**ATTACHMENT 1-19: Biological Information on Listed Species of Amphibians and Model Parameterization for Pesticide Effects Determinations**

1. **Introduction**

The purpose of this document is to summarize available information for currently listed, proposed and candidate amphibian species (from the US Fish and Wildlife Service). The focus of this effort is to capture information that may be used in ecological risk assessments of pesticides to make species-specific effects determinations. This report focuses on defining parameters, such as body weight and diet, which may be used to estimate pesticide exposures to listed amphibians. This report also focuses on defining species characteristics that may be used to assess potential indirect effects to the species (*e.g.,* diet and habitat).

A formal quality assurance and quality control plan was implemented in the collection of species specific data. The instructions for extracting information for amphibians are included in **SUPPLEMENTAL INFORMATION 1**. A template for the worksheet used to record relevant biological information for each species is provided in **SUPPLEMENTAL INFORMATION 2**. **SUPPLEMENTAL INFORMATION 3** contains the completed worksheets containing biological information on each listed amphibian species or DPS. These worksheets were completed by Lewis Brown, Kris Garber and Melissa Panger.

At this time, there are a total of 35 federally listed as endangered and threatened (listed) species, subspecies or populations of amphibians that are listed under the Endangered Species Act (ESA) and occur in the United States, its territories and its waters. In addition, there are 5 species that are candidates (**Tables A 1-19.1 and A 1-19.2**). Of these species, 24 have designated critical habitats. Amphibians fall into two orders: Caudata (salamanders; N = 23) and Anura (frogs and toads; N = 17). These species will be considered in the national level risk assessments for chlorpyrifos, diazinon, and malathion. This assessment does not consider species listed as “foreign”. This is because they occur outside of the action area for pesticide registrations in the US.

**Table A 1-19.1. Number of listed amphibians by status.**

|  |  |
| --- | --- |
| **Status** | **Number of listings** |
| Endangered | 20 |
| Threatened | 15 |
| Candidate | 5 |
| Total | 40 |

**Table A 1-19.2. Listed species of amphibians included in pesticide effects determinations.**

| **Scientific Name** | **Common Name** | **Order** | **Listing Status\*** | **Critical habitat?** | **USFWS Species ID (ENTITY\_ID)** |
| --- | --- | --- | --- | --- | --- |
| *Ambystoma bishopi* | Reticulated Flatwoods Salamander | Caudata | E | Yes | 9943 |
| *Ambystoma californiense* | California Tiger Salamander (Santa Barbara County DPS) | Caudata | E | Yes | 8395 |
| *Ambystoma californiense* | California Tiger Salamander (Sonoma County DPS) | Caudata | E | Yes | 203 |
| *Ambystoma californiense* | California Tiger Salamander (Central California DPS) | Caudata | T | Yes | 4773 |
| *Ambystoma cingulatum* | Frosted Flatwoods Salamander | Caudata | T | Yes | 199 |
| *Ambystoma macrodactylum croceum* | Santa Cruz long-toed Salamander | Caudata | E | No | 188 |
| *Ambystoma tigrinum stebbinsi* | Sonora Tiger Salamander | Caudata | E | No | 201 |
| *Anaxyrus baxteri* | Wyoming Toad | Anura | E | No | 202 |
| *Anaxyrus californicus* | Arroyo Toad | Anura | E | Yes | 204 |
| *Anaxyrus canorus* | Yosemite Toad | Anura | T | Yes | 1707 |
| *Batrachoseps aridus* | Desert Slender Salamander | Caudata | E | No | 191 |
| *Bufo houstonensis* | Houston Toad | Anura | E | Yes | 190 |
| *Cryptobranchus alleganiensis bishopi* | Ozark Hellbender | Caudata | E | No | 7847 |
| *Eleutherodactylus cooki* | Guajon (frog) | Anura | T | Yes | 196 |
| *Eleutherodactylus jasperi* | Golden Coqui (frog) | Anura | T | Yes | 193 |
| *Eleutherodactylus juanariveroi* | Llanero Coqui | Anura | E | Yes | 9378 |
| *Eurycea chisholmensis* | Salado Salamander | Caudata | T | Yes | 7610 |
| *Eurycea nana* | San Marcos Salamander | Caudata | T | Yes | 194 |
| *Eurycea naufragia* | Georgetown Salamander | Caudata | T | Yes | 5434 |
| *Eurycea sosorum* | Barton Springs Salamander | Caudata | E | No | 197 |
| *Eurycea tonkawae* | Jollyville Plateau Salamander | Caudata | T | Yes | 8231 |
| *Eurycea waterlooensis* | Austin blind Salamander | Caudata | E | Yes | 6346 |
| *Gyrinophilus gulolineatus* | Berry Cave salamander | Caudata | C | No | 8765 |
| *Hyla wrightorum* | Arizona Treefrog | Anura | C | No | 9694 |
| *Lithobates onca* | Relict leopard Frog | Anura | C | No | 3628 |
| *Necturus alabamensis* | Black warrior (=Sipsey Fork) Waterdog | Caudata | C | No | 5065 |
| *Notophthalmus perstriatus* | Striped newt | Caudata | C | No | 7482 |
| *Peltophryne lemur* | Puerto Rican Crested Toad | Anura | T | No | 195 |
| *Phaeognathus hubrichti* | Red Hills Salamander | Caudata | T | No | 192 |
| *Plethodon neomexicanus* | Jemez Mountains salamander | Caudata | E | Yes | 3849 |
| *Plethodon nettingi* | Cheat Mountain Salamander | Caudata | T | No | 198 |
| *Plethodon shenandoah* | Shenandoah Salamander | Caudata | E | No | 200 |
| *Rana chiricahuensis* | Chiricahua Leopard Frog | Anura | T | Yes | 206 |
| *Rana draytonii* | California Red-legged Frog | Anura | T | Yes | 205 |
| *Rana muscosa* | Mountain yellow-legged frog (Northern CA DPS) | Anura | E | Yes | 1740 |
| *Rana muscosa* | Mountain Yellow-legged Frog (southern CA DPS) | Anura | E | Yes | 207 |
| *Rana pretiosa* | Oregon spotted frog | Anura | T | yes | 4090 |
| *Rana sevosa* | Dusty Gopher Frog | Anura | E | Yes | 208 |
| *Rana sierrae* | Sierra Nevada Yellow-legged Frog | Anura | E | Yes | 10517 |
| *Typhlomolge rathbuni* | Texas Blind Salamander | Caudata | E | No | 189 |

\*E=endangered; T=threatened, C = candidate

1. **Diets**

For many listed species of amphibian, diet varies by life stage. For the tadpole lifestage of frogs and toads, most species consume algae and detritus. Salamander tadpoles consume aquatic invertebrates and tadpoles of other amphibians. When considering the adult life stage, all listed amphibians consume invertebrates. Many species also consume fish, tadpoles and adult amphibians (in both aquatic and terrestrial habitats). Only a limited number of species consume other vertebrates (**Table A 1-19.3**). **Table A 1-19.4** defines the prey consumed by listed amphibians. Additional details and source information are provided in **SUPPLEMENTAL INFORMATION 3**.

**Table A 1-19.3. Number of listed species by taxa with each dietary item categories.**

|  |  |
| --- | --- |
| **Dietary item** | **Number of species** |
| **Tadpole life stage** | **Adults** |
| Plant matter | Algae | 13 | 0 |
| Invertebrates | Aquatic (FW) | 23 | 20 |
| Terrestrial, above ground | 6 | 28 |
| Terrestrial, below ground | 0 | 11 |
| Vertebrates | Birds | 0 | 1 |
| Fish (FW) and aquatic amphibians | 7 | 6 |
| Terrestrial-phase amphibians | 0 | 8 |
| Mammals | 0 | 1 |

**Table A 1-19.4. Diets of listed amphibians: tadpoles (larvae).**

| **Scientific Name** | **Common Name** | **Algae/****aquatic plants** | **Aquatic Inverts** | **Terrestrial Inverts (above ground)** | **Fish and amphibians\*** |
| --- | --- | --- | --- | --- | --- |
| *Ambystoma bishopi* | Reticulated Flatwoods Salamander | No | Yes | No | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Santa Barbara County DPS) | No | Yes | No | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Sonoma County DPS) | No | Yes | No | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Central California DPS) | No | Yes | No | Yes |
| *Ambystoma cingulatum* | Frosted Flatwoods Salamander | No | Yes | No | Yes |
| *Ambystoma macrodactylum croceum* | Santa Cruz long-toed Salamander | No | Yes | No | Yes |
| *Ambystoma tigrinum stebbinsi* | Sonora Tiger Salamander | No | Yes | No | No |
| *Anaxyrus baxteri* | Wyoming Toad | Yes | No | No | No |
| *Anaxyrus californicus* | Arroyo Toad | Yes | No | No | No |
| *Anaxyrus canorus* | Yosemite Toad | Yes | Yes | No | Yes |
| *Batrachoseps aridus* | Desert Slender Salamander | No | No | Yes | No |
| *Bufo houstonensis* | Houston Toad | Yes | No | No | No |
| *Cryptobranchus alleganiensis bishopi* | Ozark Hellbender | No | Yes | No | No |
| *Eleutherodactylus cooki* | Guajon (frog) | No | Yes | No | No |
| *Eleutherodactylus jasperi* | Golden Coqui (frog) | No | No | Yes | No |
| *Eleutherodactylus juanariveroi* | Llanero Coqui | No | Yes | No | No |
| *Eurycea chisholmensis* | Salado Salamander | No | Yes | No | No |
| *Eurycea nana* | San Marcos Salamander | No | Yes | No | No |
| *Eurycea naufragia* | Georgetown Salamander | No | Yes | No | No |
| *Eurycea sosorum* | Barton Springs Salamander | No | Yes | No | No |
| *Eurycea tonkawae* | Jollyville Plateau Salamander | No | Yes | No | No |
| *Eurycea waterlooensis* | Austin blind Salamander | No | Yes | No | No |
| *Gyrinophilus gulolineatus* | Berry Cave salamander | No | Yes | No | No |
| *Hyla wrightorum* | Arizona Treefrog | No | Yes | No | No |
| *Lithobates onca* | Relict leopard Frog | Yes | No | No | No |
| *Necturus alabamensis* | Black warrior (=Sipsey Fork) Waterdog | No | Yes | No | No |
| *Notophthalmus perstriatus* | Striped newt | No | Yes | No | No |
| *Peltophryne lemur* | Puerto Rican Crested Toad | No | Yes | No | No |
| *Phaeognathus hubrichti* | Red Hills Salamander | No | No | Yes | No |
| *Plethodon neomexicanus* | Jemez Mountains salamander | No | No | Yes | No |
| *Plethodon nettingi* | Cheat Mountain Salamander | No | No | Yes | No |
| *Plethodon shenandoah* | Shenandoah Salamander | No | No | Yes | No |
| *Rana chiricahuensis* | Chiricahua Leopard Frog | Yes | No | No | No |
| *Rana draytonii* | California Red-legged Frog | Yes | No | No | No |
| *Rana muscosa* | Mountain yellow-legged frog (Northern CA DPS) | Yes | No | No | No |
| *Rana muscosa* | Mountain Yellow-legged Frog (southern CA DPS) | Yes | No | No | No |
| *Rana pretiosa* | Oregon spotted frog | Yes | No | No | No |
| *Rana sevosa* | Dusty Gopher Frog | Yes | No | No | No |
| *Rana sierrae* | Sierra Nevada Yellow-legged Frog | Yes | No | No | No |
| *Typhlomolge rathbuni* | Texas Blind Salamander | No | Yes | No | No |

\*Generally tadpoles.

**Table A 1-19.5. Diets of listed amphibians: adults.**

| **Scientific Name** | **Common Name** | **Invertebrates** | **Vertebrates** |
| --- | --- | --- | --- |
| **Aquatic** | **Terrestrial (above ground)** | **Terrestrial (below ground)** | **Fish and aq. amphibians** | **Mammals** | **Birds** | **Terrestrial-phase amphibians** |
| *Ambystoma bishopi* | Reticulated Flatwoods Salamander | No | No | Yes | No | No | No | No |
| *Ambystoma californiense* | California Tiger Salamander (Santa Barbara County DPS) | No | Yes | Yes | No | No | No | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Sonoma County DPS) | No | Yes | Yes | No | No | No | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Central California DPS) | No | Yes | Yes | No | No | No | Yes |
| *Ambystoma cingulatum* | Frosted Flatwoods Salamander | No | No | Yes | No | No | No | No |
| *Ambystoma macrodactylum croceum* | Santa Cruz long-toed Salamander | No | Yes | Yes | No | No | No | No |
| *Ambystoma tigrinum stebbinsi* | Sonora Tiger Salamander | Yes | Yes | No | Yes | No | No | No |
| *Anaxyrus baxteri* | Wyoming Toad | No | Yes | No | No | No | No | No |
| *Anaxyrus californicus* | Arroyo Toad | No | Yes | No | No | No | No | No |
| *Anaxyrus canorus* | Yosemite Toad | No | Yes | No | No | No | No | No |
| *Batrachoseps aridus* | Desert Slender Salamander | No | Yes | No | No | No | No | No |
| *Bufo houstonensis* | Houston Toad | No | Yes | No | No | No | No | Yes |
| *Cryptobranchus alleganiensis bishopi* | Ozark Hellbender | Yes | No | No | Yes | No | No | No |
| *Eleutherodactylus cooki* | Guajon (frog) | Yes | Yes | No | No | No | No | No |
| *Eleutherodactylus jasperi* | Golden Coqui (frog) | No | Yes | No | No | No | No | No |
| *Eleutherodactylus juanariveroi* | Llanero Coqui | Yes | Yes | No | No | No | No | No |
| *Eurycea chisholmensis* | Salado Salamander | Yes | No | No | No | No | No | No |
| *Eurycea nana* | San Marcos Salamander | Yes | No | No | No | No | No | No |
| *Eurycea naufragia* | Georgetown Salamander | Yes | No | No | No | No | No | No |
| *Eurycea sosorum* | Barton Springs Salamander | Yes | No | No | No | No | No | No |
| *Eurycea tonkawae* | Jollyville Plateau Salamander | Yes | No | No | No | No | No | No |
| *Eurycea waterlooensis* | Austin blind Salamander | Yes | No | No | No | No | No | No |
| *Gyrinophilus gulolineatus* | Berry Cave salamander | Yes | No | No | No | No | No | No |
| *Hyla wrightorum* | Arizona Treefrog | No | Yes | Yes | No | No | No | No |
| *Lithobates onca* | Relict leopard Frog | No | Yes | No | No | No | No | No |
| *Necturus alabamensis* | Black warrior (=Sipsey Fork) Waterdog | Yes | No | No | Yes | No | No | No |
| *Notophthalmus perstriatus* | Striped newt | Yes | Yes | Yes | No | No | No | No |
| *Peltophryne lemur* | Puerto Rican Crested Toad | Yes | Yes | No | No | No | No | No |
| *Phaeognathus hubrichti* | Red Hills Salamander | No | Yes | No | No | No | No | No |
| *Plethodon neomexicanus* | Jemez Mountains salamander | No | Yes | No | No | No | No | No |
| *Plethodon nettingi* | Cheat Mountain Salamander | No | Yes | Yes | No | No | No | No |
| *Plethodon shenandoah* | Shenandoah Salamander | No | Yes | Yes | No | No | No | No |
| *Rana chiricahuensis* | Chiricahua Leopard Frog | Yes | Yes | No | Yes | No | Yes | Yes |
| *Rana draytonii* | California Red-legged Frog | No | Yes | No | Yes | Yes | No | Yes |
| *Rana muscosa* | Mountain yellow-legged frog (Northern CA DPS) | Yes | Yes | No | No | No | No | No |
| *Rana muscosa* | Mountain Yellow-legged Frog (southern CA DPS) | Yes | Yes | No | No | No | No | No |
| *Rana pretiosa* | Oregon spotted frog | Yes | Yes | No | No | No | No | Yes |
| *Rana sevosa* | Dusty Gopher Frog | No | Yes | Yes | No | No | No | Yes |
| *Rana sierrae* | Sierra Nevada Yellow-legged Frog | Yes | Yes | No | No | No | No | No |
| *Typhlomolge rathbuni* | Texas Blind Salamander | Yes | No | No | Yes | No | No | No |

1. **Exposure models**

Species-specific diets will be used to assess potential direct effects through consumption of pesticide-contaminated dietary items. These diets will also be used to consider potential indirect effects. For direct effects, exposures to the pesticide through the diet are assessed using either T-HERPS or KABAM, depending upon whether the species’ diet includes terrestrial or aquatic food items. If the species consumes plants, invertebrates or vertebrates (amphibians, reptiles, birds or mammals) that inhabit terrestrial areas, T-HERPS should be used (n = 30). If the adults of the species are air breathing (referred to as terrestrial phase) and consume fish or aquatic organisms, then KABAM should be used (n = 13). The surface water concentration calculator is used to estimate aqueous exposures to the tadpole life stage if it is aquatic and for obligate aquatic adults (n = 34). **Table A 1-19.9** lists the models that will be run for each species.

As noted in the Problem Formulation, to improve efficiency and expand EFED’s modeling capabilities to other, non-dietary routes of exposure for terrestrial organisms, the Terrestrial Effects Determination (TED) tool was developed. This tool integrates T-REX, T-HERPS and the earthworm fugacity model, along with several other models used by EFED. When this document indicates that T-HERPS or the earthworm fugacity models should be run for a species, the TED tool will be run. Assessors could also run the current version of T-HERPS. As discussed in the terrestrial exposure appendix, KABAM will not be run for chlorpyrifos, diazinon or malathion. In its place, BCF values will used to estimate exposure through consumption of aquatic food items.

T-HERPS and KABAM require body weight (BW) in order to generate dose-based pesticide exposure estimates.If all other parameters are kept equal, decreases in the species BW parameter result in increases in risk. Therefore, for all listed amphibians, the lowest available BW value is used (**Table A 1-19.9**).

**Table A 1-19.6. Models and Body weights used to estimate dietary exposures to listed amphibians.**

| **Scientific Name** | **Common Name** | **T-HERPS?** | **Earthworm fugacity?** | **KABAM?** | **PRZM5/ VVWM?** | **BW (g)** |
| --- | --- | --- | --- | --- | --- | --- |
| *Ambystoma bishopi* | Reticulated Flatwoods Salamander | Yes | Yes | No | Yes | 4.3 |
| *Ambystoma californiense* | California Tiger Salamander (Santa Barbara County DPS) | Yes | Yes | Yes | Yes | 31 |
| *Ambystoma californiense* | California Tiger Salamander (Sonoma County DPS) | Yes | Yes | Yes | Yes | 31 |
| *Ambystoma californiense* | California Tiger Salamander (Central California DPS) | Yes | Yes | Yes | Yes | 31 |
| *Ambystoma cingulatum* | Frosted Flatwoods Salamander | Yes | Yes | No | Yes | 3.9 |
| *Ambystoma macrodactylum croceum* | Santa Cruz long-toed Salamander | Yes | Yes | No | Yes | 3.0 |
| *Ambystoma tigrinum stebbinsi* | Sonora Tiger Salamander | Yes | No | Yes | Yes | 4.6 |
| *Anaxyrus baxteri* | Wyoming Toad | Yes | No | No | Yes | 15 |
| *Anaxyrus californicus* | Arroyo Toad | Yes | No | No | Yes | 14 |
| *Anaxyrus canorus* | Yosemite Toad | Yes | No | No | Yes | 2.3 |
| *Batrachoseps aridus* | Desert Slender Salamander | Yes | No | No | No | 2.3 |
| *Bufo houstonensis* | Houston Toad | Yes | No | No | Yes | 8.0 |
| *Cryptobranchus alleganiensis bishopi* | Ozark Hellbender | No | No | No | Yes | 36 |
| *Eleutherodactylus cooki* | Guajon (frog) | Yes | No | No | Yes | 8.9 |
| *Eleutherodactylus jasperi* | Golden Coqui (frog) | Yes | No | No | No | 3.9 |
| *Eleutherodactylus juanariveroi* | Llanero Coqui | Yes | No | Yes | No | 3.0 |
| *Eurycea chisholmensis* | Salado Salamander | No | No | No | Yes | 0.3 |
| *Eurycea nana* | San Marcos Salamander | No | No | No | Yes | 0.18 |
| *Eurycea naufragia* | Georgetown Salamander | No | No | No | Yes | 0.30 |
| *Eurycea sosorum* | Barton Springs Salamander | No | No | No | Yes | 0.20 |
| *Eurycea tonkawae* | Jollyville Plateau Salamander | No | No | No | Yes | 0.30 |
| *Eurycea waterlooensis* | Austin blind Salamander | No | No | No | Yes | 0.30 |
| *Gyrinophilus gulolineatus* | Berry Cave salamander | No | No | No | Yes | 11 |
| *Hyla wrightorum* | Arizona Treefrog | Yes | Yes | No | Yes | 1.9 |
| *Lithobates onca* | Relict leopard Frog | Yes | No | No | Yes | 0.014 |
| *Necturus alabamensis* | Black warrior (=Sipsey Fork) Waterdog | No | No | No | Yes | 0.13 |
| *Notophthalmus perstriatus* | Striped newt | Yes | Yes | Yes | Yes | 0.80 |
| *Peltophryne lemur* | Puerto Rican Crested Toad | Yes | No | Yes | Yes | 23 |
| *Phaeognathus hubrichti* | Red Hills Salamander | Yes | No | No | No | 0.24 |
| *Plethodon neomexicanus* | Jemez Mountains salamander | Yes | No | No | No | 8.1 |
| *Plethodon nettingi* | Cheat Mountain Salamander | Yes | No | No | No | 1.2 |
| *Plethodon shenandoah* | Shenandoah Salamander | Yes | No | No | No | 1.2 |
| *Rana chiricahuensis* | Chiricahua Leopard Frog | Yes | No | Yes | Yes | 13 |
| *Rana draytonii* | California Red-legged Frog | Yes | No | Yes | Yes | 1.4 |
| *Rana muscosa* | Mountain yellow-legged frog (Northern CA DPS) | Yes | No | Yes | Yes | 13.78 |
| *Rana muscosa* | Mountain Yellow-legged Frog (southern CA DPS) | Yes | No | Yes | Yes | 13.78 |
| *Rana pretiosa* | Oregon spotted frog | Yes | No | Yes | Yes | 8.0 |
| *Rana sevosa* | Dusty Gopher Frog | Yes | Yes | No | Yes | 21 |
| *Rana sierrae* | Sierra Nevada Yellow-legged Frog | Yes | No | Yes | Yes | 6.0 |
| *Typhlomolge rathbuni* | Texas Blind Salamander | No | No | No | Yes | 0.55 |

1. **Habitat**

Most listed amphibians inhabit aquatic, wetland and terrestrial habitats. Several species (n=10) are aquatic obligate or inhabit terrestrial areas only (n=6). **Table A 1-19.7** defines the generic habitat of each listed amphibian. These generic habitats should be used to determine potential indirect effects by considering the appropriate exposure estimates and plant toxicity thresholds and endpoints. More details, including source information are provided in **SUPPLEMENTAL INFORMATION 3**. For habitats defined as terrestrial or aquatic-associated terrestrial, indirect effects to habitat will be assessed using AgDRIFT and TerrPlant. For habitats defined as aquatic, the Surface Water Concentration Calculator will be used with the species-specific aquatic bin. **ATTACHMENT 1-10** includes the aquatic bin assignments that may be used to estimate direct exposures to amphibians that consume aquatic organisms and to assess potential indirect effects.

