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A New Species of *Notropis* (Cypriniformes: Cyprinidae) from the Southeastern United States

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***Notropis amplamala*, the Longjaw Minnow, is described as a new species for the southern populations of *N. buccatus*. *Notropis amplamala* differs from its sister species, *N. buccatus*, by possessing longer gill rakers (length to width ratio average 2.2, 1.8–2.5 vs. average 1.0, 0.8–1.4), having no breast squamation (vs. breast with scales), and possessing five infraorbital ossicles (vs. four). The two species have a disjunct distribution with *N. amplamala* occurring in Gulf of Mexico and Atlantic Ocean tributaries from the Pearl River to the Altamaha River, and *N. buccatus* occurring in Mississippi River, Ohio River, and Atlantic coastal tributaries north of the Cumberland River from eastern Missouri to Virginia and Maryland.**

NOTROPIS buccatus (Cope, 1865), the silverjaw minnow, is a small cyprinid found throughout the eastern United States. *Notropis buccatus* is a benthic species that prefers moderately flowing streams with bottoms of sand or sand mixed with fine gravel (Wallace, 1972). The silverjaw minnow was originally described from the Kiskiminitas River in western Pennsylvania (Cope, 1865) based on the presence of greatly expanded infraorbital and preoperculomandibular canals (Reno, 1971) and was placed in the monotypic genus, *Ericymba* (Cope, 1865). Mayden (1989) placed the silverjaw minnow in a *Hybopsis* clade along with several other members of the genus *Notropis* based on the derived presence of a deep premaxillary process on the maxilla, the maxillary process of the palatine L-shaped with a long anterolaterally directed projection, and the articular surface on the palatine for the preethmoid restricted posteriorly by a mesially directed shelf. Wiley and Titus (1992) placed the silverjaw minnow in their *Hybopsis dorsalis* group (*H. dorsalis* is currently recognized in *Notropis*), and Coburn and Cavender (1992) placed the silverjaw minnow in *Notropis*. The silverjaw minnow was found to be sister to *Notropis dorsalis* based on complete nucleotide sequences of the mitochondrial cytochrome *b* gene (Raley and Wood, 2001). We follow the placement of the species in *Notropis* as per Coburn and Cavender (1992), Raley and Wood (2001), and Boschung and Mayden (2004).

Notropis buccatus is unique among members of the family Cyprinidae in that it possesses modified infraorbital and preoperculomandibular canals. The only other North American freshwater fishes to have these large canals are the sandroller (*Percopsis transmontanus*) and the trout perch (*P. omiscomaycus*) of the Percopsidae. These structures have an unknown function but they probably increase the lateral line sensitivity in the head region.

Notropis buccatus has a disjunct distribution, with populations essentially occurring north and south of the state of Tennessee (Lee, 1980; Fig. 1). These populations have been separated at least since the Pleistocene (Wallace, 1973). The northern population occurs in tributaries of the Mississippi River of southwestern Illinois and eastern Missouri, in the Wabash and Ohio River drainages of Illinois, Indiana, Kentucky, Ohio, Pennsylvania, Tennessee, and West Virginia, and in Atlantic Ocean drainages of Maryland and Virginia. The southern population occurs in Gulf of Mexico drainages from eastern tributaries of the Mississippi River in Louisiana eastward to the Apalachicola River in Florida (Fig. 1).

Since the separation of the populations, differences between the two populations have arisen. It is possible that these differences, whether due to habitat changes or life history differences, may be enough to warrant separate species status for the southern population. Etnier and Starnes (1993) noticed that northern specimens have greater breast and belly squamation and longer and more numerous gill rakers when compared to southern ones; however, a detailed comparison of northern and southern populations has not been published. In this study, the taxonomic status of the southern population of *Notropis buccatus* is assessed using morphometrics, meristics, and osteology, and *N. amplamala*, new species, is described for the southern population of *N. buccatus*.

MATERIALS AND METHODS

Institutional abbreviations are as listed in Leviton et al. (1985). Counts and measurements were taken on the left side of the body for bilaterally symmetrical features unless the feature was damaged. Only fishes over 50 mm standard length (SL) were measured in order to control

