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Bottom Fishes of South Carolina Estuaries – Relative Abundance, Seasonal Distribution and Length-Frequency Relationships

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South Carolina Marine

BOTTOM FISHES OF SOUTH CAROLINA ESTUARIES - RELATIVE ABUNDANCE, SEASONAL DISTRIBUTION, AND LENGTH-FREQUENCY RELATIONSHIPS[1]

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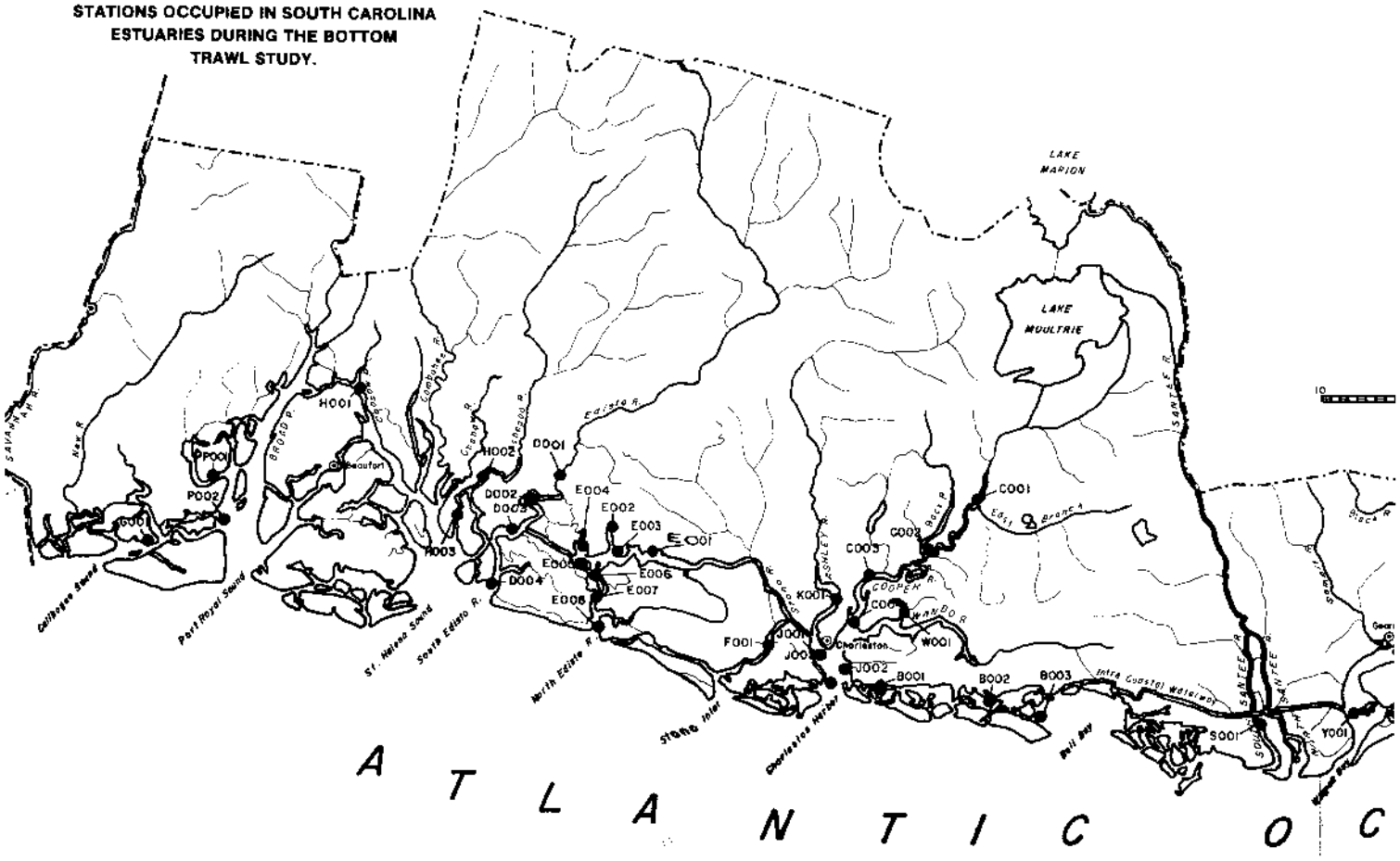
INTRODUCTION

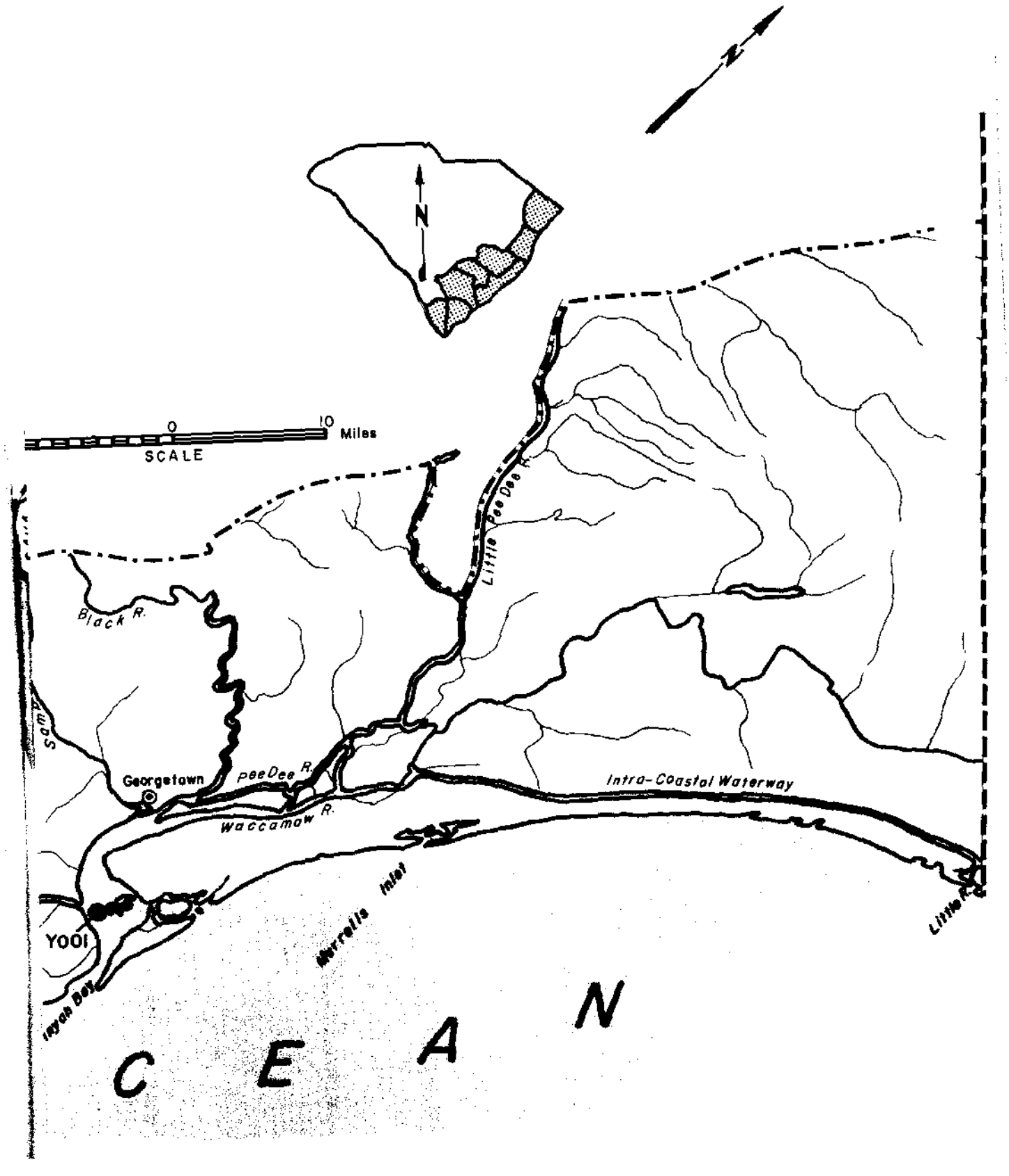
In February, 1973 the South Carolina Wildlife and Marine Resources Department initiated a major statewide estuarine research program. This ongoing project, "An Environmental Base Line Study of South Carolina Estuaries," is primarily an effort of the Marine Resources Division's Marine Resources Research Institute (MRRI), with assistance from the Division's Office of Conservation and Management (OCM). The broad objectives of this program are to determine the basic biological, chemical, and physical characteristics of the major estuaries of South Carolina, the seasonal changes in these characteristics, and their interactions over a several-year period.

During the first year of the program, extensive meteorological, hydrographic, nektonic, planktonic, and benthic studies were conducted during all seasons of the year at 33 selected stations (Figure 1).

This report presents data on relative abundance, seasonal distribution, and length-frequency relationships for 88 fish species captured by bottom trawl in South Carolina estuaries during the 12-month period from February, 1973 through January, 1974.

FIGURE 1.
STATIONS OCCUPIED IN SOUTH CAROLINA ESTUARIES DURING THE BOTTOM TRAWL STUDY.




N
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SCALE
Black R.
Little PeeDee R.
Georgetown
PeeDee R.
Waccamaw R.
Intra-Coastal Waterway
Murrells Inlet
YOOI
C E A N

METHODS AND MATERIALS

Sampling Design

Thirty-three sampling sites were selected in the South Carolina coastal zone (Figure 1) and divided into two categories, Intensive Phase stations or Extensive Phase stations. A schedule of cruises conducted to stations in each phase is given in Table 1.

The Intensive Phase consisted of a concentration of 17 stations, eight in the North Edisto, four in the South Edisto, and five in the Cooper River, each of which was occupied monthly throughout the year. Locations, mean depths, tidal ranges, bottom salinity and temperature ranges, and bottom types for these stations are given in Table 2.

The Extensive Phase included 16 additional stations over much of the remaining South Carolina coastal zone. These locations were visited quarterly and encompassed a wide range of geographic locations, depths, and bottom types. Locations, mean depths, tidal ranges, bottom salinity and temperature ranges, and bottom types for these stations are given in Table 3. Included in this quarterly phase were stations in South Santee River; Winyah and Bull Bays; Price, Nowell, and Inlet Creeks; Charleston Harbor; Ashley and Stono Rivers; Rock Creek; Ashepoo River; Whale Branch; Port Royal Sound; Colleton River; and Calibogue Sound.

Trawl Techniques

Trawl operations. All bottom trawling was accomplished utilizing the South Carolina Wildlife and Marine Resources Department's R/V ANITA, a 16-m (52-ft) shallow-draft research vessel rigged as a stern trawler

Table 1. Schedule of Estuarine Survey cruises in South Carolina during the 12-month cycle from February, 1973 through January, 1974.

Date		Cruise
1973	February	North and South Edisto, Cooper Rivers (Intensive Phase)
	March	North and South Edisto, Cooper Rivers (Intensive Phase)
	April	*Entire State (Intensive and Extensive Phases)
	May	North and South Edisto, Cooper Rivers (Intensive Phase)
	June	North and South Edisto, Cooper Rivers (Intensive Phase)
	July	*Entire State (Intensive and Extensive Phases)
	August	North and South Edisto, Cooper Rivers (Intensive Phase)
	September	North and South Edisto, Cooper Rivers (Intensive Phase)
	October	*Entire State (Intensive and Extensive Phases)
	November	North and South Edisto, Cooper Rivers (Intensive Phase)
	December	North and South Edisto, Cooper Rivers (Intensive Phase)
1974	January	*Entire State (Intensive and Extensive Phases)

*North and South Edisto and Cooper Rivers; South Santee River; Winyah and Bull Bays; Price, Inlet, and Nowell Creeks; Charleston Harbor; Ashley and Stono Rivers; Rock Creek; Ashepoo River; Whale Branch; Port Royal Sound; Colleton River; and Calibogue Sound.

Table 2. Locations of 17 Estuarine Survey stations, Intensive Phase, occupied monthly in the North and South Edisto and Cooper Rivers, South Carolina, during the 12-month annual cycle from February, 1973 through January, 1974.

Estuary	Station	Latitude	Longitude	Mean Depth (m)	Tidal Range (m) Mean	Tidal Range (m) Spring	Bottom Salinity Range (o/oo)	Bottom Temperature Range (C)	Bottom Type
North Edisto	E001 - Yonges Island	32° 41.2'N	80° 10.4'W	7.4	2.0	2.3	14.0 - 28.7	10.4 - 30.1	sand - shell - mud (hard)
	E002 - Toogoodoo Creek	32° 41.3'N	80° 17.3'W	3.6	1.9	2.3	11.9 - 28.4*	11.6 - 30.4*	sand - shell - mud
	E003 - Bears Bluff	32° 38.8'N	80° 15.7'W	7.3	1.8	2.1	16.4 - 28.9	9.4 - 29.8	sand and shell
	E004 - Dawho River	32° 37.9'N	80° 18.6'W	4.7	1.8	2.1	14.2 - 28.2	14.2 - 30.1	sand
	E005 - Steamboat Creek	32° 36.2'N	80° 17.7'W	6.7	1.7	2.0	15.6 - 31.3	9.4 - 29.9	sand
	E006 - Wadmalaw Island	32° 36.5'N	80° 14.8'W	8.0	1.8	2.1	17.7 - 30.4	9.2 - 29.9	sand
	E007 - Point of Pines	32° 35.9'N	80° 13.5'W	7.5	1.7	2.0	17.8 - 31.2	8.1 - 29.3	mud
	E008 - Deveaux Bank	32° 33.6'N	80° 10.7'W	10.2	1.8	2.1	22.1 - 34.4	8.7 - 29.1	shell and sand
South Edisto	D001 - Snuggedy Swamp	32° 39.7'N	80° 24.8'W	2.8	1.9	2.2	< 0.1 - 0.3*	7.2 - 28.3*	sand
	D002 - Sampson Island	32° 36.3'N	80° 25.4'W	10.6	1.9	2.2	< 0.1 - 10.8	7.2 - 29.0	mud and shell
	D003 - Fenwick Island	32° 33.7'N	80° 23.7'W	4.2	1.9	2.2	0.1 - 24.2*	6.6 - 29.5*	sand
	D004 - Bay Point	32° 29.7'N	80° 21.2'W	7.3	1.8	2.1	14.2 - 34.0	8.6 - 29.0	sand
Cooper River	C001 - The Tee	33° 04.0'N	79° 55.5'W	10.0	1.2	1.4	< 0.1 - 0.2	5.7 - 28.8	mud (hard)
	C002 - Big Island	32° 58.2'N	79° 55.5'W	7.4	1.4	1.7	< 0.1 - 18.1	9.1 - 29.3	sand
	C003 - N. Charleston	32° 53.8'N	79° 57.6'W	6.8	1.5	1.8	0.1 - 13.7	11.2 - 29.1	shell and sand
	C004 - Mouth of Cooper	32° 51.1'N	79° 56.0'W	11.1	1.6	1.9	2.0 - 26.2	11.6 - 29.2	mud - sand - shell
	J003 - Cummings Point	32° 44.9'N	79° 51.6'W	9.7	1.5	1.8	21.4 - 31.5	12.4 - 29.4	shell and sand

* Surface reading.

Table 3. Locations of 16 Estuarine Survey stations, Extensive Phase, occupied quarterly in a number of estuaries throughout the South Carolina coastal zone during the 12-month annual cycle from February, 1973 through January, 1974.

Estuary	Station	Latitude	Longitude	Mean Depth (m)	Tidal Range (m) Mean	Tidal Range (m) Spring	Bottom Salinity Range (o/oo)	Bottom Temperature Range (C)	Bottom Type
Northern Region	Y001 - Winyah Bay	33° 15.6'N	79° 15.4'W	4.2	1.0	1.2	<0.1 - 25.9	11.6 - 8.4	mud
	S001 - South Santee	33° 08.8'N	79° 19.2'W	3.5	1.2	1.4	12.6 - 23.1	12.7 - 29.5	sand and clay
	B003 - Bull Bay	32° 55.9'N	79° 36.2'W	5.0	1.5	1.7	32.1 - 34.2	10.4 - 29.5	mud and sand
	B002 - Price Creek	32° 54.2'N	79° 40.7'W	7.8	1.6	1.8	23.4 - 34.2	10.3 - 29.2	sand and shell
Charleston Region	B001 - Inlet Creek	32° 47.5'N	79° 49.5'W	4.2	1.6	1.8	23.7 - 33.8	14.7 - 27.8	sand and shell
	W001 - Nowell Creek	32° 53.1'N	79° 52.6'W	3.5	1.8	2.1	11.2 - 18.4	14.7 - 29.0	sand and mud
	J001 - Fort Johnson	32° 45.4'N	79° 55.1'W	6.6	1.6	1.8	10.9 - 25.1	13.2 - 28.0	mud and sand
	J002 - Hog Island	32° 47.1'N	79° 53.2'W	2.8	1.6	1.8	15.7 - 29.0	13.3 - 25.9	mud and silt
	K001 - Ashley River	32° 48.6'N	79° 58.1'W	5.5	1.6	1.9	7.6 - 18.7	14.2 - 29.3	mud
Southern Region	F001 - Stono River	32° 44.9'N	80° 00.7'W	5.0	1.6	1.8	10.5 - 21.8	13.6 - 29.9	shell and sand
	H002 - Ashepoo River	32° 34.0'N	80° 29.9'W	5.8	1.9	2.2	0.2 - 12.3	15.1 - 29.9	sand
	H003 - Rock Creek	32° 30.9'N	80° 27.9'W	4.8	1.9	2.2	12.0 - 24.1	15.2 - 30.5	mud - sand - shell
	H001 - Whale Branch	32° 32.1'N	80° 43.7'W	5.2	2.2	2.5	10.4 - 25.9	16.6 - 31.4	mud - sand - shell
	P002 - Port Royal Sound	32° 16.2'N	80° 43.7'W	5.7	2.1	2.5	24.1 - 30.9	14.1 - 30.0	mud and sand
	P001 - Colleton River	32° 16.2'N	80° 48.5'W	7.5	2.3	2.7	22.3 - 30.4	14.7 - 30.6	mud - sand - clay
	G001 - Calibogue Sound	32° 10.9'N	80° 47.8'W	6.7	2.2	2.5	22.2 - 28.8	14.3 - 30.5	mud - sand - shell

(Figure 2). Twenty-minute trawl tows were made against flood tide during daylight. All tows were made at an engine speed of 750 rpm, resulting in a vessel speed of about 2.5 - 3.0 knots against flood tide. Distance covered on any trawl transect during a twenty-minute tow was in part dependent on water current and wind velocities at that location. During the year, distances covered on trawl transects averaged about 1.5 km (0.8 nautical miles/tow) and generally fell within a range of 1.1 - 1.9 km (0.6 - 1.0 nautical miles/tow).

Description of trawl. Six-m (20-ft), semiballoon otter trawls, constructed to project specifications, were utilized throughout the study. These nets were built with 6-m (20-ft) head rope and 8-m (26-ft) foot rope and were made of 2.5-cm (1-inch) stretch mesh, knotless, green nylon netting throughout the body and cod end. The head rope, foot rope, and breast ropes were made of 1.0-cm (3/8-inch) diameter Poly-Dac net ropes, with legs extended 1.2 m (4 ft) and heavy-duty wire rope thimbles spliced in at each end with 9.3-cm (5/16-inch) screw pin shackles attached to fasten the nets onto the trawl doors. These ropes were hemmed in a 7.6-cm (3-inch) dacron collar around the entire mouth of the net. The wooden trawl doors, 90.0-cm (36-inches) long by 50.0-cm (20-inches) wide by 3.5-cm (1.5-inches) thick, had iron boots 7.6-cm (3-inches) wide and 1.0-cm (3/8-inch) thick.

Three 15.2-cm (6-inch) plastic floats were used on the head rope and 2/0 galvanized chain was hung loop-style on the foot rope. Flotation and chains were lashed to the collar of the head and foot ropes through 6.5-mm (1/4-inch) brass grommetts inserted into the collar.