**Table A 1-19.7. Generic habitat descriptions of listed amphibians.**

| **Scientific Name** | **Common Name** | **Terrestrial?** | **Aquatic-associated terrestrial?\*** | **Aquatic?** |
| --- | --- | --- | --- | --- |
| *Ambystoma bishopi* | Reticulated Flatwoods Salamander | Yes | Yes | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Santa Barbara County DPS) | Yes | Yes | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Sonoma County DPS) | Yes | Yes | Yes |
| *Ambystoma californiense* | California Tiger Salamander (Central California DPS) | Yes | Yes | Yes |
| *Ambystoma cingulatum* | Frosted Flatwoods Salamander | Yes | Yes | Yes |
| *Ambystoma macrodactylum croceum* | Santa Cruz long-toed Salamander | Yes | Yes | Yes |
| *Ambystoma tigrinum stebbinsi* | Sonora Tiger Salamander | Yes | Yes | Yes |
| *Anaxyrus baxteri* | Wyoming Toad | Yes | Yes | Yes |
| *Anaxyrus californicus* | Arroyo Toad | Yes | Yes | Yes |
| *Anaxyrus canorus* | Yosemite Toad | Yes | Yes | Yes |
| *Batrachoseps aridus* | Desert Slender Salamander | Yes | No | No |
| *Bufo houstonensis* | Houston Toad | Yes | Yes | Yes |
| *Cryptobranchus alleganiensis bishopi* | Ozark Hellbender | No | No | Yes |
| *Eleutherodactylus cooki* | Guajon (frog) | Yes | Yes | Yes |
| *Eleutherodactylus jasperi* | Golden Coqui (frog) | Yes | No | No |
| *Eleutherodactylus juanariveroi* | Llanero Coqui | Yes | Yes | No |
| *Eurycea chisholmensis* | Salado Salamander | No | No | Yes |
| *Eurycea nana* | San Marcos Salamander | No | No | Yes |
| *Eurycea naufragia* | Georgetown Salamander | No | No | Yes |
| *Eurycea sosorum* | Barton Springs Salamander | No | No | Yes |
| *Eurycea tonkawae* | Jollyville Plateau Salamander | No | No | Yes |
| *Eurycea waterlooensis* | Austin blind Salamander | No | No | Yes |
| *Gyrinophilus gulolineatus* | Berry Cave salamander | No | No | Yes |
| *Hyla wrightorum* | Arizona Treefrog | Yes | Yes | Yes |
| *Lithobates onca* | Relict leopard Frog | Yes | Yes | Yes |
| *Necturus alabamensis* | Black warrior (=Sipsey Fork) Waterdog | No | No | Yes |
| *Notophthalmus perstriatus* | Striped newt | Yes | Yes | Yes |
| *Peltophryne lemur* | Puerto Rican Crested Toad | Yes | Yes | Yes |
| *Phaeognathus hubrichti* | Red Hills Salamander | Yes | No | No |
| *Plethodon neomexicanus* | Jemez Mountains salamander | Yes | No | No |
| *Plethodon nettingi* | Cheat Mountain Salamander | Yes | No | No |
| *Plethodon shenandoah* | Shenandoah Salamander | Yes | No | No |
| *Rana chiricahuensis* | Chiricahua Leopard Frog | Yes | Yes | Yes |
| *Rana draytonii* | California Red-legged Frog | Yes | Yes | Yes |
| *Rana muscosa* | Mountain yellow-legged frog (Northern CA DPS) | Yes | Yes | Yes |
| *Rana muscosa* | Mountain Yellow-legged Frog (southern CA DPS) | Yes | Yes | Yes |
| *Rana pretiosa* | Oregon spotted frog | Yes | Yes | Yes |
| *Rana sevosa* | Dusty Gopher Frog | Yes | Yes | Yes |
| *Rana sierrae* | Sierra Nevada Yellow-legged Frog | Yes | Yes | Yes |
| *Typhlomolge rathbuni* | Texas Blind Salamander | No | No | Yes |

**\*Bin 1; wetlands, riparian zones, beaches**

1. **Obligate Relationships**

Of the 41 listed of amphibians, 4 are known to have obligate relationships with other organisms: the California tiger salamander (all 3 DPSs) and the golden coqui. These relationships are summarized in **Table A 1-19.8** and briefly described below. Based on the diets and habitat requirements of these species, the USFWS does not describe any other obligate relationships between listed amphibians and other individual species or taxonomic groups.

**Table A 1-19.8. Obligate relationships of 4 listed amphibians. All other listed amphibians have no obvious obligate relationships with other taxa.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Scientific Name** | **Common Name** | **Obligate Taxa** | **Description of obligate relationship** |
| *Ambystoma californiense* | California Tiger Salamander (Santa Barbara County DPS) | Small mammals | Dependent upon mammal burrows for habitat |
| *Ambystoma californiense* | California Tiger Salamander (Sonoma County DPS) | Small mammals | Dependent upon mammal burrows for habitat |
| *Ambystoma californiense* | California Tiger Salamander (Central California DPS) | Small mammals | Dependent upon mammal burrows for habitat |
| *Eleutherodactylus jasperi* | Golden Coqui (frog) | Terrestrial plants | Dependent upon bromeliads for habitat |

\*Information applies to all 3 DPS for this species (*i.e.,* Santa Barbara County, Sonoma County and Central California)

The California tiger salamander (which includes all 3 separately listed DPS) has an obligate relationship to small mammals, such as the California ground squirrel (*Spermophilus beecheyi*) and the Botta’s pocket gopher (*Thomomys bottae*), because the salamander requires the use of abandoned mammal burrows for estivation during dry summer and fall months. The golden coqui (*Eleutherodactylus jasperi*) has an obligate relationship with bromeliads that grow on trees. The golden coqui lives within the bromeliads throughout its life.

1. **Geographic Ranges of Listed Species**

The majority of listed amphibians occur in California and the south west (AZ, NV, TX). There are several states and territories in the US where no listed amphibians occur (**Table A 1-19.9**). County specific location information for each listed species, subspecies or DPS is provided in **SUPPLEMENTAL INFORMATION 3**.

**Table A 1-19.9. Number of listed amphibians by state or territory.**

|  |  |  |
| --- | --- | --- |
| **Abbreviation** | **State** | **Count** |
| AK | Alaska | 0 |
| AL | Alabama | 5 |
| AR | Arkansas | 2 |
| AS | American Samoa | 0 |
| AZ | Arizona | 8 |
| CA | California | 13 |
| CO | Colorado | 3 |
| CT | Connecticut | 0 |
| DC | District of Columbia | 0 |
| DE | Delaware | 0 |
| FL | Florida | 4 |
| GA | Georgia | 4 |
| GU | Guam | 0 |
| HI | Hawaii | 0 |
| IA | Iowa | 0 |
| ID | Idaho | 0 |
| IL | Illinois | 0 |
| IN | Indiana | 0 |
| KS | Kansas | 0 |
| KY | Kentucky | 1 |
| LA | Louisiana | 1 |
| MA | Massachusetts | 0 |
| MD | Maryland | 1 |
| ME | Maine | 0 |
| MI | Michigan | 0 |
| MN | Minnesota | 0 |
| MO | Missouri | 2 |
| MP | Commonwealth of the Northern Mariana Islands | 0 |
| MS | Mississippi | 2 |
| MT | Montana | 0 |
| NC | North Carolina | 1 |
| ND | North Dakota | 0 |
| NE | Nebraska | 0 |
| NH | New Hampshire | 0 |
| NJ | New Jersey | 0 |
| NM | New Mexico | 4 |
| NV | Nevada | 7 |
| NY | New York | 0 |
| OH | Ohio | 0 |
| OK | Oklahoma | 0 |
| OR | Oregon | 2 |
| PA | Pennsylvania | 0 |
| PR | Puerto Rico | 4 |
| RI | Rhode Island | 0 |
| SC | South Carolina | 1 |
| SD | South Dakota | 0 |
| TN | Tennessee | 1 |
| TX | Texas | 8 |
| UT | Utah | 3 |
| VA | Virginia | 3 |
| VI | United States Virgin Islands | 0 |
| VT | Vermont | 0 |
| WA | Washington | 1 |
| WI | Wisconsin | 0 |
| WV | West Virginia | 1 |
| WY | Wyoming | 1 |

1. **Elevation Restrictions**

**Table A 1-19.10** lists the elevation restrictions for listed amphibians. Nineteen of the 40 listed amphibians have elevation restrictions.

**Table A 1-19.10. Elevation restrictions of listed amphibians.**

| **Scientific Name** | **Common Name** | **Elevation restriction?** | **If yes, define** **(in m)** |
| --- | --- | --- | --- |
| *Ambystoma bishopi* | Reticulated Flatwoods Salamander | No | NA |
| *Ambystoma californiense* | California Tiger Salamander (Santa Barbara County DPS) | Yes | 0-460 |
| *Ambystoma californiense* | California Tiger Salamander (Sonoma County DPS) | Yes | 0-460 |
| *Ambystoma californiense* | California Tiger Salamander (Central California DPS) | Yes | 0-460 |
| *Ambystoma cingulatum* | Frosted Flatwoods Salamander | No | NA |
| *Ambystoma macrodactylum croceum* | Santa Cruz long-toed Salamander | No | NA |
| *Ambystoma tigrinum stebbinsi* | Sonora Tiger Salamander | No | NA |
| *Anaxyrus baxteri* | Wyoming Toad | Yes | 2100-2300 |
| *Anaxyrus californicus* | Arroyo Toad | Yes | 0-2440 |
| *Anaxyrus canorus* | Yosemite Toad | Yes | 1460-3630 |
| *Batrachoseps aridus* | Desert Slender Salamander | No | NA |
| *Bufo houstonensis* | Houston Toad | No | NA |
| *Cryptobranchus alleganiensis bishopi* | Ozark Hellbender | No | NA |
| *Eleutherodactylus cooki* | Guajon (frog) | Yes | 5.5-361 |
| *Eleutherodactylus jasperi* | Golden Coqui (frog) | Yes | 700-850 |
| *Eleutherodactylus juanariveroi* | Llanero Coqui | No | NA |
| *Eurycea chisholmensis* | Salado Salamander | No | NA |
| *Eurycea nana* | San Marcos Salamander | No | NA |
| *Eurycea naufragia* | Georgetown Salamander | No | NA |
| *Eurycea sosorum* | Barton Springs Salamander | No | NA |
| *Eurycea tonkawae* | Jollyville Plateau Salamander | No | NA |
| *Eurycea waterlooensis* | Austin blind Salamander | No | NA |
| *Gyrinophilus gulolineatus* | Berry Cave salamander | No | NA |
| *Hyla wrightorum* | Arizona Treefrog | Yes | 1525-2590 |
| *Lithobates onca* | Relict leopard Frog | No | NA |
| *Necturus alabamensis* | Black warrior (=Sipsey Fork) Waterdog | No | NA |
| *Notophthalmus perstriatus* | Striped newt | No | NA |
| *Peltophryne lemur* | Puerto Rican Crested Toad | Yes | <200 |
| *Phaeognathus hubrichti* | Red Hills Salamander | No | NA |
| *Plethodon neomexicanus* | Jemez Mountains salamander | Yes | 2130-3420 |
| *Plethodon nettingi* | Cheat Mountain Salamander | Yes | >610 |
| *Plethodon shenandoah* | Shenandoah Salamander | Yes | >800 |
| *Rana chiricahuensis* | Chiricahua Leopard Frog | Yes | 1000-2710 |
| *Rana draytonii* | California Red-legged Frog | Yes | 1500 |
| *Rana muscosa* | Mountain yellow-legged frog (Northern CA DPS) | Yes | 1067-3660 |
| *Rana muscosa* | Mountain Yellow-legged Frog (southern CA DPS) | Yes | 370-2300 |
| *Rana pretiosa* | Oregon spotted frog | No | NA |
| *Rana sevosa* | Dusty Gopher Frog | No | NA |
| *Rana sierrae* | Sierra Nevada Yellow-legged Frog | Yes | 1067-3660 |
| *Typhlomolge rathbuni* | Texas Blind Salamander | No | NA |

1. **Strategy for grouping species**

In order to efficiently assess the risks of a pesticide to listed amphibians, it is necessary to group them by their defining features that are relevant in the context of the risk assessment framework. There are two major factors that impact the risk of a pesticide to a species: exposure and effects. In terms of effects, relevance of surrogate test species for a listed species may alter the confidence associated with the risk call. Surrogacy is determined by taxonomy, specifically whether toxicity data are available for species within the same order as the listed species. Therefore, species are grouped according to their order (either Caudata or Anura; **Table A 1-19.2**). Amphibians are lumped based on their diets since this impacts exposure estimates. Since indirect effects are based on diet and habitat, lumping according to diet will also serve the needs of indirect effects. Species are also grouped according to similarity of their habitats (**Table A 1-19.7**). A final consideration in this strategy is whether or not a species has an obligate relationship. If a species has an obligate relationship, it may be treated separately from other species. **Table A 1-19.11** summarizes the 8 groups of listed amphibians. Each group of species will share risk hypotheses and lines of evidence. Note that several species did not have similarities to other listed amphibians, therefore, they will be assessed separately.

**Table A 1-19.11. Summary of listed amphibian groups.**

| **Order(s)** | **Species** | **N** | **Diet** | **Obligate relationship?** | **Critical habitat?** | **Habitat(s)** | **Model(s)** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Caudata | Salamanders in Edwards aquifer (Salado, San Marcos, Georgetown, Barton Springs, Jollyville, Austin Blind, Texas blind) | 7 | Aquatic invertebrates | No | Yes (5) | Aquatic | PRZM5/ VVWM |
| Caudata | Berry cave salamander | 1 | Aquatic invertebrates | No | No | Aquatic | PRZM5/ VVWM |
| Caudata | Ozark Hellbender, Black Warrior waterdog | 2 | Aquatic invertebrates, fish and aquatic amphibians | No | No | Aquatic | PRZM5/ VVWM |
| Caudata | California tiger salamanders | 3 | Aquatic and terrestrial invertebrates (above and below ground), terrestrial-phase amphibians | Yes (mammal burrows) | Yes (3) | Aquatic, Wetland, terrestrial | PRZM5/ VVWM, T-HERPS, KABAM |
| Caudata | Terrestrial salamanders (desert slender, red hills, Jemez mountains, cheat mountain, Shenandoah) | 5 | Terrestrial invertebrates (above and below ground) | No | Yes (1) | Terrestrial | T-HERPS |
| Anura | Reticulated Flatwoods Salamander, Frosted Flatwoods Salamander, Santa Cruz long-toed Salamander, Sonora Tiger Salamander, Striped newt | 5 | Aquatic invertebrates, fish and aquatic invertebrates, terrestrial invertebrates (above and below ground) | No | Yes (2) | Aquatic, Wetland, terrestrial | PRZM5/ VVWM, T-HERPS, KABAM |
| Anura | Leopard frogs (Relict Leopard, Chiricahua Leopard, California Red-legged, Mountain yellow-legged, Oregon spotted, Dusty Gopher, Sierra Nevada Yellow-legged) | 8 | Algae, aquatic and terrestrial invertebrates, vertebrates (varies by species: fish, amphibians, birds, mammals) | No | Yes (7) | Aquatic, Wetland, terrestrial | PRZM5/ VVWM, T-HERPS, KABAM |
| Anura | Toads (Wyoming, Arroyo, Yosemite) | 3 | Algae, aquatic and terrestrial invertebrates,  | No | Yes (2) | Aquatic, Wetland, terrestrial | T-HERPS, PRZM5/ VVWM |
| Anura | Houston Toad | 1 | Algae, aquatic and terrestrial invertebrates, terrestrial phase amphibians | No | Yes | Aquatic, Wetland, terrestrial | T-HERPS, PRZM5/ VVWM |
| Anura | Puerto Rican Crested toad | 1 | Aquatic and terrestrial invertebrates | No | No | Aquatic, Wetland, terrestrial | PRZM5/ VVWM, T-HERPS, KABAM |
| Anura | *Eleutherodactylus sp* (Guajon, Llanero coqui) | 2 | Aquatic invertebrates, terrestrial invertebrates,  | No | Yes (2) | Terrestrial | T-HERPS, PRZM5/ VVWM |
| Anura | Golden coqui | 1 | Terrestrial invertebrates | Yes (bromeliads) | Yes | Terrestrial | T-HERPS |
| Anura | Arizona tree frog | 1 | Aquatic invertebrates, terrestrial invertebrates (above and below ground) | No | No | Aquatic, Wetland, terrestrial | T-HERPS, PRZM5/ VVWM |

**SUPPLEMENTAL INFORMATION 1. Instructions for extracting biological information for listed amphibians**

The purpose of this project is to compile biological information on federally listed endangered and threatened, proposed or candidate amphibian species. This document contains instructions for extracting relevant biological information on each of these species and a form for entering this information.

**Instructions:**

Step 1. Copy the template (**SUPPLEMENTAL INFORMATION 2**) for the listed amphibian species worksheet used to record biological information for individual species. This worksheet will be used to record biological information for one of the listed amphibian species listed in the table above.

Step 2. Go to the species profile for the species of interest. This can be accessed on the US Fish and Wildlife Service website.

Currently listed as threatened or endangered:

<http://ecos.fws.gov/tess_public/pub/SpeciesReport.do?groups=D&listingType=L&mapstatus=1>

Candidate species:

<http://ecos.fws.gov/tess_public/reports/candidate-species-report>

Proposed species:

<http://ecos.fws.gov/tess_public/pub/SpeciesReport.do?listingType=SC>

Step 3. If available, acquire the most recent recovery plan available for the listed species of interest. Recovery plans can be located by clicking on the “recovery” quick link of the species profile for the species of interest. Save the pdf of the recovery plan.

Step 4. Extract information on body weight, habitat, diet and the other parameters listed in the attached sheet. When information is entered into the worksheet, note the source number in ( ). These data can generally be found in the life history portion of the recovery plan, so it is not necessary to review the entire recovery plan. When a data point is extracted, highlight the appropriate information in the PDF. When all data are extracted from the recovery plan, save the revised file. All information that appears in the species worksheet must have a source and must be highlighted in the original document. This is a critical component of the Quality Control (QC) for this project.

Step 5. If no body weight information is provided in the recovery plan, this value can be estimated using relationships between snout to vent length and body weights. In this approach, body weights for listed species should be predicted using regressions for the same genus, if possible.

For example, for a *Rana sp.* (frog), regressions from *Rana clamitans* and *R. sphenocephala* can be used to estimate body weights for *R. draytonii, R. chiricahuensis, R. capito seyosa* and *R. mucosa.* The mean of the weights estimated from these species regressions should be used. When a range of lengths is given, the corresponding range of weights should be calculated. For *Rana* sp*.* and *Bufo* sp*.*, snout to vent length and body weight relationships from Deichmann *et al*. 2008[[1]](#footnote-1) can be used. Data for *Bufo* sp. will also be used to estimate the weight for the Puerto Rican crested toad (*Peltophryne lemur*), which is in the same family as this genus*.*

For salamanders:

* For adults of *Ambystoma sp.* (family: Ambystomatidae)*,* snout to vent length and body weight relationships for *A. gracile* can be used (Table 3 of Taylor 1984[[2]](#footnote-2)).
* For terrestrial adults of listed salamander species in the Plethodontidae family, including: *Plethodon sp*., *Batrachoseps aridus* (desert slender salamander) and *Phaeognathus hubrichti* (red hills salamander), the following regression determined from data published by Heatwole and Heatwole 1962[[3]](#footnote-3) can be used: $BW=(L-29)/8.5$, where: BW = body weight in g and L = length in mm. This regression, was derived by K. Garber using the figure in the article. The relationship between SVL and BW from *Plethodon cinereus* is used for listed species within the same genus and family. If other sources are located with body weight data on these species or on the genera, the other sources can be used instead.

Step 6. If data are not located in the recovery plan, other scientifically valid sources (*e.g.,* scientific literature, USFWS publications) may be used to acquire the necessary information. Please check with Kris Garber before extracting data from other sources.

Step 7. Fill out the “relevant EFED model(s)” entry. For this, enter T-HERPS if the animal consumes grass, terrestrial invertebrates (excluding worms), seeds, leaves or fruit. Enter KABAM if the animal consumes aquatic organisms, including algae, aquatic invertebrates and fish. Both models can be entered if the diet of the animal would suggest that it consumes both sets of food items (*e.g.,* California red-legged frog). For aquatic-phase amphibians, exposures may also occur through the water. In that case, the PRZM5/VVWM should be run to estimate exposure to the species.

Notes:

1. Many recovery plans include information on multiple listed species. If this is the case, data can be extracted at the same time for all of the species included in the recovery plan.
2. It is recommended that the data extractor do a search of the recovery plan for the term “obligate” to determine whether the listed species of interest has any obligate relationships with other species.
3. For any questions, please see Jean Holmes or Kris Garber.

**SUPPLEMENTAL INFORMATION 2. Template for worksheet used to collect biological information on listed amphibian species**

**Species (common name):**

Listed status:

Designated critical habitat?

Primary Constituent Elements:

Map of range/occurrences in recovery plan?

Population size (most current estimate):

Snout to vent length (in mm):

Body weight (in g):

Dates of breeding period:

Federal lands or Indian reservations species is known to occur:

Diet:

Relevant EFED model(s):

Habitat:

Elevation restriction (in m):

Obligate relationships:

Comments:

Name of data extractor (date):

QC reviewer (date):

Sources:

**SUPPLEMENTAL INFORMATION 3. Species, subspecies or Distinct Population Segment-specific information for listed amphibians**

This appendix contains a summary of the biological and geographical information available (from the US Fish and Wildlife Service) for amphibian species, subspecies and Distinct Population Segments (DPS).

**Species (common name): *Ambystoma bishopi* (reticulated flatwoods salamander)**

Listed status: endangered (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: (1, p. 6726)

1. Breeding habitat: Small (generally less than 1 to 10 acres (ac)) (less than 0.4 to 4.0 hectares (ha))), acidic, depressional standing bodies of fresh water (wetlands) that: (a) Are seasonally flooded by rainfall in late fall or early winter and dry in late spring or early summer; (b) Are geographically isolated from other water bodies; (c) Occur in pine flatwoods-savanna communities; (d) Are dominated by grasses and grass-like species in the ground layer and overstories of pond-cypress, blackgum, and slash pine; (e) Have a relatively open canopy, necessary to maintain the herbaceous component that serves as cover for flatwoods salamander larvae and their aquatic invertebrate prey; and (f) Typically have a have burrowing crayfish fauna, but, due to periodic drying, the breeding ponds typically lack large, predatory fish (for example, *Lepomis* (sunfish), *Micropterus* (bass), *Amia calva* (blowfin)).

2. Non-breeding habitat: Upland pine flatwoods-savanna habitat that is open, mesic woodland maintained by frequent fires and that: (a) Is within 1,500 ft (457 m) of adjacent and accessible breeding ponds; (b) Contains crayfish burrows or other underground habitat that the flatwoods salamander depends on for food, shelter, and protection from the elements and predation; (c) Has an organic hardpan in the soil profile, which inhibits subsurface water penetration and typically results in moist soils with water often at or near the surface under normal conditions; and (d) Often have wiregrass as the dominant grasses in abundant herbaceous ground cover, which supports the herbivorous invertebrates that serve as a food source for the flatwoods salamander.

3. Dispersal habitat: Upland habitat areas between non-breeding and breeding habitat that allow for salamander movement between such sites and is characterized by: (a) A mix of vegetation types representing a transition between wetland and upland vegetation (ecotone); (b) An open canopy and abundant native herbaceous species; (c) Moist soils as described in PCE 2; and (d) Subsurface structure, such as that that created by deep litter covers or burrows, which provides shelter for salamanders during seasonal movements.

Map of range/occurrences in recovery plan? no

Population size (most current estimate): not located

Snout to vent length (in mm):

Male: 43.8 (mean) (2)

Female: 46.13 (mean) (2)

Body weight (in g):

Male: 4.3 (mean estimated using *Ambystoma gracile* regressions from 3)

Female: 4.9 (mean estimated using *Ambystoma gracile* regressions from 3)

Dates of breeding period: late September to December (1)

Locations known to occur:

Georgia (Miller and Baker Counties) (1)

Florida (Bay, Calhoun, Escambia, Gulf, Holmes, Jackson, Okaloosa, Santa Rosa, Walton, and Washington Counties) (1)

Found West of the Apalachicola River drainage (1)

Federal lands or Indian reservations species is known to occur:

Holley Field (Navy) (5)

Eglin Air Force base (5)

Diet:

Larval: aquatic invertebrates (*e.g.,* crustaceans) and small vertebrates (tadpoles) (1)

Post larval: small invertebrates (in underground habitat), including earthworms (1)

Relevant EFED model(s):

Adults: T-HERPS, earthworm fugacity

Tadpoles: PRZM5/VVWM

Habitat: longleaf pine ecosystems (Coastal Plain in what were historically longleaf pine-wiregrass flatwoods and savannas) (1)

Adults spend most of their lives underground (1)

Breed in small, isolated ephemeral ponds (1)

Transition areas between aquatic and terrestrial (e.g., wetlands) (1)

Aquatic and terrestrial

Elevation restriction: none noted in available USFWS documentation (1)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

No recovery plan is available for this species

Larvae are aquatic (1)

Adults are terrestrial (1)

Was previously considered the same species as *Ambystoma cingulatum* (frosted flatwoods salamander) (1)

There are 20 known populations of this species, 9 occur on public lands (1)

Body weight (BW) is estimated from snout to vent length (SVL) for *A. bishopi* and regressions of body weight and SVL data for populations of *A. gracile* taken at different times. The equations are below (from 3). Once the weight is estimated using these five equations, the average value is taken.