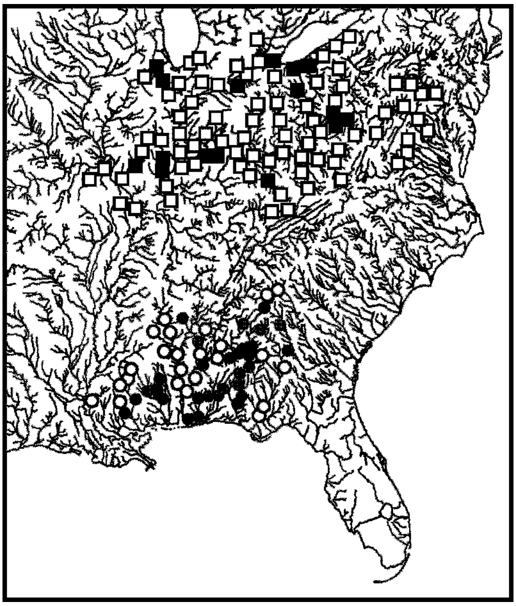

Fig. 1. Distribution of *Notropis buccatus* (squares) and *N. amplamala* (circles). Closed symbols are localities from which samples were measured for this study. Symbols may represent more than one locality. Map based on Lee (1980).

for the effects of ontogenetic change. CS refers to cleared-and-stained specimens.

A morphometric truss (Bookstein et al., 1985) was developed from nineteen homologous landmarks (Fig. 2) for a total of 26 measurements (Table 1). Distance between each landmark was measured with digital calipers to the nearest 0.1 mm. Morphometric data were analyzed univariately by linear regression of each variable using JMP (ver. 5.0.1a, SAS Institute, 2002). Analyses of Covariance (ANCOVA) were performed on log-transformed measurements of putatively diagnostic characters by using the 'Fit Model' command of JMP. The measurements on the y-axis in figure 3 were chosen as the dependent variable (Y) and the measurements on the x-axis as the covariates and species as the treatment were chosen for the model effects. Because an ANCOVA can only be performed on regressions whose slopes are homogeneous, a cross command was also added as a model effect between species and the x-axis variable in order to test for homogeneity of slopes. A gill raker length to width ratio was estimated by visually dividing the length of the longest gill raker by its basal width.

Meristics follow Hubbs and Lagler (1947). Counts taken were dorsal-fin rays, pectoral-fin rays, pelvic-fin rays, anal-fin rays, caudal rays, lateral-line scales, scales above lateral line, scales below lateral line, caudal-peduncle scales, predorsal scales, postdorsal scales, postanal scales, number of gill rakers, pharyngeal teeth, and breast squamation. Breast squamation was measured by observing the pattern of scales found on the ventral side of the fish between the pelvic fin insertions and the gill membrane connection.

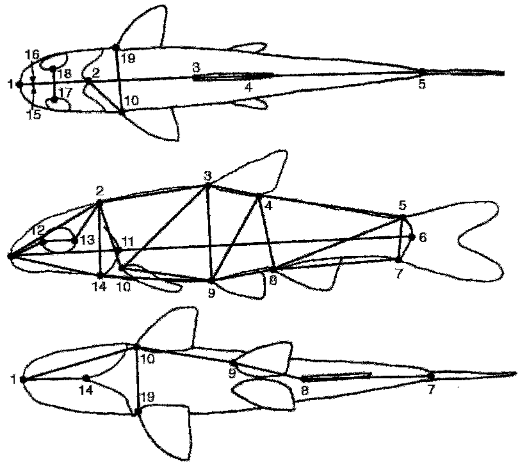

Fig. 2. Landmarks and distances measured in dorsal, lateral, and ventral views. Landmarks are defined as follows: 1. Tip of snout, 2. Posterior margin of supraoccipital, 3. Insertion of first dorsal-fin ray, 4. Insertion of last dorsal-fin ray, 5. Posterodorsal margin of caudal peduncle, 6. Posteromedial margin of caudal peduncle, 7. Posteroventral margin of caudal peduncle, 8. Insertion of first anal-fin ray, 9. Insertion of first left pelvic-fin ray, 10. Insertion of first left pectoral-fin ray, 11. Posterior margin of opercle, 12. Anterior margin of left orbit, 13. Posterior margin of left orbit, 14. Connection of gill membranes, 15. Mesial edge of left nasal flap, 16. Mesial edge of right nasal flap, 17. Dorsal margin of left orbit, 18. Dorsal margin of right orbit, 19. Insertion of first right pectoral-fin ray.

Skeletons of representative specimens from each major drainage examined were cleared and double-stained using the methods of Taylor and Van Dyke (1985) for a total of 38 specimens. Characters found to be different between populations after examination in all individuals were quantified and sketched with the aid of a camera lucida attached to a Leica MZ8 stereoscope.

Notropis amplamala, new species

Longjaw Minnow

Figure 4

Holotype.—AUM 39911, 64.2 mm SL, Alabama, Lee County, 5 km NE Bleecker, County Road 379, Wacoochee Creek, 33.62262°N, 085.

