of Fish and Game 1972 as reported in BLM 1972). Due to widespread agricultural development of natural habitat in the San Joaquin Valley, the current distribution of blunt-nosed leopard lizards is restricted to less than 15 percent of its historic range (Germano and Williams 1992a; Jennings 1995). In the remaining habitat that exists, blunt-nosed leopard lizards occur in alkali sink scrub, saltbush scrub, as well as native and nonnative grasslands on the Valley floor and in the surrounding foothills areas (Montanucci 1965; Germano et al. 2001; Stebbins 2003).
Threats: Past research on this species reported that collective habitat loss has caused the reduction and fragmentation of populations and decline of blunt-nosed leopard lizards (Stebbins 1954; Montanucci 1965; Service 1980, 1985; Germano and Williams 1993). Since listing, the Service has identified additional potential threats to the blunt-nosed leopard lizard including: landscape leveling and cultivation which caused habitat disturbance, destruction and fragmentation; grazing (under- or over-grazing); mineral development, primarily oil and gas extraction; and, agricultural pest control, primarily spraying for the beet leafhopper (Montanucci 1965).

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2010. Blunt-nosed Leopard Lizard (*Gambelia sila*) 5-Year Review: Summary and Evaluation. Sacramento Fish and Wildlife Office, Sacramento, California. 79 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK

(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Individuals are not expected to enter use sites. Effects from spray drift are not expected.

Risk to the species from labelled uses across the range:

The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	No effects expected
Spray drift areas - Prey item mortality	Effects to terrestrial invertebrates
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	80% terrestrial invertebrates, 7% reptiles and terrestrial amphibians

Risk modifiers:

Blunt-nosed leopard lizards are not expected to enter use sites. Exposure is only expected via spray drift and mosquito adulticide.

Allowable uses driving effects/other considerations: We anticipate effects to the invertebrate prey base from malathion near use sites or from mosquito control applications. Invertebrates exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. These reductions are likely temporary (based on application frequency), with community recovery over a short period of time.

Overall Risk: ☐ **High** ☒ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Agricultural usage based on CalPUR data:

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	9,977,085	79.58	9,100	0.07
Orchards and Vineyards	*	2,157,843	17.21	17,766	0.14
Other Crops	*	1,006,031	8.02	0	0
Open Space Developed	*	485,835	3.88	24,292	0.19
Wheat	*	460,660	3.67	7,082	0.06
Pasture	*	403,827	3.22	36,044	0.29
Developed	*	396,665	3.16	19,833	0.16
Vegetables and Ground Fruit	*	283,740	2.26	29,051	0.23
Cotton	*	241,783	1.93	14,766	0.12
Other Grains	*	216,436	1.73	2,453	0.02
Corn	*	70,390	0.56	474	0.004
Rice	*	2,722	0.02	0	0.00
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		0	0	0	0
TOTAL[4]:		9,977,085	79.58	9,100	0.07

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in mortality to prey species from spray drift (whether or not the species will utilize the site itself).

 # acres in species range: 12,536,694 acres
% of range in California (i.e., where CalPUR data is available): 100%
Range overlap with Federal lands: 1,079,181 acres, 8.6%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit set the maximum allowable number of applications to 2-4 per year (depending on the specific crop). The reduction in the maximum application rate for citrus (outside of California), in particular, is expected to reduce potential environmental concentrations to one-third of modeled values. These measures will help reduce the amount of malathion used and decrease exposure to invertebrate prey species for the blunt-nosed leopard lizard.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the blunt-nosed leopard lizard. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The blunt-nosed leopard lizard has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is medium, with a low amount of estimated usage within the range of the species that overlaps with non-Federal lands based on CalPUR usage data. We do not anticipate that mortality or sublethal effects will occur to individuals on use sites or from spray drift. We estimated that across the species range, annual malathion uses pursuant to the labels could result in the loss of forage base, approximately 80% terrestrial invertebrates and 7% of reptiles and terrestrial amphibians due to mosquito control and a loss of terrestrial invertebrates due to spray drift.

While usage is not expected on all use sites and at the maximum rates allowed by the labels, wherever used each year, we anticipate that usage will occur in up to 0.07% of the species range annually based on CalPUR past usage data. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only very low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Opinion. In addition to the extremely low malathion usage within the species range, we anticipate that the

conservation measures described above, including reductions in application rates and number of applications for certain use sites, and residential use label changes, will further reduce the risk of exposure to prey resources. Thus, we do not expect species-level effects to the blunt-nosed leopard lizard.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the blunt-nosed leopard lizard in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Thamnophis sirtalis tetrataenia	San Francisco garter snake	152

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Endangered
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 ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The historic range of the San Francisco garter snake (SFGS) extended from just north of the San Francisco-San Mateo County line near Merced Lake south along the base of the Santa Cruz Mountains to Waddell Creek (U.S. Fish and Wildlife Service 1985). Six current significant populations include the West of Bayshore property (San Francisco International Airport), San Francisco State Fish and Game Refuge property (San Francisco Public Utilities Commission), Laguna Salada/Mori Point property (City of San Francisco/National Park Service), Pescadero Marsh and Ano Nuevo State Reserve properties (California State Parks) and Cascade Ranch property (private land owner). The primary threats to the survival and recovery of the SFGS were the alteration and isolation of habitats resulting from urbanization. This remains a primary threat to SFGS recovery. The continuous expansion of cities and associated infrastructure in San Mateo County reduces the quantity and quality of habitat by filling wetlands and fragmenting upland habitat. Finally, chytrid fungus, parasites, and illegal collection may negatively affect the species, although the degree to which these threats impact the snake remains unknown.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2006. San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*) 5-Year Review: Summary and Evaluation. Sacramento Field Office, Sacramento, California. 46 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: San Francisco garter snakes exposed to malathion at maximum rates on use sites from consuming amphibians - the primary dietary item - are not anticipated to experience direct effects. Consumption of small mammals could result in effects to growth or reproduction.

Risk to the species from labelled uses across the range:

The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected from consumption of amphibians (primary dietary item). Up to 28% (G, R – consumption of mammals)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	9% aquatic amphibians, 28% reptiles and terrestrial amphibians
Spray drift areas - Prey item mortality	Additional mortality
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	88% fish and aquatic amphibians, 9% reptiles and terrestrial amphibians

Risk modifiers: The San Francisco garter snake is endemic to the San Francisco Peninsula and is known only from San Mateo County, California. San Francisco garter snakes are found on the San Francisco Peninsula from approximately the San Francisco County line, south along the eastern and western bases of the Santa Cruz Mountains at least to the Upper Crystal Springs Reservoir, and along the coast south to Año Nuevo Point, San Mateo County, California.

San Francisco garter snakes are opportunistic carnivores that primarily feed on ranid frogs, including Pacific tree frogs and California red-legged frogs. Immature California newts, recently metamorphosed western toads, bullfrogs, threespine stickleback, and mosquitofish have also been recorded in the diet. Individuals on the Stanford University property have been documented to feed on invertebrates and possibly small rodents and birds in addition to amphibians and fish. Prey items are usually captured in wetlands, either in emergent vegetation or in areas of shallow open water.

San Francisco garter snakes are habitat specialists with several strict habitat requirements. Necessary habitat for San Francisco garter snakes includes densely vegetated standing freshwater habitats with some open water areas, open grassy uplands and shallow marshlands for breeding, and rodent burrows for hibernacula (shelters where they spend dormant winter months) and refugia. The San Francisco garter snake also depends on ground-burrowing rodents to create

burrows for snakes to use as hibernacula and refugia during the winter. The connectivity between aquatic and upland habitat is important and is currently threatened by development and infrastructure, including roads and highways.

San Francisco garter snakes mate in the spring or fall, and mating is concentrated in the first few warm days of March. The augmented frequency in spring mating is thought to be due to the increased likelihood of encountering a mate as individuals emerge from hibernacula and concentrate near aquatic hunting grounds. Mating occurs on open grassy slopes, typically in the morning. Ovulation generally occurs in late spring, pregnancy in early summer, and live birth of young sometime in July or August. Like many members of the genus Thamnophis, females can store sperm throughout the winter. Mating aggregations of San Francisco garter snake have been observed in late October and early November. Females are ovoviviparous (internal fertilization and young are born live, but no placental connection) and typically bear young in secluded areas, either hidden in dense vegetation or under some type of cover.

San Francisco garter snakes are nonmigratory, but move between pond foraging habitats and upland wintering sites seasonally. Peak activity occurs between March and July, which may correspond with dispersal patterns of their prey. Radio tracking studies indicate that most individuals remain within 100 to 200 m (328 to 656 ft.) of pond foraging habitats and wintering upland sites. San Francisco garter snakes do not appear to move distances greater than 1 km (0.6 mi.), but they may disperse to new areas in pursuit of prey. Roads and highways may adversely affect dispersal and movement of the San Francisco garter snakes.

Garter snakes may use developed, developed open space areas, right of ways, and golf courses for foraging and traveling through, but are unlikely to enter agricultural areas, orchards and vineyards, managed forests, and rangeland (Pers. Comm. 2016 co-occurrence information, USFWS field office request).

Allowable uses driving effects/other considerations: Sublethal effects are based on overlap with developed and open space developed use sites, and are expected only from consumption of mammals, which is considered to be a potential dietary item only. Therefore, while effects based on this dietary item are possible, they are over-estimated based solely on overlap with use sites.

We anticipate effects to the invertebrate prey base from malathion near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Agricultural usage based on CalPUR data:

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	574,133	92.88	0	0
Developed	D, I	96,981	15.69	4,849	0.78
Open Space Developed	D, I	73,448	11.88	3,672	0.59
Other Crops	*	1,959	0.32	0	0
Vegetables and Ground Fruit	*	1,616	0.26	1,616	0.26
Nurseries	D, I	746	0.12	4	<0.001
Orchards and Vineyards	*	735	0.12	28	0.004
Wheat	*	453	0.07	0	0
Pasture	*	413	0.07	0	0
Other Grains	*	319	0.05	0	0
Rice	*	73	0.01	0	0
Corn	*	57	0.01	0	0
Sub-TOTAL (D): *Other uses with direct effects only*[3]		171,175	27.69	8,521	1.37
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		171,175	27.69	8,521	1.37
TOTAL[4]:		745,308	120.58	8,521	1.37

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 618,122 acres
% of range in California (i.e., where CalPUR data is available): 100%
Range overlap with Federal lands: 32,507 acres, 5.3%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

CONSERVATION MEASURES

Rain restriction and aquatic habitat buffers: While the San Francisco garter snake is not strictly an aquatic species, it is known to rely on aquatic habitat for food resources or is otherwise closely associated with aquatic habitats and may experience effects of malathion through effects to the aquatic system.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions and aquatic habitat buffers required of all agricultural and residential uses will reduce effects to the prey species of the San Francisco garter snake.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service’s biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the San Francisco garter snake. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The San Francisco garter snake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is medium, with a low amount of estimated usage within the range of the species, based on CalPUR usage data. We do not anticipate that mortality will occur on use sites or from spray drift; however, 28% of snakes across the species range may experience sublethal effects (growth and reproduction) if the species consumes contaminated mammals and all use sites are treated. We estimated that across the species range, annual malathion uses pursuant to the labels could result in the loss of 88% of fish and amphibians and 9% reptiles and terrestrial amphibians due to mosquito control and 9% (amphibians) and 28% (reptiles and terrestrial amphibians) on use sites on non-Federal lands. Additional prey mortality may occur in spray drift areas. In addition, 7% of plants across the species range may experience a decline in growth.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to approximately 1.37% of the species range annually based on CalPUR past usage data provided above. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only very low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

The San Francisco garter snake primarily feeds on amphibians and fish and may occasionally feed on invertebrates and small mammals. With this preference in diet, sublethal effects, which may occur if a small mammal was consumed, is thought to be overestimated and likely uncommon, and would affect only small numbers of individuals. Considering usage data within the range of the San Francisco garter snake, we expect that only 1.37% percent of the non-Federal portions of the range would be treated in any given year for developed and open-space developed use sites, and that no mosquito adulticide applications would occur (which would account for the highest impact to prey resources, should exposure occur); consequently, anticipated impacts to preferred prey items is considered insignificant due to the small proportion of the range treated in any given year. In addition to the extremely low malathion usage within the species range, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, and residential use label changes, will further reduce the risk of exposure to the species and its prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Considered together, we expect these conservation measures will substantially reduce exposure to the San Francisco garter snake and its prey resources and therefore minimizes

overall risk and adverse effects to the species. Thus, while we anticipate low levels of adverse effects to individual snakes and the loss of a small number of prey resources from the proposed use of malathion over the duration of the action, we do not anticipate species-level effects to this species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the San Francisco garter snake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Crotalus willardi obscurus	New Mexican ridge-nosed rattlesnake	166

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Small, endemic, constrained, and/or isolated population(s)
Number of Populations: Single population
Species Trends: Unknown population trends
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
Ridgenose rattlesnakes occur from southeastern Arizona and southwestern New Mexico south through portions of Chihuahua and Senora to southern Durango and southwestern Zacatecas. But the specific subspecies of *C. w. obscurus* are found in the Animas Mountains of New Mexico and adhacent Sierra San Luis of Chihuahua (Harris and Simmons 1976). These habitats are typically semi-evergreen oaks, but conifers and other tree and scrub species may also be present. Wild populations have not been censused. Threats to the snake include habitat alteration, habitat fragmentation, predation, starvation and disease.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 1985. New Mexico Ridgenose Rattlesnake Recovery Plan. Albuquerque, New Mexico. 64 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

New Mexican ridge-nosed rattlesnake exposed to maximum rates on use sites are not expected to experience mortality. Effects to reproduction are expected to occur on all use sites from consumption of birds or mammals.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	<0-2% (G, R)
Direct spray or contact with contaminated media	<1% mortality
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	2% terrestrial invertebrates, reptiles, and amphibians
Spray drift areas - Prey item mortality	Amphibians, reptiles, and fish
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	No effects expected

Risk modifiers: The New Mexican ridge-nosed rattlesnake occurs locally in Animas Mountains (New Mexico), Peloncillo Mountains (Arizona and New Mexico), and Sierra de San Luis (Sonora and Chihuahua, Mexico).

The New Mexican ridge-nosed rattlesnake preys on scorpions, centipedes, lizards, small mammals and birds. It is inactive in cold temperatures and extreme heat. This rattlesnake is mainly diurnal but probably at least partially nocturnal during hot summer weather; in summer, most active on warm humid mornings; rains may stimulate late afternoon activity; in fall, active mainly in afternoon.

The New Mexico ridge-nosed rattlesnake typically lives in riparian communities or pine-oak woodlands in areas that are open, with scattered stands dominated by pines or oaks. The New Mexico ridge-nosed rattlesnake needs areas where they can burrow, such as fallen logs and debris. Winter dens are often in talus slopes or other rocky areas, with crevices and holes that protect the snakes from frost. The New Mexico ridge-nosed rattlesnake is restricted to mountainous terrain at elevations ranging from approximately 5,971 to 8,500 feet (ft) (1,820 meters (m) to 2,590 m) in the Animas Mountains and 4,987 ft to 6,200 ft (1,520 to 1890 m) in the Peloncillo Mountains (NMDGF 1990; Degenhardt et al. 1996; Fedorko 2017). The rattlesnake hides in leaf litter among cobbles and rocks, and can climb into trees. Habitat destruction has limited the geographic range and areas where these snakes can be found.

The New Mexico round-nosed rattlesnake is ovoviviparous. These rattlesnakes breed from July through September, and the gestation period for the New Mexico round-nosed rattlesnake is approximately 13 months. Reproduction is considered biennial by mating in one year and giving

birth in the next. Females mate in summer to fall, with ovulation and fertilization occurring early the following spring. The female carries the developing eggs in her oviducts until a clutch of four to nine young hatch and are born alive in August through October. These rattlesnakes have a low parental care investment rate; they leave young to fend for themselves, though newborn rattlesnakes are found sharing the same hiding place with their mother for a few days. Rattlesnakes are active on the surface as early as April and as late as October, with heightened activity between July and September. Temperature and rainfall (summer monsoons) are important factors in activity levels. This species moves only relatively short distances, and moves less frequently compared to other rattlesnake species. This sedentary nature contributes to the limited area the species is known to occupy.

Allowable uses driving effects/other considerations: Effects on use sites are driven by the "other crops" use category (1.5% overlap). However, data from the NASS census indicates that malathion-registered crops do not appear to be grown in the range of this species. This information is captured below in the usage data. Therefore, effects are likely over-estimated from this analysis, with <1% overlap resulting in effects on use sites.

We anticipate effects to the invertebrate prey base from malathion near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☐ Medium ☒ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	N	0	0	0	0
Other Crops	D, I	35,277	1.51	0	0
Pasture	D, I	6,447	0.28	5,215	0.22
Corn	D, I	3,610	0.15	156	0.01
Open Space Developed	D, I	3,264	0.14	163	0.01
Developed	D, I	1,749	0.07	87	<0.01
Other Grains	D, I	1,426	0.06	1,339	0.06
Cotton	D, I	1,253	0.05	1,253	0.05
Wheat	D, I	630	0.03	<1	<0.01

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Vegetables and Ground Fruit	D, I	261	0.01	261	0.01
Orchards and Vineyards	D, I	72	<0.01	71	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		53,989	2.31	8,346	0.36
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		53,989	2.31	8,346	0.36
TOTAL[4]:		53,989	2.31	8,346	0.36

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself).

 # acres in species range: 2,335,818 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 950,515 acres, 40.7%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the New Mexican ridge-nosed rattlesnake.

The New Mexican ridge-nosed rattlesnake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is low, with a low amount of estimated usage within the species range that overlaps non-Federal lands based on standard usage data. Mortality (<1%) may occur if the species comes into direct contact with malathion during a spray event. Two percent or less of exposed individuals across the species range may experience sublethal effects to growth and reproduction. We estimated that across the species range, annual malathion uses pursuant to the labels could result in the loss of about 2% of terrestrial invertebrates, reptiles, and amphibians; spray drift may lead to additional mortality to amphibians, reptiles and fish.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to approximately 0.38% of

[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

non-Federal portions of the species range annually based on standard past usage data provided above. There is no reported mosquito adulticide usage within the species range. New Mexican ridge-nosed rattlesnakes are known to inhabit mountainous terrain in pine-oak vegetation at elevations greater than 4,987 feet (1,520 meters). Data from the NASS census indicates that malathion-registered crops do not appear to be grown in the range of this species. The most recent 5-year review (2019) for the species describes the current distribution and potential distribution based on known elevation range of the species. Based on the maps in the 5-year review (2019) compared to the current range map used for this analysis, overlap with use sites is likely even much lower than described above, or even non-existent. Additionally, we did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion. We do not anticipate species-level effects to this species since estimated usage is extremely low, the species is not likely to occur within use sites (due to elevation restrictions) and because we anticipate that effects to the species based on the risk analysis is likely overestimated.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the New Mexican ridge-nosed rattlesnake in the wild.

Conclusion: Is not likely to jeopardize.

ADDITIONAL REFERENCES

U.S. Fish and Wildlife Service (USFWS). 2019. New Mexico Ridge-nosed Rattlesnake (*Crotalus willardi obscurus*) 5-Year Review: Summary and Evaluation. New Mexico Ecological Services Field Office. Albuquerque, New Mexico. 23 pp.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Nerodia clarkii taeniata	Atlantic salt marsh snake	167

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Population size/location(s) unknown
Number of Populations: Unknown number of populations
Species Trends: Unknown population trends
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The Atlantic salt marsh snake was listed on the basis of two primary concerns: 1) loss of habitat resulting from intensive drainage and development in coastal salt marshes; and 2) the accompanying disruption of reproductive isolating mechanisms, which can lead to hybridization with the Florida banded water snake, and potential swamping of the Atlantic salt marsh snake gene pool by the much larger Florida banded water snake gene pool (FWS 1993).

According to the 2019 5-year review, the Atlantic salt marsh snake range appears to be restricted to the salt marshes of Volusia County, as reported in the Recovery Plan (1993), Multi-Species Recovery Plan (MSRP 1999), and surveys (2010- 2012), and Parkinson (2016). This range contraction from the original listed range in 1977 is not due to habitat loss but likely related to developing a better understanding of the salt marsh snake species and where they occur. The loss of salt marsh habitat in Volusia County has slowed because of Federal and State protections but conversion from salt marsh to mangrove dominated marshes needs to be assessed. Approximately thirty percent of the salt marsh habitat in Volusia County is within publicly managed lands, and thus, future development in these areas will likely be limited. Salt marshes are protected by the Clean Water Act and as sovereign submerged lands of the State of Florida.

An initiative to restore the salt marsh systems that were dragline ditched during the 1950s and 1960s in Volusia County continues. To date, over 1,000 of acres of disturbed salt marsh areas have been restored and enhanced and are likely improving the habitat conditions for the Atlantic salt marsh snake in those areas. Also, conservation land acquisitions are targeting habitat that will add to, connect and buffer public lands with Atlantic salt marsh snake habitat.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2008. Atlantic Salt Marsh Snake (*Nerodia clarkii taeniata*) 5-Year Review: Summary and Evaluation. Jacksonville Ecological Services Field Office, Jacksonville, Florida. 20 pp.

