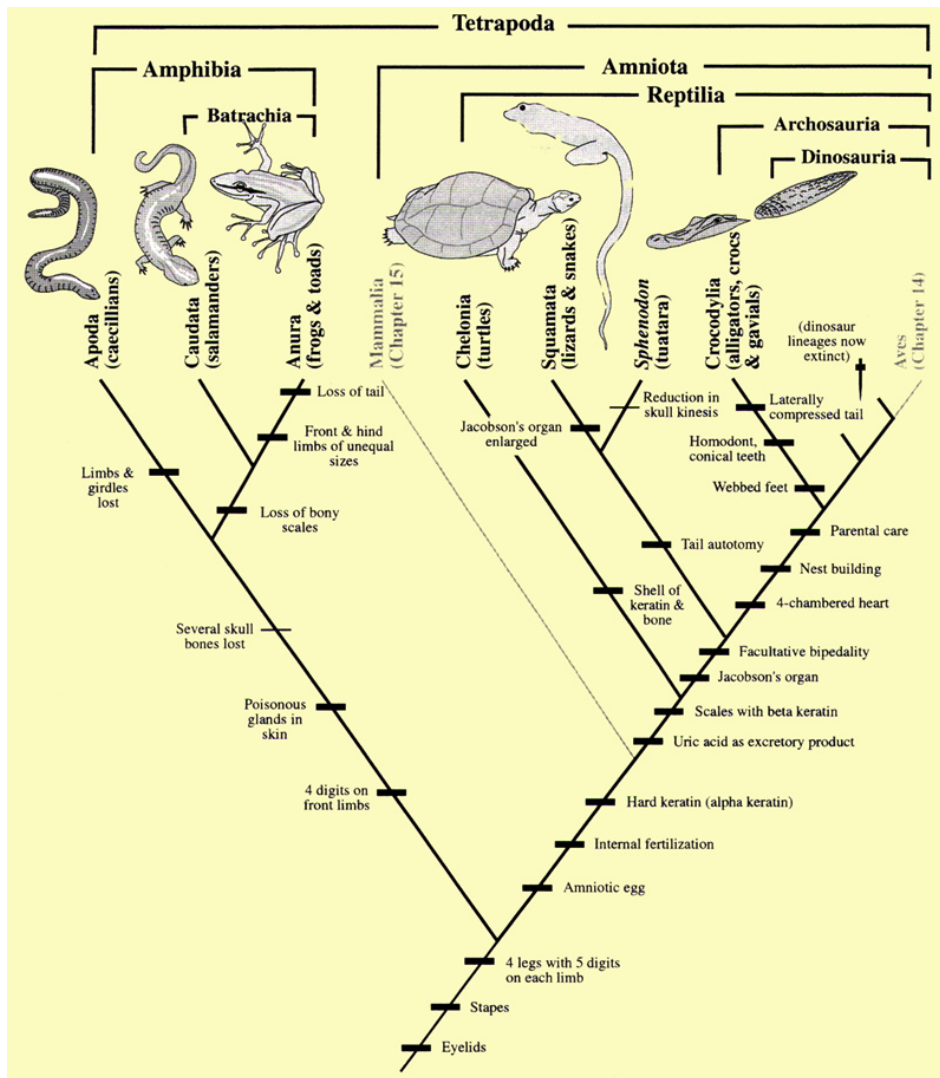


Reptiles and Amphibians

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Reptiles and amphibians are composed of a diverse set of tetrapod lineages whose common ancestor dates back to 360 million years ago. The ancestor to the Tetrapoda evolved adaptations to life on land, including four limbs, eyelids, ears, and a more developed respiratory system for breathing air. These early ancestors gave rise to two major lineages: Modern Amphibians and the Amniotes, who are noted for their terrestrial egg. The Modern Amphibians are composed of three major groups: salamanders, frogs, and caecilians. The Amniotes are composed of two major groups: mammals and reptiles. Reptilia is currently recognized as a group consisting of the traditional "reptiles" and the birds. The traditional "reptile" groups include turtles, lizards, snakes, and crocodiles. Many biologist now refer to Reptilia as being either 'avian' or 'non-avian'. The science of Herpetology studies both the Modern Amphibians and the non-avian Reptilia.



Laboratory Manual for Animal Diversity: An Evolutionary Approach (4th edition).
 Adapted by Annalisa Berta. Originally written by Simpson, Gergus, McMillan. San Diego State University, 2002.

