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Keywords

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Southeastern Fishes Council

PROCEEDINGS

DEDICATED TO THE PRESERVATION OF SOUTHEASTERN FISHES

Number 20 August 1989

DISTRIBUTION AND CONSERVATION STATUS OF THE NORTHERN STUDFISH, *FUNDULUS CATENATUS*, IN INDIANA.

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ABSTRACT

Robust populations of northern studfish, *Fundulus catenatus,* a "species of special concern" in Indiana, were found at 13 sites, East Fork White River drainage, in southeast central Indiana. Populations in the Muscatatuk River seem to have been extirpated. Restricted distribution in Indiana, and potential threats from siltation and low-water dam construction, continue to justify its present conservation status classification.

INTRODUCTION

The northern studfish, *Fundulus catenatus*, has been designated a "species of special concern" by the Indiana Department of Natural Resources because of its limited distribution and presumed small numbers in Indiana. Previous to this study, it had been documented as occurring, in small numbers, at only six localities in Indiana. Four of these localities were on tributaries to the Flat Rock River in Johnson, Shelby, and Bartholomew counties (Gerking, 1945; Thomerson, 1969; Bill James, *in litt*. 1984-Herriot Creek in Johnson Co., probably extirpated by impoundment). The fifth collection (Gerking, 1945) was from Flat Rock River in Bartholomew Co. The sixth collection, two specimens, was taken in a rotenone sample from the Vernon Fork, a tributary of the Muscatatuk River, near Zenas in Jennings Co. (Zook, 1972). All localities (Fig.1) are in upper tributaries of the East Fork White River.

Gerking's (*in litt*., 1966) assessment of northern studfish abundance in Indiana, "... in my opinion this species is very rare in Shelby and Johnson counties. I never found this species abundant, and I doubt very much whether you would be able to obtain 100 specimens even thought you work very long and very hard," strongly suggests that their populations were small in the past.

METHODS

During 9-12 July and 14-19 September, 1985, we examined 59 potential northern studfish sites (several more than once) (Fig.1). Presence of northern studfish was documented either by catching them with a 10' x 6', 1/4" Delta mesh seine, or by seeing them swimming at the water surface, or both. In Fig. 1, a "not-present" site means we did not get them there by seining. Seven general fish collections were made during the September period (Table 1). Because of their conservation status, we did not intentionally preserve any northern studfish. Twenty specimens were collected from upper Leatherwood Creek for electrophoretic analysis.

RESULTS

We found northern studfish at 13 sites. Six of the sites were on first order streams, two on second order streams, and five on third order streams. We did not find northern studfish as far down the Flat Rock River as we had expected, and they seem to have been extirpated in the Muskatatuk River.

Leatherwood Creek-Sugar Creek population (Johnson Co.):

The population occurs in Leatherwood Creek, a small tributary of Sugar Creek, and downstream in Sugar Creek to above the confluence of Franklin Creek. Early collections reported from Sugar Creek and Cress Creek were taken from this population. We did not encounter northern studfish at 14 other sites in Sugar Creek and its tributaries, nor were they found in the Big Blue River drainage. None were encountered in the lower Driftwood River and its small tributaries, between Sugar Creek and Flat Rock River, even though suitable habitat appeared to be present.

Lewis Creek-Flat Rock River population (Shelby and Bartholomew cos.):

Gerking (1945) reported two records from this population, but we did not find northern studfish as far down the Flat Rock River as he did (2 mi. NE Columbus). Below our downstream northern studfish site, just south of the county line (Fig. 1), the Flat Rock River has been ponded by a series of low-

Table 1. Collections at sites wi

Number and percentage

SPECIES	SUGAR CREEK		FLAT ROCK NO. 1		LEWIS CREEK	
	Number	Percent	Number	Percent	Number	Percent
Esox americanus			2	0.43%		
Catostomus commersoni						
Hypentelium nigricans	1	0.61%	6	1.28%	1	0.19%
Minytrema melanops						
Moxostoma duguesnei						
Moxostoma erythrurum					3	0.56%
Campostoma anomalum	15	9.09%	30	6.38%	8	1.48%
Ericymba buccata	20	12.12%	44	9.36%	39	7.22%
Hybopsis amblops			5	1.06%	4	0.74%
Hybopsis dissimilis						
Hybopsis x-punctata						
Nocomis biguttata			1	0.21%	4	0.74%
Nocomis micropogon			24	5.11%		
Notropis atherinoides	9	5.45%	8	1.70%	10	1.85%
Notropis boops			27	5.74%	14	2.59%
Notropis chrysocephalus	21	12.73%	54	11.49%	238	44.07%
Notropis photogenis	12	7.27%				
Notropis spilopterus	17	10.30%	110	23.40%	29	5.37%
Notropis stramineus	22	13.33%			13	2.41%
Notropis umbratilis	4	2.42%	38	8.09%	13	2.41%
Notropis volucellus					1	0.19%
Notropis whipplei	8	4.85%	24	5.11%		
Notropis sp.			10	2.13%		
Phenacobius mirabilis			1	0.21%	3	0.56%
Pimephales notatus	1	0.61%	27	5.74%	125	23.15%
Rhinichthys atratulus						
Semotilus atromaculatus	4	2.42%	7	1.49%		
Ictalurus natalis						
Noturus flavus			18	3.83%		
Noturus miurus						
Fundulus catenatus	yes		yes		yes	
Fundulus notatus					20	3.70%
Labidesthes sicculus	1	0.61%	6	1.28%		
Ambloplites rupestris	2	1.21%				
Lepomis cyanellus						
Lepomis macrochirus	1	0.61%				
Lepomis megalotis			6	1.28%	13	2.41%
Lepomis microlophus					1	0.19%
Micropterus dolomieui			1	0.21%		
Micropterus punctulatus	2	1.21%	4	0.85%		
Micropterus salmoides						
Etheostoma blennioides	17	10.30%	12	2.55%		
Etheostoma caeruleum	2	1.21%				
Etheostoma flabellare			1	0.21%		
Etheostoma nigrum	4	2.42%	2	0.43%	1	0.19%
Etheostoma spectabile			1	0.21%		
Percina caprodes						
Percina maculata						
Percina phoxocephala			1	0.21%		
Percina sciera	2	1.21%				
Total	165		470		540	
Number of Species	21		28		20	

* SITE LOCALITIES IN INDIANA

Sugar Creek at Hwy. 44, E of Franklin, Shelby Co. 14:IX:1985.

Flat Rock R. (#1) at Hwy. 252 W of Flat Rock, Shelby Co. 15:IX:1985.

Vernon Fork, Muscatatuck R. @ 1 mi. below Zenas, Jennings Co.
Zook's collection: 7/8/71, Our collection: 18:IX:1985.

Clifty Creek. at Hwy. 31 SE of Columbus, Bartholomew Co. 17:IX:1985.