Figure 2. The R/V ANITA, a 16-m (52-ft) shallow-draft research vessel, preparing to set a 6-m (20-ft) semiballoon otter trawl on one of the stations in South Carolina estuaries occupied throughout the study.

Catch processing. Specimens collected at each station were either processed immediately on board (Figure 3) or preserved in 10% buffered formalin and returned to the laboratory for identification, sorting, measuring, and weighing. All fish were identified to species, and scientific and common names used are those accepted by the American Fisheries Society (Bailey, 1970).

Individual specimens were weighed to the nearest 0.1 gram utilizing a Mettler top-loading precision electronic balance, Model P-11. Weighing techniques generally followed procedure standards for measuring fish weight outlined by Lagler (1968).

Total lengths were measured to the nearest millimeter on 75-cm measuring boards. Total length, as utilized in this study was equivalent to that used by Miller and Jorgenson (1969) and was the distance from the tip of the snout (jaws closed) to the tip of the longest lobe, or ray, of the caudal fin.

When ≤ 50 specimens of a given species were caught in a single tow, all specimens were individually measured. In those instances where extremely large numbers of any species were captured in a single tow, a total count was made, but individual weights and measurements were taken only for a subsample. Subsampling was conducted as follows: if > 50 to ≤ 250 were captured, 50 randomly-selected specimens were individually measured. If > 250 to ≤ 500 were caught, 20% were measured. When > 500 were caught, 10% were measured. The smallest and largest fish were selected prior to taking a representative sample of additional specimens.

Using this subsampling system, the project was assured of obtaining individual history data on all, or at least 50, individuals over the entire size range of a given species in any trawl catch.

Figure 3. Scientific personnel of the South Carolina Wildlife and Marine Resources Department processing a trawl catch resulting from a 20-minute bottom tow. Such measurements provided quantitative information on length-frequencies, relative abundance, and seasonal distribution for 88 fish species frequenting South Carolina estuaries.

Summarization of Trawl Data

Total catch. Eighty-eight species were caught during the year. A summary table for the entire year's catch, all stations combined, was prepared showing all species, their rankings in order of abundance by total numbers and weights, and the percent of the total number and weight contributed to the year's catch by each species. Similar tables were prepared for the North Edisto, South Edisto, and Cooper Rivers individually so that species rankings could be compared between these three estuaries that were sampled monthly. Several species, especially less common ones, were caught in equal numbers or weights during the year. In the tables listing species in decreasing order of abundance, all such species are assigned the same numerical rank. These ranking data were generated by IBM 370/145 computer utilizing a FORTRAN program entitled "Species Rankings by Numbers, Weights, and Percents of Total Catch" which was developed specifically for this study. An additional table was prepared showing all species and summarizing whether each was present or absent in each estuary or state region during the year.

Total length, temperature, and salinity ranges. A table was prepared listing all species, their total length, bottom temperature, and bottom salinity ranges. Also, included in this table is a synopsis of the primary locations at which each species occurred during the year.

Length-frequency relationships. Length-frequency relationships were also tabulated for the 23 fish species most commonly captured by bottom trawl. For each species a single table was prepared combining length-frequency data for all stations across the state.

For all species, the length-frequency data are presented by month in 5-mm increment groups. For some species the largest specimens were combined in larger size increment groupings.

Relative abundance and seasonal distribution. For the eight most common fishes, numbers caught throughout the year were individually tabled by species, showing catch per month at each station in each estuary or state region. Species summarized in this manner are: Anchoa mitchilli (bay anchovy), Bairdiella chrysura (silver perch), Cynoscion regalis (weakfish), Ictalurus catus (white catfish), Leiostomus xanthurus (spot), Micropogon undulatus (Atlantic croaker), Stellifer lanceolatus (star drum), and Urophycis regius (spotted hake). These relative abundance and seasonal distribution data were generated by IBM 370/145 computer utilizing a FORTRAN program entitled "Summation of Trawl Catches (Numbers) by Station and Months" which was developed specifically for this study.

For an additional 15 fishes collected in moderate abundance, numbers caught thoughout the year were individually tabled by species, showing catch per month with data for all stations combined within each estuary or state region. Species summarized in this manner are: Alosa aestivalis (blueback herring), Anchoa hepsetus (striped anchovy), Arius felis (sea catfish), Brevoortia tyrannus (Atlantic menhaden), Chloroscombrus chrysurus (Atlantic bumper), Dorosoma petenense (threadfin shad), Ictalurus punctatus (channel catfish), Larimus fasciatus (banded drum), Menticirrhus americanus (southern kingfish), Opisthonema oglinum (Atlantic thread herring), Opsanus tau (oyster toadfish), Peprilus alepidotus (harvestfish), Trichiurus lepturus (Atlantic cutlassfish), Trinectes maculatus (hogchoker), and Symphurus plagiusa (blackcheek tonguefish).

Within each table for the 23 most common species, the percentages of the total number collected were given for each month and location. Grand total for all months and locations combined was also recorded in each table.

Hydrographic Analyses

Six-liter capacity Van Dorn water sample bottle casts were made at all stations immediately before trawling. Samples were collected 1 m below the water surface and 0.3 m above the bottom at each station. Water temperatures were read immediately from stem thermometers internally mounted in the Van Dorn samplers. All water samples were then returned for salinity analysis by the chemical oceanography laboratory of the Marine Resources Research Institute. Salinity was analyzed utilizing a Beckman RS7B Induction Salinometer. Throughout this report, wherever specific estuaries were being described on the basis of their salinity characteristics, terminology followed the Venice System (1958).

RESULTS AND CONCLUSIONS

Total Catch Composition

A systematic listing of all fish species collected by bottom trawl in South Carolina estuaries during the 12-month period from February, 1973 through January, 1974 is presented in Table 4.

The estuaries or regions of the South Carolina coastal zone in which these species were obtained are summarized in Table 5. Twenty-two of the 88 species caught were highly ubiquitous and were found in all estuaries or state regions sampled. Included in this group were the sciaenids Stellifer lanceolatus (star drum), Micropogon undulatus (Atlantic croaker), Leiostomus xanthurus (spot), Bairdiella chrysura (silver perch), and Cynoscion regalis (weakfish); the clupeids Brevoortia tyrannus (Atlantic menhaden) and Opisthonema oglinum (Atlantic thread herring); the carangids Chloroscombrus chrysurus (Atlantic bumper), Selene vomer (lookdown), and Vomer setapinnis (Atlantic moonfish); the bothids Paralichthys dentatus (summer flounder), Paralichthys lethostigma (southern flounder), and Citharichthys spilopterus (bay whiff); the cynoglossid Symphurus plagiusa (blackcheek tonguefish); the soleid Trinectes maculatus (hogchoker); the engraulid Anchoa mitchilli (bay anchovy); the ictalurid Ictalurus catus (white catfish); the batrachoid Opsanus tau (oyster toadfish); the gadid Urophycis regius (spotted hake); the bleniid Hypsoblennius hentzi (feather blenny); the trichiurid Trichiurus lepturus (Atlantic cutlassfish); and the triglid Prionotus tribulus [(bighead searobin), tentative identification].

Table 4. Systematic listing by orders and families for the 88 fish species collected by bottom trawl in South Carolina estuaries during the 12-month period from February, 1973 through January, 1974.

Order Squaliformes
- Family Carcharhinidae
  - *Rhizoprionodon terraenovae* (Atlantic sharpnose shark)
- Family Sphyrnidae
  - *Sphyrna zygaena* (Smooth hammerhead)
- Family Squalidae
  - *Squalus acanthias* (Spiny dogfish)

Order Rajiformes
- Family Dasyatidae
  - *Dasyatis sabina* (Atlantic stingray)
  - *Gymnura micrura* (Smooth butterfly ray)
- Family Myliobatidae
  - *Rhinoptera bonasus* (Cownose ray)

Order Acipenseriformes
- Family Acipenseridae
  - *Acipenser oxyrhynchus* (Atlantic sturgeon)

Order Semionotiformes
- Family Lepisosteidae
  - *Lepisosteus osseus* (Longnose gar)

Order Anguilliformes
- Family Anguillidae
  - *Anguilla rostrata* (American eel)
- Family Congridae
  - *Conger oceanicus* (Conger eel)

Order Clupeiformes
- Family Clupeidae
  - *Alosa aestivalis* (Blueback herring)
  - *Alosa sapidissima* (American shad)
  - *Brevoortia tyrannus* (Atlantic menhaden)
  - *Dorosoma cepedianum* (Gizzard shad)
  - *Dorosoma petenense* (Threadfin shad)
  - *Opisthonema oglinum* (Atlantic thread herring)
- Family Engraulidae
  - *Anchoa hepsetus* (Striped anchovy)
  - *Anchoa mitchilli* (Bay anchovy)

Order Myctophiformes
- Family Synodontidae
  - *Synodus foetens* (Inshore lizardfish)

Order Siluriformes
- Family Ictaluridae
  - *Ictalurus catus* (White catfish)
  - *Ictalurus melas* (Black bullhead)
  - *Ictalurus natalis* (Yellow bullhead)
  - *Ictalurus nebulosus* (Brown bullhead)
  - *Ictalurus platycephalus* (Flat bullhead)
  - *Ictalurus punctatus* (Channel catfish)

Table 4. (Continued.)

Family Ariidae
Arius felis (Sea catfish)
Bagre marinus (Gafftopsail catfish)

Order Batrachoidiformes
Family Batrachoididae
Opsanus tau (Oyster toadfish)

Order Gobiesociformes
Family Gobiesocidae
Gobiesox strumosus (Skilletfish)

Order Gadiformes
Family Gadidae
Urophycis earlli (Carolina hake)
Urophycis floridanus (Southern hake)
Urophycis regius (Spotted hake)
Family Ophidiidae
Rissola marginata (Striped cusk-eel)

Order Atheriniformes
Family Atherinidae
Menidia menidia (Atlantic silverside)

Order Gasterosteiformes
Family Syngnathidae
Syngnathus floridae (Dusky pipefish)
Syngnathus fuscus (Northern pipefish)

Order Perciformes
Family Percichthyidae
Morone saxatilis (Striped bass)
Family Serranidae
Centropristis philadelphica (Rock sea bass)
Centropristis striata (Black sea bass)
Family Centrarchidae
Lepomis auritus (Redbreast sunfish)
Family Percidae
Perca flavescens (Yellow perch)
Family Pomatomidae
Pomatomus saltatrix (Bluefish)
Family Carangidae
Caranx hippos (Crevalle jack)
Chloroscombrus chrysurus (Atlantic bumper)
Selene vomer (Lookdown)
Vomer setapinnis (Atlantic moonfish)
Family Lutjanidae
Lutjanus griseus (Gray snapper)
Family Pomadasyidae
Orthopristis chrysoptera (Pigfish)
Family Sparidae
Lagodon rhomboides (Pinfish)

Table 4. (Continued.)

- Family Sciaenidae
  - Bairdiella chrysura (Silver perch)
  - Cynoscion nebulosus (Spotted seatrout)
  - Cynoscion nothus (Silver seatrout)
  - Cynoscion regalis (Weakfish)
  - Larimus fasciatus (Banded drum)
  - Leiostomus xanthurus (Spot)
  - Menticirrhus americanus (Southern kingfish)
  - Micropogon undulatus (Atlantic croaker)
  - Pogonias cromis (Black drum)
  - Stellifer lanceolatus (Star drum)
- Family Ephippidae
  - Chaetodipterus faber (Atlantic spadefish)
- Family Mugilidae
  - Mugil cephalus (Striped mullet)
  - Mugil curema (White mullet)
- Family Sphyraenidae
  - Sphyraena guachancho (Guaguanche)
- Family Uranoscopidae
  - Astroscopus y-graecum (Southern stargazer)
- Family Blenniidae
  - Hypsoblennius hentzi (Feather blenny)
- Family Gobiidae
  - Gobionellus boleosoma (Darter goby)
  - Gobionellus hastatus (Sharptail goby)
  - Gobionellus stigmaticus (Marked goby)
  - Gobiosoma bosci (Naked goby)
  - Gobiosoma ginsburgi (Seaboard goby)
- Family Trichiuridae
  - Trichiurus lepturus (Atlantic cutlassfish)
- Family Scombridae
  - Scomberomorus maculatus (Spanish mackerel)
- Family Stromateidae
  - Peprilus alepidotus (Harvestfish)
  - Peprilus triacanthus (Butterfish)
- Family Triglidae
  - Prionotus carolinus (Northern searobin)*
  - Prionotus evolans (Striped searobin)*
  - Prionotus tribulus (Bighead searobin)*

Order Pleuronectiformes

- Family Bothidae
  - Ancylopsetta quadrocellata (Ocellated flounder)
  - Citharichthys spilopterus (Bay whiff)
  - Etropus crossotus (Fringed flounder)
  - Paralichthys dentatus (Summer flounder)
  - Paralichthys lethostigma (Southern flounder)
  - Scophthalmus aquosus (Windowpane)
- Family Soleidae
  - Trinectes maculatus (Hogchoker)
- Family Cynoglossidae
  - Symphurus plagiusa (Blackcheek tonguefish)

*Tentative identification.

Table 4. (Continued.)

Order Tetraodontiformes
Family Balistidae
Monacanthus hispidus (Planehead filefish)
Family Tetraodontidae
Lagocephalus laevigatus (Smooth puffer)
Family Diodontidae
Chilomycterus schoepfi (Striped burrfish)

Table 5. Species occurrence by locality summarized from bottom trawl catches in South Carolina estuaries during the 12-month period from February, 1973 through January, 1974.

Species	Monthly Sampling			Quarterly Sampling		
	North Edisto	South Edisto	Cooper River	Northern Region	Charleston Region	Southern Region
Acipenser oxyrhynchus	*	*				*
Alosa aestivalis	*	*	*		*	
Alosa sapidissima	*	*	*		*	*
Anchoa hepsetus	*	*	*			
Anchoa mitchilli	*	*	*	*	*	*
Ancylopsetta quadrocellata	*		*		*	*
Anguilla rostrata		*	*	*		
Arius felis	*	*	*	*		*
Astroscopus y-graecum	*					
Bagre marinus	*	*	*		*	*
Bairdiella chrysura	*	*	*	*	*	*
Brevoortia tyrannus	*	*	*	*	*	*
Caranx hippos	*		*	*		
Centropristis philadelphica	*		*	*		*
Centropristis striata	*		*	*	*	*
Chaetodipterus faber	*		*			*
Chilomycterus schoepfi						*
Chloroscombrus chrysurus	*	*	*	*	*	*
Citharichthys spilopterus		*	*	*	*	*
Cynoscion nebulosus	*		*	*	*	*
Cynoscion nothus	*	*				*
Cynoscion regalis	*	*	*	*	*	*
Conger oceanicus					*	
Dasyatis sabina	*	*	*			
Dorosoma cepedianum			*			
Dorosoma petenense	*		*	*	*	*
Etropus crossotus	*	*	*		*	*
Gobiesox strumosus	*		*	*		
Gobionellus boleosoma			*			
Gobionellus hastatus	*					
Gobionellus stigmaticus		*				
Gobiosoma bosci	*					
Gobiosoma ginsburgi		*				
Gymnura micrura	*					*

Table 5. (Continued.)

Species	Monthly Sampling			Quarterly Sampling		
	North Edisto	South Edisto	Cooper River	Northern Region	Charleston Region	Southern Region
Hypsoblennius hentzi	*	*	*	*	*	*
Ictalurus catus	*	*	*	*	*	*
Ictalurus melas			*			
Ictalurus natalis			*			
Ictalurus nebulosus			*			
Ictalurus platycephalus			*			
Ictalurus punctatus	*	*	*			
Lagocephalus laevigatus		*	*			
Lagodon rhomboides	*			*	*	
Larimus fasciatus	*	*		*		*
Leiostomus xanthurus	*	*	*	*	*	*
Lepisosteus osseus		*	*		*	*
Lepomis auritus			*			
Lutjanus griseus		*	*	*		
Menidia menidia	*					
Menticirrhus americanus	*	*	*	*		*
Micropogon undulatus	*	*	*	*	*	*
Monacanthus hispidus	*	*			*	*
Morone saxatilis		*	*			
Mugil cephalus	*				*	
Mugil curema	*					
Opisthonema oglinum	*	*	*	*	*	*
Opsanus tau	*	*	*	*	*	*
Orthopristis chrysoptera	*			*		*
Paralichthys dentatus	*	*	*	*	*	*
Paralichthys lethostigma	*	*	*	*	*	*
Peprilus alepidotus	*		*	*	*	*
Peprilus triacanthus	*		*	*	*	*
Perca flavescens			*			
Pogonias cromis			*			
Pomatomus saltatrix	*	*	*		*	*
Prionotus carolinus*		*		*		*
Prionotus evolans*						*
Prionotus tribulus*	*	*	*	*	*	*

*Tentative identification.

Table 5. (Continued.)

Species	Monthly Sampling			Quarterly Sampling		
	North Edisto	South Edisto	Cooper River	Northern Region	Charleston Region	Southern Region
Rhinoptera bonasus	*					
Rhizoprionodon terraenovae	*			*		
Rissola marginata	*					*
Scomberomorus maculatus	*	*	*	*	*	
Scophthalmus aquosus	*	*		*		
Selene vomer	*	*	*	*	*	*
Sphyraena guachancho	*					
Sphyrna zygaena						*
Squalus acanthias	*					
Stellifer lanceolatus	*	*	*	*	*	*
Symphurus plagiusa	*	*	*	*	*	*
Syngnathus floridae	*					
Syngnathus fuscus				*		
Synodus foetens					*	
Trichiurus lepturus	*	*	*	*	*	*
Trinectes maculatus	*	*	*	*	*	*
Urophycis earlli	*					
Urophycis floridanus	*			*	*	*
Urophycis regius	*	*	*	*	*	*
Vomer setapinnis	*	*	*	*	*	*

Numbers of species and families, listed by order, and their relative contributions to bottom trawl catches in South Carolina estuaries during the 12-month period from February, 1973 through January, 1974 are summarized in Table 6. Represented in the year's catch were 46 families from 16 orders. Six families were represented by four or more species. These families were Sciaenidae (10 species), Clupeidae (6 species), Ictaluridae (6 species), Bothidae (5 species), Gobiidae (5 species), and Carangidae (4 species). In terms of numerical abundance, sciaenids alone made up 67.9% of the year's catch, followed by engraulids with 19.6%. Sciaenids also contributed the greatest biomass (62.5% of the total catch weight), followed by ictalurids (11.2%).

Total numbers, total weights, rankings in order of abundance by number and weight, and percentage of total catch represented by all fish species captured by bottom trawl (all stations combined) in South Carolina estuaries from February, 1973 through January, 1974 are summarized in Table 7.

Description of Catch (Most Common Species)

Stellifer lanceolatus (Star Drum)

The star drum (*Stellifer lanceolatus*), one of the smaller sciaenids, was the most abundant bottom-dwelling species of estuarine fish caught during the study (Table 7). Star drum was also described as the most abundant estuarine fish in South Carolina in earlier reports (Dawson, 1958; Bearden, 1964; Lunz and Schwartz, 1970). This fish ranges from Chesapeake Bay to Texas and possibly to Mexico (Hildebrand and Cable, 1934) and has been reported to be one of the most abundant fishes on

Table 6. Numbers of species and families by order and their relative contributions (by numbers and weights) to bottom trawl catches in South Carolina estuaries during the 12-month period from February, 1973 through January, 1974.

Orders and Families Represented in Catch	Species Represented (Number)	Relative Numbers		Relative Biomass	
		Total Number Caught	Percent of Total Catch	Total Weight (kg)	Percent of Total Catch
Order Squaliformes					
Family Carcharhinidae	1	2	<0.1	0.5	0.1
Family Sphyrnidae	1	1	<0.1	0.5	0.1
Family Squalidae	1	1	<0.1	3.4	0.7
Order Rajiformes					
Family Dasyatidae	2	7	<0.1	7.0	1.4
Family Myliobatidae	1	1	<0.1	1.1	0.2
Order Acipenseriformes					
Family Acipenseridae	1	14	<0.1	7.7	1.6
Order Semionotiformes					
Family Lepisosteidae	1	24	<0.1	17.5	3.6
Order Anguilliformes					
Family Anguillidae	1	35	<0.1	4.0	0.8
Family Congridae	1	1	<0.1	0.1	<0.1
Order Clupeiformes					
Family Clupeidae	6	1,855	3.9	13.2	2.7
Family Engraulidae	2	12,290	19.6	21.1	4.3
Order Myctophiformes					
Family Synodontidae	1	5	<0.1	0.2	<0.1
Order Siluriformes					
Family Ictaluridae	6	1,868	3.0	61.1	12.5
Family Ariidae	2	140	0.2	10.4	2.1
Order Batrachoidiformes					
Family Batrachoididae	1	76	0.1	4.1	0.8

Table 6. (Continued.)

