

Notes on the Captive Spawning of *Fundulus bifax*

Joseph Scanlan

175 Pike Road Trail, Pike Road, AL 36064, drkillinut@mac.com
Photographs by John Brill.

My interest in *Fundulus bifax* began when Dave Koran (native killifish expert with the American Killifish Association) visited my home in 1999. He was on one of his collecting trips and was passing through Alabama. He mentioned that his goal was to catch *F. bifax* and that he feared its numbers were declining in Alabama. He had collected them in large numbers in the past, but now they were hard to find. The only other state where *F. bifax* could be found was in Georgia at the headwaters of the Tallapoosa River, but its last known collection there was in 1991. With rapid development in the area, *F. bifax* is likely extirpated from Georgia.

Dave called *F. bifax* the “canary of the Tallapoosa” because it appears to decline in creeks where water quality is degraded. I asked him if he had ever bred the fish. He said that as far as he knew no one had bred *F. bifax*. This started me on a quest that has lasted more than seven years.

A Substrate Spawner

I had been keeping *F. bifax* in a rubber-lined outdoor pools for over seven years with no breeding success. So, in 2000, I called Pat Rakes of Conservation Fisheries in Knoxville, Tennessee. He said that *F. bifax* was probably a substrate spawner and that a fine gravel substrate would likely be preferred by the fish. So I placed a gravel-filled container inside the pool to serve as a spawning substrate. Still no breeding.

Placing a pair of *F. bifax* in a large aquarium with fine gravel substrate, however, proved to be successful. For the first few years I extracted the gravel with a large siphon hose and swirled it in a large round container. I could usually obtain an egg or two by passing a net over the surface of the gravel, or

by swirling the gravel and rapidly pouring the water into the net. The more violently I swirled the gravel, the more eggs I extracted. Many times the eggs were dead or would die during the incubation period. Even eyed-up eggs that looked like they were about to hatch died. My results were abysmal.

One day I found an egg attached to a piece of fine gravel. This seemed to explain why egg survival was so poor. Violent swirling was necessary to free the egg from its attachment to the gravel, but this apparently damaged the egg capsule. I began to realize that collecting *F. bifax* eggs in this manner was a bad idea.

Shy and Secretive

By nature, *F. bifax* is a shy and secretive fish that prefers to hide next to rocks or logs and under mops in an aquarium. It is easily frightened and, if startled, will dash into the glass or jump from the aquarium. It abruptly stops spawning if there is any disturbance in the room. For this reason it is very difficult to observe the spawning of captive *F. bifax*. In seven years of observation I have only been able to photograph the spawning act once. It happened at midday when the water was warming. Breeding usually begins when the temperature reaches 70°F and peaks in the upper 70s. If the temperature exceeds 80°F, spawning activity slows and eventually ceases.

Feeding *F. bifax*

A rich protein diet is important. The feces of wild caught *F. bifax* usually contain insect parts, so I believe they consume a large number of benthic insects. This may explain why the fish is not found in degraded streams. Prior to the breeding

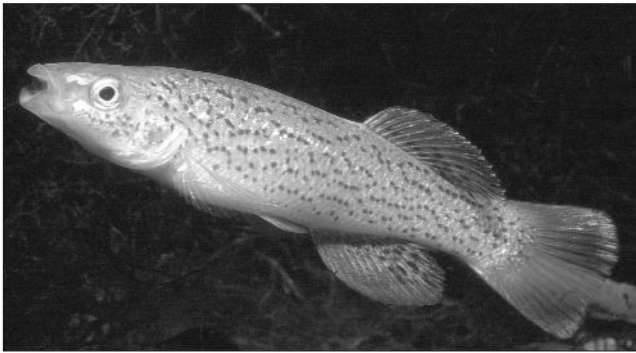


Fig. 1.

Fundulus bifax, adult male, c. 6" TL, tank-raised from wild young fish, Hillabee Creek, Tallapoosa Co., Alabama. Note the spade-like upper and lower lips that are used to dive into gravel and sand for spawning and food (benthic insects?).

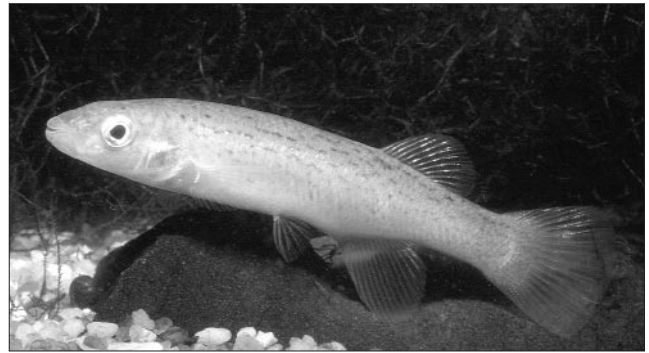


Fig. 2.

Fundulus bifax, female, tank-raised from wild young fish, Hillabee Creek, Tallapoosa Co., Alabama. Note the shape of the head and closed mouth. It's easy to imagine how this fish disappears into the gravel when frightened. This often occurs when attempting to net this fish in the aquarium or when seining a creek.

season I stuff the fish with as many redworms and slices of gulf shrimp as possible. They also avidly consume tadpoles, dragonfly larvae, fish eggs and fish meat. During breeding they can consume as many as six redworms a day. A poor diet results in a failure to breed and the wasting away of the fish, so be prepared to feed them a huge amount of food during the month of May when breeding peaks.