TABLE 1. SELECTED MORPHOMETRICS AND MERISTICS OF *Notropis buccatus* AND *Notropis amplamala*. Landmarks are defined in figure 2. Measurements represent percentages of SL.

		Notropis buccatus		*Notropis amplamala*	
		n = 171		*n* = 272	
Landmarks	Measurement	Average ± SD	Range	Average ± SD	Range
1–6	SL (mm)	54.8 ± 3.4	48.5–67.0	58.1 ± 5.0	47.6–71.9
1–2	Head length	23.3 ± 0.7	21.7–25.2	23.9 ± 0.6	22.5–25.6
2–3	Supraoccipital-dorsal distance	28.4 ± 1.0	25.1–31.1	26.7 ± 0.9	24.6–29.6
3–4	Base of dorsal length	11.5 ± 0.5	10.4–12.7	11.8 ± 0.4	10.7–12.9
4–5	Dorsal-caudal distance	38.5 ± 1.3	35.7–42.2	39.6 ± 0.9	37.0–42.8
1–10	Snout-pectoral distance	29.4 ± 0.8	27.4–31.1	28.8 ± 0.7	26.9–30.7
9–14	Gill membrane-pelvic distance	30.6 ± 1.0	28.6–33.5	29.9 ± 0.9	27.8–32.5
9–10	Pectoral-pelvic distance	71.9 ± 2.9	64.5–78.4	22.4 ± 0.8	20.3–25.2
8–9	Pelvic-anal distance	17.1 ± 0.8	15.0–19.1	17.6 ± 0.7	15.6–19.7
7–8	Anal-bottom of caudal distance	32.4 ± 1.4	29.7–35.8	33.0 ± 1.1	29.0–36.1
2–14	Head depth	15.9 ± 0.5	14.7–17.2	15.5 ± 0.5	14.4–17.1
1–14	Snout-gill membrane distance	19.9 ± 0.8	17.9–22.0	20.1 ± 0.6	18.3–21.8
1–11	Snout-opercle distance	27.1 ± 0.9	24.9–29.4	26.9 ± 0.7	24.7–28.9
1–12	Snout-orbit distance	8.9 ± 0.3	8.2–9.9	9.7 ± 0.4	8.9–10.6
2–13	Orbit-supraoccipital distance	9.0 ± 0.3	8.0–9.8	8.9 ± 0.4	8.0–10.2
15–16	Internares distance	5.9 ± 0.3	5.2–6.7	5.9 ± 0.3	5.3–6.7
17–18	Interorbital distance	6.0 ± 0.2	5.4–6.6	5.6 ± 0.3	5.0–6.5
12–13	Orbit diameter	8.0 ± 0.4	7.3–8.8	8.5 ± 0.4	7.4–9.4
10–19	Pectoral width	14.8 ± 0.9	12.7–17.0	14.4 ± 0.8	11.9–16.4
2–10	Supraoccipital-pectoral distance	16.8 ± 0.5	15.5–18.3	16.0 ± 0.6	14.3–17.9
3–10	Pectoral-dorsal distance	26.8 ± 1.0	23.7–29.5	26.2 ± 1.0	23.9–29.8
3–9	Dorsal-pelvic distance	21.4 ± 1.4	18.2–25.9	20.5 ± 1.1	17.6–23.3
4–9	Pelvic-rear of dorsal distance	20.5 ± 1.3	17.6–24.4	20.0 ± 0.9	17.7–22.5
4–8	Rear of dorsal-anal distance	18.4 ± 1.0	15.9–20.6	18.1 ± 0.9	16.1–20.6
5–8	Anal-top of caudal distance	35.0 ± 1.2	32.7–38.6	36.3 ± 1.0	33.4–38.9
5–7	Caudal depth	9.8 ± 0.4	8.9–11.0	10.4 ± 0.4	9.4–11.4
	Meristic	Mode	Range	Mode	Range
	Dorsal-fin rays	8	8–8	8	8–8
	Pectoral-fin rays	16	14–17	15	15–17
	Pelvic-fin rays	8	7–9	8	8–9
	Anal-fin rays	8	7–8	8	7–9
	Caudal-fin rays	19	17–19	19	18–20
	Lateral line scales	36	33–37	36	34–38
	Scales above lateral line	4	4–4	4	4–4
	Scales below lateral line	4	4–4	4	4–4
	Caudal peduncle scales	12	12–12	12	12–12
	Predorsal scales	13	12–14	13	12–14
	Postdorsal scales	18	16–19	18	17–19
	Postanal scales	9	9–10	9	8–9
	Number of gill rakers	6	4–8	5	3–9

13232°W, 22 July 2004, T. P. Pera, D. C. Werneke, N. K. Lujan, K. O. Maloney, and R. M. Mitchell.