U.S. Fish and Wildlife Service. 1993. Recovery Plan for the Atlantic Salt Marsh Snake (*Nerodia clarkii taeniata*). Atlanta, Georgia. 24 pp.

Overall Vulnerability: ☐ High ☒ Medium ☐ Low

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The Atlantic salt marsh snake is not expected to forage in use sites and no direct effects are expected from exposure following mosquito control.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	No effects expected
Spray drift areas - Prey item mortality	Fish and amphibians
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	54% fish and amphibians

Risk modifiers: The Atlantic salt marsh snake is not expected to forage in use sites.

Allowable uses driving effects/other considerations:

We anticipate effects to the invertebrate prey base from malathion near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	740,534	80.98	128,225	14.02
Developed	*	140,389	15.35	7,019	0.77
Open Space Developed	*	103,514	11.32	5,176	0.57
Orchards and Vineyards	*	24,492	2.68	24,492	2.68
Other Crops	*	3,329	0.36	0	0
Other Grains	*	873	0.10	873	0.10
Nurseries	*	861	0.09	861	0.09
Vegetables and Ground Fruit	*	391	0.04	391	0.04
Corn	*	243	0.03	43	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		0	0	0	0
TOTAL[4]:		740,534	80.98	128,225	14.02

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 914,443 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 169,738 acres, 18.6%

Overall Usage: ☒ **High** ☐ **Medium** ☐ **Low**

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

CONSERVATION MEASURES

Rain restriction and aquatic habitat buffers: The Atlantic salt marsh snake is known to rely on aquatic habitat for food resources which may experience effects through malathion exposure in the aquatic system.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions and aquatic habitat buffers required of all agricultural and residential uses will reduce the level of effects to the prey base of the Atlantic salt marsh snake.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and ground fruit lower the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species, thus decreasing the risk of effects to the species.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service’s biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the Atlantic salt marsh snake. As discussed below, even

though the vulnerability and risk are medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The Atlantic salt marsh snake has a medium vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is medium, with a high amount of estimate usage within the range of the species, based on standard usage data. We do not anticipate that mortality or sublethal effects to individuals will occur on use sites or from spray drift, as current knowledge suggests that Atlantic salt marsh snakes do not forage in malathion use sites We estimated that across the species range, annual malathion uses pursuant to the labels could result in the loss of about 54% of aquatic amphibians and fish prey due to mosquito control. Additional mortality to aquatic amphibian and fish prey items may occur from spray drift.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we previously anticipated that usage would occur in up to 14.02% of the non-Federal portions of the species range annually based on standard past usage data. This 14.02% is based on malathion usage for mosquito control within the species' former range, including the counties of Indian River, Flagler, and Orange. Based on the most recent 5-year review (2019), recent population surveys indicate that viable populations of the Atlantic salt marsh snake only exist in Volusia County, Florida, near Merritt Island National Wildlife Refuge (Parkinson 2016), where malathion has not been documented as a mosquito control agent in recent past usage data. Therefore, malathion use as a mosquito control agent is likely not occurring within this species' range as described in the 2019 5-year review, although future use cannot be discounted. Current use of malathion is typically used to reduce resistance to the more commonly used pesticides for mosquito control, and therefore, malathion may be used in the future for such use, but most likely less than the 14.02% that we originally estimated. This large reduction in anticipated usage for mosquito control within the species' currently known range will significantly reduce overall reductions in prey, thus reducing impacts to the snake. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion. Additionally, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, residential use label changes, and reduced number of applications and rates on certain use sites, will further reduce the risk of exposure to prey resources associated with use sites.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing

the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species prey resources. Considered together, we expect these conservation measures will substantially reduce exposure to the Atlantic salt marsh snake's prey resources and therefore minimizes overall adverse effects to the species. Thus, while we anticipate that adverse effects to prey items will occur, we do not expect species-level effects because of the low amount of usage within the range, reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affected prey items), and the ability of the snakes to move to other suitable untreated forage habitats nearby.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the Atlantic salt marsh snake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Sternotherus depressus	Flattened musk turtle	169

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
At the time of listing in 1987, the flattened musk turtle was known from less than one-half of the approximately 125 sites in the Black Warrior River upstream of the Bankhead Dam (52 FR 22418). The current range includes William Bankhead National Forest (Sipsey Fork and Brushy Creek in the Sipsey drainage), Sipsey Fork, especially in the Bankhead National Forest; Upper Black Warrior River and Mulberry Fork and a new populations in Lost Creek and Lake Nicol (Mulberry drainage below the confluence with the Sipsey Fork and Upper Warrior River drainage). The species is limited throughout its current range to areas minimally impacted by pollution, sedimentation and impoundments (Dodd 2008). With the ongoing deterioration of water quality, expansion of urbanization, fragmented distribution caused by impoundments, small populations of flattened musk turtle, and reopened old coal mines and new coal mining sites; the individual numbers within the populations seem to be declining and all populations remain vulnerable to stochastic and anthropomorphic events.

Habitat degradation is the primary factor that has reduced the distribution of populations of the flattened musk turtle in the upper Black Warrior system (U.S. Fish and Wildlife Service 1990). Specifically the habitat of the flattened musk turtle has been highly degraded and fragmented by dams, reservoirs (Bankhead and Lewis Smith Lake Reservoir; Alabama Power Company 2006), smaller impoundments, industrial pollution, silviculture (USDA Forest Service 2007), agriculture, mining and urbanization (U.S. Fish and Wildlife Service 1987). Sediment is the most abundant pollutant in the Mobile River Basin (Alabama Department of Environmental Management 1996). Sedimentation in the upper Black Warrior River system has negatively affected the flattened musk turtle with the following injurious effects: (1) reduction of mollusks and other invertebrates used as food; (2) physical alteration of rocky habitats where the species forage and take cover, and (3) accumulation of substrate in which chemicals toxic to flattened musk turtles and their prey persist (Dodd et al. 1988). Increased sediment clogs gills of invertebrates and fish while increased water velocities carry suspended sediment that act as scrubbers, removing algae, plants and aquatic life from substrate (Waters 1995). Pollutants (i.e. fertilizers, pesticides, animal wastes, septic and gray water, and petroleum products) tend to

increase concentrations of nutrients and toxins in the water and alter the water chemistry such that the habitat and food sources for the species are negatively impacted.

Construction and road maintenance activities associated with mining, urban development, forestry and agriculture typically involve earth-moving activities that increase sediment loads into nearby aquatic systems through stormwater runoff during and after precipitation events. The Warrior Coal Basin lies underneath the majority of the Black Warrior River watershed. This basin is the southernmost coal deposit in Appalachia and the largest coal basin in Alabama, with approximately 94 active mines in the Black Warrior watershed (Southern Environmental Law Center 2009). Surface mining affects the distribution of the flattened musk turtle (Ernst et al. 1989, Dodd et al. 1986, Mount 1981). Runoff from coal surface mining generates pollution through acidification, increased mineralization, and sediment loading. Impacts associated with past mining activities and abandoned mines include leakage of sediment ponds and mine tailing (Mathis 2007; Diehl et al. 2004).

Mortality from disease since 1985 has led to a decline of the species in the Sipsey Fork population (Dodd 1985). Disease symptoms in Brushy Creek, Locust Fork, and Lost Creek along with heavy metal and bacteria counts, were reported and summarized by Dodd (2008) and Fonnesbeck and Dodd (2003). Although not very well understood, disease may be a significant threat to the species. Regulatory mechanisms are in place to protect aquatic species, but multiple stream reaches within the occupied habitat of the flattened musk turtle (i.e. portions of the Sipsey Fork, Brushy Creek, Blackwater Creek and Blackburn Fork) fail to meet current State of Alabama regulatory standards. The lack of specific information on the sensitivity of the flattened musk turtle to common industrial and municipal pollutants limits the application of these regulations.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2014. Flattened Musk Turtle (*Sternotherus depressus*) 5-Year Review: Summary and Evaluation. Mississippi Ecological Services Field Office, Jackson, Mississippi. 30 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed:

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected

Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	Risk of mortality if exposed on use sites
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	11% aquatic invertebrates
Spray drift areas - Prey item mortality	Up to 25% aquatic invertebrates
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	16% aquatic invertebrates

Risk modifiers:
The flattened musk turtles diet consists primarily of mollusks and aquatic insects. Adults appear to target and feed primarily on gastropods (aquatic snails), clams (including the exotic Asiatic clam) and mussels, while juveniles (less than 2.75 inches) primarily prey upon softer-bodied aquatic insects.

The nesting season is May through September. While very little is known about nesting preference of the flattened musk turtle, it is thought that they nest within 100 feet from the river bank in full to partial sun areas such as woodlands and roadsides.

Allowable uses driving effects/other considerations: Anticipated effects to aquatic invertebrates on use sites assumes that all of the overlap for each site represents suitable habitat for aquatic invertebrates. Effects may be over-estimated depending on habitat suitability of use sites. Overlap with developed and open space developed use sites accounts for most anticipated prey mortality on use sites for the flattened musk turtle.

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	718,235	16.27	18,167	0.41
Open Space Developed	I	260,245	5.89	13,012	0.29
Developed	I	173,700	3.93	8,685	0.20
Corn	I	18,258	0.41	585	0.01
Cotton	I	8,316	0.19	7,484	0.17
Other Crops	I	5,185	0.12	0	0
Other RowCrops	I	951	0.02	951	0.02
Wheat	I	740	0.02	297	0.01
Other Grains	I	501	0.01	362	0.01
Vegetables and Ground Fruit	I	419	0.01	181	<0.01
Orchards and Vineyards	I	28	<0.01	28	<0.01
Pasture	I	12	<0.01	6	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		468,354	10.61	31,591	0.72
TOTAL[4]:		1,186,590	26.88	49,758	1.13

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself).

 # acres in species range: 4,414,945 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 357,159 acres, 8.1%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Rain restriction and aquatic habitat buffers: The flattened musk turtle is known to rely on aquatic habitat for food resources or is otherwise closely associated with aquatic habitats and may experience effects of malathion through effects to the aquatic system.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions and aquatic habitat buffers required of all agricultural and residential uses will reduce the level of effects impacting the flattened musk turtle.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service’s biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the flattened musk turtle. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The flattened musk turtle has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portions of their range is estimated to be medium, with a low amount of estimated usage

within the range, based on standard usage data. We do not anticipate that mortality or sublethal effects from consuming contaminated prey will occur on use sites or from spray drift. Mortality may occur if the species was exposed to the chemical on use sites. We estimated that across the non-Federal portions of the species range, annual malathion uses pursuant to the labels could result in the loss of the species prey base, about 16% of aquatic invertebrates due to mosquito control, 11% aquatic invertebrates on use sites, and up to 25% aquatic invertebrates as a result of spray drift across the species range. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 1.13% of the non-Federal portions of the species range annually based on standard past usage data. Mosquito adulticide applications account for 0.41% of this usage. The flattened musk turtle is primarily aquatic, only venturing out of the water for nesting (up to 100 feet from the river bank) and basking (basking on deadwood, with easy escape to water). While flattened musk turtles could enter a use site (during egg laying), it is likely a rare event that this would coincide with a malathion application. Also, since the turtles do not travel far from the river (typically <100 feet from the river bank), it is possible that they may never actually enter a use site. However, prey resources could be impacted from spray drift and mosquito adulticide applications. In addition to the extremely low malathion use within the species range, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, and residential use label changes, will further reduce the risk of exposure to prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Considered together, we expect these conservation measures will substantially reduce exposure to the flattened musk turtle’s prey resources and therefore minimizes adverse effects to the species. Thus, while we anticipate low levels of adverse effects to prey items will occur, we do not expect species-level effects because of the low amount of usage within the range, reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affect prey items), and the ability of the turtles to move to other suitable untreated forage habitats nearby.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the flattened musk turtle in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Graptemys oculifera	Ringed map turtle	171

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Species/Populations neither constrained nor widespread
Number of Populations: Multiple populations (few)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The ringed map turtle is restricted to the Pearl River and its major tributaries in Mississippi and Louisiana. It is not found in the tidally influenced section of the lower West Pearl River. This species' distribution has been monitored periodically since the late 1970's (McCoy and Vogt 1980; Jones and Hartfield 1995; Dickerson and Reine 1996; Lindeman 1998; Shively 1999; Jones 2009; LDWF 2009). The spatial distribution of the ringed map turtle throughout the Pearl River drainage has not changed based on these studies. The decline of the ringed map turtle has been attributed to habitat modification and water quality deterioration, reservoir construction, channelization, desnagging for navigation, siltation, and the subsequent loss of invertebrate food sources (U.S. Fish and Wildlife Service 1988). Little information is available on any improvements that have been made in quality and quantity of ringed map turtle habitat. During a study of the largest population of ringed map turtles, Jones (2006) found that the turtles endured a very high level of nest predation from both vertebrate (84% of nests) and invertebrate (24% of remaining eggs) predators.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2010. Ringed Map Turtle (*Graptemys oculifera*) 5-Year Review: Summary and Evaluation. Mississippi Ecological Services Field Office, Jackson, Mississippi. 17 pp.

Overall Vulnerability: ☐ **High** ☒ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Ringed map turtles exposed to malathion at maximum rates on certain use sites are may experience effects to growth and reproduction (developed, open space developed, cotton, other row crops) and are not expected to experience mortality. Effects from spray drift are not expected.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	7% (G, R – low effects; terrestrial invertebrates only)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	7% aquatic and terrestrial invertebrates
Spray drift areas - Prey item mortality	Up to 15% invertebrates
Plants affected (decline in growth)	7%
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	36% aquatic and terrestrial invertebrates

Risk modifiers:
Allowable uses driving effects/other considerations: Overlap with developed and open space developed uses account for most of the anticipated effects.

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	3,206,907	36.16	643,715	7.26
Open Space Developed	D, I	410,607	4.63	20,530	0.23
Developed	D, I	175,487	1.98	8,774	0.10
Corn	I	36,385	0.41	3,221	0.04
Cotton	D, I	19,249	0.22	10,177	0.11

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Other Crops	I	4,052	0.05	0	0
Other RowCrops	D, I	2,675	0.03	688	0.01
Wheat	I	2,023	0.02	757	0.01
Other Grains	I	1,608	0.02	1,529	0.02
Vegetables and Ground Fruit	D, I	242	<0.01	237	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		608,260	6.86	40,406	0.46
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		652,327	7.36	45,914	0.52
TOTAL[4]:		3,859,234	43.52	689,629	7.78

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 8,868,363 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 515,542 acres, 5.8%

Overall Usage: ☐ **High** ☒ **Medium** ☐ **Low**

CONSERVATION MEASURES

Rain restriction and aquatic habitat buffers: The ringed map turtle is known to rely on aquatic habitat for food resources or is otherwise closely associated with aquatic habitats and may experience effects to its prey base through exposure to malathion from the aquatic system.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most

[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions and aquatic habitat buffers required of all agricultural and residential uses will reduce the level of effects impacting the ringed map turtle.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the ringed map turtle. As discussed below, even though the vulnerability and risk are medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The ringed map turtle has a medium vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses, across the non-Federal portion of the species' range is anticipated to be medium, with a medium amount of estimated usage based on standard usage data. We do not anticipate mortality of individuals of the species will occur on use sites or from spray drift; however, 7% of turtles across the non-Federal portion of the species range may experience sublethal effects (growth and reproduction) if the species consumes contaminated terrestrial invertebrates and all use sites are treated. We estimated that across the species range, annual malathion uses pursuant to the labels could result in the loss of the prey base, about 36% of aquatic and terrestrial invertebrates due to mosquito control and 7 to 15% aquatic and terrestrial invertebrates on use sites (7%) and spray drift areas (15%) within the non-Federal portion of the species range. In addition, 7% of plants may experience a decline in growth. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to approximately 8% of the

non-Federal portions of the species range annually based on standard past usage data provided above, primarily as a result of mosquito adulticide applications (7%). The ringed map turtle is primarily aquatic, only venturing out of the water for nesting (sandy beaches) and basking (basking on deadwood, with easy escape to water). Nesting may occur up to 200 meters from shore. Since ringed map turtles' preferred nesting habitat occurs directly adjacent to their aquatic habitat, we do not anticipate any direct applications to these areas; however, spray drift and mosquito adulticide applications could occur, which may impact prey resources. Ringed map turtles feed primarily on terrestrial and aquatic invertebrates. While we anticipate that adverse effects to prey items will occur, we do not expect species-level effects because only 8% of the non-Federal portion of the species range is being treated annually. In addition, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, and residential use label changes, will further reduce the risk of exposure to prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Considered together, we expect these conservation measures will substantially reduce exposure to the ringed map turtle and its prey resources and therefore minimizes overall risk and adverse effects to the species. Thus, while we anticipate low levels of adverse effects to prey items will occur, we do not expect species-level effects because of the moderate amount of usage within the range, reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affected prey items), and the ability of the turtles to move to other suitable untreated forage habitats nearby. Additionally, we do not anticipate substantial impacts from sublethal effects since we do not expect individuals would encounter and consume contaminated invertebrates in a large enough quantity to cause sublethal effects.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the ringed map turtle in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Graptemys flavimaculata	Yellow-blotched map turtle	172

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The yellow-blotched map turtle is known to occur in several areas, from the Leaf River from the U.S. Highway 84 bridge in Covington County (Cliburn 1971) downstream to the confluence of the Leaf and the Chickasawhay Rivers. It occurs in the Chickasawhay River upstream to Enterprise in Clarke County (McCoy and Vogt 1987). The species is also present in the Pascagoula River from its point of origin near Merrill, George County, south to where the river forks into the East and West Pascagoula channels near Vancleave, Jackson County. It occurs in the West Pascagoula to just south of the 1-10 bridge (Dobie 1991), and has been observed in the East Pascagoula River from the fork downstream to approximately 1 mile north of the 1-10 bridge (T.C. Majure, Mississippi Dept. Wildlife, Fisheries and Parks, pers. comm. 1991). A small population also occurs in the lower Escatawpa River, Jackson County (T.C. Majure, pers. comm. 1991). Cliburn (1971) reported specimens from Tallahala Creek, Perry County (T4N, R11W, Sec. 9), approximately 13 river kilometers (8 river miles) above its confluence with the Leaf River, and from Red Creek at MS Hwy. 57, Jackson County (T45, R8W, Section 12), approximately 18 river kilometers (11 river miles) above its confluence with the Pascagoula River.

A variety of factors that may have contributed to the decline of the yellow-blotched map turtle: Sedimentation and stream modification; commercial collecting, shooting, and trapping; diseases and predation; and water quality degradation.

2018 5-Year Review:
The yellow-blotched map turtle is endemic to rivers and large creeks of the Pascagoula River system of southeastern Mississippi. Along the river, this turtle requires structures (logs, snags, deadwood) on which it can safely bask and obtain food while being protected from predation, and suitable nesting habitat (large, high, sandbars adjacent to the river). At the time the yellow-blotched map turtle was listed, its decline was attributed to habitat modification and water quality deterioration resulting from runoff from cities, streets, and agriculture; reservoir construction (impoundments); channelization; desnagging for navigation and flood control;

siltation; and the subsequent loss of invertebrate food sources resulting from habitat degradation (U.S. Fish and Wildlife Service 1991).

Pollutants include excessive nutrients, organic enrichment/low dissolved oxygen, pesticides, mercury and other toxics, sedimentation/siltation, and pathogens. Mercury in the Escatawpa River and the entire length of the Pascagoula River continues to result in advisories for limiting human consumption of fish from these areas (MDEQ 2008). These lists and reports are valuable tools to monitor the impacts to water quality in the Pascagoula River. However, pollutants are continuing to affect water quality in the drainage. Benchmarks for improving water quality are not supported by enforceable regulation and thus there has been limited success in reducing water quality degradation within the yellow-blotched map turtle's habitat.

The purchase of conservation lands has provided a measure of habitat protection for the yellow-blotched map turtle. Conservation lands include properties along the mainstem Pascagoula River frontage and along both the Leaf River and Chickasawhay River drainages. No conservation lands currently occur within areas of the Escatawpa River known to be occupied by the yellow-blotched map turtle. The protection of conservation lands is very important but it does not eliminate many of the existing threats to the yellow-blotched map turtle. The management of these preserves focuses on terrestrial habitat; management plans need to be expanded to include protections for the turtle, especially the production of a steady supply of deadwood for use as basking sites and source of food items preferred by the yellow-blotched map turtle. Threats to the species are ongoing with many of those present at the time of listing likely to continue into the future. River channel erosion with subsequent habitat loss, potential reservoirs, water quality degradation, "recreational" shooting, and commercial collecting continue to be problems. Not addressed specifically in the final rule, but a current threat, is the increasing amount of boating and other recreational uses of the Pascagoula River drainage, particularly the lower Pascagoula River, which have direct and indirect effects on yellowblotched map turtle populations and their habitat. Another newly-identified threat is the increase in the already high level of nest predation. This may represent a factor that when added to the other threats and the current low reproductive potential, will seriously impact yellow-blotched map turtle populations.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2018. Yellow-blotched Map Turtle (*Graptemys flavimaculata*) 5-Year Review: Summary and Evaluation. Mississippi Ecological Services Field Office, Jackson, Mississippi. 33 pp.

