Edwards Aquifer Species

Scientific Name: San Marcos Salamander – *Eurycea nana,* Texas Blind Salamander – *Typhlomolge rathbuni,* San Marcos Gambusia – *Gambusia georgei,* Fountain Darter – *Etheostoma fonticola,* Peck's Cave Amphipod – *Stygobromus pecki*, Comal Springs Riffle Beetle – *Heterelmis comalensis*, Comal Springs Dryopid Beetle – *Stygoparnus comalensis*

Federal Status: Endangered except for the San Marcos Salamander, which is listed as Threatened • State Status: Endangered except for the San Marcos Salamander, which is listed as Threatened

San Marcos Salamander
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Texas Blind Salamander
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San Marcos Gambusias
© Bob Edwards

Fountain Darters
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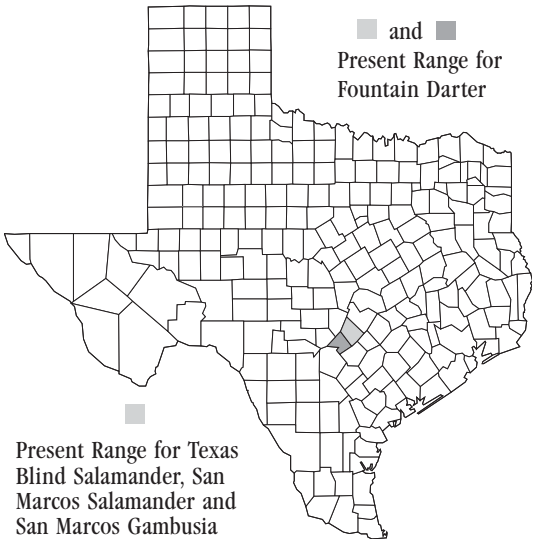
Description of Species, Habitats and Life History

The **San Marcos Salamander** is small and slender, with a total length of about 2.5 inches. It is uniformly light brown to golden brown, with small yellow flecks along each side of the back. The underside of its body is yellowish-white. A member of the brook salamander group, the San Marcos Salamander has external gills, which are retained throughout life. It has relatively short slender legs, with four toes on the fore feet and five on the hind feet. It has a slender tail with a well developed dorsal or top fin.

The San Marcos Salamander occurs only in Spring Lake and an adjacent downstream portion of the upper San Marcos River. They are most often found in spring areas with a substrate of sand and gravel, and larger rocks interspersed with large limestone boulders. These boulders in shallow water support a lush growth of aquatic moss. Interspersed with the moss and covering the shallow sandy substrate are thick mats of coarse filamentous blue-green algae. The dark reddish-brown color of this alga almost perfectly matches the dark dorsal color of the San Marcos salamander. Vegetative cover is important for protection and for providing habitat for living organisms that serve as food for the salamander. This species does not inhabit areas with a sandy bottom devoid of vegetation, nor do they occur where the bottom is muddy, whether or not vegetation is present. Clean, clear, flowing water of constant temperature is required for suitable habitat.

San Marcos Salamanders feed on amphipods (tiny aquatic crustaceans), aquatic insects, and small aquatic snails. Breeding is thought to occur throughout the year with a possible peak in May and June.

The **Texas Blind Salamander** occurs only in the subterranean waters of the Edwards aquifer near San Marcos, Texas. Because it is adapted to living in a subterranean environment, it lacks eyes and has little skin pigment. It is all white, with blood-red external gills and toothpick-like legs. The head and snout of this salamander are strongly flattened, with two vestigial eyes (appearing as black dots) beneath the skin. Its total length is about 5 inches.



This salamander is strictly aquatic, and lives in the water-filled caverns in the San Marcos Pool of the Edwards aquifer. It requires clean water of relatively constant temperature.

The Texas Blind Salamander feeds on a variety of small subterranean aquatic organisms, including

tiny snails, amphipods, and shrimp. When feeding, the salamanders probe the bottom using lateral movements of the head. When anything living is encountered, the mouth quickly opens and the food item is immediately sucked into the mouth. Numerous sharp teeth prevent the prey from escaping. It is thought that sensitivity to water vibrations also helps these salamanders locate food.

Although courtship and reproductive behavior have been observed and recorded for captive specimens, little information exists regarding reproduction of the Texas Blind Salamander in its natural habitat. Females with eggs and juveniles have been observed throughout the year, so it is thought that reproduction occurs year-round.

