107-lb Spoonbill Sets Nebraska State Record

While fishing in the Missouri River this fall, Louis Maring landed a whopper of a fish. The Merna, Neb. man caught what was confirmed as a new Nebraska state record. The paddlefish, which was caught Oct. 6, 2011, weighed in at 107 pounds 12 ounces. The leviathan was caught off the bank on the south side of the tailwaters of Gavins Point Dam. It was weighed on a certified scale at a local grain elevator in Yankton, S.D. The fish measured 51 3/4 inches eye-to-fork, had a girth of 39 inches, and was 74 inches in total length. Of its nearly 108-pound mass, about 40 pounds were viscera, mostly fat, and had no eggs. It had a South Dakota GFP jaw tag number PP4568. The fish was tagged June 2, 1992, below South Dakota's Fort Randall Dam. Since then it has grown 10 inches in length and added nearly 60 pounds. Nebraska Game and Parks fisheries outreach program manager Daryl Bauer believes the fish spent the past two decades living in Lewis and Clark Reservoir, which is upstream of Gavins Point Dam, prior to escaping this past summer during large releases resultant from record breaking floods on the Missouri River. Bauer estimated the fish to be about 40 years old at the time of capture.

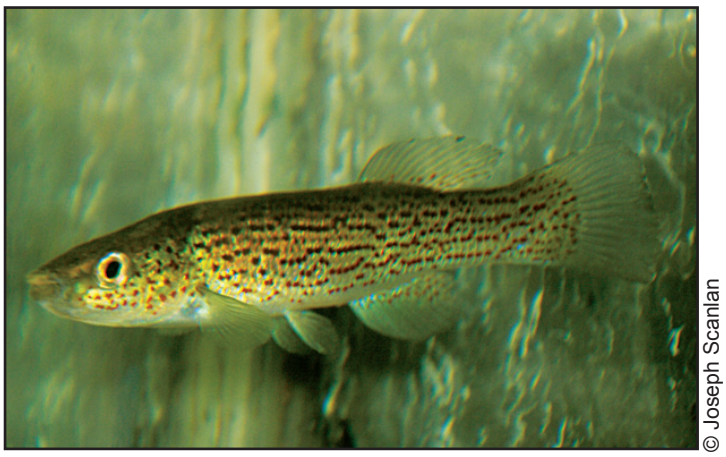

Fig. 1.
A breeding male Southern Studfish (*Fundulus catenatus*) is on full display in Joseph Scanlan's tank.

Fig. 2.
A female Northern Studfish (*Fundulus catenatus*) in full breeding colors. NANFA member Joseph Scanlan shares his tips for breeding *F. catenatus* and its close relative, the Southern Studfish (*F. stellifer).* Read all about it on page 17.

Observations on the Aquarium Spawning of the *Xenisma* Group of Killifishes in Alabama

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In the 2008 Winter issue of *American Currents*, I described the spawning activity of the Stippled Studfish, *Fundulus bifax*. Since then, I have successfully spawned and raised fry of the other two *Xenisma* fishes. All are substrate spawners. They do not spawn on plants like most other species of *Fundulus* fishes. The female fish does dive head first into the substrate in order to create a small depression in which to lay a single egg. A good description of this behavior is given in the 2008 *Currents*.

Alabama has the unique distinction of having more species of native fishes than any other state in the United States. Among these are 19 species of killifish, 13 of which are entirely fresh water. Three of these species are in the subgenus *Xenisma*: the Northern Studfish, *Fundulus catenatus*, found mostly in creeks draining into the Tennessee River; the Southern Studfish, *Fundulus stellifer*, which is found in creeks of the Coosa River system; and the Stippled Studfish, *Fundulus bifax*, which is found only in a limited number of creeks in the Tallapoosa River system. Though geographically widespread, none of these fishes could be considered common in Alabama waters.

