

Concho Water Snake

Scientific Name: *Nerodia paucimaculata*

Federal Status: Threatened, 9/3/1986, with federally-designated critical habitat • State Status: not listed

Description

The Concho Water Snake is small compared to most other water snakes, with adults rarely exceeding 3 feet in total length. This nonvenomous snake has four rows of alternating dark brown spots or blotches on its back, two rows on each side. The coloration on its back is similar to a checkerboard of dark brown spots on a gray, brown, or reddish-brown color. The Concho Water Snake has a light pinkish or orange belly that is unmarked or has somewhat indistinct spots along the sides.



Concho Water Snake
© N. Scott

Two other water snakes occur within the range of the Concho Water Snake. Both the Diamondbacked Water Snake (*Nerodia rhombifer rhombifer*) and the Blotched Water Snake (*Nerodia erythrogaster transversa*) have dark markings on the back. However, adult Diamondbacked and Blotched Water Snakes may be distinguished from adult Concho Water Snakes by their larger size. The Diamondbacked Water Snake has a distinct black chain-like pattern on its back. The Blotched Water Snake has three rows of large squarish blotches on the back, which are especially prominent in juveniles. As Blotched Water Snakes age, they become darker in color and may appear to lack markings.

The cottonmouth is another large aquatic snake that may be confused with the Concho Water Snake. The cottonmouth, a venomous snake, is usually uniformly black or dark brown with little or no trace of a pattern, although both neonates and juveniles are banded; neonates have a yellow or gold-colored tail tip, juveniles retain it but not as distinct. Cottonmouths often vibrate their tails when excited,

whereas water snakes usually do not. Also, an aroused cottonmouth will sometimes stand its ground, throw its head upward and backward, and hold its mouth wide open, revealing a white "cotton-like" interior.

Distribution

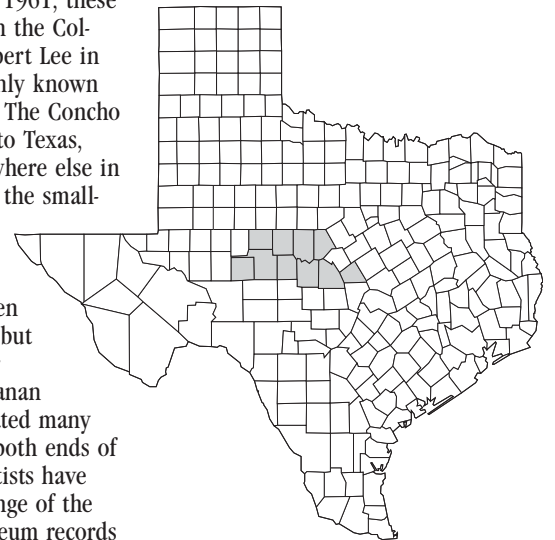
Historically, the Concho Water Snake occurred over about 276 river miles of the Colorado and Concho Rivers in central Texas. The snake was first collected from the South Concho River and Dove Creek, which are tributaries to the Concho River west of San Angelo, Texas. When the subspecies was described in 1961, these records and one other on the Colorado River south of Robert Lee in Coke County were the only known localities for this snake. The Concho Water Snake is endemic to Texas, which means it lives nowhere else in the world. It has one of the smallest distributions of any North American snake.

The Concho Water Snake may once have been more widely distributed, but the E.V. Spence Reservoir upstream and Lake Buchanan downstream have inundated many miles of river habitat at both ends of the current range. Scientists have estimated the historic range of the subspecies based on museum records and unpublished records supported by specimens. The probable historic range of this snake is estimated to include, at a minimum, the Colorado River from Spence Reservoir downstream to the vicinity of Lake Buchanan, Elm, Bluff, and Coyote Creeks (Runnels County), and the entire Concho River (Tom Green and Concho Counties) and its headwater tributaries, Dove Creek, Spring Creek, and the South Concho River (Irion and Tom Green Counties).

Today, the Concho Water Snake occupies a restricted geographic range in the Concho and Colorado River Basins. The current distribution includes relatively continuous occupation of riverine habitat of the Colorado River below the town of Bronte (Coke County), of Elm, Coyote, and Bluff creeks below Winters (Runnels County), and of the Concho River from San Angelo (Tom Green County) downstream to its confluence with the Colorado River, and then down-

stream to the FM 45 bridge over the Colorado River (Mills and San Saba Counties). This is a distance of about 233 river-miles.