Fay Lake population, 1978BW = e^(2.986\*LN(SVL)-9.649)

Dark Lake population, 1978BW = e^(2.056\*LN(SVL)-6.409)

Fay Lake population, 1981BW = e^(3.187\*LN(SVL)-10.43)

Dark Lake population, 1981BW = e^(2.349\*LN(SVL)-7.494)

Scout Lake population, 1981BW = e^(2.152\*LN(SVL)-6.906)

Some studies suggest that a symbiotic relationship exists between algae and embryos of two different species of salamanders in the *Ambystoma* genus, including: *A. maculatum* (spotted salamander) and *A. gracile* (northwestern salamander). These algae are assumed to be *Chlamydomonas* species; however, this is not well documented. Algae reside within egg capsules around salamander embryos. Studies involving removal of algae from salamander eggs reported decreased survival, delayed hatching and decreased growth. Several studies have suggested that salamander embryos benefit from oxygen production and waste removal by algae (4). Since salamander embryos survived without algae, this is not necessarily an obligate relationship; however, salamanders appear to benefit from the relationship. These data suggest that impacts to algae could potentially decrease the survival or growth of *Ambystoma* species.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/24/12)

Sources:

1. USFWS 2009. Federal Register, vol. 74, No. 26. 50 CFR 17. Endangered and threatened wildlife and plants; determination of endangered status of reticulated flatwoods salamander; designation of critical habitat for frosted flatwoods salamander and reticulated flatwoods salamander. United States Fish and Wildlife Service. Available on line at: <http://www.gpo.gov/fdsys/pkg/FR-2009-02-10/pdf/E9-2403.pdf#page=1>
2. Pauly, G. B., Piskurek, O. and Shafer, H. B. 2007, Phylogeographic concordance in the southeastern United States: the flatwoods salamander, *Ambystoma cingulatum*, as a test case. Molecular Ecology, 16: 415–429.
3. Taylor, J. 1984. Comparative evidence for competition between the salamanders *Ambystoma gracile* and *Taricha granulosa*. Copeia, 3: 672-683.
4. Kerney, R. 2011. Symbioses between salamander embryos and green algae. Symbiosis, 54 (3): 107-117.
5. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Ambystoma californiense* (California tiger salamander) – Sonoma County Distinct Population Segment (DPS)**

Listed status: endangered (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: (1, p. 54355)

1. Standing bodies of fresh water (including natural and manmade (*e.g.*, stock) ponds, vernal pools, and other ephemeral or permanent water bodies) that typically support inundation during winter and early spring, and hold water for a minimum of 12 consecutive weeks in a year of average rainfall.

2. Upland habitats adjacent to and accessible from breeding ponds that contain small mammal burrows or other underground refugia that the species depends upon for food, shelter, and protection from the elements and predation.

3. Accessible upland dispersal habitat between locations occupied by the species that allow for movement between such sites.

Map of range/occurrences in recovery plan? no

Population size (most current estimate): not available (2)

Snout to vent length (in mm):

Average for adults: 91 (2)

Body weight (in g): 31 (estimated using regression of snout vent length and weight data for *Ambystoma gracile* from 4)

Dates of breeding period: Fall and Winter (depending upon rain) (2)

Locations known to occur: Sonoma County, California (1)

Federal lands or Indian reservations species is known to occur: (6)

California Coastal National Monument (BLM)

Public Domain Land BLM

Diet:

Larvae: zooplankton, small crustaceans, aquatic insects, tadpoles (2)

Adults: terrestrial invertebrates, insects, frogs, worms (3)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS, earthworm fugacity, KABAM

Habitat: vernal pools, seasonal ponds in grassland and oak savannahs (2)

Aquatic and terrestrial

Elevation restriction: sea level – 460 m (2)

Obligate relationships: small mammals such as the CA ground squirrel (for burrows) (2)

Comments:

There are three separately listed DPSs for this species

There are no recovery plans for any of the listed distinct population segments of the CA tiger salamander

Subadults and adults estivate (hibernate) during dry summer and fall months in burrows of small mammals (including CA ground squirrel (*Spermophilus beecheyi*) and Botta’s pocket gopher (*Thomomys bottae*)). During this time, they eat little. (2)

Salamanders emerge when fall/winter rains begin (2)

The occurrence of California tiger salamanders is associated with occurrence of gophers (2)

Females attach eggs to twigs, grass, stems, vegetation, debris and rocks in ponds (2)

An estimated 83 percent of CA tiger salamanders rely on rodent burrows for shelter (2)

Body weight (BW) is estimated from snout to vent length (SVL) for *A. californiense* and regressions of body weight and SVL data for populations of *A. gracile* taken at different times. The equations are below (from 4). Once the weight is estimated using these five equations, the average value is taken.

Fay Lake population, 1978BW = e^(2.986\*LN(SVL)-9.649)

Dark Lake population, 1978BW = e^(2.056\*LN(SVL)-6.409)

Fay Lake population, 1981BW = e^(3.187\*LN(SVL)-10.43)

Dark Lake population, 1981BW = e^(2.349\*LN(SVL)-7.494)

Scout Lake population, 1981BW = e^(2.152\*LN(SVL)-6.906)

Some studies suggest that a symbiotic relationship exists between algae and embryos of two different species of salamanders in the *Ambystoma* genus, including: *A. maculatum* (spotted salamander) and *A. gracile* (northwestern salamander) (4 and 5). These algae are assumed to be *Chlamydomonas* species; however, this is not well documented. Algae reside within egg capsules around salamander embryos. Studies involving removal of algae from salamander eggs reported decreased survival, delayed hatching and decreased growth. Several studies have suggested that salamander embryos benefit from oxygen production and waste removal by algae (4). Since salamander embryos survived without algae, this is not necessarily an obligate relationship; however, salamanders appear to benefit from the relationship. These data suggest that impacts to algae could potentially decrease the survival or growth of *Ambystoma* species.

Name of data extractor (date): Kris Garber (3/20/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (3/26/12)

Sources:

1. USFWS 2011. Federal Register, vol. 76, No. 169. 50 CFR 17. Endangered and threatened wildlife and plants; revised designation of critical habitat for the Sonoma County distinct population segment of California Tiger Salamander. United States Fish and Wildlife Service. Available on line at: <http://www.gpo.gov/fdsys/pkg/FR-2011-08-31/pdf/2011-21945.pdf>
2. USFWS. 2003. Endangered and threatened wildlife

and plants: determination of endangered status for the Sonoma County distinct population segment of the California tiger salamander. Federal Register 68 (53):13498-13520. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/federal_register/fr4072.pdf> (Accessed on March 16, 2009).

1. U.S. Fish and Wildlife Service (USFWS). 2005. Endangered and threatened wildlife

and plants: designation of critical habitat for the Sonoma County distinct population segment of the California tiger salamander. Federal Register 70 (239):74138-74163. Available online at:

<http://ecos.fws.gov/docs/federal_register/fr4495.pdf>

1. Taylor, J. 1984. Comparative evidence for competition between the salamanders *Ambystoma gracile* and *Taricha granulosa*. Copeia, 3: 672-683.
2. Kerney, R. 2011. Symbioses between salamander embryos and green algae. Symbiosis, 54 (3): 107-117.
3. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Ambystoma californiense* (California tiger salamander) – Santa Barbara County Distinct Population Segment (DPS)**

Listed status: endangered (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: (1, p. 68584)

1. Standing bodies of fresh water, including natural and man-made (*e.g.*, stock) ponds, vernal pools, and dune ponds, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a sufficient length of time (*i.e.*, 12 weeks) necessary for the species to complete the aquatic portion of its life cycle.

2. Barrier-free uplands adjacent to breeding ponds that contain small mammal burrows. Small mammals are essential in creating the underground habitat that adult California tiger salamanders depend upon for food, shelter, and protection from the elements and predation.

3. Upland areas between breeding locations (PCE 1) and areas with small mammal burrows (PCE 2) that allow for dispersal among such sites.

Map of range/occurrences in recovery plan? no

Population size (most current estimate): not available (2)

Snout to vent length (in mm):

Average for adults: 91 (2)

Body weight (in g): 31 (estimated using regression of snout vent length and weight data for *Ambystoma gracile* from 4)

Dates of breeding period: Fall and Winter (depending upon rain) (2)

Locations known to occur: Santa Barbara County, California (1)

Federal lands or Indian reservations species is known to occur: (6)

Los Padres National Forest (Forest Service)

California Coastal National Monument (BLM)

Public Domain Land BLM

Diet:

Larvae: zooplankton, small crustaceans, aquatic insects, tadpoles (2)

Adults: terrestrial invertebrates, insects, frogs, worms (3)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS, earthworm fugacity, KABAM

Habitat: vernal pools, seasonal ponds in grassland and oak savannahs (2)

Aquatic and terrestrial

Elevation restriction: sea level – 460 m (2)

Obligate relationships: small mammals such as the CA ground squirrel (for burrows) (2)

Comments:

There are three separately listed DPSs for this species

There are no recovery plans for any of the listed distinct population segments of the CA tiger salamander

Subadults and adults estivate (hibernate) during dry summer and fall months in burrows of small mammals (including CA ground squirrel (*Spermophilus beecheyi*) and Botta’s pocket gopher (*Thomomys bottae*)). During this time, they eat little. (2)

Salamanders emerge when fall/winter rains begin (2)

The occurrence of California tiger salamanders is associated with occurrence of gophers (2)

Females attach eggs to twigs, grass, stems, vegetation, debris and rocks in ponds (2)

An estimated 83 percent of CA tiger salamanders rely on rodent burrows for shelter (2)

Body weight (BW) is estimated from snout to vent length (SVL) for *A. californiense* and regressions of body weight and SVL data for populations of *A. gracile* taken at different times. The equations are below (from 4). Once the weight is estimated using these five equations, the average value is taken.

Fay Lake population, 1978BW = e^(2.986\*LN(SVL)-9.649)

Dark Lake population, 1978BW = e^(2.056\*LN(SVL)-6.409)

Fay Lake population, 1981BW = e^(3.187\*LN(SVL)-10.43)

Dark Lake population, 1981BW = e^(2.349\*LN(SVL)-7.494)

Scout Lake population, 1981BW = e^(2.152\*LN(SVL)-6.906)

Some studies suggest that a symbiotic relationship exists between algae and embryos of two different species of salamanders in the *Ambystoma* genus, including: *A. maculatum* (spotted salamander) and *A. gracile* (northwestern salamander) (4 and 5). These algae are assumed to be *Chlamydomonas* species; however, this is not well documented. Algae reside within egg capsules around salamander embryos. Studies involving removal of algae from salamander eggs reported decreased survival, delayed hatching and decreased growth. Several studies have suggested that salamander embryos benefit from oxygen production and waste removal by algae (5). Since salamander embryos survived without algae, this is not necessarily an obligate relationship; however, salamanders appear to benefit from the relationship. These data suggest that impacts to algae could potentially decrease the survival or growth of *Ambystoma* species.

Name of data extractor (date): Kris Garber (3/20/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (3/26/12)

Sources:

1. U.S. Fish and Wildlife Service (USFWS). 2004. Endangered and threatened wildlife

and plants: designation of critical habitat for the California tiger salamander (*Ambystoma californiense*) in Santa Barbara County. Federal Register 69 (226):68568-69609. Available online at: <http://edocket.access.gpo.gov/2004/pdf/04-25775.pdf> (Accessed on March 16, 2009).

1. USFWS. 2003. Endangered and threatened wildlife

and plants: determination of endangered status for the Sonoma County distinct population segment of the California tiger salamander. Federal Register 68 (53):13498-13520. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/federal_register/fr4072.pdf> (Accessed on March 16, 2009).

1. USFWS. 2005. Endangered and threatened wildlife

and plants: designation of critical habitat for the Sonoma County distinct population segment of the California tiger salamander. Federal Register 70 (239):74138-74163. Available online at:

<http://ecos.fws.gov/docs/federal_register/fr4495.pdf>

1. Taylor, J. 1984. Comparative evidence for competition between the salamanders *Ambystoma gracile* and *Taricha granulosa*. Copeia, 3: 672-683.
2. Kerney, R. 2011. Symbioses between salamander embryos and green algae. Symbiosis, 54 (3): 107-117.
3. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Ambystoma californiense* (California tiger salamander) – Central California Distinct Population Segment (DPS)**

Listed status: threatened (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: (1, p. 49390)

1. Standing bodies of fresh water (including natural and manmade (*e.g.*, stock)) ponds, vernal pools, and other ephemeral or permanent water bodies which typically support inundation during winter rains and hold water for a minimum of 12 weeks in a year of average rainfall.

2. Upland habitats adjacent and accessible to and from breeding ponds that contain small mammal burrows or other underground habitat that CTS depend upon for food, shelter, and protection from the elements and predation.

3. Accessible upland dispersal habitat between occupied locations that allow for movement between such sites.

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available (2)

Snout to vent length (in mm):

Average for adults: 91 (2)

Body weight (in g): 31 (estimated using regression of snout vent length and weight data for *Ambystoma gracile* from 4)

Dates of breeding period: Fall and Winter (depending upon rain) (2)

Locations known to occur: Alameda, Amador, Calaveras, Contra Costa, Fresno, Kern, Kings, Madera, Mariposa, Merced, Monterey, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Clara, Solano, Stanislaus, Tulare, Yolo Counties California (1)

Federal lands or Indian reservations species is known to occur: (6)

Fort Ord Military Reservation (Army)

Concord Naval Weapons Station

Hunter-Liggett Military Reservation (Army)

San Joaquin River National Wildlife Refuge (FWS)

Los Padres National Forest (Forest Service)

California Coastal National Monument (BLM)

Eastman Lake National Recreation Area (Forest Service)

Merced National Wildlife Refuge (FWS)

Don Edwards San Francisco Bay National Wildlife Refuge (FWS)

Travis Air Force Base

Public Domain Land BLM

San Luis National Wildlife Refuge (FWS)

Santa Lucia Wilderness (FS)

Butte Sink Wildlife Management Area (FWS)

Grasslands Wildlife Management Area (FWS)

Soboba Indian Reservation

Diet:

Larvae: zooplankton, small crustaceans, aquatic insects, tadpoles (2)

Adults: terrestrial invertebrates, insects, frogs, worms (3)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS, earthworm fugacity, KABAM

Habitat: vernal pools, seasonal ponds in grassland and oak savannahs (2)

Aquatic and terrestrial

Elevation restriction: sea level – 460 m (2)

Obligate relationships: small mammals such as the CA ground squirrel (for burrows) (2)

Comments:

There are three separately listed DPSs for this species

There are no recovery plans for any of the listed distinct population segments of the CA tiger salamander

Subadults and adults estivate (hibernate) during dry summer and fall months in burrows of small mammals (including CA ground squirrel (*Spermophilus beecheyi*) and Botta’s pocket gopher (*Thomomys bottae*)). During this time, they eat little. (2)

Salamanders emerge when fall/winter rains begin (2)

The occurrence of California tiger salamanders is associated with occurrence of gophers (2)

Females attach eggs to twigs, grass, stems, vegetation, debris and rocks in ponds (2)

An estimated 83 percent of CA tiger salamanders rely on rodent burrows for shelter (2)

Body weight (BW) is estimated from snout to vent length (SVL) for *A. californiense* and regressions of body weight and SVL data for populations of *A. gracile* taken at different times. The equations are below (from 4). Once the weight is estimated using these five equations, the average value is taken.

Fay Lake population, 1978BW = e^(2.986\*LN(SVL)-9.649)

Dark Lake population, 1978BW = e^(2.056\*LN(SVL)-6.409)

Fay Lake population, 1981BW = e^(3.187\*LN(SVL)-10.43)

Dark Lake population, 1981BW = e^(2.349\*LN(SVL)-7.494)

Scout Lake population, 1981BW = e^(2.152\*LN(SVL)-6.906)

Some studies suggest that a symbiotic relationship exists between algae and embryos of two different species of salamanders in the *Ambystoma* genus, including: *A. maculatum* (spotted salamander) and *A. gracile* (northwestern salamander) (4 and 5). These algae are assumed to be *Chlamydomonas* species; however, this is not well documented. Algae reside within egg capsules around salamander embryos. Studies involving removal of algae from salamander eggs reported decreased survival, delayed hatching and decreased growth. Several studies have suggested that salamander embryos benefit from oxygen production and waste removal by algae (4). Since salamander embryos survived without algae, this is not necessarily an obligate relationship; however, salamanders appear to benefit from the relationship. These data suggest that impacts to algae could potentially decrease the survival or growth of *Ambystoma* species.

Name of data extractor (date): Kris Garber (3/20/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (3/26/12)

Sources:

1. U.S. Fish and Wildlife Service (USFWS). 2005. Endangered and threatened wildlife

and plants: designation of critical habitat for the California tiger salamander, Central population. Federal Register 70 (162):49380-49458. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2005-08-23/pdf/05-16234.pdf#page=1 (Accessed on February 22, 2012).

1. USFWS. 2003. Endangered and threatened wildlife

and plants: determination of endangered status for the Sonoma County distinct population segment of the California tiger salamander. Federal Register 68 (53):13498-13520. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/federal_register/fr4072.pdf> (Accessed on March 16, 2009).

1. U.S. Fish and Wildlife Service (USFWS). 2005. Endangered and threatened wildlife

and plants: designation of critical habitat for the Sonoma County distinct population segment of the California tiger salamander. Federal Register 70 (239):74138-74163. Available online at:

<http://ecos.fws.gov/docs/federal_register/fr4495.pdf>

1. Taylor, J. 1984. Comparative evidence for competition between the salamanders *Ambystoma gracile* and *Taricha granulosa*. Copeia, 3: 672-683.
2. Kerney, R. 2011. Symbioses between salamander embryos and green algae. Symbiosis, 54 (3): 107-117.
3. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Ambystoma cingulatum* (frosted flatwoods salamander)**

Listed status: threatened (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: (1, p. 6726)

1. Breeding habitat: Small (generally less than 1 to 10 acres (ac)) (less than 0.4 to 4.0 hectares (ha))), acidic, depressional standing bodies of fresh water (wetlands) that: (a) Are seasonally flooded by rainfall in late fall or early winter and dry in late spring or early summer; (b) Are geographically isolated from other water bodies; (c) Occur in pine flatwoods-savanna communities; (d) Are dominated by grasses and grass-like species in the ground layer and overstories of pond-cypress, blackgum, and slash pine; (e) Have a relatively open canopy, necessary to maintain the herbaceous component that serves as cover for flatwoods salamander larvae and their aquatic invertebrate prey; and (f) Typically have a have burrowing crayfish fauna, but, due to periodic drying, the breeding ponds typically lack large, predatory fish (for example, *Lepomis* (sunfish), *Micropterus* (bass), *Amia calva* (blowfin)).

2. Non-breeding habitat: Upland pine flatwoods-savanna habitat that is open, mesic woodland maintained by frequent fires and that: (a) Is within 1,500 ft (457 m) of adjacent and accessible breeding ponds; (b) Contains crayfish burrows or other underground habitat that the flatwoods salamander depends on for food, shelter, and protection from the elements and predation; (c) Has an organic hardpan in the soil profile, which inhibits subsurface water penetration and typically results in moist soils with water often at or near the surface under normal conditions; and (d) Often have wiregrass as the dominant grasses in abundant herbaceous ground cover, which supports the herbivorous invertebrates that serve as a food source for the flatwoods salamander.

3. Dispersal habitat: Upland habitat areas between non-breeding and breeding habitat that allow for salamander movement between such sites and is characterized by: (a) A mix of vegetation types representing a transition between wetland and upland vegetation (ecotone); (b) An open canopy and abundant native herbaceous species; (c) Moist soils as described in PCE 2; and (d) Subsurface structure, such as that that created by deep litter covers or burrows, which provides shelter for salamanders during seasonal movements.

Map of range/occurrences in recovery plan? no

Population size (most current estimate): not located

Snout to vent length (in mm):

Adult females: 59.4 (mean) (2)

Adult males: 54.3 (mean) (2)

Body weight (in g):

Adult non-gravid females: 3.9 (mean) (2)

Adult gravid females: 8.0 (mean) (2)

Adult males: 4.4 (mean) (2)

Adult females: 9.6 (estimated using mean snout to vent length and data in source 3)

Adult males: 7.6 (estimated using mean snout to vent length and data in source 3)

Dates of breeding period: late September to December (1)

Locations known to occur: Florida (Baker, Franklin, Jefferson, Liberty, and Wakulla Counties),

Georgia (Bryan, Charlton, Chatham, Evans, Lanier, Liberty, Long, McIntosh, and Screven Counties),

South Carolina (Beaufort, Berkeley, Charleston, Jasper, and Orangeburg Counties) (1)

Found East of the Apalachicola River drainage (1)

Federal lands or Indian reservations species is known to occur:

Moody Air Force Base

Fort Stewart (Army)

Townsend Range (Marine Corps)

Apalachicola National Forest (Forest Service)

Francis Marion National Forest (Forest Service)

Ocala National Forest (Forest Service)

Osceola National Forest (Forest Service)

Banks Lake National Wildlife Refuge (FWS)

Okefenokee National Wildlife Refuge (FWS)

Saint Marks National Wildlife Refuge (FWS)

Savannah National Wildlife Refuge (FWS)

Cecil Field Naval Air Station

Okefenokee Wilderness / Okefenokee National Wildlife Refuge (FWS)

Diet:

Larval: aquatic invertebrates (*e.g.,* crustaceans) and small vertebrates (tadpoles) (1)

Post larval: small invertebrates (in underground habitat), including earthworms (1)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS, earthworm fugacity

Habitat: Fire-maintained, open-canopied, flatwoods and savannas dominated by longleaf pine (*Pinus palustris*), with naturally occurring slash pine (*P. elliotti*) in wetter areas (1)

Adults spend most of their lives underground (1)

Breed in small, isolated ephemeral ponds (1)

Aquatic and terrestrial

Elevation restriction: none noted in available USFWS documentation (1)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

No recovery plan is available for this species

Note that since this species only consumes aquatic animals during the tadpole stage and this life stage is represented using fish as surrogates, KABAM will not be run for this species.

Adults are terrestrial (1)

There are 25 known populations of this species, 22 occur on public lands (1)

Note that body weight estimated using source 3 is slightly higher (within a factor of 3) than the empirical body weights reported in 2. Estimates of body weights were made in order to check the accuracy of the regression method.

Body weight (BW) is estimated from snout to vent length (SVL) for *A. californiense* and regressions of body weight and SVL data for populations of *A. gracile* taken at different times. The equations are below (from 4). Once the weight is estimated using these five equations, the average value is taken.

