

Captive Propagation of Two Pupfishes, *Cyprinodon nevadensis armagosae* and *Cyprinodon fontinalis*

Ken McKeighen, Jr.

46 Cuerdo Lane, Los Lunas, NM 87031

I first became acquainted with pupfishes in 1970. A local aquarium shop had a 29-gallon saltwater tank on display which contained about a dozen sheepshead topminnow (*Cyprinodon variegatus*) that the owner had collected in Florida. I found them interesting but kind of bland. Although they were a good size they weren't very colorful. Nor were they for sale. I didn't get a chance to keep *Cyprinodon* until 1978, when I was invited to go killie collecting in Georgia and Florida with some good friends of mine. There I caught my first pupfish.

It was interesting where we found them. We stopped at an estuary on the St. John's River outside of Jacksonville, Florida. While my companions went down to the estuary's waters, which looked like they would contain all kinds of fishes, I checked out a muddy blackwater pool near where some road construction was going on. As I approached the pool hundreds of fish fled towards the middle. Sweeping my net through the water, I caught small sailfin molly (*Poecilia latipinna*) and young but colorful *C. variegatus*. No fish were found in the weeds of the estuary, but this muddy black pool was full of them! We collected several pairs of pupfish and successfully brought them home. Since then I have had the opportunity to work with several species of this unique and amazing genus of killifishes.

For those not familiar with pupfishes, they are members of the family Cyprinodontidae, subfamily Cyprinodontinae. They are small, 1.5 to 3-inch fishes with short heavy bodies. Pectoral fins are much reduced or absent in some species. Dorsal and anal fins are set well back on the body. The caudal fin is squared off. Pupfishes exhibit a pronounced sexual

dimorphism with males showing a brilliant metallic blue and females being olivaceous to brown. Both sexes have a barred pattern that can be distinct to vague depending on the mood of the fish. Reproduction is oviparous, with eggs that hatch in 4-7 days. Growth is rapid for most species.

The sheepshead topminnow is the most wide-ranging species in the genus, ranging from Cape Cod to the Rio Grande River. It can be found in both fresh and brackish water along the coast. The pupfish with the most limited range is the Devils Hole pupfish (*C. diabolis*, back cover). It's restricted to an isolated pool that is really the opening of a water-filled cave system in Ash Meadows, Nevada. All told, there are around 45 species and subspecies of *Cyprinodon* found in the U.S., México, and several Caribbean islands.

Although all U.S. pupfishes except *C. variegatus* are state or federally protected, several species were grandfathered into the hobby, including the two pupfishes discussed here: *C. nevadensis armagosae* (Fig. 1) and *C. fontinalis* (Fig. 2).

Distribution and Description

C. n. armagosae There are two populations of *C. n. armagosae*. One is located in the Armagosa River below Tecopa, California, in a permanent section of the river that flows through Armagosa Canyon for 9-12 km. The other is from Tecopa Bore, a hot spring near Tecopa Hot Springs. The original subspecies that inhabited the hot springs—the Tecopa pupfish (*C. n. calidae*, back cover)—was replaced by *C. n. armagosae* when natural barriers between the springs and the Armagosa River were removed.

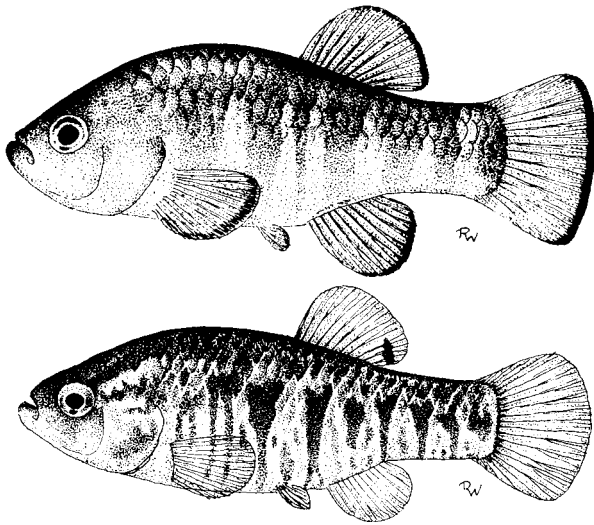


Fig. 1.