Driftwood R., Lowell Access NW of Columbus, Bartholomew Co. 18:IX:1985.

and without northern studfish.

species at each collection site.*

Zook's MUSCATATUCK Number	Percent	Our MUSCATATUCK Number	Percent	FLAT ROCK NO. 2 Number	Percent	CLIFTY CREEK Number	Percent	DRIFTWOOD RIVER Number	Percen
								1	0.53%
						1	0.17%		
9	1.07%	1	0.10%	10	3.14%	6	1.00%	2	1.06%
								1	0.53%
				1	0.31%				
						30	5.02%		
188	22.35%	359	37.63%	15	4.72%	74	12.37%		
17	2.02%	171	17.92%	55	17.30%	127	21.24%		
81	9.63%			11	3.46%	5	0.84%		
				1	0.31%	1	0.17%		
				14	4.40%	1	0.17%		
				1	0.31%				
				2	0.63%			14	7.41%
				23	7.23%				
6	0.71%							10	5.29%
174	20.69%	7	0.73%	35	11.01%	72	12.04%		
								17	8.99%
				60	18.87%			26	13.76%
						77	12.88%	5	2.65%
5	0.59%					1	0.17%		
								31	16.40%
				15	4.72%	55	9.20%	13	6.88%
4	0.48%	326	34.17%	15	4.72%	34	5.69%	1	0.53%
115	13.67%	27	2.83%	37	11.64%	81	13.55%	30	15.87%
						1	.17%		
42	4.40%	42	4.40%	2	0.63%	14	2.34%	1	0.53%
3	0.36%								
				1	0.31%			4	2.12%
41	4.88%								
yes		no		no		no		no	
				1	0.31%	2	0.33%		
				13	4.09%			1	0.53%
12	1.43%					1	0.17%	2	1.06%
1	0.12%							1	0.53%
				1	0.31%	4	0.67%	2	0.53%
92	10.94%			2	0.63%			7	3.70%
3	0.36%								
4	0.48%			1	0.31%	3	0.50%	2	1.06%
				1	0.31%				
8	0.95%					1	0.17%	2	1.06%
20	2.38%								
		1	0.10%			2	0.33%		
2	0.24%	20	2.10%	1	0.31%	5	0.84%	2	1.06%
10	1.19%								
1	0.12%								
								15	7.94%
814		954		318		598		189	
23		9		24		23		23	

water dams. We found them at five sites in the Lewis Creek drainage, but they seem to be absent from the upper Flat Rock River.

Haw (or Howe) Creek population (Bartholomew Co.):

Northern studfish were found at two sites in Haw Creek, but were not found in a small tributary, Tough Creek. The lower site (Fig.1) is in downtown Columbus across from the Cummings Company parking lot. An additional nine sites in Clifty Creek, the next tributary to the south, and Sand Creek (in Jennings Co.) did not have northern studfish.

Vernon Fork population (Jennings Co.):

This population, reported by Zook (1972), seems to have been extirpated. In July, we seined intensively at the site where they had previously been taken without encountering northern studfish. We revisited the locality (18/IX/'85) and made a general seine collection of 954 specimens for comparison with Zook's collection (Table 1). We inspected the river at a number of sites along the county roads which closely parallel the river from near Zenas to near the western county line, but did not encounter northern studfish habitat.

DISCUSSION

Northern studfish are usually found in relatively clear water over a sand and gravel substrate (Pflieger, 1975; Fisher, 1981). They spawn by burying their eggs individually in sand, gravel, or plant debris. The eggs take about two weeks to hatch, and can easily be smothered if a silt load is being deposited. Juveniles are most abundant in shallow, slackwater nursery areas. In larger streams, adults also concentrate in or near these shallow areas, but in smaller streams they swim along the surface out over deeper areas, as well as in the shallows (McCaskill et al., 1972). When alarmed, juveniles hide motionless in or near cover or on the bottom. Larger fish will swim rapidly some distance away, or will dive into cover or loose substrate.

Density of the Indiana populations seemed to be about the same as that we have seen in other parts of the species' range. In fact, the most adults we have ever seen in one place was at Slash Creek (a Lewis Creek tributary), where we estimated we could see well over 100 adults from our vantage point on a small bridge over the creek. Everywhere we found studfish we found several individuals, and there were almost always young of the year present.

For at least the last ten years (Charlie Grimes, personal communication), aquarists have collected northern studfish for personal use from the sites in Leatherwood Creek. This has occurred one or more times each year, and has resulted in small numbers of northern studfish being removed from the population. This population seems to be tolerating the current collecting pressure without harm, perhaps because sites with easy access constitute only a small part of the stream reach inhabited by the northern studfish. Lewis Creek has also been collected by aquarists. In September, we heard that two aquarists from Ohio had recently visited the creek to collect northern studfish.

The seine collection we made at the Vernon Fork locality (Table 1) contained 954 individuals in comparison to the rotenone collection of 843 fishes reported by Zook (1972). Our collection comprised only nine species compared to 23 species collected by Zook on 07/08/71. The central stoneroller, *Campostoma anomalum*, was numerically dominant in both collections, but no other dominant species was shared by the two collections. Six species (*C. anomalum*, 22.3%; *Notropis chrysocephalus*, 20.6%; *Pimephales notatus*, 13.6%; *Lepomis megalotis*, 10.9%; *Noturus miurus*, 9.9%; and *Hybopsis amblops*, 9.6%) comprised 86.9% of the total individuals in Zook's collection. Three species (*C. anomalum*, 38.0%; *Phenacobius mirabilis*, 34.5%; and *Ericymba buccata*, 18.1%) made up 90.6% of our collection. Modified Sorenson Similarity (Barbour et al., 1980) between the two collections was only 32%. It may be that differences between the two collections reflected different seasonal collecting dates, different water levels, or collecting bias. As to the latter, the water was low, much of the bottom was smooth rock, and seining was very effective.

The fishes collected by Zook (1972) represent a reasonable group of associate species for northern studfish, but we would not expect northern studfish to be associated with the fauna we collected at the Zenas locality. Our collection at this site stands out as different from other collections listed in Table 1. In comparison with Zook's collection, its fewer dominant species, order of magnitude fewer total species, and shift in species composition suggest considerable environmental degradation, as did the cm or so of silt we found deposited on the bottom.

Table 1 includes significant distributional records for four species. Gerking (1945; Map 27) shows *Hybopsis amblops* widely distributed in East Fork White River, but it was not recorded from that drainage by Clemmer (1980). Gerking (1945, p. 50) lists *Hybopsis dissimilis* from Bartholomew Co.: Flat Rock R., 2m. NE Columbus, and from Crawford Co., Blue R., Milltown. Harris (1980) shows only two Indiana records, both in the Tippecanoe River drainage in northern Indiana. Gerking (1945, p. 50) lists three White River drainage records for "*Erimystax* new species Hubbs and Crowe", which we presume is, at least in part, *Hybopsis x-punctata* Hubbs and Crowe. One of Gerking's records is in West Fork, and his two East Fork records are well downstream of our study area. Gilbert (1980) does not show any records of this species in the White River drainage. Gerking (1945, map 33) shows a record of *Notropis atherinoides* in the Upper Muscatatuck drainage, near the Zenas locality. Gilbert and Burgess (1980) include all of Gerking's dots for *N. atherinoides* except this one, so perhaps the record is suspect. Our collections of *N. atherinoides* document its presence in the Flat Rock River drainage.