Paratypes.—AUM 39912, 64, 19.5–63.6 mm SL, same data as holotype. ANSP 180646, 5, 48.4–58.2 mm SL; AUM 2266, 17, 31.8–61.2 mm SL; INHS 99095, 5, 51.8–55.1 mm SL; TU 198057, 5, 47.6–56.9 mm SL; UAIC 14126.01, 5, 49.9–55.2 mm SL; UF 148374, 5, 46.0–60.2 mm SL, Alabama, Lee County, 0.4 km NE Powledge Valley, tributary to Wacoochee Creek, T19N, R28E, S16, 22 Nov. 1969, E. H. Williams and J. Germann.

Diagnosis.—*Notropis amplamala* can be distinguished from all other cyprinids except for *Notropis buccatus* by possessing modified infraorbital and preoperculomandibular canals. *Notropis amplamala* differs from its sister species, *Notropis buccatus*, by possessing longer gill rakers (length

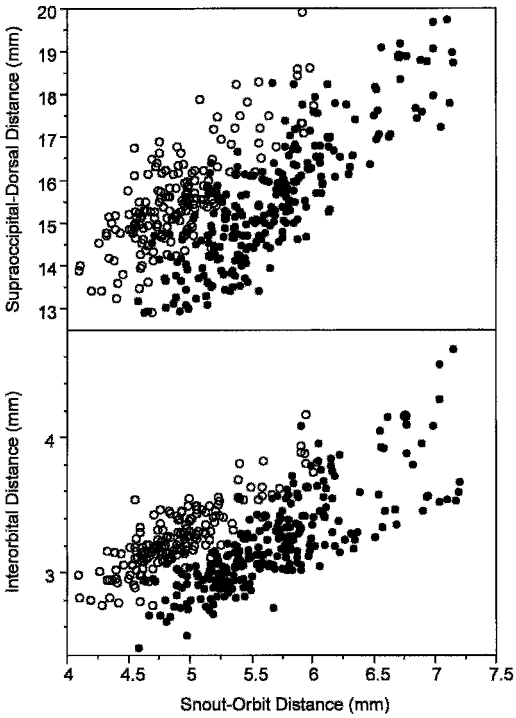

Fig. 3. Supraoccipital-dorsal distance and interorbital distance vs. snout-orbit distance. Open circles represent *Notropis buccatus*; closed circles represent *N. amplamala.*

to width ratio average 2.2, 1.8–2.5 vs. average 1.0, 0.8–1.4), having no breast squamation (vs. breast with scales), and possessing five infraorbital ossicles (vs. four).

Description.—Small cyprinid (largest specimen examined 71.9 mm SL). Morphometrics and meristics in Table 1. Dorsal-fin rays 8 (272 individuals); anal-fin rays 7 (2), 8 (268), 9 (2); pectoral-fin rays 15 (130), 16 (137), 17 (5); pelvic-fin rays 8 (270), 9 (2); principal caudal-fin rays 18 (3), 19 (268), 20 (1); lateral-line scales 34 (3), 35 (37), 36 (142), 37 (84), 38 (6); scale rows above lateral line 4; scale rows below lateral line 4; caudal-peduncle scale rows 12; predorsal scale rows 12 (49), 13 (222), 14 (1); postdorsal scale rows 17 (11), 18 (163), 19 (98); postanal scale rows 8(3), 9 (269); gill rakers 3 (10), 4 (44), 5 (104), 6 (71), 7 (32), 8 (7), 9 (4); ratio of gill raker length to gill raker width averages 1.0 (0.8–1.4); pharyngeal teeth 1,4–4,1 (10).

Body slightly laterally compressed, fusiform. Ventral surface flat to insertion of anal fin, angled dorsally dorsal to anal fin, angle decreasing from posterior insertion of anal fin to caudal peduncle, ventral surface angled slightly ventrally just before caudal fin. Dorsal surface rising in arc to insertion of dorsal fin, angled ventrally below dorsal fin, angle decreasing from posterior insertion to caudal peduncle where dorsal surface angles slightly dorsally before caudal fin. Body depth greatest at insertion of dorsal fin, least at caudal peduncle. Caudal peduncle narrow oval in cross-section. Snout long and conical.