Armagosa River pupfish, *Cyprinodon nevadensis armagosae*, male (top), female (bottom). Illustrations by Rudolf H. Wildekamp.
© American Killifish Association.

I acquired six fry of the Tecopa Bore population of *C. n. armagosae* several years ago at an American Killifish Association convention. From what I learned these fry were from a stock that had been maintained in captivity for many years. I placed the fry into a 29-gallon aquarium containing tap water. They grew quickly and were breeding within a few months.

Breeding male colors are blue to violet with several dark bars on the sides. The dorsum is olivaceous with a metallic blue brilliance on the shoulders and upper sides. The belly is light. The dorsal fin is dark gray, shading to black on the outer edge. (Non-spawning males have a pale dorsal fin edged in black.) The anal fin is blue with black edging. The ventral fins are blue and the pectorals are dusky to black. Males start spawning at about an inch long and grow to over two inches in length.

Females are brown with lighter bellies. Markings are variably bars or blotches. Fins are colorless with the dorsal fin having a black ocellus on the posterior rays. Females reach 1.5 inches in length.

C. fontinalis The Carbonera pupfish comes from a series of springs, outflows, and adjoining irrigation ditches around Ejido Rancho Nuevo and Ejido Rancho Alegre, west of Ville Ahumada in Chihuahua, México.

Breeding males are olivaceous to green on the backs. The nape is yellowish. The belly and lower part of the head is white with a silver cast. The sides have 5 to 15 vertical bars. The dorsum between the eye and dorsal fin is iridescent blue to silver blue, sometimes turquoise. The dorsal fin is gray with a yellow to yellow-orange border. The anal fin is blue to yellowish.

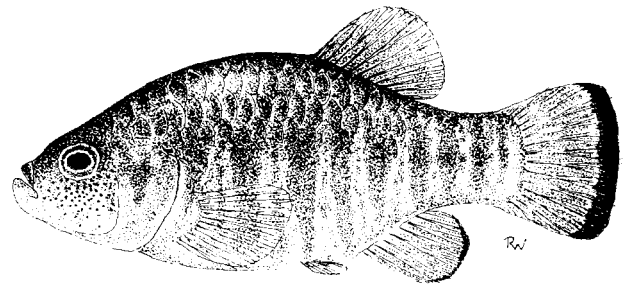


Fig. 2.

Carbonera pupfish, *Cyprinodon fontinalis*.
Illustration by Rudolf H. Wildekamp.
© American Killifish Association.

The caudal fin is white to bluish with a submarginal white band and a wide black border.

Females are olivaceous to brown, some with a golden cast. Several gray-brown bands widen to form a series of blotches on the middle of the body, giving the appearance of a dark band running along the lateral line. The fins are colorless with the dorsal fin having a black ocellus surrounded by white.

Males grow to over two inches in length and begin spawning at half that size. Females grow to just under two inches and also start spawning at about half that size.

Captive Maintenance

Water Conditions and Quality Maintenance of these two pupfishes is identical despite the fact that they come from somewhat different habitats. *C. n. armagosae* lives at a higher temperatures than *C. fontinalis*, in water that's more alkaline. During a visit to Tecopa, California, I measured the water temperature at the springheads to be near 44°C (111°F). Salt encrusted the shorelines of the stream outflows. In contrast to these conditions, I've been told that water from Ojo de Carbonera—where the original broodstock of my *C. fontinalis* came from—has one of the lowest mineral contents of any pupfish habitat. Fortunately, *C. n. armagosae* adapts well to a range of conditions, so I keep both species in well water with a low carbonate hardness and a neutral pH. What's more, both species do well at room temperature in my area (New Mexico). However, since these pupfishes come from springs, water changes should be performed frequently, at least 25 percent once or twice weekly.

Feeding In the wild both pupfishes eat algae, small insects and detritus. In captivity they readily take frozen brine shrimp, flake foods, and brown algae growing in the tank. They are heavy feeders and can be fed several times a day. Well-fed specimens grow rapidly and spawn prolifically.