Modern Amphibians

The frogs (Anura), salamanders (Caudata), and caecilians (Apoda) compose the Modern Amphibians. In San Diego County, there are five species of salamanders and eight species of frogs native to the region. In addition, there are two introduced species of frogs, the American Bullfrog and African Clawed Frog, which are responsible for a considerable amount of ecological damage. Caecilians are not found in this region because they prefer tropical habitats. The overall amphibian diversity in the region is considered low due to the drier climate and hotter temperatures.

Most amphibians have a dual life, generalized as an aquatic larval stage and a terrestrial adult stage. Amphibians are ectothermic (rely on environmental heat) and lack many adaptations for life away from water. However, some do surprisingly well despite San Diego's arid climate. Most amphibians have functional lungs, but many breathe through their skin as well. The skin has evolved poisonous glands, presumably to defend against predators. Amphibians in this region are seasonally active in the wintertime, corresponding to the greater amount of precipitation and cooler temperatures. They are also nocturnal to avoid the heat of the day. Amphibians are most active in the evening during, or immediately after, a rain shower.

Salamanders

The generalized body-form of salamanders gives them a lizard-like appearance. In San Diego County, there are two families with remarkably different ways of life. The California Newt has a generalized amphibian life history. They lay eggs underwater, aquatic larval hatch, and metamorphosis transforms the larvae into terrestrial adults. The California Newt relies on standing bodies of water to reproduce and are known to return to pools from which they were hatched. These newts are also extremely toxic which makes them less susceptible to predation. The Lungless Salamanders have a different strategy. These salamanders are adapted to a terrestrial existence, despite the complete absence of lungs. Lungless Salamanders breathe entirely through their skin, so they must rely on moist habitats. They are only active during the wet season. Larvae of these salamanders have direct development. Eggs are laid in moist areas, usually underneath rocks or logs. The larvae remain in the egg where they develop and undergo metamorphosis. The young hatch as miniature adults.



California Newt (*Taricha torosa*) from Boulder Creek, San Diego County.

Frogs

Frogs and toads are tail-less amphibians that are noted for their ability to jump and their ability to vocalize. Toads belong to a family of frogs adapted to a terrestrial life. Toads have shorter hindlimbs, burrow in loose soils, and have a glandular 'warty' skin that produces potent toxins to deter predation. In comparison, the other species of frogs in San Diego County have a more typical body plan with longer legs, an aquatic lifestyle, and smoother skin.



Arroyo Toad (*Bufo californicus*)



Pacific Treefrog (*Pseudacris regilla*)

Frogs can be noisy animals. Males will call to attract females and to signal rival males about territorial boundaries. Calling is also used to establish social status. Calls consist of simple *rib-its* to lengthly *trills*. During the springtime breeding season, females will choose a suitable male and enter his territory. The male will mount the female, grasping her behind the forelimbs in a behavior called *amplexus*. When the female lays her eggs, the male will fertilize them externally. Eggs hatch into tadpoles (frog larvae) and transform through metamorphosis into tail-less adults.

Frogs are considered an indicator species, helpful in determining the health of the environment. In San Diego County, both the Red-legged Frog and Mountain Yellow-legged Frog, are extinct. In addition, the Arroyo Toad is federally listed as an endangered species. With three of the eight native species extinct or endangered, the overall health of frog diversity in the region is declining.

Reptilia

Non-avian Reptilia include turtles, squamates (lizards and snakes), and crocodiles. In San Diego County, there is one native species of freshwater turtle, a large diversity of lizards and snakes, and no crocodiles. There are a number of introduced freshwater turtles that displace native species and contribute to a decline in the health of the environment. There are also various reports of lizards being introduced, however none have become naturalized. In total, there are six native species of turtles, 30 lizards, and 25 snakes. The overall reptile diversity is considered high due to the warmer climate and diverse landscape.

The high reptile diversity in the region gives us an opportunity to examine a greater range of morphologies and life histories. All non-avian reptiles have a keratinized integument and reproduce through internal fertilization. Three general types of turtles occur in San Diego County: freshwater, marine, and terrestrial. There are both limbed and limbless lizards, some with or without eyelids. Some lizards are insectivorous, others herbivorous, some diurnal, others nocturnal. Among snakes, there are predatory specialists who eat arthropods, lizards, or mammals, either using ram-feeding, constriction, or a lethal dose of venom. Some snakes lay eggs, while others have live birth. Reptiles in San Diego County have a wide array of survival strategies with interesting morphological and behavioral adaptations.