Fay Lake population, 1978BW = e^(2.986\*LN(SVL)-9.649)

Dark Lake population, 1978BW = e^(2.056\*LN(SVL)-6.409)

Fay Lake population, 1981BW = e^(3.187\*LN(SVL)-10.43)

Dark Lake population, 1981BW = e^(2.349\*LN(SVL)-7.494)

Scout Lake population, 1981BW = e^(2.152\*LN(SVL)-6.906)

Some studies suggest that a symbiotic relationship exists between algae and embryos of two different species of salamanders in the *Ambystoma* genus, including: *A. maculatum* (spotted salamander) and *A. gracile* (northwestern salamander). These algae are assumed to be *Chlamydomonas* species; however, this is not well documented. Algae reside within egg capsules around salamander embryos. Studies involving removal of algae from salamander eggs reported decreased survival, delayed hatching and decreased growth. Several studies have suggested that salamander embryos benefit from oxygen production and waste removal by algae (4). Since salamander embryos survived without algae, this is not necessarily an obligate relationship; however, salamanders appear to benefit from the relationship. These data suggest that impacts to algae could potentially decrease the survival or growth of *Ambystoma* species.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/24/12)

Sources:

1. USFWS 2009. Federal Register, vol. 74, No. 62. 50 CFR 17. Endangered and threatened wildlife and plants; determination of endangered status of reticulated flatwoods salamander; designation of critical habitat for frosted flatwoods salamander and reticulated flatwoods salamander. United States Fish and Wildlife Service. Available on line at: <http://www.gpo.gov/fdsys/pkg/FR-2009-02-10/pdf/E9-2403.pdf#page=1>
2. Palis, J.G.; Aresco, M.J.; and S. Kilpatrick. 2006. Breeding biology of a Florida population of *Ambystoma cingulatum* (Flatwoods salamander) during a drought. *Southeastern Naturalist*, 5(1): 1-8.
3. Taylor, J. 1984. Comparative evidence for competition between the salamanders *Ambystoma gracile* and *Taricha granulosa*. *Copeia*, 3: 672-683.
4. Kerney, R. 2011. Symbioses between salamander embryos and green algae. Symbiosis, 54 (3): 107-117.
5. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Ambystoma macrodactylum croceum* (Santa Cruz long-toed salamander)**

Listed status: endangered (1)

Designated critical habitat? proposed (4)

Primary Constituent Elements: Not applicable

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not located

Snout to vent length (in mm):

Average is 42-71 (1)

Body weight (in g):

3.0-9.8 (empirical values, 1)

3.8-16 (estimated using snout to vent length and data in source 2)

Dates of breeding period: January and February (1)

Locations known to occur: California (1)

Santa Cruz and Monterey Counties (1)

Federal lands or Indian reservations species is known to occur: None (5)

Diet:

Larvae: aquatic invertebrates (mosquito larvae, worms) and tadpoles of frogs and salamanders (1)

Adults: invertebrates on the soil surface, primarily isopods (1)

Adults also forage on beetles, slugs, earthworms (1)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS, earthworm fugacity

Habitat:

Shallow ephemeral freshwater ponds for breeding, adjacent upland scrub and woodland areas during nonbreeding times (1)

Spends a “substantial portion of its life underground in burrows of small mammals [*e.g.,* mice (*Peromyscus* spp.), California voles (*Microtus californicus*), Botta pocket gophers, (*Thomomys bottae*) California moles (*Scapanus latimanus*)] (1)

Also found in upland chaparral and woodlands areas of coast live oak or Monterey pine and in riparian vegetation (*e.g.,* arroyo willows, cattails and bulrush) (1)

Aquatic and terrestrial

Elevation restriction: none noted in recovery plan (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Note that body weight estimated using source 2 is consistent with the empirical body weights reported in 1

Note that since this species only consumes aquatic animals during the tadpole stage and this life stage is represented using fish as surrogates, KABAM will not be run for this species.

Adults leave upland habitats at the beginning of the rainy season (November or December) (1)

Eggs are laid on stalks of vegetation in ponds (1)

The population consists of 3 metapopulations, each with one or more subpopulations. Subpopulations are focused around breeding ponds. Specific ponds are listed in Table 1 of the recovery plan. (1)

Note that body weight estimated using source 2 is similar to the empirical body weights reported in 1. Estimates of body weights were made in order to check the accuracy of the regression method.

Body weight (BW) is estimated from snout to vent length (SVL) for *A. californiense* and regressions of body weight and SVL data for populations of *A. gracile* taken at different times. The equations are below (from 4). Once the weight is estimated using these five equations, the average value is taken.

Fay Lake population, 1978BW = e^(2.986\*LN(SVL)-9.649)

Dark Lake population, 1978BW = e^(2.056\*LN(SVL)-6.409)

Fay Lake population, 1981BW = e^(3.187\*LN(SVL)-10.43)

Dark Lake population, 1981BW = e^(2.349\*LN(SVL)-7.494)

Scout Lake population, 1981BW = e^(2.152\*LN(SVL)-6.906)

Some studies suggest that a symbiotic relationship exists between algae and embryos of two different species of salamanders in the *Ambystoma* genus, including: *A. maculatum* (spotted salamander) and *A. gracile* (northwestern salamander). These algae are assumed to be *Chlamydomonas* species; however, this is not well documented. Algae reside within egg capsules around salamander embryos. Studies involving removal of algae from salamander eggs reported decreased survival, delayed hatching and decreased growth. Several studies have suggested that salamander embryos benefit from oxygen production and waste removal by algae (3). Since salamander embryos survived without algae, this is not necessarily an obligate relationship; however, salamanders appear to benefit from the relationship. These data suggest that impacts to algae could potentially decrease the survival or growth of *Ambystoma* species.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/24/12)

Sources:

1. USFWS. 1999. Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum)* Draft revised recovery plan (second revision). United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery\_plan/990702.pdf.
2. Taylor, J. 1984. Comparative evidence for competition between the salamanders *Ambystoma gracile* and *Taricha granulosa*. Copeia, 3: 672-683.
3. Kerney, R. 2011. Symbioses between salamander embryos and green algae. Symbiosis, 54 (3): 107-117.
4. USFWS. 1978. Proposed determination of critical habitat for the Santa Cruz long-toed salamander. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/federal\_register/fr221.pdf.
5. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Ambystoma tigrinum stebbinsi* (Sonora tiger salamander)**

Listed status: endangered (1)

Designated critical habitat? no (1)

Primary Constituent Elements: Not applicable

Map of range/occurrences in recovery plan? No (1)

Population size (most current estimate): not located

Snout to vent length (in mm):

Metamorphosed adults (terrestrial): 45-150 (1)

Branchiate adults (aquatic): 65-165 (1)

Body weight (in g):

Metamorphosed adults: 4.6-125 (estimated using regression of snout vent length and weight data for *Ambystoma gracile* from 2)

Branchiate adults: 12-165 (estimated using regression of snout vent length and weight data for *Ambystoma gracile* from 2)

Dates of breeding period: begins in January (1)

Locations known to occur: San Rafael Valley (Cochise and Santa Cruz counties) of Arizona (1)

Federal lands or Indian reservations species is known to occur:

Fort Huachuca (Army) (4)

Coronado National Forest (Forest Service) (4)

Diet:

Larvae: zooplankton (*e.g.,* daphnids, copepods, bosminids, ostracods) and larger aquatic macroinvertebrates (*e.g.,* chironomids, trichopterans, mollusks, zygopterans) (1)

Branchiate adults: zooplankton, mactoinvertebrates, salamander eggs and larvae (1)

Metamorphosed adults: terrestrial insects, macroinvertebrates, aquatic macroinvertebrates (1)

Relevant EFED model(s): PRZM5/VVWM

Larvae: PRZM5/VVWM

Adults: T-HERPS, KABAM

Habitat: standing water, grassland and oak woodland terrestrial habitats (1)

Human-constructed ponds or cattle tanks (1)

Terrestrial adults most likely spend time in mammal burrows or buried in the ground (1)

Aquatic and terrestrial

Elevation restriction: none noted in recovery plan (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Eggs are attached to aquatic vegetation, sticks, rocks and substrate (1)

Branchiate adults stay in ponds throughout their lives (1)

Some studies suggest that a symbiotic relationship exists between algae and embryos of two different species of salamanders in the *Ambystoma* genus, including: *A. maculatum* (spotted salamander) and *A. gracile* (northwestern salamander). These algae are assumed to be *Chlamydomonas* species; however, this is not well documented. Algae reside within egg capsules around salamander embryos. Studies involving removal of algae from salamander eggs reported decreased survival, delayed hatching and decreased growth. Several studies have suggested that salamander embryos benefit from oxygen production and waste removal by algae (3). Since salamander embryos survived without algae, this is not necessarily an obligate relationship; however, salamanders appear to benefit from the relationship. These data suggest that impacts to algae could potentially decrease the survival or growth of *Ambystoma* species.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/24/12)

Sources:

1. USFWS. 2002. Sonora tiger salamander recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/020924.pdf>.
2. Taylor, J. 1984. Comparative evidence for competition between the salamanders *Ambystoma gracile* and *Taricha granulosa*. Copeia, 3: 672-683.
3. Kerney, R. 2011. Symbioses between salamander embryos and green algae. Symbiosis, 54 (3): 107-117.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Anaxyrus baxteri,*** *formerly* ***Bufo baxteri* (Wyoming toad)**

Listed status: endangered (1)

Designated critical habitat? no

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): 100 – 150 adults (1)

Snout to vent length (in mm): Adult: 56 (mean) (1)

Body weight (in g): 15 (estimated using *Bufo sp.* regressions from 2)

Dates of breeding period: Mid May to Mid June (1)

Locations known to occur: Southwest of Laramie, WY in Albany County (1)

Historical distribution: within 30 mi of Laramie, WY (1)

Federal lands or Indian reservations species is known to occur:

Hutton Lake National Wildlife Refuge (FWS) (3)

Mortenson Lake National Wildlife Refuge (FWS) (3)

Public Domain Land (BLM) (3)

Diet: ants, beetles, variety of other arthropods (1)

No data on larval diet were provided in recovery plan. Based on diet of other *Bufo sp*., reviewer assumes that larvae eat algae.

Relevant EFED model(s): T-HERPS, PRZM5/VVWM

Habitat: breeding occurs in shallow water (<6 in) (1)

Breeding occurs in vegetated margins and bays of lakes, ponds and irrigated meadows (1)

Floodplains, ponds, margins of small seepage lakes in shortgrass communities of the Laramie Basin (1)

Aquatic and terrestrial

Elevation restriction (in m): Laramie Basin is 2100-2300 (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments: Adults emerge from hibernation in May after daytime maximum temperatures reach 70oF (1)

Hibernation occurs after September 1 (1)

Eggs are laid from mid May to early June (1)

Larvae transform by mid-July (1)

Population estimate is from 1987 and 1988(1)

Body weight is estimated from snout to vent length (SVL) for *Bufo baxteri* and regressions of body weight and SVL data for four species in the *Bufo* genus (*i.e.,* *B. fowleri, B. terrestrial, B. nebulifer, B. margaritifer*). The equations are below (from 2). Once the weight is estimated using these five equations, the average value is taken.

*B. fowleri:* BW = 10^(LogSVL\*3.01-4.07)

*B. terrestrial* BW = 10^(LogSVL\*3.05-4.14)

*B. nebulifer* BW = 10^(LogSVL\*2.94-4.00)

*B. margaritifer (Ecuador)* BW = 10^(LogSVL\*3.00-4.04)

*B. margaritifer* (Peru) BW = 10^(LogSVL\*3.04-4.13)

Name of data extractor (date): Kris Garber (1/24/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (02/01/12)

Sources:

1. USFWS. 1991. Wyoming toad recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/910911a.pdf>.
2. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
3. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Anaxyrus californicus*** **(arroyo southwestern toad)**

(Formerly: ***Bufo microscaphus californicus)***

Listed status: endangered (1)

Designated critical habitat? yes (2)

Primary Constituent Elements: (2, p. 7255)

1. Rivers or streams with hydrologic regimes that supply water to provide space, food, and cover needed to sustain eggs, tadpoles, metamorphosing juveniles, and adult breeding toads. Breeding pools must persist a minimum of 2 months for the completion of larval development. However, due to the dynamic nature of southern California riparian systems and flood regimes, the location of suitable breeding pools may vary from year to year. Specifically, the conditions necessary to allow for successful reproduction of arroyo toads are:

* + Breeding pools that are less than 6 in (15 cm) deep;
	+ Areas of flowing water with current velocities less than 1.3 ft per second (40 cm per second); and
	+ Surface water that lasts for a minimum of 2 months during the breeding season (a sufficient wet period in the spring months to allow arroyo toad larvae to hatch, mature, and metamorphose).

2. Riparian and adjacent upland habitats, particularly low-gradient (typically less than 6 percent) stream segments and alluvial streamside terraces with sandy or fine gravel substrates that support the formation of shallow pools and sparsely vegetated sand and gravel bars for breeding and rearing of tadpoles and juveniles; and adjacent valley bottomlands that include areas of loose soil where toads can burrow underground, to provide foraging and living areas for juvenile and adult arroyo toads.

3. A natural flooding regime, or one sufficiently corresponding to natural, that: (A) Is characterized by intermittent or near-perennial flow that contributes to the persistence of shallow pools into at least mid-summer; (B) Maintains areas of open, sparsely vegetated, sandy stream channels and terraces by periodically scouring riparian vegetation; and (C) Also modifies stream channels and terraces and redistributes sand and sediment, such that breeding pools and terrace habitats with scattered vegetation are maintained.

4. Stream channels and adjacent upland habitats that allow for movement to breeding pools, foraging areas, overwintering sites, upstream and downstream dispersal, and connectivity to areas that contain suitable habitat.

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not provided in recovery plan (1)

Snout to vent length (in mm): adults: 55-82 (1)

Juveniles: 17-50 mm (1)

Body weight (in g): 14-50 (estimated using *Bufo sp.* regressions from 3)

Dates of breeding period: January – July (1)

May be extended, depending upon weather (1)

Locations known to occur: California (1)

Los Angeles, Monterey, Orange, Riverside, Santa Barbara, San Bernardino, San Diego, Ventrua Counties (1, 2)

Federal lands or Indian reservations species is known to occur:

Capitan Grande Indian Reservation (BIA) (4)

Pala Indian Reservation (BIA) (4)

Rincon Indian Reservation (BIA) (4)

Hunter-Liggett Military Reservation (Army) (4)

Camp Pendleton Marine Corps Base (Marine Corps) (4)

Angeles National Forest (Forest Service) (4)

Cleveland National Forest (Forest Service) (4)

Los Padres National Forest (Forest Service) (4)

San Bernardino National Forest (Forest Service) (4)

San Diego National Wildlife Refuge (FWS) (4)

Public Domain Land (BLM) (4)

Agua Tibia Wilderness – Cleveland National Forest (Forest Service) (4)

San Mateo Canyon – Cleveland National Forest (Forest Service) (4)

San Rafael Wilderness – Los Padres National Forest (Forest Service) (4)

Sespe Wilderness – Angeles National Forest (Forest Service) (4)

Sespe Wilderness – Los Padres National Forest (Forest Service) (4)

Diet:

larvae: detritus, algae, bacteria, diatoms (1)

juveniles: mostly ants (*Liometopum occidentale*) and beetles (1)

adults: insects, prefer ants (2)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS

Habitat: stream channels and surrounding uplands (1)

For breeding, requires shallow, slow-moving streams and riparian habitats that are disturbed on a regular basis (flooding) (1)

Upland habitats include costal sage scrub, chaparral, grassland and oak woodlands (1) these may be located over 3 km from the breeding sites.

Aquatic and terrestrial

Elevation restriction (in m): sea level to 2440 (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Body weight is estimated from snout to vent length (SVL) for *Bufo microscaphus californicus* and regressions of body weight and SVL data for four species in the *Bufo* genus (*i.e.,* *B. fowleri, B. terrestrial, B. nebulifer, B. margaritifer*). The equations are below (from 3). Once the weight is estimated using these five equations, the average value is taken.

*B. fowleri:* BW = 10^(LogSVL\*3.01-4.07)

*B. terrestrial* BW = 10^(LogSVL\*3.05-4.14)

*B. nebulifer* BW = 10^(LogSVL\*2.94-4.00)

*B. margaritifer (Ecuador)* BW = 10^(LogSVL\*3.00-4.04)

*B. margaritifer* (Peru) BW = 10^(LogSVL\*3.04-4.13)

Juveniles are nocturnal (1)

Males reach adulthood at 2 years (1)

Females are sexually mature at 2-3 years age (1)

Juveniles and adults dig burrows (require fine sand to burrow) (1)

Name of data extractor (date): Kris Garber (10/17/11, revised 8/14/15)

QC reviewer (date): Melissa Panger (01/30/12)

Sources:

1. USFWS. 1999. Arroyo southwestern toad (*Bufo microscaphus californicus*) recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/990724.pdf>.
2. USFWS. 2011. Federal Register, Vol. 76, no. 27. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Arroyo Toad. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2011-02-09/pdf/2011-1703.pdf.
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Anaxyrus canorus* (Yosemite Toad)**

Listed status: Threatened

Designated critical habitat? Yes

Primary Constituent Elements (2, Page 24522):

*Aquatic breeding habitat.* (a) This habitat consists of bodies of fresh water, including wet meadows, slow-moving streams, shallow ponds, spring systems, and shallow areas of lakes, that: (i) Are typically (or become) inundated during snowmelt, (ii) Hold water for a minimum of 5 weeks, and (iii) Contain sufficient food for tadpole development. (b) During periods of drought or less than average rainfall, these breeding sites may not hold water long enough for individual Yosemite toads to complete metamorphosis, but they are still considered essential breeding habitat because they provide habitat in most years.

*Upland areas.* (a) This habitat consists of areas adjacent to or surrounding breeding habitat up to a distance of 1.25 km (0.78 mi) in most cases (that is, depending on surrounding landscape and dispersal barriers), including seeps, springheads, and areas that provide: (i) Sufficient cover (including rodent burrows, logs, rocks, and other surface objects) to provide summer refugia, (ii) Foraging habitat, (iii) Adequate prey resources, (iv) Physical structure for predator avoidance, (v) Overwintering refugia for juvenile and adult Yosemite toads, (vi) Dispersal corridors between aquatic breeding habitats, (vii) Dispersal corridors between breeding habitats and areas of suitable summer and winter refugia and foraging habitat, and/or (viii) The natural hydrologic regime of aquatic habitats (the catchment). (b) These upland areas should also allow maintain sufficient water quality to provide for the various life stages of the Yosemite toad and its prey base.

Map of range/occurrences in recovery plan? Yes (3)

Population size (most current estimate): not available (1)

Snout to vent length (in mm): 30–71 mm (1, Page 24498)

Body weight (in g): 2.3-31 (estimated, see below)

Dates of breeding period: immediately after snowmelt (1, Page 24498)

Federal lands or Indian reservations species is known to occur: not available

Locations known to occur: California (1)

Alpine, Amador, Calaveras, El Dorado, Fresno, Inyo, Madera, Mariposa, Mono, Tulare and Tuolumne Counties

Diet: (2, Page 24521):

tadpoles: algae, bacteria, protozoans, detritus, tadpoles, aquatic invertebrates

Adults: insects (Hymenoptera)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS

Habitat: uplands, wet meadows, lake shores, ponds (1, Page 24498)

Aquatic and terrestrial

Elevation restriction (in m): (1, Page 24499) 1,460 to 3,630 m (4,790 to 11,910 ft)

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet or habitat.

Comments:

Rodent burrows are used for overwintering and to take refuge from summer heat (3).

Body weight is estimated from regressions of body weight and SVL data (from 4), using the average of the following five equations (all for toads) for the min and max of the SVL values.

*B. fowleri:* BW = 10^(LogSVL\*3.01-4.07)

*B. terrestrial* BW = 10^(LogSVL\*3.05-4.14)

*B. nebulifer* BW = 10^(LogSVL\*2.94-4.00)

*B. margaritifer (Ecuador)* BW = 10^(LogSVL\*3.00-4.04)

*B. margaritifer* (Peru) BW = 10^(LogSVL\*3.04-4.13)

Name of data extractor (date): Lewis R. Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/17/15)

Sources:

1. USFWS 2013 Endangered Status for the Sierra Nevada Yellow-Legged Frog and the Northern Distinct Population Segment of the Mountain Yellow-Legged Frog and Threatened Status for the Yosemite Toad: Proposed Rule: Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-04-25/pdf/2013-09600.pdf
2. USFWS 2013 Designation of Critical Habitat for the Sierra Nevada Yellow-Legged Frog, The Northern Distinct Population Segment of the Mountain Yellow-Legged Frog and the Yosemite Toad; Proposed Rule: Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-04-25/pdf/2013-09598.pdf
3. USFWS 2014 Endangered Species Status for Sierra Nevada Yellow-Legged Frog and Northern Distinct Population Segment of the Mountain Yellow-Legged Frog and Threatened Status for the Yosemite Toad: Proposed Rule Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-04-29/pdf/2014-09488.pdf
4. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
5. Species profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D02K

**Species (common name): *Batrachoseps aridus* (desert slender salamander)**

Listed status: endangered (1)

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? no

Population size (most current estimate): not available

Snout to vent length (in mm): 48.4 (largest specimen) (1)

Body weight (in g): 2.3 (estimated from regression of length and weight data for *Plethodon cinereus* (3), which is in the same family as this species)

Dates of breeding period: Shortly before November through January (1)

Locations known to occur: Hidden Palms Canyon, located in Riverside County, California (1)

Guadalupe Canyon (2)

Federal lands or Indian reservations species is known to occur:

Santa Rosa Wilderness (BLM) (4)

Diet: arthropods, including flies and ants (1)

Relevant EFED model(s): T-HERPS

Habitat: desert, dry waterfalls, desert oasis (1)

Lives within porous soil, bedrock fractures or limestone sheeting (1)

Crevices, cracks, animal burrows (2)

Terrestrial only

Elevation restriction: none noted in recovery plan (1)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Nocturnal (1)

Respiration occurs through skin (2)

Probably lay eggs deep underground (2)

Salamanders have not been found since 1996 (2)

5-year review includes recommendation to change species name to *Batrachoseps major aridus* (2)

Only two populations have been identified (2)

The following regression was determined by K. Garber using data for *Plethodon cinereus* published by Heatwole and Heatwole 1962 (see figure): $BW=(L-29)/8.5$, where: BW = body weight in g and L = length in mm. The relationship between SVL and BW from *P. cinereus* is used to estimate the BW for *B. aridus* using the SVL from source 1.

The reviewer assumes that larvae and adults have the same diet.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/27/12)

Sources:

1. USFWS. 1982. Desert slender salamander recovery plan. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery\_plan/820812.pdf
2. USFWS. 2009. Desert slender salamander (*Batrachoseps aridus*) 5-year review: summary and evaluation. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/five\_year\_review/doc2600.pdf
3. Heatwole, H. and A. Heatwole. 1962. Weight-length curve of the salamander, *Plethodon cinereus*. Journal of the Ohio Herpetological Society 3: 37-39.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Bufo houstonensis* (Houston toad)**

Listed status: endangered (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: not defined in FR for designation of critical habitat (3)

Map of range/occurrences in recovery plan? yes

Population size (most current estimate): no in depth estimate has been made (1)

Snout to vent length (in mm):

Males: 45-70 (1)

Females: 52-80 (1)

Body weight (in g):

Males: 8-40 (estimated using *Bufo sp.* regressions from 2)

Females: 12-45 (estimated using *Bufo sp.* regressions from 2)

Dates of breeding period: Begins in January (1)

Reported egg-laying dates range from February-June (1)

Federal lands or Indian reservations species is known to occur:

Camp Swift N.G. Facility (Army) (4)

Locations known to occur: Texas (1)

Austin, Bastrop, Burleson, Colorado, Fort Bend, Harris, Liberty Counties (1)

Diet: Adults: insects (including ants and beetles), toads (1)

Tadpoles: algae, pollen, jelly envelopes of other tadpoles (of the same species) (1)

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults: T-HERPS

Habitat: areas with sandy soils, wooded areas (pine, mixed deciduous) with some grassy areas, costal prairie, non-flowing pools necessary for egg and tadpole development (1)

Use Rain pools, flooded fields and natural or manmade ponds for breeding (1)

Known calling sites include waters in pastures, shallow ravines, lakes, roadside ditches, ponds, temporary rain pools, flooded fields, puddles, prairie potholes, moist spots in residential areas, aquatic sites near runways on Ellington Air Force Base (1)

Aquatic and terrestrial

Elevation restriction (in m): none noted in recovery plan (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Body weight is estimated from snout to vent length (SVL) for *Bufo houstonensis* and regressions of body weight and SVL data for four species in the *Bufo* genus (*i.e.,* *B. fowleri, B. terrestrial, B. nebulifer, B. margaritifer*). The equations are below (from 2). Once the weight is estimated using these five equations, the average value is taken.