Apparently isolated lake populations have been found in E.V. Spence Reservoir and Ballinger Municipal Lake (formerly Lake Moonen). Concho Water Snakes have also been found at a number of sites in O.H. Ivie Reservoir, and there are indications that this population is reproducing. Scattered river populations occur along the Colorado River above Lake Buchanan, near the towns of Regency, Harmony Ridge, Adams, and



Bend. Recently, Concho Water Snakes have been found at all six artificial riffles (fast-flowing, shallow water over a rocky bottom) constructed in 1989 in the 17-mile stretch of the Colorado River between the Robert Lee Dam and Bronte.

Although the Concho River has been dammed and channelized within the City of San Angelo, a population of Concho Water Snakes persists just below the Bell Street Bridge. They have also been found about 4 river-miles downstream from Bell Street Dam. From this point they are present in all suitable habitats to the confluence with Ivie Reservoir, a distance of about 43 river-miles.

Habitat

Optimal habitat for the Concho Water Snake consists of free-flowing streams

over rocky substrates, abundant rock debris and crevices for shelter, and shallow riffles. Periodic scouring by floods is important in providing relatively sediment free rock rubble and open banks.

Riffles, considered critical to juvenile survival, are characterized by shallow, fast-flowing water connecting deeper areas of quiet water. Riffles begin when the upper pool overflows at a change in slope and forms rapids. They end when the rapids enter the next downstream pool. Riffles often contain bars, shoals, or islands separated by flowing water.

Limestone bedrock shelves in and along the stream channel seem to support the largest snake populations. The snakes forage and seek cover among the numerous splits, crevices, cracks, and jumbled stream cobble of shelf rock. Other rock, such as limestone boulders, can also provide suitable habitat.

Juvenile snakes are generally restricted to rocky riffles. Neonates (newborn snakes) are most often found in gravel bars or along the shoreline in areas where rocks range in size from small cobbles to small boulders. However, some habitats with thriving populations lack typical gravel bars. In these areas, juveniles use boulders and shelf rock for cover. During their second year, snakes begin to use larger rocks, usually medium to large boulders.

Mature snakes use a much wider range of habitats than juveniles. Although adults forage in riffles, they are known to use a variety of cover sites for resting, including exposed bedrock, thick herbaceous vegetation, debris piles, and crayfish burrows. During the latter stages of gestation, gravid females occupy dense patches of vegetation and brush piles.

In lake habitats, Concho Water Snakes occupy areas of broken rock along the shoreline. Although they seem to prefer the shallower areas, they are occasionally found on steeper shorelines where rock is present. As in river habitats, first-year snakes use smaller rocks for cover, while mature snakes use medium to large rocks. When available, dead shrubs and trees killed by fluctuating water levels are used as basking sites by juveniles and adults. At Spence Reservoir, where there are almost no dead trees or shrubs, snakes bask on the ground among the protection of rocks.

Bank and shoreline vegetation is important in providing cover and basking sites for Concho Water

Snakes. Although the type of vegetation does not appear to be important, its use depends on vegetation density and orientation. For example, pregnant females seek basking sites protected by thick vegetation. Larger trees and shrubs, such as pecan, cedar elm, and willow, with limbs that hang over water, provide basking sites for juveniles and adults. Common bank and shoreline vegetation used for cover and basking sites include switchgrass, devil-weed aster, greenbrier, poison ivy, willow, salt cedar, button bush, hackberry, pecan, cedar elm, and mesquite.

Concho Water Snakes hibernate during the winter, either singly or in small groups. Adults use a variety of sites for hibernation, including crayfish burrows, rock ledges, debris piles, and concrete low water crossings. These sites are usually within 20 feet of the water. Newborn snakes have been found hibernating in areas of loose rock and moist soil.

