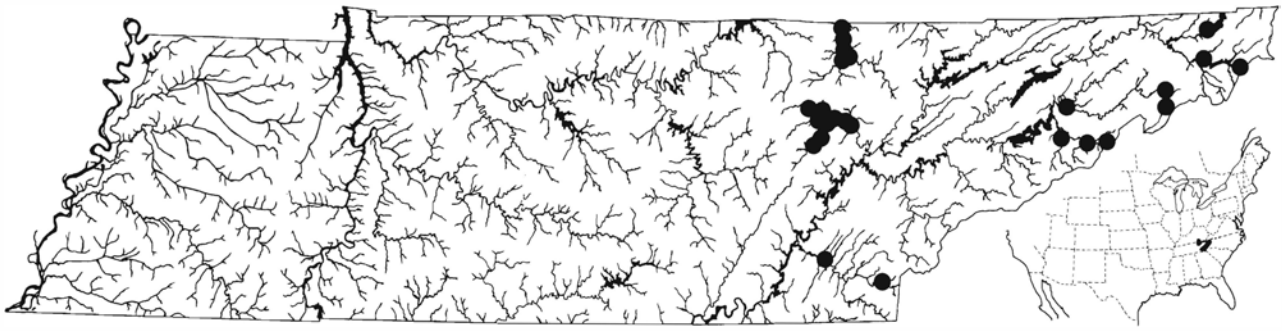


Range Map 277. *Percina squamata*, olive darter.

*caprodes*) and tangerine darter (*P. aurantiaca*) with which it occurs are easily separable based on their yellow to orange (vs. gray green pigment) and completely different snout shapes.

**Systematics:** Subgenus *Swainia*. Closely related to *P. oxyrhynchus* of southern tributaries to the Ohio River (Mayden, 1985). Thompson (1977) recognized separate races of *P. squamata* in the Big South Fork and Tennessee systems based on differences in meristics and coloration, with Big South Fork populations having higher average scale counts and more somber coloration.

**Etymology:** *squamata* = scaly.

*Percina tanasi* Etnier.

## Snail darter

**Characters:** Lateral-line scales 48–56 (47–60). Dorsal fin with 10–11 (9–12) spines and 14–16 (13–17) soft rays. Anal fin soft rays 11–12 (10–13). Pectoral fin rays 13–15. Principal caudal fin rays 15–17. Gill rakers 15–17, length of longest rakers about 2.5 times their basal width. Vertebrae 39–41. Premaxillary frenum absent or weakly developed. Gill membranes separate. Opercles and nape fully scaled. Cheeks typically with a few scales behind eye, but ranging from apparently naked (juveniles) to almost fully scaled in some adults. Breast and prepectoral area naked in juveniles, but these areas usually with embedded scales in adults and occasionally with exposed scales. Belly with naked area adjacent to modified midventral scales, which are weakly developed in females and moderately developed in males. Body brownish to brownish gray with traces of green. Back with four distinct, dark brown saddles which extend down and forward to contact the series of ten or so lateral blotches along lateral line. Dark

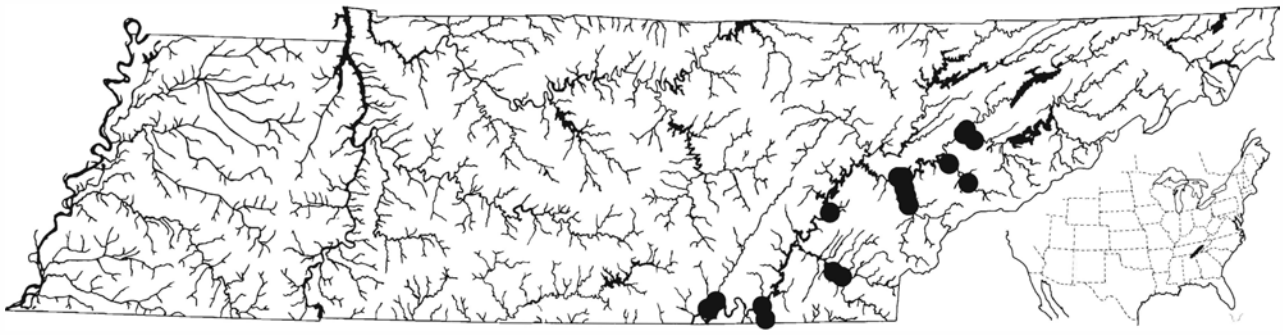
Plate 287. *Percina tanasi*, snail darter, male, 63 mm SL, Holston R., TN.

