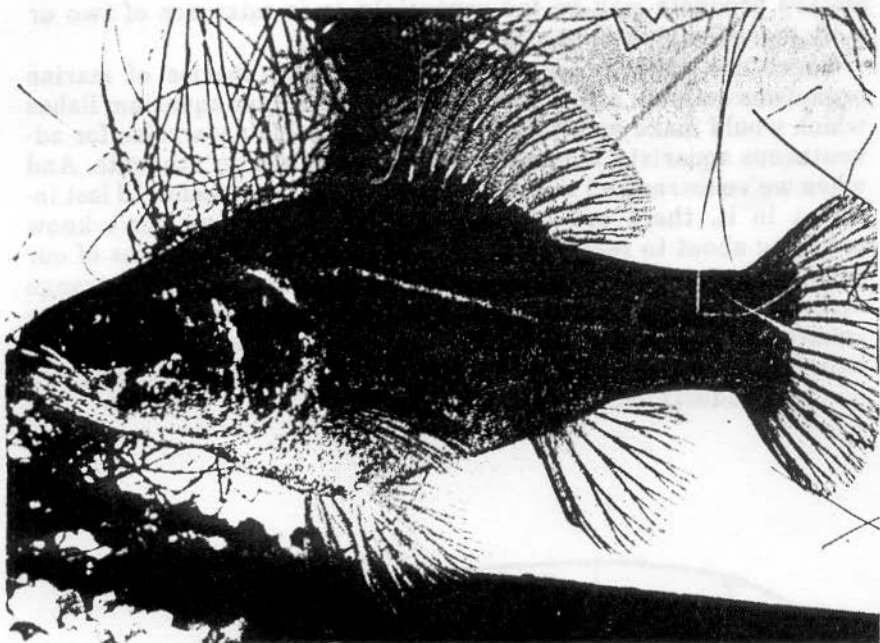


Pirate Perch

Notes on Abortive Spawnings of the Pirate Perch, *Aphredoderus sayanus*, With Comments on Sexual Distinctions

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A four-inch female Pirate Perch, *Aphredoderus sayanus*, collected in Toms River, N. J.

The pirate perch, *Aphredoderus sayanus* (Gilliams), alone comprises the family Aphredoderidae, order Salmopercae. As is the case with many fishes, the term "perch" is used erroneously. Two subspecies are recognized: *A. s. sayanus* which ranges along the eastern coastal plain northward to New York, and *A. s. gibbosus* which occurs from southern Minnesota throughout the Mississippi drainage system. These ranges are not completely distinct, overlapping somewhat in their southerly extents. Throughout its range the species is associated with soft, muddy bottoms of silt and/or organic material.

A. sayanus is a small fish growing to at least five inches, but most commonly collected at about three inches. It is grayish to black overall becoming paler or whiteish ventrally. In spring and summer individuals may exhibit a yellowish and/or purpleish iridescence on the ventral surface and opercles. All specimens collected by the author in New Jersey exhibit a complete lateral line, although much

of the literature claims the lateral line to incomplete or absent (e.g. Jordan and Evermann, 1896; Eddy and Underhill, 1974). It is probable that this trait varies geographically. The most interesting and least understood characteristic of *A. sayanus* is the positioning of the anus. In the newborn, the anus occupies a "conventional" position, i.e. immediately anterior to the anal fin. As the fish grows the anal and urogenital openings actually move forward until in the adult they are situated just below the throat. The benefits of such an arrangement are unknown, although it has been suggested (Martin and Hubbs, 1973) that such would facilitate oral incubation of the eggs, should *Aphredoderus* prove to be a mouthbrooder.

Virtually nothing is known about reproduction in *A. sayanus*. Eddy and Underhill (1974) report that *A. sayanus* builds and guards a nest. Others (Pflieger, 1975; Martin and Hubbs, 1973) speculate that the species may be a mouthbrooder, basing such speculation on anatomical similarity to the mouthbrooding species *Amblyopsis spelaea*. In a study of embryological development in *A. sayanus*, Martin and Hubbs (1973) effected fertilization "by expressing eggs and milt into petri dishes and mixing them". At 19°-20° C these eggs hatched in five days and were considered ready to be moved out of doors by five days after hatching. While such information is enlightening in that it sheds some light on early development, still virtually nothing is revealed about the natural spawning process in *A. sayanus*.