Orders and Families Represented in Catch	Species Represented (Number)	Relative Numbers		Relative Biomass	
		Total Number Caught	Percent of Total Catch	Total Weight (kg)	Percent of Total Catch
Order Gobiesociformes					
Family Gobiesocidae	1	3	<0.1	<0.1	<0.1
Order Gadiformes					
Family Gadidae	3	1,621	2.6	17.9	3.7
Family Ophidiidae	1	2	<0.1	<0.1	<0.1
Order Atheriniformes					
Family Atherinidae	1	3	<0.1	<0.1	<0.1
Order Gasterosteiformes					
Family Syngnathidae	2	2	<0.1	<0.1	<0.1
Order Perciformes					
Family Percichthyidae	1	33	<0.1	0.2	<0.1
Family Serranidae	2	21	<0.1	0.4	<0.1
Family Centrarchidae	1	1	<0.1	<0.1	<0.1
Family Percidae	1	3	<0.1	<0.1	<0.1
Family Pomatomidae	1	17	<0.1	1.2	0.2
Family Carangidae	4	690	1.1	4.3	0.9
Family Lutjanidae	1	5	<0.1	<0.1	<0.1
Family Pomadasyidae	1	5	<0.1	0.4	<0.1
Family Sparidae	1	6	<0.1	0.4	<0.1
Family Sciaenidae	10	42,568	67.9	285.2	58.1
Family Ephippidae	1	41	<0.1	0.5	<0.1
Family Mugilidae	2	4	<0.1	<0.1	<0.1
Family Sphyraenidae	1	1	<0.1	<0.1	<0.1
Family Uranoscopidae	1	12	<0.1	<0.1	<0.1
Family Blenniidae	1	35	<0.1	0.2	<0.1
Family Gobiidae	5	6	<0.1	<0.1	<0.1
Family Trichiuridae	1	189	0.3	7.6	1.5
Family Scombridae	1	17	<0.1	0.4	<0.1
Family Stromateidae	2	169	0.3	2.0	0.4
Family Triglidae	3	28	<0.1	<0.1	<0.1

Table 6. (Continued.)

Orders and Families Represented in Catch	Species Represented (Number)	Relative Numbers: Total Number Caught	Relative Numbers: Percent of Total Catch	Relative Biomass: Total Weight (kg)	Relative Biomass: Percent of Total Catch
Order Pleuronectiformes					
Family Bothidae	6	103	0.2	6.9	1.4
Family Soleidae	1	399	0.6	3.5	0.7
Family Cynoglossidae	1	368	0.6	6.0	1.2
Order Tetraodontiformes					
Family Balistidae	1	9	<0.1	<0.1	<0.1
Family Tetraodontidae	1	2	<0.1	<0.1	<0.1
Family Diodontidae	1	1	<0.1	<0.1	<0.1
Totals	88	62,684	100.0	<490.5	100.0

Table 7. Total numbers, total weights, rankings in order of abundance by number and weight, and percentage of total catch represented by 88 fish species captured by bottom trawl (all stations combined) in South Carolina estuaries from February, 1973 through January, 1974.

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Stellifer lanceolatus	23,992	1	38.3	105.6	1	19.3
Anchoa mitchilli	12,074	2	19.3	19.4	7	3.5
Micropogon undulatus	9,030	3	14.4	95.5	2	17.4
Leiostomus xanthurus	5,347	4	8.5	57.1	3	10.4
Cynoscion regalis	2,136	5	3.4	31.0	6	5.7
Bairdiella chrysura	1,863	6	3.0	43.6	5	8.0
Ictalurus catus	1,732	7	2.8	54.2	4	9.9
Urophycis regius	1,612	8	2.6	17.6	8	3.2
Brevoortia tyrannus	823	9	1.3	8.9	11	1.6
Chloroscombrus chrysurus	578	10	0.9	3.4	20	0.6
Alosa aestivalis	462	11	0.7	1.5	33	0.3
Trinectes maculatus	407	12	0.6	3.5	19	0.6
Symphurus plagiusa	362	13	0.6	6.0	14	1.1
Dorosoma petenense	327	14	0.5	0.9	36	0.2
Anchoa hepsetus	216	15	0.3	1.7	30	0.3
Opisthonema oglinum	214	16	0.3	1.6	32	0.3
Trichiurus lepturus	189	17	0.3	7.6	13	1.4
Peprilus alepidotus	151	18	0.2	1.8	28	0.3
Arius felis	90	19	0.1	10.0	10	1.8
Ictalurus punctatus	77	20	0.1	3.2	23	0.6
Opsanus tau	76	21	0.1	4.1	17	0.8
Larimus fasciatus	75	22	0.1	2.1	26	0.4
Menticirrhus americanus	75	22	0.1	1.8	27	0.3
Ictalurus nebulosus	53	23	0.1	2.6	24	0.5
Vomer setapinnis	53	23	0.1	0.2	52	< 0.1
Bagre marinus	50	24	0.1	0.4	45	0.1
Chaetodipterus faber	41	25	0.1	0.5	40	0.1
Cynoscion nothus	40	26	0.1	1.6	31	0.3
Selene vomer	39	27	0.1	0.4	43	0.1

Table 7. (Continued.)

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Anguilla rostrata	35	28	0.1	4.0	18	0.7
Hypsoblennius hentzi	35	28	0.1	0.3	50	0.1
Morone saxatilis	33	29	0.1	0.2	55	< 0.1
Alosa sapidissima	28	30	< 0.1	0.2	53	< 0.1
Paralichthys dentatus	25	31	< 0.1	1.7	29	0.3
Paralichthys lethostigma	25	31	< 0.1	4.9	15	0.9
Lepisosteus osseus	24	32	< 0.1	17.5	9	3.2
Prionotus tribulus *	24	32	< 0.1	0.1	67	< 0.1
Citharichthys spilopterus	23	33	< 0.1	0.2	57	< 0.1
Caranx hippos	20	34	< 0.1	0.3	51	< 0.1
Peprilus triacanthus	18	35	< 0.1	0.2	56	< 0.1
Pomatomus saltatrix	17	36	< 0.1	1.2	34	0.2
Scomberomorus maculatus	17	36	< 0.1	0.4	41	0.1
Etropus crossotus	15	37	< 0.1	0.1	61	< 0.1
Acipenser oxyrhynchus	14	38	< 0.1	7.7	12	1.4
Centropristis striata	14	38	< 0.1	0.3	47	< 0.1
Astroscopus y-graecum	12	39	< 0.1	0.1	63	< 0.1
Scophthalmus aquosus	11	40	< 0.1	0.3	48	< 0.1
Monacanthus hispidus	9	41	< 0.1	< 0.1	69	< 0.1
Centropristis philadelphica	7	42	< 0.1	0.1	60	< 0.1
Cynoscion nebulosus	6	43	< 0.1	0.5	38	0.1
Lagodon rhomboides	6	43	< 0.1	0.4	42	0.1
Urophycis earlli	6	43	< 0.1	0.2	54	< 0.1
Lutjanus griseus	5	44	< 0.1	0.1	66	< 0.1
Orthopristis chrysoptera	5	44	< 0.1	0.4	44	0.1
Synodus foetens	5	44	< 0.1	0.3	49	0.1
Ancylopsetta quadrocellata	4	45	< 0.1	< 0.1	70	< 0.1
Gymnura micrura	4	45	< 0.1	4.7	16	0.9
Pogonias cromis	4	45	< 0.1	3.3	22	0.6
Dasyatis sabina	3	46	< 0.1	2.4	25	0.4
Gobiesox strumosus	3	46	< 0.1	< 0.1	75	< 0.1

*Tentative identification.

Table 7. (Continued.)

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Ictalurus natalis	3	46	< 0.1	0.8	37	0.1
Menidia menidia	3	46	< 0.1	< 0.1	77	< 0.1
Perca flavescens	3	46	< 0.1	< 0.1	72	< 0.1
Prionotus carolinus *	3	46	< 0.1	< 0.1	76	< 0.1
Urophycis floridanus	3	46	< 0.1	0.1	59	< 0.1
Gobiosoma bosci	2	47	< 0.1	< 0.1	79	< 0.1
Ictalurus platycephalus	2	47	< 0.1	0.3	46	0.1
Lagocephalus laevigatus	2	47	< 0.1	0.1	65	< 0.1
Mugil cephalus	2	47	< 0.1	< 0.1	71	< 0.1
Mugil curema	2	47	< 0.1	< 0.1	73	< 0.1
Rhizoprionodon terraenovae	2	47	< 0.1	0.5	40	0.1
Rissola marginata	2	47	< 0.1	0.1	62	< 0.1
Chilomycterus schoepfi	1	48	< 0.1	< 0.1	82	< 0.1
Conger oceanicus	1	48	< 0.1	0.1	58	< 0.1
Dorosoma cepedianum	1	48	< 0.1	< 0.1	78	< 0.1
Gobionellus boleosoma	1	48	< 0.1	< 0.1	85	< 0.1
Gobionellus hastatus	1	48	< 0.1	< 0.1	68	< 0.1
Gobionellus stigmaticus	1	48	< 0.1	< 0.1	74	< 0.1
Gobiosoma ginsburgi	1	48	< 0.1	< 0.1	86	< 0.1
Ictalurus melas	1	48	< 0.1	0.1	64	< 0.1
Lepomis auritus	1	48	< 0.1	< 0.1	80	< 0.1
Prionotus evolans *	1	48	< 0.1	< 0.1	83	< 0.1
Rhinoptera bonasus	1	48	< 0.1	1.1	35	0.2
Sphyraena guachancho	1	48	< 0.1	< 0.1	84	< 0.1
Sphyrna zygaena	1	48	< 0.1	0.5	39	0.1
Squalus acanthias	1	48	< 0.1	3.4	21	0.6
Syngnathus floridae	1	48	< 0.1	< 0.1	87	< 0.1
Syngnathus fuscus	1	48	< 0.1	< 0.1	81	< 0.1
GRAND TOTALS	62,684		100.0	< 547.7		100.0

*Tentative identification.

the south Atlantic and Gulf coasts (Welsh and Breder, 1923). However, star drum abundance varies considerably within this range. Although present in the Chesapeake Bay area, this species is more abundant in North Carolina (Hildebrand and Cable, 1934), South Carolina (Dawson, 1958; Bearden, 1964; and Lunz and Schwartz, 1970), Georgia (Dahlberg and Odum, 1970; Dahlberg, 1971; Hoese, 1973), and in Florida south to Cape Canaveral (Anderson, 1968). Star drum is not common in southeastern Florida (Gunter and Hall, 1963) or along Florida's west coast (Joseph and Yerger, 1956; Springer and Woodburn, 1960). Low numbers of star drum were reported in Alabama (Swingle, 1971) and Mississippi (Christmas and Waller, 1973) with numbers increasing to the west in Louisiana (Gunter, 1938; Perret et al., 1971; Perret and Caillouet, 1974) and Texas (Gunter, 1941). This species was represented by some life stage in every month and in every major estuary or coastal region of South Carolina (Table 5). Dahlberg and Odum (1970) also found star drum abundant during all months in two Georgia estuarine systems.

Total catch. During the year, 23,992 star drum, with a total weight of 105.6 kg, were obtained at all stations combined (Table 7). This species ranked first in numerical abundance statewide, constituting 38.3% of the total number of fish captured and first in weight, representing 19.3% of the total fish biomass for the year.

Total length, temperature, and salinity ranges. Star drum collected in the estuaries during the year had a total length range of 16 - 217 mm and occurred over a bottom salinity range of 0.9 - 34.4°/oo and a bottom temperature range of 8.6 - 30.5 C (Table 8).

Table 8. Total length ranges, bottom salinity and temperature ranges, and primary locations at which 88 fish species were captured by bottom trawl in South Carolina estuaries from February, 1973 through January, 1974.

Species	Total Length Range (mm)	Bottom Salinity Range (°/oo)	Bottom Temperature Range (C)	Primary Locations
Acipenser oxyrhynchus (Atlantic sturgeon)	110 - 615	<0.1 - 33.2	16.2 - 29.9	Upper South Edisto River
Alosa aestivalis (Blueback herring)	35 - 307	0.1 - 25.1	11.5 - 29.0	Wide distribution
Alosa sapidissima (American shad)	50 - 181	0.1 - 27.3	11.5 - 29.3	Wide distribution
Anchoa hepsetus (Striped anchovy)	58 - 140	8.8 - 34.4	16.9 - 30.5	Edisto and Cooper Rivers
Anchoa mitchilli (Bay anchovy)	22 - 88	<0.1 - 34.2	10.3 - 31.4	Wide distribution
Ancylopsetta quadrocellata (Ocellated flounder)	38 - 118	21.8 - 25.1	17.1 - 22.0	North Edisto, Charleston Region
Anguilla rostrata (American eel)	265 - 528	0.1 - 25.9	16.2 - 22.8	Upper Cooper River
Arius felis (Sea catfish)	58 - 296	0.2 - 33.2	16.8 - 30.5	Wide distribution
Astroscopus y-graecum (Southern stargazer)	25 - 79	10.5 - 30.8	13.7 - 21.9	North Edisto River
Bagre marinus (Gafftopsail catfish)	75 - 158	8.3 - 27.1	18.3 - 30.1	Wide distribution
Bairdiella chrysura (Silver perch)	40 - 192	0.1 - 34.4	7.2 - 31.4	Wide distribution
Brevoortia tyrannus (Atlantic menhaden)	35 - 243	0.1 - 30.3	12.0 - 31.0	Wide distribution
Caranx hippos (Crevalle jack)	28 - 151	9.5 - 28.0	17.0 - 29.3	Cooper and North Edisto Rivers
Centropristis philadelphica (Rock sea bass)	35 - 126	4.8 - 25.9	21.0 - 30.0	Cooper River (Mouth), Port Royal Sound
Centropristis striata (Black sea bass)	60 - 198	10.9 - 33.8	10.3 - 29.2	North Edisto (Deveaux Bank)
Chaetodipterus faber (Atlantic spade fish)	37 - 137	14.2 - 33.2	26.5 - 30.1	North Edisto and Cooper Rivers
Chilomycterus schoepfi (Striped burrfish)	44	25.4	30.5	Calibogue Sound
Chloroscombrus chrysurus (Atlantic bumper)	38 - 132	13.7 - 32.3	18.4 - 30.5	South Edisto River
Citharichthys spilopterus (Bay whiff)	68 - 131	21.4 - 26.6	10.4 - 29.5	Port Royal, Charleston Region
Cynoscion nebulosus (Spotted seatrout)	202	26.2	12.7 - 17.4	Cooper River (Mouth)
Cynoscion nothus (Silver seatrout)	78 - 180	23.8 - 30.8	17.4 - 30.5	North Edisto, Calibogue Sound
Cynoscion regalis (Weakfish)	23 - 323	0.4 - 34.4	13.7 - 31.4	Wide distribution
Conger oceanicus (Conger eel)	450	<0.1	17.8	Charleston Region, Ft. Johnson
Dasyatis sabina (Atlantic stingray)	202 - 509	0.2 - 28.9	17.1 - 27.5	North & South Edisto, Cooper River
Dorosoma cepedianum (Gizzard shad)	112	9.5	17.0	Cooper River (Big Island)
Dorosoma petenense (Threadfin shad)	36 - 134	0.1 - 32.3	16.6 - 29.9	Wide distribution
Etropus crossotus (Fringed flounder)	39 - 105	14.2 - 31.2	17.1 - 30.1	North & South Edisto, Cooper River
Gobiesox strumosus (Skilletfish)	57 - 61	20.9 - 26.2	14.0 - 17.4	Lower North Edisto & Cooper River
Gobionellus boleosoma (Darter goby)	74	21.4	29.4	Charleston Harbor (Cummings Point)
Gobionellus hastatus (Sharptail goby)	254	24.6	8.6	North Edisto (Point of Pines)
Gobionellus stigmaticus (Marked goby)	62 - 63	0.2 - 24.1	29.4	Port Royal Sound, South Edisto River

Table 8. (Continued.)

Species	Total Length Range (mm)	Bottom Salinity Range (°/oo)	Bottom Temperature Range (C)	Primary Locations
Gobiosoma bosci (Naked goby)	61 - 72	15.0 - 22.8	27.6	Upper North Edisto River
Gobiosoma ginsburgi (Seaboard goby)	42	14.2	16.6 - 21.5	South Edisto River
Gymnura micrura (Smooth butterfly ray)	248 - 327	1.1 - 28.0	26.5 - 30.5	North Edisto and Calibogue Sound
Hypsoblennius hentzi (Feather blenny)	67 - 108	10.3 - 34.4	10.3 - 30.4	North Edisto and Cooper River
Ictalurus catus (White catfish)	28 - 392	<0.1 - 23.9	11.6 - 31.4	Upper South Edisto, Cooper and Ashepoo Rivers
Ictalurus natalis (Yellow bullhead)	97 - 351	<0.1 - 0.1	14.2	Upper South Edisto and Cooper Rivers
Ictalurus nebulosus (Brown bullhead)	59 - 269	0.1 - 3.4	8.7 - 28.8	Cooper River
Ictalurus platycephalus (Flat bullhead)	201 - 272	0.1	14.2	Cooper River (The Tee)
Ictalurus punctatus (Channel catfish)	56 - 234	0.1 - 0.2	8.7 - 27.8	Upper South Edisto and Cooper Rivers
Lagocephalus laevigatus (Smooth puffer)	95 - 110	22.6 - 22.7	28.8 - 29.0	Lower South Edisto and Cooper Rivers
Lagodon rhomboides (Pinfish)	62 - 192	29.8 - 33.8	20.5 - 24.4	North Edisto and Charleston Region
Larimus fasciatus (Banded drum)	37 - 146	12.9 - 34.2	16.0 - 30.5	North Edisto River
Leiostomus xanthurus (Spot)	22 - 188	0.1 - 34.4	11.6 - 31.4	Wide distribution
Lepisosteus osseus (Longnose gar)	314 -1018	0.1 - 18.1	9.1 - 29.9	Cooper River and Upper South Edisto
Lepomis auritus (Redbreast sunfish)	76	0.1	26.0	Upper Cooper River (The Tee)
Lutjanus griseus (Gray snapper)	70 - 107	0.1 - 34.2	17.0 - 27.4	South Edisto, Charleston Region
Menidia menidia (Atlantic silverside)	85	21.8	13.7 - 17.5	North Edisto, Charleston Region
Menticirrhus americanus (Southern kingfish)	43 - 271	0.9 - 34.2	9.2 - 30.1	Wide distribution
Micropogon undulatus (Atlantic croaker)	20 - 293	<0.1 - 34.2	9.2 - 31.4	Wide distribution
Monacanthus hispidus (Planehead filefish)	16 - 76	4.2 - 32.3	9.2 - 30.6	Calibogue Sound, North Edisto
Morone saxatilis (Striped bass)	47 - 142	<0.1 - 0.3	14.2 - 28.8	Upper South Edisto (Snuggedy Swamp)
Mugil cephalus (Striped mullet)	93	23.2	13.2 - 28.2	North Edisto and Charleston Harbor
Mugil curema (White mullet)	98 - 111	23.2	28.1	Upper North Edisto (Yonges Island)
Opisthonema oglinum (Atlantic thread herring)	40 - 174	0.1 - 34.2	12.7 - 30.1	North Edisto and Cooper Rivers
Opsanus tau (Oyster toadfish)	23 - 245	2.0 - 34.2	11.6 - 30.4	Wide distribution
Orthopristis chrysoptera (Pigfish)	171 - 264	27.6 - 34.2	19.6 - 24.4	Lower North Edisto, Northern Region
Paralichthys dentatus (Summer flounder)	45 - 250	3.4 - 28.7	8.7 - 30.6	North Edisto, Cooper, Southern Region
Paralichthys lethostigma (Southern flounder)	34 - 412	0.1 - 28.6	9.4 - 30.1	North & South Edisto, Charleston Region
Peprilus alepidotus (Harvest fish)	20 - 131	0.9 - 33.2	17.4 - 30.1	Wide distribution
Peprilus triacanthus (Butterfish)	50 - 143	14.2 - 26.7	21.1 - 30.5	North Edisto, Charleston Harbor

Table 8. (Continued.)

