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Abstract

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Species Dominance in the Fish Populations of the Pearl River at Two Study Areas in Mississippi and Louisiana: 1966-1988. By G.E. Gunning and R.D. Suttkus, 9 pp. Plus Minutes and Regional Reports.

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LIFE HISTORY OF THE BRIGHTEYE DARTER *ETHEOSTOMA LYNCEUM* (PISCES: PERCIDAE), IN TERRAPIN CREEK, KENTUCKY

Diana Bell and Tom J. Timmons

Department of Biological Sciences
Hancock Biological Station
Murray State University
Murray, Kentucky 42071

ABSTRACT

The brighteye darter, *Etheostoma lynceum* (Hay), is limited to eastern tributaries of the lower Mississippi River below the Fall Line. *E. lynceum* from Terrapin Creek, Graves County, Kentucky, was studied from January 1983 through December 1983. It was collected in undercut stream banks with dense tree roots in winter and in fast flowing, shallow, gravel riffles in summer. Chrinomids were the predominant food item (50% by volume; 68-100% frequency of occurrence). Feeding was diurnal, peaking at 1700 hrs. Adult and juvenile brighteye darters ate the same bottom invertebrates, but juveniles ate smaller and fewer items. The reproductive season extended from April into June. The bright green coloration of the vertical bands, fins, breast, and belly was more intense in males than females. Females exhibited greatly enlarged genital papillae during breeding and could be sexed externally. Fecundity varied from a range of 33-116 mature ova for age I fish to 65-201 for age III. Ripe ova were 1.1 to 1.6 mm in diameter, translucent, yellow, and appeared as early as February. Both sexes attained age III, and the oldest fish was a female (44 mm) approximately 3.5 years old.

INTRODUCTION

The brighteye darter, *Etheostoma lynceum* (Hay), was formerly one of two recognized subspecies of *E. zonale* (Tsai and Raney 1974). The difference in appearance and meristic characters between *E. zonale* and the allopatric *E. lynceum* have been discussed in depth by Etnier and Starnes (1986). The distribution of *E. lynceum* is limited to eastern tributaries of the lower Mississippi River below the Fall Line in Kentucky and Tennessee (Obion, Hatchie and Wolf river systems) and Mississippi (Yazoo,Black and Homochitto river systmes); and in eastern Gulf slope drainages in Mississippi and Louisiana (Tangipahoa, Pearl and Pascagoula river drainages). *E. zonale* is found in the Mississippi River drainages above the Fall Line, western drainages of Lake Michigan, and headwaters of the Savannah River on the Atlantic slope (Tsai and Raney 1974).

The life history of *E. zonale* has been described from several regions: Pennsylvania (Lachner et al. 1950), Ohio (Adamson and Wissing 1977), Minnesota (Erickson 1977), West Virginia (Holbrook and Tarter 1977), New York (Nemecek 1980), and Illinois (Cordes and Page 1980). There have, however, been no studies on the life history of *E. lynceum*. The objective of this study was to provide information on the life history of this new species, not only for comparison to *E. zonale*, but also because the habitat of the brighteye darter is often destroyed by channelization and the adverse impacts from intensive agricultural practices. *Etheostoma lynceum* is found in Kentucky only in Terrapin Creek, a stream included in the list of Outstanding Resource Waters by the Kentucky Nature Preserves Commission (Hannan et al. 1982).

MATERIALS AND METHODS

Specimens of *E. lynceum* were collected from Terrapin Creek, Graves County, Kentucky with a 3-m long seine from January to December 1983 and preserved in 10% formalin. Data recorded on field conditions included depth and width of stream sites, description of substrate type and size, presence of vegetation or cover, and water temperature. Flow was measured using a Teledyne Gurley water current meter.

Each fish was blotted dry with a paper towel and weighed to the nearest 0.001 g on a Mettler analytical balance. The standard length (SL) was measured to the nearest 0.1 mm with a dial caliper and the sex was determined. Scales were removed from the right side above the lateral line and near the junction of the soft and spinous dorsal fins. The scales were mounted between glass slides and viewed with a microprojector. Fish were assigned to age groups by counting the annuli. Age class designations consisted of 0-III years, with fish spawned in the spring or summer considered to be age class 0 until January 1.

The population density (number of fish/m²) of *E. lynceum* was estimated on 6 September 1983 by the Leslie method (Leslie and Davis 1939). A 12-m long section of stream, with a surface area of 24 m² and an average depth of approximately 0.3 m, was sampled. The length of the stream section between two 5-mm mesh block nets was sampled by numerous short seine hauls on each sample until only a few fish were collected per 24 m² sample. Fish were identified, counted, and released below the downstream block net. The number of seine hauls per sample was constant. A regression line was then projected to the intercept of the X-axis to estimate the population size.

Changes in the ova diameters and ovarian weights were observed. Ovaries were removed and weighed to the nearest 0.001 g. Ovarian weight was calculated as a percentage of the somatic body weight. Ova, taken from fish collected from April through July, were separated from other ovarian tissue and measured with a calibrated ocular micrometer. Fecundity was determined by direct counts of mature ova.

Feeding habits of *E. lynceum* from Terrapin Creek were evaluated by removing contents of the digestive tract anterior to the intestine and examining them under a dissecting microscope. Food items from each fish were identified, counted, and their relative volumes estimated using an ocular micrometer. Volume was estimated because numerical analysis may overemphasize the importance of small food items (Windell 1971). The frequency of occurrence of food items and the percent volume of a food item were calculated.

The feeding periodicity of *E. lynceum* was determined by seine collections at 3-hr. intervals from 0500 hrs on 13 July to 0200 hrs on 14 July. Drift and bottom invertebrates were sampled every three hours using Surber samplers and drift nets set upstream from the area seined for darters. Drift nets were left in the latter and checked every three hours.

Study Site

Terrapin Creek is a tributary of the North Fork of the Obion River in Graves County in western Kentucky. The study site was 4.2 km upstream from its mouth and 3.2 km south of Bell City. County road number 1270 crosses the creek at the study site. The creek bottom was shifting sand and fine and medium-sized gravel without a constant pool to riffle ratio. It was common in some areas to sink 0.3 m into the loose sand and gravel while walking in the stream. The loose bottom allowed the stream to meander and constantly change within the banks. The study site consisted of pools less than 1 m in depth, riffles, and undercut banks. Except in winter, the tree-lined banks shaded the entire stream. Aquatic macrophytes were absent and fallen trees and tree roots were the only cover in the pools. Water overflowed the 3-m banks into nearby farmland and woods after heavy rainfall. Small springs flow into Terrapin Creek, and it was one of the few streams still flowing during the severe summer drought in 1983. The inflow of spring water keeps the temperature cool during the summer (maximum of 22.2° C) and ice free in the winter (minimum of 4.4° C). The discharge was 33 cfs and the velocity was 0.63 m/s on 6 July 1983. A list of fish species known from Terrapin Creek appears in Burr and Warren (1986).

RESULTS AND DISCUSSION

Life History

In the winter, *E. lynceum* specimens were collected in water 0.3-0.6 m deep with moderate current among dense tree roots beneath the undercut banks. Also common in seine hauls with the brighteye darter were *Lampetra aepyptera* ammocoetes, *Semotilus atromaculatus*, *Erimyzon oblongus*, *Aphredoderus sayanus*, *Etheostoma nigrum*, and *E. pyrrhogaster*. During the summer the brighteye darter moved into the shallow gravel riffles. They were commonly collected in riffles with *E. nigrum* and *E. pyrrhogaster*. Young-of-the-year brighteye darters were found over a solid gravel bottom in the lower portion of a riffle as it entered a pool. They were commonly collected with young-of-the-year *E. nigrum*, *E. pyrrhogaster*, and several cyprinids.

The density of brighteye darters was estimated to be 4.2 fish/m². The projected regression line (r = 0.88) indicated 100 brighteye darters per 24/m². The density of the second most abundant darter, *E. nigrum*, was estimated to be 44 per 24/m² (r = 0.98).

The monthly, mean standard length of each group by sex was determined for 406 *E. lynceum*. Little growth occurred from October through May for most brighteye darters. The most rapid growth occurred between June and August. After the second year males were longer than females of the same age. Age II fish were absent or poorly represented in samples throughout the year. Annuli were readily identified on scales by changes in spacing of circuli and cutting over of circuli at edges of lateral fields. It is unlikely that age II fish were not recognized. A poor spawning season or destruction of eggs or young from floods may account for reduced numbers of that year class. Matthews (1986) documented alterations of species compositions during a catastrophic flood in the Piney Creek watershed in Arkansas. He noted that benthic species in riffles showed the least reduction in numbers during the December flood. Young-of-the-year centrarchids and cyprinids were extremely susceptible to downstream displacement by flooding in Brier Creek, Oklahoma (Harvey 1987). John (1964) observed that flash floods in streams of the Chiricahua Mountains, Arizona, could annihilate, or at least displace downstream, a fish population, especially young of the year. Occasional spring floods in Terrapin Creek raise the water level more than 3 m and may have been responsible in 1981 for the missing age II darters. A flood at spawning time could wash away or destroy eggs, since the loose gravel bottom of Terrapin Creek must move and be churned to a considerable depth during floods.

Of the 406 fish for which the age was determined, 12.1% were age 0, 69.0 % were age I, 2.4% were age II, and 16.5% were age III. Males of age 0-III represented 14.5%, 68.3%, 4.1% and 13.1%, respectively. Females age 0-III represented 7.5%, 71.8%, 1.6%, and 19.0%. Age I fish of both sexes comprised the greatest percentages. Sixty-seven brighteye darters were in age group III. Assuming an April spawn, the oldest fish was a 44.3 mm female, 3.5 years of age, collected November 1983.

