

## SPAWNING THE EASTERN MUDMINNOW (*Umbra pygmaea*)

by John Eccleston .

I have discovered a new method to induce fish to spawn: by writing an article saying that they will not breed in the aquarium! In the March/April edition of Lateral Line, I described the Eastern Mudminnow and briefly explained my failed attempts at breeding in 1981. My stock of these fish at the end of 1981 consisted of seven fish, three of them about 3½-4" and the remainder between 2" and 3" in length. They overwintered in a 20-gallon aquarium with a few small sunfish and a Tadpole Madtom (*Noturus gyrinus*). The room was unheated and though the water in this aquarium did not freeze, that in most of the other aquaria in the room did, so the fish were probably subjected to long periods of below 40°F. During this time, all of the fish were eating regularly, mainly frozen bloodworms and occasionally live adult brine shrimp.

This was the state of the aquarium on March 27. That evening, after removal of a thick layer of brown algae from the front glass, I noticed that one of the 3½" fish, obviously swollen with eggs, was being courted by two of the smaller fish. This behavior consisted of quivering of the body and a display of the fins. No obvious change in color or markings had occurred in any of the fish. Although I did not wish to move the female at this stage, I thought that attempts to remove all of the other fish would be even more traumatic. I therefore set up an aquarium containing 50% water from the original tank and 50% aged tapwater. The bottom was covered with 1" of gravel; several pieces of rock were placed on this together with a flower pot on its side. I was under the impression that these would provide suitable cover for spawning. I also placed a piece of synthetic spawning yarn, about 6" in diameter, in the bottom of the tank. The female was transferred to this setting within two hours of my initial observation of breeding behavior. The next evening, the smaller males were added.

Spawning occurred sometime during the next day (March 29), since by 6 p.m. the female was obviously much thinner. She was hovering over the spawning material, and closer examination revealed the presence of relatively large (c. 1.5 mm diameter), transparent, adhesive eggs apparently scattered all over the material. The two males were well away from the 'nest', and though they made occasional forays towards it, they were vigorously repelled by the female. They were removed from the aquarium after two days, when it was clear that they played no part in caring for the eggs.

The temperature of the water on the day of spawning was 55°F and the pH was 6.7. (The pH in the tank in which the fish overwintered was 6.3.)

For the next two weeks, the female remained close to the eggs, usually hovering or resting over them. Although often making the characteristic paddling motion with the pectoral and ventral fins, I would not characterize this as active fanning of the eggs, as occurs with Cottus species. She occasionally could be induced away from the eggs with live food, but fed little compared to before spawning. The temperature of the water over this period varied between 57°F and 45°F. Hatching of the eggs occurred on April 15 (10 days' incubation) when fry approximately 6 mm long were observed at the surface of the water, on sides of the aquarium, and on the bottom. The female was removed from the aquarium at this stage.

Unfortunately, I had to leave home the day the eggs hatched for 10 days. However, this was not the disaster I expected. On returning, all of the fry (now about 8 mm long) were free-swimming, but remnants of the yolk sacs could be observed on some of them. Initial attempts to feed frozen brine shrimp were unsuccessful, but they readily took newly hatched shrimps as soon as I could hatch a culture. This was their staple diet for the next few weeks.

Attempts at counting the fry at this stage usually resulted in numbers of about 80, so it is likely that the total number was over 100.

At the time of writing (July 4), they are 2 cm long, and the dark vertical band on the caudal peduncle is well defined on all of them. Pigmentation is starting to appear on the bodies of some of the larger ones; the horizontal bands are also becoming visible on some of these larger ones.

A larger supply of food and less absence from home on my part would probably have resulted in a much faster rate of growth. Despite extensive feeding of the female, there is no sign of any second spawning.

The Atlas of North American Freshwater Fishes states that no definitive studies have been made of the biology of this species, though Breder & Rosen's Modes of Reproduction in Fishes quotes from several old accounts of spawning behavior in the wild and in the aquarium. They are generally in agreement with my observations, though some of the accounts differ markedly from my experience. For example, one author describes the construction of a nest hollowed out of a mass of algae, the opening of which was closed after spawning. Eggs are also reported to be deposited in a single layer on the undersides of rocks; in this account, the male as well as the female appears to guard them. Another author describes spawning occurring in early June in the Philadelphia area; he says the eggs are yellowish to bright orange. Whether the variations of the published accounts and my observations is due to dietary factors or effects of captivity on behavior is not clear. It may be that this fish has a wide variety of nesting behavior, depending on habitat.

One interesting aspect of the behavior of U. pygmaea discussed by Breder & Rosen is an upstream migration of the fish before spawning. They are described as working their way up ice-cold brooks over miniature cascades, not unlike salmon, to fresher and cleaner water. Although I obviously could not study this aspect of their behavior in an aquarium, this migration does not seem to be an essential prerequisite to spawning.

In conclusion, I would like to repeat my observation in the March/April Lateral Line that the Eastern Mudminnow is an interesting and rewarding fish to keep in the aquarium. My only reservation then--that it would not breed--has been dispelled!

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