Species	Total Length Range (mm)	Bottom Salinity Range (°/oo)	Bottom Temperature Range (C)	Primary Locations
Perca flavescens (Yellow perch)	92 - 107	0.1	8.7 - 14.2	Upper Cooper River (The Tee)
Pogonias cromis (Black drum)	180 - 512	3.4 - 4.8	11.2 - 16.2	Upper Cooper River
Pomatomus saltatrix (Bluefish)	65 - 280	0.7 - 34.4	16.2 - 30.5	North and South Edisto, Cooper River
Prionotus carolinus (Northern searobin)*	Not Available	16.9 - 32.1	Not Available	Upper Cooper River
Prionotus evolans (Striped searobin)*	Not Available	25.4	Not Available	Calibogue Sound (Marsh Island)
Prionotus tribulus (Bighead searobin)*	16 - 96	0.1 - 34.2	16.9 - 28.0	North Edisto, Charleston Region
Rhinoptera bonasus (Cownose ray)	366	24.6	27.6	North Edisto (Point of Pines)
Rhizoprionodon terraenovae (Atlantic sharpnose shark)	298 - 412	28.2 - 33.2	27.3 - 28.2	North Edisto and Price Creek
Rissola marginata (Striped cusk-eel)	161	28.7	14.0 - 27.3	Lower North Edisto and Price Creek
Scomberomorus maculatus (Spanish mackerel)	72 - 179	0.4 - 28.0	26.4 - 30.4	North & South Edisto, Charleston Region
Scophthalmus aquosus (Windowpane)	65 - 205	7.6 - 25.0	9.4 - 22.0	North Edisto River
Selene vomer (Lookdown)	32 - 115	6.0 - 33.2	16.9 - 30.1	North & South Edisto, Charleston Region
Sphyraena guachancho (Guaguanche)	87	27.6	27.2	North Edisto (Point of Pines)
Sphyrna zygaena (Smooth hammerhead)	468	25.4	30.5	Calibogue Sound (Marsh Island)
Squalus acanthias (Spiny dogfish)	916	20.9	8.7	North Edisto (Deveaux Bank)
Stellifer lanceolatus (Star drum)	16 - 217	0.9 - 34.4	8.6 - 30.5	Wide distribution
Symphurus plagiusa (Blackcheek tonguefish)	53 - 156	0.1 - 34.2	8.6 - 30.5	Wide distribution
Syngnathus floridae (Dusky pipefish)	40	25.7	26.7	North Edisto (Dawho River)
Syngnathus fuscus (Northern pipefish)	235	33.2	10.4	Bull Bay
Synodus foetens (Inshore lizardfish)	52 - 261	15.4 - 20.2	25.5 - 27.4	Charleston Harbor (Hog Island)
Trichiurus lepturus (Atlantic cutlassfish)	136 - 667	0.7 - 34.4	16.2 - 30.6	Wide distribution
Trinectes maculatus (Hog choker)	21 - 152	<0.1 - 32.3	6.6 - 30.5	Wide distribution
Urophycis earlli (Carolina hake)	112 - 174	25.0	16.9	North Edisto (Deveaux Bank)
Urophycis floridanus (Southern hake)	155 - 184	25.0	16.9	North Edisto (Deveaux Bank)
Urophycis regius (Spotted hake)	57 - 190	3.4 - 29.8	8.6 - 22.6	Wide distribution
Vomer setapinnis (Atlantic moonfish)	32 - 102	4.8 - 28.6	18.5 - 30.1	North and South Edisto, Cooper Rivers

*Tentative identification.

Length-frequency relationship. The length-frequency relationship for star drum from all stations is summarized in Table 9. Both young and adults were captured in quantity by our bottom trawls. This is consistent with the findings of Hildebrand and Cable (1934) that star drum appear to dwell at or near the bottom throughout life.

Total lengths for fish obtained from February to June ranged from 38 - 137 mm, suggesting that the majority of these were young-of-the-year from the previous summer spawning period. These can be traced from February at a modal length of 60 mm, to April at a modal length of 65 mm, and further to June at a modal length of 85 mm. The first recruits from summer spawning appeared in July and ranged from about 18 - 67 mm total length. In the same month, overlap was apparent between the new recruits and one-year-olds (approximate total length range 68 - 117 mm) with distinct modes of about 50 mm and 100 mm for the two respective year-classes. From July, 1973 to January, 1974, a wide range of total lengths occurred, indicating continued overlapping size distribution between young-of-the-year and one-year-old star drum. One exception occurred in October when a single specimen, with a total length of 217 mm, was collected. In all probability this fish was at least 2 years old.

Our length-frequency results compare favorably with those obtained by Welsh and Breder (1923) for midsummer star drum populations in Winyah Bay, South Carolina, and also are consistent with results obtained by Dahlberg and Odum (1970) for Georgia star drum populations. Star drum spawning occurs in late spring and early summer, with May and June the principal spawning months on the Atlantic coast. Maturity is reached at

Table 9. Length-frequency relationship for Stellifer lanceolatus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
						Month						
13 - 17								1				
18 - 22						5		2	1			
23 - 27						14		6				
28 - 32						25		11				
33 - 37						17		12	1			
38 - 42					1	14	7	27	12	1	3	4
43 - 47	2	1	1			32	13	44	38	2	4	6
48 - 52	4	3	1	1		32	33	43	32	9	15	16
53 - 57	9	11	18	3		28	56	40	67	18	28	15
58 - 62	13	14	34	2	2	17	58	58	118	27	55	27
63 - 67	11	20	41	9	4	3	23	118	154	55	40	35
68 - 72	11	13	28	13	3	1	2	119	173	83	70	36
73 - 77	9	5	38	25	26	2		104	156	80	15	30
78 - 82	5	18	39	32	44	2		85	129	55	127	34
83 - 87	1	3	17	30	58	1		27	79	21	63	24
88 - 92		3	11	22	30	10		11	33	12	30	23
93 - 97			10	10	25	15			17		14	6
98 - 102			7	4	13	19		1	6	1	7	10
103 - 107			3	2	5	18		4	3		3	2
108 - 112			2		2	10		8	2		1	1
113 - 117			1		2	3	1	3	3		1	6
118 - 122			4					3	4		1	5
123 - 127			4			1		5	4			4
128 - 132			1		1				5			8
133 - 137			1		1				2		1	1
148 - 152												1
213 - 217									1			
Mean Total Length (mm)	65	68	75	81	89	60	56	66	65	71	75	76

the age of one year (Welsh and Breder, 1923). The length-frequency data indicate that both young and adults are present in South Carolina estuaries during the spawning season. These results agree with Hildebrand and Cable's (1934) observation that the young are hatched on the same grounds regularly occupied by the adults and that no spawning migration occurs.

Distribution and relative abundance. In the North Edisto River, 14,347 star drum, with a total weight of 57.7 kg, were caught during the year (Table 10). In this estuary, the species ranked first in numerical abundance, constituting 50.8% of the total number, and first in weight, representing 33.4% of the total fish biomass for the year. Star drum were present in this estuary throughout the year, and were most abundant in the estuary during fall and early winter (September - December), when 81.5% of the year's catch occurred (Table 11). The species was not present at any station during every month, but was recorded at one station (Wadmalaw) during 11 months. This fish was most prevalent at three stations - Yonges Island, Bears Bluff, and Steamboat Creek, which together accounted for 91.2% of the star drum caught. Of all eight stations, Bears Bluff showed the greatest abundance with 47.4% of the total obtained for the North Edisto River.

In the South Edisto River, 3,478 star drum, with a total weight of 18.8 kg, were caught during the year (Table 12). In this estuary, the species ranked first in numerical abundance, constituting 34.7% of the total number, and second in weight, representing 19.2% of the total fish biomass for the 12-month period. Star drum were most prevalent in the lower reaches of the South Edisto, with little penetration into the upper brackish to freshwater portions of the estuary (Table 13). The two seawardmost stations (Bay Point and Fenwick Island)

Table 10. Total numbers, total weights, rankings in order of abundance by number and weight, and percentage of total catch represented by 62 fish species captured by bottom trawl in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Stellifer lanceolatus	14,347	1	50.8	57.7	1	33.4
Anchoa mitchilli	5,216	2	18.5	8.6	4	5.0
Leiostomus xanthurus	3,378	3	12.0	23.9	3	13.8
Micropogon undulatus	2,779	4	9.8	28.1	2	16.3
Cynoscion regalis	596	5	2.1	7.9	5	4.6
Urophycis regius	483	6	1.7	4.8	8	2.8
Bairdiella chrysura	415	7	1.5	7.3	7	4.2
Symphurus plagiusa	101	8	0.4	1.6	12	1.0
Trichiurus lepturus	73	9	0.3	3.5	10	2.0
Alosa aestivalis	66	10	0.2	0.1	36	0.1
Arius felis	63	11	0.2	7.4	6	4.3
Trinectes maculatus	63	11	0.2	1.6	13	0.9
Peprilus alepidotus	60	12	0.2	0.9	17	0.5
Chloroscombrus chrysurus	59	13	0.2	0.3	26	0.2
Larimus fasciatus	50	14	0.2	0.4	22	0.3
Brevoortia tyrannus	49	15	0.2	0.9	20	0.5
Menticirrhus americanus	47	16	0.2	1.2	14	0.7
Anchoa hepsetus	39	17	0.1	0.2	28	0.2
Vomer setapinnis	29	18	0.1	0.2	34	0.1
Chaetodipterus faber	28	19	0.1	0.3	25	0.2
Opisthonema oglinum	26	20	0.1	0.2	30	0.1
Cynoscion nothus	23	21	0.1	0.9	19	0.5
Opsanus tau	19	22	0.1	0.3	24	0.2
Bagre marinus	15	23	0.1	0.2	32	0.1
Paralichthys dentatus	15	23	0.1	1.1	15	0.6
Peprilus triacanthus	15	23	0.1	< 0.1	39	0.1
Hypsoblennius hentzi	13	24	0.1	0.1	40	0.1
Prionotus tribulus *	12	25	< 0.1	< 0.1	51	< 0.1
Astroscopus y-graecum	11	26	< 0.1	0.1	46	< 0.1
Dorosoma petenense	10	27	< 0.1	0.1	46	< 0.1
Selene vomer	9	28	< 0.1	0.1	41	0.1
Etropus crossotus	8	29	< 0.1	0.1	45	< 0.1

*Tentative identification

Table 10. (Continued.)

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Scophthalmus aquosus	8	29	< 0.1	0.1	42	0.1
Caranx hippos	7	30	< 0.1	0.2	35	0.1
Pomatomus saltatrix	6	31	< 0.1	0.4	23	0.2
Scomberomorus maculatus	6	31	< 0.1	0.2	33	0.1
Urophycis earlli	6	31	< 0.1	0.2	29	0.1
Alosa sapidissima	5	32	< 0.1	0.1	43	0.1
Centropristis striata	5	32	< 0.1	0.1	44	< 0.1
Gymnura micrura	3	33	< 0.1	4.3	9	2.5
Paralichthys lethostigma	3	33	< 0.1	0.8	21	0.4
Urophycis floridanus	3	33	< 0.1	0.1	38	0.1
Ancylopsetta quadrocellata	2	34	< 0.1	< 0.1	55	< 0.1
Dasyatis sabina	2	34	< 0.1	0.9	18	0.5
Gobiesox strumosus	2	34	< 0.1	< 0.1	54	< 0.1
Gobiosoma bosci	2	34	< 0.1	< 0.1	53	< 0.1
Menidia menidia	2	34	< 0.1	< 0.1	56	< 0.1
Monacanthus hispidus	2	34	< 0.1	< 0.1	58	< 0.1
Mugil curema	2	34	< 0.1	< 0.1	52	< 0.1
Centropristis philadelphica	1	35	< 0.1	< 0.1	63	< 0.1
Gobionellus hastatus	1	35	< 0.1	< 0.1	48	< 0.1
Ictalurus catus	1	35	< 0.1	0.2	31	0.1
Ictalurus punctatus	1	35	< 0.1	0.3	27	0.2
Lagodon rhomboides	1	35	< 0.1	< 0.1	50	< 0.1
Mugil cephalus	1	35	< 0.1	< 0.1	53	< 0.1
Orthopristis chrysoptera	1	35	< 0.1	< 0.1	49	< 0.1
Rhinoptera bonasus	1	35	< 0.1	1.1	16	0.6
Rhizoprionodon terraenovae	1	35	< 0.1	0.1	37	0.1
Rissola marginata	1	35	< 0.1	< 0.1	47	< 0.1
Sphyraena guachancho	1	35	< 0.1	< 0.1	57	< 0.1
Squalus acanthias	1	35	< 0.1	3.4	11	1.9
Syngnathus floridae	1	35	< 0.1	< 0.1	59	< 0.1
GRAND TOTALS	28,193		100.0	< 172.5		100.0

Table 11. Numerical abundance of Stellifer lanceolatus collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →)								Total Catch by Month	Monthly Contribution to Total Catch (%)
	Yonges Island (E001)	Toogoodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)		
1973										
February						5		24	29	0.3
March	39		92		3	2			136	0.9
April	345		41	25	112			47	570	4.0
May	297		2	10	108	12		2	431	3.0
June	49		549	1	46	10		93	748	5.2
July	28			1		12	29	71	81	0.6
August	187		203	26		3	6	59	484	3.4
September	2,130	1	2,110		378	141	1	273	5,034	35.0
October	163		32	14	1,450	12	2	295	1,968	13.7
November	159		1		790	16	13		979	6.8
December		2	3,760			3		1	4,766	26.0
1974										
January			7	1	1	28		85	122	0.8
Total Catch by Station	3,397	3	6,797	78	2,888	244	51	890	14,348	
Station Contribution to Total Catch (%)	23.7	<0.1	47.4	0.5	20.1	1.7	0.4	6.2		100.0

Grand Total (All stations and months combined) = 14,348

Table 12. Total numbers, total weights, rankings in order of abundance by number and weight, and percentage of total catch represented by 47 fish species captured by bottom trawl in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Stellifer lanceolatus	3,478	1	34.7	18.8	2	19.2
Micropogon undulatus	1,623	2	16.2	9.6	3	9.8
Ictalurus catus	1,380	3	13.8	26.2	1	26.8
Anchoa mitchilli	1,155	4	11.5	2.0	12	2.0
Chloroscombrus chrysurus	491	5	4.9	2.9	7	2.9
Urophycis regius	461	6	4.6	5.6	6	5.8
Cynoscion regalis	316	7	3.2	7.1	4	7.2
Leiostomus xanthurus	223	8	2.2	1.4	14	1.4
Trinectes maculatus	204	9	2.0	1.0	16	1.0
Symphurus plagiusa	147	10	1.5	2.6	9	2.7
Bairdiella chrysura	100	11	1.0	2.6	10	2.6
Brevoortia tyrannus	99	12	1.0	2.7	8	2.8
Anchoa hepsetus	79	13	0.8	0.7	18	0.7
Ictalurus punctatus	61	14	0.6	1.9	13	2.0
Morone saxatilis	32	15	0.3	0.2	22	0.2
Bagre marinus	28	16	0.3	0.1	28	0.1
Alosa sapidissima	19	17	0.2	0.1	32	0.1
Menticirrhus americanus	17	18	0.2	0.2	20	0.2
Alosa aestivalis	16	19	0.2	< 0.1	36	< 0.1
Lepisosteus osseus	14	20	0.1	2.0	11	2.0
Acipenser oxyrhynchus	13	21	0.1	6.5	5	6.6
Vomer setapinnis	11	22	0.1	< 0.1	35	< 0.1
Scomberomorus maculatus	7	23	0.1	0.2	21	0.2
Arius felis	6	24	0.1	0.3	19	0.3
Larimus fasciatus	6	24	0.1	0.1	31	0.1
Selene vomer	6	24	0.1	< 0.1	38	< 0.1
Trichiurus lepturus	5	25	0.1	0.2	23	0.2
Citharichthys spilopterus	4	26	< 0.1	0.1	29	0.1
Etropus crossotus	4	26	< 0.1	< 0.1	37	< 0.1
Opisthonema oglinum	4	26	< 0.1	0.1	26	0.1
Monacanthus hispidus	3	27	< 0.1	< 0.1	44	< 0.1

Table 12. (Continued.)

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Paralichthys lethostigma	3	27	< 0.1	0.1	24	0.2
Pomatomus saltatrix	3	27	< 0.1	0.1	25	0.1
Ictalurus natalis	2	28	< 0.1	0.8	17	0.8
Lutjanus griseus	2	28	< 0.1	< 0.1	39	< 0.1
Opsanus tau	2	28	< 0.1	0.1	33	< 0.1
Paralichthys dentatus	2	28	< 0.1	0.1	27	0.1
Anguilla rostrata	1	29	< 0.1	0.1	30	0.1
Cynoscion nothus	1	29	< 0.1	< 0.1	43	< 0.1
Dasyatis sabina	1	29	< 0.1	1.3	15	1.3
Gobionellus stigmaticus	1	29	< 0.1	< 0.1	40	< 0.1
Gobiosoma ginsburgi	1	29	< 0.1	< 0.1	45	< 0.1
Hypsoblennius hentzi	1	29	< 0.1	< 0.1	43	< 0.1
Lagocephalus laevigatus	1	29	< 0.1	< 0.1	34	< 0.1
Prionotus carolinus *	1	29	< 0.1	< 0.1	42	< 0.1
Prionotus tribulus *	1	29	< 0.1	< 0.1	45	< 0.1
Scophthalmus aquosus	1	29	< 0.1	< 0.1	41	< 0.1
GRAND TOTALS	10,033		100.0	<98.0		100.0

*Tentative identification.

Table 13. Numerical abundance of *Stellifer lanceolatus* collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution To Total Catch (%)
1973						
February				37	37	1.0
March				2	2	0.1
April				1	1	<0.1
May					0	0.0
June		4		3	7	0.2
July					0	0.0
August		2			2	0.1
September			146	162	308	8.8
October			120	584	704	20.2
November		88	328		416	12.0
December		90	1,780		1,870	53.8
1974						
January			127	5	132	3.8
Total Catch by Station	0	184	2,501	794	3,479	
Station Contribution to Total Catch (%)	0.0	5.3	71.9	22.8		100.0

Grand Total (All stations and months combined) = 3,479

together accounted for 94.7% of the star drum caught in the South Edisto. The species was absent throughout the year at Snuggedy Swamp, the station furthest upriver above the freshwater line. From midwinter through summer, this fish was restricted to the mouth of the river (Bay Point), with no appreciable penetration into the estuary. Star drum were most abundant in the estuary during mid-fall to early winter (October - December), when 86.0% of the year's catch occurred.

In the Cooper River, 2,727 star drum, with a total weight of 11.3 kg, were caught during the year (Table 14). In this estuary, the species ranked first in numerical abundance, constituting 26.0% of the total number, and fourth in weight, representing 8.2% of the total fish biomass for the 12-month period. This fish was most numerous in the lower third of the estuary (at the mouth of the Cooper River and at Cummings Point), which accounted for 98.3% of the star drum caught in the Cooper River. Star drum were completely absent throughout the year at "The Tee", the station furthest upriver above the freshwater line. This species was most abundant in the Cooper River estuary during September and October, when 57.3% of the year's catch occurred (Table 15). No Cooper River station had star drum present during all months. This fish was absent from all catches during February, March, and June in contrast to the North and South Edisto, where star drum were present during those same months.