suborbital bar usually prominent. Rays of all fins are usually speckled, but pelvic and anal fins occasionally immaculate. Nuptial males develop iridescent blue-green coloration on sides and venter and on the branchiostegal membranes and breast region. Gold flecks appear ventrolaterally at pectoral fin bases, cheeks, and opercles, and the iris is bright gold. Females have some similar gold coloration but generally are much more subdued during spawning, with the usually prominent dorsal saddles becoming virtually invisible in some specimens. Prominent breeding tubercles develop on rays of elongate anal fin of males as well as on ventral surfaces of median pelvic rays, lower caudal fin rays, and branchiostegal rays. Scales of cheeks, breast, and ventral portion of the body also bear tubercles.

**Biology:** The snail darter has been the center of world-renowned controversy due to its presumed Endangered status and the construction of Tellico Dam on the Little Tennessee River which inundated much of the habitat, and all of the reproductive habitat, it was known to occupy at that time. Consequently, the snail darter became almost a household word, and in current usage the term "snail darter types" is approximately synonymous with "ultraliberal environmental activists." Stemming from this controversy, which ultimately ascended to the Supreme Court of the United States and finally resulted in congressional action exempting the Tellico project from all federal law, were numerous biological studies on the snail darter. Consequently, the biology of this species, which was not discovered until 1973, has probably been the most intensely studied of any non-game fish. Studies have been published (Starnes, 1977; Hickman and Fitz, 1978), which together with ongoing studies by Tennessee Valley Authority and U.S. Fish and Wildlife Service biologists and members of the federally appointed Snail Darter Recovery Team, have constituted a considerable compilation of knowledge concerning the ecology and life history of the snail darter.

The snail darter is an inhabitant of larger creeks where it frequents sand and gravel shoal areas; it also occurs in deeper portions of rivers and reservoirs where current is present. The dorsal color pattern of alternating dark saddles and pale brown areas serves as highly effective camouflage against the snail darter's preferred substrate of sand and scattered gravel. It also has the capacity to burrow beneath the substrate, similar to the behavior exhibited by the sand darters of the genus *Ammocrypta*, perhaps serving both as concealment and an energy-conservation measure. Spawning occurs early in the year, extending from February to about mid April. Males move to shoal areas in early February and are joined by more and more females as the season progresses. Males court females by following them along the bottom and butting them on the caudal peduncle with their heads and stroking the females' backs with their pectoral fins. Although actual spawning has not been observed, spawning behavior probably approximates that described for *P. caprodes* and other members of the genus. Females contain an average of about 600 mature eggs and probably mate with several males over the course of the season. Hatching requires 15–20 days depending on water temperature. Newly hatched larvae are about 7 mm long. During their early development, which is extended by cooler water temperatures, snail darter larvae drift considerable distances downstream to deeper areas. The larvae survive by first absorbing nutrients from the yolk sac and then probably feed on zooplankton. By late summer, young snail darters attain lengths approaching 40 mm or so and many have begun to migrate upstream toward the spawning habitat. Sexual maturity is apparently reached by some individuals at age 1, at lengths averaging 55 mm. At age 2, lengths are 65–70 mm, and 3-year-olds are 80 mm or more. A few individuals may survive into a 4th year. Larvae are very phototaxic (attracted to light), a phenomenon also noted in larval walleye by Bulkowski and Meade (1983). This phenomenon may have implications regarding diurnal movements in the water column or depth maintenance. The dietary preference of the snail darter gave it its name. *Percina tanasi* specializes on small pleurocerid river snails, mostly *Leptoxis* (= *Anculosa*) and *Lithasia*, as well as some physid snails and limpets. This preference is exhibited to some degree by all members of the subgenus *Imostoma*. The gape (mouth size) of *Imostoma* species exceeds that of other *Percina* and is perhaps an adaptation to feeding on these relatively large particles. Snails comprised 60% of the overall annual diet of Little Tennessee River snail darters, but there was considerable utilization of caddisfly larvae (*Glossosoma*, *Hydropsyche*, *Brachycentrus*), midge and blackfly larvae, and a few mayfly nymphs. Maximum total length 90 mm (3.55 in).

