

FUNDULUS CINGULATUS

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Fundulus cingulatus is an egg-laying toothcarp of the family Cyprinodontidae. It hails from the southeastern United States, mainly from states bordering the Gulf of Mexico, under conditions which will be described. Most importantly, it is a species which adapts immediately and splendidly to the aquarium environment--and is very attractive to boot! My first cingulatus were wild-caught specimens skillfully captured and shipped by a fellow North American Native Fishes Association member, Bill Ballard of Elberta, Alabama. They arrived in excellent condition. Bill included painstakingly thorough notes on the species' appearance, habitat, and preferences. Those findings are paraphrased as follows:

The best comparison is with F. chrysotus [a species more familiar to killie and native-fish aquarists--BMCD]; size (3") and shape are about the same. Females look much like female chrysotus, but without the glittery spots on the side. Males are slightly reddish with bright, lemonade-pink fins; on well-developed males, the tail often has a gray border. Once found in tidepools along the lower parts of streams and in sluggish lowland creeks; has become rarer in recent years. Seems to be tolerant of brackish water, but seems to be "hated" by brackish killies! Often found in areas where a red algae thrived; this might explain the males' color. It prefers water that is almost fresh, but with just a very slight bit of salinity. It will likely breed well in captivity if given the right conditions. I've never seen it on any endangered list, but feel it should be watched and conserved.

To flesh out Bill's accurate description just a bit, males' unpaired fins take on (in subdued lighting) a deep rosy hue; horizontal rows of red dots run along the flanks. Females' color is pale by comparison, which causes the vertical bar along their flanks to be more prominent than those along the males' sides. A fleshy area, referred to as the "spawning sac" by some sources, adjoins the leading edge of the female's anal fin and is a clear indicator of sex. The same may be said for the eye of the male, which reflects a beautiful blue sheen and bears an hourglass-shaped pupil.

As luck would have it, I was between "obsessions" at the time of obtaining F. cingulatus, and was able to devote an entire 29-gallon tank to their care. As later research (Axelrod, et al.; Sterba; Terceira) revealed, plenty of swimming space

is a distinct factor in the well-being of this species. The full 30" (76mm) length of the tank is well used during the cingulatus' "playful" chasing; a tank much shallower than their 18" (46cm) home would, however, serve just as well--this is decidedly an upper-level fish. Having recently housed a breeding colony of Jordanella floridae, the selected aquarium was already compatible with this Fundulus' needs. The water was soft (via our household softener only; no measurement taken), warm (80°F/27°C), and had been subjected to raised salinity (c. 3 tsp. Instant Ocean marine mix per gallon). A massive water change was performed, though, both to remove dissolved wastes and to lower the salinity, to c. 1 tsp./gal. Fresh, softened water of the same temperature was added and the eight cingulatus were released after only a brief temperature/chemistry adjustment period. Perhaps the most remarkable of this species' admirable qualities (and it has many!) is its almost incredibly adaptive nature.

At the time of their arrival, I had no live food cultures going and simply tossed them a few dry flakes. You'd have thought they were raised on the stuff! While I now make every effort to provide a generous balance of nutrition and variety, Fundulus cingulatus has yet to refuse any item offered. With the exception of breeding periods, my cingulatus receive a diet of dry (flakes, pellets), freeze-dried (ocean plankton), frozen (brine shrimp), and live (daphnia, baby brine shrimp) foods. Regular water changes (of 2-4 gals. weekly) are performed. When combined with the services of undergravel filtration and several hundred (or million?) Malayan Livebearing Snails, these changes maintain water quality in the sparsely populated tank. Decor consists of a fairly heavy concentration of rocks, drift-wood, and both live and artificial plants. As stated earlier, no long-term exploration of the substrate is made by F. cingulatus, though food is taken at all levels; thus, behavioral interaction with the decor is minimal at most. Plant matter, even floating masses of Water Sprite and Najas sp., seems not to have any dietary or behavioral significance for this species.

As some individuals have doubled in size to nearly 3" (7.6 cm) in roughly 60 days, it must be assumed that the conditions and procedures described are to the liking of this fish. When sexual distinctions were researched and observed, it was soon evident that my colony consisted of a 7:1 male:female ratio. Fortunately, males are not hard drivers, and--in spacious conditions, at least--they do not really fight among themselves. Due to the endless chasing and occasional group courtship, however, it was quickly evident that separate quarters would be needed for a successful spawning.