The Texas Blind Salamander is at the top of the food chain in a very unique community of subterranean organisms living in the Edwards Aquifer. This aquifer has exhibited the greatest diversity of any know aquifer system. There are forty plus species living in the aquifer with the salamander, and most of them are just as endangered as the salamander. If any of the species are lost from the system it will have an effect on the Texas Blind Salamander. One of the greatest threats to the Aquifer system is the potential for over pumping which may allow saline water to enter areas that are now fresh water.

One of the rarest animals of the San Marcos River, and one which may already be extinct, is the **San Marcos Gambusia**. Last collected in the wild in 1983, this fish is a member of a genus having more than 30 species of live bearing freshwater fishes. It is a small fish, about 1 inch in length, known only from the upper San Marcos River. This species is plainly marked and similar in appearance to the western mosquitofish (*Gambusia affinis*). It has a prominent dark stripe along the upper edges of the dorsal fin. The unpaired fins tend to be yellow or yellowish-orange. A bluish sheen is evident near the head, especially in more darkly pigmented adult females. The anal fin of *Gambusia* males is modified into a tube-like structure called a gonopodium. The gonopodium is used to transfer sperm from the male to the female.

The San Marcos Gambusia prefers shallow, quiet waters adjacent to sections of flowing water. Constant water temperature is also very important. This fish prefers a muddy, but not silted, bottom. Partial shade from bridges or overhanging vegetation also seems to be an important habitat factor.

There is little information on the food habits or reproduction of this species. It is thought that insect larvae and other invertebrates comprise most of the diet.

The **Fountain Darter** is a small fish, usually about 1 to 2 inches in length, found only in the San Marcos and Comal River headwaters. It is reddish-brown with fine specks in the dorsal region. A series of horizontal stitch-like dark lines occur along the middle of the sides, forming an interrupted lateral streak. There are three small dark spots on the base of the tail, and one on the opercle (flap covering the gills). Dark bars appear in front of, below, and behind the eye. The lower half of the dorsal fin is black, above this is a broad red band, and above this the fin is edged in black.

The Fountain Darter prefers vegetated stream-floor habitats with a constant water temperature. They are most often found in and among rooted aquatic plants, mosses, and algae. They are occasionally found in areas lacking vegetation. Young Fountain Darters are found in heavily vegetated, backwater areas of the San Marcos and Comal Rivers where there are low water velocities. Adults occur in all suitable habitats, including riffles.

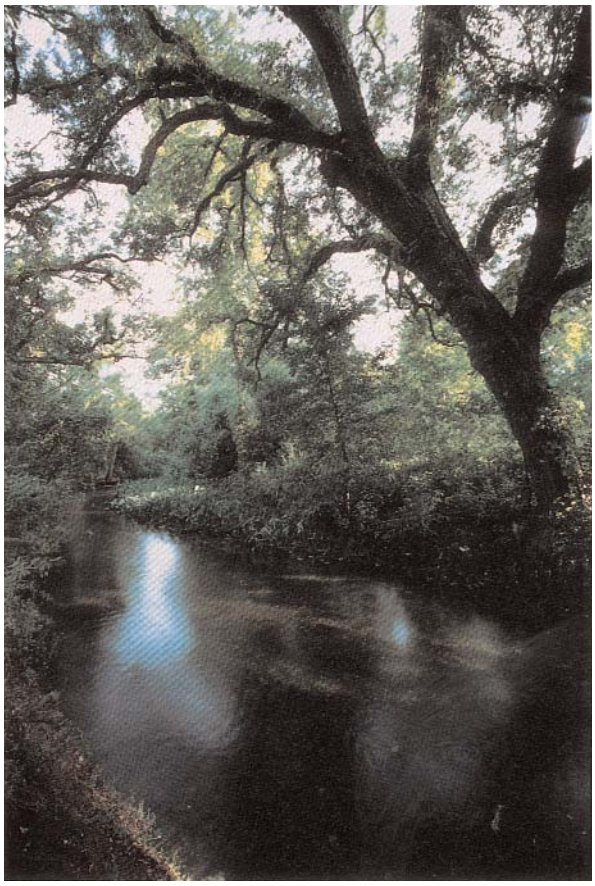
Fountain Darters feed on copepods (tiny aquatic crustaceans) and mayfly larvae. They feed primarily during the day, and show selective feeding behavior. Observations suggest that darters feed on small moving aquatic animals, while ignoring immobile ones.