The sex ratios (male:female) were determined for all bright eye darters (1:1.7) and by age groups. At age 0 there was no significant departure from 1:1 ratio ($X^2 = 0.10$, $0.90<P<0.75$). Females did outnumber males at age I (1:1.8, $X^2 = 24.01$ $P<0.001$)

and age III (1:2.5, $X^2 = 12.55$, $P<0.001$). This could indicate either an accelerated male mortality rate or sampling bias of males because of preferential habitat selection. At age II, males outnumbered females (1:0.67, $X^2 = 0.40$, $0.70<P<0.50$). Values for the age group II may not be accurate because of the small sample size.

Breeding males attained greater lengths than females of the same age, and displayed more intense green coloration of the vertical bands, fins, breast, and belly than females. In both sexes, the green coloration persisted most of the year, and was least intense in the fall. The intensity of coloration increased not only within females and males, but also with age, the oldest fish being the deepest green. Mature females exhibited greatly enlarged genital papillae (upon intensification of breeding coloration) and could be sexed externally. The abdomens of females started to enlarge by February, and eggs were expelled with slight pressure on the abdomen in April. All females collected by August were spent.

The percent of the body weight contributed by the ovaries (Gonadosomatic Index or GSI) was compared monthly for the degree of ovary maturity. The GSI increases until the start of spawning, at which time there is a distinct decrease with the smallest percentages occurring when spawning activity ends (Pickford and Atz 1957). GSI decreased after the peak of 12% in April (Fig. 1), indicating the start of spawning when the water temperature was 18°C. The lowest value (1%) was in August, indicating the time spawning was completed. The slight increase from May to June may have resulted from an interruption of spawning by flooding as has been observed in *Etheostoma tetrazonum* in Missouri (Taber and Taber 1983).

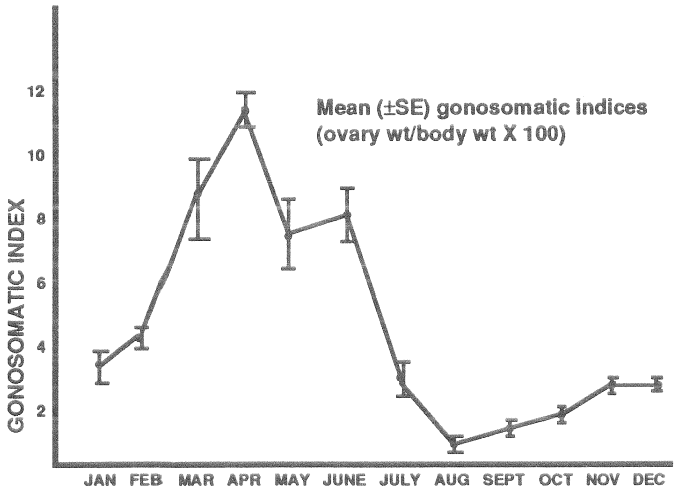


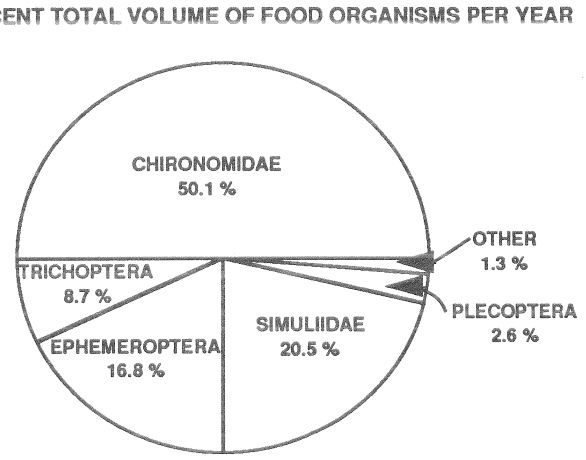
Figure 1. Mean monthly percent of body weight contributed by the ovary for brighteye darters in Terrapin Creek, January through December, 1983.

The ovarian development was followed throughout the year. Only small, white, immature ova less than 0.7 mm in diameter were present in August. These ova started to mature in October and continued to do so during the winter months. Maturing ova were yellow and 0.7-1.1 mm in diameter. Ripe ova (1.1-1.6 mm in diameter and translucent) were present as early as February. All three types of ova were present through the possible spawning months of April to July. The ova may have continued to mature during these months, being spawned as they became ripe. Spawning was complete for most fish by the end of June since most of the ovaries were spent in July. Young of the year were not collected until 27 August 1983. Those collect 6 September (n = 9) ranged in size from 12.9 to 22.8 mm (SL).

Spawning activity was not observed in the stream or in aquaria. Bright eye darters lived successfully in aquaria from May until November when they were released. Many darters have been observed to spawn successfully in aquaria (New 1966, Braasch and Smith 1967, May 1969, Seesock 1979, Ryon 1986).

Examination of ova size-frequency distribution indicated ova greater than 0.6 mm were spawned, and there was no sign of reabsorption. Fecundity was estimated for fish collected in April, May, and June. Females attaining age I and which were also at least 27 mm SL were capable of spawning. Females were either age I or age III, and fecundity ranged from 21-116 for age I to 65-201 for age III. Males were also sexually mature at age I.

The predominant foods of *E. lynceum* were Diptera (Chironomidae and Simuliidae), Ephemeroptera nymphs, and Trichoptera larvae (Fig. 2). The most abundant food item was chironomid larvae, (50% by volume and 67 % frequency of occurrence (Table 1). Chironomids did not make up the greatest volume every month (Table 2). The greatest volume was Simuliidae larvae in June (75.3%), Ephemeroptera in October (54.6%), and Trichoptera in November (53.4%). Of the stomachs examined, 19.8% were empty. Adults and juveniles consumed the same food items, but juveniles ate fewer and smaller organisms.



The brighteye darter in Terrapin Creek had a diurnal feeding pattern, with a peak in volume and number of food items at 0500 hrs and 1700 hrs (Fig 3). Feeding began at or just before sunrise (0500 hrs), decreased after three hours, and increased to peak at 1700 hrs. Feeding decreased in the early evening and stopped after sunset (2100 hrs). After sunset, all stomachs were empty or contained extremely digested insect larvae.

Dipteran and Ephemeroptera larvae were the most abundant food items in stomachs and in invertebrate samples made during the 24-hour study. Food items in the stomach of brighteye darters were those invertebrates predominantly found in the Surber samples. The greatest number of invertebrates was found at 2300 hrs in both

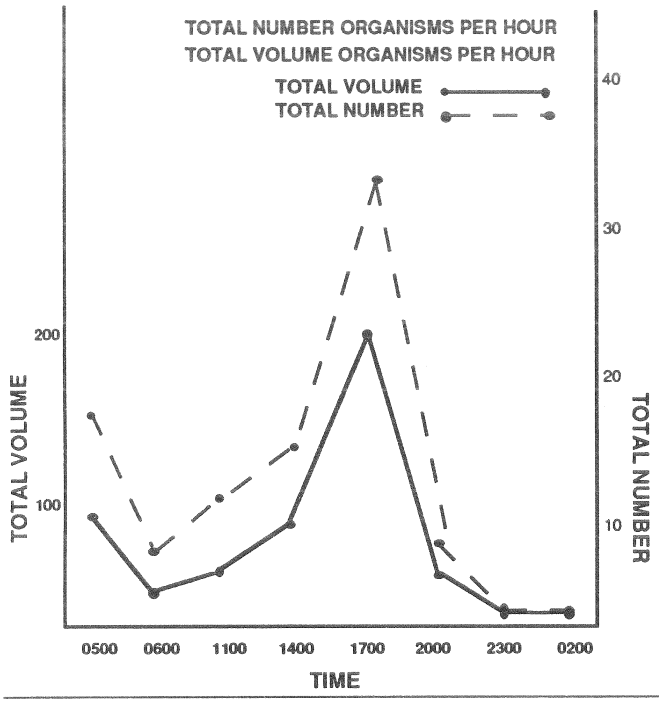


Figure 3. Total number and volume of food organisms per three hour period in brighteye darters from Terrapin Creek, during a 24-hr study on 6 September 1983.

Surber and drift net samples. The brighteye darter did not feed at night and could not take advantage of the great number of invertebrates present in the night samples.

Comparison of *E. zonale* and *E. lynceum*

Published life history information for *E. zonale* was compared with our data for *E. lynceum* in Terrapin Creek. *E. zonale* is typically found in riffle areas of larger streams (usually order 4 or larger), over large gravel or rubble and is often associated with aquatic vegetation (Lachner et al. 1950, Erickson 1977, Nemecek 1980). Whereas, we found *E. lynceum* in smaller streams (order 2 or 3) with fine to medium gravel and sand bottoms and utilizing existing cover of undercuts. Brighteye darter young-of-the-year were first observed at the edge of pools below riffles, whereas Erickson (1977) observed young-of-the-year banded darters in sand-gravel substrate in slow moving water 30-50cm in depth below a large riffle.

E. zonale has its highest growth rate in the first year (Lachner et al. 1950, Lutterbie 1976) and fastest growth during the summer (Erickson 1977). *E. zonale* survives to age IV in both Wisconsin (Lutterbie 1976) and Minnesota (Erickson 1977) and reach a maximum of size of 62 mm SL in Pennsylvania (Lachner et al. 1950). *E. lynceum* also achieves greatest growth in the first year during June to August. The oldest fish was estimated to be 3.5 years, and the largest specimen was 52 mm SL.

