

The Southern cavefish, *Typhlichthys subterraneus*

Skip Kendrick, 2006



Middle Tennessee is karst country. Sinkholes, springs, karst windows are plentiful. The area is called the Central Basin and is composed primarily of limestone (the official state rock of Tennessee) with some dolomite, which readily forms submerged solution and fracture caves. The bedrock was laid down in the Ordovician Period some 450 million years ago and is now known as the Nashville Dome. Tennessee was a warm shallow sea filled with brachiopods, bryozoans, crinoids, trilobites, bivalves, sponges and echinoderms, whose fossilized remains form the limestone.

The Southern cavefish, *Typhlichthys subterraneus*, is a small troglobite of the family *Amblyopsidae* and is currently listed as in need of management by the State of Tennessee. The Southern cavefish has been documented in five counties of Alabama, three counties in Arkansas, six counties in Kentucky, 14 counties of Missouri, and 16 counties in Tennessee. Some sources also add one county in Georgia and one county in Illinois, but these have been questioned.

The Southern cavefish is small, 75mm total length, depigmented, with vestigial eyes and an elongated, flattened head. It has 7-10 dorsal fin soft rays, 7-10 anal fin soft rays, lacks pelvic fins, and has 10-15 branched caudal fin rays. The anus is in front of the anal fin in adults. The lateral line branches extensively over the head and there are two rows of neuromasts on the caudal fin and a post-cleithrum bone. The brain of the Southern cavefish features enlarged olfactory and acoustico-lateralis, and reduced optic centers.

The lifespan of the Southern cavefish is measured in decades, not years, although it is unknown how long they live. They are very slow growing and have a preference for cave areas near the efflux (spring runs). However, they appear to live in networks of dolomite pores, like swiss cheese, in solution caves, where water flow-through is 30 days or so, with water residence times of 16-30 days. Obviously, the water is replenished by rains, sinkholes, and general movement through the soil. Further, the Southern cavefish is believed to reside up to several hundred meters below the surface (although they are often found within 50-100 feet of the surface at water depths as shallow as 20 feet). Specimens brought into sunlight die when exposed to UV, but with staged exposure will repigment. Captured specimens survive in aquaria when kept in the dark.

The Southern cavefish is found in completely submerged conduits (underwater caves), although some sources have claimed to have found them in cave streams. However, it is more likely they have been flushed from their preferred locations. In fact, the Southern cavefish has rarely been seen in its natural habitat for the obvious reason that it is underground, underwater, typically in areas too small for humans. Its presence is known primarily from being sucked up water pumps from ground wells and from toxic spills that flush dead and dying specimens out of the cave system. Specimens have been verified in several counties of Southern Missouri, Kentucky, Middle Tennessee, and Northern Alabama.

The habitat of the Southern cavefish does not have many food sources. Copepods comprise the primary diet (estimated at 60-90%), with larva of tricopterans, tenebrionids, cladocerans, isopods, and crayfish, making up the remaining 10-40%. Copepods are the most numerous metazoans (multi-celled animals) and range in size from 0.2mm to 10mm. They inhabit water everywhere from oceans to water-filled caves, polar ice-water to hydrothermal vents, and even wet leaf litter. With over ten thousand species of copepods, they make up the majority of the planets' biomass. Southern cavefish hunt and capture prey (and avoid predators) primarily by vibration detection. Chemical senses are not well-developed. Prey must typically be within 10mm to elicit capture movements; however, the Southern cavefish has distance perception and spatial memory.



Copepods

Southern cavefish are not rheotactic, like many cave fish (they don't face into the current), but they are uniquely thigmotactic, preferring to keep the top of the head touching and parallel to surfaces (the head is elongated and flattened). Conversely, they spend a good amount of time setting on the substrate. They have little opportunity to meet and interact with conspecifics due to low population densities and their preference for haphazard arrays of interconnected pore spaces. Thus they display a variety of behavior types, energetic territorial charges (defenses), and rather long bouts during conspecific interactions compared to other cavefish species (e.g., Ozark Cavefish – *Amblyopsis rosae*). Females make more and bigger eggs also.

The author has been visiting a fairly stable population of the Southern cavefish in the Three Sisters system in Rutherford County, the first documentation of a population of Southern cavefish in the county and the first sighting since 1941, when several specimens were pumped up from a well just off Castle Street in Murfreesboro. This local population numbers in the dozens, with individual sightings occurring from approximately 300 feet in at a depth of 18 feet to 1800 feet in at a depth of 40 feet. The number and activity of individuals is greatest in the Spring and Summer, with counts tapering off in the Fall and Winter months. Some visits produce no sightings at all in the Winter.

This new addition to the Southern cavefish distribution list offers a unique opportunity to study the population with an eye towards management. One of the primary problems with managing a species that inhabits water-filled caves is accessibility, which typically limits investigations to those few specimens that are flushed out due to toxic spills and/or pumped up in home owners water systems. Three Sisters cave system is accessible to cave divers and is a diverse haphazard honeycomb of passages. It is one of the very few places where humans can go and find a substantial population of Southern cavefish for study in their natural habitat. Hopefully, further studies will be made and from those a basis for a management plan at the state level can be realized.

Sources

Kuhajda, B.R. and Mayden, R.L. (2001). Status of the federally endangered Alabama cavefish, *Speoplatyrhinus poulsoni* (*Amblyopsidae*), in Key Cave and surrounding caves, Alabama. *Environmental Biology of Fishes*, 62, 215-222.

Lewis, J.J. (2002). Conservation Assessment for Southern Cavefish (*Typhlichthys Subterraneus*). USDA Forest Service, Eastern Region.

Noltie, D.B. and Wicks, C. M. (2001). How hydrogeology has shaped the ecology of Missouri's Ozark cavfish, *Amblyopsis rosae*, and Southern cavefish, *Typhlichthys subteraraneus*: Insights on the sightless from understanding the underground. *Environmental Biology of Fishes*, 62, 171-194.