*B. fowleri:* BW = 10^(LogSVL\*3.01-4.07)

*B. terrestrial* BW = 10^(LogSVL\*3.05-4.14)

*B. nebulifer* BW = 10^(LogSVL\*2.94-4.00)

*B. margaritifer (Ecuador)* BW = 10^(LogSVL\*3.00-4.04)

*B. margaritifer* (Peru) BW = 10^(LogSVL\*3.04-4.13)

Name of data extractor (date): Kris Garber (1/5/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (02/01/12)

Sources:

1. USFWS. 1984. Recovery plan for the Houston toad (*Bufo houstonensis*). United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/840917.pdf>.
2. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
3. USFWS. 1979. Determination of critical habitat for the Houston toad. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/federal_register/fr179.pdf>
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Cryptobranchus alleganiensis bishopi* (Ozark hellbender)**

Listed status: endangered (1)

Designated critical habitat? no (1)

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? no

Population size (most current estimate):

North Fork: 200 (estimate from 2006, 1)

Eleven Point River: 300 (estimate from 2006, 1)

Current River: 80 (estimate from 2006, 1)

Snout to vent length (in mm): not available

Body weight (in g):

Adult average: 314.3(4)

Adult range: 36-1140 (estimated using total length (TL) and weight-TL regression from 4)

Dates of breeding period: mid September to Early October (1)

Locations known to occur:

Southern Missouri and Northern Arkansas (1)

Missouri Counties: Carter, Dent, Douglas, Howell, Oregon, Ozark, Ripley, Shannon, Texas, Wright (3)

Arkansas Counties: Baxter, Clay, Fulton, Lawrence, Randolph, Sharp (3)

Ozark Plateau (1)

North Fork of the White River, Eleven Point River and Current River (1)

Federal lands or Indian reservations species is known to occur:

Mark Twain National Forest (Forest Service) (5)

Ozark National Forest (Forest Service) (5)

Ozark National Scenic Riverways (NPS) (5)

Ozark National Scenic Riverways – Mark Twain National Forest (NPS/Forest Service) (5)

Eleven Point National Wild and Scenic River (NPS) (5)

Devils Backbone Wilderness – Mark Twain National Forest (Forest Service) (5)

Diet:

Adults: crayfish, small fish, aquatic invertebrates, hellbenders, hellbender eggs (1, 2)

Larva: aquatic insects (1)

Relevant EFED model(s): PRZM5/VVWM

Habitat:

Species is aquatic only (1)

Beneath rocks during the day (1)

Moderate to deep (<1-3 m), rocky, fast flowing streams (1)

Dissolved oxygen, temperature and flow must be consistent (1)

Elevation restriction: none noted in available USFWS documentation (1)

Obligate relationships: none noted in available USFWS documentation (1, 2) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Home range:

Females: 28 sq m (average; 1)

Males: 81 sq m (average; 1)

Comments:

There is no recovery plan for this species

This subspecies and the eastern hellbender (*C. a. alleganiensis*) have similar habitat requirements and reproductive biology (1).

Adults are diurnal during the breeding season and nocturnal otherwise (1).

Species is territorial and migrates little (1).

Species diet is primarily composed of crayfish (1, 2)

Total length and snout to vent length are correlated and total length is more accurately measured, weight and total length relationships were generated by source 4. Those relationships are as follows (BW = weight in g; TL = total length in mm): BW = 0.0000084\*TL2.9667

This equation that applies to both males and females was used to derive weight ranges from TL data provided in source 4 (TL range = 172-551 mm)

Name of data extractor (date): Kris Garber (4/17/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (4/26/12)

Sources:

1. USFWS. 2011. Endangered and threatened wildlife and plants; Endangered status for the Ozark hellbender salamander. United States Fish and Wildlife Service. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2011-10-06/pdf/2011-25690.pdf.
2. USFWS. 2011. Ozark Hellbender fact sheet. United States Fish and Wildlife Service. Available online at: http://www.fws.gov/midwest/endangered/amphibians/ozhe/ozheFactSheet.html
3. Species profile for Ozark Hellbender. Available online at: <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D032>
4. Peterson, C.L., Wilkinson, Jr., R.F., Topping, M.S. and D.E. Metter. 1983. Age and growth of the Ozark hellbender (*Cryptobranchus alleganiensis bishopi*). Copeia, 1983 (1): 225-231.
5. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Eleutherodactylus cooki* (Guajon or Puerto Rican Demon)**

Listed status: threatened (1)

Designated critical habitat? yes (2)

Primary Constituent Elements: (2, p. 60071-60072)

1. Subtropical forest (which may include trees such as *Cecropia schreberiana, Dendropanax arboreus, Guarea guidonia, Piper aduncum, Spathodea campanulata, Syzygium jambos, and Thespesia populnea*) at elevations from 118 to 1,183 ft (36 to 361 m) above sea level.

2. Plutonic, granitic, or sedimentary rocks/boulders that form caves, crevices, and grottoes (interstitial spaces) in a streambed; and that are in proximity, or connected, to a permanent, ephemeral, or subterranean clear-water stream or water source. The interstitial spaces between or underneath rocks provide microenvironments characterized by generally higher humidity and cooler temperatures than outside the rock formations.

3. Vegetation-covered rocks (the vegetation typically includes moss, ferns, and hepatics such as Thuidium urceolatum, Taxilejeunea sulphurea, and Huokeria acutifolia) extending laterally to a maximum of 99 ft (30 m) from each bank of the stream; these rocks provide cover and foraging sites and help conserve humidity.

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not provided in recovery plan (1)

Snout to vent length (in mm):

females: 50.94 (average) (1)

males: 43.43 (average) (1)

Body weight (in g):

females: 10.4 (mean; estimated using data from *E. coqui* reported by (3), see comment below)

males: 8.9 (mean; estimated using data from *E. coqui* reported by (3), see comment below)

Dates of breeding period: Reproductive season: April-November (1)

Locations known to occur: in the Cuchilla de Panduras Mountain range in Puerto Rico (1)

Arroyo, Patillas, Maunabo, Yabucoa, San Lorenzo, Las Piedras, Humacao Municipalities (1)

Federal lands or Indian reservations species is known to occur: None (4)

Diet: insects, other invertebrates (*e.g.,* spiders, Chilopoda, Diplopods) (1)

Relevant EFED model(s): T-HERPS, PRZM5/VVWM

Habitat:

Caves formed by large boulders of granite rock (“guajonales”), crevices and grottoes among boulders, rocky streams (1)

Caves are within subtropical moist and subtropical wet forests and subtropical lower montane wet forests (1)

Foraging habitat may extend 30 m from water (1)

Aquatic and terrestrial

Elevation restriction (in m): 5.5-361 (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Reviewer assumes that this species may consume aquatic inverts

Males sit over egg clutches for defense (1)

Michael et al. 2004 (3) report that gravid individuals of *E. coqui* had a length of 43.5 ± 5.0 mm and a weight of 8.9 ±1.0 g. The ratio of mean length and weight data reported for *E. coqui* (4.9) was applied to the length of *E. cooki* to estimate the latter species’ body weight.

Eggs are laid on humid boulders within grottoes and on flat surfaces (1)

Reviewer assumes that diet information available in USFWS documentation applies to all life stages.

Name of data extractor (date): Kris Garber (1/4/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (01/30/12)

Sources:

1. USFWS. 2004. Recovery plan for the Guajon or Puerto Rican Demon (*Eleutherodactylus cooki*). United States Fish and Wildlife Service. Atlanta, GA. Available online at: <http://ecos.fws.gov/docs/recovery_plan/040924b.pdf>
2. USFWS. 2007. Federal Register, Vol. 72, no. 204. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Guajon (*Eleutherodactylus cooki)*. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2007-10-23/pdf/07-5056.pdf#page=1.
3. Michael, S.F.; Buckley, C.; Toro, E.; Estrada, A.R. and S. Vincent. 2004. Induced ovulation and egg deposition in the direct developing anuran *Eleutherodactylus coqui*. Reproductive Biology and Endocrinology, 2: 6.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Eleutherodactylus jasperi* (Golden coqui)**

Listed status: threatened (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: not defined in FR for designation of critical habitat (3)

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): 1510-3010 (1)

Snout to vent length (in mm): 19-22 (1)

Body weight (in g): 3.9-4.5 (estimated using data from *E. coqui* reported by (2), see comment below)

Dates of breeding period: Reproduction may be acyclical (1)

Locations known to occur: Puerto Rico (1)

Small (24 ha) area south of Cayey (1)

Federal lands or Indian reservations species is known to occur: None (4)

Diet: insects (1)

Relevant EFED model(s): T-HERPS

Habitat: leaf axis of bromeliads (1)

On mountain tops (1)

Species is terrestrial only

Elevation restriction (in m): 700-850 (1)

Obligate relationships: bromeliads (1)

Comments:

Gives birth to live young (1)

Population estimate is from 1973-1974 (1)

Michael et al. 2004 (2) report that gravid individuals of *E. coqui* had a length of 43.5 ± 5.0 mm and a weight of 8.9 ±1.0 g. The ratio of mean length and weight data reported for *E. coqui* (4.9) was applied to the length of *E. jasperi* to estimate the latter species’ body weight.

Critical habitat appears to be located in Cayey Municipality (based on comparison of landmarks on maps for critical habitat (3) and county map of Puerto Rico)

Reviewer assumes that diet information available in USFWS documentation applies to all life stages.

Name of data extractor (date): Kris Garber (10/17/11, revised 8/14/15)

QC reviewer (date): Melissa Panger (01/30/12)

Sources:

1. USFWS. 1984. Recovery plan for the golden coqui. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/840419c.pdf>.
2. Michael, S.F.; Buckley, C.; Toro, E.; Estrada, A.R. and S. Vincent. 2004. Induced ovulation and egg deposition in the direct developing anuran *Eleutherodactylus coqui*. Reproductive Biology and Endocrinology, 2: 6.
3. USFWS. 1977. Federal register, Vol 42, number 216, November 11, 1977. Available online at: <http://www.fws.gov/caribbean/es/PDF/CaribbeanCH.pdf>
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Eleutherodactylus juanariveroi* (Llanero Coqui)**

Listed status: Endangered

Designated critical habitat? Yes

Primary Constituent Elements: (2, Page: 63434)

Primary Constituent Element 1—*Palustrine herbaceous wetland.* Palustrine emergent persistent wetlands that are seasonally to permanently flooded. Ocean-derived salts need to be less than 0.5 parts per thousand (ppt) salinity.

Primary Constituent Element 2—*Vegetation and vegetation composition* *of the palustrine herbaceous wetland.* Emergent vegetation characterized by erect, rooted herbaceous hydrophytes usually dominated by perennial plants like ferns, *Sagittaria lancifolia,* flatsedges, spike rushes, vines, and grasses. In addition to the combination of vegetation, at least 25 percent of the

vegetation should be ferns and *S. lancifolia.*

Primary Constituent Element 3—*Hydrology.* A hydrologic flow regime (i.e., the pathways of precipitation, surface run-off, groundwater, tides, and flooding of rivers and canals [manmade ditches]) that maintains the palustrine herbaceous wetland

Map of range/occurrences in recovery plan? Yes (2)

Population size (most current estimate): Not available

Snout to vent length (in mm): (1, Page 60779)

Males: 14.7

Females: 15.8

Body weight (in g): (estimated)

Males: 3.0

Females: 3.2

Dates of breeding period: Not Mentioned

Federal lands or Indian reservations species is known to occur: not available

Locations known to occur: Toa Baja County, Puerto Rico (3)

Diet: aquatic and terrestrial invertebrates (1, Page 60779)

Relevant EFED model(s): T-HERPS, PRZM5/VVWM and KABAM

Habitat: herbaceous wetland (1)

Aquatic and terrestrial

Elevation restriction: not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Michael et al. 2004 (4) report that gravid individuals of *E. coqui* had a length of 43.5 ± 5.0 mm and a weight of 8.9 ±1.0 g. The ratio of mean length and weight data reported for *E. coqui* (4.9) was applied to the length of this speciesto estimate body weight.

Reviewer assumes that tadpole stage is aquatic and consumes aquatic invertebrates.

Name of data extractor (date): Lewis R. Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/17/15)

Sources:

1. USFWS 2012 Determination of Endangered Species Status for Coqui Llanero Throughout Its Range and Designation of Critical Habitat: Final Rule Available online

At: http://www.gpo.gov/fdsys/pkg/FR-2012-10-04/pdf/2012-23999.pdf

1. USFWS 2011 12-Month Petition Finding Proposed Listing of Coqu[iacute] Llanero as Endangered, and Designation of Critical Habitat for Coqu[iacute] Llanero; Proposed Rule: Available online at : http://www.gpo.gov/fdsys/pkg/FR-2011-10-12/pdf/2011-25809.pdf
2. Species profile, available online at: <https://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=D03V>
3. Michael, S.F.; Buckley, C.; Toro, E.; Estrada, A.R. and S. Vincent. 2004. Induced ovulation and egg deposition in the direct developing anuran *Eleutherodactylus coqui*. Reproductive Biology and Endocrinology, 2: 6.

**Species (common name): *Eurycea chisholmensis* (Salado Salamander)**

Listed status: Threatened

Designated critical habitat? Yes

Primary Constituent Elements: (1, Page 50809)

1. *Water from the Northern Segment of the Edwards Aquifer.* The groundwater must be similar to natural aquifer conditions both underground and as it discharges from natural springoutlets. Concentrations of water qualityconstituents that could have a negativeimpact on the salamander should bebelow levels that could exert directlethal or sublethal effects (such aseffects to reproduction, growth,development, or metabolic processes),or indirect effects (such as effects to theSalado salamander’s prey base).Hydrologic regimes similar to thehistorical pattern of the specific sitesmust be present, with at least temporal surface flow for spring sites and continuous flow for subterranean sites.The water chemistry must be similar to natural aquifer conditions, with temperatures between 65.3 and 69.8 °F(18.5 and 21.0 °C), dissolved oxygenconcentrations between 5.6 and 8 mg/L, and conductivity between 550 and 721 mS/cm. The best scientific evidence available suggests that thegroundwater of Salado salamanderhabitat is the same as Georgetown andJollyville Plateau salamander habitat interms of chemistry. Therefore, weinclude here for the Salado salamanderthe range of water chemistry parametersthat encompass the ranges found in Jollyville and Georgetown salamanderhabitats.

2. *Rocky substrate with interstitial spaces.* Rocks (boulders, cobble, orgravel) in the substrate of thesalamander’s surface aquatic habitatshould be large enough to providesalamanders with cover, shelter, andforaging habitat. The substrate andinterstitial spaces should have minimal sedimentation.

3. *Aquatic invertebrates for food.* The spring and cave environments should be capable of supporting a diverse aquatic invertebrate community that includes crustaceans and insects.

4. *Subterranean aquifer.* During periods of drought or dewatering on the surface in and around spring sites, access to the subsurface water table should be provided for shelter and protection

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available (1, p. 50770)

Snout to vent length (in mm): 33 (estimated)

Body weight (in g): 0.30 (estimated)

Dates of breeding period: not available

Federal lands or Indian reservations species is known to occur: Not available

Locations known to occur: Bell County, Texas (4)

Diet: aquatic invertebrates (copepods, isopods, and insect larvae) (1, p. 50770)

Relevant EFED model(s): PRZM5/VVWM

Habitat: aquatic habitats (pools, springs, springruns, and wet caves) (1, p. 50770)

This species is aquatic. It does not have a terrestrial phase (1, p. 50770)

Elevation restriction (in m): not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Total length is 50 mm (1, page 50770). It is assumed that 1/3 of the length (based on picture from source 4) is represented by the tail (i.e., SVL = 33).

Body weight is estimated using the ratio of mean adult SVL to body weight for the San Marcos salamander (110; source 3).

Water source: Northern Segment of the Edwards Aquifer (1, p. 50770)

Eggs are likely deposited underground for protection (1, p. 50770)

Reviewer assumes that all life stages of this species consume aquatic invertebrates.

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/17/15)

Sources:

1. USFWS 2012 Endangered Status for Four Central Texas Salamanders and Designation of Critical Habitat. Available online at: <http://www.gpo.gov/fdsys/pkg/FR-2012-08-22/pdf/2012-19659.pdf>
2. USFWS 2014 Determination of Threatened Species Status for the Georgetown Salamander and Salado Salamander Throughout Their Ranges; Final Rule. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-02-24/pdf/2014-03717.pdf
3. Berkhouse, C.S. and J.N. Fries. 1995. Critical thermal maxima of juvenile and adult San Marcos salamanders (*Eurycea nana*). The Southwestern Naturalist, 40(4): 430-434.
4. Species profile, available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D02X

**Species (common name): *Eurycea nana* (San Marcos salamander)**

Listed status: threatened (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: not defined in FR for designation of critical habitat (3)

Map of range/occurrences in recovery plan? no

Population size (most current estimate): 53,200 (1)

Snout to vent length (in mm):

Juvenile: <20 (1)

Adult males: >=19 (1)

Adult females: >=20 (1)

Juveniles: 10.7 (mean) (2)

Juveniles: 8-14 (range) (2)

Adults: 25.8 (mean) (2)

Adults 22-30 (range) (2)

Body weight (in g): Adults: 0.24 (mean) (2)

Adults: 0.18-0.32 (range) (2)

Dates of breeding period: June and the fall (1)

Locations known to occur: Spring Lake in Hays County, Texas (1)

Federal lands or Indian reservations species is known to occur: None (4)

Diet: aquatic invertebrates, including amphipods, midge fly larvae and pupae, small insect pupae and naiads, small aquatic snails (1)

Relevant EFED model(s): PRZM5/VVWM

Habitat: Spring Lake (1)

Found among aquatic plants on the bottom of the lake (1)

Found under stones in sand and gravel areas (1)

Must have flowing water (from springs flowing into Spring Lake) (1)

Aquatic (1)

Elevation restriction: none noted in available USFWS documentation (1)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat

Comments:

.”… protective cover such as that afforded by the moss and cyanophycean bacteria (=blue-green algae) is essential to the survival of the salamander” (1)

Retains external gills throughout life (1)

Breeds in the water (1)

Protective cover is essential to survival (1)

Flowing spring water has pH 7.2, temperature 21-22oC, oxygen content is 4 mg/L (1)

Reviewer assumes that all life stages of this species consume aquatic invertebrates.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/24/12)

Sources:

1. USFWS. 1996. San Marcos and Comal Springs and associated aquatic ecosystems (Revised) recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/960214.pdf>
2. Berkhouse, C.S. and J.N. Fries. 1995. Critical thermal maxima of juvenile and adult San Marcos salamanders (*Eurycea nana*). The Southwestern Naturalist, 40(4): 430-434.
3. USFWS. 1980. Endangered and threatened wildlife and plants: listing of the San Marcos salamander as threatemed, the San Marcos gambusia as endangered, and the listing of Critical Habitat for Texas wildrice, San Marcos salamander, San Marcos gambusia and fountain darter. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/federal_register/fr437.pdf>
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Eurycea naufragia* (Georgetown Salamander)**

Listed status: Threatened

Designated critical habitat? Yes

Primary Constituent Elements: (1, Page 50809)

 1. *Water from the Northern Segment of the Edwards Aquifer.* Thegroundwater must be similar to naturalaquifer conditions both undergroundand as it discharges from natural springoutlets. Concentrations of water qualityconstituents that could have a negativeimpact on the salamander should bebelow levels that could exert directlethal or sublethal effects (such aseffects to reproduction, growth,development, or metabolic processes),or indirect effects (such as effects to theGeorgetown salamander’s prey base).Hydrologic regimes similar to thehistorical pattern of the specific sites must be present, with at least temporalsurface flow for spring sites andcontinuous flow for subterranean sites.The water chemistry must be similar tonatural aquifer conditions, withtemperatures between 68.4 and 69.8 °F(20.2 and 21.0 °C), dissolved oxygenconcentrations between 6 and 8 mg/L, and specific water conductivity between 604 and 721 uS /cm.

2. *Rocky substrate with interstitial spaces.* Rocks (boulders, cobble, orgravel) in the substrate of thesalamander’s surface aquatic habitatshould be large enough to providesalamanders with cover, shelter, andforaging habitat. The substrate andinterstitial spaces should have minimalsedimentation.

3. *Aquatic invertebrates for food.* The spring and cave environments should be capable of supporting a diverse aquatic invertebrate community that includes crustaceans and insects.

4. *Subterranean aquifer.* During periods of drought or dewatering on the surface in and around spring sites, access to the subsurface water table must exist to provide shelter and protection

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available (1, p. 50770)

Snout to vent length (in mm): 33 (estimated)

Body weight (in g): 0.30 (estimated)

Dates of breeding period: not available

Locations known to occur: Williamson County, Texas. (1, p. 50772)

Federal lands or Indian reservations species is known to occur: Not available

Diet: aquatic invertebrates (copepods, isopods, and insect larvae) (1, p. 50770)

Relevant EFED model(s): PRZM5/VVWM

Habitat: aquatic habitats (pools, springs, springruns, and wet caves) (1, p. 50770)

This species is aquatic. It does not have a terrestrial phase (1, p. 50770)

Elevation restriction (in m): not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Total length is 50 mm (1, page 50770). It is assumed that 1/3 of the length (based on picture from source 3) is represented by the tail (i.e., SVL = 33).

Body weight is estimated using the ratio of mean adult SVL to body weight for the San Marcos salamander (110; source 2).

Water source: Northern Segment of the Edwards Aquifer (1, p. 50770)

Eggs are likely deposited underground for protection (1, p. 50770)

Reviewer assumes that all life stages of this species consume aquatic invertebrates.

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2012 Endangered Status for Four Central Texas Salamanders and Designation of Critical Habitat Also available online: http://www.gpo.gov/fdsys/pkg/FR-2012-08-22/pdf/2012-19659.pdf
2. Berkhouse, C.S. and J.N. Fries. 1995. Critical thermal maxima of juvenile and adult San Marcos salamanders (*Eurycea nana*). The Southwestern Naturalist, 40(4): 430-434.
3. Species profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D02S

**Species (common name): *Eurycea sosorum* (Barton Springs salamander)**

Listed status: endangered (1)

Designated critical habitat? No (1)

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not located

Snout to vent length (in mm):

Average: 22 (2)

Range: 9-40 (2)

Body weight (in g): 0.20 (estimated using relationship between total length and SVL of San Marcos salamander, see comment below)

Dates of breeding period: year-round (1)

Locations known to occur: Barton Springs in Austin (Travis County) Texas (1)

Federal lands or Indian reservations species is known to occur: None (4)

Diet: aquatic invertebrates, including amphipods, ostracods, copepods, chironomids, snails, mayfly larvae, leeches, riffle beetles (1)

Relevant EFED model(s): PRZM5/VVWM

Habitat: stenothermal spring flows, substrates are mixtures of gravel, cobble, aquatic plants, leaf litter and are free of sediment (1)

Pools and spring runs, subsurface portions of the aquifer (within water-bearing karst formations) (1)

Found under boulder, cobble, gravel and plant (aquatic plants, leaf litter, woody debris) substrates (1)

Aquatic (1)

Elevation restriction: none noted in available USFWS documentation (1)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Retains external gills throughout life (1)

Respiration is through the gills and skin (1)

Of vertebrate species in N. America, this species has one of the smallest geographical ranges (1)

Water passing through Barton Springs is from the Edwards Aquifer and occasionally from Barton Creek (when it floods) (1)

Water conditions are stable (pH = approximately 7, temperature =21-22 oC, dissolved oxygen average = 6 mg/L) (1)

Opportunistic feeders (1)

Since this species is aquatic, T-HERPS is not used to estimate dietary exposures; therefore, body weight is not a necessary parameter for this species.

Total length (adults): 63-76 mm (1)

Body weight is estimated using the ratio of mean adult SVL to body weight for the San Marcos salamander (110; source 3).

Reviewer assumes that all life stages of this species consume aquatic invertebrates.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/12/24)

Sources:

1. USFWS. 2005. Barton Springs salamander (*Eurycea sosorum*) recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/050921.pdf>.
2. City of Austin. 2006. Raw data on snout vent lengths of Barton Springs salamanders. Data collected from 2003-2005.
3. Berkhouse, C.S. and J.N. Fries. 1995. Critical thermal maxima of juvenile and adult San Marcos salamanders (*Eurycea nana*). The Southwestern Naturalist, 40(4): 430-434.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Eurycea tonkawae* (Jollyville Plateau Salamander)**

Listed status: Threatened

Designated critical habitat? Yes

Primary Constituent Elements: (4, Page 51342)

Surface Habitat PCEs i. *Water from the Trinity Aquifer,* *Northern Segment of the Edwards* *Aquifer, and local alluvial aquifers.* The groundwater is similar to natural aquifer conditions as it discharges from natural spring outlets. Concentrations of water quality constituents and contaminants should be below levels that could exert direct lethal or sublethal effects (such as effects to reproduction, growth, development, or metabolic processes), or indirect effects (such as effects to the Jollyville Plateau salamander’s prey base). Hydrologic regimes similar to the historical pattern of the specific sites are present, with at least some surface flow during the year. The water chemistry is similar to natural aquifer conditions, with temperatures from 64.1 to 73.4 °F (17.9 to 23 °C), dissolved oxygen concentrations from 5.6 to 8 mg/L, and specific water conductance from 550 to 721 uS/cm.

ii. *Rocky substrate with interstitial* *spaces.* Rocks in the substrate of the salamander’s surface aquatic habitat are large enough to provide salamanders with cover, shelter, and foraging habitat (larger than 2.5 in (64 mm)). The substrate and interstitial spaces have minimal sedimentation.

iii. *Aquatic invertebrates for food.* The spring environment supports a diverse aquatic invertebrate community that includes crustaceans, insects, and flatworms.

iv. *Subterranean aquifer.* Access to the subsurface water table should exist to provide shelter, protection, and space for reproduction. This access can occur in the form of large conduits that carry water to the spring outlet or porous voids between rocks in the streambed that extend down into the water table.