Distribution and relative abundance of star drum at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are summarized in Table 16.

Table 14. Total numbers, total weights, rankings in order of abundance by number and weight, and percentage of total catch represented by 57 fish species captured by bottom trawl in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Stellifer lanceolatus	2,727	1	26.0	11.3	4	8.2
Micropogon undulatus	2,512	2	24.0	41.4	1	30.3
Anchoa mitchilli	1,481	3	14.1	2.6	14	1.9
Brevoortia tyrannus	583	4	5.6	3.0	12	2.2
Urophycis regius	582	5	5.6	6.1	7	4.4
Cynoscion regalis	494	6	4.7	6.6	6	4.8
Leiostomus xanthurus	381	7	3.6	3.1	10	2.3
Alosa aestivalis	373	8	3.6	1.4	16	1.0
Ictalurus catus	304	9	2.9	15.6	2	11.4
Dorosoma petenense	286	10	2.8	0.7	19	0.5
Bairdiella chrysura	279	11	2.7	9.3	5	6.8
Peprilus alepidotus	55	12	0.5	0.7	18	0.5
Ictalurus nebulosus	53	13	0.5	2.6	15	1.9
Trinectes maculatus	52	14	0.5	0.3	26	0.2
Opisthonema oglinum	45	15	0.4	0.1	32	0.1
Symphurus plagiusa	38	16	0.4	0.6	22	0.4
Anchoa hepsetus	32	17	0.3	0.3	27	0.2
Anguilla rostrata	32	17	0.3	3.7	8	2.7
Trichiurus lepturus	25	18	0.2	0.6	21	0.5
Opsanus tau	24	19	0.2	3.1	11	2.3
Ictalurus punctatus	15	20	0.1	1.0	17	0.8
Caranx hippos	12	21	0.1	0.1	31	0.1
Paralichthys lethostigma	11	22	0.1	3.0	13	2.2
Lepisosteus osseus	7	23	0.1	13.3	3	9.8
Vomer setapinnis	7	23	0.1	< 0.1	40	< 0.1
Selene vomer	6	24	0.1	0.1	33	0.1
Pomatomus saltatrix	5	25	0.1	0.6	20	0.5
Alosa sapidissima	4	26	< 0.1	0.1	33	0.1
Cynoscion nebulosus	4	26	< 0.1	0.5	23	0.3
Paralichthys dentatus	4	26	< 0.1	0.2	28	0.1
Pogonias cromis	4	26	< 0.1	3.3	9	2.4
Arius felis	3	27	< 0.1	0.4	24	0.3
Centropristis philadelphica	3	27	< 0.1	0.1	34	0.1

Table 14. (Continued.)

Species	Relative Numbers			Relative Biomass		
	Total Number Caught	Numerical Rank	Percent of Total Catch	Total Weight (kg)	Biomass Rank	Percent of Total Catch
Chloroscombrus chrysurus	3	27	< 0.1	< 0.1	43	< 0.1
Etropus crossotus	3	27	< 0.1	< 0.1	44	< 0.1
Menticirrhus americanus	3	27	< 0.1	0.1	30	0.1
Perca flavescens	3	27	< 0.1	< 0.1	42	< 0.1
Bagre marinus	2	28	< 0.1	< 0.1	37	< 0.1
Citharichthys spilopterus	2	28	< 0.1	< 0.1	49	< 0.1
Hypsoblennius hentzi	2	28	< 0.1	< 0.1	47	< 0.1
Ictalurus platycephalus	2	28	< 0.1	0.3	25	0.2
Peprilus triacanthus	2	28	< 0.1	0.1	35	< 0.1
Ancylopsetta quadrocellata	1	29	< 0.1	< 0.1	51	< 0.1
Centropristis striata	1	29	< 0.1	< 0.1	41	< 0.1
Chaetodipterus faber	1	29	< 0.1	< 0.1	38	< 0.1
Dasyatis sabina	1	29	< 0.1	0.2	29	< 0.1
Dorosoma cepedianum	1	29	< 0.1	< 0.1	46	< 0.1
Gobiesox strumosus	1	29	< 0.1	< 0.1	50	< 0.1
Gobionellus boleosoma	1	29	< 0.1	< 0.1	52	< 0.1
Ictalurus melas	1	29	< 0.1	0.1	36	< 0.1
Ictalurus natalis	1	29	< 0.1	< 0.1	47	< 0.1
Lagocephalus laevigatus	1	29	< 0.1	< 0.1	42	< 0.1
Lepomis auritus	1	29	< 0.1	< 0.1	48	< 0.1
Lutjanus griseus	1	29	< 0.1	< 0.1	45	< 0.1
Morone saxatilis	1	29	< 0.1	< 0.1	39	< 0.1
Prionotus tribulus *	1	29	< 0.1	< 0.1	53	< 0.1
Scomberomorus maculatus	1	29	< 0.1	< 0.1	38	< 0.1
GRAND TOTALS	10,480		100.0	<136.6		100.0

*Tentative identification.

Table 15. Numerical abundance of *Stellifer lanceolatus* collected monthly by bottom trawl at five stations in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (JC03)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February						0	0.0
March						0	0.0
April				1		1	<0.1
May				480	165	645	23.7
June						0	0.0
July					27	27	1.0
August			2		62	64	2.3
September				581		581	21.3
October		1	41	890	50	982	36.0
November				51	53	104	3.8
December				174		174	6.4
1974							
January				144	5	149	5.5
Total Catch by Station	0	1	43	2,321	362	2,727	
Station Contribution to Total Catch (%)	0.0	<0.1	1.6	85.0	13.3		100.0

Grand Total (All stations and months combined) = 2,727

Table 16. Numerical abundance of Stellifer lanceolatus collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers) Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)	Total Catch by Station	Station Contribution to Total Catch (%)
Northern Region						
Winyah Bay (Y001)		12	2	1	15	0.6
South Santee (S001)			18		18	0.8
Bull Bay (B003)	178	63	25		266	11.5
Price Creek (B002)			3		3	0.1
Charleston Region						
Inlet Creek (B001)					0	0.0
Nowell Creek (W001)					0	0.0
Fort Johnson (J001)				2	2	0.1
Hog Island (J002)			7		7	0.3
Ashley River (K001)	3		435	102	540	23.5
Southern Region						
Stono River (F001)	2	31	238		271	11.7
Ashepoo River (H002)			119		119	5.1
Rock Creek (H003)	7	83		6	96	4.1
Whale Branch (H001)			9		9	0.4
Port Royal Sound (P002)		623			623	26.9
Colleton River (P001)			26		26	1.1
Calibogue Sound (G001)		257	60		317	13.7
Total Catch by Season	190	1,069	942	111	2,312	
Season Contribution to Total Catch (%)	8.2	46.2	40.7	4.8		100.0

Grand Total (All stations and seasons combined) = 2,312

Anchoa mitchilli (Bay Anchovy)

The bay anchovy (Anchoa mitchilli) is the most abundant engraulid in South Carolina estuaries (Table 7). This schooling fish ranges from Massachusetts to Texas (Smith, 1907; Hildebrand and Schroeder, 1928) and as far south as Yucatan, Mexico (Hildebrand, 1963). The species was previously reported in South Carolina by Fowler (1945), Lunz and Schwartz (1969), and Cupka (1972). This engraulid was present in some life stage in every month and in all major estuaries or coastal regions of South Carolina (Tables 5 and 17). Miller and Jorgenson (1969) and Dahlberg and Odum (1970) also found bay anchovy abundant throughout the year along Georgia beaches and marshes.

Total catch. During the year 12,074 bay anchovy, with a total weight of 19.4 kg, were obtained at all stations combined (Table 7). This species ranked second in numerical abundance statewide, constituting 19.3% of the total number, and seventh in weight, representing 3.5% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Bay anchovy collected in the estuaries during the year had a total length range of 22 - 88 mm and occurred over a bottom salinity range of <0.1 - 34.2‰ (Table 8) and a bottom temperature range of 10.3 - 31.4 C (Table 8).

Length-frequency relationship. The length-frequency relationship for bay anchovy from all stations is summarized in Table 17. In different parts of its range, spawning may occur from as early as April to as late as September (Hildebrand and Cable, 1930), with peak spawning in the Carolinas occurring about July (Kuntz, 1914). Bay anchovy present in

Table 17. Length-frequency relationship for Anchoa mitchilli collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
18 - 22						1						
23 - 27							2	1				
28 - 32			1			13	5	12	2			
33 - 37	1	2		1		11	14	30	53	4	3	1
38 - 42	6	15	6			3	31	37	52	8	44	30
43 - 47	52	22	40	8	14	1	37	29	113	14	60	83
48 - 52	54	28	44	22	62	28	32	58	165	38	68	180
53 - 57	61	41	65	31	89	67	74	75	193	85	72	160
58 - 62	30	63	105	34	57	79	59	54	224	113	108	171
63 - 67	8	89	104	51	37	80	57	37	136	103	61	135
68 - 72	1	63	91	73	30	80	18	7	68	75	50	91
73 - 77		19	71	52	35	42	6	2	36	39	25	34
78 - 82		7	26	22	18	26	5	2	26	7	7	2
83 - 87		1	4	7	4	5	1		5	1	1	
88 - 92				2		1						
98 - 97												
Mean Total Length (mm)	50	59	61	64	59	60	53	49	54	60	55	55

South Carolina estuaries during February had a total length range of 33 - 72 mm, and doubtless were the progeny from previous summer spawning. These young-of-the-year can be traced from a modal length of about 55 mm in February to modal lengths of 65 mm in April and 70 mm in May. As summer and the new spawning season approached, difficulty in separating one-year-old fish from new recruits increased. This extensive overlapping in summer estuarine populations can be attributed, in large part, to the lack of any major migration by the species (Hildebrand, 1963) and also to the long spawning season and the small size attained (Hildebrand and Cable, 1930).

The new young-of-the-year were first recruited into our trawl catches in July, at about 18 - 47 mm in total length. These new recruits were probably the offspring of the one-year-old fish already present in South Carolina estuaries. From July through January, 1974, it is difficult to trace the young-of-the-year beyond 42 mm total length since these lengths integrate quickly with the remainder of the population. This bay anchovy length-frequency relationship is similar to that found in Georgia marshes by Miller and Jorgenson (1969).

Distribution and relative abundance. In the North Edisto River, 5,216 bay anchovy, with a total weight of 8.6 kg, were caught during the year (Table 10). In this estuary, the species ranked second in numerical abundance, constituting 18.5% of the total, and fourth in weight, representing 5.0% of the total fish biomass for the 12-month period. Bay anchovy were rather evenly distributed in the estuary throughout the year and at all stations (Table 18). Catches were greatest

Table 18. Numerical abundance of Anchoa mitchilli collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →)								Total Catch by Month	Monthly Contribution to Total Catch (%)
	Yonges Island (E001)	Toogoodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)		
1973										
February	59	5	10	7		74	8	16	179	3.4
March	28	35	2	207	27	84	181	182	746	11.3
April	7	201	12	301	24	14	24	8	591	11.3
May	78	18	13	39	3	3	14	13	181	3.5
June	114	56	97	31	49	17	59		423	8.1
July	20	82		17	9	10	76	8	222	4.3
August	78	50	13	35	27	62	51	12	328	6.3
September	3	171		22	5	13	80	6	300	5.8
October	31	199	11	135		4	229	13	622	11.9
November	25	50	41	84	82	78	42	25	427	8.2
December	19	11	18	166	113	7	34	13	370	7.1
1974										
January	168	12	83	451	3	25	76	9	827	15.9
Total Catch by Station	630	879	300	1,495	342	391	874	305	5,216	
Station Contribution to Total Catch (%)	12.1	16.9	5.8	28.7	6.6	7.5	16.8	5.9		100.0

Grand Total (All stations and months combined) = 5,216

during January, 1974, but only slightly so, with 15.9% of the year's total contributed during that month. Although this species was most prevalent at the Dawho River station (accounting for 28.7% of the year's total catch in the estuary), all stations accounted for appreciable portions of the total catch.

In the South Edisto River, 1,155 bay anchovy, with a total weight of 2.0 kg, were caught during the year (Table 12). In this estuary, the species ranked fourth in numerical abundance, constituting 11.5% of the total number, and 12th in weight, representing 2.0% of the total fish biomass for the 12-month period. Bay anchovy were present in the South Edisto estuary throughout the year, with slight peaks occurring during April - May and December (Table 19). Catches decreased with increasing distance upriver (therefore with decreasing salinity), with Bay Point at the estuary mouth contributing 67.4% of the year's catch, followed by Fenwick Island, Sampson Island, and Snuggedy Swamp at 30.1, 2.2, and 0.5% of the catch, respectively.

In the Cooper River, 1,481 bay anchovy, with a total weight of 2.6 kg, were caught during the year (Table 14). In this estuary, the species ranked third in numerical abundance, constituting 14.1% of the total number, and 14th in weight, representing 1.9% of the total fish biomass for the 12-month period. Bay anchovy were present in the Cooper River estuary throughout the year, but were most abundant in December, when 33.2% of the year's catch occurred (Table 20). This species was moderately abundant at all stations from Cummings Point (at the mouth of Charleston Harbor), upriver as far as Big Island. However, no bay anchovy managed to penetrate as far as "The Tee", the station furthest upriver above the freshwater line.

Table 19. Numerical abundance of Anchoa mitchilli collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973						
February				33	33	2.9
March			6	40	46	4.0
April			8	285	293	25.4
May		2	59	158	219	19.0
June	1	5	6	8	20	1.8
July			3		3	0.3
August	3	7	87		97	8.4
September		1	9	6	16	1.4
October		1	17	73	91	7.9
November		8	95	6	109	9.5
December	1	1	24	123	149	12.9
1974						
January			33	46	79	6.9
Total Catch by Station	5	25	347	778	1,155	
Station Contribution to Total Catch (%)	0.5	2.2	30.1	67.4		100.0

Grand Total (All stations and months combined) = 1,155

Table 20. Numerical abundance of Anchoa mitchilli collected monthly by bottom trawl at five stations in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (J003)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February			14	33		47	3.2
March			7	3		10	0.7
April				1		1	0.1
May		66	14	15	110	205	13.8
June		15	12	1	4	32	2.1
July			21	4	59	84	5.6
August		2	6	5	11	24	1.6
September		2	74	25	44	145	9.8
October			75	1	42	118	7.9
November		38	55	3	88	184	12.4
December		187	194	7	104	492	33.2
1974							
January		2	53	22	62	139	9.3
Total Catch by Station	0	312	525	120	524	1,481	
Station Contribution to Total Catch (%)	0.0	21.0	35.4	8.1	35.4		100.0

Grand Total (All stations and months combined) = 1,481

Distribution and relative abundance of bay anchovy at 16 additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are summarized in Table 21.

Micropogon undulatus (Atlantic Croaker)

The Atlantic croaker (Micropogon undulatus) is known from Massachusetts to Texas (Welsh and Breder, 1923; Hildebrand and Schroeder, 1928; Hildebrand and Cable, 1930) and is one of the most common species of marine fishes present in South Carolina coastal waters. Some life history stage of this sciaenid is present in every month and in every major estuary or coastal region of the state (Bearden, 1964). The Atlantic croaker is utilized by South Carolina's inshore fishermen as a source of recreation and as a food fish.

Total catch. During the year, 9,030 croaker, with a total weight of 95.5 kg, were obtained at all stations combined (Table 7). This species ranked third in numerical abundance statewide, constituting 14.4% of the total number, and second in weight, representing 17.4% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Croaker collected in the estuaries during the year had a total length range of 20 - 293 mm and occurred over a bottom salinity range of <0.1 - 34.2°/oo and a bottom temperature range of 9.2 - 31.4 C (Table 8).

Length-frequency relationship. The length-frequency relationship for Atlantic croaker from all stations is summarized in Table 22. At various locations throughout its range, Atlantic croaker spawn from August to April, with the majority of spawning occurring between

Table 21. Numerical abundance of *Anchoa mitchilli* collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers) Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)	Total Catch by Station	Station Contribution to Total Catch (%)
Northern Region						
Winyah Bay (Y001)	5	7	3	3	18	3.1
South Santee (S001)	6	1	138	104	249	43.0
Bull Bay (B003)	174		41	44	259	44.6
Price Creek (B002)	51		1	2	54	9.3
Charleston Region						
Inlet Creek (B001)	27	10	329	3	369	18.5
Nowell Creek (W001)	143	59	453	4	659	33.1
Fort Johnson (J001)	11	43	44	23	121	6.1
Hog Island (J002)	170	72	178	45	465	23.4
Ashley River (K001)	83	14	135	144	376	18.9
Southern Region						
Stono River (F001)	41	1	6	38	86	5.2
Ashepoo River (H002)	11	4	56	10	81	4.9
Rock Creek (H003)	321	73	154	28	576	34.7
Whale Branch (H001)	161	9	46	75	291	17.5
Port Royal Sound (P002)	10	10		3	23	1.4
Colleton River (P001)	1		1	10	12	0.7
Calibogue Sound (G001)	266	169	135	21	591	35.6
Total Catch by Season	1,481	472	1,720	557	4,230	
Season Contribution to Total Catch (%)	35.0	11.2	40.7	13.2		100.0

Grand Total (All stations and seasons combined) = 4,230

Table 22. Length-frequency relationship for Micropogon undulatus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
13 - 17		1										
18 - 22		1	4									1
23 - 27			14									
28 - 32	2		19	4		1						
33 - 37	10	5	21	10	1	2						5
38 - 42	7	2	26	16	3	1						19
43 - 47	4	3	14	17	10					5		13
48 - 52	3	4	26	17	5					5	3	14
53 - 57	6	6	29	17	17	7	2			2	3	11
58 - 62	13	5	70	11	15	12	1				11	11
63 - 67	8	6	55	18	28	26	4			1	9	6
68 - 72	10	7	57	22	40	49	15		1	4	6	13
73 - 77	10	4	31	15	58	89	11		1		3	8
78 - 82	1	5	17	26	42	105	27	3	3		6	3
83 - 87		1	18	19	61	77	28	5	6	1	2	3
88 - 92		2	10	8	37	67	18	12	9		2	2
93 - 97			4	4	20	71	18	21	10			2
98 - 102		1	7	3	16	81	18	18	13		2	
103 - 107			5	3	5	59	13	25	15	6	1	
108 - 112			4	2	5	64	12	18	11	3	8	1
113 - 117	2		5		3	33	15	18	16	4	6	2
118 - 122	2		1		5	10	15	14	10	3	10	
123 - 127	1	1	1		1	5	6	8	16	4	14	1
128 - 132	1		1			6	4	17	6	7	6	6
133 - 137	1				1	4	4	21	16	4	3	3
138 - 142		5	4			8	8	24	15	2	5	1
143 - 147	3		10			3		15	7	1	1	4
148 - 152	1	1	5			6	1	21	3	1	3	
153 - 157			9			6	4	5	5	1	1	4
158 - 162	3	1	8			5	2	7	4		2	
163 - 167			3			2	1		4		1	1
168 - 172	1	2	5			1	1		4			1
173 - 177		1	4			1	1		2			4
178 - 182	1							1	1			4

Table 22. (Continued.)

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
183 - 187	1		2								2	4
188 - 192			1								1	6
193 - 197											1	3
198 - 202												5
203 - 207												8
208 - 212												4
213 - 217												3
218 - 222												2
223 - 227												1
228 - 232												2
233 - 237												
238 - 242												1
243 - 247												3
248 - 252											1	4
253 - 257											1	3
258 - 262												
263 - 267												
268 - 272												
273 - 277												
278 - 282												
283 - 287											1	
288 - 292											1	
293 - 297												1
Mean Total Length (mm)	71	76	71	65	79	92	100	121	121	101	110	113

November and February (Welsh and Breder, 1923; Hildebrand and Schroeder, 1928; Hildebrand and Cable, 1930; Suttkus, 1954; Hansen, 1969). Spawning takes place in South Carolina coastal waters from October through January (Bearden, 1964).