The project outlined in this paper was undertaken in an attempt to elucidate aspects of *A. sayanus*' reproductive behavior and related contingencies.

Six adult *A. sayanus*, ranging in size from 2¾ to 3¼ inches, were collected over a two month period (June-August, 1976) from a typical Pine Barrens habitat in Roms River, N. J. They were living sympatrically with, in descending order of abundance, *Enneacanthus obesus*, *Acantharchus pomotis*, *Umbra pygmaea*, *Esox americanus americanus*, *Fundulus diaphanus*, and *Notemigonus crysoleucas*. The water was fresh, soft, and with a pH of 6.4. Water depth was from 0-36 inches and there was always at least a very slight current. The stream's bottom was of soft mud and detritus, necessitating the use of a dip-net from the banks: seining was impractical. *A. sayanus* was always associated with the mud and like *Acantharchus* and *Umbra*, was rarely, if ever, netted without a net-full of mud accompanying it.

The six specimens intended for spawning were set up in a slate-bottom 10 gal. tank, bare except for a corner filter and a large flower pot laid horizontally. Aeration was vigorous and substantial water changes were made twice weekly. Little attention was paid to water chemistry except for the addition of 3-5 tbs. of kosher salt. Water temperature varied with room temperature, from about 82° F in summer to a low of 65° in autumn. Their diet consisted predominantly of chunks of beefheart and live tubifex worms. In-

termittently, their diet was augmented with pieces of fresh and frozen fish, crabmeat, earthworms, and an occasional live fish. Under these conditions all specimens thrived.

On Nov. 27, 1976 the six specimens were moved to a tank of 10 gal. capacity, only slightly more than half filled, in an unheated attic. The glass-bottom tank contained a corner filter, a large flower pot, a mass of Java Moss (*Vesicularia*), a rock, and a green woolen spawning mop. Initially the temperature was 62°, dropping to 48°, with an average temperature of 41° and a modal temperature of 40°. Throughout this period the fish were under the influence of a natural photoperiod (except for disruptions for periodic checks during darkness). Feedings were from two to seven days apart (typically two to four days apart) and consisted solely of live tubifex worms and frozen beefheart. Every two to seven days a two gallon water change was effected. Surprisingly, the behavior of these fish under these conditions differed little from that observed under "normal" conditions. They still spent all of their time hanging motionless in mid-water or on the bottom, darting away quickly when frightened. The only significant differences in their behavior were: 1) They would no longer approach and eat food as it fell through the water, preferring instead to search the bottom for food in the darkness of night; 2) They were observed at times to align side-by-side in a quivering motion, the purpose of which never became apparent.

During this "cold period" all specimens appeared to be in excellent condition: all were relatively full-bodied, exhibited a deep, dark color, and all fins were intact. Although diet remained constant for all, some fish remained heavier than others, even when not fed for extended periods. It was believed that these individuals were females. However, possessing only six specimens, and considering none expendable, these individuals were not sacrificed to confirm this belief.

Two assumptions were made regarding the cold period described above. First it was assumed that these specimens would spawn most readily if maintained under conditions similar to those in their natural habitat: hence the use of a cold period. Secondly, it was assumed (optimistically) that a "compressed" cold period (i. e. only about one half to one third the duration of that encountered in the wild) would suffice for this purpose.

On Jan. 17, 1977 all six specimens were moved from their cold tank to a 10 gal. tank with a fixed temperature range of 65° to 70°. This tank had a gradient gravel substrate (from bare slate on one side of the tank to ½ inch of gravel on the other side), and contained a large mass of hairgrass (*Eleocharis*), some *Elodea*, and the usual flowerpot. Initially the water level in this tank was too high and two of the fish jumped out and died. The water level was subsequently reduced to three inches below the top of the tank. Although this tank was not lighted directly, it received a small amount of light from a tank just above it. In this way the light-shy *A. sayanus* were

subjected to an 18-24 hour photoperiod, albeit at a low intensity level at which they were presumably most comfortable.

During this time quantitative and qualitative changes in feeding habits became apparent. Beefheart was now being taken reluctantly or not at all. Moreover, there was a noticeable decrease in their appetites. They were fed once or twice weekly with live tubifex worms, the only food they were eating at this time. Diet notwithstanding, two fish maintained a very full-bodied appearance. These fish were presumed to be females and differed from their "male" counterparts in at least two other important respects: 1) They were of a larger body size overall; 2) They were paler in color. This latter difference was especially marked on the ventral surface. At this point in time the females were almost 4 inches in total length and the males about 3½ inches.