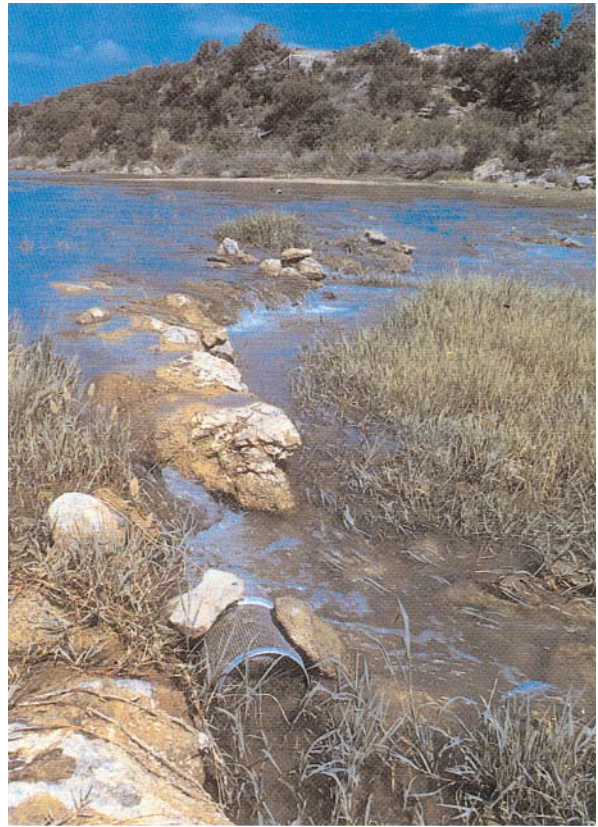
Life History

Concho Water Snakes are active primarily from March through October. Adult activity gradually decreases during June and remains low until mid-September. Activity levels increase again during late September and October. The snakes enter the hibernation site (hibernacula) during late October, although they can occasionally be seen on warm winter days basking in the open. Newborn Concho Water Snakes, born in August and September, are commonly found under rocks in late summer and early fall. In the heat of the summer, Concho Water Snakes are active primarily in the early morning and evening until about 9 p.m.

Research indicates that adult males move an average of 141 to 325 ft/day. Pregnant females move less, averaging 62 to 131 ft/day, with distances decreasing as parturition approaches, and increasing again after the young are born. Linear distances of river habitat occupied by individual snakes range from 689 to 1,542 feet.

Long range movements of 3.1 and 4.5 miles have been recorded for juvenile snakes dispersing from their birthplace. In one instance, a snake moved 12 river-miles over a four-year period.

The diet of the Concho Water Snake is composed almost entirely of fish. In river habitats, minnows are most often consumed. Neonates (newborn snakes) feed almost exclusively on minnows, particularly the red shiner and bullhead minnow. Their diet becomes more varied as their body size increases. In addition



Concho Water Snake river habitat
© USFWS Pat Connor



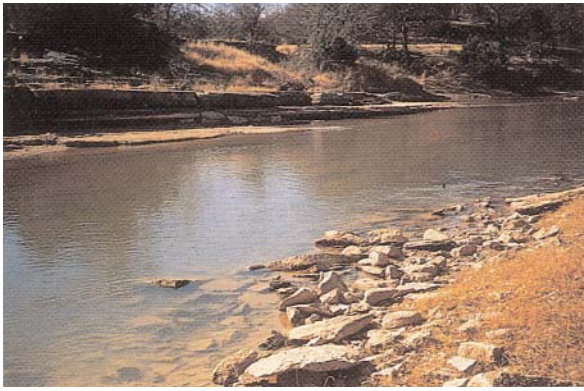
Habitat along the shoreline of Spence Reservoir
© UWFWS Alisa Shull

to minnows, large snakes consume mosquitofish, channel catfish, flathead catfish, gizzard shad, and several species of sunfish. The bullhead minnow, sheepshead minnow, and bigscale logperch were found to be the dominant prey of snakes in Ballinger Municipal Lake.

Concho Water Snakes catch prey by remaining stationary near fish concentrations or by actively searching under and around rocks in riffles. Juveniles are most often seen using the "sit-and-wait" strategy.

Mating occurs predominantly in April and early May, and sometimes again in October. Litter sizes average 10 embryos per female, and births occur from late July through September. As females increase in size during their lifetimes, their litter size also increases.

Concho Water Snakes grow rapidly and mature early, at about



Habitat on the Concho River
© USFWS Alisa Shull



Artificial riffle habitat
© USFWS Pat Connor

11 to 12 months of age. Females produce their first litters at 2 or 3 years of age. Females grow more rapidly and mature at larger sizes than males, with adult females reaching a length on average 30% greater than adult males. Differences in growth rates and mature sizes have been observed between populations, suggesting differences in food availability.

Survivorship of Concho Water Snakes is directly related to age. Only about 20% of Concho Water Snakes survive their first year. The adult survival rate is estimated to be about 50 percent. Population studies have shown that most adults are less than 4 years old, and only one snake in 100 exceeds 5 years of age. Predation is considered to be a significant source of mortality. Major natural predators include kingsnakes, Coachwhip Snakes, racers, Raccoons, Great Blue Herons, and various hawks and owls.