Lateral line complete. Infraorbital and preoperculomandibular canals greatly enlarged. Mouth large, reaching to below anterior naris, subterminal. Gill membranes united to isthmus. Nares large, positioned on dorsal plane of head. Eye large, about one-third the length of head, positioned supralaterally on sides of head. Dorsal, pectoral, pelvic, and anal fins slightly convex, caudal fin forked. Insertion of pelvic fins slightly posterior to insertion of dorsal fin. Pectoral fin almost reaching insertion of pelvic fin when adpressed, pelvic fin almost reaching anus when adpressed.

Scales diamond-shaped with posterior margins pigmented. Nape fully scaled. Breast unscaled. Belly from just anterior to pelvic fins to anal fin with scales placed irregularly. Scales present between anus and anal fin. Peritoneum silver.

Coloration in alcohol.—Narrow, diffuse black stripe along lateral line from opercle to base of caudal fin. Scales above midlateral stripe edged in dark brown, scales below without or with few melanophores, melanophores fading ventrally. Dorsal color light brown, ventral color pale yellow with sparse speckling located between pectoral and pelvic fins. Dorsal-fin rays, caudal-fin rays, and first pectoral-fin rays pigmented with melanophores. Anal and pelvic fins clear. Diffuse dark line running along nape from supraoccipital to insertion of dorsal fin. Base of anal fin pigmented with melanophores. Head dark dorsally, color beginning to fade at level of dorsal surface of eye so that head ventral to eye unpigmented. Iris silver ventrally and dark with silver ventral margin dorsally.

Coloration in life.—Pale olive-green with silvery sheen dorsally; yellow-white with silvery sheen ventrally. Midlateral stripe faint with silver sheen; cheek and opercle silver-white. Not known to develop breeding pigmentation.

Range.—*Notropis amplamala* ranges from the Pearl River Drainage in Mississippi east to the Apalachicola River Drainage in Florida and Georgia. On the Atlantic slope, it is found only in the Altamaha River Drainage. It is most common below the fall line (Fig. 1).

Fig. 4. Dorsal, lateral, and ventral views of *Notropis amplamala*, holotype, AUM 39911, 64.2 mm SL.

Ecology.—*Notropis amplamala* occurs in small schools in predominantly clear, shallow (up to 50 cm) streams in slow to moderate runs. It prefers sandy to sand mixed with gravel substrates.

Etymology.—From the Latin *ampla* meaning enlarged and *mala* meaning jaw, in reference to the longjaw and expanded infraorbital and preoperculomandibular canals of the species. Treated as a noun in apposition.

Discussion

There is a great deal of overlap between *Notropis amplamala* and *N. buccatus* for all of the morphometric characters except for the following: distance between the posterior margin of the supraoccipital bone and the insertion of the dorsal fin, interorbital distance, and distance between the tip of the snout and the front of the orbit. The first two represent the larger cranial region of *N. amplamala*, while the latter represents the longer snout of *N. buccatus*. When the first two characters are graphed against the third, *N. amplamala* and *N. buccatus* are largely separated (Fig. 3). The slopes of the two species were found to be homogeneous ($P = 0.6665$ for supraoccipital-dorsal distance and $P = 0.2683$ for interorbital distance), and the two species were significantly different based on ANCOVA ($P < 0.0001$ for both comparisons).

The number and shape of the infraorbital ossicles, the bones that form the enlarged infraorbital canal, differs between species. There are four infraorbital ossicles in *N. buccatus*, whereas there are five in *N. amplamala*. The shape of the infraorbitals also differs. In *N. buccatus*, there was a larger notch on the lateral wall of the ossicles. Also, the dorsal flange of the medial wall above the lateral wall is almost nonexistent in *N. buccatus* and about as tall as the lateral wall in *N. amplamala* (Fig. 5). No significant differences were found among the various drainages within *N. amplamala* in any characters.

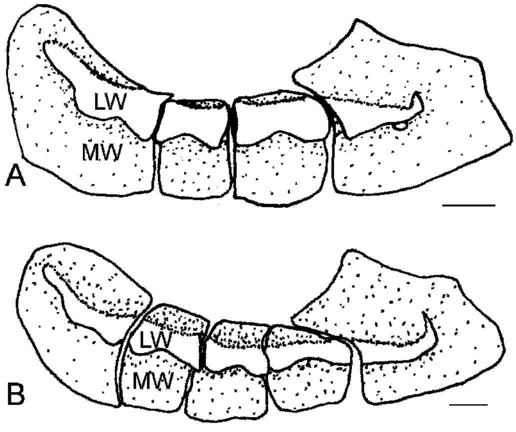

Fig. 5. Infraorbital ossicles, right side, lateral view of (A) *Notropis buccatus*, INHS 18293 and (B) *N. amplamala*, AUM 7502. LW = lateral wall and MW = medial wall.