The adult **Comal Springs Riffle Beetle** has a narrow body about 2 mm long, and it is reddish-brown in color. The larva has an elongate, tubular body and can be up to 10 mm in length. The Comal Springs riffle beetle is known primarily from Comal Springs where it has been collected from only the primary spring-runs and from up-wellings underlying Landa Lake. A single specimen of this species was taken from the impounded San Marcos Springs, but additional collections of this species have not been made at this location. Comal Springs riffle beetle is highly dependent on the constant and narrow range of habitat conditions associated with the springs-flows issuing from the Edwards Aquifer. Larval and adult riffle beetles both feed on microorganisms and debris scraped from the substrate. However, the specific feeding habits of this riffle beetle are unknown. All beetles (Coleoptera) are holometabolous and have complete life cycles consisting of an egg, larva with multiple instars, pupa, and

Peck's Cave Amphipod

Comal Springs Riffle Beetle

Comal Springs Dryopid Beetle



San Marcos River

San Marcos River

adult. All life stages, except eggs, of Comal Springs riffle beetle are present throughout the year. Several larval instars have been observed in collections taken throughout the year indication that the Comal Springs riffle beetle has overlapping, asynchronous generations.

Adult **Comal Springs Dryopid Beetles** are oblong, slender insects with elongate legs and a length typically around 3 to 4 mm. The cuticle is thin and translucent giving the beetles a reddish-brown color. Larvae are elongate and cylindrical is shape and yellowish-brown in color. Neither the adult or immature stages have eyes. This species has been collected only from the Edwards Aquifer and associated habitats at Comal Springs, New Braunfels, Texas, and Fern Bank Springs near Wimberley, Texas. Some specimens have been found in the upper spring-runs at Comal Springs, but they are thought to have been flushed from the Aquifer. Adults and larvae of this species have been collected with drift nets placed over the springs sources at Comal Springs and in the upper portions of each spring-run. The specific micro-habitat this species inhabits is unknown. However, larvae of other dryopid species are semi-aquatic or terrestrial and the larvae of the Comal Springs dryopid beetle may inhabit the ceilings of the spring openings. These spring openings typically have soil, roots and debris exposed above the water line that may serve as habitat for the larvae. Adults by comparison are fully aquatic. The feeding habits of these beetles are unknown as is the life history and reproductive biology. All other dryopid beetles are detritivores and possibly herbivorous. Captive adults have been observed apparently grazing on the surface of rocks.

The **Peck's Cave Amphipod** is a small crustacean known only from the Edwards Aquifer. Like most other subterranean amphipods, this species is unpigmented and lacks eyes. Numerous examples of this species have been collected only from the Edwards Aquifer at Comal Springs in Landa Park, New Braunfels, Texas, and a single specimen was taken at Hueco Springs, Texas in 1992. Specimens of this species were collected near a spring opening following a heavy rain, and an additional specimen was collected from just inside a "cave-like" spring opening under a rock. Nothing is known about the reproduction biology, life history or feeding habits of the Peck's cave amphipod.

Threats and Reasons for Decline

Both the San Marcos and Comal Rivers originate from springs fed by the Edwards Aquifer. Because the flow of these springs is intimately tied to water usage over the entire Edwards Aquifer region, human population growth and increased use of groundwater resources throughout the region are likely to decrease spring flow. Relatively constant water temperatures and flows are requirements for these listed species. The danger of reduced spring flow is the most serious threat to the continued existence of the San Marcos and Comal Rivers and their endemic plants and animals.

The effects of periodic drought coupled with increased groundwater use are a serious threat. For example, a severe drought from 1950-1956 greatly reduced the aquifer level and spring discharges. During 1956, Comal Springs ceased to flow for five months. Less severe droughts in 1984 and 1990 resulted in minimum daily flows at Comal Springs of 24 cfs (cubic feet per second) and 46 cfs, respectively, compared to the mean spring flow discharge (1933-1990) of 293 cfs.