U.S. Fish and Wildlife Service (USFWS). 1993. Recovery Plan for the Yellow-blotched Map Turtle (*Graptemys flavimaculata*). Atlanta, Georgia. 23 pp.

Overall Vulnerability: ☒ High ☐ Medium ☐ Low

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Yellow blotched map turtles exposed to malathion at maximum rates on use sites or from spray drift are not expected to experience direct effects.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	6% aquatic invertebrates
Spray drift areas - Prey item mortality	Up to 17% aquatic invertebrates
Plants affected (decline in growth)	6%
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	29% aquatic invertebrates

Risk modifiers:
Allowable uses driving effects/other considerations: Overlap with developed and open space developed accounts for most of the anticipated indirect effects on use sites.

We anticipate effects to the aquatic invertebrate prey base from malathion on or near use sites or from mosquito control applications. Aquatic invertebrates taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	1,660,933	29.02	263,401	4.60
Open Space Developed	I	226,718	3.96	11,336	0.20
Developed	I	88,211	1.54	4,411	0.08
Other RowCrops	I	13,548	0.24	5,282	0.09
Cotton	I	13,509	0.24	12,846	0.22
Other Crops	I	8,470	0.15	5	<0.01
Corn	I	4,835	0.08	2,384	0.04
Vegetables and Ground Fruit	I	1,876	0.03	1,831	0.03
Other Grains	I	610	0.01	610	0.01
Wheat	I	291	0.01	217	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0.00	0	0.00
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		358,067	6.26	38,922	0.68
TOTAL[4]:		2,019,000	35.28	302,332	5.28

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 5,772,928 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 977,613 acres, 17.1%

Overall Usage: ☐ **High** ☒ **Medium** ☐ **Low**

CONSERVATION MEASURES

Rain restriction and aquatic habitat buffers: The yellow-blotched map turtle is known to rely on aquatic habitat for food resources or is otherwise closely associated with aquatic habitats and may experience effects to its prey base from exposure to malathion in the aquatic system.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions and aquatic habitat buffers required of all agricultural and residential uses will reduce the level of effects impacting the yellow-blotched map turtle.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service’s biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the Yellow-blotched map turtle. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The yellow-blotched map turtle has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of the species range is medium, with a medium amount of estimated usage, based on standard usage data. We do not anticipate that mortality or sublethal effects will occur to individuals on use sites or from spray drift. We estimated that across the non-Federal portion of the species range, annual malathion uses pursuant to the labels could result in the loss of forage base, about 29% of aquatic invertebrates due to mosquito control and 6 to 17% aquatic invertebrates on use sites (6%) and spray drift areas (17%). In addition, 6% of plant species may experience a decline in growth. We did not quantitatively evaluate use or usage on Federal lands

that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 5.28% of the non-Federal portion of the species range annually based on standard past usage data. The yellow-blotched map turtle is primarily aquatic, only venturing out of the water for nesting (sand bars and small clearings along the river) and basking (basking on deadwood, with easy escape to water). Since yellow-blotched map turtles' preferred nesting habitat is directly adjacent to their aquatic habitat, we do not anticipate any direct applications to these areas, however, spray drift and mosquito adulticide applications may occur which may impact prey resources. Yellow-blotched map turtles feed on sponges, mollusks, insects and algae, with a greater preference by females to feed on mollusks during egg development as energy needs increase. Spray events coinciding with the egg development phase may reduce aquatic invertebrates during the critical time when more food is needed prior to egg laying. However, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, and residential use label changes, will reduce the risk of exposure to prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Considered together, we expect these conservation measures will substantially reduce exposure to the yellow-blotched map turtle and its prey resources and therefore minimizes overall risk and adverse effects to the species. Thus, while we anticipate low levels of adverse effects to prey items will occur, we do not expect species-level effects because of the moderate amount of usage within the range, reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affected prey items), and the ability of the turtles to move to other suitable forage habitats nearby (e.g., upstream) or forage on other non-invertebrate food resources.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the yellow-blotched map turtle in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

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

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Population size/location unknown
Number of Populations: Multiple populations (few)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

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 (Loding 1922, Haltom 1931, Carr 1940, Cook 1954, Diemer and Speake 1983, Lohoefener and Altig 1983, Moler 1985a). The eastern indigo snake has been extirpated in Alabama and Mississippi and, since listing under the ESA its distribution has further contracted in other areas, particularly in the Florida Panhandle due to the decline of gopher tortoise populations (Enge et al. 2013). 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 (Service 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 SSA (Service 2019).
Fifty-three (53) potential populations were estimated in the SSA (Service 2019). Of these populations, resilience was classified based primarily on habitat conditions as follows: 8 very low, 28 low to medium-low, 13 medium to medium-high, and 4 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.

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.

EB/CE Source:
U.S. Fish and Wildlife Service (USFWS). 2019. Eastern Indigo Snake (*Drymarchon corais couperi*) 5-Year Review: Summary and Evaluation. Georgia Ecological Services Field Office, Athens, Georgia. 51 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Eastern indigo snakes exposed to malathion at maximum rates on use sites could experience effects to growth, reproduction, and behavior, but are not expected to experience mortality.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	Up to 16% (G, R, B – low effects; arthropods, birds, and mammals only); Up to 15% (G, R – high effects; birds and mammals only)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	15% fish, 8% birds, 21% terrestrial invertebrates, reptiles, and amphibians
Spray drift areas - Prey item mortality	Fish, invertebrates, reptiles, and amphibians
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	65% (R – low effects, birds only)
Indirect	46% fish and amphibians. 65% terrestrial invertebrates, 6% reptiles and terrestrial amphibians

Risk modifiers: We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☒ **High** ☐ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	D, I	39,851,869	64.67	2,532,656	4.11
Open Space Developed	D, I	3,420,541	5.55	171,027	0.28
Developed	D, I	2,889,140	4.69	144,457	0.23
Pine Seed Orchards	D, I	1,751,123	2.84	25	<0.01
Cotton	D, I	1,226,779	1.99	49,144	0.08
Orchards and Vineyards	D, I	1,145,646	1.86	267,177	0.43
Other Crops	D, I	867,679	1.41	0	0
Other RowCrops	D, I	801,873	1.30	25,880	0.04
Other Grains	D, I	661,504	1.07	22,365	0.04
Corn	D, I	315,330	0.51	1,747	<0.01
Wheat	D, I	39,383	0.06	2,325	<0.01
Pasture	D, I	383	<0.01	79	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		13,119,381	21.29	729,155	1.11
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		13,119,381	21.29	729,155	1.11
TOTAL[4]:		52,971,249	85.96	3,261,811	5.22

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

 # acres in species range: 61,626,128 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 6,028,326 acres, 9.8%

Overall Usage: ☐ **High** ☒ **Medium** ☐ **Low**

CONSERVATION MEASURES

Rain restriction and aquatic habitat buffers: While the eastern indigo snake is not strictly an aquatic species, it is known to rely on aquatic habitat for food resources or is otherwise closely associated with aquatic habitats and may experience effects to its prey base through exposure to malathion.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions (which allow for malathion to degrade before runoff events can occur) and aquatic habitat buffers required of all agricultural and residential uses will reduce the level of effects impacting the eastern indigo snake.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit set the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10

days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the eastern indigo snake. As discussed below, even though the vulnerability and risk are high for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The eastern indigo snake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of the species range is anticipated to be high, with a medium amount of estimated usage based on standard usage data. We do not anticipate mortality will occur on use sites or from spray drift; however, up to 65% of individuals across the non-Federal portion of the species range could experience low-level sublethal effects (reproduction) from consuming contaminated birds as a result of mosquito adulticide applications. Additional low-level sublethal effects (growth, reproduction, behavior) could occur to 16% of individuals across the range as a result of consuming contaminated arthropods, birds, and mammals and 15% of individuals could experience high-level sublethal effects (growth, reproduction) from consuming contaminated birds and mammals. In addition, we estimated that across the species range, annual malathion uses pursuant to the labels could result in the loss of prey resources, about 46% of aquatic amphibians and fish, 65% terrestrial invertebrates, and 6% reptiles and terrestrial amphibians due to mosquito control, and 15% fish, 8% birds, and 21% terrestrial invertebrates, reptiles, and amphibians on use sites. Additional mortality to prey resources could occur from spray drift. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to approximately 5.22% of the non-Federal portion of the species range annually based on standard past usage data provided above. This is primarily the result of mosquito adulticide applications (4.11%). The eastern indigo snake prefers upland habitat types (e.g. longleaf pine sandhills, scrub, pine flatwoods, tropical hardwood hammocks, and coastal dunes), but also uses a variety of lowland and human-altered habitats. They 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. Eastern indigo snakes routinely eat turtles, lizards, amphibians, small birds, mammals, and eggs. Although malathion usage across the range

is relatively low, the likelihood of at least some individuals encountering contaminated prey items within their range seems likely due to their large home ranges and seasonal movements. We anticipate that small numbers of individuals will experience sublethal effects to varying degrees over the duration of the action, although we do not anticipate that effects would result in species-level effects. We also anticipate that adverse effects to prey items will occur; however, eastern indigo snakes are opportunistic feeders and have the ability to move away from affected areas in search of food and reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affect prey items) In addition, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, residential use label changes, and reduced number of applications and rates on certain use sites will reduce the risk of exposure to the species and its prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit), further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species and its prey. Considered together, we expect these conservation measures will substantially reduce exposure to the eastern indigo snake and its prey resources and therefore minimizes overall risk and adverse effects to the species. Thus, while we anticipate low levels of adverse effects to individuals (sublethal) and the loss of a small number of prey resources from the proposed use of malathion over the duration of the action, we do not anticipate species-level effects to this species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the eastern indigo snake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Uma inornata	Coachella Valley fringe-toed lizard	175

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Small, endemic, constrained, and/or isolated population(s)
Number of Populations: Multiple populations (few)
Species Trends: All populations stable, with none known to be increasing or decreasing
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The Coachella Valley fringe-toed lizard was historically and remains endemic to the Coachella Valley. The Coachella Valley Association of Governments (CVAG), created a model for the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) and estimated that as of 2000, 27,000 acres (10,932 ha, 43 percent) of habitat, of the 63,000 acres (25,506 ha) available at listing (USFWS 1980, p. 63812) remained (Table 1). Thus, according to this CVAG estimate, the distribution of suitable Coachella Valley fringe-toed lizard habitat decreased by more than 50 percent since the species was listed. There are currently 59 presumed extant occurrences in the Coachella Valley with 41 occurring, or partially occurring, within six conservation area boundaries of the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) (CFWO Staff, CNDDB 2010). Conservation areas include Thousand Palms Conservation Area, Whitewater Floodplain Conservation Area, Willow Hole Conservation Area, Edom Hill Conservation Area, Snow Creek/Windy Point Conservation Area, and East Indio Hills Conservation Area. Threats: Small population size and climate change are newly recognized threats facing Coachella Valley fringe-toed lizards since listing.

More data is needed to fully assess population numbers, however, impacts from population fluctuations, genetic bottlenecks, and population isolation could pose a significant threat for this species rangewide especially when compounded with threats associated with habitat loss, and modification analysis. Though currently difficult to quantify, changes in climate including higher temperatures, drought, and longer periods of time between heavy rainfall events pose a significant threat to this species rangewide. Higher temperatures will affect foraging and burrowing behavior of this species and extended periods of drought and stochastic climatic events will affect the seasonal deposition of fluvial sediments needed to rejuvenate decreasing Coachella Valley fringe-toed lizard habitat.

EB/CE Source:
U.S. Fish and Wildlife Service (USFWS). 2010. Coachella Valley Fringe-toed Lizard (*Uma inornata*) 5-Year Review: Summary and Evaluation. Carlsbad Fish and Wildlife Office, Carlsbad, California. 53 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Individuals exposed to malathion on use sites with higher allowable application rates could experience mortality from consumption of leaves or terrestrial invertebrates, or if exposed to direct spray.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	1-2% terrestrial invertebrates, leaves; 0% reptiles
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	4% (G, R – low effects; arthropods, leaves)
Direct spray or contact with contaminated media	Mortality if exposed on use sites (except mosquito control)
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	4% reptiles, terrestrial invertebrates
Spray drift areas - Prey item mortality	Up to 4% terrestrial invertebrates
Plants affected (decline in growth)	4%
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	11% terrestrial invertebrates, 1% reptiles

Risk modifiers:

Allowable uses driving effects/other considerations: Effects are driven by overlap with developed, and open space developed.

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where

estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Agricultural usage based on CalPUR data:

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	25,010	11.38	0	0
Developed	D, I	6,096	2.77	305	0.14
Open Space Developed	D, I	1,361	0.62	68	0.03
Other Crops	I	786	0.36	0	0
Vegetables and Ground Fruit	D, I	676	0.31	3	<0.01
Orchards and Vineyards	D, I	627	0.29	0	0
Pasture	I	42	0.02	0	0
Corn	I	9	<0.01	0	0
Cotton	D, I	6	<0.01	0	0
Wheat	I	4	<0.01	0	0
Nurseries	D, I	3	<0.01	2	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		8,770	3.99	376	0.18
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		9,611	4.37	376	0.18
TOTAL[4]:		34,621	15.76	376	0.18

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 337,215 acres
% of range in California (i.e., where CalPUR data is available): 100%
Range overlap with Federal lands: 299,903 acres, 88.9%

Overall Usage: ☐ High ☐ Medium ☒ Low

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
C[4] TOTAL includes usage on all use sites with effects, including mosquito control.

CONSERVATION MEASURES

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the Coachella Valley fringe-toed lizard. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The Coachella Valley fringe-toed lizard has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of the species range is medium, with a low amount of estimated usage based on CalPUR usage data. We estimated that annual malathion uses pursuant to the labels could result in the mortality of the species (1-2%) on use sites from consuming contaminated terrestrial invertebrates or by being in direct contact with malathion spray. Approximately 4% of individuals across the non-Federal portions of the species range exposed to contaminated arthropods or leaves could experience low-level sublethal effects (growth and behavior). Additionally, applications on use sites could reduce prey resources (reptiles, terrestrial invertebrates) by 4%, spray drift could subsequently reduce terrestrial invertebrates by 4% and 4% of plants could see a reduction in growth. Mosquito adulticide applications could reduce the availability of terrestrial invertebrates by 11% and reptiles by 1%. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.18% of the non-Federal

portion of the species range annually based on CalPUR past usage data. No reported mosquito adulticide applications have occurred (CalPUR data, 2012-2017), and thus we anticipate future applications are unlikely over the duration of the proposed action. Nearly 70% of Coachella Valley fringe-toed lizard occur or partially occur within protected conservation areas. The species occupies a specific habitat type consisting of accumulations of windblown (aeolian) sand. We do not expect that developed use sites contain suitable habitat for this species; however, suitable habitat may remain in open-space developed areas. We do anticipate that some individuals (i.e., those outside conservation areas) of Coachella Valley fringe-toed lizards may be exposed to malathion, may experience sublethal effects, or be subjected to a slightly reduced prey items over the duration of the proposed action; however, with such low usage within the species range, we do not expect species-level effects. In addition, we anticipate that the conservation measure above (i.e., residential use label changes), will significantly reduce the risk of exposure to the species and its' prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. This change to residential use substantially reduces exposure to the Coachella Valley fringe-toed lizard and therefore minimizes overall risk and adverse effects to the species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the Coachella Valley fringe-toed lizard in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Crocodylus acutus	American crocodile	176

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened; Downlisted to Threatened (3/20/2007)
Distribution: Species/Populations neither constrained nor widespread
Number of Populations: Multiple populations (few)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The current distribution of the American crocodile is limited to extreme South Florida including coastal areas of Miami-Dade, Monroe, Collier, and Lee counties. In Biscayne Bay, crocodiles have been observed as far north as Crandon Park, Bill Baggs Cape Florida SRA, and Snapper Creek (J. Maguire, Miami-Dade County Park and Recreation Department, personal communication 1998). The distribution of crocodiles during the non-nesting season may vary considerably among years since adult crocodiles can disperse great distances (Kushlan and Mazzotti 1989). However, the majority of crocodiles are present in the vicinity of core nesting areas, located near Biscayne and Florida bays (Kushlan and Mazzotti 1989). Throughout their range, American crocodiles are sympatric with other crocodilians, although they tend to inhabit more saline waters than most other species. There is designated critical habitat for this species.

Historical hunnting and habitat modification greatly reduced the numbers and available area for the species. Formerly occupied habitats from Lake Worth, Palm Beach County, south to central Biscayne Bay, Miami-Dade County, have been largely destroyed by urbanization. In some of these areas, crocodiles have been essentially extirpated (DeSola 1935, FWS 1984). Human encroachment into estuarine habitats can disturb crocodiles to such an extent that normal behavior patterns are altered. As recreational demands increase on public lands, indirect disturbance by apparently innocuous human activities such as camping, fishing, and boating are expected to increasingly affect crocodiles. Observations suggest that repeated close human presence may cause female crocodiles to abandon nests or relocate nest sites (Kushlan and Mazzotti 1989). Recreational boating, including use of jet skis, has been limited in portions of the American crocodile's habitat within Everglades National Park, but public demands for additional recreational opportunities will likely threaten these sanctuaries in the future. Natural, catastrophic, stochastic events such as hurricanes also are known to adversely affect American crocodiles and may be one of the most important factors limiting the number and distribution of this species in South Florida. Crocodiles are long-lived and suffer high juvenile mortality and must produce many young over their lifetime to ensure sufficient recruitment and population persistence. Natural events that add substantial adult mortality can result in long periods of little

or no recruitment. Failure to successfully recruit age classes in consecutive years can, if repeated periodically, depress small populations. Crocodiles undoubtedly perish during tropical storms and hurricanes that make landfall in extreme South Florida. The tidal surges, rough seas, and high winds probably result in direct mortality, but may also erode important nesting beaches, destroy nests, and alter other important habitat features. The adverse effects of tropical weather have not been quantified or reported extensively in the literature."

EB/CE Source:
U.S. Fish and Wildlife Service. 1999. South Florida Multi-Species Recovery Plan. South Florida Ecological Services Field Office, Vero Beach, Florida.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: American crocodiles exposed to malathion at maximum rates are not expected to experience mortality on use sites but could experience effects to growth and/or reproduction from consuming contaminated bird and mammals on all use sites. Consumption of contaminated benthic invertebrates, fish, and reptiles is not expected to result in adverse effects to American crocodiles.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	Up to 25% (G, R – birds and mammals only), 0% for invertebrates, fish, reptiles
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	Up to 25% aquatic invertebrates, reptiles, amphibians; up to 14% fish and birds
Spray drift areas - Prey item mortality	Effects to fish, reptiles, amphibians
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	53% (R – birds only, low effects), 0% from all other dietary items
Indirect	53% aquatic invertebrates, 35% fish and amphibians, 5% reptiles; no effect to mammals and birds

Risk modifiers: The current range of the American crocodile in Florida largely consists of coastal areas of Broward, Charlotte, Collier, Lee, Miami-Dade and Monroe Counties. Crocodiles are regularly observed in the Everglades National Park along the shoreline of Florida Bay, in the Florida Keys and adjacent canals and wetlands at the Florida Power and Light Turkey Point Nuclear Power Plant. Crocodiles are currently found as far north as Tampa Bay on the Florida's west coast and Brevard County on the east.

American crocodiles are opportunistic feeders and will eat whatever they can catch and consume. The diet of adult crocodiles consists of snakes, fish, crabs, small mammals, turtles, and birds. Adult crocodiles are capable of taking large prey but generally do not capture prey larger than a raccoon or cormorant. Hatchlings feed largely on small fish but will also eat crabs, snakes, insects, and other invertebrates. Crocodiles usually forage from immediately prior to sunset to just after sunrise.

The American crocodile in south Florida occurs primarily in mangrove swamps and along low-energy mangrove-lined bays, creeks and inland swamps. Deep water habitats (>1.0 meter [3.3 ft]) are also known to be an important component of crocodile habitat. Crocodiles exhibit seasonal differences in habitat use. Nesting habitat includes sites with sandy shorelines or raised marl creek banks adjacent to deep water. Crocodiles also nest on berms and other sites where sandy fill has been placed.

Courtship and breeding occur in late winter and early spring, and nests are usually built in late April or early May.

Allowable uses driving effects/other considerations: Effects to the American crocodile are primarily anticipated due to overlap with developed and open space developed use sites, and consumption of certain food items (i.e., birds and mammals). The highest sublethal effect estimates are based on these dietary items alone and would assume that all individuals overlapping with these use sites would consume these items preferentially. However, the American crocodile is an opportunistic feeder and, therefore, effects are likely to be lower than predicted for consuming these dietary items exclusively. Similarly, we predict that the American crocodile is only likely to experience sublethal effects if consuming birds exposed from mosquito control (i.e., not mammals or other dietary items).

We anticipate effects to portions of the prey base (i.e., invertebrates, fish, amphibians, reptiles, birds) from malathion on or near use sites or from mosquito control applications. Species within these taxa taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These effects would also be tempered by the opportunistic nature of the American crocodile.