**Distribution and Status:** It is generally felt that the snail darter inhabited the main channel of the upper Tennessee River and the lower reaches of major tributaries. Impoundments have fragmented much of this range. After its discovery in the lower Little Tennessee River in 1973 by D. A. Etnier and R. A. Stiles, the snail darter was thought to be restricted to that habitat, with stragglers from that population dispersing into the adjacent headwaters of Watts Bar Reservoir below Fort



Range Map 278. *Percina tanasi*, snail darter.

Loudon Dam. In 1976 it was transplanted to the lower Hiwassee River by TVA biologists in an attempt to preserve the species prior to impoundment of the Little Tennessee River by Tellico Dam, which ultimately occurred in 1979. A population estimated at about 2,500 persists in the Hiwassee River. A smaller transplant to the Nolichucky River was also attempted by TVA in 1975, but was curtailed when surveys there revealed a population of another federally jeopardized fish, the sharphead darter (*Etheostoma acuticeps*). The Nolichucky transplant, and 1979–1980 transplant attempts in the lower Holston and middle Elk rivers may have been unsuccessful, but the 1988 and 1989 collections of snail darters from the lower French Broad and lower Holston rivers, respectively (C. F. Saylor, pers. comm.), may represent progeny of snail darters transplanted into the lower Holston. Neither the numerous fish collections from the Tennessee River drainage dating back into the late 1800s nor the massive effort to locate additional populations conducted by TVA during the 1970s revealed any snail darters besides the population in the lower Little Tennessee River, unless those from upper Watts Bar could be demonstrated to represent a breeding population not dependent on the Little Tennessee River for spawning habitat. Reproduction apparently does not occur in upper Watts Bar, as considerable effort by TVA biologists subsequent to impoundment of Tellico Reservoir revealed only large adults persisting for a few years post-impoundment.

In 1978, a recovery team for the snail darter was appointed by the director of the U.S. Fish and Wildlife Service consisting of the authors of this book plus biologists from the Fish and Wildlife Service, TVA, and Tennessee Wildlife Resources Agency. Various recovery plans were devised (e.g., Biggins and Eager, 1983) over the succeeding years to identify objectives for preservation. In 1980, the future of the snail darter brightened considerably when W. C. Dickinson, D. A. Etnier, A. G. Haines, and G. J. Kaufmann discovered an additional population in South Chickamauga Creek in Chattanooga. This discovery prompted the recovery team to search for additional populations in similar habitats, the lower reaches of larger tributary streams of the Tennessee River. These searches and more recent general collections resulted in the discovery of a substantial population of snail darters in the lower portion of Big Sewee Creek in Meigs County and apparently smaller populations (represented by only one or a few specimens) from lower Sequatchie River in Marion County, Little River in Blount County, lower French Broad River in Sevier County, and lower Paint Rock River in Madison County, Alabama. The population in South Chickamauga Creek extends upstream a short distance into north Georgia. These new discoveries prompted the Snail Darter Recovery Team to suggest reclassification of the snail darter from Endangered to Threatened, an action accomplished in July 1984 by the U.S. Office of Endangered Species.

**Similar Sympatric Species:** Occurs with the related saddleback darter (*P. vigil*) in the lower Paint Rock River in Alabama, and perhaps additional sites of sympatry will be discovered near the lower bend of the Tennessee River. See comments under *P. vigil*. Also occurs with the blenny darter (*Etheostoma blennius*) in the Sequatchie River. In the blenny darter, the most anterior of the four dorsal saddles is entirely in advance of the dorsal fin, and modified midventral scales are lacking on the completely scaled belly.

**Systematics:** Subgenus *Imostoma*. Systematics presented by Etnier (1976). Intimately related to the stargazing darter, *P. uranidea*, of the White and Ouachita river systems of Missouri and Arkansas and formerly of the lower Wabash River, Illinois and Indiana.