Turtles

Turtles are most noted for their hard, protective shell. Turtles first appear in the fossil record approximately 200 million years ago. Little has changed since and their morphology is considered conserved. As a result, turtles have never been diverse and currently there are only 330 species worldwide.

In San Diego County, there are records of four species of seaturtles, of which, only the Green Seaturtle is a resident. The Desert Tortoise has been reported from the extreme northeast corner of the county in Anza Borrego Desert, although it is now likely extinct. And, of the many freshwater turtles that inhabit streams, rivers, ponds, and reservoirs, only the Pacific Pond Turtle is native.



Pacific Pond Turtle (*Clemmys marmorata*) from Boulder Creek, San Diego County.

Lizards

Lizards have a generalized body plan with four legs and a tail. In San Diego County, lizards represent the most diverse reptile group. There are a variety of species including iguanas, geckos, skinks, legless lizards, and whiptails. Lizards have a scaly integument and a number of survival strategies. Most lizards have the ability to detach their tail to misdirect a predator's interest. Many use caudal luring to attract predators to the tail. Tails are either brightly colored or waved above the body in an undulating motion. If the tail is lost during an attack, it will eventually regrow.



A juvenile Western Skink (*Eumeces skiltonianus*) with a bright blue tail.

Lizards communicate using visual, olfactory, and behavioral cues. Elaborate displays of push-ups, tail-wagging, body-arching, and head-bobs are usually performed by the males. Many have brightly colored belly and throat patches on their undersides, but remain camouflaged above. Some exude chemicals from pores located along the underside of the legs and near the cloacal vent. These cues mark territories, signal rivals, establish social status, and attract mates.

Lizards can be categorized into two major groups based on their generalized foraging behaviors. 'Wait and watch' predators rely on eyesight to eat. For example, the Western Fence Lizard will perch on a territorial rock or log until an insect is seen. In comparison, 'seek and search' predators rely on smell to eat. As an example, the Orange-throated Whiptail actively forages on the ground, probing under leaf-litter with its nose to uncover grubs and arthropods. Lizards eat a wide variety of food items, but most are insectivorous. Two species, the Desert Iguana and Chuckwalla, are herbivorous and favor flower petals and leafy annuals.



Western Fence Lizard (*Sceloporus occidentalis*) perched on log showing camouflaged color pattern.



Western Fence Lizard (*Sceloporus occidentalis*) showing display colors below.

Lizards in San Diego County all reproduce by laying eggs. Internal fertilization is achieved with the use of one of the two hemipenes that evert from the cloacal vent.

Snakes

All snakes are predatory. They lack fully formed legs, external ear openings, and eyelids. Snakes evolved from large, carnivorous, 'seek and search' lizards and represent a highly specialized lineage of squamate reptiles. In San Diego County, there are a wide array of snake species with diverse morphologies and behaviors.

Most snakes are nocturnal, but some, like the Gartersnakes, are active during the daytime. Generalized feeders, like the Gophersnakes, eat a wide diversity of animal prey, but prefer small to medium-sized mammals. Other snakes are specialized feeders, eating specific prey items from ants to other snakes. Snakes subdue their prey by active foraging or ambush hunting. Active foragers usually swallow their prey once grasped, while ambush hunters use either constriction or venom to immobilize food items.

There are no sexual differences in color pattern between males and females in snakes, likely because snakes are color blind. Snakes communicate mainly through smell, but rattlesnakes have highly ritualized combat and courtship behaviors. Reproduction is similar to that describe for lizards with the use of the hemipenis that everts from the cloacal vent. Gartersnakes, boas, and rattlesnakes retain their eggs and give birth to live, fully-formed babies. Other snakes lay eggs in burrows and leave them to hatch on their own.



Gophersnake (*Pituophis catenifer*)



Baja California Coachwhip (*Masticophis f. fuliginosus*)

Living With Snakes

An article reprinted from *Field Notes*

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The winter storm cycle has officially come to an end. The temperature is once again warming. And judging by the number of people swarming to the beach and parks, the spring season is in full swing. With each warming day, I receive more and more reports about snakes. The warmer weather brings snakes out. They begin living their lives again. After all, this is the time of year when all of God's creations are the most active.