Overall Risk: ☒ High ☐ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	D	2,810,163	52.75	1,482,694	27.83
Developed	D	916,443	17.20	45,822	0.86
Other Grains	D	3,844	0.07	3,844	0.07
Open Space Developed	D	374,079	7.02	18,704	0.35
Pasture		0	0.00	0	0.00
Other Crops	D	10,569	0.20	0	0.00
Orchards and Vineyards	D	30,301	0.57	7,415	0.14
Vegetables and Ground Fruit	D	11,684	0.22	2,145	0.04
Pine Seed Orchards	D	0	0.00	7,169	0.13
Rice	D	40	0.00	18	0.00
Corn	D	18	0.00	61	0.00
Nurseries	D	4,659	0.09	4,659	0.09
Sub-TOTAL (D): *Other uses with direct effects only*[3]		1,351,639	25.37	89,838	1.69
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		1,351,639	25.37	89,838	1.69
TOTAL[4]:		4,161,802	78.12	1,572,532	29.52

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 5,327,681 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 1,268,353 acres, 23.81%

Overall Usage: ☒ **High** ☐ **Medium** ☐ **Low**

CONSERVATION MEASURES

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Rain restriction: Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values, (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of effects.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit set the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species, thus decreasing the risk of effects to the species.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service’s biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the American crocodile. As discussed below, even though the vulnerability and risk are high for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The American crocodile has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-

Federal portion of the species range is anticipated to be high, with a high amount of estimated usage within the range, based on standard usage data. We do not anticipate that mortality to crocodiles will occur on use sites or from spray drift; however, we estimated that annual malathion uses pursuant to the labels across the non-Federal portion of the species range could cause 25% of individuals to experience sublethal effects (growth and reproduction) from consuming contaminated birds and mammals on use sites and 53% of individuals to experience sublethal effects (reproduction - low effects) from consuming contaminated birds as a result of mosquito control applications. Additionally, we estimated that annual malathion uses pursuant to the labels could result in the loss of about 53% of aquatic invertebrates, 35% fish and amphibians and 5% reptiles due to mosquito control and 25% aquatic invertebrates, reptiles, and amphibians, and 14% birds and fish on use sites within the non-Federal portion of the species range. Spray drift may cause additional mortality to amphibians, fish and reptiles. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we estimated that usage will occur in up to 29.52% of the species range annually based on standard past usage data, occurring on the non-Federal portion of the range. Mosquito adulticide applications account for 27.83% of this usage. As stated before, we do not anticipate that mosquito control will occur on 27.83% of the species range, since we looked at a worst case scenario (i.e., each acre is only treated once in a given year). In most cases, mosquito adulticide applications occur multiple times to the same general locations in a given year. For example, Miami-Dade County (https://www.miamidade.gov/global/solidwaste/mosquito/home.page), which only uses truck-mounted sprayers for malathion applications, may spray a designated area (e.g, Little River, Miami Beach North, South Miami), which is generally the more populated areas, anywhere from two to five times in a given month and likely even more in a given year. Therefore, we anticipate that the percent of the species non-Federal range treated with malathion is likely much less than 27.83% due to locations the chemical is actually applied and how often it is applied in a given year.

The breeding range of the American crocodile is still restricted relative to its reported historic range (Kushlan and Mazzotti 1989a), with most breeding occurring on the mainland shore of Florida Bay between Cape Sable and Key Largo (Mazzotti et al. 2002). Most of the remaining suitable habitat is currently protected in public ownership (e.g., Everglades National Park, Crocodile Lake National Wildlife Refuge, and other Federal and State Lands) or engaged in support of energy production (Turkey Point Power Plant) (Mazzotti and Cherkiss, 2003). As with most current range maps, the occupied area of the range is significantly smaller and restricted to suitable nesting and foraging habitat, and many areas that are not suitable, heavily developed areas that lack suitable habitat are the areas that are most likely to be treated with malathion (developed, mosquito treatment areas) within this species range.

Since a majority of crocodiles are found mostly on Federal and other protected lands, we anticipate that exposure to malathion will be far less than usage data suggest. There is potential that individual crocodiles could occur next to application sites (developed and mosquito treatment areas) in limited portions of their range, but the likelihood is low compared to Federal and other protected lands. Those exposed on use sites could incur sublethal effects from consuming birds and mammals and those exposed from mosquito adulticide applications from consuming birds. Crocodiles are opportunistic feeders and will eat almost anything that moves. Hatchlings and young crocodiles eat small fish, snails, crustaceans, and insects. Adults feed mostly at night on fish, crabs, turtles, snakes, and small mammals. Since crocodiles are opportunistic feeders, they are unlikely to consume only birds or mammals (a portion of their diet) in a given area during course of a day or even week, and the likelihood for consuming enough contaminated prey to reach high enough concentrations of malathion to cause sublethal effects is likely low. In addition, if prey items are killed due to malathion applications, crocodiles are opportunistic feeders and would likely find other suitable prey items within their range or have the ability to move to untreated areas close by where prey would be available. While we do anticipate that some individuals may be subjected to sublethal effects and prey resources could be adversely affected, we do not expect species-level effects because a large majority of crocodiles occur on Federal and other protected lands and the percent of the species range being treated for mosquitos is likely much less than 27.83% (as stated above) and only 1.21% of the species range is being treated on developed and open-developed use sites. In addition, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, residential use label changes, and reduced number of applications and rates on certain use sites, will further reduce the risk of exposure to prey resources and sublethal effects to the crocodile.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the American crocodile and its prey resources and therefore minimizes overall risk and adverse effects to the species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the American crocodile in the wild.

Conclusion: Is not likely to jeopardize.

ADDITIONAL REFERENCES

Mazzotti, F.J. and M.S. Cherkiss. 2003. Status and Conservation of the American Crocodile in Florida: Recovering and Endangered Species While Restoring an Endangered Ecosystem. University of Florida, Ft. Lauderdale Research and Education Center. Tech. Rep. 2003. 41 pp.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Eumeces egregius lividus	Blue-tailed mole skink	178

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Small, endemic, constrained, and/or isolated population(s)
Number of Populations: Single population
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The blue-tailed mole skink is endemic to the Lake Wales Ridge in central Florida and occurs in Highlands, Polk, and Osceola Counties (Service 1999). The current range of the blue-tailed mole skink is based on the best available information and contains lands on and off the Lake Wales Ridge. Despite intensive sampling efforts in scrub habitat with similar herpetofauna, the blue-tailed mole skink has not been recorded at Avon Park Air Force Range on the Bombing Range Ridge (located over 1.5 miles from Lake Wales Ridge) (Branch and Hokit 2000). The few locations where the blue-tailed mole skink was reported off the Lake Wales Ridge require verification and may not be valid (Mushinsky 2007). It appears that blue-tailed mole skinks are still distributed throughout their historical range, although their numbers have likely declined substantially because of habitat loss and degradation. Of the 31 locations on which the blue-tailed mole skink is reported to occur, at least 20 sites are protected, 18 of which are managed (Turner et al. 2006, Weekley et al. 2008, Service unpublished data 2021, USF 2021, Wildlands Conservation 2021). Sites with the blue-tailed mole skink depend upon active management, most often prescribed fire, to persist long-term (Turner et al. 2006). Much of the remaining habitat occurs in small, isolated fragments surrounded by residential areas or citrus groves, making them difficult to protect and manage. Many of these fragments are overgrown and in need of restoration. Habitat degradation on these sites continues to be a moderate threat because vegetation restoration and management programs are costly and depend upon availability of funding. If not acquired for conservation, privately-owned sites remain at risk of being developed and management remains a concern.
Overutilization for commercial, recreational, scientific, or educational purposes; and disease and predation are not considered to be threats to this species. Current threats include habitat loss and fragmentation, changes in land use, improper habitat management, invasion by exotic plant species, limited geographic range, isolated populations, limited dispersal, and anticipated climate change factors.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2021. Blue-tailed Mole Skink (*Eumeces egregius lividus*) 5-Year Review: Summary and Evaluation. Florida Ecological Services Field Office, Vero Beach, Florida. 20 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Blue-tailed mole skinks exposed to malathion at maximum rates on pasture are expected to experience up to 22% mortality, while skinks on other use sites, including orchards and vineyards, developed, and developed open space could experience 100% mortality.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	30%
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	30% (G,R – low effects), 13% (R – high effects)
Direct spray or contact with contaminated media	Risk of mortality if exposed
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	30% terrestrial invertebrates
Spray drift areas - Prey item mortality	Terrestrial invertebrates
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	<1%
Sublethal	No effects expected
Indirect	72% terrestrial invertebrates

Risk modifiers: The blue-tailed mole skink occurs in suitable habitat on the Lake Wales Ridge in Highlands, Polk and Osceola counties in central Florida. It is apparently rare throughout its range, even in the most favorable habitats (Christman 1992). A variety of xeric upland communities provide habitat for the blue-tailed mole skink, including rosemary and oak-dominated scrub, turkey oak barrens, high pine, and xeric hammocks. Areas with few plant roots, open canopies, scattered shrub vegetation, and patches of bare, loose sand provide optimal habitats. Within these habitat types, blue-tailed mole skinks are typically found under leaves, logs, palmetto fronds, and other ground debris. Shaded areas presumably provide suitable microhabitat conditions for thermoregulation, egg incubation, and foraging. Blue-tailed mole skinks tend to be clumped in distribution with variable densities that may approach 25 adults per

acre. The distribution of blue-tailed mole skinks appears to be closely linked to the distribution of surface litter and, in turn, suitable microhabitat sites.

Blue-tailed mole skinks are semi-fossorial; they hunt primarily at the soil surface or at shallow depths to 2 inches and consume mostly terrestrial arthropods. Foraging activities usually occur during the morning or evening. Roaches, crickets, and spiders make up the bulk of the diet. Mole skinks show an activity peak in spring. No data are available on blue-tailed mole skink home ranges or dispersal.

Blue-tailed mole skinks likely utilize citrus fields (active and fallow), tree plantations, developed and open-space developed areas and likely other agricultural lands if suitable habitat conditions exist. Since blue-tailed mole skinks are much more elusive, use of these sites is inferred based on sand skink occurrence records. Blue-tailed mole skinks and sand skinks have been found to utilize the same habitats where their ranges overlap. (L. Nester, South Florida Ecological Services Field Office, Pers. Comm., June 30, 2020)

Allowable uses driving effects/other considerations: Calculations assume an equal preference for all malathion use sites, and as such, could over-estimate effects.

The blue-tailed mole skink could experience mortality if exposed to malathion via direct spray. However blue-tailed mole skinks are semi-fossorial and are typically found under leaves, logs, palmetto fronds, and other ground debris, reducing the opportunity for exposure to direct spray.

We anticipate effects to the invertebrate prey base from malathion on or near use sites or from mosquito control applications. Invertebrates taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☒ High ☐ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	D, I	158,417	72.10	10,679	4.86
Orchards and Vineyards	D, I	28,611	13.02	28,611	13.02

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Open Space Developed	D, I	20,712	9.43	1,036	0.47
Developed	D, I	15,509	7.06	775	0.35
Nurseries	D, I	175	0.08	175	0.08
Other Grains	D, I	173	0.08	165	0.08
Other Crops	D, I	165	0.08	0	0
Vegetables and Ground Fruit	D, I	43	0.02	37	0.02
Corn	D, I	7	<0.01	7	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		65,389	29.76	30,806	14.03
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		65,396	29.76	30,806	14.03
TOTAL[4]:		223,812	101.87	41,485	18.89

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 1,702,825 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 34,820 acres, 2.0%

Overall Usage: ☒ **High** ☐ **Medium** ☐ **Low**

CONSERVATION MEASURES

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit set the maximum allowable number of applications to 2-4 per year (depending on the specific crop). In particular, the reduction in the maximum application rate for citrus (outside of California) is expected to reduce potential environmental concentrations to one-third of modeled values. This will help reduce the amount of malathion used and decrease potential exposure to the species, thus decreasing the risk of effects to the blue-tailed mole skink.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75%

[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the blue-tailed mole skink. As discussed below, even though the vulnerability and risk are high for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

Blue-tailed mole skinks have a high vulnerability based on their status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of their range is anticipated to be high, with a high amount of estimated usage, based on standard usage data. We estimated that across the non-Federal portions of the species range, annual malathion uses pursuant to the labels could result in about 30% mortality of individuals on use sites, or result in low-level sublethal effects to 30% of individuals (growth, reproduction) and high-level sublethal effects to 13% of individuals (reproduction). Individuals may experience mortality from direct contact with malathion or low (<1%) levels of mortality from mosquito adulticide application. Spray drift is not anticipated to cause mortality. Additionally, we estimated that across the non-Federal portion of the species range, annual malathion uses pursuant to the labels could result in the loss of about 72% of terrestrial invertebrates due to mosquito control and 30% of terrestrial invertebrates on use sites. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 19.08% of the non-Federal portion of the species range annually based on standard past usage data. Mosquito adulticide applications is expected to account for 4.86% of this usage. The blue-tailed mole skink occurs on the Lake Wales Ridge in Highlands, Polk, and Putnam Counties. They are semi-fossorial and are typically found in xeric uplands with sandy soils, such as scrub, turkey oak barrens, and sandy areas of the high pine community. Of the 31 locations on which the blue-tailed mole skink occurs, 20 are protected and, as of 2021, 18 were managed. According to L. Nester (Pers. Comm., 06/30/2020), protected areas are assumed to be free from agriculture and development, and while managers do use herbicides, they are not expected to use insecticides. Much of the skinks' remaining suitable habitat occurs in small, isolated fragments surrounded by residential

areas or citrus groves, making them difficult to protect and manage. However, protection and management of these small and isolated sites is critical to the long-term survival and recovery of the species.

Blue-tailed mole skinks may use, to some degree, these residential areas, citrus fields (active and fallow), and other agricultural sites where suitable habitat within use sites exists; although their abundance in these non-preferred habitats are expected to be low since they rely on loose, sandy soils to swim around. It is also expected that skinks are more likely to utilize the edge of active citrus fields where the soils are more suitable. Blue-tailed mole skinks and sand skinks have been found to utilize the same habitats where their ranges overlap, and since blue-tailed mole skinks are much more elusive than sand skinks, use of these sites is inferred based on sand skink occurrence records; (L. Nester, USFWS, Vero Beach, Pers. Comm., 06/30/2020). While usage data suggests that up to 14% of the non-Federal portion of the specie range (areas comingled with citrus, developed and open-space developed sites) could be treated in a given year, we do not anticipate that a large portion of blue-tailed mole skink individuals occur in these areas. Malathion applications are not expected in fallow citrus fields. Direct mortality to individual skinks from mosquito adulticide applications is anticipated to be less than one percent; if exposed. The skinks semi-fossorial behavior also minimizes the risk for direct exposure. Therefore, mortality or sublethal effects are only anticipated for a small number of individuals over the course of the action. For similar reasons, anticipated loss of prey resources are likely overestimated, based on the species habitat preferences and low abundance on use sites. Additionally, since blue-tailed mole skinks can and do forage below the surface, terrestrial invertebrates that are found in these areas are less likely to be impacted by malathion applications. In addition, we anticipate that the conservation measures above, including residential use label changes and reduced number of applications and rates on certain use sites will further reduce the risk of exposure to the species and prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the blue-tailed mole skink and its prey resources and therefore minimizes overall risk and adverse effects to the species.

While we do anticipate that adverse effects to prey items will occur, we do not expect species-level effects because reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affected prey items), and the skink can still forage underground or under surface plant litter where prey are less likely to be impacted or killed by malathion spray.

While a small number of individuals in non-preferred habitats (use sites) may be killed, subjected to sublethal effects, or see a loss of prey items, we do not anticipate that the loss of these individuals would impact the viability of populations found in adjacent suitable habitats, and therefore, we do not anticipate species-level effects.

Therefore, we do anticipate that the proposed action would appreciably reduce survival and recovery of the blue-tailed mole skink in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Neoseps reynoldsi	Sand skink	179

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The sand skink is endemic to the sandy ridges of central Florida and occurs on the Lake Wales, Winter Haven, and Mt. Dora Ridges in Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam Counties (Service 1999). Putnam County was only recently listed as part of the known range of the species based on the capture of two individuals by Telford (1998). It appears that skinks are still distributed throughout their historic range, although we assume their numbers have likely declined substantially because of habitat loss and degradation. One study found that sand skink populations were patchily distributed on the landscape, and distribution was clumped (Gianopulos et al. 2001), but additional work is needed in this area. Sand skink distribution appears to be correlated with microhabitat conditions.

Continued habitat loss, fragmentation, and changes in land use threaten the existence of sand skinks. Although many populations are on sites that are publicly owned, populations on private sites are threatened with destruction or habitat modification due to improper or lack of management. Overutilization by amateur reptile and scientific collectors was identified as a potential threat in the original listing package. At this time, we have no evidence to suggest that this is a current threat. Disease is also not known to be a threat at this time. Existing regulations are not specific enough to guard against habitat loss or the loss of genetic integrity of the species. Research has shown that it is important to preserve certain areas of the historic range to maintain genetic diversity. Improper habitat management and invasion by exotic plant species threaten the existence of sand skinks. Active management is necessary to maintain suitable habitat for skinks, and pesticide use is considered a threat to the species on adjacent agricultural and residential lands.

EB/CE Source:
U.S. Fish and Wildlife Service (USFWS). 2007. Bluetail Mole Skink (*Eumeces egregius lividus*) and Sand Skink (*Neoseps reynoldsi*) 5-Year Review: Summary and Evaluation. South Florida Ecological Services Field Office, Vero Beach, Florida. 20 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Sand skinks foraging on prey exposed to malathion at maximum rates on use sites are likely to die.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	25%
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	18% (G,R – low effects), 10% (R – high effects)
Direct spray or contact with contaminated media	Risk of mortality if exposed on use sites
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	25% terrestrial invertebrates
Spray drift areas - Prey item mortality	Up to 27% terrestrial invertebrates
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	45%
Sublethal	No effects expected
Indirect	90% terrestrial invertebrates

Risk modifiers:

Sand skinks utilize citrus fields (active and fallow), tree plantations, developed and open-space developed areas and likely other agricultural lands if suitable habitat conditions exist (L. Nester, South Florida Ecological Services Field Office, Pers. Comm., June 30, 2020).

Allowable uses driving effects/other considerations: Overlap with developed, open space developed, and orchards and vineyards use sites accounts for most direct effects to the sand skink.

We anticipate effects to the invertebrate prey base from malathion on or near use sites or from mosquito control applications. Invertebrates taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☒ **High** ☐ **Medium** ☐ **Low**

USAGE

(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	D, I	3,344,013	79.73	224,623	5.36
Open Space Developed	D, I	423,145	10.09	21,157	0.50
Developed	D, I	335,646	8.00	16,782	0.40
Orchards and Vineyards	D, I	265,741	6.34	252,588	6.02
Other RowCrops	D, I	9,501	0.23	5,052	0.12
Other Crops	D, I	7,009	0.17	0	0
Nurseries	D, I	3,909	0.09	3,909	0.09
Other Grains	D, I	2,338	0.06	2,069	0.05
Vegetables and Ground Fruit	D, I	1,067	0.03	1,024	0.02
Corn	D, I	554	0.01	158	0.00
Sub-TOTAL (D): *Other uses with direct effects only*[3]		1,048,910	25.01	302,740	7.22
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		1,048,910	25.01	302,740	7.22
TOTAL[4]:		4,392,922	104.73	527,363	12.57

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in mortality to prey species from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 4,194,378 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 412,565 acres, 9.8%

Overall Usage: ☒ **High** ☐ **Medium** ☐ **Low**

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

CONSERVATION MEASURES

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit set the maximum allowable number of applications to 2-4 per year (depending on the specific crop). The reduction in the maximum application rate for citrus (outside of California), in particular, is expected to reduce potential environmental concentrations to one-third of modeled values, reducing the effects to listed species and prey items on and adjacent to these use areas.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the sand skink. As discussed below, even though the vulnerability and risk are high for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The sand skink has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of their range is anticipated to be high, where exposure of individuals or their prey occurs, with a high amount of estimated usage, based on standard usage data. We estimated that annual malathion uses pursuant to the labels could result in about 25% mortality of individuals on use sites and 45% mortality due to mosquito control. Additional mortality could result from exposure to direct spray. The species could be subjected to indirect effects (18% low-level effects to growth and reproduction; 10% high-level effects to reproduction) if exposed on use sites across the species range. Additionally, we estimated that across the non-Federal portion of the species range, annual malathion uses pursuant to the labels could result in the loss of about 90% of terrestrial invertebrates due to mosquito control, 25% mortality to terrestrial invertebrates on use sites and 27% of terrestrial invertebrates due to spray drift. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels

of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 12.57% of the species range annually based on standard past usage data. Mosquito adulticide applications account for 5.36% of this usage. The sand skink occurs on the Lake Wales, Winter Haven, and Mt. Dora Ridges in Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam Counties. They are fossorial and are typically found in xeric uplands with sandy soils, such as scrub, turkey oak barrens, and sandy areas of the high pine community. Of the 73 locations on which the sand skink occurs, 38.5 are protected and, as of 2004, 27 were managed. According to L. Nester (Pers. Comm., 06/30/2020), protected areas are assumed to be free from agriculture and development, and while managers do use herbicides, they are not expected to use insecticides. Much of the skinks' remaining suitable habitat occurs in small, isolated fragments surrounded by residential areas or citrus groves, making them difficult to protect and manage. However, protection and management of these small and isolated sites is critical to the long-term survival and recovery of the species.