Biogeography.—The distribution of *Notropis amplamala* and *N. buccatus* is unlike that of any other North American fish because it is missing from tributaries of the Tennessee River and the central Mississippi River. Wallace (1973) suggested that the most likely scenario was a dispersal route via the Mississippi River Valley. Wallace suggested that subsequent dispersal occurred through the Gulf drainages by stream capture and sea level regression. According to Wallace, the absence of either *N. buccatus* or *N. amplamala* from the Tennessee River Valley is likely due to its inability to adapt to high levels of siltation in lowland streams and the high gradient nature of upland streams found there (Wallace, 1973; Etnier and Starnes, 1986).

The dispersalist prospective of Wallace (1973) does not seem to be an adequate explanation for the distribution of *Notropis amplamala* and *N. buccatus.* There is no suitable habitat between the two populations except in eastern tributaries of the Mississippi River in western Tennessee; however, despite much collecting, neither species was found to be present in western Tennessee (Etnier and Starnes, 1986). It would seem unlikely for the progenitor of *N. buccatus* and *N. amplamala* to have migrated through western Tennessee and then become extirpated when the habitat is suitable. Another possibility is that because the populations of *N. buccatus* are found largely in glaciated regions and *N. amplamala* are largely found below the fall line, the two species may have been derived from different refuges at times of low and high sea levels.

The absence of the silverjaw minnow from western tributaries of the Mississippi River is likely due to its absence from the pre-Wisconsinan Mississippi River channel (Etnier and Starnes, 1986). Since Wisconsinan times, the Mississippi River has eroded its way eastward, creating silt deposits that may have eliminated the silverjaw minnow from southern tributaries of the Mississippi River (Etnier and Starnes, 1986).

Material Examined

Notropis amplamala. Non-type material.—Alabama: AUM 5498, 6, 54.3–64.8 mm SL, Escambia County, 6.3 km NE East Brewton, Cedar Creek, 12 Oct. 1968, R. Mount et al.; AUM 6529, 8, 54.4–64.9 mm SL, Macon County, 5.6 km N Tuskegee, Uphapee Creek at I-85, 29 Oct.–2 Nov. 1971, J. S. Ramsey, L. A. Barclay, and ichthyology class; AUM 7446, 10, 53.7–61.8 mm SL, Macon County, I-85 bridge crossing, 1.6 km S Milstead, Calebee Creek, 11 April 1972, J. S. Ramsey and J. W. Jensen; AUM 7467, 3, 57.5–62.2 mm SL, Dallas County, 4.8 km S Sardis, Mush Creek at Alabama Highway 41, T15N, R12E, S29W, 3 April 1972, H. Wahlquist and D. Mathur; AUM 23323, 7, 51.0–55.6 mm SL, Houston County, 18 km W Dothan, Panther Creek at Alabama Highway 84, 14 June 1982, M. Pierson and S. Krotzer; AUM 23815, 4, 54.5–63.0 mm SL, Randolph County, 7.4 km NW Malone, Crooked Creek, T20S, R10E, S31, 27 Sept. 1982, M. Pierson et al.; AUM 26761, 2, 2 CS, 55.8–62.2 mm SL, Escambia County, 2 km NNW Brewton, Burnt Corn Creek at Highway 41, 18 Aug. 1990, H. Bart, M. Taylor, and J. Harbaugh; AUM 27070, 6, 48.3–52.6 mm SL, Bullock County, Johnson Creek at Alabama Highway 14, 5 June 1991, H. Bart and M. Taylor; AUM 27126, 5, 50.8–54.3 mm SL, Coffee County, Bowles Creek inside Fort Rucker, 4 Aug. 1991, H. Bart, M. Taylor, and J. Harbaugh; AUM 30428, 10, 53.2–59.2 mm SL, Covington County, 19.3 km S Andalusia, Five Runs Creek at County Road 31, 31°08′06″N, 086°29′11″W, 2 Aug. 2000, C. E. Johnston, K. N. Leftwich, S. J. Herrington, B. W. Phillips, and D. C. Werneke; AUM 31266, 6, 50.7–52.0 mm SL, Baldwin County, 12.9 km ENE Loxley, Styx River at County Road 64, 30°38.27′N, 087°36.941′W, 13 Oct. 2000, J. W. Armbruster, J. D. Evans, D. C. Werneke, and T. P. Pera; AUM 31421, 10, 57.0–60.7 mm SL, Covington County, 2 km NW Red Oak, Five Runs Creek at Forest Road 339, 31°08′34″N, 086°29′05″W, 31 Aug. 2000, S. J. Herrington, B. W. Phillips, D. C. Werneke, and T. P. Pera; AUM 31445, 4, 2 CS, 55.1–59.7 mm SL, Covington County, 4.8 km WSW Stanley, Bay Branch at County Road 36, 31°13′58″N, 86°29′17″W, 25 Aug. 2000, S. J. Herrington, B. W. Phillips, D. C. Werneke, and T. P. Pera; AUM 31509, 6, 56.6–61.1 mm SL, Covington County, 6.4 km SW Red Oak, Five Runs Creek at County Road 24, 31°06′22″N, 086°31′03″W, 26 Aug. 2000, B. W. Phillips, D. C. Werneke, S. J. Herrington, and T. P. Pera; AUM 31526, 11, 49.6–58.5 mm SL, Dale County, 4.8 km E Clayhatchee, Choctawhatchee River at Alabama Highway 92, 31°13.86′N, 085°41.704′W, 1 Nov. 2000, J. W. Armbruster, D. C. Werneke, and T. P. Pera; AUM 32046, 2, 47.6–51.7 mm SL, Henry County, Highway 10, 1.9 km E Abbeville, Tributary of Abbie Creek, 31°34′09″N, 085°13′54″W, 13 April 2001, L. K. Mione and S. J. Herrington; AUM 32520, 4, 54.2–64.9 mm SL, Lee County, Bird Creek at junction with Tallapoosa River, T19N, R24E, S14E, 11 Nov. 1970, J. Sullivan and J. Naftel; AUM 34618, 5, 50.1–56.7 mm SL, Bibb County, 6.3 km NNW Centreville, Schultz Creek at Alabama Highway 219, 10–15 Nov. 1978, T. J. Timmons and E. Rosa; AUM 35185, 10, 51.5–59.2 mm SL, Opelika, Lee County, 12.9 km NE Opelika, Halawakee Creek at County Road 390, 32.69667°N, 085.25639°W, 4 Dec. 2001, S. J. Herrington, J. W. Armbruster, and D. C. Werneke; UAIC 10797, 15, 54.3–63.5 mm SL, Fayette County, 8.4 km NE Kirkland, Stewart Creek at U.S. Highway 43, 33°50′39″N, 087°49′23″W, 16 Sept. 1993, B. R. Kuhajda, E. B. Jones, and L. M. Rojas; UAIC 10799, 13, 2 CS, 55.1–64.3 mm SL, Fayette County, 6.8 km NE Kirkland, Stewart Creek at County Road 21, 33°50′10″N, 087°50′17″W, 28 Sept. 1993, B. R. Kuhajda, E. B. Jones, and L. M. Rojas.