Nemecek (1980) observed *E. zonale* laying eggs on algae (Cladophora) in water depths of 15-30 cm, and water temperatures of 18.5 to 22.0° C. Some age I fish are capable of spawning (Lachner et al. 1950,Erickson 1977). Spawning of the banded darter has been reported from late March to June (Lachner et al. 1950, Cross 1967, Miller and Robinson 1973, Lutterbie 1979, Nemecek 1980, Hubbs 1985). The ovarian weight to body weight of Wisconsin banded darters average 13% from April to July with a range of 9% to 19% (Lutterbie 1979) and average 13% in New York with a peak of 29% in one individual in May (Nemecek 1980). The number of ripe ova (1.51-1.84) range from 80 to 262 (Erickson 1977).

All age I *E. lynceum* of greater than 27 mm SL were sexually mature with the reproductive season lasting from April to June. The peak percentage for ovarian weight to body weight was in April (12%) and slowly decreased until July. Brighteye darters probably have multiple spawns during the three-month period. Some individuals may have spawned later as indicated by Burr and Mayden's (1979) observation of ripe females in July 1978 in

Table 1. Percent frequency of occurrence of food items in brighteye darters from Terrapin Creek, 1983.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Total Number	30	34	40	18	19	15	41	42	33	21	25	30
Number empty	11	4	2	1	2	0	17	4	3	2	11	12
Nematoda					5.9							
Copepoda									3.3			
Diptera												
Chironomidae	89.5	96.7	100.0	100.0	70.6	93.3	87.75	71.1	86.7	68.4	78.6	77.8
Simuliidae		3.3		35.3	23.5	86.7	8.3	13.1			7.1	
Tabanidae								2.6				
Plecoptera	31.6	6.7										11.1
Ephermeroptera		3.3	26.3	47.1	35.3	6.7	8.3	65.8	40.0	63.2	21.4	27.8
Trichoptera		13.3	10.5				50.0	36.8	6.7		35.7	11.1
Orthroptera			2.6									
Undet. insects	5.3	3.3	7.9				4.2			10.5		
Fish Eggs			2.6	5.9			4.2					

Table 2. Percent volume of food organisms in brigheye darters from Terrapin Creek, 1983.

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Total Number	30	34	40	18	19	15	41	42	33	21	25	30
Number empty	11	4	2	1	2	0	17	4	3	2	11	12
Nematoda					0.3							
Copepoda									*			
Diptera												
Chironomidae	55.2	80.6	86.7	51.6	44.8	24.3	48.6	42.6	56.1	39.3	36.3	64.4
Simuliidae		1.0		12.8	15.3	75.3	4.4	13.5			4.7	
Tabanidae								0.5				
Plecoptera	39.1	3.9										15.4
Ephermeroptera		1.1	7.4	34.9	39.6	0.4	2.2	25.1	43.3	54.6	5.6	9.6
Trichoptera		17.5	2.7				42.8	18.3	0.6		53.4	10.6
Orthroptera			0.9									
Undet. insects	5.7	0.7	1.6				1.3			6.1		
Fish Eggs			0.8	0.7			0.8					

* less than 0.01

Terrapin Creek. Fecundity ranged from 21 to 301. Spawning has not been observed.

Feeding is similar for both species of darter and chironomids are the predominant food. Simuliidae, Trichopterans and Ephermeropterans are consumed to a lesser extent by both *E. zonale* (Erickson 1977), Adamson and Wissing 1977, Bryant 1979, Cordes and Page 1980, Nemecek 1980) and *E. lynceum.* Feeding activity in banded darters in the Iroquois River, Illinois increased markedly after sunrise, peaked (in weight of stomach contents) at midday (1800 hrs), and decreased after sunset (Cordes and Page 1980). Feeding activity in brighteye darters in Terrapin Creek also increased at sunrise, decreased later in the morning, peaked at 1700 hrs, and ceased after sunset.

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SPECIES DOMINANCE IN THE FISH POPULATIONS OF THE PEARL RIVER AT TWO STUDY AREAS IN MISSISSIPPI AND LOUISIANA: 1966-1988

Gerald E. Gunning

Department of Ecology, Evolution, and Organismal Biology
Tulane University
New Orleans, Louisiana 70118

and

Royal D. Suttkus

Tulane University Museum of Natural History
Belle Chasse, Louisiana 70037

ABSTRACT

Two long-term data sets for the Pearl River, Mississippi and Louisiana, are presented. The Mississippi study area yielded 287,758 fishes of 17 families and 87 species in 16 years. The Louisiana study area yielded 342,899 fishes of 19 families, 92 species and two hybrids in 22 years. Seven families of fishes (Clupeidae, Cyprinidae, Catostomidae, Ictaluridae, Cyprinodontidae, Centrarchidae, and Percidae) accounted for 99.34% of the Mississippi catch. In six of the seven families listed above, a single species constituted a clear majority of the total catch per family (all but the Percidae). In the Louisiana study area, the same seven families of fishes listed above for Monticello accounted for 98.80% of the total catch. There was but one dominant species in each of the seven families at Bogalusa. The major conclusion of this paper was that for each of the seven families at both study areas, with one exception as noted, there was just one numerically dominant species.

INTRODUCTION

A general pattern of biotic communities is that the majority of species are rare, with relatively few species contributing most to numbers of individuals (Smith, 1986). Stream fish assemblages follow this general pattern (Sheldon, 1987) and may, in addition, show numerical dominance patterns within families. For instance, the channel catfish (*Ictalurus punctatus*) tends to dominate ictalurid populations in the rivers studied.

An important aspect in determining the patterns of numerical dominance in stream fish assemblages is whether the pattern is persistent over space and time. In a broader sense, the understanding of long-term population trends of organisms is of importance to both basic and applied ecology. Yet, in spite of the now recognized need for long-term studies (Wiens, 1984; Strayer, 1986), few have actually been published. As pointed out by Strayer (1986), long-term may be in the context of the life span of the organisms studied, or in comparison with the normal duration of ecological studies.

We present two long-term data sets on fishes from the Pearl River in Louisiana and Mississippi which document patterns of numerical dominance. The Mississippi data set spans 16 years while the Louisiana data set spans 22 years. These durations exceed the normal life spans of essentially all the species commonly collected in our study. For instance, most small, southeastern US stream fishes have life spans of seven or fewer years (Ross et al., 1985). Our study durations also exceed or are equivalent with most other 'long term' studies of stream fishes (Grossman et al., 1982; Ross et al., 1985; Ross et al., 1987; Matthews et al., 1988; Meffe and Berra, 1988).

METHODS

The Mississippi study area was a 42km (26 mile) segment of the Pearl River upstream and downstream from Monticello (Lawrence Co.). A total of 512 fish collections was made along the shoreline at eight stations sampled quarterly for 16 years (1973-1988) in the months of February, May, August, and November. The predominant substrate was sand, however, considerable gravel and silt occurred in some localities. The Louisiana study area consisted of 16.1 km (10 miles) of the Pearl River both upstream and downstream from Bogalusa (Washington Parish). A total of 528 fish collections was made at Bogalusa (six stations sampled quarterly for 22 years in July, October, January, and April). The predominant substrate was sand, although gravel and silt also occurred in some localities.

A typical shoreline fish collection covered 30-60 meters (100-200 feet) of stream and required 30 minutes, except when the river was flooded and depth limited sampling. At each station, an effort was made to sample consistently in all micro-habitats over all types of substrate and under all current regimes. Although we realize that larger fishes are not sampled adequately by the 2 X 3 meter seine (0.47 cm Ace mesh) used in this study, we consider the samples to be quantitative enough to indicate relative abundance. As Matthews (1986) has pointed out, "No sampling method for stream fishes is without bias, but in stream habitats without serious obstructions, vigorous collecting with seines provides a good estimate of relative abundance of the small fishes" (see Matthews, 1986 for references). "Seine collections are commonly used to quantify relative abundance of fishes in streams ranging from small creeks to wide, shallow rivers" (Matthews, 1986).

All fish specimens were fixed in the field in 10% commercial formalin, and subsequently stored in 50% isopropanol at the Tulane University Museum of Natural History.