Threats and Reasons for Decline

Habitat loss and degradation has been identified as the greatest general threat to Concho Water Snake populations. Reservoir construction has flooded many miles of former stream habitat above the dams. Below the dams, restriction of stream flow and prevention of floodwater

scouring have resulted in siltation of rocky streambeds, encroaching vegetation, and loss of riffle habitat required by young snakes. Loss of adequate instream flow due to natural conditions (drought) and water diversion is also a concern.

Pollution and degradation of water quality in the Concho and Colorado Rivers or their tributaries is another potential threat in certain portions of the snake's range. Non-point source pollution in the vicinity of San Angelo, petroleum production, refining, and transportation in the watershed, treated sewage disposal, pesticide use, and feedlot activities have been identified as water quality concerns that could affect habitat. These same water quality issues affect municipal water supplies and recreational use of lakes and rivers. Keeping the water clean benefits people as well as the Concho Water Snake and other wildlife.

Finally, fragmentation and isolation of populations following various habitat alterations remain a concern. The full effects of recent habitat modifications and natural events are unknown.

Recovery Efforts

Several ongoing and recently completed studies are leading to a better understanding of the habitat requirements, life history, and genetic structure of Concho Water Snake populations. During the period 1987 through 1996, the Colorado River Municipal Water District (CRMWD) monitored Concho Water Snake populations at 15 sites three times each year. Physical aspects of the habitat were recorded and changes noted. Fish populations were surveyed at the monitoring sites each fall. In addition, potential habitat along the shoreline of Ivie Reservoir has been characterized, and researchers are documenting the reservoir's Concho Water Snake distribution.

As a condition of building Ivie Reservoir, the CRMWD is required to release water from both Spence and Ivie Reservoirs according to a schedule which scientists hope will maintain suitable habitat for the Concho Water Snake. These water releases include both continuous daily flows and flushing flows designed to maintain stream channels.

The Conservation Reserve Program (CRP) of the U.S. Department of Agriculture provides incentives to set aside highly erodible lands and establishing these areas to perennial native vegetation. The program benefits the Concho Water Snake by reducing soil erosion and contributing to

maintenance of high quality surface waters. Enrollment in the CRP of the primary areas contributing to sedimentation in the watershed may significantly reduce the threat of sedimentation of riffle habitat.

Finally, in an effort to restore former habitat heavily degraded by siltation and vegetation encroachment, six artificial riffles were built in 1989 in an unoccupied stretch of the Colorado River below Spence Reservoir. Though this area once contained excellent habitat and dense populations of Concho Water Snakes, none were found in surveys done in the late 1980's. In 1991, four of the artificial riffles were found to be occupied by Concho Water Snakes, and by 1992, all six were occupied. Future restoration efforts will likely involve construction of more riffles in river habitat. The use of various man-made structures by Concho Water Snakes indicates high potential for success with habitat enhancement.

Conservation education that provides information and raises public awareness is also important. Although the number of Concho water snakes killed intentionally or inadvertently by people is not known, public outreach may help reduce adverse impacts to this snake.

The Concho Water Snake controversy provides a good example of an effective compromise between human resources needs and endangered species management; objectives which are not necessarily mutually exclusive. Efforts by numerous individuals representing various universities and local, state, and federal agencies, serve as a model of cooperation and compromise. The future of the Concho Water Snake is not as bleak as once thought. If habitat conditions remain stable and adequate instream flows are maintained, the Concho Water Snake will remain a part of the diversity of Texas for many years to come.

Where To See Concho Water Snakes

Concho Water Snakes can sometimes be found along rocky shorelines of Ivie and Spence Reservoirs and Ballinger Municipal Lake. They may also be seen on the Concho and Colorado Rivers. If you see one of these snakes, remember that they are protected by federal and state laws. Do not disturb them or the surrounding area in any way.

How You Can Help

You can encourage and support private landowners who are managing their land to protect the rivers, streams, and lakes that serve as habitat for the Concho Water Snake. Concho water snakes and their prey base need adequate instream flows. If you are a landowner along one of the rivers or streams that serve as habitat, we encourage you to learn about the habitat requirements of the Concho Water Snake and other species that depend on these waterways. Landowners can help by maintaining clear free-flowing streams over rocks, rock debris and crevices for shelter, shallow riffle areas, and basking sites, and by being careful with pesticides and other potential pollutants. Alternatives such as integrated pest management, organic gardening, and the use and management of native plants can help reduce reliance on chemicals and can often save money.