Georgia: AUM 27539, 3, 52.3–57.8 mm SL, Lamar County, Buck Creek at Chappel Mill Road, 21 Sept. 1991, H. Bart, M. Taylor, and J. Harbaugh; AUM 27505, 29, 52.5–56.9 mm SL, Houston County, N Umadilla, Big Elko Creek at Elko Road, 28 Sept. 1991, H. Bart, M. Taylor, and J. Harbaugh; AUM 31205, 2, 55.8–62.3 mm SL, Meriweather County, County Road 351, 5.6 km S Rocky Mount, Brittens Creek, 33.11790°N, 084.68482°W, 31 Aug. 1999, J. Biagi; AUM 35351, 11, 51.8–64.7 mm SL, Cobb County, 4.8 km NE Mableton, Nickajack Creek at Cooper Lake Road, 33.84194°N, 084.53444°W, 6 June 2002, S. J. Herrington and R. H. Carpenter.

Florida: AUM 26002, 24, 2 CS, 54.6–70.8 mm SL, Escambia County, 3.2 km W Walnut Hill, Brushy Creek at County Road 29, 18 Aug. 1989, H. Bart, M. Taylor, and J. Harbaugh.

Louisiana: UAIC 10066, 2, 62.3–63.7 mm SL, Washington County, 0.3 km S Varnado, Pushepatapa Creek at Louisiana Highway 21, 16 March 1991, S. R. Layman, A. M. Simons, and R. M. Wood.