SUMMARY AND CONCLUSIONS

The northern studfish is more widely distributed in the upper part of the East Fork White River drainage than had been thought. It is locally present in robust populations, and is

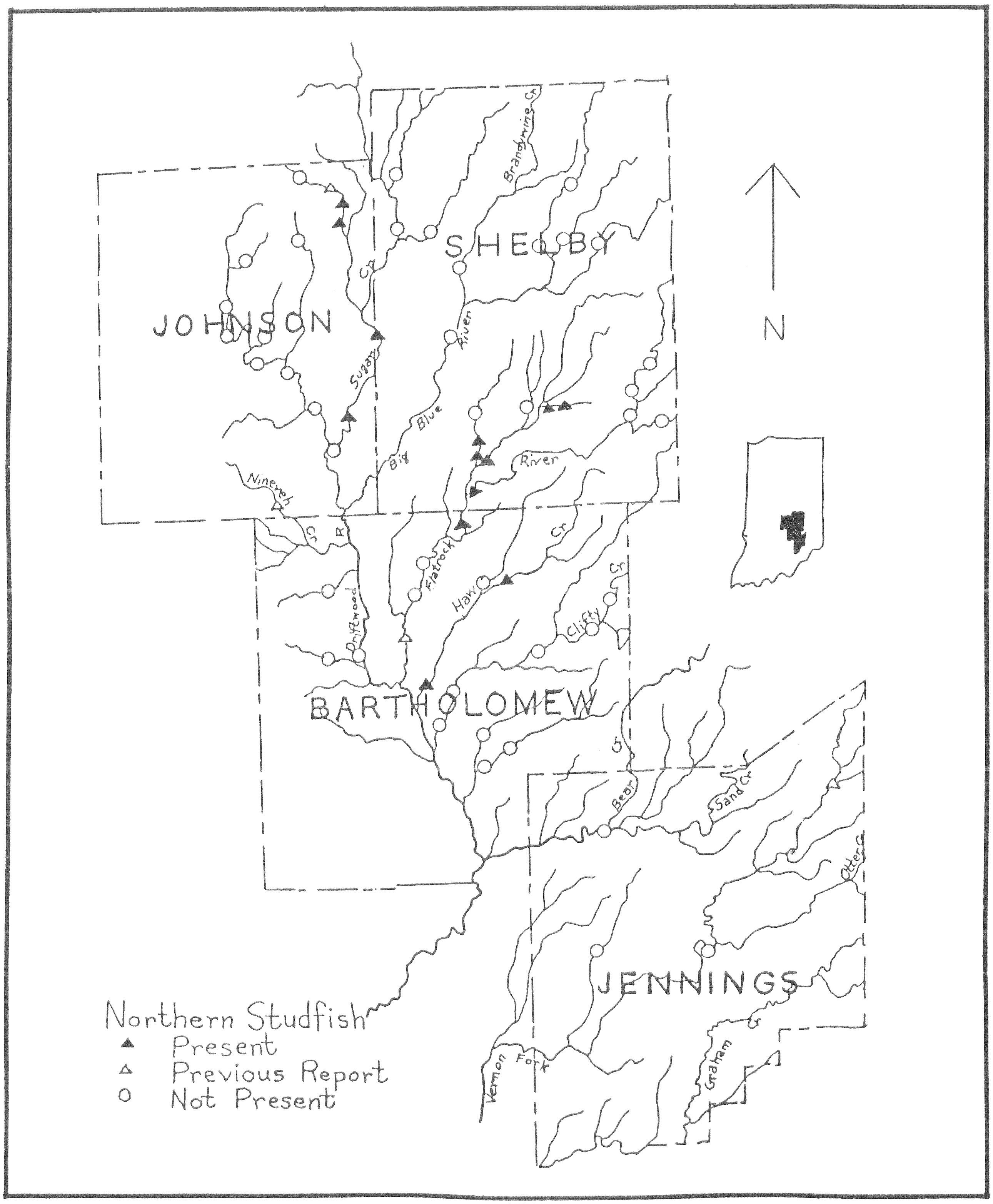

Figure 1. Distribution of northern studfish, *Fundulus catenatus,* in Indiana.

in no immediate danger of needing a more endangered classication. Its present "Species of Special Concern" classification seems to us to be appropriate in that it calls attention to the northern studfish's restricted distribution in Indiana without subjecting it to presently unnecessary protective regulation. We think the northern studfish is now extirpated from the Muscatatuk River where it was taken in 1971. If so, obvious probable causes are siltation, which smothers northern studfish eggs, and construction of low-water dams, which flood shallow areas used by juvenile studfish as nursery areas. These two factors adversely affect not only the northern studfish, but also the rest of the clear-water, gravel-bottom, pool-riffle-pool fish fauna. We would subsequently applaud efforts of State of Indiana, Federal, and local agencies to reduce siltation and restore free flow to rivers within the northern studfish's range.

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New Records and Comments on the Distribution of Blair's starhead topminnow, *Fundulus blairae* (Fundulidae).

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INTRODUCTION

Blair's starhead topminnow, *Fundulus blairae,* is distributed primarily on the Gulf Coastal Plain. The range presented by Wiley and Hall (1975) extended from northwestern Louisiana, northwestward to the Red River drainage of southeastern Oklahoma, southwestward to the Middle Brazos River drainage in eastern Texas, and along the Gulf Coast from the Galveston Bay drainage, to the Atchafalaya River in Louisiana. *Fundulus blairae* was later reported in the tributaries of the Little River (Red River drainage) in southwestern Arkansas (Robison 1977), and east of the Mississippi River in the Pearl, Pascagoula, and Mobile Bay drainages (Wiley, 1977; 1980).

In this report we extend the range of *F. blairae* to the eastern embayment of the lower Mississippi River in southwestern Mississippi and eastern Louisiana, and comment on records for *F. blairae* from the Conecuh-Escambia River drainage in Alabama and Florida.

RESULTS

Collections

Two of the new records of *F. blairae* are from the Homochitto and Buffalo rivers, both tributaries to the lower Mississippi River in southwestern Mississippi. The first record was a single male specimen (30.3 mm SL) collected from an unnamed tributary to the lower Homochitto River on 12 March 1988 near a cypress swamp, on Woodlawn Rd., 13.7 km northwest of Lanehart, Wilkinson County, MS, (Sec. 11, T3N, R3W) (Figure 1). Due to recent rainfall, the water was high and the slow-moving stream was approximately 7.6m wide with a clay-mud substrate. Submerged riparian vegetation was abundant, but no aquatic vegetation was present. The specimen was collected at a water depth of 0.5m in a clump of dead vegetation at a small inlet along the shore.

The Buffalo River is the lowermost major westward flowing tributary to the Mississippi River (Figure 1), and its 87 km length is wholly contained in Wilkinson County, MS. From September 11, 1986 to March 12, 1988, during a year-long stream survey, 289 specimens of *F. blairae* were collected at three sites from the lower Buffalo River (Figure 1). Two specimens were taken on March 28, 1987 from a locality 8.0 km N of U.S.Hwy 24 at Lessley, MS. on Southland Rd., (Sec. 25, T3N, R3W), six more specimens were collected on March 12, 1988, from a lower section of the river, 4.0 km N of US Hwy 24 at Pleasant Valley Plantation, and at the same time 281 specimens were taken in a cypress swamp lake, 11.1 km W of Lessley, MS (Sec. 10, T2N, R4W).