By Feb. 2 one of the females had died, apparently from "dropsy". Thus the potential spawning aggregate was reduced to a trio of, presumably, two males and one female.

On Feb. 21 a small area of gravel appeared to have been fanned away revealing the slate bottom. For two weeks prior to this, the female was observed to hover constantly above and slightly behind the area where this depression was made. At this point she was joined by one of the males who previously remained in and around the flowerpot on the other side of the tank. In the evening (Feb. 21) this male was observed to swim up and down the sides of the tank and splash at the surface so vigorously that the resulting sound could be heard at least six feet away. In light of this unusual behavior and the increasing heaviness of the female it was anticipated that a spawning was imminent.

At 10:00 p.m. Feb. 22 about 100 eggs were discovered. The tank had been in total darkness for 4 hours prior to the discovery of the spawn. Unfortunately, no aspects of the spawning process were observed. The eggs, 2mm in diameter, were strewn over the bottom of the tank in an apparently random manner, although most were concentrated in a specific area. This area, however, was not the depression made the previous day. Many eggs were also found inside the filter, the top (intake) of which was several inches off of the tank bottom. It was reasoned that the fish broadcast their spawn, with water circulation patterns accounting for the distribution of the eggs over the bottom of the tank. It is alternately possible that the eggs were taken into the mouth (as suggested above) only to be spewn out for some reason.

The eggs were divided into three groups:

- 1) Twenty-nine eggs were removed and placed in a 5½ gal. tank filled to a depth of 3½ inches with water from the spawning tank. The substrate was of boiled peat moss — similar to that found in *A. sayanus*' natural habitat. Thirteen eggs were placed on top of the peat and sixteen were buried slightly. The water was soft and with a pH of 6.2. Aeration was slight.

2) Twenty eggs were allowed to rest on the slate bottom of a 2½ gal. tank filled to a depth of seven inches with relatively new water. Filtration through an old peat filter was sluggish. The water was tinted slightly with methylene blue and was soft and with a pH of 7.0. Two tps. kosher salt were also added. All four sides of the tank were covered with black paper, should the eggs be light sensitive.

3) The remaining eggs were left in the spawning tank, some resting on the gravel/slate bottom and some lodged in various parts of the filter. This water was also soft and with a pH of 6.5. All tanks were kept at room temperature (65°-70°).

No eggs hatched under any circumstances nor was any development observed in any of the eggs. It is believed that the male(s) involved were defective or that the eggs were laid spontaneously by the female, in the absence of a male.

It is interesting to note that the female did not extrude all of her eggs on a single occasion. Twenty-four hours after the eggs were first discovered, the female, visibly stressed during the course of a long photography session, began laying eggs spontaneously. The eggs emerged singly while the female hovered in the familiar "rowing" posture — by rhythmic movements of the pectoral fins. The urogenital pore was protruding somewhat, directly below the posterior edge of the base of the pectoral fin. Perhaps in the wild spawning takes place over the course of several days (or longer). It is also possible that in initially discovering the eggs the author disrupted the spawners and thus the female retained some of the eggs which would otherwise have been spent in a single spawn.

A second spawn was discovered at 11:30 p. m. March 13 and a third spawn was found six days later at 4:00 p. m. March 19. The eggs from both spawns were left in the spawning tank (which now had half peat substrate and half bare slate bottom) but in both cases no development was observed. Of possible significance was the fact that both spawns were preceded (by several days) by relatively heavy feedings of tubifex worms and substantial water changes.

Of obvious significance was the behavior of the male(s) during the twenty-four hour periods preceding all three spawns. Only at these times were they atypically active, swimming up and down the sides and corners of the aquarium and splashing vigorously at the surface. This activity correlated perfectly with the occurrence of a spawn and could thusly be used as a predictor. Moreover, such behavior is so diametrically opposite their behavior at all other times that it could scarcely go unnoticed.