Subsurface Habitat PCEs

i. *Water from the Trinity Aquifer, Northern Segment of the Edwards Aquifer, and local alluvial aquifers.* Thegroundwater is similar to natural aquifer conditions. Concentrations of water quality constituents and contaminants are below levels that could exert direct lethal or sublethal effects (such as effects to reproduction, growth, development, or metabolic processes), or indirect effects (such as effects to the Jollyville Plateau salamander’s prey base). Hydrologic regimes similar to the historical pattern of the specific sites are present, with continuous flow. The water chemistry is similar to natural aquifer conditions, including temperature, dissolved oxygen, and specific water conductance.

ii. *Subsurface spaces.* Voids between rocks underground are large enough to provide salamanders with cover, shelter, and foraging habitat. These spaces have minimal sedimentation.

iii. *Aquatic invertebrates for food.* The habitat supports an aquatic invertebrate community that includes crustaceans, insects, or flatworms

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available (1, p. 50770)

Snout to vent length (in mm): 33 (estimated)

Body weight (in g): 0.30 (estimated)

Dates of breeding period: Not available

Locations known to occur: Jollyville Plateau and Brushy Creek areas of the Edwards Plateau in Travis and Williamson Counties, Texas (1, p. 50771)

Federal lands or Indian reservations species is known to occur: not available

Diet: aquatic invertebrates (copepods, isopods, and insect larvae) (1, p. 50770)

Relevant EFED model(s): PRZM5/VVWM

Habitat: aquatic habitats (pools, springs, springruns, and wet caves) (1, p. 50770)

This species is aquatic. It does not have a terrestrial phase (1, p. 50770)

Elevation restriction (in m): not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Total length is 50 mm (1, page 50770). It is assumed that 1/3 of the length (based on picture from source 3) is represented by the tail (i.e., SVL = 33).

Body weight is estimated using the ratio of mean adult SVL to body weight for the San Marcos salamander (110; source 2).

Water source: Northern segment of the Edwards Aquifer (1, p. 50770)

Eggs are likely deposited underground for protection (1, p. 50770)

Reviewer assumes that all life stages of this species consume aquatic invertebrates.

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2012 Endangered Status for Four Central Texas Salamanders and Designation of Critical Habitat Also available online: http://www.gpo.gov/fdsys/pkg/FR-2012-08-22/pdf/2012-19659.pdf
2. Berkhouse, C.S. and J.N. Fries. 1995. Critical thermal maxima of juvenile and adult San Marcos salamanders (*Eurycea nana*). The Southwestern Naturalist, 40(4): 430-434.
3. Species profile. Available online at: <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D02T>
4. USFWS 2013. Designation of Critical Habitat for the Austin Blind and Jollyville Plateau Salamanders. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-08-20/pdf/2013-19713.pdf

**Species (common name): *Eurycea waterlooensis* (Austin blind Salamander)**

Listed status: Endangered

Designated critical habitat? Yes

Primary Constituent Elements (4, Page 51341):

Surface Habitat PCEs

i. *Water from the Barton Springs Segment of the Edwards Aquifer.* Thegroundwater is similar to natural aquiferconditions as it discharges from naturalspring outlets. Concentrations of waterquality constituents and contaminantsare below levels that could exert directlethal or sublethal effects (such aseffects to reproduction, growth,development, or metabolic processes),or indirect effects (such as effects to theAustin blind salamander’s prey base).Hydrologic regimes similar to thehistorical pattern of the specific sites arepresent, with constant surface flow. Thewater chemistry is similar to naturalaquifer conditions, with temperaturesfrom 67.8 to 72.3 °F (19.9 and 22.4 °C),dissolved oxygen concentrations from 5to 7 mg/L, and specific waterconductance from 605 to 740 uS/cm.

ii. *Rocky substrate with interstitial spaces.* Rocks in the substrate of thesalamander’s surface aquatic habitat arelarge enough to provide salamanderswith cover, shelter, and foraging habitat(larger than 2.5 in (64 mm)). Thesubstrate and interstitial spaces haveminimal sedimentation.

iii. *Aquatic invertebrates for food.* The spring environment supports a diverse aquatic invertebrate community that includes crustaceans, insects, and flatworms.

iv. *Subterranean aquifer.* Access to the subsurface water table exists to provide shelter, protection, and space for reproduction. This access can occur in the form of large conduits that carry water to the spring outlet or fissures in the bedrock

Subsurface Habitat PCEs

i. *Water from the Barton Springs Segment of the Edwards Aquifer.* Thegroundwater is similar to natural aquiferconditions. Concentrations of waterquality constituents and contaminantsare below levels that could exert directlethal or sublethal effects (such aseffects to reproduction, growth,development, or metabolic processes),or indirect effects (such as effects to the

Austin blind salamander’s prey base). Hydrologic regimes similar to the historical pattern of the specific sites are present, with continuous flow in the subterranean habitat. The water chemistry is similar to natural aquifer conditions, including temperature, dissolved oxygen, and specific water conductance.

ii. *Subsurface spaces.* Conduits underground are large enough to provide salamanders with cover, shelter, and foraging habitat.

iii. *Aquatic invertebrates for food.* The habitat supports an aquatic invertebrate community that includes crustaceans, insects, or flatworms

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available (1, p. 50770)

Snout to vent length (in mm): 33 (estimated)

Body weight (in g): 0.30 (estimated)

Dates of breeding period: Not available

Locations known to occur: Barton Springs in Austin Texas (1, p. 50771)

Federal lands or Indian reservations species is known to occur: not available

Diet: aquatic invertebrates (copepods, isopods, and insect larvae) (1, p. 50770)

Relevant EFED model(s): PRZM5/VVWM

Habitat: aquatic habitats (pools, springs, springruns, and wet caves) (1, p. 50770)

This species is aquatic. It does not have a terrestrial phase (1, p. 50770)

Elevation restriction (in m): not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Total length is 50 mm (1, page 50770). It is assumed that 1/3 of the length (based on picture from source 3) is represented by the tail (i.e., SVL = 33).

Body weight is estimated using the ratio of mean adult SVL to body weight for the San Marcos salamander (110; source 2).

Water source: Barton Springs Segment of the Edwards Aquifer (1, p. 50770)

Eggs are likely deposited underground for protection (1, p. 50770)

Reviewer assumes that all life stages of this species consume aquatic invertebrates.

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2012 Endangered Status for Four Central Texas Salamanders and Designation of Critical Habitat Also available online: http://www.gpo.gov/fdsys/pkg/FR-2012-08-22/pdf/2012-19659.pdf
2. Berkhouse, C.S. and J.N. Fries. 1995. Critical thermal maxima of juvenile and adult San Marcos salamanders (*Eurycea nana*). The Southwestern Naturalist, 40(4): 430-434.
3. Species profile. Available online at: <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D033>
4. USFWS 2013. Designation of Critical Habitat for the Austin Blind and Jollyville Plateau Salamanders. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-08-20/pdf/2013-19713.pdf

**Species (common name): *Gyrinophilus gulolineatus* (Berry Cave salamander)**

Listed status: Candidate

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available

Snout to vent length (in mm): 122 (2)

Body weight (in g): 11 (estimated)

Dates of breeding period: not available (1)

Locations where species is known to occur: Tennessee (1)

Federal lands or Indian reservations species is known to occur: Tennessee Valley Authority (1)

Diet: organic detritus, aquatic organisms (1)

Aquatic invertebrates (likely including isopods, annelids, and aquatic invertebrates) (2)

Relevant EFED model(s): PRZM5/VVWM

Habitat: subterranean waters (caves) (1)

Aquatic only

Elevation restriction (in m): not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

The following regression was determined by K. Garber using data for *Plethodon cinereus* published by Heatwole and Heatwole 1962 (see figure): $BW=(L-29)/8.5$, where: BW = body weight in g and L = length in mm. The relationship between SVL and BW from *P. cinereus* is used to estimate the BW for this species (from source 2).

Identified threats to this species include (1):

* agricultural runoff,
* road runoff,
* pesticide use in residential and agricultural settings,
* over-collection,
* increased water flow into and through cave systems following timber operations, and
* siltation caused by the removal of trees from riparian zones.

Reviewer assumes that all life stages of this species consume aquatic invertebrates.

Name of data extractor (date): Lewis Ross Brown, May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2014 Species Assessment Form for Berry Cave salamander (*Gyrinophilus gulolineatus*). Available online at: <http://ecos.fws.gov/docs/candidate/assessments/2014/r4/D03B_V01.pdf>
2. Amphibiaweb. 2015. Species profile for berry cave salamander. Available online at:

[**http://amphibiaweb.org/cgi/amphib\_query?where-genus=Gyrinophilus&where-species=gulolineatus**](http://amphibiaweb.org/cgi/amphib_query?where-genus=Gyrinophilus&where-species=gulolineatus)

1. Heatwole, H. and A. Heatwole. 1962. Weight-length curve of the salamander, *Plethodon cinereus*. Journal of the Ohio Herpetological Society 3: 37-39.

**Species (common name): *Hyla wrightorum* (Arizona Treefrog)**

Listed status: Candidate

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? No

Population size (most current estimate): Not available

Snout to vent length (in mm) (1, Page 3): 46 mm

Body weight (in g): 1.9-2.5 (estimated)

Dates of breeding period: summer (adult males heard calling from July to August, 1, p. 5)

Locations known to occur: Cochise and Santa Cruz Counties, AZ (1, p. 2)

Federal lands or Indian reservations species is known to occur:

Fort Huachuca (1)

Coronado National Forest (1)

Diet: invertebrates (beetles, spiders, earthworms, flies) (1, Page 6)

Relevant EFED model(s): T-HERPS, earthworm fugacity, PRZM5/VVWM

Habitat: oak woodland and savannah, pine-oak woodland, mixed conifer forest, grassland (1, p. 5)

Ponds used for breeding (1, p. 5)

Elevation restriction (in m): 1525-2590 m (1, p. 5)

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Body weight estimated using SVL for this species and ratio of BW to SVL for *Hyla squirella* (0.041-0.055; from source 2).

Most areas where this species is known to occur are federal lands (1, p. 2)

Reviewer assumes that tadpoles consume aquatic invertebrates.

Name of data extractor (date): Lewis Ross Brown, May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2013 Species Assessment Form for the *Hyla wrightorum* (Huachuca/Canelo Population). Available online at: http://ecos.fws.gov/docs/candidate/assessments/2014/r2/D03S\_V02.pdf
2. Joseph C. Mitchell (*2014*) Natural History of an Introduced Population of Squirrel Treefrogs (*Hyla squirella*) on the Delmarva Peninsula. Journal of North Carolina Academy of Science: Spring 2014, Vol. 130, No. 1, pp. 6-10.

**Species (common name): *Lithobates onca* (Relict leopard Frog)**

Listed status: Candidate

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? No

Population size (most current estimate):

2012: 1693 adults (1452-2340) (1, Page 7)

2013: 1893 adults (1673-2581) (1, Page 7)

Snout to vent length (in mm) 4.4-8.9 (1, Page 3)

Body weight (in g): 0.014-0.095 (estimated)

Dates of breeding period: February through April and November (1, Page 4)

Locations where species is known to occur: Mohave County, AZ, Clark County, NV (1; p. 2)

Federal lands or Indian reservations species is known to occur: not available

Diet: Adults and juveniles: invertebrates (1, Page 4)

Tadpoles: algae and detritus (1, Page 4)

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults: T-HERPS

Habitat: springs, streams, wetlands (1, Page 4)

Aquatic and terrestrial

Elevation restriction (in m): Not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Body weight is estimated from snout to vent length (SVL) for this species and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*), which is closely related to this species (both are in the Ranidae family). The equations are below (from 2). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Given the habitat, the reviewer assumes that adults consume aquatic and terrestrial invertebrates.

Name of data extractor (date): Lewis Ross Brown, May 29, 2015

QC reviewer (date): Kris Garber (8/3/15)

Sources:

1. USFWS 2014 Species Assessment for *Lithobates onca.* Available online at: http://ecos.fws.gov/docs/candidate/assessments/2014/r8/D00E\_V01.pdf
2. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.

**Species (common name): *Necturus alabamensis* (Black warrior (=Sipsey Fork) Waterdog)**

Listed status: candidate

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available

Snout to vent length (in mm) (1, Page 3):

Subadults: 40 to 100

Adults: ≤248 millimeters (mm)

Body weight (in g):

Subadults= 0.13-3.2 (estimated)

Adults=≤76 (estimated)

Dates of breeding period: Not available

Location where species is known to occur: Winston, AL (1, p. 2)

Federal lands or Indian reservations species is known to occur: William B. Bankhead National Forest (1, p. 2)

Diet: aquatic invertebrates, fish (1, Page 4)

Relevant EFED model(s): PRZM5/VVWM

Habitat: streams (1, Page 3)

Aquatic only

Elevation restriction (in m): not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Individuals are assumed to be carnivores. Prey in the wild has not been described.

Species is aquatic and nocturnal (1, p. 3)

Body weight estimated using the following equation for *Necturus maculosus* reported by source 3: Log(BW) = Log(Length)\*3.47-6.43

Reviewer assumes that tadpoles consume aquatic inveretbrates.

Name of data extractor (date): Lewis Ross Brown, May 29, 2015

QC reviewer (date): Kris Garber (8/3/15)

Sources:

1. USFWS 2013 SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM for *Necturus alabamensis.* Available online at: <http://ecos.fws.gov/docs/candidate/assessments/2013/r4/D030_V01.pdf>
2. Vandevalk, A.J. and J. H. Coleman. 2010. A proposed weight-length relationship for the Common Mudpuppy. Herpetological Review, 2010, 41(1), 29–31.

**Species (common name): *Notophthalmus perstriatus* (Striped newt)**

Listed status: Candidate

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? Yes

Population size (most current estimate): not available

Snout to vent length (in mm): 50-100 (1, Page 3)

Body weight (in g): 0.80 (2)

Dates of breeding period: not available

Locations where species is known to occur: Alachua, Baker, Bradford, Citrus, Clay, Columbia, Dixie, Duval, Flagler, Gilchrist, Leon, Marion, Nassau, Orange, Putnam, Seminole, St. Johns, Sumter, Suwannee, Union, Wakulla, Counties FL,

Baker, Bryan, Camden, Charlton, Evans, Irwin, Lanier, Long, Lowndes, Counties, GA (1, p. 2)

Federal lands or Indian reservations species is known to occur:

Apalachicola National Forest,

Camp Blanding Military Reservation,

Ft. Stewart Military Reservation,

Ocala National Forest,

Okefenokee NWR,

Osceola National Forest (1, p. 3)

Diet: frog eggs, worms, snails, fairy shrimp, spiders, and insects (adult and larvae) (1, Page 5)

Relevant EFED model(s): KABAM, PRZM5/VVWM, T-HERPS and earthworm fugacity

Habitat: Ephemeral ponds, upland habitats (forest, scrub) (1, Page 4)

Aquatic and terrestrial

Elevation restriction (in m): Not available

Obligate relationships: None noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Habitat is fire-dependent (1, p. 4)

Reviewer assumes that tadpoles are aquatic, preying on aquatic invertebrates.

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (8/3/15)

Sources:

1. USFWS 2014 SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM for the *Notophthalmus perstriatus*. Available online at: <http://ecos.fws.gov/docs/candidate/assessments/2014/r4/D02P_V01.pdf>
2. http://animaldiversity.org/accounts/Notophthalmus\_perstriatus/

**Species (common name): *Peltophryne lemur* (Puerto Rican Crested Toad)**

Listed status: threatened (1)

Designated critical habitat? no

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): 2025-2050 (1)

Snout to vent length (in mm): 64-120 (1)

Body weight (in g): 23-151 (estimated using *Bufo sp.* regressions from 2)

Females: 85-170 (3)

Males: 57 (3)

Dates of breeding period: year round

Locations known to occur: Puerto Rico (1)

Guanica and Quebradillas Municipalities (1)

Federal lands or Indian reservations species is known to occur: None (4)

Diet: snails, beetles, insects (3)

Relevant EFED model(s): T-HERPS, KABAM , PRZM5/VVWM

Habitat: low elevation arid or semi-arid rocky areas with limestone fissures and cavities in well-drained soil (1)

Breed in ponds (1)

Aquatic and terrestrial

Reviewer assumes that tadpoles are aquatic, preying upon aquatic invertebrates.

Elevation restriction (in m): <200 (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Reviewer assumes that all life stages consume invertebrates and that adults may consume both aquatic and terrestrial invertebrates.

There are two known populations in Puerto Rico (1)

Species is believed to be extirpated from Virgin Gorda and British Virgin Islands (1)

Body weight is estimated from snout to vent length (SVL) for *Peltophryne lemur* and regressions of body weight and SVL data for four species in the *Bufo* genus (*i.e.,* *B. fowleri, B. terrestrial, B. nebulifer, B. margaritifer*). Data for *Bufo sp* were used because *P. lemur* is in the same family as species in this genus.

The equations are below (from 2). Once the weight is estimated using these five equations, the average value is taken. Estimated body weights are similar to those reported by source 3.

*B. fowleri:* BW = 10^(LogSVL\*3.01-4.07)

*B. terrestrial* BW = 10^(LogSVL\*3.05-4.14)

*B. nebulifer* BW = 10^(LogSVL\*2.94-4.00)

*B. margaritifer (Ecuador)* BW = 10^(LogSVL\*3.00-4.04)

*B. margaritifer* (Peru) BW = 10^(LogSVL\*3.04-4.13)

Breeding is sporadic, occurring after heavy rains (at least 5 cm rainfall) (1). Since rainfall can occur year round in Puerto Rico, it is assumed by the reviewer that breeding can occur year-round.

More than one breeding event may occur in a season (1)

Eggs are wrapped around emergent vegetation in ponds (1)

Name of data extractor (date): Kris Garber (1/4/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (3/26/12)

Sources:

1. USFWS. 1992. Recovery plan for the Puerto Rican crested toad (*Peltophryne lemur*). United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/920807a.pdf>.
2. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
3. Association of Zoos and Aquariums. Puerto Rican Crested Toad. Available online at: <http://www.aza.org/Education/KidsAndFamilies/detail.aspx?id=1790>.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Phaeognathus hubrichti* (red hills salamander)**

Listed status: threatened (1)

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not provided in recovery plan

Snout to vent length (in mm): 31-120 (2)

Body weight (in g): 0.24-11 (estimated from regression of length and weight data for *Plethodon cinereus* (3), which is in the same family as this species)

Dates of breeding period: not available in recovery plan (1)

Locations known to occur: southern, central Alabama (1)

Monroe, Conecuh, Butler, Covington, Crenshaw Counties (1)

Areas between the Alabama and Conecuh Rivers (1)

Tallahatta and Hatchetigbee formations of the Red Hills (1)

Federal lands or Indian reservations species is known to occur: None (4)

Diet: arthropods (1)

Relevant EFED model(s): T-HERPS

Habitat: Mesic ravine slopes and bluff sides (facing North) with hardwood trees (1)

Burrows within siltstone (1)

Usually found on sites with loamy, friable topsoils (1)

Terrestrial only

Elevation restriction: none noted in recovery plan (1)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

The following regression was determined by K. Garber using data for *Plethodon cinereus* published by Heatwole and Heatwole 1962 (see figure): $BW=(L-29)/8.5$, where: BW = body weight in g and L = length in mm. The relationship between SVL and BW from *P. cinereus* is used to estimate the BW for *P. hubrichti* using the SVL from source 2.

Reviewer assumes that all life stages consume terrestrial arthropods.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/27/12)

Sources:

1. USFWS. 1983. Recovery plan for the red hills salamander (*Phaeognathus hubrichti* Highton). United States Fish and Wildlife Service. Available online at:http://ecos.fws.gov/docs/recovery\_plan/831123.pdf
2. Brandon, R.A. 1965. Morphological Variation and Ecology of the Salamander *Phaeognathus hubrichti.* *Copeia*, 1965 (1): 67-71.
3. Heatwole, H. and A. Heatwole. 1962. Weight-length curve of the salamander, *Plethodon cinereus*. Journal of the Ohio Herpetological Society 3: 37-39.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Plethodon neomexicanus* (Jemez Mountains salamander)**

Listed status: Endangered

Designated critical habitat? Yes

Primary Constituent Elements (1, Pages 69580-81):

(1) Moderate to high tree canopy cover, typically 50 to 100 percent canopy closure, that provides shade and maintains moisture and high relative humidity at the ground surface, and:

(a) Consists of the following tree species alone or in any combination: Douglas fir (*Pseudotsuga menziesii*); blue spruce (*Picea pungens*); Engelman spruce (*Picea engelmannii*); white fir (*Abies concolor*); limber pine (*Pinus* *flexilis*); Ponderosa pine (*Pinus ponderosa*); and aspen (*Populus tremuloides*); and

(b) Has an understory thatpredominantly comprises: RockyMountain maple (*Acer glabrum*); New Mexico locust (*Robinia neomexicana*); oceanspray (*Holodiscus* spp.); or shrubby oaks (*Quercus* spp.).

(2) Elevations from 6,988 to 11,254 ft (2,130 to 3,430 m).

(3) Ground surface in forest areas with:

(a) Moderate to high volumes of large fallen trees and other woody debris, especially coniferous logs at least 10 in (25 cm) in diameter, particularly Douglas fir, which are in contact with the soil in varying stages of decay from freshly fallen to nearly fully decomposed; or

(b) Structural features, such as rocks, bark, and moss mats, that provide the species with food and cover.

(4) Underground habitat in forest or meadow areas containing interstitial spaces provided by:

(a) Igneous rock with fractures or loose rocky soils;

(b) Rotted tree root channels; or

(c) Burrows of rodents or large invertebrates.

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available

Snout to vent length (in mm):

Males: 98 (3)

Females: 104 (3)

Body weight (in g):

Males: 8.1 (estimated)

Females: 8.8 (estimated)

Dates of breeding period: unknown

Locations where species is known to occur: Los Alamos, Rio Arriba and Sandoval Counties, New Mexico (5)

Federal lands or Indian reservations species is known to occur: not available

Diet: invertebrates (2, Page 55601)

Relevant EFED model(s): T-HERPS

Habitat: mixed conifer forest (2, Pages 55601-55602)

Terrestrial only

Elevation restriction (in m): 2,130 to 3,430 (2, Page 55601)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

The following regression was determined by K. Garber using data for *Plethodon cinereus* published by Heatwole and Heatwole 1962 (see figure): $BW=(L-29)/8.5$, where: BW = body weight in g and L = length in mm. The relationship between SVL and BW from *P. cinereus* is used to estimate the BW for *P. hubrichti* using the SVL from source 4.

Species is terrestrial, spending most of its time underground. Individual emerge when conditions are warm and wet (July-September) (2, 55601)

Diet includes ants, mites and beetles (2, Page 55601)

Reviewer assumes that all life stages consume terrestrial invertebrates.

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (8/3/15)

Sources:

1. USFWS 2013 Designation of Critical Habitat for the Jemez Mountains Salamander. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-11-20/pdf/2013-27736.pdf.
2. USFWS 2013 Determination of Endangered Species Status for Jemez Mountains Salamander (*Plethodon neomexicanus*) Throughout Its Range. Available online at: <http://www.gpo.gov/fdsys/pkg/FR-2013-09-10/pdf/2013-21583.pdf>
3. Reagan, D.P. 1972. Ecology and distribution of the jemez mountains salamander, *Plethodon neomexicanus*. Copeia, 1972 (3): 486-492.
4. Brandon, R.A. 1965. Morphological Variation and Ecology of the Salamander *Phaeognathus hubrichti.* *Copeia*, 1965 (1): 67-71.
5. Species profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D019#lifeHistory

**Species (common name): *Plethodon nettingi* (Cheat Mountain salamander)**

Listed status: threatened (1)

Designated critical habitat? No

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? yes (1, 2)

Population size (most current estimate): not located

Snout to vent length (in mm): Average = 39.0 (3)

Body weight (in g): 1.2 (estimated from regression of length and weight data for *Plethodon cinereus* (4), which is in the same genus as this species)

Dates of breeding period: Spring (March-April), fall (September-October) (2)

Locations known to occur: West Virginia (1)

Grant, Pendleton, Pocahontas, Randolph, Tucker Counties (1, 2)

Federal lands or Indian reservations species is known to occur:

Monongahela National Forest (Forest Service) (5)

Spruce Knob-Seneca Rocks National Recreation Area – Monongahela National Forest (Forest Service) (5)

Canaan Valley National Wildlife Refuge (FWS) (5)

Monongahela National Forest Purchase Unit – Monongahela National Forest (Forest Service) (5)

Dolly Sods Wilderness – Monongahela National Forest (Forest Service) (5)

Otter Creek Wilderness – Monongahela National Forest (Forest Service) (5)

Diet: terrestrial invertebrates, including mites, springtails, beetles, flies, ants (1)

Relevant EFED model(s): T-HERPS

Habitat: red spruce and mixed deciduous forests (1)

Microhabitats have high humidity, moist soil and cool temperatures (1)

Forest floor is (usually) covered with liverwort (*Bazzania trilobata*) and contains rocks (2)

Terrestrial only

Elevation restriction: >610 m (2)

Obligate relationships: none noted in available USFWS documentation (1, 2) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

The area where this species is known to exist is 700 sq. miles in size (1)

Found in microhabitats with high humidity, moist soils, cool temperatures (1)

There are 68 known populations. Most of these are located on federal (n = 60) or state (n = 3) lands.