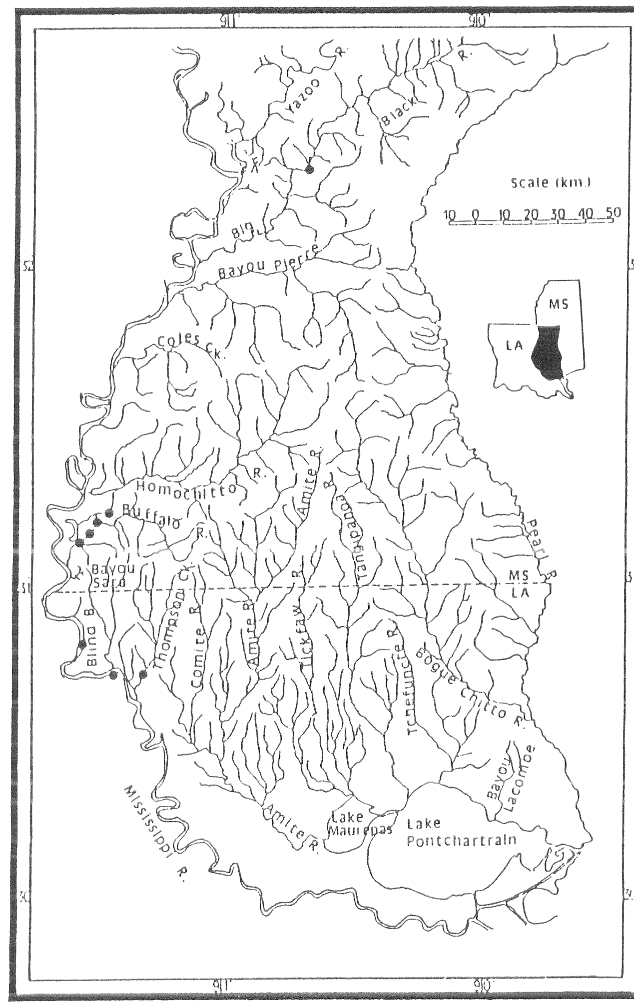

Figure 1. Distribution of *Fundulus blairae* in the eastern embayment drainages of the lower Mississippi River.

The uppermost site on the Buffalo River is characterized by a flat, sandy, shifting substrate with little emergent aquatic vegetation and a slow to moderate water flow. The river at the lowermost sites is a slowly moving meandering bayou with bald cypress (*Taxodium distichum*) and black willow (*Salix nigra*) comprising most of the terrestrial cover.

In addition to our recent collections, we report four other localities for *F. blairae* from the eastern embayment based on museum records. We examined and identified eight specimens of *F. blairae* (LSUMZ 394) from Thompson Creek col-

lected on October 27, 1972 at the US. Hwy 61 bridge, 10km southeast of St. Francisville, West Feliciana Parish, LA. One of four males had 6 prominent vertical bars across the midflank. A single adult male of *F. blairae* (TU 112455), 31mm SL, was collected on April 12, 1979 along the west bank of the Mississippi River at river mile 262.6 near St. Francisville, West Feliciana Parish, LA. We identified three specimens of *F. blairae* (LSUMZ 4780) collected from the Tunica Swamp area of Blind Bayou, West Feliciana Parish, LA on November 12, 1972. Two of the the three male specimens had 4-5 prominent vertical bars. We examined 14 specimens of *F. blairae* (UT 60.421), collected from a swamp .27 km west of the Big Black River at the US Interstate 20 bridge, Warren County, MS on May 20, 1988. The four localities are to the west of the range reported by Wiley (1980).

The specimens of Blair's starhead topminnow generally conformed to the description reported by Wiley and Hall (1975). They were identified as members of the *F. notti* species group by the presence of a subocular teardrop in both males and females, and numerous stripes on the flanks between the scale rows of females (Wiley and Hall 1975; Wiley 1977). All specimens examined showed the G-type head squamation and two-pore pattern (4a and 4b widely separated) diagnostic of the *F. blairae – F. dispar* clade (Wiley and Hall 1975; Wiley 1977). The adult males generally lacked vertical bars, the diagnostic character separating *F. blairae* from *F. dispar*. However, the series of 281, from the lowermost station in the Buffalo River, exhibited more variation in pigmentation than reported by Wiley and Hall (1975) with 44 adult males (29.1%of total) exhibiting vertical bars. The bars were thin, usually not extending anteriorly past the insertion of the pelvic fin or past the pectoral fin tip, and numbered between 2-8 (Table 1). By contrast, Wiley and Hall (1975) found vertical bars on only two males and one juvenile in 245 specimens from throughout the range of *F. blairae*.

Species Associates

Fundulus blairae is a component of a lowland fauna typical of the lower Mississippi River basin, tributaries, and backwaters. Species associates in the Homochitto and Buffalo rivers include: *Lepisosteus oculatus, Dorosoma cepedianum, D. petenense, Esox americanus, Cyprinella camura, C. lutrensis, C. venusta, Hybognathus hayi, H. nuchalis, Hybopsis longirostris, Lythrurus fumeus, Notemigonus crysoleucas, Notropis atherinoides, N. emilae, N. maculatus, N. texanus, Pimephales notatus, P. vigilax, Minytrema melanops, Ictalurus punctatus, Noturus gyrinus, Aphredoderus sayanus, Fundulus chrysotus, F. notatus, F. olivaceus, Gambusia affinis, Labidesthes sicculus, Menidia beryllina, Syngnathus scovelli, Chaenobryttus gulosus, Lepomis humilus, L. macrochirus, L. megalotis, L. microlophus, L. punctatus, L. symmetricus, Micropterus punctulatus, M. salmoides, Pomoxis annularis, P. nigromaculatus, Ammocrypta beani, Etheostoma chlorosomum, E. fusiforme, E. gracile, E. proeliare, E. stigmaeum, and Percina caprodes.*

DISCUSSION

Wiley (1977) discussed the systematics of the *Fundulus notti* species group. He concluded that *F. blairae* and *F. dispar* were sister species, and that in the Mississippi River and Mobile Bay drainages, *F. blairae* preferred the lower reaches of rivers, while *F. dispar* was usually found farther upstream. The starhead topminnows in the lower Buffalo River occurred in a stream section and habitat more typical of *F. blairae* than *F. dispar*. Still, the higher incidence of barring in these specimens raises several questions about the taxonomic status of the Buffalo River population of starhead topminnows. Given the close proximity of the southern limit of the range of *F. dispar* (Wiley 1980), the barred specimens might represent *F. dispar* occurring sympatrically with *F. blairae*, or they may represent *F. blairae* x *F. dispar* hybrids. More likely perhaps, the expression of a few bars in some male *F. blairae* in a small, relatively isolated population is due to genetic drift. The resolution of the problem is difficult using only morphological characters. *Fundulus blairae* and *F. dispar* share the same head pore and squamation pattern (Wiley, 1977), and differ primarily in the absence versus presence of vertical bars, respectively, in male specimens only. Perhaps some biochemical genetic technique could be employed to resolve the problem, but for the present it seems most parsimonious to identify the lower Buffalo River starheads as *F. blairae*.