Newly-recruited croaker from fall-early winter spawning were abundant in South Carolina estuaries as early as January (Table 22). These young fish, with a total length range of about 13 - 82 mm, dominated the catches during February and March. In addition, some larger croaker, at 113 - 187 mm and in all probability one-year-old fish, were also present. During this period, however, most adults remain outside the estuaries in coastal waters, where spawning has recently taken place (Bearden, 1964), thus probably accounting for the low numbers of older fish collected. Total lengths for croaker captured in April ranged from 18 - 192 mm with two distinguishable modes (at 60 and 145 mm), suggesting an overlapping presence of young-of-the-year (total length range of about 18 - 122 mm) and one-year-old fish (total length range of about 123 - 192 mm). From April through October the catches were once more dominated by young-of-the-year which originated in the 1972 - 1973 winter spawning. These young-of-the-year can be further traced to July at a modal length of 80 mm. Migration of larger adult Atlantic croaker out of the estuary once more in late summer and early fall is typical of the species (Bearden, 1964; Hansen, 1969) and may account for the low numbers caught at that time. These smaller catches of larger fish may also be due at least in part to escapement from the small 6-m (20-ft) otter trawl.

The wide range of total lengths, from 18 - 297 mm, occurring in December, 1973 and January, 1974 almost certainly indicates an overlapping size distribution of the young-of-the-year, one-, and two-year-old fish.

These length-frequency results compare favorably with those previously obtained by Bearden (1964) for South Carolina croaker populations, by Hildebrand and Cable (1930) for North Carolina populations, and by Suttkus (1954) for Louisiana populations.

Distribution and relative abundance. In the North Edisto River, 2,779 Atlantic croaker, with a total weight of 28.1 kg, were caught during the year (Table 10). In this estuary, the species ranked fourth in numerical abundance, constituting 9.8% of the total number, and second in weight, representing 16.3% of the total fish biomass for the 12-month period. Croaker were generally distributed throughout the estuary, but were most prevalent at two adjacent stations, Steamboat Creek and Wadmalaw, which together accounted for 70.4% of this species caught in the North Edisto. Croaker were present in the estuary throughout the year and were most abundant in the estuary during June and July, when 85.7% of the year's catch occurred (Table 23). However, no North Edisto station had this fish present during all months and in Toogoodoo Creek only eight croaker were caught, with all of those occurring during a single month.

In the South Edisto River, 1,623 croaker, with a total weight of 9.6 kg, were caught during the year (Table 12). In this estuary, the species ranked second in numerical abundance, constituting 16.2% of the total number, and third in weight, representing 9.8% of the total fish biomass for the 12-month period. Croaker were present in the estuary throughout the year, but were most abundant in December, when 21.0% of the year's catch occurred (Table 24). At least 10.0% of the year's catch occurred in each of five separate months, indicating a relatively even seasonal distribution. No South Edisto station had croaker present

Table 23. Numerical abundance of Micropogon undulatus collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Yonges Island (E001)	Toogoodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973										
February				1		1			2	0.1
March	1							1	2	0.1
April	2		3	7	8	1			21	0.8
May	22			30	18				70	2.5
June	117		180	7	1,318	2	1		1,625	58.5
July	94	8		121	244	210	71	8	756	27.2
August	27			7			56	3	93	3.3
September	9		15		17	124	15	2	182	6.5
October	2			3	10			7	22	0.8
November	1			1					2	0.1
December						2		1	3	0.1
1974										
January					1				1	< 0.1
Total Catch by Station	275	8	198	177	1,616	340	143	22	2,779	
Station Contribution to Total Catch (%)	9.9	0.3	7.1	6.4	58.2	12.2	5.1	0.8		100.0

Grand Total (All stations and months combined) = 2,779

Table 24. Numerical abundance of Micropogon undulatus collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution To Total Catch (%)
1973						
February					0	0.0
March			2		2	0.1
April			115	8	123	7.6
May		33	197		230	14.1
June	19	163	54	43	279	17.2
July		19	70		89	5.5
August		165	1		166	10.2
September		63	115	33	211	13.0
October		3	50	15	68	4.2
November		34	18		52	3.2
December	4	260	78		342	21.0
1974						
January		18	46		64	3.9
Total Catch by Station	23	758	746	99	1,623	
Station Contribution to Total Catch (%)	1.4	46.6	45.9	6.1		100.0

Grand Total (All stations and months combined) = 1,623

throughout all months, although the species was found at Fenwick Island during 11 months of the year. The species favored the middle reaches of the South Edisto, with Sampson Island and Fenwick Island stations together accounting for 92.5% of the croaker found in the estuary during the year. At times, this fish was found at the river mouth (Bay Point). However, abundance at this location was lower than at adjacent stations upriver. Croaker were generally absent from the station furthest upriver above the freshwater line, but in two months (June and December) the species was able to penetrate upriver to Snuggedy Swamp, a typically freshwater habitat.

In the Cooper River, 2,512 croaker, with a total weight of 41.4 kg, were caught during the year (Table 14). In this estuary, the species ranked second in numerical abundance, constituting 24.0% of the total number, and first in weight, representing 30.3% of the total fish biomass for the 12-month period. Croaker were most prevalent in the seaward third of the estuary, at the mouth of the Cooper River and at Cummings Point, which together accounted for 91.2% of this species caught in the Cooper River. Like the South Edisto, few croaker were able to penetrate to the stations furthest upriver (Big Island and "The Tee") in brackish to freshwater. The species was present in every month except November, when seaward migration takes place (Bearden, 1964). This fish was most abundant in the Cooper River in April, when 44.6% of the year's catch occurred (Table 25). No Cooper River station had croaker present during all months..

Distribution and relative abundance of Atlantic croaker at 16 additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are summarized in Table 26.

Table 25. Numerical abundance of *Micropogon undulatus* collected monthly by bottom trawl at five stations in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (J003)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February			4	86		90	3.6
March			3	220		223	8.9
April		11	117	990		1,118	44.6
May	4		2	139	4	145	5.8
June			2	1		3	0.1
July				5	387	392	15.6
August			68	6	208	282	11.3
September				25	27	52	2.1
October		8		45		53	2.1
November						0	0.0
December				8		8	0.3
1974							
January				136		136	5.4
Total Catch by Station	4	19	196	1,657	626	2,512	
Station Contribution to Total Catch (%)	0.2	0.8	7.8	66.2	25.0		100.0

Grand Total (All stations and months combined) = 2,512

Table 26. Numerical abundance of Micropogon undulatus collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers) Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)	Total Catch by Station	Station Contribution to Total Catch (%)
Northern Region						
Winyah Bay (Y001)	6	321	2	43	372	93.9
South Santee (S001)		4		1	5	1.3
Bull Bay (B003)	8	8			16	4.0
Price Creek (B002)		1	1	1	3	0.8
Charleston Region						
Inlet Creek (B001)		16			16	3.1
Nowell Creek (W001)	7				7	1.4
Fort Johnson (J001)	1	231	2		234	45.4
Hog Island (J002)	13	3	1		17	3.3
Ashley River (K001)	217	1	7	16	241	46.6
Southern Region						
Stono River (F001)	167	198	2		367	29.5
Ashepoo River (H002)	6	110	1	9	126	10.1
Rock Creek (H003)	112	50	12	10	184	14.8
Whale Branch (H001)	72	3			75	6.0
Port Royal Sound (P002)		9			9	0.7
Colleton River (P001)			16		16	1.3
Calibogue Sound (G001)	1	463	2		466	37.5
Total Catch by Season	610	1,418	46	80	2,154	
Season Contribution to Total Catch (%)	28.3	65.8	2.1	3.7		100.0

Grand Total (All stations and seasons combined) = 2,154

Leiostomus xanthurus (Spot)

The spot (Leiostomus xanthurus) is one of the abundant small sciaenids and is present in some life stage in every month and in every major estuary or coastal region of South Carolina (Tables 5 and 27). This species is distributed along the Atlantic and Gulf coasts from Massachusetts to Texas (Welsh and Breder, 1923; Hildebrand and Schroeder, 1928; Hildebrand and Cable, 1930) and as far south as the Bay of Campeche (Springer and Bullis, 1956; Dawson, 1958). Throughout its range, spot is an integral part of the commercial fishing industry and is also an established favorite of sport fishermen.

Total catch. During the year, 5,347 spot, with a total weight of 57.1 kg, were obtained at all stations combined (Table 7). This species ranked fourth in numerical abundance statewide, constituting 8.5% of the total number, and third in weight, representing 10.4% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Spot collected in the estuaries during the year had a total length range of 22 - 212 mm and occurred over a bottom salinity range of 0.1 - 34.4°/oo and a bottom temperature range of 11.6 - 31.4 C (Table 8). This salinity range corresponds closely to the 4.5 - 36.0°/oo reported for spot in South Carolina waters by Dawson (1958). Although spot are euryhaline (Gunter, 1956), most individuals remain in waters above 10°/oo.

Length-frequency relationship. The length-frequency relationship for spot from all stations is summarized in Table 27. Few individuals were present in the estuaries during February and March, 1973. Total

Table 27. Length-frequency relationship for Leiostomus xanthurus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
18 - 22			2									
23 - 27			4	1		1						
28 - 32			5									
33 - 37			3	3	1							
38 - 42			6	8	3							
43 - 47				21	3	1						
48 - 52			2	28	4	2	1					
53 - 57				22	17	18	4					
58 - 62				37	35	44	8					
63 - 67				18	41	88	28					
68 - 72				11	46	89	42					
73 - 77				5	51	86	39	5				
78 - 82				1	35	71	18	3	8	1		
83 - 87	2				37	52	18	7	14		1	
88 - 92				1	17	47	11	4	14			2
93 - 97					19	33	4	6	13	1		3
98 - 102					12	29	4	4	4	1		7
103 - 107			3	4	8	18	3	5	4			6
108 - 112			4		6	8		2	2		1	8
113 - 117		1	2		5	8	1	5	2		3	4
118 - 122	1		5	1	4	12		1	4	1	4	6
123 - 127			4		1	6			2	1	1	7
128 - 132			4	3	1	4		1				8
133 - 137			8	1		2						6
138 - 142	1		9	1		2						5
143 - 147			6	4		4					1	6
148 - 152						1		1				3
153 - 157			1				1					8
158 - 162			1									16
163 - 167											1	11
168 - 172											3	10

Table 27. (Continued.)

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
173 - 177												14
178 - 182		1									3	6
183 - 187											1	6
188 - 192											1	4
193 - 197												2
198 - 202												1
203 - 207												1
208 - 212	1											
Mean Total Length (mm)	128	148	99	62	77	80	76	97	94	104	144	147

lengths for spot that were captured during that period ranged from 83 - 212 mm, suggesting that these fish were at least one year of age. During this period most adult spot remain outside estuaries in coastal waters following previous fall spawning (Hildebrand and Schroeder, 1928). This may account in part for the low numbers captured by trawl prior to April.

Postlarval spot were abundant in South Carolina estuaries during February and March, but due to their small size and the fact that the majority have not adopted a benthic mode, they were not susceptible to capture by bottom trawl at that time.

In April the first recruits of the new year-class (originating from the 1972 - 1973 spawning) were apparent and ranged from about 18 - 52 mm in total length. At this time, one-year-old spot also appeared in greater abundance in the estuaries, with their presence in April shown by a clearly separated mode and a mean total length of about 140 mm. From April through November, the catches were dominated by young-of-the-year. These are also evident in July at a modal length of 70 mm and October at a modal length of 90 mm. The absence of larger adult fish during late summer and early fall is probably due, at least in part, to avoidance or escapement from the small 6-m (20-ft) trawl. The wide range of total lengths, 88 - 207 mm, occurring in January, 1974 almost certainly indicates an overlapping size distribution of one-and two-year-old fish.

These length-frequency results compare favorably with those obtained previously by Dawson (1958) for South Carolina spot populations. Our length-frequencies for young-of-the-year correspond with those for first-year spot collected with seines in Georgia marshes (Miller and Jorgenson, 1969), and by trawl, seine, and push nets in Tampa Bay, Florida (Springer and Woodburn, 1960).

Distribution and relative abundance. In the North Edisto River, 3,378 spot, with a total weight of 23.9 kg, were caught during the year (Table 10). In this estuary, the species ranked third in numerical abundance, constituting 12.0% of the total number, and third in weight, representing 13.8% of the total fish biomass for the 12-month period. Spot were generally distributed throughout the estuary, but were most prevalent at two stations, Steamboat Creek and Dawho River, which together accounted for 63.9% of the spot caught in the North Edisto. This fish was most abundant in the estuary during June and July, when 87.8% of the year's catch occurred (Table 28). No North Edisto station had spot present during all months and the species was absent at all stations in February and March.

In the South Edisto River, 223 spot, with a total weight of 1.4 kg, were caught during the year (Table 12). In this estuary, the species ranked eighth in numerical abundance, constituting 2.2% of the total number, and fourteenth in weight, representing 1.4% of the total fish biomass for the 12-month period. Spot were most prevalent in the lower half of the estuary, at Fenwick Island and Bay Point, which together accounted for 91.9% of the spot caught in the South Edisto. This fish generally did not penetrate the upper reaches of the estuary and was never taken at Snuggedy Swamp, the station furthest upriver above the freshwater line. The species was most abundant in the estuary during May and June, when 74.9% of the year's catch occurred (Table 29). No South Edisto station had spot present during all months and the species was absent from all catches during February and March.

In the Cooper River, 381 spot, with a total weight of 3.1 kg, were caught during the year (Table 14). In this estuary, the species ranked

Table 28. Numerical abundance of Leiostomus xanthurus collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →)								Total Catch by Month	Monthly Contribution to Total Catch (%)
	Yonges Island (E001)	Toogoodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)		
1973										
February									0	0.0
March									0	0.0
April			1	14	1		2		18	0.5
May	12			107	16	19	7		161	4.8
June	174	12	188	3	1,330	21	203	6	1,937	57.3
July	209	42		355	228	15	182		1,031	30.5
August	3	7	1	88			4	1	104	3.1
September	1		4		3	7	8	1	24	0.7
October	71			4	3		1	1	80	2.4
November						1			1	<0.1
December						15	3		18	0.5
1974										
January				2	2				4	0.1
Total Catch by Station	470	61	194	573	1,583	78	410	9	3,378	
Station Contribution to Total Catch (%)	13.9	1.8	5.7	17.0	46.9	2.3	12.1	0.3		100.0

Grand Total (All stations and months combined) = 3,378

Table 29. Numerical abundance of *Leiostomus xanthurus* collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973						
February					0	0.0
March					0	0.0
April				1	1	0.4
May		3	113	2	118	52.9
June		7	29	13	49	22.0
July			8		8	3.6
August		5	7		12	5.4
September			12	8	20	9.0
October		2	2	7	11	4.9
November					0	0.0
December			1	1	2	0.9
1974						
January		1		1	2	0.9
Total Catch by Station	0	18	172	33	223	
Station Contribution to Total Catch (%)	0.0	8.1	77.1	14.8		100.0

Grand Total (All stations and months combined) = 223

seventh in numerical abundance, constituting 3.6% of the total number, and tenth in weight, representing 2.3% of the total fish biomass for the 12-month period. Spot were most numerous in the lower third of the estuary (at the mouth of the Cooper River and at Cummings Point), which accounted for 72.2% of the spot caught in the Cooper River. This fish was absent from the catches throughout the year at "The Tee", the station furthest upriver above the freshwater line. The species was most abundant in the Cooper River estuary during July and August, when 88.2% of the year's catch occurred (Table 30). Spot were almost completely absent in the estuary from September through January. No Cooper River station had this fish present during all months. In contrast to the North and South Edisto, at least a few spot were present in this river during February and March. However, the species was absent from all catches during December.

Distribution and relative abundance of spot at additional stations trawled quarterly in the northern, Charleston and southern regions of the state are summarized in Table 31.

Cynoscion regalis (Weakfish)

The weakfish (Cynoscion regalis) is one of the larger sciaenids found in South Carolina coastal waters. This species contributes to both sport and commercial fisheries (Lunz and Schwartz, 1969) and can be found along the Atlantic coast of the United States from Massachusetts to Florida (Welsh and Breder, 1923; Hildebrand and Cable, 1934; Guest and Gunter, 1958; Joseph, 1972). The weakfish is abundant in all major estuaries or coastal regions of South Carolina (Table 5). This widespread distribution in South Carolina coastal waters has long been noted

Table 30. Numerical abundance of Leiostomus xanthurus collected monthly by bottom trawl at five stations in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (J003)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February			4	1		5	1.3
March			2			2	0.5
April		5	2	1		8	2.1
May		3	1	5	4	13	3.4
June			12			12	3.1
July			10	4	101	115	30.2
August		63	3	154	1	221	58.0
September					1	1	0.3
October					1	1	0.3
November		1				1	0.3
December						0	0.0
1974							
January				1	1	2	0.5
Total Catch by Station	0	72	34	166	109	381	
Station Contribution to Total Catch (%)	0.0	18.9	8.9	43.6	28.6		100.0

Grand Total (All stations and months combined) = 381

Table 31. Numerical abundance of Leiostomus xanthurus collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers) Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)	Total Catch by Station	Station Contribution to Total Catch (%)
Northern Region						
Winyah Bay (Y001)		66		6	72	27.0
South Santee (S001)	2	1		5	8	3.0
Bull Bay (B003)	21	12	1	35	69	25.8
Price Creek (B002)				118	118	44.2
Charleston Region						
Inlet Creek (B001)		2		38	40	33.1
Nowell Creek (W001)	6	1	1		8	6.6
Fort Johnson (J001)	1	19	1	2	23	19.0
Hog Island (J002)	12	32			44	36.4
Ashley River (K001)	1	3		2	6	4.9
Southern Region						
Stono River (F001)		30			30	3.8
Ashepoo River (H002)					0	0.0
Rock Creek (H003)	1	3		3	7	0.9
Whale Branch (H001)		18		2	20	2.6
Port Royal Sound (P002)		22			22	2.8
Colleton River (P001)			1	1	2	0.2
Calibogue Sound (G001)		699			699	89.6
Total Catch by Season	44	908	4	212	1,168	
Season Contribution to Total Catch (%)	3.8	77.7	0.3	18.2		100.0

Grand Total (All stations and seasons combined) = 1,168

(Holbrook, 1860; Fowler, 1945). Some life history stage of this species is present during most, if not all, months of the year (Lunz and Schwartz, 1969). Dahlberg and Odum (1970) also found weakfish abundant in two Georgia estuarine systems.

Total catch. During the year 2,136 weakfish, with a total weight of 31.0 kg, were obtained at all stations combined (Table 7). This species ranked fifth in numerical abundance statewide, constituting 3.4% of the total number, and sixth in weight, representing 5.7% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Weakfish collected in the estuaries during the year had a total length range of 23 - 323 mm and occurred over a bottom salinity range of 0.4 - 34.4°/oo and a bottom temperature range of 13.7 - 31.4 C (Table 8).

Length-frequency relationship. The length-frequency relationship for weakfish from all stations is summarized in Table 32. Previous investigators have noted a prolonged spawning season for weakfish (Welsh and Breder, 1923; Hildebrand and Cable, 1934; Pearson, 1941; Daiber, 1957; Massman, Whitcomb, and Pacheco, 1958). Lunz and Schwartz (1970) indicated that, for South Carolina waters, the major spawning period is from May to August.