The majority of snake sightings come from residents living near urban canyons or those in newly constructed developments. Other reports come from interested naturalists and hikers who spot snakes crossing the trails or speeding through the grass. San Diegans have a healthy appetite for knowledge, so along with the reports come a host of questions.

This intrigue about nature is a human quality often overlooked. In the course of our daily lives, many San Diegans tune out the wilderness that surround them. Unfortunately, in many places, we have simply sterilized the wilderness by replacing it with manicured lawns and tree lined roads. In our daily lives, little remains to remind us about nature's arousals. Yet, even when we pass a coastal marsh or see a hawk flying overhead, our fascination about nature is often not provoked. These scenes blend into our daily consciousness and go unnoticed.

A snake sunning itself on the pool deck is a completely different matter. Intrigue rushes back in. It is something to tell your friends about and it is first subject discussed at the dinner table. Snakes have the ability to awaken us from our daily routine and stimulate our interest about nature. They are particularly good at eliciting a response.

Most San Diegans simply want help identifying which species of snake was seen crawling through their woodpile. Others are more concerned. San Diego County is home to 25 different species of snakes. Four of these are rattlesnakes. Two species of rattlesnakes are not commonly seen by San Diegans. The Sidewinder (*Crotalus cerastes*) is restricted to our deserts and the Speckled Rattlesnake (*C. mitchellii*) is more secretive, preferring rocky terrain.



Sidewinder (*Crotalus cerastes*).



Speckled Rattlesnake (*Crotalus mitchellii*)



Red Diamond Rattlesnake (*Crotalus ruber*).



Western Rattlesnake (*Crotalus viridis*).

Most encounters involve the Red Diamond (*Crotalus ruber*) and Western Rattlesnakes (*C. viridis*). Both are large-bodied, terrestrial snakes that prefer the same habitat prized by housing developers. As a result, homes are built in areas already occupied by these snakes. During times of construction, the snake populations are either destroyed by bulldozers and earthmovers or pushed into the adjacent wild lands. Once the construction stops, families living along the margins of the development often have the highest occurrence of snake encounters.

These families will call or email me at the San Diego Natural History Museum seeking professional advice. Luckily, most San Diegans already have a high regard for their native wildlife, so convincing them not to kill these animals is generally unnecessary. Despite, the vast majority is looking for ways to prevent snake encounters from occurring in the first place.

I personally feel these people are lucky to still see snakes. Many snakes have been neglected by conservation-minded biologist and are in direr trouble of extinction. This includes a number of species here in San Diego County. However, the negative image the general public holds for snakes makes them less of a priority. I also know there are a few people who wouldn't mind having snakes disappear altogether.

Yet, throughout the world, many cultures revere snakes. They are a highly successful group of predators. They are a product of natural selection and have diversified greatly. Snakes are specialists at hunting specific types of prey. Rattlesnakes are at the pinnacle of specialization. They have accumulated a host of features during their evolution and are considered supreme hunters. They have heat-seeking pits, the ability to taste scents in the air, fangs that fold when the mouth closes, and a venom capable of killing their prey within a matter of minutes.

When speaking to a concerned parent of a toddler, my reverence for such highly evolved predators often falls on deaf ears. These families are usually dog owners as well, so an additional amount of concern is displayed for their pets. Practical advice is the only kind of guidance they are willing to hear. And I can hardly blame them. Keeping your home free of dangers should be a high priority.

But the biologist in me wants to tell them that the vast majority of rattlesnake bites occur when someone tries to pick them up. On top of this, a rattlesnake will vigorously buzz its rattle as a warning signal. It is simply trying to give fair warning that it will use its dangerous bite in defense. In the end, I relent to the parent's concerns and begin the list of do's and don'ts.

I offer suggestions to keep snakes from entering the yard. Clear woodpiles and areas where rodents live. Possibly erect a wall around the perimeter of the property or a two to three foot high mesh fence which is partly buried into the ground. This is especially good advice for homes bordering native habitats. While even the best-planned fortresses can be entered, walls and fences will dramatically reduce the ability of rattlesnakes from coming into the yard. Other harmless snakes may not be deterred because of their propensity for climbing.

