# The Tessellated Darter

## by Robert E. Schmidt
## illustrated by Kathleen A. Schmidt

Introduction

This article is the first in what hopefully will be a series of articles on our native darters. I intend to describe the biology, the distribution and the habitat of as many species as time will allow. One of the biggest difficulties I encountered was deciding where to start and how to proceed. I'm sure that everyone who knows freshwater fish has their favorite darter and no matter where I start, I risk disappointing someone. So I decided that the first darters I would consider are those that inhabit New England and then I would travel south along the coast and discuss the animals as they are encountered.

Systematics and Geography

The tessellated darter is found in the eastern United States from the Connecticut River system in New Hampshire (Scarola, 1973) and the Ottawa River, eastern Ontario in Canada (Scott and Crossman, 1973), south on the Atlantic coastal plain to the St. Johns River, Florida (Cole, 1967). In the river systems south of the Susquehanna River, this species is encountered only below the fall line except in the upper Rappahannock River, Virginia and the Santee-Cooper and Peedee Rivers in South Carolina (Cole. 1967). The fall line is an area between the Piedmont and the coastal plain where the streams have a relatively high gradient characterized by falls (or rapids) from which the term is derived.

This darter can be recognized by the tessellations (dark "W" or "M" markings) on the sides (Fig. 1). Cole (1967) discussed four subspecies that are distinguished by the scalation patterns on the head, back and belly. The distribution of the subspecies is shown in Fig. 2. Scott and Crossman (1973) point out that the characters that distinguish *E. olmstedi* from the johnny darter (*E. nigrum*) do not seem to work in Canada, so there is some question about the validity of the difference between the two species. McAllister and Coad (1974) indicated that the two organisms act like species in the Ottawa area although hybridization does occur.

Habitat

All darters are intimately associated with the substrate of their environment. In general, they lack swim bladders and their rounded tails are not very efficient for swimming. At best, they appear clumsy to our eyes. The result of these anatomical modifications is that darters usually sit on the substrate and move from place to place in short "darts," hence the name of the group.

Tessellated darters prefer sandy substrates on moderate to slow-flowing water. They can be collected in sandy lakes on occasion. Frequently many hundreds of small tessellated darters can be collected in a single area. The larger, breeding-size adults can also be found in rocky riffles. These darters are very abundant in New England and can be collected in virtually any stream in this area. Rather poor water quality is tolerated by these creatures, so super-clean streams are not a prerequisite for this species. In southern coastal plain areas (south of the Susquehanna River) they become harder to find; more localized in any given river system. I have successfully collected them in North Carolina streams, although never in large numbers.

General Biology

In nature, the tessellated darter feeds on benthic invertebrates, primarily midge larvae (Chironomidae-Tendipedidae) but other organisms, such as amphipods, mayfly nymphs, cladocera and copepods, are taken in smaller amounts. In a study in Massachusetts (Layzer and Reed, 1978) they appeared to be daytime feeders and laboratory observations indicate that vision is very important in feeding. In terms of aquarium care, live food is probably accepted more readily than frozen or prepared foods. I have had tessellated darters take live *Tubifex* and *Daphnia*.

I know of only three studies published on growth of this species; Raney and Lachner (1943) used specimens from the Susquehanna River system, Layzer and Reed (1978) from the Connecticut River and environs in Massachusetts, and Tsai (1972) from the Patuxent River, Maryland. These studies probably dealt with the subspecies *E. olmstedi olmstedi*. Maximum age of tessellated darters in these studies (as determined by annuli on the scales) was four years old (three females from New York). In this case, four-year-old means a fish that has lived through its fourth winter. Maximum size reported was an 88 mm standard length (from tip of the nose to end of the vertebral column) male from Springfield, Massachusetts, also in its fourth year. Most tessellated darters do not survive beyond their second year but this may be due to predation or some other environmental factor. Females tend to grow faster than males and are therefore larger (on the average) than males of the same age.