The most significant, albeit somewhat tentative, conclusions to be drawn from this series of abortive spawning concerns sexual distinctions. Since the distinctions mentioned above (and reiterated below) were readily observable, and since the fish designated as "female" was observed to lay eggs, confirmation (in terms of internal anatomy) of the sex of the two "male" fish would remove much of the tentative nature from these conclusions. In this order the two males have been preserved and are available to any

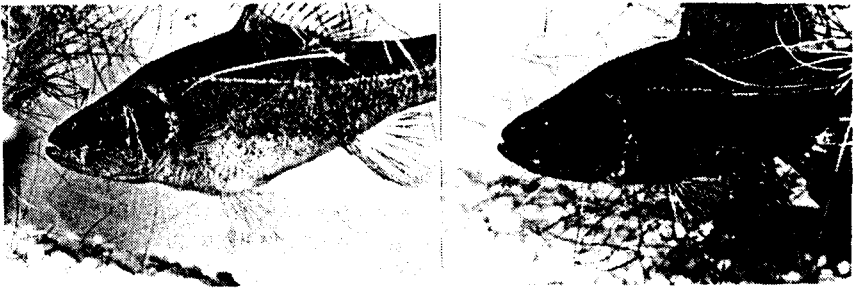
qualified persons for dissection. Whatever the outcome it must be realized that with such a small sample (three fish) it is risky to try to speak with too much certainty: instead these tentative conclusions should serve as guidelines for work with larger samples. *

In summary, the author's method for sexing *A. sayanus* is as follows:

females: *larger* than male; *fuller-bodied* overall, especially in pelvic area; *heaviness*, unlike "dropsy" or "bloat" is very localized — almost angular — at base of pelvic fins; heaviness persists in absence of heavy feedings; ovipositor may protrude; *lighter in color* overall; *pale* as compared to male; very *light* or white *in pelvic area*; anal and pelvic fins clear or with very little pigmentation.

males: *smaller* in size; *slender*, remaining so even when heavily fed; never exhibits distension in pelvic area; dark, velvety *black* overall; *dark even on ventral surface*; anal and pelvic fins dusky (charcoal to black)

These distinctions are claimed to be most exaggerated in spring and summer. Many or all of them, however, may be in evidence in varying degrees throughout the year.



The sexual distinctions outlined in this paper are readily observable in the photographs above. The male, right, is darker and more slender than the female, left.

Summary

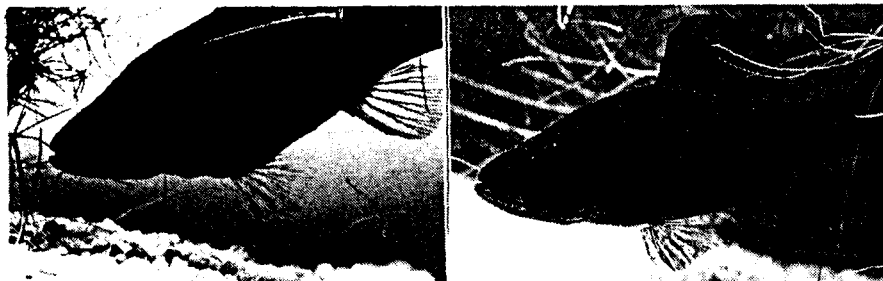
Since no viable eggs were obtained, very little can be said of the adequacy of the conditions (variable) provided for them or the spawners. Should the spawning have been successful it would be fairly obvious that all conditions were at least adequate, albeit not necessarily optimum. However where failure is concerned it can not necessarily be determined (in the absence of control groups) which conditions were adequate and which were inadequate. Or whether all of the conditions provided were adequate but the fishes themselves were defective.

For example, no conclusions can be drawn concerning the validity

* By the time this appears in print such work will probably have been started.

of either assumption about the cold period since, in the absence of control groups it is not known whether viable eggs would have been produced if a "natural" (as opposed to "compressed") cold period had been used. Perhaps no cold period is required and the eggs failed to hatch for some other reason. Using only three fishes it is very possible that failure to obtain viable eggs was due to only one of the fishes being defective.

All of this points to the major shortcoming of the present project, specifically its very small scale. This was due mainly to the author's limited amount of tank space. It is anticipated that, utilizing some of the knowledge presented in this paper (e. g. regarding sexual distinctions, diet, cold storage, etc.) and some extrapolation, future investigations employing a larger number of individuals (and groups) might easily delineate the spawning behavior of *A. sayanus*.



The distinctive profile of the ripe female is evident in the photo at left. It is unmistakably different from that of the male, right. The female's urogenital pore is evident as a slight bulge mid-way between the lower margin of the operculum and the pelvic fins.

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