Sand skinks do use, to some degree, these residential areas, citrus fields (active and fallow), and other agricultural sites where suitable habitat within use sites exists; although their abundance in these non-preferred habitats are expected to be low compared to more suitable habitats since they rely on loose, sandy soils to swim around. It is also expected that skinks are more likely to utilize the edge of active citrus fields where the soils are more suitable. While usage data suggests that up to 7.22% of the non-Federal portion of the specie range (areas comingled with citrus, developed and open-space developed sites) could be treated in a given year, we do not anticipate that a large portion of sand skink individuals occur in these areas. Malathion applications are not expected in fallow citrus fields. While direct mortality to individual skinks from mosquito adulticide applications is anticipated to be high (45%), if exposed, we anticipate that most applications would occur in residential areas where sand skink abundance is low. The skinks semi-fossorial behavior also minimizes the risk for direct exposure. Therefore, mortality or sublethal effects are only anticipated for a small number of individuals over the course of the action. For similar reasons, anticipated loss of prey resources are likely overestimated, based on the species habitat preferences and low abundance on use sites. Additionally, since sand skinks can and do forage below the surface, terrestrial invertebrates that are found in these areas are less likely to be impacted by malathion applications. In addition, we anticipate that the conservation measures above, including residential use label changes and reduced number of applications and rates on certain use sites will further reduce the risk of exposure to the species and prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of

malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the sand skink and its prey resources and therefore minimizes overall risk and adverse effects to the species.

While we do anticipate that adverse effects to prey items will occur, we do not expect species-level effects because reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affect prey items), and the skink can still forage underground or under surface plant litter where prey are less likely to be impacted or killed by malathion spray. While a small number of individuals in non-preferred habitats (use sites) may be killed, subjected to sublethal effects, or see a loss of prey items, we do not anticipate that the loss of these individuals would impact the viability of populations found in adjacent suitable habitats, and therefore, we do not anticipate species-level effects.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the sand skink in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

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

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened, Five-Year Review Recommendation: Uplist to Endangered, 9/5/2018
Distribution: Small, endemic, constrained, and/or isolated population(s)
Number of Populations: Multiple populations (few)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The copperbelly water snake is the northern Midwest representative of the plain-bellied water snake. Populations of copperbelly water snake span from western Kentucky and southern Illinois to northern Indiana and Ohio and southern Michigan. The northern population segment in northern Indiana and Ohio and southern Michigan is listed as a Threatened Distinct Population Segment. The northern population of the copperbelly water snake (*Nerodia erythrogaster neglecta*) is listed as threatened by the U.S. Fish and Wildlife Service as a 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.

The principal limiting factor for copperbelly water snakes is the availability of wetland/upland habitat complexes of sufficient size. Research indicates that copperbelly water snakes require many hundreds of hectares of contiguous habitat in order to persist. Additional threats are human persecution, inadequate habitat management, and road crossings. Other factors that may adversely affect copperbelly water snake habitat include increased sedimentation and contamination caused by fertilizer runoff. Sedimentation, usually resulting from agricultural activities, but also caused by construction, may change hydrological characteristics and plant succession, as well as reduce the numbers of amphibians and fish used by the snake as food.

In the most recent 5 Year Review (2018), the copperbelly water snake is recommended to be uplisted to endangered. 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.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2018. Copperbelly Water Snake (Northern Population Segment) (*Nerodia erythrogaster neglecta*) 5-Year Review: Summary and Evaluation. Michigan Ecological Services Field Office, East Lansing, Michigan. 22 pp.

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

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

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The copperbelly water snake is not expected to experience effects from foraging on dietary items exposed to malathion at maximum rates on use sites or from spray drift.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	Risk of mortality if exposed on use sites
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	11% aquatic invertebrates, 3% fish and amphibians
Spray drift areas - Prey item mortality	Aquatic invertebrates, fish, and amphibians
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	1-2% Aquatic invertebrates, fish, and amphibians

Risk modifiers:
Copperbelly water snakes are expected to enter agricultural sites only on a very limited basis. These sites were not included in the calculation of effects, but could contribute to prey item mortality. Copperbelly water snakes may travel through and rest in developed and open space developed use sites.

Allowable uses driving effects/other considerations: Overlap with developed and open space developed use sites accounts for most anticipated prey mortality for the copperbelly water snake.

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ **High** ☒ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	121,768	2.37	0	0
Corn	*	1,249,110	24.35	25,065	0.49
Pasture	*	133,183	2.60	38,223	0.75
Wheat	*	126,070	2.46	31,578	0.62
Open Space Developed	I	300,113	5.85	15,006	0.29
Developed	I	240,144	4.68	12,007	0.23
Other Crops	*	24,346	0.47	0	0
Vegetables and Ground Fruit	*	20,835	0.41	17,281	0.34
Orchards and Vineyards	*	13,964	0.27	2,813	0.05
Other Grains	*	6,883	0.13	4,096	0.08
Nurseries	I	1,625	0.03	1,625	0.03
Christmas Trees	I	277	0.01	124	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I):		542,159	10.57	28,761	0.56

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Other uses with indirect effects only[3]					
TOTAL[4]:		663,926	12.94	28,761	0.56

Malathion usage on any use site has the potential to result in mortality to prey species from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 5,129,506 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 8,019 acres, 0.2%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

Rain restriction: Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values, (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk to listed species and prey items.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit set the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species, thus decreasing the risk of both effects to the species.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is

[4] TOTAL includes usage on all use sites with effects, including mosquito control.

limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the copperbelly water snake. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The copperbelly water snake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of the species range is estimated to be medium, with a low amount of estimated usage within the range should exposure of individuals or their prey occur, based on standard usage data. We estimate that across the species range, annual malathion uses pursuant to the labels would not result in mortality or sublethal effects to individuals of the species. Mortality could occur if an individual is directly sprayed with the chemical. Additionally, we estimated that across the non-Federal portion of the species range, annual malathion uses pursuant to the labels could result in the loss of about 11% of aquatic invertebrates, 3% of fish and amphibians on use sites and 1 to 2% of aquatic invertebrates, fish and amphibians from mosquito control. Spray drift could cause additional prey item mortality. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.56% of the non-Federal portion of the species range annually based on standard past usage data. There is no past mosquito adulticide usage data reported, and thus we anticipate future adulticide usage is unlikely. Copperbelly water snakes are generally in hibernacula, underground and inactive for approximately six months out of the year (late October to late April). During the active season, copperbelly water snakes use wetland complexes and adjacent uplands (areas elevated above wetlands). Copperbelly water snakes concentrate their activities in several small areas within their home ranges and spend a limited amount of time in transit between these activity centers. Copperbelly water snakes appear to travel relatively directly from activity center to activity

center across apparently suitable habitats, or use habitat edges as corridors, as suggested by Kingsbury (1996). They do not cross expansive agricultural areas readily, nor do they appear to detour extensively to follow streams or other aquatic thoroughfares. Copperbelly water snakes eat primarily amphibian adults and larvae. Foraging primarily occurs in wetlands and adjacent uplands. Telemetry work by Kingbury (1996) showed that copperbelly water snakes using uplands spent substantial time in forest gaps and at the margins of forests and fields. While mortality could occur if a copperbelly water snake came into direct contact with malathion or contaminated media, we do not expect this is likely to occur based on the species habitat preferences. In addition to the extremely low malathion use within the species range (0.56% of the non-Federal portion of the species range treated annually), we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, residential use label changes, and reduced number of applications and rates on certain use sites, will further reduce the risk of exposure to prey resources.

As stated previously, conservation measures are aimed at reducing the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the copperbelly water snake and its prey resources and therefore minimizes overall risk and adverse effects to the species.

While we do anticipate that adverse effects to prey items will occur, we do not expect species-level effects because of the low amount of usage within the range, the fact that reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affect prey items), and the ability of the snakes to move to other suitable untreated forage habitats nearby (if necessary). Additionally, estimated effects to amphibians (preferred prey resource) is anticipated to be relatively low.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the copperbelly water snake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Gopherus polyphemus	Gopher tortoise	181

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Species/Populations neither constrained nor widespread
Number of Populations: Multiple populations (few)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
"Historically, the western population was found in the longlead pine hills of northern Mobile, Washingston, and southeastern Choctaw Counties in Alabamal in the southeastern upland areas of the pinehills province in Mississippi; and in the upland pine pidfes in St. Tammany, Washington, and Tangipahoa Parishes, Louisiana (Lohoefener and Lohmeier 1984). The amount of gopher tortoises habitat as defined by Lohoefener and Lohmeier (1984), for the listed population by State is as follows: southwestern Alabama- 40,770 ha; Louisiana- 4,815 ha; and Mississippi with 102,084 ha. The entire western population is within the originial range of longleaf pine (Pinus palustris). They typically inhabit the sandhills, pine/scrub oak uplands, and pine flatwoods associated with the longleaf pine ecosystem.

The gopher tortoise is threatened by habitat fragmentation, destruction, and modification, predation, disease, invasive species, vehicle and heavy equipment mortality.

EB/CE Source: U.S. Fish and Wildlife Service. 1990. Gopher Tortoise (*Gopherus Polyphemus*) Recovery Plan. Atlanta, Georgia. 35 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Gopher tortoises exposed to malathion at maximum rates are not expected to experience mortality on open space developed use sites from consuming contaminated plant material but could experience effects to growth and reproduction. The gopher tortoise is not expected to enter pasture or other agricultural areas.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	5% (G – low effects), 5% (R – high effects)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	N/A
Spray drift areas - Prey item mortality	N/A
Plants affected (decline in growth)	5%
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	No effects expected

Risk modifiers: The range of the gopher tortoise extends from southern South Carolina through southern Georgia to southern Florida, west through southern Alabama and southeastern Mississippi to eastern Louisiana. Occurs on islands off the Gulf coast of Florida as far south as Cape Sable, and is most common in southern Georgia and northern and central Florida.

The gopher tortoise is the primary grazer in its xeric habitats and aids in seed dispersal for native grasses.

Breeding periods may begin as early as February and extend into September, depending on location. The period of maximum reproductive activity has been reported as May and June. Incubation periods range from 80-90 days in northern Florida to 110 days in South Carolina, the northern limit of the gopher tortoise's range.

Gopher tortoises occupy a wide range of upland habitat types; however most suitable habitat includes: 1. the presence of well-drained, sandy soils, which allow easy burrowing (because of lower ambient temperatures, the western population may require a meter or more of sandy soil depths); 2. an abundance of herbaceous ground cover; and 3. a generally open canopy and sparse shrub cover, which allow sunlight to reach the forest floor.

Gopher tortoises have been found to limit feeding activity to within 30 m (33 yards) of the burrow being used, be in a nearly circular or elliptical pattern around the burrow. Food availability can increase or decrease foraging distances. In one study, home ranges of males were much larger than females; males had a home range of~ 0.06—1.44 ha (0.14—3.56 A) with a

mean of 0.47 ha (1.16 A), while females had a home range of 0.04-0.14 ha (0.10—0.35 A) with a. mean of 0.08 ha (0.20 A).

Gopher tortoises may forage and breed in managed forests, rangeland, and right of ways, forage in developed open space areas, and travel through developed areas. Gopher tortoises are not expected to enter agricultural areas. (Pers. Comm 2016 co-occurrence information, USFWS field office request).

Allowable uses driving effects/other considerations: All effects result from overlap with open-space developed use sites.

Overall Risk: ☐ **High** ☐ **Medium** ☒ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	N	100,755	45.86	29	0.01
Open Space Developed	I	9,929	4.52	496	0.23
Developed	N	4,197	1.91	210	0.10
Cotton	*	355	0.16	306	0.14
Other RowCrops	*	349	0.16	107	0.05
Other Crops	*	336	0.15	0	0
Corn	*	188	0.09	74	0.03
Vegetables and Ground Fruit	*	39	0.02	37	0.02
Other Grains	*	32	0.01	30	0.01
Wheat	*	15	0.01	8	0.00
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		9,929	4.52	496	0.23
TOTAL[4]:		9,929	4.52	496	0.23

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in indirect effects from spray drift (whether or not the species will utilize the site itself).

 # acres in species range: 11,234,770 acres

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 1,139,035 acres, 10.1%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the gopher tortoise (western population). As discussed below, even though the vulnerability is high for this species, we anticipate the risk is low and the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The gopher tortoise has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be low, with a low amount of estimated usage within the non-Federal portion of the range of the species, should exposure of individuals or their prey, based on standard usage data. We do not anticipate that mortality will occur on use sites or from spray drift. We estimated that across the non-Federal portion of the range of the species, annual malathion uses pursuant to the labels could result in 5% low-level (growth) and 5% high-level (reproduction) sublethal effects and a 5% reduction in plant growth. All effects would result from overlap with open-space developed use sites. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all open-space developed use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.23% of the species range annually based on standard past usage data. In addition to the extremely low malathion use within the species range, we anticipate that the conservation

measure above, residential use label changes, will further reduce the risk of exposure to prey resources and thus reduce the risk of sublethal effects.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. This residential use conservation measure will substantially reduce exposure to the gopher tortoise and therefore minimize the overall risk and adverse effects to the species.

We do not anticipate species-level effects for the following reasons: open-space developed areas only account for approximately 5% of the non-Federal portion of the species range, and it is only one of many of habitats/use sites that the species will utilize; the anticipated level of sublethal effects is low even if all open-space developed use sites were treated; and usage data suggest applications in this use site are extremely low.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the gopher tortoise in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Clemmys muhlenbergii	Bog (=Muhlenberg) turtle	182

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Species/Populations neither constrained nor widespread
Number of Populations: Multiple populations (few)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The species has been reported from twelve eastern states, with a discontinuous and localized distribution from western Massachusetts and Connecticut, southward through New York, New Jersey, Pennsylvania, Delaware and Maryland, and then southward in the Appalachian Mountains from southwestern Virginia, North Carolina, Tennessee and South Carolina to northern Georgia. Bog turtles have been found at elevations ranging from near sea level in the north to 1500 meters in the south (Herman and George 1986). 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. Kiviat (1978) reported that bog turtles were able to 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 (Klemens 1993a). Bog turtles become active in late March to late April, depending upon latitude, elevation, and seasonal weather conditions. Bog turtles generally retreat back 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.

Threats include the loss, degredation, and fragmentation of its habitat as well as the take of long-lived adults from wild populations for illegal wildlife trade.

EB/CE Source:
U.S. Fish and Wildlife Service. 1995. Bog Turtle (*Clemmys muhlenbergii*) Northern Population Recovery Plan. Hadley, Massachusettes. 109 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed:

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	18% (G – low effects, terrestrial invertebrates only; 0% other dietary items), 19% (R – low effects; terrestrial invertebrates and leaves; 0% other dietary items)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	27% invertebrates, reptiles, amphibians
Spray drift areas - Prey item mortality	Invertebrates, reptiles, amphibians
Plants affected (decline in growth)	18%
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	62% invertebrates, 6% reptiles and amphibians

Risk modifiers: Information is not available regarding the tendency of bog turtles to utilize malathion use sites. As such, calculations assume an equal preference for these sites, and as such, could over-estimate effects.

Allowable uses driving effects/other considerations: Overlap with open space developed and developed use sites are responsible for most anticipated effects.

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☒ **High** ☐ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	135,346	61.60	706	0.32
Pasture	I	2,669	1.21	520	0.24
Corn	I	11,814	5.38	74	0.03
Open Space Developed	D, I	21,954	9.99	1,098	0.50
Developed	D, I	17,940	8.17	897	0.41
Other Crops	I	1,388	0.63	6	<0.01
Wheat	I	1,100	0.50	84	0.04
Other Grains	I	522	0.24	69	0.03
Vegetables and Ground Fruit	D, I	651	0.30	65	0.03
Orchards and Vineyards	D, I	467	0.21	29	0.01
Christmas Trees	D, I	59	0.03	47	0.02
Nurseries	D, I	192	0.09	192	0.09
Sub-TOTAL (D): *Other uses with direct effects only*[3]		41,263	18.78	2,328	1.06
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		58,756	26.74	3,081	1.40
TOTAL[4]:		194,102	88.34	3,787	1.72

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 19,520,833 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 306,000 acres, 1.6%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Rain restriction: Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values, (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of effects.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit set the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service’s biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the bog turtle. As discussed below, even though the vulnerability and risk are high for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The bog turtle has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be high, with a low amount of estimated usage within the non-Federal portion of the range of

the species based on standard usage data. We do not anticipate that mortality will occur on use sites or from spray drift. We estimated that across the non-Federal portion of the range of the species, annual malathion uses pursuant to the labels could result in 18% low-level (growth) and 19% low-level (reproduction) sublethal effects. In addition, we estimated that annual malathion uses pursuant to the labels could result in the loss of about 62% of invertebrates, 6% of reptiles and amphibians from mosquito control and 27% invertebrates, reptiles and amphibians on use sites. Spray drift could cause additional prey item mortality. Applications of malathion could lead to a 18% reduction in plant growth. Most effects would result from overlap with developed and open-space developed use sites. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 1.72% of the non-Federal portion of the species range annually based on standard past usage data. Mosquito adulticide applications account for 0.32% of this usage. Bog turtles in the Northeast are found in the inter-montane valleys and rolling hills of the Piedmont. This coincides with the portions of the landscape that have the highest-value agricultural lands and with sites that are most useful for human settlement and transportation corridors. Because of the high agricultural value of the land and historical settlement patterns, most bog turtle populations and their wetland habitats encompass lands held by multiple owners; in certain more urban areas, these ownerships can exceed 100 separate properties per bog turtle site. The bog turtle's diet consists primarily of insects, but also includes plants, frogs and carrion. Although effects to the bog turtle are anticipated to be high (sublethal and loss of prey resources) if used on all use sites across the range, estimated usage across the range is expected to be low. While we cannot rule out impacts to individuals (sublethal, reduced prey) due to the juxtaposition of bog turtle habitat and agricultural, developed and open space developed use sites, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, residential use label changes, and reduced number of applications and rates on certain use sites, will reduce the risk of exposure to prey resources and sublethal effects to the turtle.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the bog turtle and its prey resources and therefore minimizes overall risk and adverse effects to the species.

Since there is a low amount of estimated usage within the range and the bog turtle has a varied diet (insects, plants, frogs, and carrion), reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affect prey items), and the ability of the turtles to eat other available food items not impacted by malathion within their environment. Thus, while we anticipate small numbers of individuals would be adversely affected over the duration of the proposed action, we do not anticipate species-level effects.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the bog turtle in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Masticophis lateralis euryxanthus	Alameda whipsnake (=striped racer)	183

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
Our current understanding of the Alameda whipsnake range suggests it is slightly larger than the ranges depicted by Reimer (1954) and Jennings (1983). The range of the Alameda whipsnake and phenotypic-intergrade specimens includes mosaics of chaparral, coastal scrub, and adjacent vegetation types throughout Contra Costa County, most of Alameda County, and small portions of northern Santa Clara and western San Joaquin counties.

Threats: Urban development and associated impacts due to increased human population is a threat to the Alameda whipsnake. California population growth projections indicate the human population in California is expected to increase by more than 25 million by 2050 (State of California 2007). Often interrelated to urban development and an expanding human population in California is the need to increase the water supply that supports urban development. Prior to listing, numerous water storage reservoirs were constructed throughout the range of the Alameda whipsnake (i.e., San Pablo, Briones, Lake Chabot, and Upper San Leandro reservoirs). These reservoirs resulted in the inundation and large scale losses and fragmentation of Alameda whipsnake habitat. It is likely collection for the pet trade occurs most often on isolated roadways, the effects of which would be greatest to small and isolated Alameda whipsnake populations. The collection of Alameda whipsnakes for the pet trade remains a minor threat. At the time of listing (Service 1997), the Service determined that the potential impact of disease on the Alameda whipsnake was unknown, but that a number of native and exotic mammals and birds were likely to be predators of the Alameda whipsnake. Fire suppression and lack of a natural fire regime remains a threat. The continual effects of off-highway vehicle activities could act as a sink and thus represent a threat to the Alameda whipsnake. Where populations are isolated, a changing climate may result in local extinction, with range shifts precluded by lack of habitat.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2011. Alameda Whipsnake (*Masticophis lateralis euryxanthus*) 5-Year Review: Summary and Evaluation. Sacramento Fish and Wildlife Office, Sacramento, California. 34 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Alameda whipsnakes are not anticipated to experience mortality from dietary exposure to malathion at maximum rates on use sites. Consumption of reptiles and amphibians is not expected to result in other direct effects, but consumption of other prey items could result in effects to growth and reproduction.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected from consumption of reptiles and amphibians (main dietary items). Up to 9% (G, R – arthropods, birds, mammals)
Direct spray or contact with contaminated media	Risk of mortality if exposed
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	9% reptiles, amphibians,
Spray drift areas - Prey item mortality	Reptiles
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No direct effects
Sublethal	97% (R – low effects, birds only)
Indirect	97% terrestrial invertebrates, 9% reptiles

Risk modifiers: The Alameda whipsnake inhabits the inner Coast Ranges in western and central Contra Costa and Alameda counties. The historical range was continuous, but has been fragmented into five disjunct populations: Tilden–Briones, Oakland–Las Trampas, Hayward–Pleasanton Ridge, Sunol–Cedar Mountain, and Mount Diablo–Black Hills.