TABLE 1. Number of fishes collected from the

Family and Species	Number collected per year										
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Clupeidae											
Dorosoma cepedianum	5	38	72	94	55	18	58	363	2	22	106
Dorosoma petenense	42	65	642	47		2	149	339	15	362	46
1 species with <1.00% of clupeids											
Cyprinidae											
Notropis venustus	4,637	3,970	2,246	9,712	9,068	10,142	7,561	6,430	19,750	22,578	12,831
Hybognathus nuchalis	2,468	3,025	894	3,812	3,513	541	6,057	1,212	1,152	525	1,436
Notropis longirostris	1,196	783	588	295	1,600	1,094	502	1,359	1,588	1,533	1,539
Pimephales vigilax	1,001	626	359	1,681	1,242	1,304	610	926	1,161	1,831	819
Notropis volucellus	558	976	396	1,091	789	474	247	216	238	582	138
Notropis texanus	508	748	434	904	646	176	340	525	359	168	377
Notropis atherinoides	735	1,194	222	299	156	121	73	224	198	97	641
Hybopsis aestivalis	306	105	42	222	209	1,011	159	333	112	477	71
11 species each with <1.00% of cyprinids											
Catostomidae											
Carpiodes velifer	25	19	43	51	131	127	39	22	237	106	164
Hypentelium nigricans	20	5	1	11	1	9	11	3	3	10	7
5 species each with <1.00% of catostomids											
Ictaluridae											
Ictalurus punctatus	576	122	50	192	70	283	76	182	181	15	5
Noturus munitus *	8	19	1	9	10		139	29	6	2	1
6 species each with <1.00% of ictalurids											
Cyprinodontidae											
Fundulus notatus	8	16	25	8	49	249	42	79	22	326	174
Fundulus olivaceus	13	6	11	33	28	68	7	20	2	84	26
Fundulus catenatus	12	5	5	3	1	31	29	6	5	13	11
1 species with <1.00% of cyprinodontids											
Centrarchidae											
Lepomis megalotis	270	209	353	198	427	369	321	203	329	347	142
Pomoxis annularis	14	22	28	15	57	239	107	127	2	35	59
Micropterus punctulatus	70	75	66	57	58	45	53	89	93	102	31
Lepomis macrochirus	44	71	59	35	12	43	79	58	13	47	55
Micropterus salmoides	14	49	22	44	16	8	9	10	4	25	9
Elassoma zonatum	3	191				2					
Lepomis humilis	2	21	2	2		2	4	8			2
8 species each <1.00% of centrarchids											
Percidae											
Ammocrypta beani	255	300	163	153	497	196	104	107	24	252	179
Percina vigil	251	65	23	73	80	144	104	46	17	44	2
Percina sciera	58	28	3	40	28	40	72	32	5	56	3
Percina caprodes			10	12	17	6	28	12	10	1	3
Ammocrypta vivax	6	2		3	7	11		3		17	4
13 species and one hybrid each <1.00% of percids											
Total fishes of seven most abundant families ** in the sample (74 species)***											

* Collection of *Noturus munitus* was permitted through 1983.

** Two families had more total specimens than some families designated as most abundant families defined as those having three or more species represented in the populations.

*** Scientific and common names of fishes follow Robins, *et al.*, 1980, with a few exceptions.

Pearl River at Monticello, Mississippi: 1973-1988.

1984	1985	1986	1987	1988	Total	Percent	Freq. of Occur. N= 16
6	53	1	73		966	28.76	15
17	8	403	246	7	2,390	71.15	15
					3	0.09	
					3,359	100.00	
11,533	6,251	10,124	15,727	17,500	170,060	64.62	16
1,992	210	112	388	1,064	28,401	10.79	16
1,437	2,189	532	1,762	2,234	20,231	7.69	16
799	690	1,744	1,368	1,244	17,405	6.61	16
467	516	436	807	1,688	9,619	3.65	16
347	16	62	18	19	5,647	2.15	16
505	240	79	21	27	4,832	1.84	16
504	131	41	65	7	3,795	1.44	16
					3,187	1.21	
					263,177	100.00	
88	88	720	104	166	2,130	91.61	16
6	9	41	14	11	162	6.97	16
					33	1.42	
					2,325	100.00	
181	8	52	11	27	2,031	88.85	16
					224	9.80	*
					36	1.35	
					2,291	100.00	
23	111	69	45	44	1,290	71.11	16
2	12	10		13	335	18.47	15
10	21	9	6	8	175	9.65	16
					14	0.77	
					1,814	100.00	
166	225	521	189	316	4,585	54.39	16
79	391	45	16	18	1,254	14.88	16
35	47	64	22	23	930	11.03	16
31	65	43	176	50	881	10.45	16
18	27	4	26	2	286	3.39	16
		1			197	2.34	4
2	26	4	21	2	99	1.17	13
					199	2.35	
					8,431	100.00	
102	101	69	201	101	2,804	62.78	16
3	3	4	1		860	19.26	15
14		26	9	18	432	9.67	15
7		2	1	2	111	2.49	13
2		10	1	6	72	1.61	12
					187	4.19	
					4,466	100.00	
					285,863		

RESULTS AND DISCUSSION

Monticello Study Area

The total sample over the 16-year period at Monticello included 285,863 fishes of the families Clupeidae, Cyprinidae, Catostomidae, Ictaluridae, Cyprinodontidae, Centrarchidae, and Percidae, representing 74 species and 99.34% of the total sample (Table 1), and 1,895 fishes of the families Petromyzontidae, Lepisosteidae, Amiidae, Esocidae, Anguillidae, Aphredoderidae, Belonidae, Poeciliidae, Atherinidae and Sciaenidae (Table 3), representing 13 species and 0.66% of the total catch (Table 3).

The threadfin shad (*Dorosoma petenense*) was the dominant clupeid species comprising 71.15% of the clupeid catch; the gizzard shad (*D. cepedianum*) ranked second with 28.76% of the catch (Table 1). Both species were taken in 15 of the 16 years of this study. Three specimens of the skipjack (*Alosa chrysochloris*) were taken in 16 years.

The blacktail shiner (*Notropis venustus*) was the dominant cyprinid; 170,060 specimens (64.62%) were taken in 16 years (Table 1). Ross *et al.*, (1987) reported that *Notropis roseipinnis* made up 53.8% of the cyprinids collected from the upper reaches of Black Creek, Mississippi, and that the minnows (Cyprinidae) were the numerical dominants comprising 64.7% of the total number of fishes collected. The silvery minnow (*Hybognathus nuchalis*) was the second-ranking minnow at Monticello with 28,401 specimens, although the abundance has declined in recent years (Table 1). The longnose shiner (*Notropis longirostris*) was the third-ranking minnow with 20,231 specimens (Table 1). The bullhead minnow (*Pimephales vigilax*) ranked fourth with 17,405 specimens (Table 1); the numbers of specimens for this species were rather stable throughout the 16-year period. The weed shiner (*Notropis texanus*) ranked sixth in relative abundance over 16 years with a precipitous decline from 1985-1988 (Table 1). This decline was sustained through 1989 when 58 specimens were taken (Gunning and Suttkus, unpublished data). Note that the eight top-ranking species were taken in all 16 years of this study (Table 1).

The highfin carpsucker (*Carpiodes velifer*) was the dominant catostomid in our catches (2,130 specimens, 91.61% of the sucker catch) (Table 1), followed by the hogsucker (*Hypentelium nigricans*) with 162 specimens and 6.97% of the catostomid catch (Table 1). Both species were taken in all 16 years of this study.

The channel catfish was the dominant catfish in our samples with 2,031 specimens and 88.85% of the ictalurid catch (Table 1). The frecklebelly madtom (*Noturus munitus*) was the second-ranking ictalurid with 224 specimens and 9.80% of the ictalurid catch (Table 1). The latter is a protected species in Mississippi; permission was granted for us to collect the frecklebelly madtom through 1983; prior to that time we had collected this species in 10 of 11 years of this study (Table 1).

The blackstripe topminnow (*Fundulus notatus*) was the most abundant species of cyprinodontid at Monticello (1,290 specimens; 71.11% of the cyprinodontid catch - Table 1). The blackspotted topminnow (*F. olivaceus*) ranked second with 335 specimens and 18.47% of the catch. The northern studfish (*F. catenatus*) ranked third with 175 specimens and 9.65% of the catch (Table 1).

The most abundant sunfish in the Monticello study area was the longear sunfish (*Lepomis megalotis*) with 4,585 specimens comprising 54.39% of the centrarchid catch (Table 1). Following second to fifth in abundance were the white crappie (*Pomoxis annularis*), spotted bass (*Micropterus punctulatus*), bluegill (*Lepomis macrochirus*), and the largemouth bass (*Micropterus salmoides*) (Table 1). The pygmy sunfish (*Elassoma zonatum*) ranked sixth in abundance with 197 specimens and 2.34% of the total centrarchid catch (Table 1). This species was collected in only four of the 16 years of this study. The orangespotted sunfish (*Lepomis humilis*), in comparison, ranked eighth in relative abundance with 1.17% of the centrarchid catch (Table 1), but was collected in 13 of the 16 years of this study (Table 1). The relative abundance of the pygmy sunfish in the total catch of centrarchids is misleading in that 191 pygmy sunfish were collected February 12, 1974 at Atwood Water Park on the Pearl River at Monticello; only six additional specimens were taken in 1973 (3), 1978 (2), and 1986 (1) (Table 1). This was likely a prespawning aggregation since the species spawns in mid-March to early May (Böhlke and Rohde, 1979).

The naked sand darter (*Ammocrypta beani*) was the most abundant species in our percid catch with 2,804 specimens (62.78% of the total catch), and it was taken in all 16 years of this study (Table 1). The saddleback darter (*Percina vigil*) ranked second in abundance over the 16 years (860 specimens, 19.26%), however it declined progressively from a high of 251 specimens in 1973 to a low of 2 specimens in 1983, 3 specimens in 1984 and 1985, 4 specimens in 1986, a single specimen in 1987, none in 1988 (Table 1) and 4 specimens in 1989 (Gunning and Suttkus, unpublished data). The latter species was taken in 15 of 16 years.

Bogalusa Study Area

The threadfin shad (*Dorosoma petenense*) was the dominant clupeid in the Bogalusa study area (941 specimens, 82.26% of clupeid catch) (Table 2), followed by gizzard shad (*Dorosoma cepedianum*) second (182 specimens, 15.91%). Two additional species, the skipjack and the Alabama shad (*Alosa alabamae*) were taken in small numbers (Gunning and Suttkus, 1990a, Table 2).