Maximum reported total length is 102 mm (1)

During the day, individuals take cover under logs, rocks and litter (2)

Foraging occurs at night (2)

Individuals take cover during the winter and emerge in March or April to breed (2)

Nests are terrestrial and are located under rocks, logs, bark (2)

Reviewer assumes that all life stages consume terrestrial invertebrates.

The following regression was determined by K. Garber using data for *Plethodon cinereus* published by Heatwole and Heatwole 1962 (see figure): $BW=(L-29)/8.5$, where: BW = body weight in g and L = length in mm. The relationship between SVL and BW from *P. cinereus* is used to estimate the BW for *P.* *nettingi* using the SVL from source 3.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/27/12)

Sources:

1. USFWS. 1991. Cheat Mountain salamander (*Plethodon nettingi*) recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/910725.pdf>
2. USFWS. 2009. Cheat Mountain salamander (*Plethodon nettingi*) 5-year review: summary and evaluation. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/five_year_review/doc3267.pdf>.
3. Adams, D.C.; West, M.E.; and M.L. Collyer. 2007. Location-specific sympatric morphological divergence as a possible response to species interactions in West Virginia *Plethodon* salamander communities. Journal of Animal Ecology, 76: 289-295.
4. Heatwole, H. and A. Heatwole. 1962. Weight-length curve of the salamander, *Plethodon cinereus*. Journal of the Ohio Herpetological Society 3: 37-39.
5. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Plethodon shenandoah* (Shenandoah salamander)**

Listed status: endangered (1)

Designated critical habitat? no

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not available in recovery plan (1)

Snout to vent length (in mm): Adult: 40-57 (1)

Body weight (in g): 1.3- 3.3 (estimated from regression of length and weight data for *Plethodon cinereus* (2), which is in the same genus as this species)

Dates of breeding period: late spring or summer (1)

Locations known to occur: Virginia (1)

Shenandoah National Park (1)

Hawksbill Mountain, the Pinnacles and Stony Man Mountain (1)

Madison, Page, and Rappahannock Counties

Federal lands or Indian reservations species is known to occur:

Shenandoah National Park (National Park Service) (3)

Diet: terrestrial invertebrates, including mites, springtails, flies, small beetles other soil invertebrates (1)

Relevant EFED model(s): T-HERPS

Habitat: dry, rocky, talus slopes, of mountains, generally facing north (1)

Forests (1)

Terrestrial only

Elevation restriction: found >800 m (1)

Obligate relationships: none noted in available USFWS documentation (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Nocturnal (1)

Terrestrial (1)

Individuals hide under protective cover or in rock crevices during the day (1)

Individuals develop completely within the egg, therefore, they do not require open or flowing water for reproduction (1)

Eggs are laid in damp logs, moss or other crevices and females guard the eggs (1)

All species in the Plethodontidae family (the lungless salamanders) respire through their skin (1)

Reviewer assumes that all life stages consume terrestrial invertebrates.

The following regression was determined by K. Garber using data for *Plethodon cinereus* published by Heatwole and Heatwole 1962 (see figure): $BW=(L-29)/8.5$, where: BW = body weight in g and L = length in mm. The relationship between SVL and BW from *P. cinereus* is used to estimate the BW for *P. shenandoah* using the SVL from source 1.

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (2/27/12)

Sources:

1. USFWS. 1994. Shenandoah salamander (*Plethodon shenandoah* Highton and Worthington) recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/940929a.pdf>
2. Heatwole, H. and A. Heatwole. 1962. Weight-length curve of the salamander, *Plethodon cinereus*. Journal of the Ohio Herpetological Society 3: 37-39.
3. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Rana chiricahuensis* (Chiricahua leopard frog)**

Listed status: threatened (1)

Designated critical habitat? Yes (2)

Primary Constituent Elements: (2, p. 16343)

1. Aquatic breeding habitat and immediately adjacent uplands exhibiting the following characteristics: (a) Standing bodies of fresh water (with salinities less than 5 parts per thousand, pH greater than or equal to 5.6, and pollutants absent or minimally present), including natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, off-channel pools, and other ephemeral or permanent water bodies that typically hold water or rarely dry for more than a month. During periods of drought, or less than average rainfall, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but they would still be considered essential breeding habitat in non-drought years. (b) Emergent and/or submerged vegetation, root masses, undercut banks, fractured rock substrates, or some combination thereof, but emergent vegetation does not completely cover the surface of water bodies. (c) Nonnative predators (e.g., crayfish, bullfrogs, nonnative fish) absent or occurring at levels that do not preclude presence of the Chiricahua leopard frog. (d) Absence of chytridiomycosis, or if present, then environmental, physiological, and genetic conditions are such that allow persistence of Chiricahua leopard frogs. (e) Upland habitats that provide opportunities for foraging and basking that are immediately adjacent to or surrounding breeding aquatic and riparian habitat.

2. Dispersal and nonbreeding habitat, consisting of areas with ephemeral (present for only a short time), intermittent, or perennial water that are generally not suitable for breeding, and associated upland or riparian habitat that provides corridors (overland movement or along wetted drainages) for frogs among breeding sites in a metapopulation with the following characteristics: (a) Are not more than 1.0 mile (1.6 kilometers) overland, 3.0 miles (4.8 kilometers) along ephemeral or intermittent drainages, 5.0 miles (8.0 kilometers) along perennial drainages, or some combination thereof not to exceed 5.0 miles (8.0 kilometers). (b) In overland and nonwetted corridors, provide some vegetation cover or structural features (e.g., boulders, rocks, organic debris such as downed trees or logs, small mammal burrows, or leaf litter) for shelter, forage, and protection from predators; in wetted corridors, provide some ephemeral, intermittent, or perennial aquatic habitat. (c) Are free of barriers that block movement by Chiricahua leopard frogs, including, but not limited to, urban, industrial, or agricultural development; reservoirs that are 50 acres (20 hectares) or more in size and contain nonnative predatory fish, bullfrogs, or crayfish; highways that do not include frog fencing and culverts; and walls, major dams, or other structures that physically block movement.

With the exception of impoundments, livestock tanks, and other constructed waters, critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries.

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not listed in recovery plan (1)

Snout to vent length (in mm): adult: 109 (1)

Smallest adults: 53 (1)

Body weight (in g): 13-113 (estimated using *Rana sp.* regressions from 3)

Dates of breeding period: Frogs at some sites may deposit eggs year round (1)

Frogs appear to deposit eggs during spring and summer and specific timing may be influenced by elevation (1)

Locations known to occur: Arizona, New Mexico (1)

Apache, Cochise, Gila, Graham, Greenlee, Pima, Santa Cruz, Yavapai Counties, AZ (1, 2)

Catron, Grant, Hidalgo, Sierra, Socorro Counties, NM (1, 2)

Federal lands or Indian reservations species is known to occur:

Tohono O'odham Indian Reservation (Bureau of Indian Affairs) (4)

Fort Huachuca (Army) (4)

San Pedro Riparian National Conservation Area (BLM) (4)

San Pedro Riparian National Conservation Area – Public Domain Land (BLM) (4)

Apache National Forest (Forest Service) (4)

Cibola National Forest (Forest Service) (4)

Coconino National Forest (Forest Service) (4)

Coronado National Forest (Forest Service) (4)

Gila National Forest (Forest Service) (4)

Sitgreaves National Forest (Forest Service) (4)

Tonto National Forest (Forest Service) (4)

Fort Bowie National Historic Site (National Park Service) (4)

Gila Cliff Dwellings National Monument (National Park Service) (4)

Buenos Aires National Wildlife Refuge (FWS) (4)

Leslie Canyon National Wildlife Refuge (FWS) (4)

San Bernardino National Wildlife Refuge (FWS) (4)

Public Domain Land (BLM) (4)

Baboquivari Peak Wilderness (BLM) (4)

Redfield Canyon Wilderness (BLM) (4)

Aldo Leopold Wilderness – Gila National Forest (Forest Service) (4)

Chiricahua National Monument Wilderness – Coronado National Forest (Forest Service) (4)

Galiuro Wilderness – Coronado National Forest (Forest Service) (4)

Gila Wilderness – Gila National Forest (Forest Service) (4)

Mazatzal Wilderness – Tonto National Forest (Forest Service) (4)

Miller Peak Wilderness – Coronado National Forest (Forest Service) (4)

Mount Wrightson Wilderness – Coronado National Forest (Forest Service) (4)

Pajarita Wilderness – Coronado National Forest (Forest Service) (4)

Diet: larvae: bacteria, algae, aquatic plants (1)

Adults: aquatic and terrestrial invertebrates (*e.g*., snails, spiders, insects), vertebrates (fish, frogs, toads, small birds) (1)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS, KABAM

Habitat: variety of aquatic habitats (1)

Cienegas, springs, pools, cattle tanks, lakes, reservoirs, streams, rivers (1)

Adults are primarily aquatic (1)

Elevation restriction (in m): 1000-2710 (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

There are two separate populations (1)

Length is “snout-urostyle”

Inactive between November and February (1)

Body weight is estimated from snout to vent length (SVL) for *Rana chiricahuensis* and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 3). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Name of data extractor (date): Kris Garber (1/4/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (01/30/12)

Sources:

1. USFWS. 2007. Chiricahua leopard frog (*Rana chiricahuensis*) final recovery plan. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/070604_v3.pdf>.
2. USFWS. 2012. Listing and designation of critical habitat for the chiricahua leopard frog, final rule. Federal Register, Vol 77, No. 54. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2012-03-20/pdf/2012-5953.pdf.
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Rana draytonii* (California red-legged frog)**

(previously ***Rana aurora draytonii***)

Listed status: threatened (1)

Designated critical habitat? yes (1)

Primary Constituent Elements: (6, p. 12835 - 12836)

1. *Aquatic Breeding Habitat*. Standing bodies of fresh water (with salinities less than 4.5 ppt), including natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.

2. *Aquatic Non-Breeding Habitat*. Freshwater pond and stream habitats, as described above, that may not hold water long enough for the species to complete its aquatic life cycle but which provide for shelter, foraging, predator avoidance, and aquatic dispersal of juvenile and adult California red-legged frogs. Other wetland habitats considered to meet these criteria include, but are not limited to: plunge pools within intermittent creeks, seeps, quiet water refugia within streams during high water flows, and springs of sufficient flow to withstand short-term dry periods.

3. *Upland Habitat*. Upland areas adjacent to or surrounding breeding and habitat up to a distance of 1 mi (1.6 km) in most cases (i.e., depending on surrounding landscape and dispersal barriers) including various vegetational types such as grassland, woodland, forest, wetland, or riparian areas that provide shelter, forage, and predator avoidance for the California red-legged frog. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the aquatic, wetland, or riparian habitat. These upland features contribute to: (1) Filling of aquatic, wetland, or riparian habitats; (2) maintaining suitable periods of pool inundation for larval frogs and their food sources; and (3) providing nonbreeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), small mammal burrows, or moist leaf litter.

4. *Dispersal Habitat*. Accessible upland or riparian habitat within and between occupied or previously occupied sites that are located within 1 mi (1.6 km) of each other, and that support movement between such sites. Dispersal habitat includes various natural habitats, and altered habitats such as agricultural fields, that do not contain barriers (e.g., heavily traveled roads without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large lakes or reservoirs over 50 ac (20 ha) in size, or other areas that do not contain those features identified in PCE 1, 2, or 3 as essential to the conservation of the species. non-breeding aquatic and riparian

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): not available for all recovery units (1)

Snout to vent length (in mm):

Adult females (San Luis Obispo): 91-138 (4)

Adult females (Santa Barbara): 87-129 (4)

Adult males (Santa Barbara): 82-108 (4)

Adult males (San Luis Obispo): 78-116 (4)

Body weight (in g):

Adult males: 12.75-163 (empirical data; 3)

Adult males: 38-118 (estimated using *Rana sp.* regressions cited in 2 and length data from 4)

Adult females: 8.7-238 (empirical data; 3)

Adult females: 52-193 (estimated using *Rana sp.* regressions cited in 2 and length data from 4)

Adults: 59.0-94.0 (empirical data; 5)

All frogs, including juveniles: 1.4-238 (empirical data; 3)

Dates of breeding period: November – Early April (1)

Locations known to occur: California (1)

Alameda, Butte, Contra Costa, El Dorado, Fresno, Kern, Kings, Los Angeles, Marin, Merced, Monterey, Napa, Placer, Pulmas, Riverside, San Benito, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Tehama, Ventura and Yuba Counties (1)

Federal lands or Indian reservations species is known to occur:

Agua Caliente Indian Reservation (Bureau of Indian Affairs) (7)

Vandenberg Air Force Base (7)

Camp Parks Military Reservation (Army) (7)

Angeles National Forest (Forest Service) (7)

Eldorado National Forest (Forest Service) (7)

Los Padres National Forest (Forest Service) (7)

Plumas National Forest (Forest Service) (7)

San Bernardino National Forest (Forest Service) (7)

Stanislaus National Forest (Forest Service) (7)

Tahoe National Forest (Forest Service) (7)

California Coastal National Monument (BLM) (7)

Pinnacles National Monument (National Park Service) (7)

Channel Islands National Park (National Park Service) (7)

Golden Gate National Recreation Area (National Park Service) (7)

Golden Gate National Recreation Area – Open Water (National Park Service) (7)

Point Reyes National Seashore (National Park Service) (7)

Guadalupe-Nipomo Dunes National Wildlife Refuge (FWS) (7)

Public Domain Land (BLM) (7)

Ventana Wilderness – Los Padres National Forest (Forest Service) (7)

Pinnacles Wilderness – Pinnacles National Forest (National Park Service) (7)

Phillip Burton Wilderness – Point Reyes National Seashore (National Park Service) (7)

Bear Mountain Wilderness Study Area (BLM) (7)

Diet: larvae (tadpoles): algae (1)

Adults: invertebrates, pacific tree frogs (*Hyla regilla*) and California mice (*Peromyscus californicus*) (1)

Invertebrates make up the most common food item in adult frogs (1)

Relevant EFED model(s):

Larvae: PRZM5/VVWM

Adults: T-HERPS, KABAM

Habitat: variety of aquatic, riparian and upland habitats (1)

Aquatic and terrestrial

Elevation restriction (in m): sea level – 1500 (1)

Most populations are below 1050 (1)

Obligate relationships: none noted in recovery plan (1) Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Recovery plan does not include fish in diet; however, fish are included in the diet in ESA assessments completed by EFED.

This species has 8 recovery units (1)

Body weight estimate for adult CRLF that was calculated using source 2 (males: 99-137 g; females 155-232 g) is consistent with empirical data on this species, where adult body weight ranges were 12.75-163 g for males and 8.7-238 g for females (3).

Body weight is estimated from snout to vent length (SVL) for *Rana chiricahuensis* and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 2). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Name of data extractor (date): Kris Garber (10/17/11, revised 8/14/15)

QC reviewer (date): Melissa Panger (04/26/12)

Sources:

1. USFWS. 2002. Recovery plan for the California red-legged frog (*Rana aurora draytonii*). United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/020528.pdf>.
2. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
3. Fellers, G. (2007). Personal communication between Gary Fellers (Western Ecology Research Center of USGS and Thomas Steeger (U.S. EPA) via email.
4. Hayes, M. P. and M. M. Miyamoto. 1984. Biochemical, behavioral and body size differences between *Rana aurora aurora* and *R.a. draytoni*. Copeia, 4: 1018-1022.
5. Fellers, G.M. and G. Guscio. 2004. California red-legged frog surveys of lower Redwood Creek, Golden Gate National Recreation Area. Prepared for the National Park Service. 65pp.
6. USFWS. 2010. Endangered and threatened wildlife and plants; revised designation of critical habitat for the California red-legged frog. 50 CFR Part 17. Available online at: <http://www.gpo.gov/fdsys/pkg/FR-2010-03-17/pdf/2010-4656.pdf#page=2>
7. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Rana luteiventris* (Columbia spotted frog)**

Listed status: Not warranted

Designated critical habitat? No

Primary Constituent Elements: No

Map of range/occurrences in recovery plan? No

Population size (most current estimate): not available

Snout to vent length (in mm): 50-90 (2)

50-100 (1, p. 3)

Body weight (in g): 11-77

Dates of breeding period: not available

Locations where species is known to occur: Owyhee and Twin Falls Counties, Idaho (2)

Elko, Eureka, Nye Counties, Nevada (2)

Harney, Lake and Malheur counties, Oregon (2)

Federal lands or Indian reservations species is known to occur: (1, p. 2)

The Humboldt-Toiyabe National Forest (HTNF)

BLM-managed lands include the Elko and Battle Mountain District Offices in Nevada; Lakeview, Burns, and Vale District Offices in Oregon; and Jarbidge, Bruneau,

and Owyhee Field Offices in Idaho.

Malheur National Wildlife Refuge (USFWS)

Yomba-Shoshone Reservation

Duck Valley Indian Reservation

Diet: adults: invertebrates (insects, mollusks) other amphibians (1, Page 6)

Tadpoles: algae and detritus (1, p. 6)

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults: KABAM, T-HERPS

Habitat: clear, slow-moving, ponded water (little shade and constant water temperature) (1, Page 6)

Water bodies include oxbows, lakes, stock ponds, beaver-created ponds, seeps in wet meadows, backwaters

Spring seeps, meadows, marshes, ponds, streams, riparian corridors (2)

Aquatic and terrestrial habitats are used

Elevation restriction (in m): 1,700 and 2,650 (1, Page 7)

Obligate relationships: none noted in USFWS documentation. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Approximately 71% of range occurs on federal lands (1, p. 2)

Body weight is estimated from snout to vent length (SVL) for this species and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 3). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2013 Species Assessment Form for *Rana luteiventris*. Available online at: http://ecos.fws.gov/docs/candidate/assessments/2013/r8/D027\_V01.pdf
2. Species profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D027
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.

**Species (common name): *Rana muscosa* (Mountain yellow-legged frog) - Northern CA DPS**

Listed status: Endangered

Designated critical habitat? Yes

Primary Constituent Elements: (1, p. 24521)

(1) *Aquatic habitat for breeding and rearing.* Habitat that consists ofpermanent water bodies, or those thatare either hydrologically connected with, or close to, permanent waterbodies, including, but not limited to, lakes, streams, rivers, tarns, perennial creeks (or permanent plunge pools within intermittent creeks), pools (such as a body of impounded water contained above a natural dam), andother forms of aquatic habitat. This habitat must:

(a) Be of sufficient depth not to freeze solid (to the bottom) during the winter (no less than 1.7 m (5.6 ft), but generally greater than 2.5 m (8.2 ft), and optimally 5 m (16.4 ft) or deeper (unless some other refuge from freezing is available)).

(b) Maintain a natural flow pattern, including periodic flooding, and have functional community dynamics in order to provide sufficient productivity and a prey base to support the growth and development of rearing tadpoles and metamorphs.

(c) Be free of fish and other introduced predators.

(d) Maintain water during the entire tadpole growth phase (a minimum of 2 years). During periods of drought, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but they may still be considered essential breeding habitat if they provide sufficient habitat in most years to foster recruitment within the reproductive lifespan of individual adult frogs.

(e) Contain:

(i) Bank and pool substrates consisting of varying percentages of soil or silt, sand, gravel, cobble, rock, and boulders;

(ii) Shallower lake microhabitat with solar exposure to warm lake areas and to foster primary productivity of the food web;

(iii) Open gravel banks and rocks projecting above or just beneath the surface of the water for adult sunning posts;

(iv) Aquatic refugia, including pools with bank overhangs, downfall logs or branches, or rocks to provide cover from predators; and

(v) Sufficient food resources to provide for tadpole growth and development.

(2) *Aquatic nonbreeding habitat (including overwintering habitat).* Thishabitat may contain the samecharacteristics as aquatic breeding andrearing habitat (often at the same locale),and may include lakes, ponds, tarns,streams, rivers, creeks, plunge poolswithin intermittent creeks, seeps, andsprings that may not hold water longenough for the species to complete itsaquatic life cycle. This habitat providesfor shelter, foraging, predator avoidance,and aquatic dispersal of juvenile andadult mountain yellow-legged frogs.Aquatic nonbreeding habitat contains:

(a) Bank and pool substrates consisting of varying percentages of soil or silt, sand, gravel, cobble, rock, and boulders;

(b) Open gravel banks and rocks projecting above or just beneath the surface of the water for adult sunning posts;

(c) Aquatic refugia, including pools with bank overhangs, downfall logs or branches, or rocks to provide cover from predators;

(d) Sufficient food resources to provide for tadpole growth and development;

(e) Overwintering refugee, where thermal properties of the microhabitat protect hibernating life stages from winter freezing, such as crevices or holes within granite, in and near shore; and/or

(f) Streams, stream reaches, or wet meadow habitats that can function as corridors for movement between aquatic habitats used as breeding or foraging sites.

(3) *Upland areas.*

(a) Upland areas adjacent to or surrounding breeding and nonbreeding aquatic habitat that provide area for feeding and movement by mountain yellow-legged frogs.

(i) For stream habitats, this area extends 25 m (82 ft) from the bank or shoreline.

(ii) In areas that contain riparian habitat and upland vegetation (for example, mixed conifer, ponderosa pine, montane hardwood conifer, and montane riparian woodlands), the canopy overstory should be sufficiently thin (generally not to exceed 85 percent) to allow sunlight to reach the aquatic habitat and thereby provide basking areas for the species.

(iii) For areas between proximate (within 300m (984 ft)) water bodies (typical of some high mountain lake habitats), the upland area extends from the bank or shoreline between such water bodies.

(iv) Within mesic habitats such as lake and meadow systems, the entire area of physically contiguous or proximate habitat is suitable for dispersal and foraging.

(b) Upland areas (catchments) adjacent to and surrounding both breeding and nonbreeding aquatic habitat that provide for the natural hydrologic regime (water quantity) of aquatic habitats. These upland areas should also allow for the maintenance of sufficient water quality to provide for the various life stages of the frog and its prey base.

Map of range/occurrences in recovery plan? Yes (2)

Population size (most current estimate): not available

Snout to vent length (in mm): 40-80 (4)

Body weight (in g):

Sixty lake basin, 1994: 18.5 (mean) (5)

Sixty lake basin, 1995: 14.7 (mean) (5)

Tableland, Far pond site, Aug 1995: 13.84 (mean) (5)

Tableland, Far pond site, Sep 1995: 16.70 (mean) (5)

Tableland, Full Moon pond site, Aug 1995: 13.78 (mean) (5)

Tableland, Full Moon pond site, Sep 1995: 17.38 (mean) (5)

Tableland, Frog lake site, Aug 1995: 14.19 (mean) (5)

Tableland, Frog lake site, Sep 1995: 17.34 (mean) (5)

6-41(estimated)

Dates of breeding period: begins immediately after snowmelt (2)

Federal lands or Indian reservations species is known to occur: national parks of Sierra Nevada and surrounding National Forest Service lands (2)

Diet: Adults: terrestrial and aquatic insects (1, 24519)

Adults: variety of invertebrates, beetles, ants, bees, wasps, flies, true bugs, dragonflies, tadpoles (4)

Tadpoles: detritus, algae, diatoms (1, 24519)

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults: T-HERPS, KABAM

Habitat: lakes, ponds, marshes, meadows, streams, shorelines (2)

Species are “highly aquatic”. If found on land, they are within 1 m of water (2).

Elevation restriction (in m): 1067-3660 (1)

Obligate relationships: none noted in USFWS or USGS documents. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Individuals have high fidelity to summer and overwintering sites (2).