If a rattlesnake does enter the property, don't attempt to pick it up using your hand. Either call Animal Control, or if you feel competent, use a leaf rake or broom to push it into a large trashcan laid on its side. Use the handle of the rake or broom to lift the can upright. At all times, keep a four to five foot distance from the snake. It is essential that the snake is relocated to the nearest native habitat and given the opportunity to find a secure hiding place. It is believed that predation is extremely high for relocated snakes.

Educate young children that snakes should not be picked up. Have them immediately tell an adult if a snake is seen, thus forcing them to leave the snake behind while they seek out someone to tell. Children lingering near a snake may be tempted to touch it. Teaching curious or aggressive dogs is more problematic. The use of a non-venomous snake may be helpful; however, convincing the neighbor to let you use her pet python is likely an insurmountable task.

Snakes have long been associated with negative stereotypes. Even worse, the reports of rattlesnake bites in the media often portray these as aggressive attacks. In reality, snakes are secretive animals that shy away from all potential predators. This includes people. Humans have persecuted snakes for the last two millennia for either cultural, religious, economic, or personal reasons. Conservationists will view our encroachment into their natural habitats as the most destructive of these persecutions. The vast majority of rattlesnake bites happen when people invade the snake's personal space, whether intentionally or unintentionally.

All snakes are beneficial to people in one way or another. For some, this is a hard argument to swallow. They believe snakes are not worth the trouble altogether. But, snakes are integral members of our various ecosystems. Many species help control rodent populations. This is not a made-up story from some overzealous naturalists; snakes are one of the primary predators to rodents. Without them, rodent populations would swell to carrying capacity and throw the ecological balance from equilibrium.

Living with snakes will be a challenge for many of us. Taking safe, precautionary measures to make our homes safe for children and pets will reduce unwanted encounters. Educating our children and ourselves will reduce dangerous confrontations. It will also reduce the negative stereotypes that promote their extermination. These forbidding animals have the ability to allure us. They elicit a sense of mystery about the natural world that surrounds us. We all need awakening. Without the more ominous creatures, I'm afraid we will slumber in our sanitized lives.

Checklist

Reptiles of San Diego County

Introduced species are marked with an asterisk (*).

Underlined species have a fieldguide page on the website.

TURTLES AND TORTOISES (CHELONIA)

Seaturtles: Family Cheloniidae

Loggerhead Seaturtle	<i>Caretta caretta</i>
Green Seaturtle	<i>Chelonia mydas</i>
Olive Ridley Seaturtle	<i>Lepidochelys olivacea</i>

Snapping, Musk, and Mud Turtles: Family Chelydridae

Snapping Turtle	<i>Chelydra serpentina*</i>
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Leatherback Seaturtles: Family Dermochelyidae

Leatherback Seaturtle	<i>Dermochelys coriacea</i>
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Water and Box Turtles: Family Emydidae

<u>Pacific Pond Turtle</u>	<i>Clemmys marmorata</i>
Pond Slider	<i>Trachemys scripta*</i>

Land Tortoises: Family Testudinidae

Desert Tortoise	<i>Gopherus agassizii</i>
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Softshell Turtles: Family Trionychidae

Spiny Softshell	<i>Apalone spinifera*</i>
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SQUAMATE REPTILES (SQUAMATA)

LIZARDS (LACERTILIA)

Anguid Lizards: Family Anguidae

California Legless Lizard	<i>Anniella pulchra</i>
<u>Southern Alligator Lizard</u>	<i>Elgaria multicarinata</i>

Crotaphytid Lizards: Family Crotaphytidae

Baja California Collared Lizard *Crotaphytus vestigium*

Cope's Leopard Lizard *Gambelia copei*

Long-nosed Leopard Lizard *Gambelia wislizenii*

Eyelid Geckos: Family Eublepharidae

Switak's Banded Gecko *Coleonyx switaki*

Western Banded Gecko *Coleonyx variegatus*

Geckos: Family Gekkonidae

Peninsular Leaf-toed Gecko *Phyllodactylus xanti*

Iguanid Lizards: Family Iguanidae

Desert Iguana *Dipsosaurus dorsalis*

Common Chuckwalla *Sauromalus ater*

Phrynosomatid Lizards: Family Phrynosomatidae

Zebra-tailed Lizard *Callisaurus draconoides*

Banded Rock Lizard *Petrosaurus mearnsi*

Coast Horned Lizard *Phrynosoma coronatum*

Flat-tailed Horned Lizard *Phrynosoma mcallii*

Desert Horned Lizard *Phrynosoma platyrhinos*

Desert Spiny Lizard *Sceloporus magister*

Western Fence Lizard *Sceloporus occidentalis*

Granite Spiny Lizard *Sceloporus orcutti*

Southern Sagebrush Lizard *Sceloporus vandenburgianus*

Sonoran Desert Fringe-toed Lizard *Uma notata*

Long-tailed Brush Lizard *Urosaurus graciosus*

Black-tailed Brush Lizard *Urosaurus nigricaudus* (= *U. microscutatus*)