The blacktail shiner was the dominant cyprinid at Bogalusa (140,874 specimens, 45.54% of cyprinid catch – Table 2), and the silvery minnow ranked second (37,509 specimens, 12.13% of the catch – Table 2).

The highfin carpsucker was dominant at Bogalusa with 1,017 specimens in 22 years and 87.52% of the catostomid catch (Table 2).

The channel catfish was the dominant ictalurid at Bogalusa with 6,977 specimens comprising 94.69% of the ictalurid catch (Table 2) while the frecklebelly madtom ranked second (255 specimens; 3.46% of the total ictalurid catch). This latter species occurred in 19 of the 22 years (Table 2), from 1966-67 through 1980-81 (15 straight years), in 1983-84 and 1985-88. Years in which the frecklebelly madtom did not appear in the annual catches were in the latter part of this study.

The blackspotted topminnow was the dominant species at Bogalusa with 2,885 specimens and 64.86% of the cyprinodontid catch, followed by the blackstripe topminnow with 1,535 specimens (34.46% of the cyprinodontid catch – Table 2). The golden

topminnow (*Fundulus chrysotus*) was the third-ranking species collected at Bogalusa.

The longear sunfish ranked first at Bogalusa with 2,575 specimens (55.53% of the total centrarchid catch) and the bluegill ranked second with 788 specimens and 17.00% of the catch (Table 2). We attribute the abundance of longear sunfish to their tolerance of the current along the shoreline of the Pearl River, whereas the largemouth bass, bluegill and white crappie inhabit the backwaters along the river away from the faster current (Gunning and Suttkus, 1990b).

The naked sand darter ranked first at Bogalusa (4,908 specimens; 33.41% of the percid catch), and the saddleback darter a close second (4,417 specimens; 30.06% of the catch) (Table 2). Percids are thus an apparent exception to our general observation that there is usually just one dominant species for each family in both of our study areas on the Pearl River in that two species were numerically codominant at Bogalusa (Table 2). Gunning and Suttkus (in press) showed that the saddleback darter was the dominant species at Bogalusa for six straight years (1966-67 through 1971-72), and then the naked sand darter was the dominant species for 14 of the 15 remaining years of this study (1972-73 through 1986-87, with the exception of 1973-74 when the saddleback darter was dominant over the naked sand darter, 378 specimens versus 319 specimens, respectively) (Gunning and Suttkus, in press).

Comparison of Two Study Areas in Mississippi and Louisiana

The threadfin shad was dominant in both study areas and the gizzard shad ranked second at both. The threadfin shad occurred in 15 of 16 years at Monticello and in 15 of 22 years at Bogalusa.

The blacktail shiner and silvery minnow ranked first and second, respectively, in the two study areas (Tables 1 and 2). Populations of the weed shiner experienced a precipitous decline at Monticello in 1985-88; there was a concurrent decline at Bogalusa in 1984-85 through 1987-88, but not as marked as at Monticello (Tables 1 and 2). The emerald shiner decreased in abundance at Monticello in 1986-88 and also at Bogalusa from 1985-86 through 1987-88 (Tables 1 and 2). It is these concurrences in data which we feel substantiate seining as a collecting method when used properly. Also, note the marked decline in abundance of the speckled chub at Monticello (1986-88), and a less marked decline at Bogalusa for this period (Tables 1 and 2).

The highfin carpsucker was the dominant catostomid in both study areas and was taken in all years at both study areas (Tables 1 and 2). The northern hog sucker ranked second at Monticello, while blacktail redhorse and northern hog sucker were almost identical in numbers and frequency of occurrence over the 22 years at Bogalusa (Table 2).

The channel catfish ranked first at both study areas and the frecklebelly madtom ranked second (Tables 1 and 2). The frecklebelly madtom was taken in 10 of 11 years at Monticello and 19 of 22 years at Bogalusa.

The dominant cyprinodontid at Monticello was the blackstripe topminnow and the blackspotted topminnow ranked second; the order was reversed at Bogalusa (Tables 1 and 2). The northern studfish made up a significant proportion of the cyprinodontid populations at Monticello (9.65%) (Table 1).

For the centrarchids, the five top-ranked species of sunfishes were the same at both study areas, although the relative abundance among the five species varied (Tables 1 and 2). The longear sunfish was clearly the dominant species. The spotted sunfish was rare (cf. Sheldon, 1987) at the Monticello study area, one specimen taken in 16 years (Table 1), but comprised 1.21% of the centrarchid catch (56 specimens, taken in 11 of 16 years – Table 2) at Bogalusa. The spotted bass was more abundant than the largemouth bass at both study areas (11.03% and 3.39%, respectively, at Monticello, and 10.18% and 4.55 % at Bogalusa) (Tables 1 and 2). These comparative data on the basses are further confirmation of the collecting method utilized. Likewise, the white crappie was dominant at both study areas over the black crappie (Tables 1 and 2).

Three species, the naked sand darter, the saddleback darter and the dusky darter ranked first through third, respectively, at both study areas (Tables 1 and 2); as stated earlier, the saddleback darter was dominant in the early years of the study at Monticello and dwindled to near extinction toward the end of the study (Table 1), but persisted at Bogalusa in sizeable numbers (Table 2). Based on extensive field notes for the entire study, the demise of the saddleback darter was likely due to substrate changes over time; this species prefers clean, unsilted gravel substrate (Thompson and Cashner, 1979) which is diminished in the Monticello study area. The logperch (*Percina caprodes*) had declined since 1982 at both Monticello (Table 1) and Bogalusa (Table 2). The crystal darter (*Ammocrypta asprella*) is a protected species in Mississippi (Johnson, 1987); it was collected in 13 of 16 years at Monticello, and in all 22 years at Bogalusa (Table 2), where it is not protected (Johnson, 1987) and has been taken in smaller numbers since 1981-82 (Table 2). A total of 21 bluntnose darters (*Etheostoma chlorosomum*) (<1.00% of percids – Table 1) was taken at Monticello and 486 specimens were taken at Bogalusa (3.31% of percids – Table 2). Only 23 specimens of the harlequin darter (*Etheostoma histrio*) (<1.00% – Table 1) were taken at Monticello, but 341 specimens (2.32% – Table 2) were taken at the Bogalusa study area.

Only two lampreys of one species were taken at the Monticello study area (Table 3), the southern brook lamprey (*Ichthyomyzon gagei*). Two species of gars (Lepisosteidae), the spotted gar (*Lepisosteus oculatus*), and the longnose gar (*L. osseus*) were collected at both study areas (Table 3). The bowfin (*Amia calva*) was also collected in small numbers at both study areas (Table 3). Two species of pickerel (Esocidae), the redfin pickerel (*Esox americanus*), and the chain pickerel (*E. niger*), were taken. A single specimen of the American eel (*Anguilla rostrata*) was taken at Monticello in 1973; by chance, one of us (G.E.G.) was present when a fisherman caught an American eel from the Monticello study area on August 2, 1990. A total of 93 American eels was collected at Bogalusa (in 12 of 22 years), most of them less than six inches total length. The mooneye (*Hiodon tergisus*) was taken in three of 22 years at Bogalusa (Table 3). It was taken in the early years of the survey, the last specimen in 1973-74.

The pirateperch (*Aphredoderus sayanus*) was taken in five of 16 years at Monticello (13 specimens, Table 3), and in 13 of 22 years at Bogalusa (75 specimens, Table 3). The Atlantic needlefish (*Strongylura marina*) was taken at both study areas, in one of

TABLE 2. Number of fishes collected from the

Family and Species	Number collected per year											
	1966-1967	1967-1968	1968-1969	1969-1970	1970-1971	1971-1972	1972-1973	1973-1974	1974-1975	1975-1976	1976-1977	1977-1978
Clupeidae												
Dorosoma petenense	4	7	7	1	6	27	22	12	3	45	232	10
Dorosoma cepedianum			3	7		13	1	1	15	2	36	2
2 species with <1.00% of clupeids												
Cyprinidae												
Notropis venustus	4,813	3,181	6,218	7,181	7,665	3,787	5,177	2,329	2,719	1,767	5,460	5,567
Hybognathus nuchalis	384	62	744	835	1,757	1,642	40	2,639	2,546	3,270	4,448	1,775
Notropis texanus	1,250	785	3,599	1,632	2,654	1,721	614	3,445	996	1,412	1,064	1,054
Hybopsis aestivalis	2,539	1,266	1,225	2,105	1,762	1,690	768	424	642	1,497	340	2,864
Pimephales vigilax	501	209	732	565	337	400	894	331	544	386	1,643	849
Notropis atherinoides	1,443	136	211	82	1,169	678	429	1,428	678	336	1,005	817
Notropis volucellus	66	46	22	101	175	145	232	394	876	466	861	522
Notropsis longirostris	37	104	143	103	111	138	91	427	189	223	277	454
10 species each with <2.00% of cyprinids												
Catostomidae												
Carpiodes velifer	21	66	116	17	17	15	98	21	6	5	85	18
Moxostoma poecilurum	3	1			5	1		1		1		
Hypentelium nigricans	5		2	2	1	4		8	1		3	
Minytrema melanops				1	8		3			2		
Carpiodes cyprinus				25								
4 species each with <1.00% of catostomids												
Ictaluridae												
Ictalurus punctatus	381	420	519	604	735	811	188	497	489	73	84	40
Noturus munitus	24	4	5	1	21	8	10	19	101	2	8	6
8 species each with <1.00% of ictalurids												
Cyprinodontidae												
Fundulus olivaceus	6	20	26	7	2	2	4	19	22	8	4	
Fundulus notatus	6	8	33		2	1	2	7	2	1	7	2
1 species with <1.00% of cyprinodontids												
Centrarchidae												
Lepomis megalotis	142	171	126	118	167	159	187	131	106	92	120	110
Lepomis macrochirus	30	80	152	60	96	52	48	47	25	11	13	11
Micropterus punctulatus	40	18	28	9	32	22	20	26	13	22	18	18
Micropterus salmoides	11	6	11	9	6	8	8	10	13	2	10	4
Pomoxis annularis	3	10	7	29	18	13	2	10	3	2	1	20
Ambloplites ariommus	5	2	1	2	7	6	4	9	1	9	5	10
Pomoxis nigromaculatus	7	7	2		7	21	3	1	4	4		
Lepomis punctatus	3					2		5	1	10	1	
7 species and one hybrid each <1.00% of sunfishes												
Percidae												
Ammocrypta beani	36	30	11	24	29	138	139	319	365	153	278	337
Percina vigil	305	86	285	640	801	351	99	378	139	135	102	235
Percina sciera	83	33	23	18	41	51	36	71	68	74	28	55
Etheostoma swaini	17	49	82	36	45	45	14	71	68	74	28	97
Ammocrypta asprella	65	1	46	10	247	47	20	88	70	9	9	38
Ammocrypta vivax	63	32	18	7	20	67	31	28	23	11	25	11
Etheostoma chlorosomum	28	7	33	7	39	53	32	82	15	30	7	12
Percina caprodes	29	21	58	20	69	44	29	47	19	15	7	12
Etheostoma histrio	32	12	61	4	55	50	25	25	6	5	3	
10 species and one hybrid each <2.00% of percids												
Total fishes of seven most abundant families* in the sample (78 species and 2 hybrids)**												