The occurrence of *F. blairae* in the lower reaches of the Buffalo River system could likely be the result of natural dispersal across the Gulf Costal Plain during one of the three lowerings of sea level during the Pleistocene, and/or the subsequent flooding of the interconnecting swampy regions (Smith-Vaniz 1968; Swift et al., 1985). In a previous survey of the Buffalo River, *F. blairae* was not among the 75 species reported (Cashner et al., 1976). The lower sections of several other lower Mississippi tributaries seem suitable to support populations of *F. blairae*, but surveys of Bayou Pierre (Matthews, 1978), Clark Creek (Grady and Cashner, 1988), and Bayou Sara (Grady et al., 1983) failed to recover this species, possibly due to limited access to collecting sites in the lower sections. Most of the previous surveys mentioned were concentrated in the headwater and middle portions of the streams. New populations of *F. blairae* might be discovered if collecting efforts were intensified in the lower sections of these and other lower Mississippi tributaries.

Fundulus blairae has recently been found to occur syntopically with *F. escambiae* in the Conecuh-Escambia River system in Alabama and Florida (Robert C. Cashner, pers. comm.). This record extends the range eastward from the Mobile Bay drainage as reported by Wiley (1977; 1980).

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Table 1. Frequency of barred and unbarred males of *Fundulus blairae* from populations distributed across the Gulf Coastal Plain.

Population	Barred	Unbarred
Texas and Louisiana *	2	245
Buffalo River, MS	44	107
Alabama – Florida	0	22

* From Wiley and Hall (1975).

THE CHESTNUT LAMPREY, *ICHTHYOMYZON CASTANEUS* GIRARD, IN THE MOBILE BASIN

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INTRODUCTION

The chestnut lamprey, *Ichthomyzon castaneus*, is a parasitic freshwater species endemic to rivers of eastern North America. The majority of records of this species are from major rivers and large streams in the Mississippi River Basin where it is fairly common (Rohde and Lanteigne-Courchene, 1980). Often this species is captured in streams during upstream spawning migrations or found attached to host species. In the Mobile Basin, however, the chestnut lamprey is uncommon, if not rare. Rohde and Lanteigne-Courchene (1980) report only eight records of the species from the entire drainage system. Recent collection efforts and examination of previously reported records of the chestnut lamprey in the Mobile Basin provide new distributional information for this rare species. Herein, we evaluate and revise the distribution of the chestnut lamprey in the Mobile Basin.

HISTORICAL MOBILE BASIN RECORDS

Records of the chestnut lamprey from the Mobile Basin have been reported by Gudger (1930), Hubbs and Trautman (1937), Cook (1959), and Rohde and Lanteigne-Courchene (1980). Gudger (1930) and Hubbs and Trautman (1937) reported 7 specimens [American Museum of Natural History 10104(5); University of Michigan Museum of Zoology 97135 (2)] from the upper Coosa River, near Rome, Georgia (Fig.1). Cook (1959) reported two specimens from the Mobile Basin in the Buttachatchie River, Lowndes Co., Mississippi (Colb Lake, Mississippi Mus. Nat. Sci. 6841) (Fig. 1). One of these specimens was reported to have been "attached to a buffalo fish" (Cook, 1959:44)

Other Mobile Basin records of the chestnut lamprey are from Rohde and Lanteigne-Courchene (1980). In Tennessee, a single locality was reported from the Conasauga River based on a voucher specimen collected in1969 from Bradley County (University of Tennessee 2.12). In the account by Rohde and Lanteigne-Courchene (1980), however, three records from Alabama and two records from Mississippi are in error or are unsubstantiated (see their distribution map). In Mississippi, two localities were listed from the upper Tombigbee River, well upstream from Cook's (1959) report of two specimens from the Buttahatchie River System. According to Rohde (pers. comm., 29 April 1988) only the downstream locality was included in their original account; this record was taken from Cook (1959). However, this locality and the second, more upstream locality, were both plotted incorrectly. The actual collection locality is illustrated in Figure 1.

In Alabama, the distribution of the chestnut lamprey as presented by Rohde and Lanteigne-Courchene (1980) includes only the Black Warrior River. A single locality is from what appears to be the Sipsey River Drainage, one from the lower Black Warrior River in Hurricane Creek, Tuscaloosa Co., and three localities from the upper Black Warrior River. To date, only the Hurricane Creek locality, based on a single large adult (University of Alabama Ichthyological Collection 2545.01), has been located to substantiate any records from the Black Warrior Drainage. The only known record from the upper Black Warrior River is a large ammocoete from Rush Creek, Winston Co., Alabama (UAIC 4964.01, re-identified as *I. gagei*.

The Sipsey River record and the two other upper Black Warrior River localities are unsubstantiated. Thus, the only vouchered historical records for *I. castaneus* in the Mobile Basin include specimens from the Buttachatchie River in Mississippi, the Black Warrior River in Alabama, and upper Coosa River in Georgia and Tennessee.

RECENT MOBILE BASIN RECORDS

Several new distributional records of the chestnut lamprey from the Mobile Basin of Alabama have come to our attention. These records substantiate the distribution of *I. castaneus* in drainages previously thought to contain this species, and are the first for the Alabama River Drainage in Alabama.

Black Warrior River Drainage.– Clear Creek, tributary to Sipsey Fork of Mulberry Fork of Black Warrior River, 6.3 km W Double Springs [T10S, R9W, Sec. 28], Winston Co., AL; 11 April 1966 (Tulane University 40603; 1 specimen). Mulberry Fork at Underwood's Ferry, 4.8 km NW Pumpkin Center [T16S, R6W, Sec. 9], Walker Co, AL; 25 March – 8 May 1949 (UAIC 34.01; 1 specimen). Lake Tuscaloosa, near Binnion Creek [T19S, R10W, Sec. 15], Tuscaloosa Co., AL; 20 April 1988 (UAIC 8346.01; 1 specimen). The former two localities are in close proximity to the previously reported upper Black Warrior records of this species, but were not included in Rohde and Lanteigne-Courchene (1980). The later collection represents the first substantiated record from North River; the lamprey was found attached to a bluegill, *Lepomis macrochirus*.