A Spawning Trio

In the past, my usual set-up consisted of either a 55- or 30-gallon aquarium with a single pair of mature fish. One year after removing multiple pairs of *F. stellifer* from a 55-gallon tank, I noticed that a large number of fry began to hatch out. So this year (2007) I placed a trio of *F. bifax* in a 55-gallon tank on 15 May. I removed the trio on 1 June, and by 16 June I had removed 79 fry. It was my most successful hatching of *F. bifax* ever. Lesson learned: Fry never appear in a tank in which the parents have *not* been removed.

Spawning Behavior

The clue that spawning is about to begin is the closeness that a pair assumes while exploring the substrate. Usually there is a prolonged period of "cleaning" that actually precedes the spawning act. The male leads off by picking up mouthfuls of gravel and spitting them out. Actual spawning begins when he displays before the female by snapping his head downward, as if to say, "This is the place!" He does not actually pick up gravel during the spawning act itself, but rather moves his head as if he is going to. Only his chin or lips actually touch the gravel at this time.

The female appears to ignore the male's attention until she suddenly assumes a vertical position over the gravel and plunges her entire head into it, bringing up a large mouthful. She then positions her ovipositor over the small depression she has made. The male immediately races over to her side and positions himself directly parallel to her. Both list at a 45° angle and, with much excited quivering, sink a little toward the small depression. The female spits out the gravel, either before, during, or after the sex act. Within a matter of seconds, or usually minutes, the act is repeated and continues on for several hours.

Since spawning lasts for several hours, I presume the female is releasing a single egg at a time. Of course, it all happens so quickly that it's impossible to see the egg. Since fry appear over a period of two weeks, the spawning activity likely continues almost daily. This is evidenced by the fact that at the end of the two-week period of hatching, all the fry are of different sizes, with the first-hatched fry being almost twice as big as the last-hatched.

Collecting and Feeding the Fry

Since the incubation period at 75-80°F lasts about two weeks, I removed the adults and waited for the fry to appear. They did so two days later, with additional fry showing up each day thereafter. Since I believe the incubation period is 14-16 days, I didn't look for more fry after 16 June.

F. bifax fry are hard to find and have an uncanny ability to make themselves invisible by hiding next to the side of the tank or under any floating objects. I found that the best way to bring them out of hiding is to feed them baby brine shrimp.



Fig. 3.

Hillabee Creek at its confluence with Josie Leg, looking upstream from Highway 22 during high water conditions. During the summer, when the water is lower, there are a few backwaters where *F. bifax* can be found. Most members of the *Fundulus* subgenus *Xenisma* do not like fast water but will seem to wait in the backwater where they can probably ambush the foods coming downstream. I believe they do not prey on other fishes as a rule, but prefer benthic insects.

The Ideal Spawning Set-Up

The large number of fry I obtained in the spring of 2007 has convinced me that I have discovered the ideal set-up for reproducing *F. bifax* in captivity.

F. bifax requires extremely clean conditions with excellent filtration and aeration. I mounted powerheads on sub-sand filters at each end of my spawning tank. One sub-sand filter had normal flow with an aeration tube. The other had a reverse flow with a sponge filter. This produced a constant but subtle movement of water. In addition, I had a double bio-wheel external filter running during the two-week spawning period. I placed extra carbon in the filter to produce the purest water quality possible. It's also worth noting that before placing my spawning trio into this tank, I changed all the water and cleaned the gravel.

It may also be beneficial to simulate stream conditions as much as possible. The streams where *F. bifax* are still found are usually neutral in pH and low in hardness and alkalinity. During the spring of 2007 we had heavy rains, so I used a lot of rainwater in the spawning tank since my well water is hard and alkaline.

Conservation

The state of Alabama classifies *F. bifax* as a species of "Special Concern." Georgia, where *F. bifax* is likely extirpated,



Fig. 4.

Looking upstream at tributary stream Josie Leg from where it spills into Hillabee Creek. Water level is above average. As a rule, *F. bifax* are found in the shallow, slow backwaters of such a creek.

lists it as "Endangered." With the rapid expansion of "civilization" and the deforestation that invariably goes along with it, we can expect a future decline in this species. Not surprisingly, heavy forests remain around the streams where *F. bifax* can still be found.

Large chicken farms and farming activity abound in western Georgia. As a result, the Tallapoosa River gets loaded with nutrients as it enters Alabama. Lake Wedowee (R. L. Harris Reservoir) traps these nutrient-rich waters, serving as a filter. The water coming out below the dam is of better quality than the water flowing into it from the state of Georgia.

F. bifax can only survive where the water and substrate are cool and clean. It thrives in cool upland streams that flow from heavily forested areas, like the Talladega National Forest. There are historic collection sites in the Middle Tallapoosa River, but I have never seen them there.

The message for us Alabama stakeholders is clear: We must start educating the public now if we are to preserve our pristine freshwater resources. *F. bifax* can be the "canary" that helps us determine how well we are doing. ←

Mark your calendar!
2008 NANFA Convention
 Texas Freshwater Fisheries Center
 Athens, Texas
 September 25-28

Details coming soon.