Do what you can as an individual to conserve water, particularly during drought periods. In the home, you can save water by installing fixtures, appliances, and toilets designed to use less water, repairing leaky faucets, and turning off the tap while brushing teeth or doing dishes. Landscaping with native, drought tolerant plants, watering lawns in the early morning or evening to reduce evaporation, and installing a rainwater collection system for your home are other effective ways to conserve water. By protecting the natural beauty, flow, and water quality of the Colorado and Concho Rivers, landowners can play a role in assuring that future generations of Texans have the chance to enjoy the rich diversity of life these rivers support.

Concho water snakes feed almost exclusively on smaller fish. Trot lines may result in death of Concho water snakes. If you fish, do not use trot lines in the following lakes and rivers: Spence Reservoir; Ivie Reservoir; Ballinger Municipal Lake; Concho River in San Angelo and downstream to Ivie Reservoir; Colorado River between Spence and Ivie Reservoirs; Colorado River between Ivie Reservoir and Farm to Market Road 45 (near Regency); Colorado River in the vicinity of Gorman Falls, Bend and Colorado Bend State Park.

If you are a boater or enjoy swimming in the Concho or Colorado Rivers and their tributaries, remember that your actions, especially when multiplied by thousands of other recreational users, can have an

immense impact on the rivers. Responsible recreational use should include proper disposal of trash and other potential pollutants, respect for private property rights, preventing harm to plants and wildlife, and generally keeping human impacts to a minimum.

Finally, you can be involved in the conservation of Texas' nongame wildlife resources by supporting the Special Nongame and Endangered Species Conservation Fund. Special nongame stamps are available at Texas Parks and Wildlife Department (TPWD) field offices, most state parks, and the License Branch of TPWD headquarters in Austin. Contributions to this fund help TPWD conduct research, manage habitat and develop informational materials and programs for the benefit of nongame and endangered wildlife. Conservation organizations in Texas also welcome your participation and support.

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



Concho Water Snake moving over rocky streambed
© TPWD Martin Whiting

References

- Dixon, J.R., B.D. Greene, and M.J. Whiting. 1992. *1992 Annual report Concho water snake natural history study, Big Spring, Texas*. Colorado River Municipal Water District. 128 pp.
- Dixon, J.R. 1987. *Amphibians and reptiles of Texas*. Texas A&M University Press, College Station. 434 pp.
- Greene, B.D., J.R. Dixon, M.J. Whiting, and J.M. Mueller. 1999. "Reproductive ecology of the Concho water snake, *Nerodia harteri paucimaculata*." *Copeia* 701-709.
- Greene, B.D. J.R. Dixon, J.M. Mueller, M.J. Whiting, and O.W. Thornton, Jr. 1994. "Feeding ecology of the Concho water snake, *Nerodia harteri paucimaculata*." *Journal of Herpetology* 28(2):165-172.
- Greene, B.D. 1993. Life history and ecology of the Concho water, *Nerodia harteri paucimaculata*. Unpublished Ph.D. dissertation. Texas A&M University. 128 pp.
- Mathews, A.E. 1989. "Conflict, controversy, and compromise: the Concho water snake (*Nerodia harteri paucimaculata*) versus the Stacy Dam and Reservoir." *Env. Management* 13(3):297-307.
- Rose, F.L. 1989. "Aspects of the biology of the Concho watersnake (*Nerodia harteri paucimaculata*)." *Texas J. Science* 41(2):115-130.
- Scott, Jr., N.J., T.C. Maxwell, O.W. Thornton, Jr., L.A. Fitzgerald, and J.W. Flury. 1989. "Distribution, habitat, and future of Harter's water snake, *Nerodia harteri*, in Texas." *Journal of Herpetology* 23:373-389.
- Tinkle, D.W. and R. Conant. 1961. "The rediscovery of the water snake, *Natrix harteri*, in western Texas, with the description of a new subspecies." *Southwestern Naturalist* 6(1):33-44.
- U.S. Fish and Wildlife Service. 1993. *Concho water snake recovery plan*. Albuquerque, New Mexico. 66 pp.
- Werler, J.E. and J.R. Dixon. 2000. *Texas snakes: identification, distribution, and natural history*. University Texas Press, Austin, Texas
- Whiting, M.J. 1993. "Population ecology of the Concho water snake, *Nerodia harteri paucimaculata*, in artificial habitats." Unpublished M.S. thesis. Texas A&M University. 137 pp.