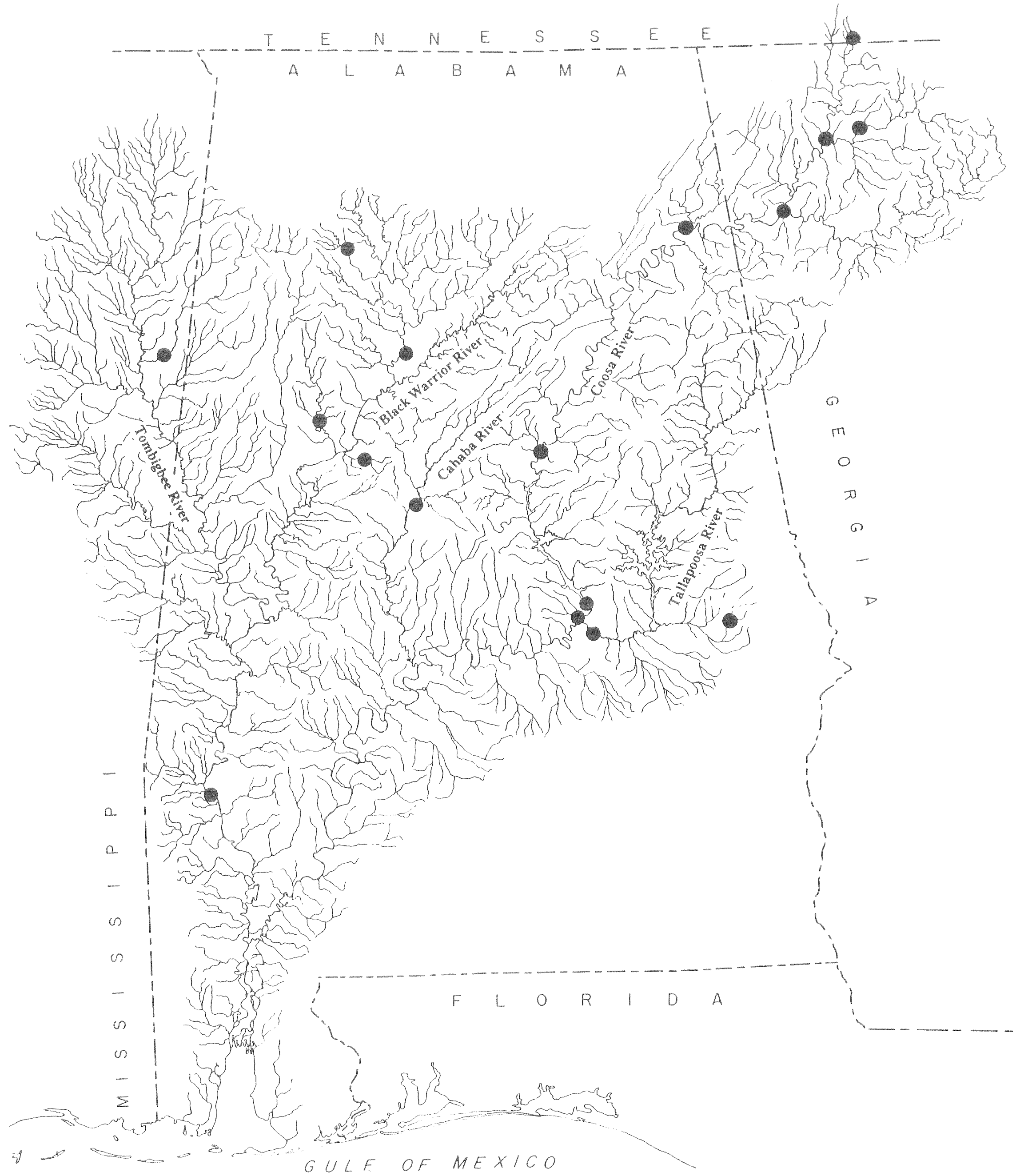

Figure 1. Distribution of the chestnut lamprey *Ichthyomyzon castaneus* in the Mobile Basin. Vouchered localities are repesented by dots and are discussed in text.

Lower Tombigbee River Drainage. – Tombigbee River at Coffeeville, mouth of Turkey Creek [T10N, R2W, Sec. 34], Choctaw Co., Al; 20 April 1988 (UAIC 8465.01; 1 specimen). This specimen was caputred while electrofishing blacktail redhorse, *Moxostoma poecilurum*, from the Tombigbee River. Although the chestnut lamprey is known from the Tombigbee River Drainage, this is the first record from the lower portion of the river as well as the first record from the Costal Plain.

Coosa River Drainage. – Coosa River at Centre, Cherokee Co., AL; 21 October 1954 (Auburn University 1639; 1 specimen). Coosawattee River, 18.8 km NE Calhoun at St. Rd. S1800, Gordon Co., GA; 16 March 1978 (AU 19132; 2 specimens). Coosa River, mouth of Yellowleaf Creek at Gaston stream plant, Shelby Co., AL; 12 June 1978 (AU 17039; 1 specimen). Oostanaula River, 8 km N Calhoun at US 41, Gordon Co., GA; 14 October 1978 (AU 19134; 4 specimens). Same locality as above; no date (AU 19150; 4 specimens). Coosa River, 2.9 km W Wallsboro and 4.2 km below Jordan Dam [T19N, R18E, Sec. 35], Elmore Co., AL; 7 May 1985 (UAIC 8440.01; 1 specimen). Coosa River, 5.6 km SW Wetumpka at Ft. Toulouse [T18N, R18E, Sec. 27], Elmore Co, AL; 17 March 1988 (no voucher specimen). The first specimen was attached to a specimen of *Ictalurus furcatus*. The S

Shelby Co. specimen was removed from the intake screen at the Gaston steam plant. The chestnut lamprey collected in Elmore Co. was 204 mm, free swimming, and captured from beneath a log while electrofishing. The last specimen represents a sight identification. This lamprey was approximately 250 mm and escaped from a gill netted, 2.2 kg common carp, *Cyprinus carpio*.

Cahaba River Drainage. – Cahaba River, Hwy 27 bridge [T24N, R10E, Sec. 33], Bibb Co., AL; 2 April 1988 (no voucher specimen). This record is based on the capture of a 320 mm, recently parasitized *Moxostoma poecilurum* (UAIC 8339.19) from this locality. The redhorse, when removed from the seine, had a large, open, semi-circular, bleeding wound in the breast region (Fig. 2). Bleeding around the wound ceased within a few minutes after the specimen had been placed in a separate container of river water. From these observations it was clear that the lamprey detached from the redhorse and escaped the seine during our collecting effort. Identification of this species as the chestnut lamprey is not controversial since this is the only parasitic lamprey in the Mobile Basin.

The size of the wound on the *M. poecilurum* measured 23.5 mm in width and 22.2 mm in length, indicating that the lamprey was quite large. Two regression equations were calculated using the width (W) and length (L) of the oral disc against body length (TL/T) of adult *I. castaneus* specimens (N = 6, TL = 104-248 mm) to predict the body size of the lamprey attached to the redhorse. Based on width of wound, the lamprey is predicted to have been 336 mm in length (TL/T = 77.8 + 11.1 W, r = 0.844). Using length of wound as a predictor of body length the lamprey would have been 327 mm (TL/T = 79.9 + 11.1L, r = 0.874). These predictions are very similar and well above the maximum body length of 310 mm reported for the species by Rohde and Lanteigne-Courchene (1980). Both predictors, however, are well within the maximum length of 380 mm reported for *I. castaneus* by Moore and Kernodle (1965) and Scott and Crossman (1973) for Mississippi River populations of this species.

Tallapossa River Drainage. – Barrow pit along Chewacla Creek, 15.8 km E of Tuskegee along Hwy 80, Macon Co., AL; 18 February 1978 (AU 16179; 1 specimen). Tallapossa River, 4.8 km WNW Bingham, near Hwy 231 [T17N, R18E, Sec. 20], Elmore Co., AL; 29 March 1989 (UAIC 9106.01; 1 specimen). The former specimen was found attached to a *Minytrema melanops*. The latter specimen was 179 mm TL and was attached to a 545 mm *Cyprinus carpio*. These collections represent the first and only records of the chetnut lamprey from this river system.

SUMMARY

Relative to other drainages inhabited by the chestnut lamprey in the eastern United States, this species is not a common member of the ichthyofauna of the Mobile Basin. This is evidenced by the obvious disparity in collections of *I. castaneus* from the Mobile Basin compared to most drainages of the Mississippi River Basin, even after extensive surveys of many Gulf Coastal rivers. Recent collections and an evaluation of previous reports of this species indicate that only 18 substantiated records are known from the Mobile Basin (Fig 1). Included are records from the following rivers: Buttahatchie, North, Black Warrior, Cahaba, Coosa, Coosawattee, Oostanaula, and Tallapoosa. Previous reports of *I. castaneus* from some of these drainages are not considered valid because no voucher specimens are available.