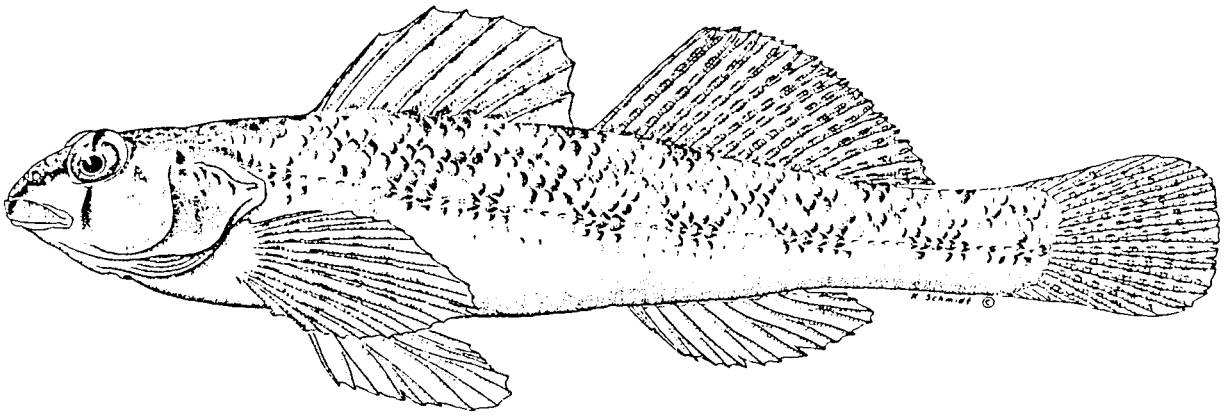

Figure 1. *Etheostoma olmstedi olmstedi* collected in the Cape Fear River drainage, Six Runs Creek on Rt. 403, Sampson County, North Carolina on May 31, 1978 by R. Schmidt, G. Benz and R. Rocks. Drawing by Kathleen A. Schmidt.

Reproductive Biology

Like many fishes, male tessellated darters assume breeding colors in the spring. Coloration in this species (and in general in the other four species of the subgenus *Boleosoma* of *Etheostoma*) is a darkening of the normal pigmentation. The result, in *E. olmstedi*, is that the banding on the second dorsal and anal fins becomes much more pronounced while the lateral markings become obscure as they are masked by the overall lateral darkening. Cole (1967) stated that males are darker anteriorly than posteriorly and are not actually black; however, I have seen very black specimens from Susquetonscut Brook, Connecticut. Black spawning colors are supposed to be diagnostic for *E. nigrum* but no *E. nigrum* have ever been reported from Connecticut. If black breeding males can be collected from New England, it would be interesting to examine them in detail. At the same time, the males develop light-colored fleshy pads at the tips of the pelvic fin rays. The function of these pads can only be guessed at present and I will discuss this in the context of spawning behavior.

Spawning occurs in the spring, the exact time of spawning is determined by the local temperature regime. In the northern areas, tessellated darters spawn in May or early June and presumably the southern populations spawn earlier. The male chooses a spawning site and guards the site throughout the spawning period. Typically, the site is under an overhanging rock or log or other obstruction but they may spawn on top of flat rocks also. Despite the relative abundance of this species, I am aware of very few published observations on spawning behavior. Most of the following description is derived from Atz (1940). Once the spawning area is selected, the male may enlarge the opening under the obstruction but does little else to "improve" the spawning site. When a gravid female approaches the nest, the male initially treats her as he does any other darter: he rushes at her with his fins erect in a threat display. If she does not retreat, he then tries to lure her into the nest. This threatening (agonistic) component of courtship seems typical of territorial fishes in general. In other instances the female may enter the nest when the male is occupied elsewhere and then spawning occurs upon his return.

Spawning is initiated by either partner turning upside down with his/her ventral side against the roof of the nest. The partner will quickly follow suit and the adhesive eggs are released, fertilized and attached to the roof of the nest in small patches. Discrete spawning acts may follow one another quite rapidly until the female has no more to lay or she may leave after a few or only one spawning act. The male will spawn with any number of different females in a season. Tsai (1972) reported that fecundity (total number of mature eggs in the ovary prior to spawning) ranged from 54-668 with larger females containing the greater numbers of eggs. A female may not necessarily lay all the eggs she contains, however.

The fine drawing of *E. olmstedi* which adorns the cover of this issue is for sale by the artist, KATHLEEN A. SCHMIDT. Prints signed by Kathleen are available postpaid for $5.00 each. Send check or money order to:

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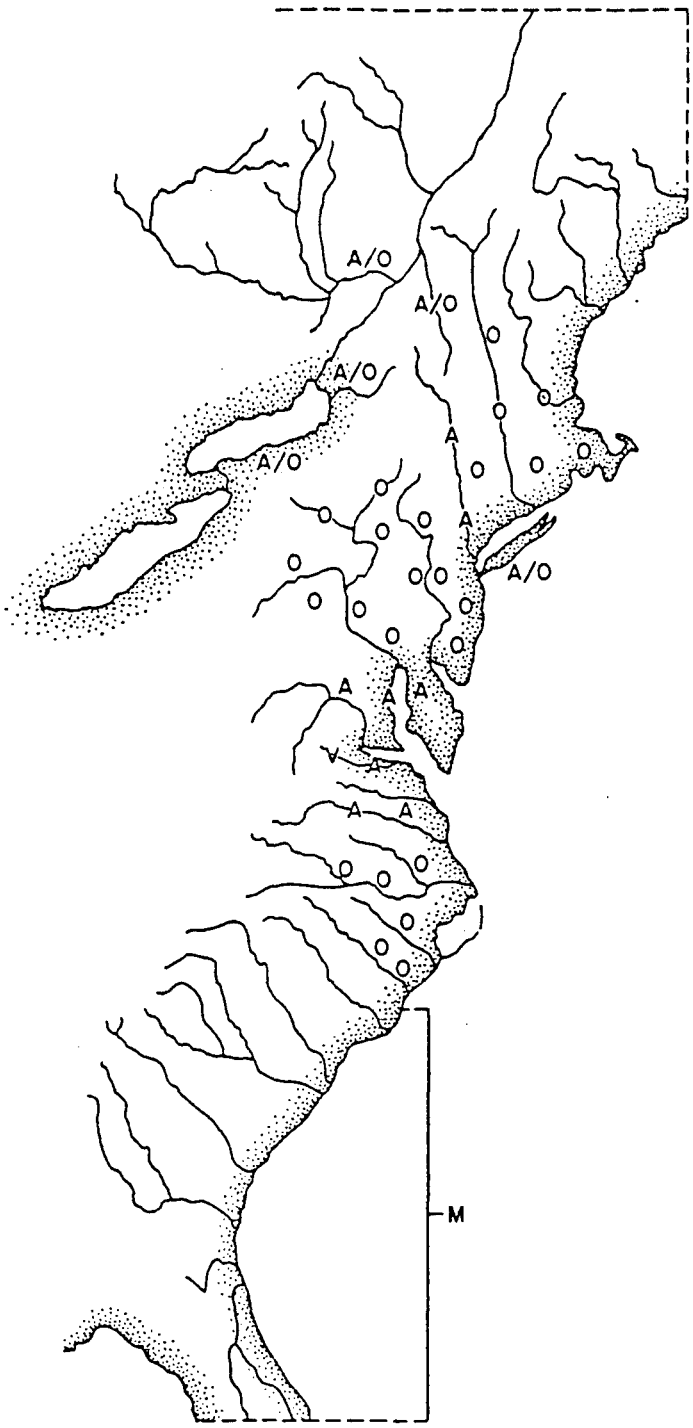


Figure 2. Distribution of the subspecies of *Etheostoma olmstedi* on the east coast of the United States from Maine to Florida (from Cole, 1967). The symbol 'A' represents *Etheostoma olmstedi atromaculatum*; 'M' is *E. o. maculaticeps*; 'O' is *E. o. olmstedi*; 'V' is *E.o. vexillare*; and 'A/O' stands for hybrids between *E. o. atromaculatum* and *E. o. olmstedi*. Drawing by Kathleen A. Schmidt.

While spawning is occurring, and after spawning is done, the male will guard and care for the eggs. These are two distinct behaviors because it has been demonstrated that if you remove the eggs, the male will continue to guard the nesting site. Egg care consists of the male frequently turning upside down and swimming over the eggs with his pelvic fins in close proximity to, if not touching, the eggs. Presumably, the pads that form on the fin tips are used to remove debris from the eggs. The male will also fan the eggs with his caudal or dorsal fins, probably providing aeration. If eggs become fungused, the male will eat them. Atz (1940) pointed out that it has been tacitly assumed that guarding and care will extend as long as the eggs are present and that after hatching the male will lose interest in the spawning site and leave. To my knowledge, this has not been observed. Hatching time is temperature dependent and has not been determined accurately for the tessellated darter. It is probable, at springtime environmental temperatures, that development takes about a week.

## Miscellaneous Observations

During a study at the University of Connecticut, I kept several hundred tessellated darters in the laboratory. I noticed that very frequently these animals would bury themselves in the substrate with only the tip of their caudal fin and their eyes visible. This behavior has occasionally been noted in the literature but it is probably very common in this species. I have spent some time underwater looking for tessellated darters in areas where other sampling techniques (seining and electrofishing) indicated they were abundant. I have never seen as many as I thought should be present. I have scared individuals out of the sand in the field by running my fingers through the sand. In the laboratory where the animal is confined, it is possible to see them when they are buried (if you look hard enough) but in nature, where they could be anywhere, it is impossible to observe them when they are in the substrate. This burying behavior doesn't seem to be a reaction to a threat because I've chased many specimens around my tanks with a pencil and they never tried to bury in the substrate; they just tried to escape by rapid swimming. Burying doesn't seem to be a response to a current because the darters would bury as often in still water as in flowing water. In those instances when I observed the animals actually burying themselves, I could find no obvious environmental cause or correlate for the behavior. In the process of burying, the darter aims his snout downward and, with extremely rapid and vigorous tail motions, forces himself into the sand. The process takes only a second or two. This propensity to bury may explain why sandy substrates are preferred by this species.

## Summary

The basic biology of the tessellated darter is fairly well known, but there are many details that could yet be discovered. Aquarium observations on behavior could be particularly valuable, especially if you took the time to quantify your observations. I have tried to indicate areas that were of interest to me; perhaps other aspects of these creatures may interest you.

The tessellated darter is quite easy to keep in an aquarium and makes an interesting and charming pet. I would suggest a substrate of fine gravel possibly mixed with sand and some large stones to provide spawning areas. Live food should be given frequently. I never had luck feeding them on commercial prepared foods, but other people tell me they can be trained to take flake foods.

## Acknowledgements

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