Mississippi: AUM 26993, 65.2 mm SL, Perry County, 10.5 km S New Augusta, Cypress Creek at Highway 29, 23 Sept. 1990, H. Bart, M. Taylor, and J. Harbaugh; UAIC 6414, 5, 51.8–53.7 mm SL, Forrest County, 1 km NE Hattiesburg, Leaf River 0.3 km downstream U.S. Highway 11, 27 Aug. 1981, D. L. Nieland, H. T. Boshung, and W. Littrel; UAIC 10050, 4, 2 CS, 57.6–67.2 mm SL, Clarke County, 9.7 km S Pachuta, Shubuta Creek at U.S. Highway 11, 3 March 1991, S. R. Layman, A. M. Simons, and B. R. Kuhajda; UAIC 10307, 9, 62.1–71.9 mm SL, Jones County, 3.2 km W Eastabuchie, Leaf River at Old Bridge, 15 March 1991, A. M. Simons, R. M. Wood, and S. R. Layman; UAIC 11364, 8, 54.9–69.5 mm SL, Covington County, 6.4 km NNE Sumrall, Bowie Creek at Mississippi Highway 589, B. R. Kuhajda and R. L. Mayden, 18 Feb. 1994; UAIC 12768, 18, 2 CS, 58.1–71.9 mm SL, Lamar County, 8.1 km NNW Baxterville, Little Creek at L. Saucier Road, 29 Oct. 2000, S. L. Powers, D. A. Neely, and N. J. Lang.

Notropis buccatus: INHS 7410, 19, 2 CS, 48.5–65.1 mm SL, Illinois, Iroquois County, 4.8 km S Beaverville, Beaver Ditch no. 2, T28N, R11W, S18, 7 July 1967, P. W. Smith and L. M. Page; INHS 14204, 9, 50.8–55.2 mm SL, Illinois, LaSalle County, 2.2 km SW Seneca, Spring Brook, T33N, R5E, S27, 11 June 1959, W. C. Starrett and A. W. Fritz; INHS 17137, 13, 50.2–57.8 mm SL, Illinois, Cumberland County, 3.2 km S Jonesville, Muddy Creek, T10N, R8E, S1, 11 July 1967, O. M. Price et al.; INHS 18293, 11, 2 CS, 50.2–55.5 mm SL, Illinois, Montgomery County, 3.2 km SW Taylor Springs, Middle Fork Shoal Creek, T8N, R4W, S27, 18 July 1966, O. M. Price et al.; INHS 19120, 9, 2 CS, 51.5–56.0 mm SL, Illinois, Coles County, 6.4 km E Diona, Hurricane Creek, T11N, R10E, S22, 27 June 1968, R. W. Horner and R. Rompasky; AUM 25167, 4, 49.8–54.9 mm SL, Indiana, Franklin County, 2.6 km S Laurel, Whitewater River, 11 Oct. 1975, B. H. Bauer et al.; INHS 30803, 25, 2 CS, 52.6–62.9 mm SL, Indiana, Bartholomew County, E Crawford, N Columbus, Flat Rock River at County Road 550N, T10N, R6E, S30, 17 Sept. 1985, J. E. Thomerson, L. Smith, and V. Parrish; INHS 88151, 25, 2 CS, 51.8–62.5 mm SL, Indiana, Allen County, 2.8 km SE Harlan, Black Creek at Richelderfer Drain, T31N, R14E, S1SW, 27 Aug. 1982, Karr et al.; INHS 88558, 21, 2 CS, 48.9–56.3 mm SL, Kentucky, Wolfe County, Daysboro, Red River, 16 May 1984, L. M. Page and K. S. Cummings; AUM 19199, 2, 59.9–61.5 mm SL, Michigan, Lenawee County, 5.2 km NNE Morenci, Bean Creek at Ridgeville Road, 10 Aug. 1979, R. K. Wallace and C. Weatherby; ANSP 82692, 55.1 mm SL, Ohio, Wayne County, 1.8 km NE Shreve, Shreve Creek, 5 Jan. 1953, F. G. Thompson and R. Maly; ANSP 82870, 6, 50.9–

58.9 mm SL, Ohio, Lorain County, 3.6 km NE Penfield, Black River, 20 Sept. 1953, F. G. Thompson; ANSP 82891, 6, 2 CS, 53.0–61.0 mm SL, Ohio, Medina County, 3.2 km E Spencer, Black River, 20 Sept. 1953, F. G. Thompson; ANSP 41333, 6, 53.7–57.3 mm SL, Pennsylvania, Indiana County, Branch of Crooked Creek, Oct. 1911, R. W. Wehrle; ANSP 41339, 4, 52.7–57.8 mm SL, Pennsylvania, Indiana County, Mud Lick Run, Oct. 1911, R. W. Wehrle; ANSP 41380, 6, 51.7–59.3 mm SL, Pennsylvania, Indiana County, Yellow Creek, April 1913, R. W. Wehrle; ANSP 73890, 4, 2 CS, 62.7–67.0 mm SL, Pennsylvania, Indiana County, Sleepy Hollow Run, 15 Sept. 1927, R. W. Wehrle.

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