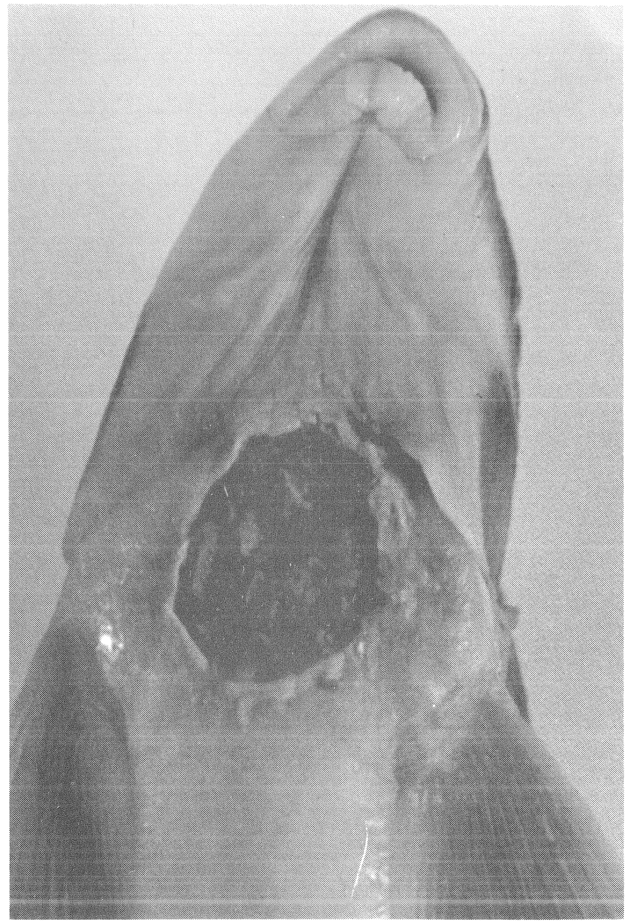

Figure 2. Breast region of 320 mm specimen of *Moxostoma poecilurum* collected from the Cahaba River, Bibb Co., AL (UAIC 8339.19), illustrating area of attachment by an *Ichthyomyzon castaneus*.

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DIET OF JUVENILE BOWFIN, *AMIA CALVA* Linnaeus, IN THE SIPSEY RIVER, ALABAMA

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INTRODUCTION

The bowfin, *Amia calva* Linnaeus, is one of only a few living holostean fishes, and the only extant Amiiform fish (Nelson, 1984). It is widespread in the lowlands of eastern North America, from the St. Lawrence River and Great Lakes south to the Gulf of Mexico (Burgess and Gilbert, 1980). Adult bowfin are notorious predators, and feed on many vertebrate species, including salamanders, frogs, snakes, and lizards, but mostly other fishes. They also eat crayfishes, insects, and leeches (Lagler and Applegate, 1942; Berry, 1955; Diana, 1966). Adult bowfin are undoubtedly sight feeders that will eat anything appearing to be food, including artificial fishing worms (Diana, 1966).

Food habits of young bowfin are poorly known. Schneberger (1937) reported that bowfin between 45 and 70 mm total length (TL) feed on planktonic crustaceans and small insect larvae, but he did not quantify the food items. Pflieger (1975) noted that young bowfin, at approximately 100 mm TL, switched from a primarily invertebrate diet to eating vertebrates. Herein, we report on the gut contents of 50 juvenile bowfin from the Sipsey River, Alabama.

METHODS

Twenty five specimens in each of two size classes were examined. The smaller fish ranged from 21 to 23 mm TL ($\bar{x}$=21.96); the larger fish varied from 39 to 59 mm TL ($\bar{x}$=49.88). Fish to make up the two size groups were randomly selected from two collections made in a flooded area by the Sipsey River, Tuscaloosa County, Alabama [University of Alabama Ichthyological Collection 800.01 (284 specimens) and 4503.01 (76)]. Each fish's stomach was excised, flushed, and its contents identified and counted. Food from each bowfin size class was pooled by taxon, dehydrated at 60°C for 48 hours and weighed.

RESULTS AND DISCUSSION

Gut contents of young bowfin were quite varied (Table 1, Figure 1). Fish in both size classes had eaten invertebrates almost exclusively. A single 46 mm specimen did contain one poeciliid fish, *Gambusia affinis*. Young bowfin most often eat cladocerans, copepods, isopods, amphipods, and dipterans. The relative abundance of each of these and other taxa differed, however, between size classes and depending on whether number or weight was considered. Cook (1959) stated that bowfin consumed vegetable matter, but we found none. The presence of some terrestrial arthropods, one aphid and one pseudoscorpion (Table 1), suggests that juvenile bowfin will eat almost any appropriate size arthropod they encounter.

Diet did not vary within a size class. This was also noted by Schneberger (1937), and is related to the compact schooling behavior of juvenile bowfin, which are herded into cohesive schools by the male parent until they reach 100 mm TL (Pflieger, 1975). Diet composition did differ appreciably between the two size classes (Table 1, Figure 1). The most conspicuous difference between the two was the infrequent number of insects in the smaller size class. Insects accounted for only 1.4% of the diet among smaller bowfins, but was nearly 23% of the diet for the larger size group. This difference may be size related, because larger insects, such as *Siphlonurus*, Macromiidae, *Chauliodes*, and *Deronectes*, were present only in the stomach of the larger class. Perhaps members of these taxa are too large or evasive for the smaller bowfin. Alternatively, the discrepancy may be related to differences in

Table 1. Food items of juvenile bowfin by number and weight. Percentages by weight for taxa within Insecta are enclosed in parentheses.

Prey item	21-23 mm specimens Number	%	% weight	39-59 mm specimens Number	%	% weight
Crustacea						
Cladocera			50.3			43.3
Chydoridae	125	13.0		1098	12.8	
Daphnidae	437	45.3		3898	45.4	
Copepoda			8.7			10.0
Ameiridae				30	0.3	
Cyclopidae	224	25.3		1878	21.9	
Ostracoda			1.2			1.7
Cypridae	6	0.6		662	7.7	
Isopoda			35.7			15.0
Asellidae						
Asellus	134	13.9		115	1.3	
Amphipoda			2.7			6.1
Gammaridae						
Gammarus	17	1.8		306	3.6	
Insecta						
Ephemeroptera						22.6
Siphlonuridae						
Siphlonurus				2	0.02	(0.6)
Odonata						
Macromiidae				1	0.01	(0.1)
Homoptera						
Aphididae				1	0.01	(0.1)
Megaloptera						
Corydalidae						
Chauliodes				2	0.02	(0.5)
Coleoptera						
Dytiscidae						
Deronectes				101	1.2	(9.6)
Diptera						
Ceratopogonidae				1	0.01	(0.2)
Chaoboridae						
Chaoborus				120	1.4	(1.4)
Chironomidae	1	0.1	1.4	320	3.7	(8.7)
Culicidae				56	0.6	(1.4)
Arachnida						0.2
Pseudoscorpionida				1	0.01	
Teleostei						1.1
Poeciliidae						
Gambusia				1	0.01	
Total	964			8593		