Alameda whipsnakes are opportunistic and active daytime predators. They prey extensively on western fence lizards, and are often used as an example of a feeding specialist. In addition to western fence lizards, Alameda whipsnakes feed on a variety of secondary prey; frogs, skinks, alligator lizards, snakes, small birds, amphibians, single-slender salamanders, small mammals, fish, and insects are also important in the whipsnake's diet.

Adult Alameda whipsnakes have a bimodal seasonal activity pattern, with peaks during the spring mating season and smaller peak during late summer and early fall. Alameda whipsnakes

are ovoviviparous. Courtship and mating occur from late March through mid-June. Suspected egg-laying sites were located in patches of grassland, within 3 to 6 m (10 to 20 ft.) of coastal scrub, and were also found in areas of low density scattered scrub intermixed with grassland. Hatchlings have been observed or captured above ground from August through November. Alameda whipsnakes generally retreat to winter hibernaculum in November and emerge in March; however, short periods of aboveground activity such as basking in the immediate vicinity of the hibernaculum may occur during this time. The Alameda is an active daytime predator.

Alameda whipsnakes are typically associated with small to large patches of chaparral or coastal scrub vegetation, interspersed with other native vegetation types and rock lands (areas containing large percentage of rocks, rocky features, and/or rock-bearing soil types). Alameda whipsnakes were also observed using adjacent vegetation types, including grassland, oak savanna, and oak-bay woodland, up to 150 m (500 ft.) from coastal scrub and chaparral. Chaparral and coastal scrub vegetation serve as the center of home ranges, providing for foraging opportunities and concealment from predators. Whipsnakes also require rock outcrops or talus. Small rodent burrows are important retreats, and brush piles and deep soil crevices can also serve as important habitat features. These habitat features are essential for normal behaviors such as breeding, reproduction, and foraging, because they provide egg-laying sites, refuge from predators, thermal cover, shelter, winter hibernacula, and increased foraging opportunities.

Alameda whipsnakes are nonmigratory species with a home range varying in size from 1.9 to 9.7 ha (4.7 to 24 ac.). Alameda whipsnakes have been found to have one or more core areas (areas of primary use) within their home range, with large areas of the home range receiving little use.

Alameda whipsnakes may travel through and possibly forage in agriculture, orchards and vineyards, developed open space; travel through, shelter, bask, and forage in rangeland and right of ways; and travel through managed forests. Alameda whipsnakes are not likely to use developed areas (Pers. Comm 2016 co-occurrence information, USFWS field office request).

Allowable uses driving effects/other considerations: Alameda whipsnakes feed extensively on Western fence lizards. Direct effects to lizards from other dietary items are based solely on overlap and assume that these items would be consumed with equal preference by all individuals. Therefore, effects to the lizard from these dietary item are expected to be lower than predicted by this analysis.

Most effects predicted for the whipsnake are the result of overlap with open space developed use sites.

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where

estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☒ **High** ☐ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Agricultural usage based on CalPUR data:

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	212,613	96.77	4,405	2.00
Pasture	D, I	40	0.02	17	0.002
Developed	*	52,422	23.86	2,621	1.19
Open Space Developed	D, I	19,102	8.69	955	0.43
Other Crops	D, I	331	0.15	0	0
Orchards and Vineyards	D, I	351	0.16	222	0.02
Wheat	D, I	257	0.12	0	0
Other Grains	D, I	137	0.06	0	0
Vegetables and Ground Fruit	D, I	22	0.01	0	0
Nurseries	D, I	99	0.05	1	<0.01
Corn	D, I	11	0.01	0	0
Sub-TOTAL (D): *Other uses with direct effects only*[3]		20,352	9.26	1,931	0.88
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		20,352	9.26	1,931	0.88
TOTAL[4]:		232,965	106.03	6,335	2.88

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 1,055,274 acres
% of range in California (i.e., where CalPUR data is available): 100%
Range overlap with Federal lands: 35,297 acres, 3.3%

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Overall Usage: ☐ High ☐ Medium ☒ Low

CONSERVATION MEASURES

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the Alameda whipsnake. As discussed below, even though the vulnerability and risk are high for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The Alameda whipsnake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of the species range is anticipated to be high, with a low amount of estimated usage based on CalPUR usage data. We do not anticipate that mortality will occur on use sites or from spray drift; however, if whipsnakes were exposed to direct spray or contaminated media, there is a risk for mortality. We estimated that across the range of the species, annual malathion uses pursuant to the labels could result in 9% sublethal effects to growth and reproduction (from consumption of arthropods, birds and mammals) on use sites and 97% low-level sublethal effects to reproduction (from consumption of birds) from mosquito control. In addition, we estimated that across the non-Federal portion of the species range, annual malathion uses pursuant to the labels could result in the loss of about 67% of invertebrates and 9% of reptiles from mosquito control and 9% amphibians and reptiles on use sites. Spray drift could cause additional mortality to reptiles. Most effects are expected to result from overlap with open-space developed use sites. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 2.88% of the species range

annually based on CalPUR past usage data. Mosquito adulticide applications account for 2% of this usage. Since Alameda whipsnakes may travel through, forage, shelter and bask in many of the malathion use sites, we cannot rule out mortality to individuals due to direct contact with the chemical; although, we anticipate there is a low likelihood of this occurring due to such low estimated usage across the species range. Although sublethal effects to the Alameda whipsnake are high if used on all use sites across the non-Federal portion of their range, whipsnakes preferred diet consists primarily of amphibians and reptiles, prey items for which we do not anticipate effects. In addition, preferred prey resources (amphibians and reptiles) are estimated to be reduced by a maximum of 9% if malathion is used across the non-Federal portion of the range of the species, although, incorporating estimated usage across the species range greatly reduces this impact. In addition to low estimated malathion usage across the species range and low estimated impacts linked to sublethal effects and reduced prey resources for preferred dietary items, we anticipate that the conservation measure above, residential use label changes, will further reduce the risk of exposure to prey resources and sublethal effects to the species.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. This residential use conservation measure will substantially reduce exposure to the Alameda whipsnake and therefore minimize the overall risk and adverse effects to the species.

Thus, we do not anticipate species-level effects, and subsequently, do not anticipate that the proposed action would appreciably reduce survival and recovery of the Alameda whipsnake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Gopherus agassizii	Desert tortoise	185

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Species/Populations neither constrained nor widespread
Number of Populations: Multiple populations (few)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The designated Mojave population of the desert tortoise includes those animals living north and west of the Colorado River in the Mojave Desert of California, Nevada, Arizona, and southwestern Utah, and in the Sonoran (Colorado) Desert in California (USFWS 1990; USFWS 1994a). At the current time, scattered desert tortoises remain in portions of Antelope, Indian Wells, and Searles valleys that have not been developed for industrial, residential, agricultural, or commercial uses. The desert tortoise's range, outside the listed Mojave population, extends into the Sonoran Desert, where tortoises occur in the lower Colorado River Valley, Arizona uplands, plains of Sonora, and the central Gulf Coast; the species has not been documented in northeastern Baja California (Figure 2) (Germano et al. 1994).

The threats identified in the original listing rule continue to affect the species today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The potential effects of global climate change have also become an important consideration in future recovery planning and implementation. Overall, human-induced impacts that cause mortality and widespread habitat loss and fragmentation, such as urbanization, proliferation of roads and highways, off-highway vehicle activity, grazing, and habitat invasion by non-native invasive species still play an important role in the conservation status of the desert tortoise (Berry et al. 1996; Boarman and Sazaki 2006; Avery 1997; Jennings 1997; Boarman 2002).

EB/CE Source:
U.S. Fish and Wildlife Service (USFWS). 2010. Mojave Population of the Desert Tortoise (*Gopherus agassizii*) 5-Year Review: Summary and Evaluation. Desert Tortoise Recovery Office, Revo, Nevada. 123 pp.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Desert tortoises exposed to malathion at maximum rates are not expected to experience mortality from consumption of contaminated plants material on use sites. However, exposed tortoises could experience effects to growth and/or reproduction on all use sites.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	1-2% (G, R – high effects)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	N/A
Spray drift areas - Prey item mortality	No effects expected
Plants affected (decline in growth)	1%
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	No effects expected

Risk modifiers: The range of the desert tortoise extends from Inyo County, California (north to Death Valley National Park and about 10 miles south of Lone Pine), southern Nevada (Clark, Nye, and Lincoln counties, north to Yucca Mt. and Coyote Springs), and extreme southwestern Utah (Washington County: Beaver Dam slope and north St. George) south throughout most of the Mohave Desert to the eastern Colorado Desert of Los Angeles, Kern, San Bernardino, Riverside, and Imperial counties, California.

Desert tortoises are herbivores that forage primarily on native winter and summer annuals (dicots and grasses), perennial grasses, cacti, and other vegetation, including a few perennial shrubs. Insects also may be eaten, and caterpillars and other insect larvae may occasionally provide rich lipid and protein supplements to an otherwise vegetarian diet; these may be especially valuable to juvenile growth.

Optimal habitat for the Mojave desert tortoise has been characterized as creosote bush scrub in which precipitation ranges from 2 to 8 inches, where a diversity of perennial plants is relatively high, and production of ephemerals is high. Soils must be friable enough for digging burrows, but firm enough so that burrows do not collapse. Desert tortoises occur from below sea level to

an elevation of 7,300 feet, but the most favorable habitat occurs at elevations of approximately 1,000 to 3,000 feet. Throughout most of the Mojave Region, tortoises occur most commonly on gently sloping terrain with soils ranging from sandy-gravel and with scattered shrubs, and where there is abundant inter-shrub space for growth of herbaceous plants. Throughout their range, however, tortoises can be found in steeper, rockier areas.

Mating occurs March through May and August through October. Females may store sperm from previous years' mating events, and egg-laying occurs May-July.

Desert tortoises travel through and possibly forage in agricultural areas; travel through, shelter, and forage in developed and developed open space areas; and travel through, shelter, forage, and breed in right of ways and rangeland. Use of other sites cannot be ruled out at this time. (Pers. Comm 2016 co-occurrence information, USFWS field office request).

Overall Risk: ☐ High ☐ Medium ☒ Low

USAGE
(Anticipated usage within the range based on past usage data)

Usage data for the whole range based on data from EPA's SUUM:

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	N	26,186	11.92	685	0.31
Developed	D, I	1,166	0.53	58	0.03
Open Space Developed	D, I	1,120	0.51	56	0.03
Pasture	D, I	1,080	0.49	312	0.14
Other Crops	D, I	566	0.26	0	0
Orchards and Vineyards	D, I	487	0.22	398	0.18
Corn	D, I	210	0.10	1	<0.01
Other Grains	D, I	157	0.07	32	0.01
Vegetables and Ground Fruit	D, I	154	0.07	154	0.07
Wheat	D, I	152	0.07	152	0.07
Other RowCrops	D, I	28	0.01	5	<0.00
Cotton	D, I	1	0.00	0	0
Sub-TOTAL (D): *Other uses with direct effects only*[3]		5,121	2.33	1,169	0.53
Sub- TOTAL (I):		2,772	1.26	479	0.21

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Other uses with indirect effects only[3]					
TOTAL[4]:		5,121	2.33	1,169	0.53

Agricultural usage in California only based on CalPUR data:

Use type	Risk to species[5]	Use overlap with range		Estimated usage in range[6]	
		Acres	%	acres	%
Pasture	D, I			1080	0.49
Other Crops	D, I			0	0
Orchards and Vineyards	D, I			487	0.22
Corn	D, I			64	<0.01
Other Grains	D, I			16	<0.01
Vegetables and Ground Fruit	D, I			154	0.07
Wheat	D, I			0	0
Other RowCrops	D, I			0	0
Cotton	D, I			0	0
TOTAL[7]:				1801	0.78

 # acres in species range: 94,197,933 acres
% of range in California (i.e., where CalPUR data is available): 50%
Range overlap with Federal lands: 71,918,561 acres, 76.3%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10

[4] TOTAL includes usage on all use sites with effects, including mosquito control.
[5] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[6] Estimated usage in the range is based on information about annual past usage.
[7] TOTAL includes usage on all use sites with effects, including mosquito control.

days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the desert tortoise. As discussed below, even though the vulnerability is high for this species, we anticipate the risk is low and the likelihood of exposure to malathion is low for this species, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The desert tortoise has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be low, with a low amount of estimated usage within the non-Federal portion of the range of the species based on standard and CalPUR usage data. We do not anticipate that mortality will occur on use sites, from spray drift or direct contact with malathion. We estimated that across the non-Federal portion of the range of the species, annual malathion uses pursuant to the labels could result in 1-2% high-level sublethal effects to growth and reproduction (from consumption of contaminated plants) on use sites. Plants could see a 1% decline in growth. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.53% of the non-Federal portion of the species and 0.78% of the non-Federal portion of the species California range annually based on standard and CalPUR past usage data, respectively. Mosquito adulticide applications account for 0.31% of this usage across the non-Federal portion of the species range. Reported California usage data is slightly higher than what was reported by EPA's SUUM data; however, both data sets indicate an extremely low usage rate. Since desert tortoises may travel through, forage, shelter and breed in many of the malathion use sites, we cannot rule out sublethal effects to individuals. However, we do not anticipate species-level effects, since estimated usage across the range is low and impacts linked to sublethal effects and reduced plant growth are low for desert tortoise. In addition, we anticipate that the conservation measure above, residential use label changes, will further reduce impacts to plant growth and reduce the risk of sublethal effects to turtles feeding on plant food items.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of

malathion used in residential areas and resulting amounts of runoff and drift. This residential use conservation measure will substantially reduce exposure to the desert tortoise and therefore minimize the overall risk and adverse effects to the species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the desert tortoise in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Thamnophis eques megalops	Northern Mexican gartersnake	1783

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
Currently, there are only five northern Mexican gartersnake populations in the United States, where the subspecies remains reliably detected and is considered viable, and all are located in Arizona. The five known populations are: (1) The Page Springs and Bubbling Ponds State Fish Hatcheries along Oak Creek, (2) lower Tonto Creek, (3) the upper Santa Cruz River in the San Rafael Valley, (4) the Bill Williams River, and (5) the upper and middle Verde River. In New Mexico, the northern Mexican gartersnake was last documented in 2013 along the Gila River in the vicinity of the Highway 180 crossing (Hotle 2013, entire) and is considered to occur in extremely low population densities within its historical distribution along the Gila River and Mule Creek.

The presence of harmful nonnative species constitutes the most significant threat to the gartersnake species. The prey base of the gartersnake includes native amphibians and fish populations. Declines in their prey base have led to subsequent declines in the distribution and density of gartersnake populations. In most areas across their ranges, prey base declines are largely attributed to the introduction and expansion of harmful nonnative species. Other activities, factors, or conditions that act in combination, such as road construction, use, and management, adverse human interactions, environmental contaminants, entanglement hazards, and competitive pressures from sympatric species, occur within the distribution of these gartersnakes and have the propensity to contribute to further population declines or extirpations where gartersnakes occur at low population densities. An emerging skin disease, SFD, has not yet been documented in gartersnakes but has affected snakes of many genera within the United States, including ecologically similar species, and may pose a future threat to northern Mexican gartersnakes.

EB/CE Source: USFWS 2014. Endangered and Threatened Wildlife and Plants; Threatened Status for the Northern Mexican Gartersnake and Narrow-Headed Gartersnake; Final Rule. Federal Register 79 (July 8, 2014): 38678-38746.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The northern Mexico garter snake is not expected to enter malathion use sites. Direct effects are not expected from spray drift from use sites, or from mosquito control.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	No effects expected
Spray drift areas - Prey item mortality	Up to 4% to invertebrates, additional risk for fish, amphibians, reptiles
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	19% invertebrates, fish, and amphibians, 2% reptiles

Risk modifiers: The Northern Mexican garter snake exists primarily on rangeland. This species may utilize some other sites on occasions, but for this analysis is considered unlikely to forage in malathion use sites.

Allowable uses driving effects/other considerations:
We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ **High** ☒ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Usage data for the whole range based on data from EPA's SUUM:

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	15,017,842	19.27	653,400	0.84
Other Crops	*	507,893	0.65	0	0
Open Space Developed	*	425,954	0.55	21,298	0.03
Developed	*	381,742	0.49	19,087	0.02
Pasture	*	240,160	0.31	102,774	0.13
Cotton	*	143,881	0.18	6,706	0.01
Corn	*	50,185	0.06	283	<0.01
Wheat	*	46,625	0.06	4,857	0.01
Other Grains	*	42,602	0.05	3,753	<0.01
Orchards and Vineyards	*	22,528	0.03	2,738	<0.01
Vegetables and Ground Fruit	*	16,253	0.02	2,902	<0.01
Nurseries	*	431	<0.01	431	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		0	0	0	0
TOTAL[4]:		15,017,842	19.27	653,400	0.84

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses.

 # acres in species range: 77,953,472 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 32,355,958 acres, 41.5%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Rain restriction and aquatic habitat buffers: While the Northern Mexican gartersnake is not strictly an aquatic species, it is known to rely on aquatic habitat for food resources or is otherwise closely associated with aquatic habitats and may experience effects of malathion through effects to the aquatic system.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions and aquatic habitat buffers required of all agricultural and residential uses will reduce the levelof effects impacting the Northern Mexican gartersnake.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and ground fruit lower the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the northern Mexican gartersnake. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The northern Mexican gartersnake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be medium, with a low amount of estimated usage within the non-Federal portion of the range of the species based on standard usage data. We do not anticipate that mortality will occur on use sites, from spray drift or direct contact with malathion. Additionally, we do not anticipate sublethal effects. We estimated that across the non-Federal portion of the range of the species, annual malathion uses pursuant to the labels could result in the loss of up to 4% invertebrates and additional loss of amphibians, fish and reptiles on use sites and 19%

invertebrates, fish and amphibians and 2% of reptiles as a result of mosquito control. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.84% of the non-Federal portion of the species range as a result of mosquito adulticide applications. The northern Mexican gartersnake is considered a riparian obligate (restricted to riparian areas when not engaged in dispersal behavior) and occurs chiefly in the following general habitat types: (1) Source-area wetlands [e.g., cienegas (mid-elevation wetlands with highly organic, reducing (basic, or alkaline) soils), stock tanks (small earthen impoundment), etc.]; (2) large river riparian woodlands and forests; and (3) streamside gallery forests (as defined by well-developed broadleaf deciduous riparian forests with limited, if any, herbaceous ground cover or dense grass). Northern Mexican gartersnakes primarily feed on amphibians and fish but have also been known to feed on invertebrates (e.g, worms, snails), reptiles, and small mammals. Although loss of prey items is around 19% if all mosquito adulticide application sites were treated across the species range, we do not anticipate species-level effects due to the low estimated usage within the species range, the species ability to eat a variety of prey items, and the ability to move to areas that have higher prey abundance. In addition, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, and reduced number of applications and rates on certain use sites, will further reduce the risk of exposure to prey resources across the species range.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species prey resources. Considered together, we expect these conservation measures will substantially reduce exposure to the northern Mexican gartersnake's prey resources and therefore minimizes adverse effects to the species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the northern Mexican gartersnake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Thamnophis rufipunctatus	Narrow-headed gartersnake	3271

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
Narrow-headed gartersnakes were detected in 5 of 16 historical localities in Arizona and New Mexico surveyed by Holycross et al. (2006) in 2004 and 2005. As of 2011, the only remaining narrow-headed gartersnake populations where the species could reliably be found were located at: (1) Whitewater Creek (NM), (2) Tularosa River (NM), (3) Diamond Creek (NM), (4) Middle Fork Gila River (NM), and (5) Oak Creek Canyon (AZ). However, populations found in Whitewater Creek and the Middle Fork Gila River were likely significantly affected by the large Whitewater–Baldy Complex Fire, which occurred in June 2012.

The presence of harmful nonnative species constitutes the most significant threat to the gartersnake species. The prey base of the gartersnake includes native amphibians and fish populations. Declines in their prey base have led to subsequent declines in the distribution and density of gartersnake populations. In most areas across their ranges, prey base declines are largely attributed to the introduction and expansion of harmful nonnative species. Other activities, factors, or conditions that act in combination, such as road construction, use, and management, adverse human interactions, environmental contaminants, entanglement hazards, and competitive pressures from sympatric species, occur within the distribution of these gartersnakes and have the propensity to contribute to further population declines or extirpations where gartersnakes occur at low population densities. An emerging skin disease, SFD, has not yet been documented in gartersnakes but has affected snakes of many genera within the United States, including ecologically similar species, and may pose a future threat to narrow-headed gartersnakes.