Young-of-the-year weakfish, newly-recruited from spring-summer spawning, were abundant in South Carolina estuaries beginning in June and continuing through October (Table 32). These young fish, with a total length range of 23 - 72 mm in June grew rapidly from a modal length

Table 32. Length-frequency relationship for Cynoscion regalis collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
23 - 27					1	1	2	1				
28 - 32					1	2	1	1	1			
33 - 37						3	2	1				
38 - 42					3	10		2	3			
43 - 47					2	17		2				
48 - 52					7	26			2			
53 - 57						54	3	2	7			
58 - 62						43	4	2	12			
63 - 67						46	8	1	4			
68 - 72					1	56	5	1	7	1		
73 - 77						62	5	6	9			
78 - 82						57	9	6	5	1		
83 - 87						65	12	4	8	3		
88 - 92						72	22	7	12	3	1	
93 - 97						50	36	15	21	6		
98 - 102						44	30	9	15	4		
103 - 107						47	34	19	21	5		
108 - 112						34	12	14	13	4	2	
113 - 117						19	5	17	13	5	4	
118 - 122			1			10	14	13	17	6	7	
123 - 127						13	4	27	9		2	
128 - 132			1			10	7	25	20	5	5	
133 - 137			1			8	4	16	14	3	4	
138 - 142						3	2	9	13	2	3	1
143 - 147						5	2	15	14	4	3	
148 - 152			1			6	3	4	8		3	1
153 - 157		1				7	2	5	6	2	3	
158 - 162						2	2	7	3		2	
163 - 167						3		1	5	2	2	
168 - 172						4			8	1		
173 - 177									8		2	1
178 - 182			1				1		4		2	
183 - 187						1		1	5	1	1	

Table 32. (Continued.)

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
188 - 192			1					1				
193 - 197								1			1	
198 - 202									1			
203 - 207									1	1		
208 - 212								1				
213 - 217												
218 - 222									1			
223 - 227												
228 - 232									1			
233 - 237												
293 - 297												1
323 - 327												1
Mean Total Length (mm)		155	151		46	84	98	140	117	119	138	152

of 90 mm in July to 125 mm in September. This growth rate, rapid compared to that of several of the other sciaenid species obtained in this study, was also observed earlier by Hildebrand and Schroeder (1928), Hildebrand and Cable (1934); and Massman et al. (1958). The wide range of total lengths for the entire population, 23 - 327 mm from July, 1973 to January, 1974, represents an overlapping of young-of-the-year and older fish.

In South Carolina, seaward migration of weakfish usually begins in late fall (Lunz and Schwartz, 1970). These fish then return to the coastal nursery grounds the following spring as one-year-olds. Interestingly, however, during the present study seaward migration was not apparent until January and this delayed seaward movement may have been influenced by an unusually warm fall of 1973. Also, few weakfish were caught in the estuaries in March and April. This relative absence in the spring may have been due at least in part to avoidance of, or escapement from, the small (6-m) otter trawl.

These length-frequency results compare favorably with those obtained earlier for weakfish populations by Hildebrand and Cable (1934), Nesbit (1954), Miller and Jorgenson (1969), and Dahlberg (1971).

Distribution and relative abundance. In the North Edisto River, 596 weakfish, with a total weight of 7.9 kg, were caught during the year (Table 10). In this estuary, the species ranked fifth in numerical abundance, constituting 2.1% of the total number, and fifth in weight, representing 4.6% of the total fish biomass for the 12-month period. Weakfish occurred at all stations and was generally distributed throughout the estuary. This fish was most prevalent at two stations, Point of

Pines and Steamboat Creek, which together accounted for 54.7% of the species caught in the North Edisto. The species was present in the estuary in March and from June to December and were most abundant during July and August, when 64.4% of the year's catch occurred (Table 33). No North Edisto station had weakfish present during all months of the year. This fish was absent from all trawl catches in the estuary in February, April and May, 1973 and in January, 1974.

In the South Edisto River, 316 weakfish, with a total weight of 7.1 kg, were caught during the year (Table 12). In this estuary, the species ranked seventh in numerical abundance, constituting 3.2% of the total number, and fourth in weight, representing 7.2% of the total fish biomass for the 12-month period. Weakfish favored the seaward half of the estuary, with the Bay Point station contributing 71.2% of the total catch in the South Edisto. Catches decreased with increasing distance upriver. At no time did this fish penetrate to Snuggedy Swamp, the station furthest upriver above the freshwater line. The species was present in the estuary from August to December, but was most abundant in September, when 57.6% of the year's catch occurred (Table 34). No station in the South Edisto estuary had weakfish present during all months of the year. This fish was absent from all trawl catches in the estuary from February through July, 1973 and in January, 1974.

In the Cooper River, 494 weakfish, with a total weight of 6.6 kg, were caught during the year (Table 14). In this estuary, the species ranked sixth in numerical abundance, constituting 4.7% of the total number, and sixth in weight, representing 4.8% of the total fish biomass for the 12-month period. Weakfish favored the seaward third of

Table 33. Numerical abundance of Cynoscion regalis collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →)								Total Catch by Month	Monthly Contribution to Total Catch (%)
	Yonges Island (E001)	Tongodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)		
1973										
February									0	0.0
March								1	1	0.2
April									0	0.0
May									0	0.0
June			1		9			7	17	2.8
July	19	19		11	69	29	49	5	201	33.7
August	18		6	9	5		139	6	183	30.7
September	12	2	19		13	21	5		72	12.1
October	16	2	5	10	14	4	2	9	62	10.4
November	6			2	14	4	1		27	4.5
December			19	1	4	4	2	3	33	5.5
1974										
January									0	0.0
Total Catch by Station	71	23	50	33	128	62	198	31	596	
Station Contribution to Total Catch (%)	11.9	3.8	8.4	5.5	21.5	10.4	33.2	5.2		100.0

Grand Total (All stations and months combined) = 596

Table 34. Numerical abundance of Cynoscion regalis collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973						
February					0	0.0
March					0	0.0
April					0	0.0
May					0	0.0
June					0	0.0
July					0	0.0
August		9	27		36	11.4
September		9	12	161	182	57.6
October		1	7	63	71	22.5
November		2	18		20	6.3
December			6	1	7	2.2
1974						
January					0	0.0
Total Catch by Station	0	21	70	225	316	
Station Contribution to Total Catch (%)	0.0	6.6	22.2	71.2		100.0

Grand Total (All stations and months combined) = 316

the estuary, with Cummings Point and the mouth of the Cooper River together accounting for 88.1% of the total catch for the estuary. The species was most abundant at Cummings Point, the seawardmost station, where 63.8% of the year's catch occurred. This fish was not able to penetrate to "The Tee", the station furthest upriver above the freshwater line. Weakfish were present in the estuary from July to December, and were most abundant during July, August, and September, when 87.5% of the year's catch occurred (Table 35). No Cooper River station had this fish present during all months.

Distribution and relative abundance of weakfish at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are summarized in Table 36.

Bairdiella chrysura (Silver Perch)

The silver perch (Bairdiella chrysura), a relatively common sciaenid in coastal waters, does not reach sufficient size for sport fishing or marketing. This species ranges from Massachusetts to Texas (Welsh and Breder, 1923; Hildebrand and Schroeder, 1928; Hildebrand and Cable, 1930) and is found frequently in South Carolina estuaries (Holbrook, 1860; Fowler, 1945). In this study, the species was present during every month of the year and in every major estuary or coastal region of the state (Tables 5 and 37). Miller and Jorgenson (1969) and Dahlberg and Odum (1970) collectively found silver perch throughout the year in Georgia estuaries from Jekyll Island to St. Catherines Sound. Springer and Woodburn (1960) captured silver perch in Tampa Bay, Florida during all but one month of the year.

Table 35. Numerical abundance of Cynoscion regalis collected monthly by bottom trawl at five stations in the Cooper River estuary, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (J003)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February						0	0.0
March						0	0.0
April						0	0.0
May						0	0.0
June						0	0.0
July				8	183	191	38.7
August			11	17	97	125	25.3
September			18	74	24	116	23.5
October			21	13	3	37	7.5
November		2	5		8	15	3.0
December		2		8		10	2.0
1974							
January						0	0.0
Total Catch by Station	0	4	55	120	315	494	
Station Contribution to Total Catch (%)	0.0	0.8	11.1	24.3	63.8		100.0

Grand Total (All stations and months combined) = 494

Table 36. Numerical abundance of Cynoscion regalis collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers)				Total Catch by Station	Station Contribution to Total Catch (%)
	Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)		
Northern Region						
Winyah Bay (Y001)		95	1		96	57.1
South Santee (S001)		1	25		26	15.5
Bull Bay (B003)		11			11	6.5
Price Creek (B002)			35		35	20.8
Charleston Region						
Inlet Creek (B001)		2	182	2	186	39.0
Newell Creek (W001)	1		17		18	3.4
Fort Johnson (J001)	5	119	8		132	24.9
Hog Island (J002)		74			74	14.0
Ashley River (K001)		54	64	2	120	22.6
Southern Region						
Stono River (F001)		38	3		41	9.5
Ashepoo River (H002)			16	1	17	3.2
Rock Creek (H003)		43	30		73	16.9
Whale Branch (H001)		55	97		152	35.8
Port Royal Sound (P002)		13			13	3.0
Colleton River (P001)			31		31	7.2
Calibogue Sound (G001)		101	4		105	24.3
Total Catch by Season	6	606	513	5	1,130	
Season Contribution to Total Catch (%)	0.5	53.6	45.4	0.4		100.0

Grand Total (All stations and seasons combined) = 1,130

Table 37. Length-frequency relationship for Bairdiella chrysura collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
18 - 22												1
23 - 27												
28 - 32												
33 - 37						1						
38 - 42						3						
43 - 47						10						
48 - 52						15	1					
53 - 57						12	1					
58 - 62						9	2					
63 - 67						10	1					
68 - 72						3	9					1
73 - 77			1			3	3	1				
78 - 82						3	7		1			
83 - 87			3			1	4	2	3			
88 - 92	1		2				2	3	10			
93 - 97			2				1	10	15			3
98 - 102	1	1					3	11	31	3	1	6
103 - 107			1				3	23	51	3	2	18
108 - 112	1		5					20	65	16	7	34
113 - 117	1	2	4	1				7	73	6	9	37
118 - 122	2	1	13	4				10	50	13	24	51
123 - 127		4	26		1			4	41	8	28	47
128 - 132		5	13		2	3		1	43	4	29	45
133 - 137	1	2	13	1		1			23	3	10	18
138 - 142		1	13	1		3		1	9	4	6	20
143 - 147			9			7	4	2	7	6	8	6
148 - 152		4	2	1		6	1	2	5	1	3	6
153 - 157			3			3	1	2	2	1	5	2
158 - 162			1			2	5	1	1	2	1	1
163 - 167						3	5		2		2	7
168 - 172		1				2	1		2	1	6	5

Table 37. (Continued.)

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
173 - 177						7		1	1		4	6
178 - 182			1			3			1		3	4
183 - 187									1			2
188 - 192						1						
Mean Total Length (mm)	113	139	128	127	128	94	104	111	120	124	132	126

Total catch. During the year 1,863 silver perch, with a total weight of 43.6 kg, were obtained at all stations combined (Table 7). This species ranked sixth in numerical abundance statewide, constituting 3.0% of the total number, and fifth in weight, representing 8.0% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Silver perch collected in the estuaries during the year had a total length range of 40 - 188 mm and occurred over a bottom salinity range of 0.1 - 34.4°/oo and a bottom temperature range of 7.2 - 31.4 C (Table 8).

Length-frequency relationship. The length-frequency relationship for silver perch from all stations is summarized in Table 37. At various locations throughout its range, silver perch spawn from as early as April to as late as August, with the majority of spawning occurring in May and June (Welsh and Breder, 1923; Hildebrand and Schroeder, 1928; Hildebrand and Cable, 1930). However, Springer and Woodburn (1960) found that spawning was completed by early May while Kuntz (1914) found that the spawning peak extends to early July.

Total lengths for silver perch obtained from February to June ranged from 73 - 182 mm, with a modal length of 125 mm in April, suggesting that these fish were then approaching an age of one year. The wide range of total lengths from July, 1973 to January, 1974 indicate an obvious overlapping of young-of-the-year and one-year-old fish. In July, August, and September, both year-classes are still represented in South Carolina estuaries, with distinct modal lengths providing clear delineation between the two age groups. The modal lengths for the young-of-the-year in July, August, and September were 50, 70, and 105 mm, while the

one-year-old fish had modal lengths of 145, 160, and 150 mm, respectively. From a modal length of 115 mm in October, the young-of-the-year can be further traced to a modal length of 130 mm in December, 1973 and 120 mm in January, 1974.

These length-frequency patterns compare favorably with those obtained previously by Hildebrand and Cable (1930) in North Carolina and by Miller and Jorgenson (1969) in Georgia waters.

Distribution and relative abundance. In the North Edisto River, 415 silver perch, with a total weight of 7.3 kg, were caught during the year (Table 10). In this estuary, the species ranked seventh in numerical abundance, constituting 1.5% of the total number, and seventh in weight, representing 4.2% of the total fish biomass for the 12-month period. Silver perch were present in the estuary most of the year (except March) and were most abundant in September and October, when 38.8% of the year's catch occurred (Table 38). This fish was found only occasionally in the estuary from February through June, but was rather evenly distributed over the subsequent months from July, 1973 through January, 1974. However, no North Edisto station had silver perch present during all months of the year. The species was most prevalent at Yonges Island (24.0%),the station furthest upriver, and Deveaux Bank (20.5%), the seawardmost station, which together accounted for 44.5% of the silver perch caught in the North Edisto. The abundance of this species at the two stations furthest apart is additional indication that silver perch were generally distributed throughout this river system.

In the South Edisto River, 100 silver perch, with a total weight of 2.6 kg, were caught during the year (Table 12). In this estuary,

Table 38. Numerical abundance of Bairdiella chrysura collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →)								Total Catch by Month	Monthly Contribution to Total Catch (%)
	Yonges Island (E001)	Toogoodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)		
1973										
February				1	1	1	1	3	7	1.7
March									0	0.0
April		1						3	4	1.0
May		1						6	7	1.7
June								3	3	0.7
July	26			1	1			1	29	7.0
August	25	6			1		3	7	42	10.1
September	3	33		1	40		2	7	86	20.7
October	19	14		1	17		2	22	75	18.1
November	26	7	1	3	6			15	58	14.0
December	1		6	20	2	1		18	48	11.6
1974										
January		3		47	6				56	13.5
Total Catch by Station	100	65	7	74	74	2	8	95	415	
Station Contribution to Total Catch (%)	24.1	15.7	1.7	17.8	17.8	0.5	1.9	20.5		100.0

Grand Total (All stations and months combined) = 415

the species ranked eleventh in numerical abundance, constituting 1.0% of the total number, and tenth in weight, representing 2.6% of the total fish biomass for the 12-month period. Silver perch occurred at all stations in this river system but were most numerous at the estuary mouth (Bay Point), which accounted for 71.0% of the year's catch. Catches of this fish decreased with increasing distance upriver. The species rarely penetrated to Snuggedy Swamp, the station furthest upriver above the freshwater line. Silver perch were present from August, 1973 to January, 1974, and were most abundant in October, 1973, when 67.0% of the year's catch occurred (Table 39).

In the Cooper River, 279 silver perch, with a total weight of 9.3 kg, were caught during the year (Table 14). In this estuary the species ranked eleventh in numerical abundance, constituting 2.7% of the total number, and fifth in weight, representing 6.8% of the total fish biomass for the 12-month period. Silver perch occurred in Cooper River catches during nine of the twelve months, and were most abundant in December, 1973, and January, 1974, which together accounted for 73.8% of the year's catch (Table 40). The species was most prevalent at three stations in the middle reaches of the Cooper River estuary. These three stations, Big Island (21.5%), North Charleston (12.9%), and the Cooper River mouth (64.9%), together accounted for 99.3% of the silver perch captured. No silver perch penetrated upriver to "The Tee", above the freshwater line.

Distribution and relative abundance of silver perch at 16 additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are summarized in Table 41.

Table 39. Numerical abundance of Bairdiella chrysura collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution To Total Catch (%)
1973						
February					0	0.0
March					0	0.0
April					0	0.0
May					0	0.0
June					0	0.0
July					0	0.0
August	1	4			5	5.0
September		2	1	5	8	8.0
October			1	66	67	67.0
November		1	1		2	2.0
December		3	14		17	17.0
1974						
January			1		1	1.0
Total Catch by Station	1	10	18	71	100	
Station Contribution to Total Catch (%)	1.0	10.0	18.0	71.0		100.0

Grand Total (All stations and months combined) = 100

Table 40. Numerical abundance of Bairdiella chrysura collected monthly by bottom trawl at five stations in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (J003)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February						0	0.0
March				22		22	7.9
April						0	0.0
May				1		1	0.4
June						0	0.0
July				2		2	0.7
August			5	1		6	2.1
September			4	6		10	3.6
October		11	2	7	2	22	7.9
November		3	7			10	3.6
December		46	3	116		165	59.1
1974							
January			15	26		41	14.7
Total Catch by Station	0	60	36	181	2	279	
Station Contribution to Total Catch (%)	0.0	21.5	12.9	64.9	0.7		100.0

Grand Total (All stations and months combined) = 279

Table 41. Numerical abundance of Bairdiella chrysura collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers) Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)	Total Catch by Station	Station Contribution to Total Catch (%)
Northern Region						
Winyah Bay (Y001)		2	1		3	1.0
South Santee (S001)		8	25	88	121	40.3
Bull Bay (B003)	21				21	7.0
Price Creek (B002)	13	8	35	99	155	51.7
Charleston Region						
Inlet Creek (B001)	52	16	182		250	55.4
Nowell Creek (W001)	1	1	17		19	4.2
Fort Johnson (J001)			8	1	9	2.0
Hog Island (J002)	1	1	3		5	1.1
Ashley River (K001)	9	3	64	92	168	37.2
Southern Region						
Stono River (F001)		16	3		19	7.4
Ashepoo River (H002)			16	16	32	12.4
Rock Creek (H003)		8	30		38	14.8
Whale Branch (H001)			97		97	37.8
Port Royal Sound (P002)	11	15			26	10.1
Colleton River (P001)			31	2	33	12.8
Calibogue Sound (G001)		8	4		12	4.7
Total Catch by Season	108	86	516	298	1,008	
Season Contribution to Total Catch (%)	10.7	8.5	51.2	29.6		100.0

Grand Total (All stations and seasons combined) = 1,008

Ictalurus catus (White Catfish)

The white catfish (Ictalurus catus) is the most abundant ictalurid present in South Carolina estuaries (Table 7). The range for this species has been variously reported from New Jersey to Florida (Hubbs and Lagler, 1949; Carlander, 1969) and into Nevada and California (Schwartz and Jachowski, 1965). Mansueti and Hardy (1967) summarized the range as being from coastal streams in Pennsylvania, New York, and Massachusetts south to Lake Okeechobee, Florida, and west along the Gulf of Mexico to the Escambia drainage system and also introduced to Lake Erie and areas of Nevada and the Pacific coast.

This species has been previously reported in South Carolina estuaries by Fowler (1945) and Lunz and Schwartz (1970). Stevens (1959) also reported white catfish from Lakes Marion and Moultrie.

This commercially-important species (Smith, 1907; Menzel, 1945; Stevens, 1959) was present in all major South Carolina estuaries or coastal regions during all months of the year (Tables 5 and 42).

Total catch. During the year, 1,732 white catfish, with a total weight of 54.2 kg, were obtained at all stations combined (Table 7). This species ranked seventh in numerical abundance statewide, constituting 2.8% of the total number, and fourth in weight, representing 9.9% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. White catfish collected in the estuaries during the year had a total length range of 28 - 392 mm and occurred over a bottom salinity range of < 0.1 - 23.9°/oo and a bottom temperature range of 11.6 - 31.4 C (Table 8).

Table 42. Length-frequency relationship for Ictalurus catus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
28 - 32						1		1				
33 - 37							1					
38 - 42			1				3	1		1		
43 - 47			1			3	9	2		1	3	
48 - 52				1		3	2	2		2	2	
53 - 57	5		3	2		6	6	3	1	11	2	
58 - 62	17		4	1		1	2	5		10	4	4
63 - 67	14		13	2	1	2	2	3		12	8	5
68 - 72	17		13	4			1	1	1	5	2	4
73 - 77	14		14	6	2		1	1	1	3	7	12
78 - 82	15		18	8	1	1		1		1	3	1
83 - 87	23	1	10	6	4	1		1	1	1	1	1
88 - 92	23	2	9	5	3	1					2	3
93 - 97	15		8	3	9	2					1	1
98 - 102	13		16	2	5	1					1	1
103 - 107	11		14	2	5	6						
108 - 112	5		8		5	5				1		
113 - 117	4		5		4	3	1					1
118 - 122	7		6	2	2	4	2			1		1
123 - 127	10		5	1		5					5	1
128 - 132	6		4		2	1				2	3	2
133 - 137	7		2	1	1	1	1			2	5	6
138 - 142	2		3			6	2			4	5	
143 - 147	7		3			4		1	1	3	2	2
148 - 152	6		2						1	1	3	
153 - 157	5		2		2	3	1	1		1	3	5
158 - 162	5	1	5		1					1	4	1
163 - 167	4		2		1	2				3	3	1
168 - 172	2		4			1					4	5
173 - 177	6		2		2					4		4
178 - 182	3		4		1		2			3		1
183 - 187			3		1	1			1	2	2	2

Table 42. (Continued.)