Common Side-blotched Lizard *Uta stansburiana*

Skinks: Family Scincidae

Gilbert's Skink *Eumeces gilberti*

Western Skink *Eumeces skiltonianus*

Teiid Lizards: Family Teiidae

Orange-throated Whiptail *Cnemidophorus hyperythrus*

Tiger Whiptail *Cnemidophorus tigris*

Night Lizards: Family Xantusiidae

Granite Night Lizard *Xantusia henshawi*

Sandstone Night Lizard *Xantusia henshawi gracilis*

Desert Night Lizard *Xantusia vigilis*

SNAKES: SUBORDER SERPENTES

Boas: Family Boidae

Rosy Boa *Lichanura trivirgata*

Colubrid Snakes: Family Colubridae

Glossy Snake *Arizona elegans*

Baja California Ratsnake *Bogertophis rosaliae*

Western Shovel-nosed Snake *Chionactis occipitalis*

Eastern Racer *Coluber constrictor*

Ring-necked Snake *Diadophis punctatus*

Nightsnake *Hypsiglena torquata*

Common Kingsnake *Lampropeltis getula*

California Mountain Kingsnake *Lampropeltis zonata*

Coachwhip *Masticophis flagellum*

Baja California Coachwhip *Masticophis flagellum fuliginosus*

Striped Racer *Masticophis lateralis*

Spotted Leaf-nosed Snake *Phyllorhynchus decurtatus*

Gophersnake *Pituophis catenifer*

Long-nosed Snake *Rhinocheilus lecontei*

Western Patch-nosed Snake *Salvadora hexalepis*

Western Black-headed Snake *Tantilla planiceps*

Two-striped Gartersnake *Thamnophis hammondi*

Common Gartersnake *Thamnophis sirtalis*

Western Lyresnake *Trimorphodon biscutatus*

Threadsnakes: Family Leptotyphlopidae

Western Threadsnake *Leptotyphlops humilis*

Vipers and Pit Vipers: Family Viperidae

Sidewinder *Crotalus cerastes*

Red Diamond Rattlesnake *Crotalus exsul* (= *Crotalus ruber*)

Speckled Rattlesnake *Crotalus mitchellii*

Western Rattlesnake *Crotalus viridis*



Checklist

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SALAMANDERS: (CAUDATA)

Lungless Salamanders: Family Plethodontidae

<u>Arboreal Salamander</u>	<i>Aneides lugubris</i>
<u>Garden Slender Salamander</u>	<i>Batrachoseps major</i>
<u>Monterey Ensatina</u>	<i>Ensatina eschscholtzii eschscholtzii</i>
<u>Large-blotched Ensatina</u>	<i>Ensatina eschscholtzii klauberi</i>

Newts: Family Salamandridae

<u>California Newt</u>	<i>Taricha torosa</i>
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FROGS AND TOADS: (ANURA)

True Toads: Family Bufonidae

Western Toad	<i>Bufo boreas</i>
<u>Arroyo Toad</u>	<i>Bufo californicus</i>
Red-spotted Toad	<i>Bufo punctatus</i>

Tree Frogs: Family Hylidae

<u>California Treefrog</u>	<i>Pseudacris cadaverina</i> (= <i>Hyla cadaverina</i>)
<u>Pacific Treefrog</u>	<i>Pseudacris regilla</i> (= <i>Hyla regilla</i>)

Spadefoot Frogs: Family Pelobatidae

Western Spadefoot	<i>Spea hammondi</i>
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Tongueless Frogs: Family Pipidae

African Clawed Frog	<i>Xenopus laevis</i> *
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True Frogs: Family Ranidae

Red-legged Frog	<i>Rana aurora</i> (probably extirpated)
American Bullfrog	<i>Rana catesbeiana</i> *
Mountain Yellow-legged Frog	<i>Rana muscosa</i> (extirpated)