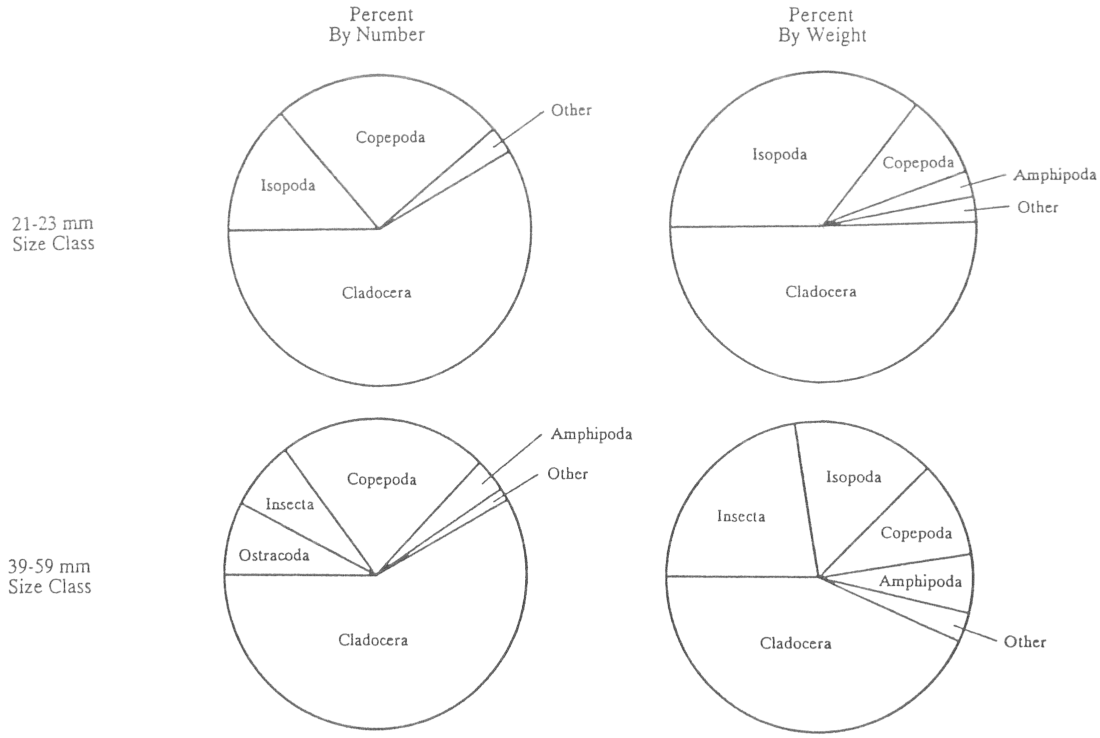

Figure 1: Stomach contents of two size classes of *Amia calva* expressed as precent by number and percent by weight.

foraging areas by the two size classes or sampling error. Smaller individuals had eaten many isopods, but larger specimens consumed slightly greater proportions of amphipods (Table 1, Figure 1).

Foraging locations of young bowfin are reflected in their diet composition. Planktonic taxa were well represented in the stomachs of both size classes (83.6% by number and 59.0% by weight in the small size class; 80.1% and 53.3% in the large size class), indicating that young bowfin feed frequently in the water column. Included in the zooplankton component of the diet are the cladocerans and cyclopoid copepods. *Chaoborus* also may be a planktonic component. Although chaoborids are a member of the benthic community during the day, they have crepuscular and nocturnal vertical migrations (Brigham et al., 1982).

Exclusive of the aphid and pseudoscorpion, all other invertebrates consumed (16.4% by number and 41.0% by weight; 19.9% by number and over 45.4% by weight by small and large class, respectively) inhabit varied benthic habitats. Other crustaceans (Ameiridae, Cypridae, *Asellus*, and *Gammarus*) and the Macromiidae inhabit benthic debris, often concealed beneath leaves or root masses. *Siphlonurus* and *Deronectes* are commonly associated with submerged vegetation and sedimentary taxa include ceratopogonids and chironomids. Occurance of these taxa suggests that young bowfin are also benthic foragers.

Young bowfin seem not to feed much near the surface. The culicids, or mosquitos, were the only surface dwelling insects consumed in any numbers by these bowfin. Culicids were not found in stomachs of the smaller bowfin and were infrequently observed in the larger bowfin. In total, mosquito larvae accounted for less than 1% by number and only 1.4% by weight of the total diet of the larger bowfin.

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SFC REGION AND SUBREGIONS

As taken from the 22 March 1989 memorandum from the then SFC chairman Robert E. Jenkins to the SFC officers, regional coordinators and others plus the ensuing discussion of the SFC business meeting held 7 April 1989 at Charlotte NC the following clarification of the SFC whole region and subregions was constructed. In addition, correspondence from Ray Bouchard, who ew up the original map and deineatd the regions, was utilized to this same end. The current logo on this number and the map below reflect the consensus of the group and the emended original constitutional provisions: "the term southeastern fishes is intended to include any endemic fish of racial, subspecies, or species status that inhabits the drainages of southeastern United States, and additional drainages and endemic fishes as determined by the Council." These drainage areas include [1] the lower Mississippi River and tributaries and all adjacent drainages within the Mississippi Embayment (lower Rio Grande in the west to an inclusive of the Mobile Bay drainages in the east); [2] the main Ohio River and all tributaries flowing into the Ohio from the south side; [3] all eastern tributaries to the Mississippi River south of the Ohio River; [4] the main Missouri River and all tributaries flowing into the Missouri form the south (from mouth of the Missouri upstream to junction of the Kansas River with the Missouri); [5] all western tributaries of the Mississippi River south of the Missouri River; [6] all drainages flowing into the Gulf of Mexico east of Mobile Bay to Key West, Florida and [7] all Atlantic drainages from the Potomac River southward to Key West.

The inclusion of the Missouri upto the mouth of the Kansas River is an addition to the logo and the map below and reflects the original intention of the founders of the society. The inclusion of the Monogahela-Youghiogheny as southern tributaries of the Ohio River in Pennsylvania was suggested by chairman Jenkins and not objected to by the members present.

Subregions

As labeled on the map below by roman numerals the following subregions are renamed geographically and delineated by drainages:

Northeast Subregion (Area I) Atlantic slope from the Potomac River southward to include the Santee River system.

Southeast Subregion (Area II) Atlantic slope from the Edisto River drainage south to Key West, and Gulf of Mexico tributaries west to include the Apalachicola River system.

North-central Subregion (Area III) Southern tributaries of the Ohio River from the Monongahela drainage to the Tennessee drainage.

South-central Subregion (Area IV) Gulf of Mexico tributaries from St. Joseph Bay (just west of Apalachiocola River mouth) west to the Mississippi River, and eastern tributaries of the Mississippi River from the Mississippi Delta to the mouth of Ohio River.

Northwest Subregion (Area V) Ozark Mountains and associated uplands, and the extension of Ozarkian rivers to the Mississippi River.

Southwest Subregion (Area VI) Ouachita Mountains and associated uplands, and portions of other Mississippi River and Gulf of Mexico tributaries, east of the Balcones Escarpment, to the Rio Grande.