Fundulus bifax is the least common and most threatened. Alabama lists it as a species "of moderate conservation concern." The *Xenisma* fishes are called "top-water minnows," but are commonly seen deeper in the water column than most members of the *Fundulus* genus. They are larger and faster, and, in my experience, always seem to avoid capture by dip-netting. Most often, they are found in sandy or gravelly bottoms of cool streams that have good cover, moderate flow, and high water quality. As a rule, the streambed is dense rock substrata with a moderate gradient. They favor the shallow edges where there is good cover provided by a large rock or log. They do not like fast-moving water and are often found lurking in the backwater regions of moderately flowing streams. When in search of *F. bifax*, there is no use looking at muddy bottom creeks as they are never found there.

The usual method of seining these fish produces poor results. These fish can dive for cover or dash well ahead or around the collector. I have also seen them disappear in fine gravel or leaf litter, both in nature and in the aquarium. Very rapid seining in shallow water is much more effective, especially if there are others present to chase the fish into the seine. One must always seine that last inch of

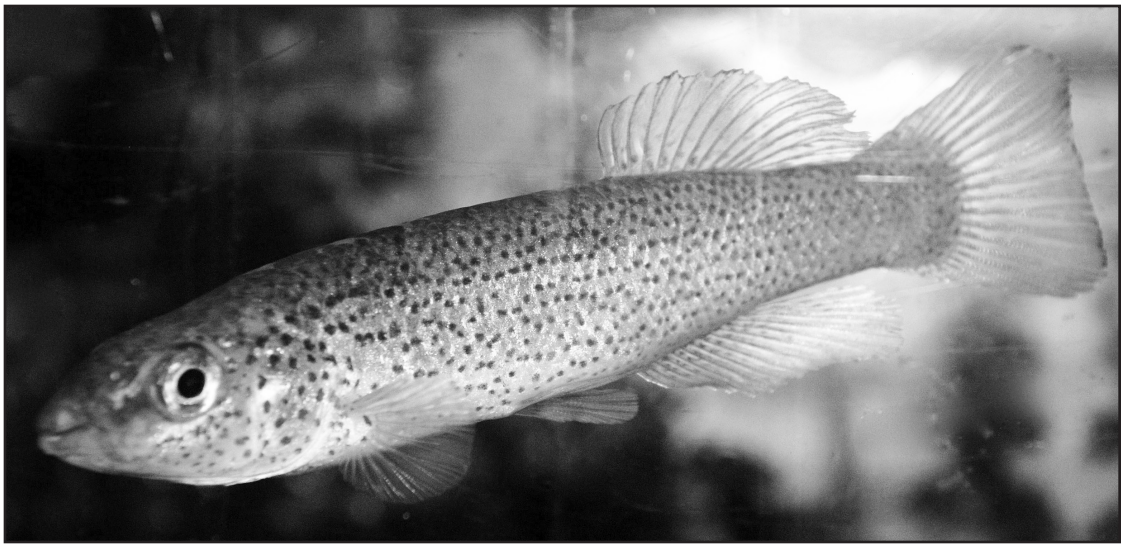


Fig. 1.
A typical non-breeding male Southern Studfish (*Fundulus stellifer).*

Fig. 2.
A typical non-breeding male (top) and female (bottom) Northen Studfish (*Fundulus catenatus).*

water at the edge in order to have a successful sweep. To prevent these little leapers from escaping, a capture bucket with a good tight lid is a must.

When placed in an aquarium that is designed to simulate its natural surrounding it spawns in a manner much as it would in nature. I always provide them with as large an aquarium as possible, as the fish always do much exploration in pursuit of appropriately sized substrate. Once a sufficient site is selected, the fish begin to pick up and move the gravel as part of spawning preparation. Because of this, the gravel must be small enough to fit in the fish's mouth (about 2-3 mm). I always use maximum filtration, using substrate filters with large tube bubblers, in addition to an outside bio-wheel filter for additional oxygenation of the water. Use activated charcoal and peat when possible to keep the water as pure as you can. These fish are happiest when there is a rock, log, or plants nearby so they may dash away to hide if the aquarist gets too curious. Aquarium covers are necessary to prevent leaping, which these fish often do when startled. Because of their shyness, they can be very difficult to photograph. As a result of their skittish countenance, I have spent years trying to get the photos you see in this article.