**Etymology:** *Tanasi* is the former capital of the Cherokee Nation, which was located on the Little Tennessee

River, the type locality of the snail darter. A derivation of this Cherokee place name is "Tennessee."

*Percina vigil* (Hay).

## Saddleback darter

Plate 288a. *Percina vigil*, saddleback darter (saddles indistinct), male, 51 mm SL, Big Sandy R. system, TN.

Plate 288b. *Percina vigil*, saddleback darter, preserved specimen with well developed dorsal saddles, 43 mm SL, Hatchie R., TN.

**Characters:** Lateral-line scales 46–62. Dorsal fin with 10–11 (9–12) spines and 13–15 (12–16) soft rays. Anal fin soft rays 10–11 (9–12). Pectoral fin rays 14–15 (13–16). Principal caudal fin rays 15–17 (14–17). Gill rakers 13–16, length of longest rakers about 4 times their basal width, even most ventral gill rakers well developed. Vertebrae 38–40. Premaxillary frenum absent or weak. Gill membranes separate. Cheeks naked in most Gulf Coast populations to well scaled elsewhere. Opercles and nape scaled. Breast and prepectoral area naked. Belly with naked areas anteriad and along midline, except for weakly to moderately developed modified midventral scales on posterior portion of belly. Dorsum straw colored with four broad, dark saddles which are often indistinct in specimens from turbid water; a fifth saddle sometimes apparent over the caudal fin insertion. Lateral blotches eight or nine. Suborbital bar well developed. Spinous dorsal fin with narrow dark marginal and broader basal dark bands separated by clear area (more conspicuous in males). Soft dorsal and caudal fins with brown markings on rays, other fins clear. As characteristic of the subgenus *Imostoma*, the anal fin of males is much longer than that of females. Extensive breeding tubercles develop over ventral half of body, on anal fin soft rays, ventral surface of pelvic fin rays, and ventral caudal fin rays. Small tubercles also develop on cheeks, opercles, and lower jaw.

**Biology:** The saddleback darter is an inhabitant of larger creeks and rivers and, occasionally, small streams, where it frequents shoal areas having sand and/or gravel substrates. As with other *Imostoma*, spawning may occur early in the year, during late winter, but it probably extends at least into April. Collette (1965) reported maximum tubercle development during February in Mississippi populations. Thompson (1977) postulated an April to June spawning season. Early life history information is not available. Length-frequency distribution of specimens in our collection indicates that lengths of about 35–50 mm are reached after 1 year's growth, and many of these are sexually mature. Lengths of about 55–60 mm are reached at age 2, and apparently few individuals survive through their third winter. Members of *Imostoma* seem predisposed to feed on snails when available, and this was found to be true in Duck River specimens of saddleback darters which had fed on pleurocerid (*Leptoxis*) river snails (Starnes, 1977). A variety of aquatic insects including hydropsychid caddisfly larvae, midge larvae, and small mayfly nymphs, such as baetids, is also utilized (Thompson, 1974; Miller, 1983). Maximum total length 65 mm (2.5 in).

**Distribution and Status:** Widespread but of sporadic occurrence in low-gradient creeks and rivers, mostly below the Fall Line, along Gulf Coastal drainages from the Escambia River westward to the Mississippi River, and continuing up both sides of the Mississippi (and in the main channel) to southeastern Missouri, and lower reaches of the Ohio and Tennessee rivers. Lower Ohio River populations are apparently extirpated, but *P. vigil* continues to be fairly common in suitable habitats in lower Tennessee and Mississippi River tributaries in west Tennessee.

**Similar Sympatric Species:** Occurs with the snail darter, *P. tanasi*, in the lower Paint Rock River in Alabama. In *P. vigil* the posterior border of the fourth dorsal saddle (Fig. 142b) is well in advance of the anterior dorsal insertion of the caudal fin (visible as a median white line); in the snail darter (Fig. 142a) the posterior border of this saddle contacts the anterior caudal fin insertion. May also be occasionally sympatric with *Etheostoma blennius*, a more upland species, which also has four conspicuous dorsal saddles that are similarly placed. In *blennius* the gill membranes are broadly connected, there is a reddish marginal band on the spinous dorsal