Captive Propagation

I've bred *C. nevadensis armagosae* and *C. fontinalis* using three different methods:

Method #1: Spawning Mop This method employs the artificial spawning mops familiar to killifish breeders. These mops consist of a bundle of yarn such as nylon. It doesn't matter whether you float the mop using a cork or allow it to rest on the bottom; either way, pupfishes readily use it to deposit their eggs. Eggs are about 1 mm in diameter, which you can easily pick out of the mop with your finger tips or gently with a pair of tweezers. Place the eggs in a small bowl or other shallow container with water from the parents' tank. A fungicide such as methylene blue can retard fungal growth. Check the eggs daily and remove dead eggs with an eye dropper. Dead eggs take on the color of the fungicide and are easy to spot. Eggs hatch fairly quickly, usually in 4-7 days. The fry have a large yolk sac and remain close to the bottom for several days. They eat newly hatched brine shrimp. In a week or so you should transfer the fry to a small aquarium containing water from the parents' tank. Use a small bubble filter or sponge filter to maintain water quality. Perform water changes regularly and transfer the fry to larger quarters as they grow.

Method #2: Gravel Instead of moving the eggs, let them hatch in the parents' spawning tank. Set up a 20-gallon long or 30-gallon aquarium with an undergravel filter and medium to coarse gravel, then allow the adults to spawn. After two weeks move the parents to another tank. Eggs will be deposited in the gravel. The advantage of this method is that more eggs and fry survive because they aren't handled. The disadvantage is that you need to maintain several aquariums to house the breeders as you move them. If the tank is over 30 gallons you can leave the fry in with the parents. Pupfishes aren't as cannibalistic as other fishes. In fact, I've spawned several pupfish species this way.

Method #3: Outdoor Pools Pupfish do wonderfully in outdoor pools. The combination of natural foods and sunlight shows them at their best. The larger size of a pool allows for a larger population and bigger specimens. Make sure your pool has shallow edges. Pupfishes spawn around the shallow edges of a pool and fry thrive in shallow areas. When raising pupfishes, I've had the most success using pools.

Spawning Behavior In all three methods described above, male pupfish set up and vigorously defend breeding territories, driving off other males and trying to entice females into their favorite areas. In pools, males stake out territories

that cover six feet or more of shoreline. Interestingly, the alpha male doesn't always get to spawn. I've watched half-grown males spawning with females twice their size while the dominant male was busy chasing off a rival. Only rarely is damage inflicted during these scuffles.

Notes on Other Pupfishes

Most species of pupfishes can be propagated using the above methods. Some species, such as the White Sands pupfish (*C. tularosa*, back cover) and desert pupfish (*C. macularius*, back cover), require salt in their water to be at their best. Pupfishes also like their water warm, ideally from 27° to 32°C (80° to 90°F). Pupfishes from thermal springs are not as cold tolerant as pupfishes that live in cooler streams and pools.

If you're keeping more than one species of pupfish, make sure they don't get mixed. Females are almost identical in most species, and species hybridize readily. Fry are impossible to tell apart.

If you would like to keep pupfishes, there are several species that can be kept. You can acquire specimens from the *Cyprinodon* and Related Genera Maintenance and Study Group of the American Killifish Association (c/o Darrell Clendinnen, 965 Pleasant View, Castle Rock, CO 80104). Most state Department of Natural Resources are reluctant to issue permits to collect wild pupfishes to private individuals. The only species that can be collected without a special permit is *C. variegatus*, although a fishing license may be required. Check with your local fish and game department if in doubt.

Pupfishes are a pleasure to keep. They are active, colorful, hardy, and adapt well to the aquarium environment. It's also gratifying to help keep an endangered species alive and well. Unfortunately, humans themselves are the main reason why so many pupfishes are endangered. Let's work together to protect pupfish habitats in the wild, and to keep these unique fishes alive and well for future generations to enjoy.

References

- Eddy, S., and J. C. Underhill. 1978. *How to know the freshwater fishes*. 3rd ed. Dubuque, Ia.: Wm. C. Brown Company.
- Soltz, D. L., and R. J. Naiman. 1978. *The natural history of native fishes in the Death Valley System*. Science Series 30. Natural History Museum of Los Angeles County.
- Wildekamp, R. H. 1995. *A world of killies: atlas of the oviparous cyprinodontiform fishes of the world*. Vol. II. Mishawaka, In.: American Killifish Association. 🐡