Lacking an available tank, a two-gallon drum bowl was hopefully pressed into service. Three nylon-yarn mops, previously boiled, were placed in the bowl and covered with two or three quarts of water from the cingulatus tank. Conditions (salt,

temperature) tapwater was added to raise the level to the widest point of the bowl's dimensions; no aeration was to be provided. In this volume, about 1 gallon, the mops filled at least 30 percent of the water space. The lone female, now plump and active, and the largest, most colorful, most vigorous male were placed together in the bowl. My expectations ranged from anxious anticipation--having read that the species has "probably not yet bred in captivity" (Sterba)--to calm confidence.

More recent literature (Axelrod, et al.; Terosira) regards propagating Fundulus cingulatus as "not difficult," and assigns it to the "Beginner" category. My references repeatedly refer to a "spawning period" of from four to seven days; I elected to leave the pair in a dim and quiet location for the longest interval mentioned. Only live foods (daphnia and brine shrimp nauplii) were used, in order to preserve cleanliness, and a few ounces of green water were added every couple of days. This latter was both to render the environment more "natural" and to sustain any food organisms hidden within the tangle of yarn. Little time or opportunity for observation of the actual spawning process was available; twice-daily feedings and verification of harmony (no aggression or damage ever occurred) were the only "intrusions" I made.

On the eighth day, the pair, still compatible and vigorous, were returned to the tank. I decided to leave the eggs alone, despite seeing one fungused ova, since I hoped that the now-thriving colony of daphnia would "filter" the water of any harmful bacteria, etc. At the end of the longest incubation period I'd seen cited--15 days--I checked the mops manually. A total of 21 eggs at nearly complete stages of development were found and placed in a small container filled with water from the bowl. They were relatively large (0.1"/2mm), and the fry were readily visible through the membranes. The lower temperature of the bowl, probably 74°F/21°C, had seemingly slowed and perhaps coordinated their rate of development. After another three days (and four days beyond the "maximum"), I elected to force-hatch the embryos. A small vial containing the eggs and very little water was warmed and agitated by carrying it around in a shirt pocket. I breathed into it periodically to introduce carbon dioxide. After two hours, and over a period of 20 minutes or so, eight fry hatched out and were returned to the spawning bowl. The mops had been removed and replaced with a clump of Java moss. The last two of this earliest group were small, and still bore a large yolk sac. They had apparently hatched prematurely during my efforts. From then on, the container's water was changed daily, but no further measures were taken to hasten fry emergence. The next day saw six more hatches and two "preemies"; the final two fry hatched on the third day, but only one survived its first hour.

While "forcing" was clearly inferred from the published data on this species, its application here served to indicate that: (a) Fundulus cingulatus does appear to concentrate spawning within periods--in this case, at least three days; (b) embryos require full-term development (no premature hatchlings survived); and (c) the duration and intensity of force-hatching methods must be adjusted downward for this and other "cyclical" species. It must also be assumed, though, either that the existing literature (Axelrod, et al.; Sterba) understates the incubation time or that, more probably in this case, temperature has a decided bearing upon development term--this despite the fact that the adults functioned, and spawned, normally in the cooler water. Viable, healthy fry are fairly easy to rear.

Reintroduced to the spawning container over a three-day period, the young cingulatus were all still the same size (1/8"/0.3cm) and grew very slowly until at least five days post-hatch, when brine shrimp nauplii were aggressively taken. To that point, piscine nutrition may have been hampered by the hungry population of daphnia which had multiplied in the bowl. At least overfeeding was not a problem; the livebearing water fleas eagerly supplied more mouths whenever an overabundance of food appeared. A wide range of small food items (green water, vinegar eels, Wardley's Small Fry liquid, live baby brine shrimp, and TetraMin Baby-Fish Formula "E") was stirred into the bowl daily. A single Pond Snail was introduced to dispose of unconsumed matter, and to encourage infusoria via the decomposition of its own wastes. Half of the bowl's water was changed every day. Of the eleven fry which were allowed full embryonic development, all have survived, at this writing, for 50 days. They have reached 1/2"/1.25cm in length.

Fundulus cingulatus is a very pleasant fish to have around. Its appearance, especially that of males, is impressive, with a subtle, warm beauty not common to many American species. Its manner is one of inquisitive flamboyance--active at all times, not spooked by viewer scrutiny, enthusiastic in greeting their keeper. Its propagation is a somewhat uncommon feat, but is relatively straightforward and simple to accomplish. In short, this species offers everything to the aquarist looking for something different. Further, it makes very few demands upon those of us fortunate enough to obtain it. Added to this, of course, is Mr. Ballard's impression of a decline over its range in the wild--a further, and important reason to maintain this delightful fish.

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References

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