Other threats associated with increased urbanization include increased flooding and erosion, pollution, siltation, and storm water runoff. All of these factors can adversely affect the listed species and their habitats. Also, exotic species pose a threat because they may: (1) parasitize or prey on these endangered species, (2) compete with them for food resources, (3) displace or destroy aquatic vegetation including Texas wild-rice, or (4) otherwise degrade habitat quality. In addition, conservation efforts for these species must include protection and conservation of the Edwards Aquifer to the extent that water quality and a range of spring-flows are maintained at historic levels. Reduced spring-flows may result in drying of subterranean cavities and spring-runs that provide habitat to this species and could result in appreciable mortality and/or extinction.

Development and maintenance of refugia stocks for endangered species is an important recovery goal. However, captive breeding stocks for all these species, exclusive of fountain darter, are not reliable or have not yet been established because their habitat requirements are extremely difficult to emulate under artificial conditions. This is especially true for the invertebrate species.

Recovery Efforts

Monitoring existing populations and habitats is important in understanding the factors affecting the listed

species and their habitats. Basic biological research addressing habitat requirements and aspects of life history, such as food habits, reproduction, diseases and parasites, and predation and competition, is currently underway to better understand the survival needs of each species.

The U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department and other cooperators are engaged in a multi-year study to assess spring flow and stream flow needs of the threatened and endangered species of the Comal and San Marcos springs ecosystems. The U.S. Fish and Wildlife Service is also working with the City of New Braunfels to ensure that the management of city properties such as parks is compatible with the conservation of the Comal Springs/River Ecosystem and the endangered species it supports. The U.S. Fish and Wildlife Service is working with the City of San Marcos and Southwest Texas State University on a habitat conservation plan (under section 10(a)1(B) of the Endangered Species Act) to minimize adverse effects to the endangered and threatened species and provide ongoing stewardship of the Fountain Darter, San Marcos Gambusia, San Marcos Salamander, and Texas Blind Salamander and their habitats.

Finally, providing information to the public regarding protection of the San Marcos and Comal River ecosystems, and the unique plant and animal species dependent on them, also is vital to the recovery of the listed species.

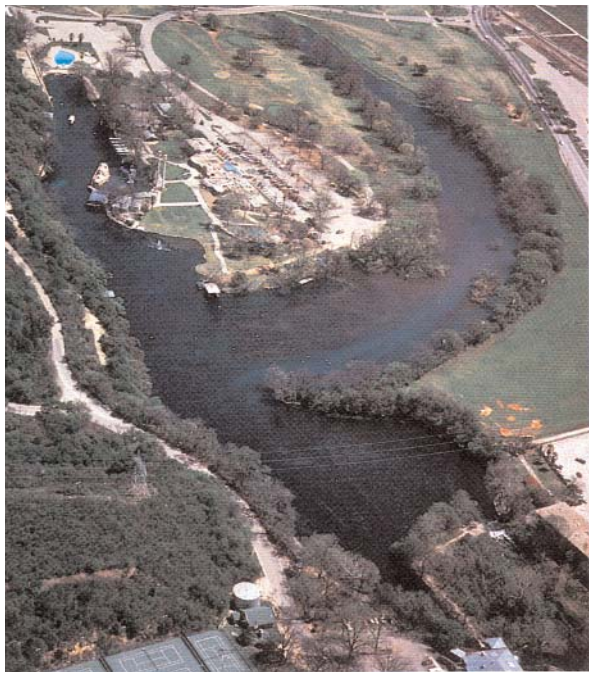
How You Can Help

Support conservation efforts to protect the San Marcos and Comal River ecosystems and their associated native species. Conservation of these spring ecosystems will result in the continued ability to use water in areas downstream from their habitats. Stay informed about conservation issues relating to the quality and quantity of groundwater and surface water in the Edwards Aquifer region. Do your part to conserve water, prevent pollution and introduction of exotic species, and preserve streambed vegetation so that Texans can continue to enjoy the clean, flowing waters and diversity of plant and animal life of the San Marcos and Comal River ecosystems.

For More Information Contact

Texas Parks and Wildlife Department
Wildlife Diversity Branch
4200 Smith School Road
Austin, Texas 78744
(512) 912-7011 or (800) 792-1112
or
U.S. Fish and Wildlife Service
Ecological Services Field Office
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057

Management guidelines are available from the Texas Parks and Wildlife Department and U.S. Fish and Wildlife Service for landowners and managers wishing to protect the Edwards Aquifer and their associated threatened and endangered species.



Urban development along the San Marcos River

River pollution

Sampling Fountain Darters in the Comal River

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