* Two families had more total specimens than some families designated as most abundant families defined as those having three or more species represented in the populations.

Pearl River at Bogalusa, Louisiana: 1966-1988.

1978-1979	1979-1980	1980-1981	1981-1982	1982-1983	1983-1984	1984-1985	1985-1986	1986-1987	1987-1988	Total	Percent	Freq. of Occur. N=22
1	238	3	203	54	2	2	10	47	5	941	82.26	22
10	28			36	1	23	4			182	15.91	15
										21	1.83	
										1,144	100.00	
6,998	3,063	13,509	13,963	5,709	8,088	3,929	8,852	10,653	10,248	140,874	45.54	22
479	1,973	1,999	1,176	1,073	2,529	1,582	2,385	1,204	2,857	37,509	12.13	22
1,486	1,653	2,285	1,017	1,119	1,928	458	371	1,157	580	32,280	10.43	22
1,527	1,010	2,301	1,063	957	247	1,420	886	188	455	27,216	8.80	22
1,480	1,036	2,306	2,032	688	2,196	2,240	1,736	2,823	2,543	26,545	8.58	22
377	715	777	589	714	1,611	180	141	37	174	13,727	4.44	22
578	385	439	539	589	372	1,687	309	502	1,834	11,140	3.60	22
306	389	281	353	521	603	699	1,244	705	739	8,137	2.63	22
										11,919	3.85	
										309,347	100.00	
62	2	36	134	51	31	16	6	75	119	1,017	87.52	22
	1	3	1	1	1	2	18	3		42	3.61	14
5	3		3					1		41	3.53	13
		5					7			26	2.24	6
										25	2.15	1
										11	0.95	
										1,162	100.00	
541	133	188	410	3	17	238	502	76	28	6,977	94.69	22
15	2	4			2		3	18	2	255	3.46	19
										136	1.85	
										7,368	100.00	
2	56	78		8	15	3	4	2		288	64.86	19
5	30	32	1	8	1	2	1	1	1	153	34.46	21
										3	0.68	
										444	100.00	
156	112	81	24	46	154	102	60	139	72	2,575	55.53	22
13	22	49	1	10	22	10	15	4	17	788	17.00	22
21	53	41	9	12	19	5	26	13	7	472	10.18	22
4	7	45	8	4	17	8	11	6	3	211	4.55	22
32	5	34	7		1	3	1		5	206	4.44	20
7	3	7	5	1	3			1	3	91	1.96	20
		4		1			1			62	1.34	12
		4		1	12			6	11	56	1.21	11
										176	3.79	
										4,637	100.00	
322	318	194	268	340	384	342	343	221	317	4,908	33.41	22
133	87	180	57	66	26	74	27	61	150	4,417	30.06	22
30	114	57	22	54	55	39	23	51	38	1,031	7.02	22
35	102	69	4	55	40	8	16	20	22	997	6.79	22
86	10	18	3	4	2	3	10	6	1	793	5.40	22
32	12	23	20	18	44	30	9	7	28	559	3.80	22
3	23	66	1	5	14	7	15	3	4	486	3.31	22
8	10	9	50	3	8	4	5	7	7	481	3.27	22
2	8	10	18	2	5	3	4	4	7	341	2.32	21
										679	4.62	
										14,692	100.00	
										338,794		

** This paper reports specifically on 92 species and two hybrids in the Pearl River at Bogalusa. An additional five species are known from other collections in additional years at nearby locations.

16 years at Monticello and in six of 22 years at Bogalusa (Table 3). The mosquitofish (*Gambusia affinis*) was taken in all 16 years at Monticello and in all years except 1983-84 at Bogalusa. The brook silverside (*Labidesthes sicculus*) was taken at both study areas (Table 3) and a single specimen of the tidewater silverside (*Menidia beryllina*) was taken at Monticello in 1987. We raise the possibility that this single specimen may be an introduction since we have never collected the species downstream at Bogalusa. The freshwater drum (*Aplodinotus grunniens*) was represented at both study areas (Table 3). The striped mullet (*Mugil cephalus*) was taken at Bogalusa (Table 3) in three of 22 years. A small percentage of mullets that enter a small seine are actually collected, and these by luck and not design.

The hogchoker (*Trinectes maculatus*) was absent in the Monticello study area but was collected in abundance at Bogalusa (Table 3); in fact, in all of 22 years (1,605 specimens). All of these specimens, except 60, were taken downstream of Pools Bluff Sill, a low concrete dam across the Pearl River downstream from the City of Bogalusa. This sill, in our opinion, serves as an effective barrier to dispersal of all species at low water levels on the Pearl River, and affects upstream movement even in flood conditions when the river inundates the dam. The hogchoker is generally found on or near the bottom of the Pearl River. Forty-one of the 60 specimens collected upstream from the sill (dam) were taken in a single collection at one station in 1968-69. We suggest that the upstream movement of hogchokers was facilitated by high water on the Pearl River, however there is also the possibility that upstream movement was made possible by the presence of the Pearl River Canal, a man-made structure.

The family Percichthyidae was not represented either at the Monticello study area (287,758 specimens – Tables 1 and 3), or the Bogalusa study area (342,899 specimens – Tables 2 and 3). Douglas (1974) and Cook (1959) did not report specimens from the Pearl River. This family is, however, represented by specimens reported in Burgess (1978) from the Pearl River farther downstream.

The large size of our two data sets permits some general observations on the extent of hybridization in natural fish populations. For the families Centrarchidae and Percidae, no hybrid combinations were taken at Monticello. At Bogalusa, however, a single specimen of the sunfish hybrid combination, *Lepomis cyanellus* x *Lepomis gulosus*, was taken, and also at the Bogalusa study area, 11 specimens of the darter (Percidae), *Percina nigrofasciata* x *Percina sciera* (Suttkus and Ramsey, 1967) were taken in seven different years out of a total of 22 years, 1976-77 (2 specimens), 1977-78 (1), 1978-79 (3), 1979-80 (2), 1982-83 (1), 1986-87 (1), and 1987-88 (1).

The infrequently collected freckled darter, *Percina lenticula*, was not taken at Monticello, but was taken in 4 of 22 years at Bogalusa, 1966-67 (1), 1975-76 (7), and 1977-78 (1); the last freckled darter taken was in 1979-80 (1). Other infrequently collected darters in our study areas included the blackside darter (*Percina maculata*) (2 specimens in 1978-79 at Bogalusa), the goldstripe darter (*Etheostoma parvipinne*) (2 specimens in 1968-69 and 1972-73 at Bogalusa), and the banded darter (*E. lynceum*) (one specimen in 1971-72, one specimen in 1978-79, and one specimen in 1987-88 at Bogalusa). One specimen of the blue sucker (*Cycleptus elongatus*) was taken in 1966-67 at Bogalusa and its presence in the Pearl river was cited by both Cook (1959) and Gilbert (1978). Although the blue sucker has not been collected by us from the Pearl River since 1966-67, we have observed this species in a discarded commercial catch (several specimens were obtained and preserved). We could not establish the exact location from which the specimens were taken, however. The river redhorse (*Moxostoma carinatum*) was represented by single specimens in four (1972-73, 1973-74, 1986-87, and 1987-88) of 22 years at Bogalusa.

Table 3. Fishes collected from the Pearl River that belong to less abundant families: 1966-1988.

