Observations on the Care and Behavior of Darters, Etheostomatinae, in the Laboratory[1]

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The ichthyological literature contains very little information concerning the habits of the common but generally unnoticed group of fishes called darters. Several species have been kept successfully in aquaria and some have spawned under laboratory conditions. Seal (7) observed spawning in aquarium-kept *Boleosoma olmstedi* (Storer) and *Etheostoma caeruleum* (Agassiz). Similar observations were made by Atz (1) in *Boleosoma nigrum olmstedi;* J. J. Petravicz (5) in *Microperca punctulata* Putnam = *Etheostoma microperca* Jordan and Gilbert; W. P. Petravicz (6) in *Hadropterus maculatus* (Girard); and Forbes and Richardson (2) in *Boleosoma nigrum* (Rafinesque). Jaffa (3) produced young in the laboratory by stripping *Etheostoma iowae* Jordan and Meek = *E. exile* (Girard), but *Hadropterus coplandi* (Jordan) (8) refused to spawn in aquaria and eggs obtained and fertilized by stripping did not develop.

This paper consists of a summary of observations on five darter species now being kept in aquaria at Oklahoma Agricultural and Mechanical College.

Possibly the most interesting of the five forms is *Ammocrypta* sp. which was collected from the Red River south of Bennington, Oklahoma. The common name, sand darter, is very appropriately applied to *Ammocrypta* for it is truly an inhabitant of the sand. Jordan and Copeland (4), who kept *Ammocrypta pellucida* (Baird) in aquaria, stated that it buried itself in the sand with only its eyes and head dorsum exposed. Several observers at Oklahoma A. and M. have found this to be true except that the form from the Red River will bury itself entirely and on occasions has been found, in the aquarium, to be about an inch or more below the surface of the sand. These darters can easily be uncovered by jetting water from a pipette and thereby blowing the sand off of them. They will lie very quietly as the tail and body are uncovered, but as soon as the head and eyes are exposed, they will usually dart away. By using a pipette in this manner, the darter will also permit itself to be completely covered with sand. Occasionally, when being thus sprayed, the darter will dive head-first into the sand and, with rapid movements of the pectoral and caudal fins, disappear completely from view so rapidly that an observer is left wondering just how it was accomplished. The time consumed in the burying act is certainly not as long as indicated by Jordan and Copeland (4). This habit of hiding in the sand has also been attributed to *Boleosoma nigrum* (2).

Ammocrypta took pigmy white worms and also plankton, but only on two occasions has it been observed in the act. Possibly since they are quite secretive and are submerged in the sand most of the time, they emerge and feed for short periods. Since food placed in the aquarium disappeared and since the darters were in excellent condition after 48 days in captivity, it is believed that feeding, except on rare occasions, has escaped notice.

Etheostoma gracile (Girard) and *E. chlorosomum* (Hay) collected from backwaters of Blue River south of Bokchito, Oklahoma, appear to readily acclimate themselves to life in aquaria. They took all types of live food such as white worms, mosquito and *Drosophila* larvae, and also, in smaller quantities, prepared foods such as shredded shrimp, powdered shrimp, dog food, and fresh liver. These fish typically inhabit more turbid waters than the other forms under consideration, and therefore may possibly depend to some extent upon the sense of taste in feeding.

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[1] Contribution No. 228 from the Department of Zoology, Oklahoma Agricultural and Mechanical College. I am indebted to Dr. George A. Moore for his helpful suggestions and criticisms of this paper and to Donald R. Miller for assistance in collecting of specimens.

Etheostoma radiosum cyanorum (Moore and Rigney) was collected at the type locality, Blue River about 20 miles south of Ada, Oklahoma. This darter is one of the more brightly-colored members of this subfamily and is typically found in the riffles of the stream. It has adapted itself quite readily to aquarium conditions. Certain individuals occasionally took artificial foods, but generally they will feed only on living organisms such as earthworms, young crayfish, mosquito and *Drosophila* larvae, pigmy white worms, and snails. When a particle of food is dropped into the water, they will dart forward and wait for the organism to move before eating it. This is in agreement with the observations of J. J. Petravicz (5) on the least darter, *E. microperca*, which generally refused artificial foods and became emaciated unless fed such live foods as small crustaceans. W. P. Petravicz (6) stated that *H. maculatus* survived 40 days without food.

Although I have successfully kept *E. r. cyanorum* in aquaria, one incident, involving an aquarium situated over a live steam line connected to a closed radiator, indicates that these darters cannot tolerate a temperature as high as 27°C. On this occasion, some fish were found dead and others, in the same aquarium, were in obvious distress. Aquaria nearby were about 3.5°C. cooler. By adding cold water to the warmer tank, the temperature was lowered to 25°C. and the remainder of the fish appeared to be relieved and have been doing well since.

The other species being kept in the laboratory at the present time is *E. spectabile* (Agassiz) which was collected from Dog Creek about 7.6 miles east and three miles north of Foreaker in northeastern Oklahoma. *E. spectabile* readily took live food and occasionally accepted artificial food. The ease with which this species adapted itself to aquarium life may be explained on the basis of the habitat from which my specimens were collected. This form is typically an inhabitant of gently moving, but not fast water. As a result of drouth conditions, Dog Creek, in which *E. spectabile* was formerly abundant, had ceased to flow, and only occasional deep, muddy pools could be found. The mud-bottomed pool from which the specimens were collected was about 100 feet long, 10 feet wide, and with a maximum depth of about three feet. One shore was strewn with rocks and it was here that many specimens of *E. spectabile* were taken in half-starved stunted condition. The water was relatively turbid, not a place in which one would expect to find *E. spectabile.*

Aeration is apparently unnecessary since three specimens have been doing well without it. However, under crowded conditions, aeration is necessary. Heavy losses occurred in a crowded tank when the air pump failed. The chlorine concentration of tap water in Stillwater is not great enough to be fatal to this species.

E. spectabile, and in fact all darters with which I have had experience, readily took suitable food immediately after being placed in aquaria. When the feeding area in a tank is established, *E. spectabile* congregated there as though begging to be fed. Individuals often rose to meet the pipette or the fingers used in placing food in the water. Living and moving organisms were preferred. The following food organisms have been tried successfully: small earthworms, pigmy white worms, small crayfish, amphipods, and larvae of *Drosophila*, mosquitoes, and chironomids. Various prepared foods, chopped earthworms, and June bug larvae were also accepted, the principal requirement seeming to be one of particle size.

As can be seen from the foregoing discussion, the major problem in rearing these fishes in the laboratory is the maintenance of an adequate supply of live foods. Attempts have been made to propagate *Drosophila* larvae, but I have been unable to secure an inexpensive medium from which the larvae can be separated readily. An attempt is also being made to raise earthworms in the laboratory. The production of mosquito larvae by means of a cage with a guinea pig as a source of blood for the breeding mosquitoes is also under consideration.

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