All these fish species posses a huge appetite, which must be satiated prior to, and in particular, during spawning. During this time, they should be fed lots of live foods. I use chopped and whole earthworms, tadpoles, dragonfly larvae, crushed snails, frozen brine and chopped gulf shrimp, and other similar types of live feed. It is interesting to note that these fundulids can be induced to eat a badly traumatized *Gambusia*, but will not eat healthy fish. I am sure that these studfishes' menu rarely, if ever, features dishes of a piscivorous nature.

In its natural setting, the species' spawning will begin when the water temperature reaches 70 degrees Fahrenheit and peaks between 75-80 degrees F. The spawn begins in late April or early May, depending on the weather, and ceases altogether with hot July temperatures. This corresponds to lengthening of daylight and rising water temperatures. At that time of year, in healthy creeks, the population of macroinvertebrates is at its peak. I am sure they are the major food source in nature. Since degraded creeks possess poor populations of these insects, this consideration may explain why such creeks show a poor population, or even absence of *Xenisma* fishes.

In 2007, Alabama had record-breaking high temperatures in the month of April. As a result, the spawn of both *F. bifax* and *F. stellifer* began in early April. Normally, the spawn does not begin in earnest until the first few days of May. Several times over the years, I have tried to prolong the spawning season through the month of July by using an air conditioner to cool the water temperatures. This has never succeeded.

Fig. 3.
Joseph just about ready for a day of seining for Studfish in Cornhouse Creek.

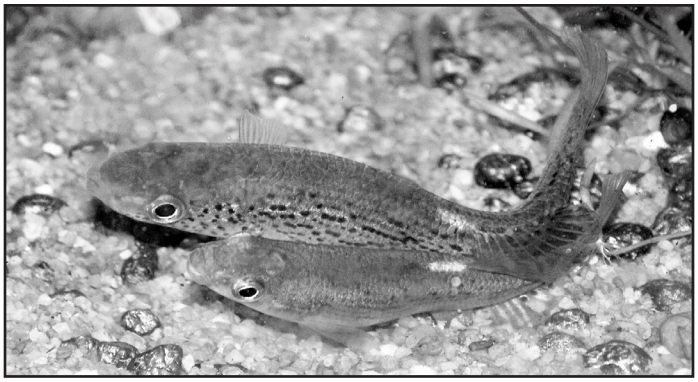
Once spawning begins the fish moves the gravel substrate either by repeatedly pecking at it or picking it up in mouthfuls. Both sexes begin to do this, and sometimes they can be seen to do a repeated "glancing" off the gravel's surface. At this time, these "top-water minnows" begin to spend most of their time swimming very close to the gravel's surface. I have observed this activity, sometimes for many days, without ever seeing any attempt at actual spawning.

The sexual activity of these fishes is very interesting. Intense breeding occurs during the course of one day, from early morning to late afternoon. Sexual encounters can occur every few minutes. These bursts of activity are followed by a rest period of many minutes. Such repeated cycles can sometimes last an entire day.

If an egg is laid during each encounter, one would expect to see a large number of fry appearing about 16 days later; however, this is not the case. I have never been able to collect more than four or five fry in one day and many days only one or two fry can be collected; still some days, no fry appear. This can be expected since the fish frequently will go two or three days without any spawning activity. Activity on many days is very secretive and I do not observe spawning.

I cannot explain the apparent disparity between the observed sexual activity and the consistent, almost daily, appearance of young fry. Either the sexual activity I can observe does not result in the deposit of many fertile eggs, or there could be some mechanism to delay hatching so that only a few fish are hatched on the same day. In keeping with their reclusive nature, it is certainly possible that on many days the fish quits spawning as soon as they are aware that someone is in the room. I have observed many times that as I enter the fishroom, the spawning pair will rise from the gravel and seek shelter behind the cover of plants or logs. How do you explain the fact that on most days during the hatching period I can collect at least one fry from the aquarium, yet spawning does not appear to be a daily event? I think these fishes rest for at least several days between spawning frenzies. But, it is possible that they are just too modest to let anyone observe their spawning activity. I cannot emphasize enough how shy these fish are.