Family	Monticello		Bogalusa	
	Number of species	Number of specimens	Number of species	Number of specimens
Petromyzonidae	1	2		
Lepisosteidae	2	8	2	15
Amiidae	1	4	1	1
Esocidae	2	28	2	31
Anguillidae	1	1	1	93
Hiodontidae			1	3
Aphredoderidae	1	13	1	75
Belonidae	1	1	1	11
Poeciliidae	1	1,537	1	1,986
Atherinidae	2	258	1	254
Sciaenidae	1	43	1	27
Mugilidae			1	4
Soleidae			1	1,605
Totals	13	1,895	14	4,105

ACKNOWLEDGMENTS

We particularly thank Drs. Tim M. Berra, G. Bresnick, J. Caruso, R. Cashner, G. Clemmer, D. Heins, J. Ramsey, S. Rohmann, P. Sorensen, and B. Thompson for both field and laboratory assistance.

Special thanks are due Dr. Steve Ross for reviewing this manuscript and for offering substantive suggestions for its improvement.

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In Memorium

Gerald E. Gunning, biologist, teacher, researcher and consultant passed away 10 February, 1991, in New Orleans, Louisiana. A faculty member at Tulane University since 1959, Gerry earned his B.S. and M.S. degrees at Southern Illinois University at Carbondale and his Ph.D. in 1958 under Shelby Gerking at Indiana University. While in the biology department at Tulane, he directed twelve doctoral students and influenced countless undergraduates as an extremely popular lecturer. His contributions and legacy to our endeavor are greatly appreciated, and he will be fondly remembered by all who knew him.

MINUTES

Business Meeting
16th Annual Meeting
Southeastern Fishes Council

The Southeastern Fishes Council met at Charleston, S.C., on June 18, 1990. Chairman Franklin F. Snelson, Jr. presided. The meeting was called to order at approximately 1:07 PM local time.

Committee Reports

1. Secretary's Report:

The Minutes of the 1989 meeting appeared in Issue Number 21 of the PROCEEDINGS. The Minutes were approved without correction.

2. Treasurer's Report:

Checking Account Balance (1-31-90)		$1,806.41
Dues & other contributions received	922.50	
Expenses	(510.79)	
Checking Account Balance (6-1-90)		2288.12
Paine Webber Cash Fund (5-31-90)		1956.22
TOTAL ASSETS (6-1-90)		$4244.34

3. Report from Treasurer on Tax Status:

The Internal Revenue Service is now able to match reports (W-9 Form) of dividends etc... paid by institutions (i.e. Paine Webber) to the "Taxpayer Identification Number" (TIN) on accounts. This was not possible prior to 1988 (about). Apparently the IRS has no record of our TIN. Therefore they questioned who is receiving these dividends. The TIN we use was obtained for the Southeastern Fishes Council sometime after May 1981, through the Memphis office of the IRS. I have communicated this to the IRS. I have also retained a Certified Public Accountant to examine our financial records and advise us regarding our status with the IRS.

At this time the CPA advises that we file a return and pay back taxes (estimated to be $300.00) and then file for official tax exempt status with the IRS. This advise was free. However, before he can make a final recommendation he will need more complete financial records on the society. I plan to provide him with this information as soon as I can obtain the records.

Phil Pister advised the members present that the Desert Fishes Council has recently gone through a similar situation regarding obtaining tax exempt status. He is willing to provide whatever information and advice we may find useful or require.

4. Editor's Report

Michael Stevenson reported that he has three manuscripts in the final stages and plans to put out the next issue (No. 22) of the PROCEEDINGS by September. This issue will include instructions for authors.

Steve proposes to publish information on fish collections in the southeast. Perhaps including a synopsis on each collection, written by an individual at the institution where the collection is located, in each future issue of the PROCEEDINGS.

Issue No. 21 contained information on editorial policy. Each manuscript received is sent to at least one reviewer, often more than one. Steve solicits recommendations of reviewers from authors. Currently authors know their reviewers and vice versa. There is a PROCEEDINGS Policy Committee, appointed by the chair. Steve suggested the committee and he meet to decide on these and other policy matters.

We have been averaging two issues per year recently.

There was a question from the floor asking what were the page costs for an issue? Steve responded that we do not charge page costs for having a manuscript published in the PROCEEDINGS. A question was asked regarding the cost of printing issues. Steve stated that the last issue (No. 21) consisted of 12 pages and there were 150 copies printed. Treasurer Wieland reported that Issue No. 21 cost $298.97 to print. Steve reminded us that we are currently not paying mailing costs. These have been subsidized by a "friend."

Chairman Snelson complemented the editor on his work and the quality of PROCEEDINGS.

Steve informed us that he has received favorable comments, especially from libraries, on our practice of numbering each issue rather than following a volume/number format.

Werner then questioned whether the society should begin charging institutions for subscriptions. Currently we send gratis copies to institutions. However, a few institutions voluntarily pay regular membership fees to receive their subscriptions. There was no motion on this matter. Chairman Snelson interpreted this to mean the membership would prefer to keep the status quo regarding subscriptions for institutions.

The Chair then asked for other Committee reports. There were none.

The Chair related to the membership that according to our Bylaws there are a number of standing committees. Most of these apparently have not met in some time. Some of these committees are:

Technical Advisory Committee
Awards Committee
Programs Committee
Resolutions Committee
Publicity Committee
Arrangements Committee
Constitution Committee
PROCEEDINGS Committee
Nominating Committee

The Chair (Buck) stated that while this seemed like a cumbersome number of standing committees we have reached a point where he feels we should have an active PROCEEDINGS Committee. This committee should discuss editorial policy and future

plans for the PROCEEDINGS. He solicited names of members interested in serving on this committee as he would make appointments directly following the Business Meeting.

Election of Officers:

The chair stated that we had failed to hold elections for the office of Secretary/Treasurer at last year's meeting. This office consists of a two year term. Bob Jenkins suggested we wait until next year (1991). This action would result in the elections of the Chairman Elect and the Secretary/Treasurer in the same year and return us to our previous schedule. A motion to this effect was made and passed.

Old Business:

1. Coal-bed Methane Release in Cahaba River Basin: Chairman Snelson wrote to the Alabama Department of Environmental Management to convey the SFC's concern over the effects of effluent from this process on the aquatic fauna of the Cahaba River. The letter was written with the help of Bob Stiles and Jim Williams. It expressed our opposition to approval of permits which would allow release of effluent from this process into the Cahaba watershed. The Alabama Department of Environmental Management responded to our letter, however, a permit was subsequently issued.

2. Report on Scientific Collecting Permits in the Southeast: Bob Jenkins surveyed 17 states based on the drainages which lie within the geographic area of interest to the society. He asked each state for information on obtaining a scientific collecting permit. He also specifically inquired about regulations on the use of gill nets, chemicals, and electroshocker. Some states responded by sending an application for a permit and no further information. In this case Bob did not pursue the matter further, therefore some information may be lacking in the following summary:

Response – Sixteen (16) states responded by stating that they have some type of application procedure. Louisiana sent a permit (this has apparently changed according to members present). Louisiana, Virginia, and South Carolina are currently changing their procedure. Most extreme was Texas which required two letters of recommendation and the application be notarized.

Cost of Permits – Ten states had no cost. Seven states have a permit fee (majority range between $1.00 to $25.00). There appears to be a trend to charge higher fees for consultants. They also want to know the purpose for collecting. Two states (Arkansas and Pennsylvania) required a fishing license in addition to the permit. Pennsylvania had a $10.00 charge for a permit plus a $20.00 fee for a license for non-residents for **each** person collecting.

Permit Coverage – Holder of permit and party – 12 states. Holder of permit only – it was not clear from the information provided by many states.

Purpose of Collecting – Basically the state requires information on the permit application about what, when, and where collecting will be conducted. Fourteen states asked where collecting is to be done. How specific this information should be varied greatly. Eight states asked when collecting would be done. However, almost all states require that anyone possessing a permit to notify a Game Warden or Biologist prior to collecting. Thirteen states wanted information as to which species would be taken. How specific this information should be also varied greatly. Eleven of these states wanted to know which species and how many of each will be taken.

Gear – All states permitted collection by seine. Four states permit use of chemicals when supervised by a (state) biologist. Several did not permit the use of chemicals. Texas was very clear that no chemicals, gill nets, or electroshocker could be used. Apparently you can request a special permit for these if necessary.

Reports – The great majority of the states want an annual or end of project report. North Carolina wants quarterly reports. South Carolina indicated they would like the information on floppy disk if possible. Several states want copies of any thesis or publications resulting from data obtained through use of the permit.

3. Historian: The chair suggested that all information regarding the society should be placed in the hands of the Historian, Donald Cloutman. The Secretary should send copies of minutes to Don. There was a suggestion from the floor that the Secretary/Treasurer hold on to copies of all information in his position until the matter with the IRS is cleared up.

4. Membership: The Chair requested as to the possibility of publishing a membership list. After some discussion, it was agreed that Werner would send a complete list to Bob Jenkins. Bob has the means to scan the list so it can easily be converted to a form for which we have access to appropriate software.

New Business:

None

Regional Reports:

Oral Regional Reports were given by the following members and will be forwarded to the Editor for inclusion in the PROCEEDINGS.

Bob Jenkins	–	Northeast
Noel Burkhead	–	Southeast
David Etnier	–	North-Central
Rick Mayden	–	South-Central
Bob Cashner	–	Southwest
Henry Robison	–	Northwest (no report)

A motion to adjourn the meeting was made. The motion passed and the meeting ended at 2:55 P.M.

Respectfully submitted

Werner Wieland

Secretary/Treasurer

REGIONAL SFC REPORTS

REGION I – Northeast

Progress is slowly being made on the "Fishes of Virginia" but with no publication date yet established. The future events in this regional subdivision will be reported by Fritz Rhode who will be taking over as Region I reporter.