Body weight is estimated from snout to vent length (SVL) for this species and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 3). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Name of data extractor (date): Lewis Ross Brown, May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2013 Designation of Critical Habitat for the Sierra Nevada Yellow-Legged Frog, the Northern Distinct Population Segment of the Mountain Yellow-Legged Frog, and the Yosemite Toad; Proposed Rule. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-04-25/pdf/2013-09598.pdf
2. USFWS 2014. Endangered Species Status for Sierra Nevada Yellow- Legged Frog and Northern Distinct Population Segment of the Mountain Yellow-Legged Frog, and Threatened Species Status for Yosemite Toad. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-04-29/pdf/2014-09488.pdf
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
4. USFWS. 2006. Federal Register, Vol. 71, no. 178. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Southern California distinct population segment of the mountain yellow-legged frog (*Rana mucosa*). Available online at: <http://ecos.fws.gov/docs/federal_register/fr5137.pdf>.
5. Fellers, Gary, Bradford, David, Pratt, David, and Wood, Leslie 2008, Experimental Repatriation of Mountain Yellow-legged Frogs (*Rana muscosa*) in the Sierra Nevada of California: U.S. Geological Survey Open-File Report 2008–1144, 58 p. *Available at http://pubs.usgs.gov/of/2008/1144/*

**Species (common name): *Rana muscosa* (Mountain yellow-legged frog)**

**Southern CA DPS**

Listed status: endangered (1, 4)

Designated critical habitat? yes (1)

Primary Constituent Elements: (1, p. 54351)

1. Water source(s) found between 1,214 to 7,546 feet (370 to 2,300 meter) in elevation that are permanent. Water sources include, but are not limited to, streams, rivers, perennial creeks (or permanent plunge pools within intermittent creeks), pools (*i.e.*, a body of impounded water that is contained above a natural dam) and other forms of aquatic habitat. The water source should maintain a natural flow pattern including periodic natural flooding. Aquatic habitats that are used by mountain yellow-legged frog for breeding purposes must maintain water during the entire tadpole growth phase, which can last for up to 2 years. During periods of drought, or less than average rainfall, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but they would still be considered essential breeding habitat in wetter years. Further, the aquatic includes: a. Bank and pool substrates consisting of varying percentages of soil or silt, sand, gravel cobble, rock, and boulders; b. Open gravel banks and rocks projecting above or just beneath the surface of the water for sunning posts; c. Aquatic refugia, including pools with bank overhangs, downfall logs or branches, and/or rocks to provide cover from predators; and d. Streams or stream reaches between known occupied sites that can function as corridors for movement between aquatic habitats used as breeding and/or foraging sites.

2. Riparian habitat and upland vegetation (*e.g.*, ponderosa pine, montane hardwood-conifer, montane riparian woodlands, and chaparral) extending 262 feet (80 meters) from each side of the centerline of each identified stream and its tributaries, that provides areas for feeding and movement of mountain yellow-legged frog, with a canopy overstory not exceeding 85 percent that allows sunlight to reach the stream and thereby provide basking areas for the species.

Map of range/occurrences in recovery plan? no

Population size (most current estimate): not located

Snout to vent length (in mm):

Sixty lake basin, 1994: 56.6 (mean) (2)

Sixty lake basin, 1995: 55.4 (mean) (2)

Tableland, Far pond site, Aug 1995: 54.5 (mean) (2)

Tableland, Far pond site, Sep 1995: 56.2 (mean) (2)

Tableland, Full Moon pond site, Aug 1995: 53.7 (mean) (2)

Tableland, Full Moon pond site, Sep 1995: 55.2 (mean) (2)

Tableland, Frog lake site, Aug 1995: 55.1 (mean) (2)

Tableland, Frog lake site, Sep 1995: 56.9 (mean) (2)

Body weight (in g):

Sixty lake basin, 1994: 18.5 (mean) (2)

Sixty lake basin, 1995: 14.7 (mean) (2)

Tableland, Far pond site, Aug 1995: 13.84 (mean) (2)

Tableland, Far pond site, Sep 1995: 16.70 (mean) (2)

Tableland, Full Moon pond site, Aug 1995: 13.78 (mean) (2)

Tableland, Full Moon pond site, Sep 1995: 17.38 (mean) (2)

Tableland, Frog lake site, Aug 1995: 14.19 (mean) (2)

Tableland, Frog lake site, Sep 1995: 17.34 (mean) (2)

1994: 16 (estimated using *Rana sp.* regressions from 3)

1995: 15 (estimated using *Rana sp.* regressions from 3)

Dates of breeding period: Eggs are laid at time of snowmelt (2)

Locations known to occur:

California (1)

Designated critical habitat for Southern CA distinct Population Segment is in San Bernardino, Riverside and Los Angeles Counties (1)

Federal lands or Indian reservations species is known to occur:

Agua Caliente Indian Reservation (Bureau of Indian Affairs) (5)

Morongo Indian Reservation (Bureau of Indian Affairs) (5)

Angeles National Forest (Forest Service) (5)

Inyo National Forest (Forest Service) (5)

Los Padres National Forest (Forest Service) (5)

San Bernardino National Forest (Forest Service) (5)

Sequoia National Forest (Forest Service) (5)

Sequoia National Monument – Sequoia National Forest (Forest Service) (5)

Public Domain Land (BLM) (5)
Golden Trout Wilderness – Inyo National Forest (Forest Service) (5)

San Gabriel Wilderness – Angeles National Forest (Forest Service) (5)

San Gorgonio Wilderness – San Bernardino National Forest (Forest Service) (5)

San Jacinto Wilderness – San Bernardino National Forest (Forest Service) (5)

Sespe Wilderness – Angeles National Forest (Forest Service) (5)

Sespe Wilderness – Los Padres National Forest (Forest Service) (5)

Sheep Mountain Wilderness – Angeles National Forest (Forest Service) (5)

Sequoia-Kings Canyon Wilderness – Kings Canyon National Park (NPS) (5)

Sequoia-Kings Canyon Wilderness – Sequoia National Park (NPS) (5)

Diet: Adults: variety of invertebrates, beetles, ants, bees, wasps, flies, true bugs, dragonflies, tadpoles (1)

No data on diet of tadpoles was located. Based on data for other *Rana sp.,* reviewer assumes that tadpoles of this species consume algae and periphyton.

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults: T-HERPS, KABAM

Habitat: mountain streams with cool water that originates from snowmelt and springs (1)

Most often found in creeks with permanent water (1)

Streams, rivers, perennial creeks, permanent plunge pools within intermittent creeks and pools, riparian and upland habitat (1)

Tadpoles metamorphose when they are two (during their third summer) (2)

Aquatic and terrestrial habitats

Elevation restriction (in m): 370-2300 (1)

Obligate relationships: none noted in USFWS or USGS documents (1 and 2). Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Distinct population segment in southern California is endangered (1)

All frogs occurring north of the Tehachapi Mountains (Butte, Pulmas, Tulare, Inyo counties and all those in between) are candidates for listing (4)

Diurnal (1)

Principally insectivorous (1)

Snout to vent length and body weight values are from frogs captured at Sixty Lake Basin in Kings Canyon National Park (2)

Body weight estimate for yellow legged frog that was calculated using source 3 is consistent with empirical data from source 2.

No recovery plan was located for this species.

Body weight is estimated from snout to vent length (SVL) for this species and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 3). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Name of data extractor (date): Kris Garber (1/30/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (02/01/12)

Sources:

1. USFWS. 2006. Federal Register, Vol. 71, no. 178. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Southern California distinct population segment of the mountain yellow-legged frog (*Rana mucosa*). Available online at: <http://ecos.fws.gov/docs/federal_register/fr5137.pdf>.
2. Fellers, Gary, Bradford, David, Pratt, David, and Wood, Leslie 2008, Experimental Repatriation of Mountain Yellow-legged Frogs (*Rana muscosa*) in the Sierra Nevada of California: U.S. Geological Survey Open-File Report 2008–1144, 58 p. *Available at http://pubs.usgs.gov/of/2008/1144/*
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
4. USFWS. 2011. Federal Register, Vol. 76, no. 207. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; review of native species that are candidates for listing as endangered or threatened; annual notice of findings on resubmitted petitions; annual description of progress on listing actions. Available online at: <http://www.gpo.gov/fdsys/pkg/FR-2011-10-26/pdf/2011-27122.pdf>
5. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Rana pretiosa* (Oregon spotted frog)**

Listed status: Threatened

Designated critical habitat? Yes

Primary Constituent Elements (1, Page 53544):

Primary constituent element 1—Nonbreeding (N), Breeding (B), Rearing (R), and Overwintering Habitat (O). Ephemeral or permanent bodies of fresh water, including, but not limited to natural or manmade ponds, springs, lakes, slow-moving streams, or pools within or oxbows adjacent to streams, canals, and ditches, that have one or more of the following characteristics:

• Inundated for a minimum of 4 months per year (B, R) (timing varies by elevation but may begin as early as February and last as long as September);

• Inundated from October through March (O);

• If ephemeral, areas are hydrologically connected by surface water flow to a permanent water body (e.g., pools, springs, ponds, lakes, streams, canals, or ditches) (B, R);

• Shallow water areas (less than or equal to 30 centimeters (12 inches), or water of this depth over vegetation in deeper water (B, R);

• Total surface area with less than 50 percent vegetative cover (N);

• Gradual topographic gradient (less than 3 percent slope) from shallow water toward deeper, permanent water (B, R);

• Herbaceous wetland vegetation (i.e., emergent, submergent, and floating leaved aquatic plants), or vegetation that can structurally mimic emergent wetland vegetation through manipulation (B, R);

• Shallow water areas with high solar exposure or low (short) canopy cover (B, R);

• An absence or low density of nonnative predators (B, R, N)

Primary constituent element 2—Aquatic movement corridors. Ephemeral or permanent bodies of fresh water that have one or more of the following characteristics:

• Less than or equal to 5 kilometers (3.1 miles) linear distance from breeding areas;

• Impediment free (including, but not limited to, hard barriers such as dams, biological barriers such as abundant predators, or lack of refugia from predators).

(3) Primary constituent element 3—Refugia habitat. Nonbreeding, breeding, rearing, or overwintering habitat or aquatic movement corridors with habitat characteristics (e.g., dense vegetation and/or an abundance of woody debris) that provide refugia from predators (e.g., nonnative fish or bullfrogs).

Map of range/occurrences in recovery plan? No

Population size (most current estimate) (2, Page 51665) 12,847 (breeding adults)

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Snout to vent length (in mm): 44 - 105 (2, Page 51658)

Body weight (in g): 8-89 (estimated)

Dates of breeding period: Feb-June (2, Page 51659)

Locations where species is known to occur: Siskiyou County, California (4)

Deschutes, Jackson, Josephine, Klamath, Lane, Wasco Counties, Oregon (4)

Benton, Chelan, Clark, Clolitz, Grays Harbor, Island, King, Kitsap, Kititas, Klickitat, Lewis, Mason, Okanogan, Pierce, San Juan, Skagit, Skamania, Snohomish, Thurston, Whatcom, Yakima Counties, Washington (4)

Federal lands or Indian reservations species is known to occur: Not available

Diet: Tadpoles: plants, bacteria, algae, detritus, carrion (1, Page 53541)

Adults: insects (aquatic and terrestrial), amphibians (2, p. 51660)

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults: T-HERPS, KABAM

Habitat: in or near perennial water (streams, springs, ponds, lakes, irrigation canals, roadside ditches) (1, p. 53541)

Eggs laid in shallow pools, shorelines and beaches of seasonal lakes and marshes, in wet meadows (2, p. 51660)

Aquatic and terrestrial

Elevation restriction (in m) Elevation restrictions vary by location. (2, Pages 51660-61)

Obligate relationships: none noted in USFWS or USGS documents (1 and 2). Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Body weight is estimated from snout to vent length (SVL) for this species and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 3). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Adults capture prey in or near water (1, Page 53541)

Insect prey includes leaf beetles (*Chrysomelidae*), ground beetles (*Carabidae*), spiders (*Arachnida*), rove beetles (*Staphylinidae*), syrphid flies (*Syrphidae*), long-legged flies (*Dolichopodidae*), ants (*Formicidae*), water striders (*Gerridae*), spittlebugs (*Cercopidae*), leaf hoppers (*Cicadellidae*), aphids (*Aphididae*), dragonflies and damsel flies (*Odonates*), and yellow jackets (*Vespidae*) (2, p. 51660)

Amphibian prey includes adult Pacific tree frogs (*Pseudacris regilla*), small red-legged frogs, and newly metamorphosed redlegged frogs and western toad (*Anaxyrus* *boreas*) juveniles (2, p. 51660)

Name of data extractor (date): Lewis Ross Brown, May 29, 2015

QC reviewer (date): Kris Garber (7/30/15)

Sources:

1. USFWS 2013 Designation of Critical Habitat for the Oregon Spotted Frog; Proposed Rule. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-08-29/pdf/2013-20985.pdf
2. USFWS 2014 Threatened Status for Oregon Spotted Frog; Final Rule. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-08-29/pdf/2014-20059.pdf
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
4. Species profile. Available online at: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=D02A

**Species (common name): *Rana sevosa* (Mississippi gopher frog or dusky gopher frog)**

Listed status: endangered (1)

Designated critical habitat? proposed (1)

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? no

Population size (most current estimate): none listed in 1 or 2

Snout to vent length (in mm):

Males 63.2-70.2 (2)

Females 78.0-82.7 (2)

Body weight (in g):

Males: 21-28 (estimated using *Rana sp.* regressions from 3)

Females: 38-45 (estimated using *Rana sp.* regressions from 3)

Dates of breeding period: Starts as early as January (1)

Locations known to occur: Mississippi (1)

Jackson and Harrison counties (1)

Federal lands or Indian reservations species is known to occur:

DeSoto National Forest (Forest Service) (4)

Bogue Chitto National Wildlife Refuge (FWS) (4)

Diet:

Tadpoles: periphyton (algae, bacteria protozoans) (1)

Juveniles and adults are carnivorous (1)

Probably similar to other gopher frogs (*i.e.,* diet probably includes frogs, toads, beetles, hemipterans, grasshoppers, spiders, roaches, earthworms) (1)

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults: T-HERPS, earthworm fugacity

Habitat: upland sandy habitats (forest dominated by longleaf pine (*Pinus palustris*)), wetlands (ephemeral ponds) embedded within the forest (1)

Adults and subadults spend the majority of their lives underground (in gopher tortoise (*Gopherus polyphemus*) and mammal burrows and holes under old stumps) (1)

Aquatic and terrestrial

Elevation restriction (in m): none listed in 1 or 2

Obligate relationships: none noted in USFWS documents (1 and 2). Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments: no recovery plan is available for this species

After this species was listed as *Rana capito sevosa*, it was reclassified by herpetologists as a separate species (*R. sevosa*; commonly referred to as the dusky gopher frog) (1)

*Rana capito*, which is also called the dusky gopher frog, is not listed as endangered or threatened (1)

Historically known to occur in Alabama, Florida and Louisiana (1)

Proposed critical habitat includes sites located in Louisiana (St. Tammany Parish) and Mississippi (Harrison, Jackson, Forrest and Perry Counties) (1)

Body weight is estimated from snout to vent length (SVL) for this species and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 3). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-43.31)

Name of data extractor (date): Kris Garber (1/26/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (02/01/12)

Sources:

1. USFWS. 2011. Federal Register, Vol. 76, no. 187. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Mississippi Gopher Frog (revised proposed rule). Available online at: <http://www.gpo.gov/fdsys/pkg/FR-2011-09-27/pdf/2011-24046.pdf>.
2. USFWS. 2001. Federal Register, Vol. 66, no. 233. 50 CFR Part 17. Endangered and Threatened Wildlife and Plants; final rule to list the Mississippi gopher frog distinct population segment of dusky gopher frog as endangered. Available online at: http://www.fws.gov/policy/library/2001/01fr62993.pdf.
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.
4. FESTF. 2012. Coincidence of ESA-listed species with federal lands and proximity to outer boundary. FIFRA Endangered Species Task Force. Data submitted to EPA March 2012.

**Species (common name): *Rana sierra* (Sierra Nevada Yellow-legged Frog)**

Listed status: Endangered

Designated critical habitat? Yes

Primary Constituent Elements: (1, p. 24521)

(1) *Aquatic habitat for breeding and rearing.* Habitat that consists ofpermanent water bodies, or those thatare either hydrologically connected with, or close to, permanent waterbodies, including, but not limited to, lakes, streams, rivers, tarns, perennial creeks (or permanent plunge pools within intermittent creeks), pools (such as a body of impounded water contained above a natural dam), andother forms of aquatic habitat. This habitat must:

(a) Be of sufficient depth not to freeze solid (to the bottom) during the winter (no less than 1.7 m (5.6 ft), but generally greater than 2.5 m (8.2 ft), and optimally 5 m (16.4 ft) or deeper (unless some other refuge from freezing is available)).

(b) Maintain a natural flow pattern, including periodic flooding, and have functional community dynamics in order to provide sufficient productivity and a prey base to support the growth and development of rearing tadpoles and metamorphs.

(c) Be free of fish and other introduced predators.

(d) Maintain water during the entire tadpole growth phase (a minimum of 2 years). During periods of drought, these breeding sites may not hold water long enough for individuals to complete metamorphosis, but they may still be considered essential breeding habitat if they provide sufficient habitat in most years to foster recruitment within the reproductive lifespan of individual adult frogs.

(e) Contain:

(i) Bank and pool substrates consisting of varying percentages of soil or silt, sand, gravel, cobble, rock, and boulders;

(ii) Shallower lake microhabitat with solar exposure to warm lake areas and to foster primary productivity of the food web;

(iii) Open gravel banks and rocks projecting above or just beneath the surface of the water for adult sunning posts;

(iv) Aquatic refugia, including pools with bank overhangs, downfall logs or branches, or rocks to provide cover from predators; and

(v) Sufficient food resources to provide for tadpole growth and development.

(2) *Aquatic nonbreeding habitat (including overwintering habitat).* Thishabitat may contain the samecharacteristics as aquatic breeding andrearing habitat (often at the same locale),and may include lakes, ponds, tarns,streams, rivers, creeks, plunge poolswithin intermittent creeks, seeps, andsprings that may not hold water longenough for the species to complete itsaquatic life cycle. This habitat providesfor shelter, foraging, predator avoidance,and aquatic dispersal of juvenile andadult mountain yellow-legged frogs.Aquatic nonbreeding habitat contains:

(a) Bank and pool substrates consisting of varying percentages of soil or silt, sand, gravel, cobble, rock, and boulders;

(b) Open gravel banks and rocks projecting above or just beneath the surface of the water for adult sunning posts;

(c) Aquatic refugia, including pools with bank overhangs, downfall logs or branches, or rocks to provide cover from predators;

(d) Sufficient food resources to provide for tadpole growth and development;

(e) Overwintering refugee, where thermal properties of the microhabitat protect hibernating life stages from winter freezing, such as crevices or holes within granite, in and near shore; and/or

(f) Streams, stream reaches, or wet meadow habitats that can function as corridors for movement between aquatic habitats used as breeding or foraging sites.

(3) *Upland areas.*

(a) Upland areas adjacent to or surrounding breeding and nonbreeding aquatic habitat that provide area for feeding and movement by mountain yellow-legged frogs.

(i) For stream habitats, this area extends 25 m (82 ft) from the bank or shoreline.

(ii) In areas that contain riparian habitat and upland vegetation (for example, mixed conifer, ponderosa pine, montane hardwood conifer, and montane riparian woodlands), the canopy overstory should be sufficiently thin (generally not to exceed 85 percent) to allow sunlight to reach the aquatic habitat and thereby provide basking areas for the species.

(iii) For areas between proximate (within 300m (984 ft)) water bodies (typical of some high mountain lake habitats), the upland area extends from the bank or shoreline between such water bodies.

(iv) Within mesic habitats such as lake and meadow systems, the entire area of physically contiguous or proximate habitat is suitable for dispersal and foraging.

(b) Upland areas (catchments) adjacent to and surrounding both breeding and nonbreeding aquatic habitat that provide for the natural hydrologic regime (water quantity) of aquatic habitats. These upland areas should also allow for the maintenance of sufficient water quality to provide for the various life stages of the frog and its prey base.

Map of range/occurrences in recovery plan? Yes (2)

Population size (most current estimate): not available

Snout to vent length (in mm): 40-80 mm (2, Page 24258)

Body weight (in g): 6-41 (estimated)

Dates of breeding period: begins immediately after snowmelt (2)

Federal lands or Indian reservations species is known to occur: not available

Diet: Adults: terrestrial and aquatic insects (1, 24519)

Tadpoles: detritus, algae, diatoms

Relevant EFED model(s):

Tadpoles: PRZM5/VVWM

Adults, T-HERPS, KABAM

Habitat: lakes, ponds, marshes, meadows, streams, shorelines (2)

Aquatic and terrestrial

Elevation restriction (in m): 1067-3660 (2)

Obligate relationships: none noted in USFWS documents. Reviewer believes that there is no obvious obligate relationships related to diet (species is opportunistic) or habitat.

Comments:

Body weight is estimated from snout to vent length (SVL) for this species and regressions of body weight and SVL data for two species in the *Rana* genus (*i.e.,* *R. clamitans* and *R. sphenocephala*). The equations are below (from 3). Once the weight is estimated using these two equations, the average value is taken.

*R. clamitans:* BW = 10^(LogSVL\*3.04-4.14)

*R. sphenocephala* BW = 10^(LogSVL\*2.57-3.31)

Name of data extractor (date): Lewis Ross Brown, III May 29, 2015

QC reviewer (date): Kris Garber (7/20/15)

Sources:

1. USFWS 2013 Designation of Critical Habitat for the Sierra Nevada Yellow-Legged Frog, the Northern Distinct Population Segment of the Mountain Yellow-Legged Frog, and the Yosemite Toad; Proposed Rule. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2013-04-25/pdf/2013-09598.pdf
2. USFWS 2014. Endangered Species Status for Sierra Nevada Yellow- Legged Frog and Northern Distinct Population Segment of the Mountain Yellow-Legged Frog, and Threatened Species Status for Yosemite Toad. Available online at: http://www.gpo.gov/fdsys/pkg/FR-2014-04-29/pdf/2014-09488.pdf
3. Deichmann, J.L.; Duellman, W.E.; and G.B. Williamson. 2008. Predicting biomass from snout-vent length in new world frogs. Journal of Herpetology, 42(2): 238-245.

**Species (common name): *Typhlomolge rathbuni* (Texas blind salamander)**

Listed status: endangered (1)

Designated critical habitat? no (1)

Primary Constituent Elements: not applicable

Map of range/occurrences in recovery plan? yes (1)

Population size (most current estimate): none reported in recovery plan (1)

Snout to vent length (in mm): 60 mm (estimated using relationship between total length and SVL of San Marcos salamander, see comment below)

Body weight (in g): 0.55 (estimated using ratio of SVL to weight for San Marcos salamander; 2)

Dates of breeding period: year-round (1)

Locations known to occur:

Edwards Aquifer in Texas (1)

Hays County, TX, near San Marcos (1)

Federal lands or Indian reservations species is known to occur: None (3)

Diet: small aquatic organisms, including copepods, amphipods, shrimp, daphnia and snails (1)

Cannibalism has been documented (1)

Relevant EFED model(s): PRZM5/VVWM

Habitat: aquatic, subterranean (caves) (1)

Elevation restriction: underground (1)

Obligate relationships: none noted in USFWS documents (1). Reviewer believes that there is no obvious obligate relationships with other organisms related to diet (species is opportunistic) or habitat.

It should be noted, that this species does require caves for survival (1).

Comments:

Water temperature is 21oC (constant; 1)

Since this species is aquatic, T-HERPS is not used to estimate dietary exposures; therefore, body weight is not a necessary parameter for this species.

Maximum reported total length is 120 mm (1). The San Marcos salamander (*Eurycea nana*) has a SVL that is approximately 50% of its total body length (1). If it is assumed that the relationship between SVL and total length of the Texas blind salamander, is comparable to that of E. nana (the two species are closely related), then the SVL of the Texas blind salamander would be 60 mm.

Body weight is estimated using the ratio of mean adult SVL to body weight for the San Marcos salamander (110; source 2).

The total distribution may only be 10 sq. km (1)

Name of data extractor (date): Kris Garber (2/22/12, revised 8/14/15)

QC reviewer (date): Melissa Panger (12/24/12)

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