I have given up trying to remove eggs from the substrate, since my experience with *F. bifax* and *F. stellifer* gave such miserable results. The best hatching results are obtained when the parents are removed



Figs. 4 and 5.
The courting behavior observed in *F. stellifer.* The male and female pair off and swim side-by-side (left) over a small area of clean gravel. Once mating occurs, the male and female release their gametes just above the gravel's surface.

and placed in a different spawning tank after 16 days. If the parents are left in the aquarium, dense floating plant cover or mops must be provided or fry will never appear. Since the production of new fry can continue for more than eight weeks, there is great variation in size among the fry collected over the course of the breeding season. For example, one-year-old fish will grow to a length of two or three inches, but are not yet mature enough to breed, and some of the fish from the same cohort will still be half the lengthy of their siblings.

Most of my observations have been gleaned from years of breeding *F. bifax*. Though many aspects of reproduction are similar across all three *Xenisma* species, I have observed a few behavioral variances. I wanted to know if the other two *Xenisma* fishes exhibited the same breeding behavior I had observed with *F. bifax*. In the fall of 2006, I first collected a group of *F. stellifer* from Swamp Creek. Many of these fish were sick due to the year's severe drought, which resulted in poor, sluggish low-water conditions. However, over time, several of these collected fish survived; by spring, I had a small group of healthy, young adults.

I had little initial success. I extracted the eggs from the gravel using the swirling technique described in the 2008 *American Currents* article. I collected only a few fry that year and most of the extracted eggs died. The following year, I had three *F. stellifer* pairs and a couple of extra females. I kept them in a 55-gallon tank. Two of the males developed an intense black border on the caudal fin and a small grey white bar just anterior to the eye. This was a remarkable transformation of color intensity within a matter of 24 hours.

F. stellifer's breeding activity was similar to what I had observed with *F. bifax*; however, there were a few notable differences. The males did not do as much gravel preparation or head-bobbing as *F. bifax*, rather, they appeared to watch the females carefully and were instantly on the female once she had made up her mind about a good place to dig her pit. Not surprisingly, I collected lots of fry that year from the dense floating plants. These fish had taught me that it was possible to collect fry from the aquarium even with the parents present, but dense floating cover had to be provided.

In 2009, I set up a tank for *F. catenatus*. I had collected a single pair the previous year in a northern Alabama creek. During the months of May and June, I saw much activity as the male and female would swim around together near the gravel surface and would occasionally pick up gravel to spit out. I watched this behavior carefully, as I knew they must be spawning, but I never saw a single contact. To my surprise, after a couple of weeks, I began to collect fry from the floating plants, usually one or two fish per day, though, some days none at all. So, this fish was exhibiting all of the secretive and shy behavior seen in the *F. bifax*. I was not able to photograph or, as much, even see a spawning event. It wasn't until the following year that my luck changed.

In April of 2010, the color intensity of the *F. catenatus* male had again become spectacular. He developed a whitish bar over and anterior to each eye. Its body's blue background color became iridescent. The female began to vigorously pickup and spit out mouthfuls of gravel, as she moved about all over the tank. Just like *F. bifax*, she would assume a vertical position over the gravel and plunge headfirst, coming out with a mouthful of gravel. Spitting it out, she would go immediately to another nearby site to repeat the same maneuver. After one final, more violent head, thrust she would position her ovipositor over the pit and the male, rushing to her side, would then position himself exactly parallel to her and push her down into the gravel. Twisting almost 45 degrees, and ecstatically shaking, they complete the sex act. Indeed, the act is so violent that gravel around the fish seems to fly out of the pit. One wonders if this has the effect of burying the egg? This behavior was exactly the same as I had