EB/CE Source: USFWS 2014. Endangered and Threatened Wildlife and Plants; Threatened Status for the Northern Mexican Gartersnake and Narrow-Headed Gartersnake; Final Rule. Federal Register 79 (July 8, 2014): 38678-38746.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The narrow-headed garter snake is not expected to experience effects from foraging on dietary items exposed to malathion at maximum rates on use sites or from spray drift.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	<1% reptiles, amphibians, and fish
Spray drift areas - Prey item mortality	<2% reptiles, amphibians, and fish
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	12% fish and aquatic amphibians, <1% reptiles and terrestrial amphibians

Risk modifiers:

Allowable uses driving effects/other considerations:

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Usage data for the whole range based on data from EPA's SUUM:

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	10,211,439	18.60	219,406	0.40
Pasture	I	25,953	0.05	17,479	0.03
Other Crops	I	142,018	0.26	0	0
Open Space Developed	I	132,265	0.24	6,613	0.01
Developed	I	94,547	0.17	4,727	0.01
Corn	I	12,519	0.02	279	<0.01
Other Grains	I	14,083	0.03	4,473	0.01
Vegetables and Ground Fruit	I	7,591	0.01	2,570	<0.01
Cotton	I	27,774	0.05	6,880	0.01
Orchards and Vineyards	I	3,974	0.01	1,985	<0.01
Wheat	I	5,302	0.01	4,801	0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		466,024	0.85	49,807	0.09
TOTAL[4]:		10,677,463	19.45	269,213	0.49

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself).

 # acres in species range: 54,888,803 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 21,812,269 acres, 39.7%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

Rain restriction and aquatic habitat buffers: While the narrow-headed gartersnake is not strictly an aquatic species, it is known to rely on aquatic habitat for food resources or is otherwise closely associated with aquatic habitats and may experience effects of malathion through effects to the aquatic system.

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Rain restrictions and aquatic habitat buffers required of all agricultural and residential uses will reduce the effects to the prey base of the narrow-headed gartersnake.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the narrow-headed gartersnake. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The narrow-headed gartersnake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be medium, with a low amount of estimated usage within the non-Federal portion of the range of the species based on standard usage data. We do not anticipate that mortality will occur on use sites, from spray drift or direct contact with malathion. Additionally, we do not anticipate sublethal effects. We estimated that across the non-Federal portion of the range of the species, annual malathion uses pursuant to the labels could result in the loss of <1% amphibians, fish and reptiles on use sites; <2% amphibians, fish and reptiles from spray drift; and 12% aquatic amphibians and fish, and <1% of reptiles and terrestrial amphibians, as a result of mosquito control. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.49% of the non-Federal portion of the species range annually based on standard past usage data. Mosquito adulticide applications account for 0.4% of this usage. The narrow-headed gartersnake is distributed across

the Mogollon Rim of Arizona and New Mexico and occur at elevations from approximately 2,300 to 8,000 feet (701 to 2,430 meters), inhabiting Petran Montane Conifer Forest, Great Basin Conifer Woodland, Interior Chaparral, and the Arizona Upland subdivision of Sonoran Desertscrub communities (Rosen and Schwalbe 1988, Brennan and Holycross 2006). Narrow-headed gartersnakes almost exclusively forage on fish; although there is some literature suggestions that amphibians may be occasionally consumed. Although loss of prey items is around 12% if all mosquito adulticide application sites were treated across the species range, and even a smaller percentage as a result of spray drift, we do not anticipate species-level effects due to the low estimated usage within the species range, and a lower likelihood of mosquito adulticide applications at higher elevations and within suitable habitat of the snake. In addition, we anticipate that the conservation measures above, including rain restrictions and aquatic habitat buffers, , will further reduce the risk of exposure to prey resources across the species range.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Considered together, we expect these conservation measures will substantially reduce exposure to the northern narrow-headed gartersnake’s prey resources and therefore minimizes adverse effects to the species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the northern narrow-headed gartersnake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Gopherus polyphemus	Gopher tortoise	3532

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Candidate
Distribution: *Species/Populations widespread or wide-ranging*
Number of Populations: Multiple populations (numerous)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The range of the gopher tortoise (eastern population) is frequently associated with the longleaf pine ecosystem. An estimated 4.7 million acres (ac) (1.9 million hectares [ha]) of longleaf pine habitat currently exist in the southeastern United States up from an estimated 3.3 million acres (1.3 million ha) in 2012 (Oswalt et al. 2012, p. 13; ALRI, 2017, p. 10). It is estimated that approximately 55% of this acreage is in private ownership, 34% is in Federal ownership, and 11%is in State or local ownership (Gaines 2010, entire). In 2010, modeling efforts were used to identify potential habitat where tortoises may be present (Hoctor and Beyeler, entire). A total of about 23.5 million ac (9.5 million ha) of potential primary, secondary, and foraging habitat is estimated to currently occur within the eastern portion of the tortoise's range (Hoctor and Beyeler 2010, p. 12). Over 80%of the potential habitat is estimated to be in private ownership, and the remainder is controlled by local, State, Federal, or private conservation entities. Currently, Georgia is expanding the amount of occupied gopher tortoise habitat that is under conservation and has conserved approximately 11,000 acres between 2015-2017 (9th Annual GT CCA report, 2018, p. 34). Although most state-wide estimates of gopher tortoise abundance have not been calculated directly from survey results, some estimates have been made based on available habitat and extrapolation of existing population data. These estimates include: approximately 785,000 in Florida (Florida Fish and Wildlife Conservation Commission (FWC) 2012, p. 2); 350,000 in Georgia (9th Annual GT CCA report); 30,000 to 130,000 in Alabama (Guyer et al., 2011, p. 4); and 1500-2000 in South Carolina (Buhlmann, Savannah River Ecology Laboratory, in litt. 2012). Many surveys indicate that tortoise populations often occur in fragmented and degraded habitat, and densities of individuals are low within populations; however, there are also many populations of tortoises in the eastern portion of the range that appear to be sufficiently large enough to persist long-term if proper management and protections are secured (Service 2011, p. 38).

There are many direct and indirect factors contributing to the destruction, modification, or curtailment of the species habitat, including (but not limited to): 1) habitat fragmentation by roads (potentially causing road mortality, reproductive isolation, small and discontinuous

populations, and edge effects that may increase predation); 2) habitat modification (either deliberately or from inattention), including conversion of open pine (e.g., longleaf pine) forests to other silvicultural or agricultural habitats, mining, shrub/hardwood/sand pine encroachment (mainly from fire exclusion or insufficient fire management), and establishment and spread of invasive species (potentially causing the aforementioned indirect effects due to canopy closure and decline of available forage/groundcover); and 3) habitat destruction from activities such as urbanization, solar farm construction, and sand extraction (potentially causing direct mortality and/or displacement of tortoises to undesirable habitats). It is anticipated that the destruction, modification, or curtailment of the gopher tortoise's habitat is currently a threat and is expected to persist. Other threats include disease, nest predation by predators, herbicide exposure and road mortality.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2019. Species Assessment and Listing Priority Form: Gopher Tortoise (*Gopherus polyphemus*) Eastern Population. Atlanta, Georgia. 47 pp.

Overall Vulnerability: ☐ **High** ☒ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Risk to individuals if exposed: Gopher tortoises exposed to malathion at maximum rates are expected are not expected to experience mortality on open space developed use sites from consuming contaminated plant material but could experience effects to growth and reproduction. The gopher tortoise is not expected to enter pasture or other agricultural areas.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	5% (G – low effects), 5% (R – high effects)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	N/A
Spray drift areas - Prey item mortality	N/A
Plants affected (decline in growth)	5%
MOSQUITO CONTROL	
Direct (mortality)	No effects expected

Sublethal	No effects expected
Indirect	No effects expected

Risk modifiers: The gopher tortoise is the primary grazer in its xeric habitats and aids in seed dispersal for native grasses.

Gopher tortoises occupy a wide range of upland habitat types; however most suitable habitat includes: 1. the presence of well-drained, sandy soils, which allow easy burrowing (because of lower ambient temperatures, the western population may require a meter or more of sandy soil depths); 2. an abundance of herbaceous ground cover; and 3. a generally open canopy and sparse shrub cover, which allow sunlight to reach the forest floor.

Gopher tortoises have been found to limit feeding activity to within 30 m (33 yards) of the burrow being used, be in a nearly circular or elliptical pattern around the burrow. Food availability can increase or decrease foraging distances. In one study, home ranges of males were much larger than females; males had a home range of~ 0.06—1.44 ha (0.14—3.56 A) with a mean of 0.47 ha (1.16 A), while females had a home range of 0.04-0.14 ha (0.10—0.35 A) with a. mean of 0.08 ha (0.20 A).

Gopher tortoises may forage and breed in managed forests, rangeland, and right of ways, forage in developed open space areas, and travel through developed areas. Gopher tortoises are not expected to enter agricultural areas. (Pers. Comm 2016 co-occurrence information, USFWS field office request).

Allowable uses driving effects/other considerations: All effects result from overlap with open space developed and pine seed orchard use sites.

Overall Risk: ☐ **High** ☐ **Medium** ☒ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	N	44,390,384	56.52	3,567,774	4.54
Open Space Developed	D, I	4,027,656	5.13	201,383	0.26
Developed	*	3,137,166	3.99	156,858	0.20
Cotton	*	1,863,298	2.37	55,208	0.07
Pine Seed Orchards	D	1,754,315	2.23	25	<0.01

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Orchards and Vineyards	*	1,359,136	1.73	267,554	0.34
Other Crops	*	1,349,637	1.72	1	<0.01
Other RowCrops	*	1,064,519	1.36	27,945	0.04
Other Grains	*	738,899	0.94	23,058	0.03
Corn	*	538,288	0.69	2,496	<0.01
Wheat	*	77,371	0.10	2,763	<0.01
Pasture	*	557	<0.01	95	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		5,781,972	7.36	201,408	0.26
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		4,027,656	5.13	201,383	0.26
TOTAL[4]:		5,781,972	7.36	201,408	0.26

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself).

 # acres in species range: 78,536,113 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 6,610,141 acres, 8.4%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and ground fruit lower the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10

[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the gopher tortoise (eastern population). As discussed below, even though the vulnerability is medium for this species, we anticipate the risk is low and the likelihood of exposure to malathion is low for this species, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The gopher tortoise has a medium vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be low, with a low amount of estimated usage within the non-Federal portion of the range of the species based on standard usage data. We do not anticipate that mortality will occur on use sites, from spray drift, from mosquito control or from direct contact with malathion. We estimated that annual malathion uses pursuant to the labels could result in the 5% low-level sublethal effects to growth and 5% high-level sublethal effects to reproduction. Approximately 5% of plant forage items across the non-Federal portion of the species range could see a decline in growth. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.26% of the non-Federal portion of the species range annually based on standard past usage data. Although sublethal effects may occur to small numbers of tortoises across the range and result in a small decline in plant growth (forage base), we do not anticipate species-level effects due to the low estimated usage within the species range. In addition, we anticipate that the conservation measures above, including residential use label changes and reduced number of applications and rate on certain use sites, will further reduce impacts to plant growth and reduce the risk of sublethal effects to turtles feeding on plant food items.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the gopher tortoise and therefore minimizes overall risk and adverse effects to the species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the gopher tortoise in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Pituophis ruthveni	Louisiana Pinesnake	3722

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
Potentially occupied habitat of the Louisiana pinesnake (based upon 1993-2013 occurrence data) is primarily concentrated on public lands (DOD lands at Fort Polk and Peason Ridge, Louisiana and the Kisatchie and Angelina National Forests) and privately-owned industrial timberlands in Louisiana and Texas. The primary threats to this species stem from extensive historical habitat losses, coupled with the disruption of natural fire regimes, which have reduced the Louisiana pinesnake to six small, isolated, naturally occupied areas.

All of these remnant individuals may be vulnerable to factors associated with low population sizes and demographic isolation such as reduced genetic heterozygosity. Habitat conditions on Federal lands are improving. However, the historical and ongoing loss or unavailability of preferable habitat (via fire suppression, conversion to short rotation, dense-canopy, off-site pine plantations, increases in the number and width of roads, and urbanization) on private lands in the matrix between these extant populations has eliminated dispersal among remnant populations and the natural re-colonization of vacant suitable habitat patches. Because it is extremely unlikely that corridors linking extant populations will be established, the loss of any extant population would be permanent without future reintroduction from captive-bred individuals.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2016. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Louisiana Pinesnake; Proposed Rule. Federal Register 81: 69454-69475.

Overall Vulnerability: ☒ High ☐ Medium ☐ Low

Note for this analysis: For this species, we used the overlap percentages from EPA's previous overlap analysis. We anticipate these values are representative of our current methods as they did not overlap with layers which had changed substantially. Usage within the range was calculated as being 5% of the overlap for each overlapping use within the species range, consistent with our

current methods for developed and open space developed use sites. We will consider rerunning the overlap analysis for this species for the final biological opinion.

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The Louisiana pinesnake may experience sublethal effects from consuming prey contaminated on developed or open-space developed use sites.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	Up to 8% (G – low effects), Up to 10% (R – low to high effects)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	No effects expected
Spray drift areas - Prey item mortality	No effects expected
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	No effects expected

Risk modifiers:
Louisiana pinesnakes are endemic to the westerly extent of the longleaf pine (*Pinus palustris*) ecosystem that historically existed in Louisiana and Texas. Louisiana pinesnake habitat consists of sandy, well-drained soils in open pine forest (especially longleaf-pine savanna), a sparse midstory, and well-developed herbaceous ground cover dominated by grasses and forbs. Abundant ground-layer herbaceous vegetation is important for the Louisiana pinesnake and their primary prey, the Bairds pocket gopher (*Geomys breviceps*). In addition, Baird's pocket gopher burrows are the primary known source of shelter for the Louisiana pinesnake. These fire-climax park-like conditions are created and maintained by recurrent low-intensity ground fires that occur on a 3 to 5 year return interval. In the absence of recurrent fire, suitable Louisiana pinesnake habitat conditions are lost due to vegetative succession. Louisiana pinesnakes have also been found in grasslands and pine plantations that contain sufficient herbaceous ground cover and sandy soils.

Baird's pocket gopher is primary food item, but Louisiana pinesnakes are also known to eat moles, cotton rats, deer mice, harvest mice, and turtle eggs.

The Lousiana pinesnake is semi-fossorial and diurnal, and relatively immobile. It has been documented that the species spends 59 percent of daylight hours (sunrise to sunset) below ground and moves an average of 163 meters per day.

Allowable uses driving effects/other considerations: Effects to the Louisiana pinesnake based are primarily based on overlap with developed and open space developed use sites. However, developed areas are less likely to contain suitable habitat and therefore these effects are likely to be over-estimated. In addition, Baird's pocket gopher, the primary prey item for the Louisiana pinesnake, spends most of its time underground and can obtain food from the roots of different plants in its tunnels. While it will come above ground when no food is available in its burrows, its feeding behavior makes it less likely to be exposed to malathion, and thus less likely to affect pinesnakes if consumed.

Overall Risk: ☐ **High** ☒ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	N	93882	8.27	0	0.00
Cotton	D	57656	5.08	333	0.03
Open Space Developed	D	25024	2.20	1251	0.11
Corn	D	13464	1.19	352	0.03
Other Crops	D	7661	0.67	0	0.00
Other Grains	D	6477	0.57	4	0.00
Developed	D	5052	0.44	255	0.02
Pasture	D	43	0.00	0	0.00
Orchards and Vineyards	D	28	0.00	54	0.00
Wheat	D	4	0.00	4	0.00
Rice	D	1	0.00	10	0.00
Pine Seed Orchards	D	0	0.00	0	0.00
Sub-TOTAL (D): *Other uses with direct effects only*[3]		115,410	10.15	2,263	0.19
Sub- TOTAL (I):		0	0.00	0	0.00

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Other uses with indirect effects only[3]					
TOTAL[4]:		115,410	10.15	2,263	0.19

This species consumes invertebrates, therefore malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself).

 # acres in species range: 1,135,475
acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 442,739 acres, 38.99%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and ground fruit lower the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the Louisiana pinesnake. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of

[4] TOTAL includes usage on all use sites with effects, including mosquito control.

exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.
The Louisiana pinesnake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be medium, with a low amount of estimated usage within the range, based on standard usage data. We do not anticipate that mortality will occur on use sites or from spray drift. We do not anticipate loss of prey resources. We estimated that across the species range, annual malathion uses pursuant to the labels could result in sublethal effects in up to 8% (low-level effects to growth) and up to 10% (low- to high-level effects to reproduction) in individuals if they consume contaminated prey items.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.19% of the species range annually based on standard past usage data. There is no past mosquito adulticide usage data reported, and we anticipate future usage is unlikely. The Louisiana pinesnake primarily feeds on Baird's pocket gophers, but may also eat other small mammals and turtle eggs. In addition, the pinesnake primarily utilizes Baird's pocket gopher burrows for shelter and spends the majority of its time below ground (night and 59% of daylight hours). Baird's pocket gophers also spend a majority of its time underground. While we cannot rule out that individual pinesnakes could be subjected to sublethal effects, we assume there is a very low likelihood of this occurring since the snakes primary prey item spends the majority its time below ground, making it less likely to be exposed to malathion, and the anticipated malathion usage within the species range is extremely low. In addition, we anticipate that the conservation measures above, including reduced number of applications and rates on certain use sites and residential use label changes, will further reduce the risk of exposure to prey resources and reduce the risk of sublethal effects to the snake.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the Louisiana pinesnake and therefore minimizes overall risk and adverse effects to the species. Thus, while small numbers of individuals may be exposed over the duration of the proposed action, we do not anticipate species-level effects.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the Louisiana pinesnake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Pituophis melanoleucus lodingi	Black Pinesnake	6097

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
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 ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:

Black pinesnakes are endemic to the longleaf pine ecosystem that once covered the southeastern United States. Now their range is likely in all historical counties in Alabama (Clarke, Mobile, and Washington Counties) and in 11 out of 14 historical counties in Mississippi (Forrest, George, Greene, Harrison, Jackson, Jones, Lamar, Marion, Perry, Stone, and Wayne Counties). Black pinesnake populations in many of the occupied counties in Mississippi occur in the De Soto NF.

Much of the habitat outside of De Soto NF has become highly fragmented, and populations on these lands appear to be small and isolated on islands of suitable habitat (Duran 1998a, p. 17; Barbour 2009, pp. 6–13). Habitat fragmentation within the longleaf pine ecosystem threatens the continued existence of all black pinesnake populations, particularly those on private lands. This is frequently the result of urban development, conversion of longleaf pine sites to densely stocked pine plantations, and the associated increases in number of roads. The black pinesnake is threatened by fragmentation and degradation of longleaf pine habitat, road mortality, hunting, low reproductive rates, the pet trade, predation, inadequacy of regulatory mechanisms, exotic plants, erosion control blankets, and stochastic events.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Black Pinesnake with 4(d) Rule; Final Rule. Federal Register 80: 60467-60489.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The black pine snake is not expected to experience mortality from exposure to malathion at maximum rates on use sites or as a result from spray drift but could experience effects to growth and reproduction from exposure on use sites.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	<1% (G,R,B)
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	<1% birds, no effects to mammals
Spray drift areas - Prey item mortality	No effects expected
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	54% (R – low effects, birds), no effects from consumption of mammals
Indirect	No effects expected

Risk modifiers: The black pine snake is not expected to utilize developed and open space developed use categories.

Black pinesnakes are known to consume a variety of food, including nestling rabbits (Sylvilagus aquaticus), bobwhite quail (Colinus virginianus) and their eggs, and eastern kingbirds (Tyrannus tyrannus) (Vandeventer and Young 1989, p. 34; Yager et al. 2005, p. 28); however, rodents represent the most common type of prey.

Overall Risk: ☐ **High** ☐ **Medium** ☒ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	D	4,012,924	53.84	163,367	2.19

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Open Space Developed	*	342,937	4.60	17,147	0.23
Developed	*	159,367	2.14	7,968	0.11
Cotton	D, I	17,669	0.24	15,377	0.21
Other RowCrops	D, I	17,568	0.24	5,467	0.07
Other Crops	D	16,558	0.22	5	<0.01
Corn	D	5,843	0.08	2,384	0.03
Vegetables and Ground Fruit	D	1,856	0.02	1,797	0.02
Other Grains	D	1,298	0.02	1,178	0.02
Wheat	D	569	0.01	277	<0.01
Sub-TOTAL (D): *Other uses with direct effects only*[3]		61,362	0.82	26,485	0.36
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		35,237	0.47	20,844	0.28
TOTAL[4]:		4,074,286	54.66	189,851	2.55

 # acres in species range: 7,453,734 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 910,576 acres, 12.2%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the black pinesnake.