R. Jenkins

REGION II – Southeast

The Gulf sturgeon (*Acipenser Oxyrhynchus desotoi*) has gone through the review process for threatened listing and should be placed in that category by the end of December. Twenty years ago today Jim Williams and Glen Clemmer began an investigation into the status of the Alabama sturgeon, *Scaphirhynchus* sp. (c.f. *platorhynchus*) with a several year (decade) hiatus due to lack of specimens. This work continues with the description of same now in review. Congratulations Jim! That is all.

N. Burkehead

REGION III – North-central

Madtom propagation. – Our efforts to establish additional smoky (*Noturus baileyi*) and yellowfin (*N. flavipinnis*) populations continue. This is our second year of culturing eggs and larvae in the excellent facilities at Aquatic Specialists, a Knoxville aquarium shop (Randy Shute, John Tullock, Pat Rakes). The facility was designed for the madtom work, employs biological , activated charcoal, and filter pad filtration, and provides water of controllable temperature and exceptional purity. Mortality of eggs taken during early developmental stages and young just prior to release in late summer has been reduced to very acceptable levels. Late last summer 245 smoky and 102 yellowfin madtoms were released into Abrams Creek, again near the GSMNP campground. Aquarium growth is at least as good as that in the wild. This year's egg/larvae harvest from Citico Creek is about to get underway. A captive brood stock is being held at Aquatic Specialists. These fish, of both species, are now one year old and in excellent condition, but they will not be sexually mature until next year. The first indication of possible success of our efforts came recently — a large adult male *baileyi* was found guarding a nest site under a rock near the transplant area this June.

Cyprinella monacha recovery efforts involving transplant of adults from the upper Little Tennessee River below Franklin, NC, into Abrams Creek were made difficult by high water levels. A crew of five of us managed to seine only about 50 specimens (we rather easily got our "limit" of 250 in a half day last year). We transplanted these farther upstream in Abrams Creek, near the GSMNP campground. The October 1988, transplant was to the extreme lower end of the creek.

The Tennessee fish book is in its final stages and is scheduled to go to UT Press for copy editing by 1 July. Wayne Starnes and I are delighted to add Dick Bryant to the title page as photographer for the book. Both TVA and TWRA have generously provided pre-publication "up-front" money that will allow us to spread color illustrations throughout the text as did Robby and Tom in the Arkansas book, and still keep the price below $50.00. TVA also came through with expense money for a rush of last minute color photos employing anesthetized rather than formalin-fixed specimens. Dick, Wayne, and I have made several trips to middle and west Tennessee and have made "new" photos of nearly 150 fishes, in addition to finding an embarrassingly high number of significant new distribution records, some of which are mentioned below. Brooks Burr, Carter Gilbert, Larry Page, Buck Snelson, and Jim Williams each received about one-fifth of the book for review, and all of them did an excellent job.

Significant new records for fishes in the area include two *Acipenser fulvescens* from the Mississippi River near Tiptonville, 1988-1989; *Etheostoma crossopterum, Phoxinus erythrogater* and *Notropis dorsalis* from Bear Creek, a tiny direct trib to the Mississippi River below the mouth of the Hatchie River in Tipton County, Tennessee; *Notropis texanus* from a western trib to the lower Tennessee near Pickwick dam, thanks almost certainly to the Tenn-Tom Waterway; *Umbra limi* from the lower Forked Deer system near Dyersburg, and *Etheostoma camurum, E. tippecanoe,* and *Percina phoxocephala* from Red River, lower Cumberland drainage, Robertson Co., TN. Carley Saylor, TVA, provided *Phoxinus* specimens from a Chickamauga Reservoir (Tennessee River) trib on the top of Waldens Ridge, Bledsoe Co., TN, that may represent a new species. He got 47 specimens in this 1976 collection, but Wayne, Dick, and I were unable to find any there this spring. UMMZ recently sent down three fine specimens of *Percina copelandi* collected during February 1947, from a small tributary to the Nolichucky River in Tusculum, Green Co., TN. This is the only record I know of from the entire French Broad system. Maybe it's still there!

Several attempts to collect *Etheostoma striatulum* for photographs from known localities in the upper Duck system this spring failed to produce a single specimen. Either we have a terrible search image for this thing, or it should be carefully monitored.

Darter Dreams – Recent additions to the UT collection include the following rather interesting combinations: *Percina caprodes* X *P. nigrofasciata, P. nigrofasciata* X *P. shumardi,* and *P. caprodes* X *Etheostoma rufilineatum.*

D.A. Etnier

REGION V – Southwest

At Northeast Louisiana University

Neil Douglas is continuing his studies on species changes in NE LA rivers where the red shiner (*Notropis lutrensis*) has increased in abundance in altered streams while *N. venustus* has

declined there. *N. lutrensis* is uncommon in unaltered streams. Neil is focusing on the partially channelized Tensas R. where *N. venustus* has been hanging on still while *N. lutvensis* numbers are increasing in a pattern of "partial replacement".

A student of Neil's, Madelen Carter, is comparing within drainage systems physical and chemical data from streams with increasing numbers of *N. lutrensis* versus those with fewer *N. lutrensis*. Another student of Neil's, Steven George, is doing a comparative fecundity study of darter subgenera.

Neil Douglas and Frank Pezold just completed a survey of the Big Black River in Mississippi. No *Ammocrypta clara* were obtained but healthy populations of *A. vivax* and *A. beani* were discovered. The river is highly silted in spots (a definite threat to sand darters) and has more new bridges under construction or recently completed than any other stream in the Nearctic. This activity definitely increases the silt load and perhaps the only place in MS to collect a sand darter is the Mississippi River itself. Frank Pezold is also revising the New World *Eleotris* as a starter to the rest of the world. These occasional denizens of LA fresh waters are represented in NA by something other than *E. pisonis* (limited to Brazil and perhaps Guiana). Our representative is either *E. abacurus* or *E. amblyopsis*. More study is needed. Frank and Neil have also just submitted a proposal to the Board of Regents to study the distribution, movement and relative abundance of the buffalo (*Ictiobus sp.*) in the lower Ouachita drainage. And lastly, Neil is gearing up for a revision of the *Fishes of LA*.

R. Cashner

ATTENTION

The business meeting of the SFC will be held from **4-6 PM** on Friday, April 12 in the Broyhill Inn – East Room. This is as it will appear in the April ASB Bulletin, not as in the January Bulletin.

NEWS NOTES

The U.S.Fish and Wildlife Service is now providing the following reference service in disseminating agency supported research reports and other information concerning co-operative units, state agencies and endangered species recovery teams:

Fish and Wildlife Reference Service
5430 Grosvenor Ln., Suite 110
Bethesda, Maryland 20814

1-800-582-3421

- Literature Searches
- Technical Reports
- Fish and Wildlife Thesaurus
- Indexes of State Fish and Wildlife Research
- Newsletter
- Referrals to other Sources

Reading Room open to the public.

Write, Visit, or Call.

Cable News Network (CNN) has a new feature unit called *Earth Matters* that airs everyday at 1:30A, 9A, and 2P (EST). They are interested in stories covering a broad spectrum of environmental topics (e.g. fish restoration programs, impact analyses, present and future endangered species concerns and etc.). To submit a story, contact: Melissa Ballard, Producer

CNN Earth Matters
One CNN Center
Atlanta, GA 30348-5366
OP 404/827-3391
FAX 404/827-3665

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Southeastern Fishes Council
PROCEEDINGS

Information for Contributors

The primary intent of the PROCEEDINGS is to publish research papers, critical reviews of problems, area reports and other pertinent information pertaining to the biology and conservation of Southeastern fishes.

Manuscripts should be submitted in duplicate with the original on good quality bond paper. A good guide for manuscript preparation is the *Fifth Edition of the CBE Style Manual* (1983) available from the Council for Biology Editors, 9650 Rockville Pike, Bethesda, Maryland 20814.

The entire manuscript including the abstract (if desired), text, Literature Cited, tables, headings and legends must be double-spaced. The title, author's name and author's address should be centered on the first page. Indicate a suggested running head of less than ten words at the bottom of the first page. An abstract (if included) will be placed at the beginning of the text. Acknowledgements will be cited in the text immediately before the Literature Cited. All references cited in the paper will follow the standard format of using the last name of the author(s) followed by the year of publication of the paper. In the Literature Cited, the references will be alphabetical by the author's last name and chronological under a single authorship. The entire reference should be given with the complete name of the journal spelled out if possible.

Tables should be typed on a separate page, consecutively numbered and should have a short descriptive heading. Figures (to include maps, graphs, charts, drawings and photographs) should be consecutively numbered and if grouped as one figure each part block lettered in the lower left corner. In general, high quality prints or photocopies are preferred to the original line art. Legends for figures must be on a separate sheet and each figure must be identified on the back. The desired location of each table or figure should be indicated in the margin of the manuscript.

Manuscripts will be subject to editing and will be reviewed by at least one person expert in the subject matter. The edited manuscript and page proofs ("galley") will be furnished to the author. Reprints will be available at a nominal cost.

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Only manuscripts form members of The Southeastern Fishes Council will be considered fro publication. There is no charge for publishing in the PROCEEDINGS. All manuscripts and short communications should be sent to the editor of the PROCEEDINGS:

Michael M. Stevenson
Department of Biological Sciences
University of New Orleans
Lakefront
New Orleans, LA 70148
(504) 286-7057