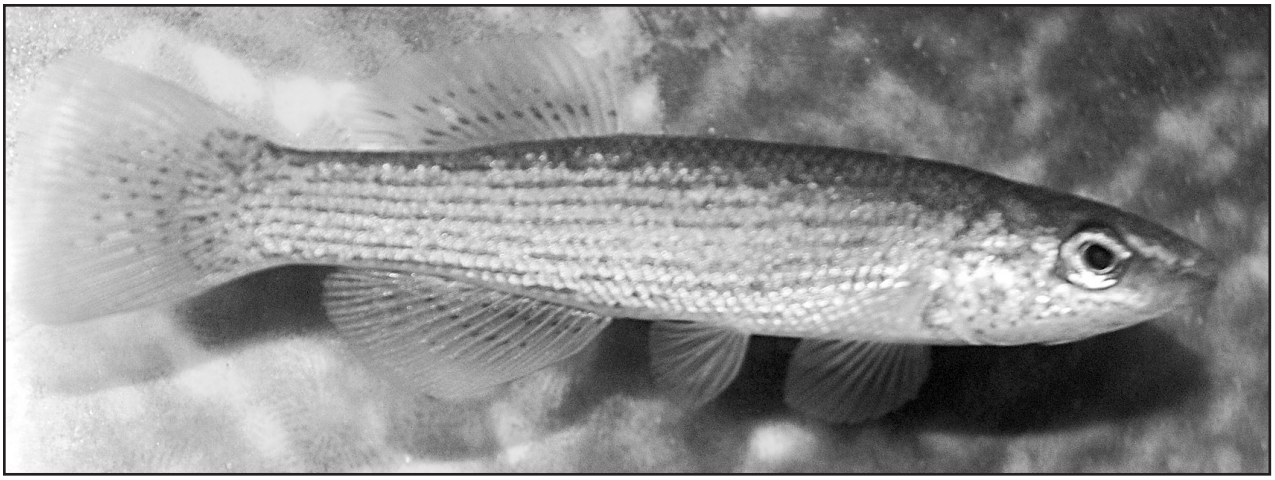


Fig. 6.
A typical breeding male Northen Studfish (*Fundulus catenatus).*

seen many times with *F. bifax*, except that the male *F. catenatus* put more time and effort into watching the female rather than helping her clean the gravel.

For those considering breeding these beautiful species, I've included a few bits of advice that should help ensure your success. Over the years, I have learned that substituting 50-percent of the aquarium's water with rain water is a very effective way to induce spawning in these *Xenisma* fishes. Intense filtration and using every possible way to increase oxygen content is also of utmost importance. However, most critical is the necessity of providing a diet of live food. A clean, small-gravel substrate is desirable. These fish will not reproduce in outdoor pools loaded with plants and containing a detritus-littered bottom. I have as yet been unable to get the fish to spawn over fine sand and I am sure that a course rocky surface is, likewise, undesirable. To remedy the substrate situation, I have collected my own substrate by using a window screen to sift river sand in order to extract the fine gravel from it. The gravel left behind on the screen is of desirable two-three mm size. I always use under-gravel filters, so there is flow through the substrate. I reckon this may be important for the viability of the deposited egg. I have not decided if having more than one pair of fish, or having trios, is beneficial or detrimental to fry production. I do know that fry never appear in tanks without floating dense vegetation as these fish must eat their newborn fry.

In summary, I see no major difference in the spawning techniques used by these three species. *F. Bifax* seems to demand the most fastidious cleansing of the substrate. The female *Xenisma* fish always does the lioness share of site preparation. The male *bifax* sometimes will start the process and is a very active participant, whereas the *catenatus* male does a lot of watching the female is anticipation of what is about to occur. Of the three species, *stellifer* seems to spend the least time preparing the site and goes rapidly about the business of reproduction. Maybe this behavioral difference explains why they have a broader range and can be found in creeks with a little less water quality? Or, are they surviving because they eat more terrestrial insects, rather than the benthic insects that *catenatus* eats. McCaskill in his study of the *catenatus* diet in 1972 states this, and I am sure *bifax* does exactly the same.

There is a general consensus that most of our non-game fish populations are declining and attempts to captive breed them are increasing. The *Xenisma* fishes are no exception. Since we know that high-quality streams with good macroinvertebrate populations are important for their survival, how do we maintain them? Too me the solution is obvious. Healthy riparian regions with lots of trees is critical. The trees produce lots of leaf litter. Leaf litter is the food of the macroinvertebrates. The macroinvertebrates are a major food source for our fish. The reckless clearing of the forests, for agriculture, poultry factories, and cattle ranching is contributing to the habitat destruction so catastrophic for these fishes. The question is can we learn to do these things and still preserve the beautiful habitats these fish require? Learning to captive breed fishes is critical if in the future we are to repopulate our restored streams. Someday my experience may be of real use, but I hope we will never be forced to use it to put beautiful fish like these back into our streams.