The black pinesnake has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portion of the range is low, with a low amount of estimated usage based on standard usage data. We do not anticipate that mortality will occur on use sites, from spray drift, from mosquito control or from direct contact with malathion. We estimated that across the non-Federal portion of the range of the species, annual malathion uses pursuant to the labels could result in 54% low-level sublethal effects to reproduction from consumption of contaminated birds from mosquito control and <1% sublethal effects to growth, reproduction and behavior from use sites. Less than 1% of prey resources (birds only) could be impacted due to spray drift. We did not quantitatively

[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 2.55% of the non-Federal portion of the species range annually based on standard past usage data. Mosquito adulticide applications account for 2.19% of the overall estimated usage. Although there is risk for sublethal effects to occur to individual black pine snakes and a very low likelihood of impacts to birds as a prey item, we do not anticipate species-level effects, due to the low estimated usage within the species range and the fact that black pinesnakes' most common prey type is mammals (birds are only taken opportunistically).

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the black pinesnake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Kinosternon sonoriense longifemorale	Sonoyta Mud Turtle	6620

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Endangered
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 ☒

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The Sonoyta mud turtle is a medium sized aquatic turtle found in southern Arizona (Quitobaquito Springs, Organ Pipe Cactus National Monument) and Sonora, Mexico. The total population is estimated at 1,200 individuals, which includes Mexico. Sonoyta mud turtles are highly aquatic and depend on permanent water and adjacent terrestrial habitat for survival. Sonoyta mud turtles depend on aquatic habitat for foraging, shelter, and mating and terrestrial habitat for nesting and estivating. Its habitats commonly experience drought and extreme heat. Loss and degradation of stream habitat from water diversion and groundwater pumping, along with its very limited distribution, are the primary threats to the Sonoyta mud turtle. This species is threatened by groundwater depletion and surface water diversion, development of and changes to urban infrastructure, contaminants, alteration of native plant composition, border activities, inadequate regulations, and climate change.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2021. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Sonoyta Mud Turtle; Final Rule. Federal Register 82: 43897-43907.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The species range is wholly on Federal lands. While we cannot rule out adverse effects to the species, we anticipate any effects that may occur will be minimal and highly localized on small sites.

Risk to the species from labelled uses across the range:

Overall Risk: ☐ **High** ☐ **Medium** ☒ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

 # acres in species range: 6,844,582 acres (higher than actual; map is based on county)
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 100%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONCLUSION
After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the Sonoyta mud turtle.

The Sonoyta mud turtle has a high vulnerability based on its status, distribution, and trends. The risk to the species posed by labeled uses across the range is anticipated to be low, as described above. We anticipate usage within the range will be low, based primarily on the usage data we acquired about malathion usage on Federal lands indicating that past malathion usage has occurred on public lands for a variety of uses, but usage has been minimal (see Usage section of Opinion), with only localized applications occurring on a rare basis. We expect any adverse effects to listed resources to be minimal, considering the small scale and low levels of past usage and in light of Federal agency programs that are designed to understand, avoid and minimize the effects to listed species. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the Sonoyta mud turtle in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Sistrurus catenatus	Eastern Massasauga	7800

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Threatened
Distribution: Small, endemic, constrained, and/or isolated population(s)
Number of Populations: Multilple populations (numerous)
Species Trends: Declining population(s) – one or more populations declining
Pesticides noted ☐

Environmental Baseline/Cumulative Effects (EB/CE) Summary:
The documented historical range of the eastern Massasauga 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. Rangewide, 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-yr review, the eastern massasauga rattlesnake is still extant in the states of Indiana, Illinois, Iowa, Michigan, New York, Ohio, Pennsylvania and Wisconsion. 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 not considered extirpated due to lack of suitable habitat. Eastern massasaugas are considered extirpated from Missouri and Minnesota.

The most prominent stressors affecting the eastern massasauga rattlesnake include habitat loss and fragmentation, especially through development and vegetative succession; road mortality; hydrologic alteration (hydrologic drawdown) resulting in drought or artificial flooding; persecution; collection; and mortality of individuals as a result of habitat management that includes postemergent (after hibernation) prescribed fire and mowing for habitat management. The emergence of a Snake Fungal Disease which has proven to be fatal for the Eastern Massasauga, human collection and killing.

EB/CE Source: U.S. Fish and Wildlife Service (USFWS). 2021. Eastern Massasauga Rattlesnake (*Sistruurs catenatus*) 5-Year Review: Summary and Evaluation. Chicago Ecological Services Field Office, Chicago, Illinois. 13 pp.

U.S. Fish and Wildlife Service (USFWS). 2016. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Eastern Massasauga Rattlesnake; Final Rule. Federal Register 81: 67193- 67214.

Overall Vulnerability: ☐ **High** ☒ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: The eastern massasauga is not expected to experience mortality from exposure to malathion at maximum rates on use sites or from spray drift, but may experience effects to growth or reproduction on use sites.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	No effects expected
Spray drift areas – mortality	No effects expected
Sublethal – growth (G), reproduction (R) and behavior (B)	7% (G – low effects, mammals), 22% (R – low effects, mammals), 7% (R – high effects, mammals); no sublethal effects from consumption of amphibians and reptiles
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	
Use areas - Prey item mortality	19% reptiles and amphibians, <1% mammals
Spray drift areas - Prey item mortality	Reptiles and amphibians
Plants affected (decline in growth)	N/A
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	1% reptiles and amphibians

Risk modifiers: The Eastern Massasauga is not expected to enter open space developed use areas.

Eastern massasauga rattlesnakes are known to eat voles, mice, other small mammals, small birds, amphibians, and even other species of snakes.

Allowable uses driving effects/other considerations: Corn, pasture, developed

We anticipate effects to the prey base from malathion on or near use sites or from mosquito control applications. Species taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time.

Overall Risk: ☒ **High** ☐ **Medium** ☐ **Low**

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	7,449,920	12.59	36,305	0.06
Corn	D, I	6,597,222	11.15	87,949	0.15
Developed	D, I	3,802,756	6.43	190,138	0.32
Open Space Developed	*	2,939,158	4.97	146,958	0.25
Pasture	D, I	1,265,906	2.14	123,026	0.21
Wheat	D, I	583,250	0.99	48,348	0.08
Vegetables and Ground Fruit	D, I	201,784	0.34	25,959	0.04
Other Crops	D, I	191,244	0.32	0	0
Orchards and Vineyards	D, I	165,572	0.28	3,820	0.01
Other Grains	D, I	88,669	0.15	15,186	0.03
Other RowCrops	D, I	41,687	0.07	4,256	0.01
Christmas Trees	D, I	14,781	0.02	9,719	0.02
Sub-TOTAL (D): *Other uses with direct effects only*[3]		12,952,871	21.89	508,401	0.86
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		12,952,871	21.89	508,401	0.86
TOTAL[4]:		20,402,791	34.49	544,706	0.92

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

Malathion usage on any use site has the potential to result in mortality to prey resources from spray drift (whether or not the species will utilize the site itself). Developed and open space developed uses have less potential for spray drift than other uses

 # acres in species range: 59,163,094 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 2,609,744 acres, 4.4%

Overall Usage: ☐ **High** ☐ **Medium** ☒ **Low**

CONSERVATION MEASURES

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and ground fruit lower the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from "repeat as necessary" to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the eastern massasauga rattlesnake. As discussed below, even though the vulnerability is medium and risk is high for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The eastern massasauga rattlesnake has a medium vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the range is anticipated to be high, with a low amount of estimated usage within the non-Federal portion of the range of the species based on standard usage data. We do not anticipate that mortality will occur on use sites, from spray drift, from mosquito control or from direct contact

with malathion. We estimated that annual malathion uses pursuant to the labels could result in 7% low-level sublethal effects to growth, 22% low-level sublethal effects to reproduction and 7% high-level sublethal effects to reproduction from consumption of contaminated mammals on use sites. In addition, the loss of prey resources could occur on use sites (19% of reptiles and amphibians and <1% mammals) and as a result of mosquito control (1% reptiles and amphibians). We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 0.92% of the non-Federal portion of the species range annually based on standard past usage data. Mosquito adulticide applications account for 0.06% of the overall estimated usage. Although there is risk for sublethal effects to occur to individual eastern massasauga rattlesnakes, we do not anticipate species-level effects due to the low estimated usage within the species range. Also, while there is a moderate risk to amphibians and reptiles as prey items, eastern massasauga rattlesnakes eat a variety of prey items. Mammals, which is likely their most abundant and preferred prey item, is less likely to be impacted from applications of malathion. In addition to the extremely low malathion use within the species range, we anticipate that the conservation measures above, including reduced number of applications and rates on certain use sites and residential use label changes, will further reduce the risk of exposure to prey resources and reduce the risk of sublethal effects to the snake.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species. Considered together, we expect these conservation measures will substantially reduce exposure to the eastern massasauga rattlesnake and therefore minimizes overall risk and adverse effects to the species. Thus, we do not anticipate species-level effects to this species.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the eastern massasauga rattlesnake in the wild.

Conclusion: Is not likely to jeopardize.

Integration and Synthesis Summary: Reptiles

Scientific Name:	Common Name:	Entity ID:
Macrochelys suanniensis	Suwannee Alligator Snapping Turtle	11657

VULNERABILITY
(Summary of status, environmental baseline and cumulative effects)

Status: Proposed threatened
Distribution: Small, endemic, constrained, and/or isolated populations
Number of Populations: Single population
Species Trends: Declining populations – one or more populations declining
Pesticides noted ☒

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 (Enge et al. 2014). 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. 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.

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 (Enge et al. 2014). 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 (Ernst and Lovich 2009; Ewert et al. 2006; Holcomb and Carr 2013). 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*) (Pritchard 1989). 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.

EB/CE Source: U.S. Fish and Wildlife Service. 2021. Endangered and Threatened Wildlife and Plants; 12-Month Petition Finding and Threatened Species Status with 4(d) Rule for Suwannee Alligator Snapping Turtle; Proposed Rule. Federal Register 86: 18014-18033.

Overall Vulnerability: ☒ **High** ☐ **Medium** ☐ **Low**

RISK
(Risk is based on species exposure and response from labelled uses across the range)

Risk to individuals if exposed: Suwannee alligator snapping turtles are not expected to experience effects from foraging on malathion use sites or as a result of exposure from spray drift.

Risk to the species from labelled uses across the range:
The table below summarizes the risk to the species from labelled uses across the range based on range overlaps with use sites and anticipated effects associated with the particular uses.

DIRECT (all uses except mosquito control)	
Use areas – mortality	None
Spray drift areas – mortality	None
Sublethal – growth (G), reproduction (R) and behavior (B)	No effects expected
Direct spray or contact with contaminated media	No effects expected
Volatilization	Not an appreciable source of exposure
INDIRECT (all uses except mosquito control)	

Use areas - Prey item mortality	Primary prey items: 23% fish, no effects to mussels; 0-27% other aquatic invertebrates, reptiles, birds and mammals.
Spray drift areas - Prey item mortality	Potential effects to fish, aquatic invertebrates other than mussels
Plants affected (decline in growth)	No effects expected
MOSQUITO CONTROL	
Direct (mortality)	No effects expected
Sublethal	No effects expected
Indirect	Primary prey items: 33% fish, no effects to mussels; 0-50% other aquatic invertebrates, reptiles, birds and mammals.

Risk modifiers: Suwannee alligator snapping turtles are typically bottom-dwelling, but surface periodically to breathe (Thomas 2014). While the species is typically found in fresh water, it can tolerate some salinity and brackish waters, as barnacles have been found on the carapace of some turtles. The species is found in a variety of habitats across its range, but all life stages rely on submerged material (*i.e.*, deadhead logs and vegetation) as important structure for resting, foraging, and cover from predators (Enge et al. 2014).

The Suwannee alligator snapping turtle is primarily carnivorous and forages on small fish and mussels; however, adults are opportunistic feeders and may also consume crayfish, mollusks, smaller turtles, insects, nutria, snakes, birds, and plant material such as acorns or other available vegetation (Elsey 2006).

The general life stages of *Macrochelys* spp. can be described as egg, hatchling (first year), juvenile (second year until age of sexual maturity), and adult (age of sexual maturity through death). Each life stage has specific requirements in order to contribute to the productivity of the next life stage. They excavate nests in sandy soils or other dry substrate near freshwater sources that are within 8 to 656 feet (2.5 to 200 meters) from the shore. The incubation period for Suwannee alligator snapping turtle is between 105 to 110 days (Ernst and Lovich 2009).

Suwannee alligator snapping turtles are long-lived species; provided suitable conditions, adults can reach carapace lengths of up to 29 inches and 249 pounds for males, while females can reach lengths of 22 inches and 62 pounds. Typical weights have been reported as 34 kg for males, and 17.2 kg for females (Johnston et al 2015).

Allowable uses driving effects/other considerations:
We anticipate effects to a portion of the prey base (i.e., fish, aquatic invertebrates other than mussels) from malathion on or near use sites or from mosquito control applications. Species within these taxa taken as food items exhibit a range of sensitivities to malathion; we expect exposure of prey would reduce, but not eliminate, prey in these areas. We anticipate reductions to be greater on use sites rather than from spray drift or mosquito control, where estimated

environmental concentrations are higher. These reductions are likely temporary (based on application frequency) with community recovery over a short period of time. In addition, because the Suwannee alligator snapping turtle is an opportunistic feeder, these reductions are expected to pose less risk to this species.

Overall Risk: ☐ High ☒ Medium ☐ Low

USAGE
(Anticipated usage within the range based on past usage data)

Use type	Risk to species[1]	Use overlap with range		Estimated usage in range[2]	
		Acres	%	acres	%
Mosquito Control	I	2,485,032	50.32	435,562	8.82
Orchards and Vineyards	I	38,814	0.79	5,882	0.12
Open Space Developed	I	209,838	4.25	10,492	0.21
Developed	I	74,502	1.51	3,725	0.08
Other Grains	I	27,776	0.56	17,980	0.36
Other Crops	I	136,196	2.76	0	0
Vegetables and Ground Fruit	I	12,347	0.25	3,397	0.07
Other Row Crops	I	159,865	3.25	16,402	0.33
Corn	I	21,515	0.43	1,161	0.02
Wheat	I	3,794	0.08	3,794	0.08
Pine seed orchards	I	358,986	7.27	23,238	0.47
Cotton	I	292,669	5.93	36,015	0.73
Sub-TOTAL (D): *Other uses with direct effects only*[3]		0	0	0	0
Sub- TOTAL (I): *Other uses with indirect effects only*[3]		1,336,302	27.08	122,086	2.47
TOTAL[4]:		3,821,334	77.40	557,648	11.29

[1] Direct effects (D), Indirect effects (I), No effects expected (N), Use site not utilized by the species (*)
[2] Estimated usage in the range is based on information about annual past usage.
[3] Mosquito control has the potential to overlap with other uses. It is not included in the Sub-TOTALs.
[4] TOTAL includes usage on all use sites with effects, including mosquito control.

 # acres in species range: 4,938,351 acres
% of range in California (i.e., where CalPUR data is available): 0%
Range overlap with Federal lands: 374,491 acres, 7.58%

Overall Usage: ☒ **High** ☐ **Medium** ☐ **Low**

CONSERVATION MEASURES

Rain restriction: Given the relatively short half-life of malathion and rapid degradation via hydrolysis and other processes, persistence of malathion in storm run-off into most aquatic habitats is not anticipated to last longer than 48 hours under typical pH values, (i.e., 6.5-8.5) and water temperatures corresponding to growing season. Restricting malathion application to periods where rain is not forecasted for at least 48 hours or when the soil is not saturated will provide time for the pesticide to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk.

Aquatic habitat buffers: Application buffers are designed to reduce spray drift from entering sensitive non-target areas, thereby providing protection to aquatic species. While the exact amount of spray drift reduction depends on the physical traits of the aquatic ecosystem (e.g. flow rate, volume, etc.) as well as the application method, we can expect (based on AgDRIFT modeling) spray drift reductions ranging from 40 to 91%, with low flow and low volume aquatic habitats receiving the most reduction in spray drift deposition. In many cases, these buffers significantly reduce exposure to aquatic organisms and subsequent risk of direct and indirect effects.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are expected to significantly reduce exposure to species that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application. In addition, exposure to aquatic organisms is reduced due to buffers from waterways and restrictions to application during periods where rain is not forecasted within 24 hours or when the soil is not saturated.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and ground fruit lower the maximum allowable number of applications to 2-4 per year (depending on the specific crop). This will help reduce the amount of malathion used and decrease potential exposure to the species.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of malathion, and the cumulative effects, it is the Service's biological opinion that the registration of malathion, as proposed, is not likely to jeopardize the continued existence of the Suwannee alligator snapping turtle. As discussed below, even though the vulnerability is high and risk is medium for this species, we anticipate the likelihood of exposure to malathion is low, and the implementation of the general conservation measures described above further reduces the likelihood of exposure.

The Suwannee alligator snapping turtle has a high vulnerability based on its status, distribution, and trends, based on the information above. The risk to the species posed by labeled uses across the non-Federal portions of their range is estimated to be medium (due to indirect effects to prey resources), with a high amount of estimated usage within the range, based on standard usage data. We do not anticipate that mortality or sublethal effects from consuming contaminated prey will occur on use sites, from spray drift, or from mosquito adulticide applications. We estimated that across the non-Federal portions of the species range, annual malathion uses pursuant to the labels could result in the loss of the species prey base. Use site applications of malathion could result in 23% mortality to fish and 0-27% mortality to aquatic invertebrates, reptiles, birds, and mammals. Spray drift has the potential kill fish and aquatic invertebrates other than mussels. Prey mortality from mosquito control could result in the loss of 33% of fish and 0-50% aquatic invertebrates, reptiles, birds, and mammals. We did not quantitatively evaluate use or usage on Federal lands that overlap with the species range, but we assume only low levels of usage for this species, per the rationale related to usage on Federal lands as described in the Biological Opinion.

While usage is not expected on all use sites and at the maximum rates allowed by the labels wherever used each year, we anticipate that usage will occur in up to 11.29% of the non-Federal portions of the species range annually based on standard past usage data. Mosquito adulticide applications account for 8.82% of this usage. *Macrochely spp.* are generally found in deeper water of larger rivers and their major tributaries, but are occasionally found in other habitats. They also select structure (e.g., submerged tree root masses, stumps, trees, etc.) more than open water and may select sites with a high percentage of canopy cover. This preference for high canopy cover likely minimizes the amount of runoff or drift that enters the aquatic habitat from mosquito adulticide applications. The Suwannee alligator snapping turtle is primarily aquatic, only venturing out of the water for nesting. They excavate nests in sandy soils or other dry substrate near freshwater sources that are within 8 to 656 feet (2.5 to 200 meters) from the shore. While Suwannee alligator snapping turtles could enter a use site (during egg laying) or mosquito adulticide application site, it is likely a rare event that this would coincide with a malathion application, since egg laying by individual females occurs over the course of two months (generally April and May), takes less than single day to complete, , and occurs at nesting sites distributed across the species range within any given year. Additionally, it is unlikely that adult

females (during egg laying) nor hatchlings (while dispersing to water) feed while on land. While prey resources could be impacted from use site applications, spray drift, and mosquito adulticide applications; foraging occurs primarily in their aquatic habitat. Reductions in prey are anticipated to be higher in terrestrial environments than in aquatic environments. Although, spray drift and runoff has the potential to impact prey resources in the aquatic environment, we anticipate that the conservation measures above, including rain restrictions, aquatic habitat buffers, residential use label changes, and reduced number of applications and rates on certain use sites will further reduce the risk of exposure to aquatic prey resources.

As stated previously, conservation measures are intended to reduce the amount of malathion runoff and spray drift that enter into sensitive habitats (e.g., species habitat, aquatic environments). For example, by placing a 48-hour rain restriction on agricultural applications, malathion has the ability to degrade after application (e.g., by hydrolysis, other processes) prior to any rain/runoff events, thus minimizing malathion runoff into aquatic habitats and decreasing exposure to listed species or their prey resources. Changes to residential labels limits applications to spot treatments and reduces the number of applications per year (2-4), significantly decreasing the overall amounts of malathion used in residential areas and resulting amounts of runoff and drift. Additional reductions in the number of applications and rates allowed for certain crops (e.g., corn, vegetables and ground fruit) further reduces the amount of malathion used in agricultural settings, thereby decreasing potential exposure to the species prey resources. Considered together, we expect these conservation measures will substantially reduce exposure to the Suwannee alligator snapping turtle's prey resources and therefore minimizes overall risk and adverse effects to the species.

While we do anticipate that adverse effects to prey items will occur, we do not expect species-level effects because reductions in prey availability will likely be temporary due to prey community recovery over time (based on the resiliency of affected prey items), the broad forage base of the adults of the species (i.e., fish and mussels and other opportunistic prey items such as crayfish, mollusks, smaller turtles, insects, nutria, snakes, birds, and plant material), and the ability of the adult turtles to move to other suitable untreated forage habitats nearby. While juveniles have a more limited diet (e.g., smaller fish, mussels, crayfish, mollusks, and plants), they still have the ability to move to other areas (i.e., upstream) to meet their dietary needs.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the Suwannee alligator snapping turtle in the wild.

Conclusion: Is not likely to jeopardize.

ADDITIONAL REFERENCES

Johnston GR, TM Thomas, E Suarez, and JC Mitchell. 2015. Population structure and body size of the Suwannee alligator snapping turtle (*Macrochelys suwanniensis*) in Northern Florida. Chelonian Conservation and Biology 14(1):73-81.