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
188 - 192	1		4			1	1			1	2	3
193 - 197	2		1		1		1		1			5
198 - 202	2		2			1				1	4	5
203 - 207	2			2	1					1	1	1
208 - 212	2		1			1	1					1
213 - 217			2						1	1		2
218 - 222			1						1	1	1	
223 - 227	2		1							1		2
228 - 232	1		1								2	
233 - 237												
238 - 242												
243 - 247	1					1						
248 - 252									1			
253 - 257												
258 - 262												
263 - 267				1								
288 - 292									1			
293 - 297												
298 - 302												
303 - 307												
308 - 312												
313 - 317									1			
318 - 322									1			
323 - 327												1
368 - 372									1			
373 - 377												
378 - 382												
383 - 387												
388 - 392									2			
Mean Total Length (mm)	104	106	170	93	118	113	84	67	219	104	125	130

Length-frequency relationship. The length-frequency relationship for white catfish from all stations is summarized in Table 42. Based on the results of an earlier age-growth study for South Carolina white catfish populations (Stevens, 1959), it appears that at least five different age groups were included in this distribution (Table 42). The total length range remained relatively stable throughout the year and ranged from 53 - 247 mm in February, 1973 to 58 - 327 mm one year later. Only during October was the total length range extended considerably, from 53 - 392 mm. This relatively stable length range is probably due to the fact that in South Carolina white catfish are residential to fresh and brackish waters throughout the year and do not migrate to and from this zone.

At various locations throughout its range, white catfish spawn from May to July. In Virginia the spawning peak occurs in late June and early July (Menzel, 1945), and in North Carolina during July (Smith, 1907). In South Carolina spawning occurs from May to July, with peak spawning activity in June (Stevens, 1959). Newly-recruited young-of-the-year first appeared in trawl catches during July at a total length range of 28 - 67 mm, followed by modal lengths of 60, 65, and 75 mm in September, November, and January, respectively. Most of the common estuarine fishes collected in this study were seasonal migrants. Because white catfish in South Carolina are residential to low-salinity waters, further data interpretations concerning recruitment are difficult.

Distribution and relative abundance. In the North Edisto River, one white catfish, with a total weight of 0.2 kg, was caught during the year (Table 10). With the exception of this one specimen captured during February at Dawho River, white catfish were absent from the North

Edisto during the year (Table 43). The North Edisto River is a high-salinity estuary with little freshwater influence, and in all probability, this stenohaline species could not tolerate for extended periods the salinities found in such a mixo-polyhaline (Venice System, 1958) environment. In fact, the upper lethal salinity limit for white catfish under some laboratory conditions has been shown to be about 14.0°/oo in some parts of its range (Kendall and Schwartz, 1968). In the North and South Newport Rivers of Georgia, Dahlberg (1971) only found white catfish in salinities less than 12.0°/oo.

In the South Edisto River, 1,380 white catfish, with a total weight of 26.2 kg, were caught during the year (Table 12). In this estuary, the species ranked third in numerical abundance, constituting 13.8% of the total number, and first in weight, representing 26.8% of the total fish biomass for the 12-month period. White catfish were present in the South Edisto estuary throughout the year (Table 44). The species was most abundant in December, when 47.1% of the year's catch occurred. This fish was most abundant at Snuggedy Swamp, the station furthest upriver, which accounted for 51.8% of the total catch in the estuary. Catches decreased proportionately moving seaward. No white catfish occurred in trawl catches at the mouth of the South Edisto (Bay Point).

In the Cooper River, 304 white catfish, with a total weight of 15.6 kg, were caught during the year (Table 14). In this estuary, the species ranked ninth in numerical abundance, constituting 2.9% of the total number, and second in weight, representing 11.4% of the total fish biomass for the 12-month period. White catfish were present in this estuary during 8 of the 12 months and were most abundant in April, when 77.3% of the year's catch occurred (Table 45). Most of the Cooper River catch was contributed

Table 43. Numerical abundance of Ictalurus catus collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →)								Total Catch by Month	Monthly Contribution to Total Catch (%)
	Yonges Island (E001)	Toogoodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)		
1973										
February				1					1	100.0
March									0	0.0
April									0	0.0
May									0	0.0
June									0	0.0
July									0	0.0
August									0	0.0
September									0	0.0
October									0	0.0
November									0	0.0
December									0	0.0
1974										
January									0	0.0
Total Catch by Station	0	0	0	1	0	0	0	0	1	
Station Contribution to Total Catch (%)	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0		100.0

Grand Total (All stations and months combined) = 1

Table 44. Numerical abundance of Ictalurus catus collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution To Total Catch (%)
1973						
February		99	133		232	16.8
March		1	2		3	0.2
April		46	28		74	5.4
May		47			47	3.4
June	53	12			65	4.7
July		12	9		21	1.5
August		37			37	2.7
September	3	18			21	1.5
October		2			2	0.1
November	58	32			90	6.5
December	600	47	3		650	47.1
1974						
January	1	118	19		138	10.0
Total Catch by Station	715	471	194	0	1,380	
Station Contribution to Total Catch (%)	51.8	34.1	14.0	0.0		100.0

Grand Total (All stations and months combined) = 1,380

Table 45. Numerical abundance of Ictalurus catus collected monthly by bottom trawl at five stations in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (J003)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February	4	42	12			58	19.1
March			1			1	0.3
April	19	2	206	8		235	77.3
May	1					1	0.3
June						0	0.0
July						0	0.0
August		1	1			2	0.6
September	1					1	0.3
October		3	1			4	1.3
November		2				2	0.6
December						0	0.0
1974							
January						0	0.0
Total Catch by Station	25	50	221	8	0	304	
Station Contribution to Total Catch (%)	8.2	16.4	72.7	2.6	0.0		100.0

Grand Total (All stations and months combined) = 304

by a single station (North Charleston) during a single month (April). As with the South Edisto, none were caught at the estuary mouth (Cummings Point).

Distribution and relative abundance of white catfish at additional stations trawled quarterly in the northern, Charleston, and southern coastal regions of the state are summarized in Table 46.

Urophycis regius (Spotted Hake)

Spotted hake (Urophycis regius) is the most abundant gadid in South Carolina estuaries (Table 7). Range for this species was reported by Hildebrand and Schroeder (1928) and Hildebrand and Cable (1938) to be from New England to the Carolinas. Bigelow and Schroeder (1953) described the range to be from southern New England and New York to Cape Hatteras (including Chesapeake Bay, where it is plentiful) and ranging southward to deep water off northern Florida. This fish also occurs in the Gulf of Mexico (Springer and Bullis, 1956). Spotted hake was present in all major South Carolina estuaries or coastal regions (Table 5), generally between January and May (Table 47). Dahlberg and Odum (1970) and Sikora, Heard,and Dahlberg (1972) also found the species seasonally abundant from January to May in Georgia estuarine systems.

Total catch. Although a seasonal migrant (Struhsaker, 1969), 1,612 spotted hake, with a total weight of 17.6 kg, were obtained during the year at all stations combined (Table 7). This species ranked eighth in numerical abundance statewide, constituting 2.6% of the total number, and eighth in weight, representing 3.2% of the total fish biomass for the 12-month period.

Table 46. Numerical abundance of Ictalurus catus collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers) Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)	Total Catch by Station	Station Contribution to Total Catch (%)
Northern Region						
Winyah Bay (Y001)	6			9	15	100.0
South Santee (S001)					0	0.0
Bull Bay (B003)					0	0.0
Price Creek (B002)					0	0.0
Charleston Region						
Inlet Creek (B001)					0	0.0
Nowell Creek (W001)					0	0.0
Fort Johnson (J001)	1				1	100.0
Hog Island (J002)					0	0.0
Ashley River (K001)					0	0.0
Southern Region						
Stono River (F001)					0	0.0
Ashepoo River (H002)	75	53	11	9	148	96.7
Rock Creek (H003)	5				5	3.3
Whale Branch (H001)					0	0.0
Port Royal Sound (P002)					0	0.0
Colleton River (P001)					0	0.0
Calibogue Sound (G001)					0	0.0
Total Catch by Season	87	53	11	18	169	
Season Contribution to Total Catch (%)	51.5	31.4	6.5	10.6		100.0

Grand Total (All stations and seasons combined) = 169

Table 47. Length-frequency relationship for Urophycis regius collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
53 - 57	1											
58 - 62	2											
63 - 67	8	2										
68 - 72	9	3										3
73 - 77	14	2	12									
78 - 82	18	13	13									
83 - 87	23	12	18	1								
88 - 92	21	14	24	1								
93 - 97	15	17	26	3								
98 - 102	12	25	28	8								
103 - 107	6	25	27	8								
108 - 112	2	42	31	22								
113 - 117		30	27	8								
118 - 122		26	20	9								
123 - 127		10	20	5								
128 - 132		8	24	7								
133 - 137		4	20	4								
138 - 142		4	14	5								
143 - 147			4	2								
148 - 152		2	4	2								
153 - 157			4	2								
158 - 162			1	1								
163 - 167			2	1								
168 - 172			2									
173 - 177				1								
178 - 182			2									
183 - 187			1									
188 - 192												
193 - 197				1								
Mean Total Length (mm)	88	107	111	120								

Total length, temperature, and salinity ranges. Spotted hake collected in the estuaries during the year had a total length range of 57 - 196 mm and occurred over a bottom salinity range of 3.4 - 29.8°/oo and a bottom temperature range of 8.6 - 22.6 C (Table 8).

Length-frequency relationship. The length-frequency relationship for spotted hake from all stations is summarized in Table 47. Spawning season has been reported to be from September to February (Hildebrand and Cable, 1938) or March (Barans, 1969; 1972), with the majority of spawning activity between September and November.

Young-of-the-year spotted hake newly recruited from the previous fall - winter spawning were abundant in February catches at total lengths of 53 - 112 mm. Similarly, Barans (1969) found that by February most new recruits had attained total lengths of 60 - 130 mm. These young-of-the-year can be further traced to a modal length of 110 mm in May. Abundant in May, spotted hake rapidly disappeared from South Carolina estuaries, with no evidence of further presence from June to December. This disappearance can be attributed to seaward migration to deeper water, which generally occurs during this time (Hildebrand and Cable, 1938). Inshore movement of spotted hake began once more in January, 1974, when several new young-of-the-year, at a total length of about 63 mm, were captured in South Carolina estuaries. These length-frequency results compare favorably with those previously obtained by Hildebrand and Cable (1938), Barans (1969), and Sikora et al. (1972).

Distribution and relative abundance. In the North Edisto River, 483 spotted hake, with a total weight of 4.8 kg, were caught during the year (Table 10). In this estuary, the species ranked sixth in

numerical abundance, constituting 1.7% of the total number, and eighth in weight, representing 2.8% of the total fish biomass for the 12-month period. Spotted hake were most prevalent at the Bears Bluff and Deveaux Bank stations, which together accounted for 60.9% of this species caught in the North Edisto. This fish was present in the estuary February - May, 1973 and in January, 1974 (Table 48). Greatest abundance occurred in March and April, when 75.6% of the year's catch occurred. At no North Edisto station were spotted hake present during all months and none were captured during the entire year at two of the three tributary stations, Lower Toogoodoo Creek and Dawho River.

In the South Edisto River, 461 spotted hake, with a total weight of 5.6 kg, were caught during the year (Table 12). In this estuary, the species ranked sixth in numerical abundance, constituting 4.6% of the total number, and sixth in weight, representing 5.8% of the total fish biomass for the 12-month period. All spotted hake caught in the South Edisto were taken at the most seaward station (Bay Point), with no penetration into the estuary. This species was present from February to May, but was most abundant in March and April when 97.8% of the total catch for the year occurred (Table 49).

In the Cooper River, 582 spotted hake, with a total weight of 6.1 kg, were caught during the year (Table 14). In this estuary, the species ranked fifth in numerical abundance, constituting 5.6% of the total number, and seventh in weight, representing 4.4% of the total fish biomass for the 12-month period. Spotted hake were captured only in the seaward third of the estuary (at the Cummings Point and Cooper River mouth stations), with no penetration further upriver during the year.

Table 48. Numerical abundance of Urophycis regius collected monthly by bottom trawl at eight stations in the North Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →)								Total Catch by Month	Monthly Contribution to Total Catch (%)
	Yonges Island (E001)	Toogoodoo Creek (E002)	Bears Bluff (E003)	Dawho River (E004)	Steamboat Creek (E005)	Wadmalaw Island (E006)	Point of Pines (E007)	Deveaux Bank (E008)		
1973										
February	10		27		3	40		5	85	17.6
March	28		74		3	4		28	137	28.4
April	26		26		3	16	32	125	228	47.2
May	6		1		1	5	11	6	30	6.2
June									0	0.0
July									0	0.0
August									0	0.0
September									0	0.0
October									0	0.0
November									0	0.0
December									0	0.0
1974										
January					1			2	3	0.6
Total Catch by Station	70	0	128	0	11	65	43	166	483	
Station Contribution to Total Catch (%)	14.5	0.0	26.5	0.0	2.3	13.4	8.9	34.4		100.0

Grand Total (All stations and months combined) = 483

Table 49. Numerical abundance of Urophycis regius collected monthly by bottom trawl at four stations in the South Edisto estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) Snuggedy Swamp (D001)	Sampson Island (D002)	Fenwick Island (D003)	Bay Point (D004)	Total Catch by Month	Monthly Contribution To Total Catch (%)
1973						
February				7	7	1.5
March				238	238	51.6
April				213	213	46.2
May				3	3	0.6
June					0	0.0
July					0	0.0
August					0	0.0
September					0	0.0
October					0	0.0
November					0	0.0
December					0	0.0
1974						
January					0	0.0
Total Catch by Station	0	0	0	461	461	
Station Contribution to Total Catch (%)	0.0	0.0	0.0	100.0		100.0

Grand Total (All stations and months combined) = 461

The Cummings Point station, at the mouth of the estuary, accounted for 64.9% of the year's catch. Spotted hake occurred in the Cooper River from February to May and were most abundant in May, when 68.9% of the total catch for the year occurred (Table 50).

Distribution and relative abundance of spotted hake at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are summarized in Table 51.

Brevoortia tyrannus (Atlantic Menhaden)

Total catch. During the year, 823 Atlantic menhaden (Brevoortia tyrannus) with a total weight of 8.9 kg, were obtained at all stations combined (Table 7). This species ranked ninth in numerical abundance statewide, constituting 1.3% of the total number, and 11th in weight, representing 1.6% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Atlantic menhaden collected in the estuaries during the year had a total length range of 35 - 243 mm and occurred over a bottom salinity range of 0.1 - 30.3°/oo and a bottom temperature range of 12.0 - 31.0 C (Table 8).

Length-frequency relationship. The length-frequency relationship for Atlantic menhaden from all stations is summarized in Table 52. This species was present in some life stage in South Carolina estuaries throughout the year. Total lengths ranged from 83 - 202 mm in February, 33 - 217 mm in July, and 63 - 217 mm in December. Young-of-the-year first appeared in bottom trawl catches in June and July, with total lengths ranging from 38 - 57 mm in June and 33 - 57 mm in July. At least two year-classes were present, but relatively low numbers hinder their adequate separation.

Table 50. Numerical abundance of Urophycis regius collected monthly by bottom trawl at five stations in the Cooper River estuary, South Carolina, from February, 1973 through January, 1974.

Month	Stations (Progressing Seaward →) The Tee (C001)	Big Island (C002)	North Charleston (C003)	Mouth of Cooper (C004)	Cummings Point (J003)	Total Catch by Month	Monthly Contribution to Total Catch (%)
1973							
February				91		91	15.6
March				63		63	10.8
April				27		27	4.6
May				23	378	401	68.9
June						0	0.0
July						0	0.0
August						0	0.0
September						0	0.0
October						0	0.0
November						0	0.0
December						0	0.0
1974							
January						0	0.0
Total Catch by Station	0	0	0	204	378	582	
Station Contribution to Total Catch (%)	0.0	0.0	0.0	35.1	64.9		100.0

Grand Total (All stations and months combined) = 582

Table 51. Numerical abundance of Urophycis regius collected quarterly by bottom trawl at 16 stations across the South Carolina coastal zone from February, 1973 through January, 1974.

Station	Trawl Catch by Season (Numbers) Spring (April, 1973)	Summer (July, 1973)	Fall (October, 1973)	Winter (January, 1974)	Total Catch by Station	Station Contribution to Total Catch (%)
Northern Region						
Winyah Bay (Y001)					0	0.0
South Santee (S001)					0	0.0
Bull Bay (B003)	4				4	100.0
Price Creek (B002)					0	0.0
Charleston Region						
Inlet Creek (B001)					0	0.0
Nowell Creek (W001)					0	0.0
Fort Johnson (J001)	28				28	87.5
Hog Island (J002)	2				2	6.2
Ashley River (K001)	2				2	6.2
Southern Region						
Stono River (F001)	30				30	60.0
Ashepoo River (H002)					0	0.0
Rock Creek (H003)	13				13	26.0
Whale Branch (H001)	2				2	4.0
Port Royal Sound (P002)	5				5	10.0
Colleton River (P001)					0	0.0
Calibogue Sound (G001)					0	0.0
Total Catch by Season	86	0	0	0	86	
Season Contribution to Total Catch (%)	100.0	0.0	0.0	0.0		100.0

Grand Total (All stations and seasons combined) = 86

Table 52. Length-frequency relationship for *Brevoortia tyrannus* collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
33 - 37						2						
38 - 42					24	6						
43 - 47					40	23						
48 - 52					10	6						
53 - 57					1	1						
58 - 62									1			
63 - 67						1			1		4	
68 - 72							5		1	1	5	
73 - 77						5	6		2		7	1
78 - 82						1	1		1		5	
83 - 87	3					1	3				3	
88 - 92	6	1					3		1		2	1
93 - 97	18										3	1
98 - 102	16	5				3					4	2
103 - 107	18	2									2	3
108 - 112	15	5		1			1				1	6
113 - 117	6	2						1			2	7
118 - 122	4	1	1	3					4		2	22
123 - 127	1		1	1					1			16
128 - 132	1								1			22
133 - 137	1										2	23
138 - 142						2					1	19
143 - 147	1										2	7
148 - 152					1						3	8
153 - 157		1			1	1					2	7
158 - 162						1	1					6
163 - 167												2
168 - 172						1	1					1
173 - 177	1	1					1					1
178 - 182												1
183 - 187		1			1		1					
188 - 192		1							2			
193 - 197	1								1			

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
198 - 202	1					1						
203 - 207							1					
208 - 212												
213 - 217			1			2					1	
218 - 222												
223 - 227									2			
228 - 232												
233 - 237										1		
288 - 292												1
Mean Total Length (mm)	107	142	153	119	49	95	100	115	126	152	100	133

Distribution and relative abundance. In the North Edisto River, 49 Atlantic menhaden, with a total weight of 0.9 kg, were caught during the year (Table 10). In this estuary, the species ranked 15th in numerical abundance, constituting 0.2% of the total number, and 20th in weight, representing 0.5% of the total fish biomass for the 12-month period. This fish was present in North Edisto catches during 6 months of the year, with a slight peak in February (Table 53). No Atlantic menhaden were captured from late summer through the end of the year in the North Edisto estuary.

In the South Edisto River, 99 Atlantic menhaden, with a total weight of 2.7 kg, were caught during the year (Table 12). In this estuary, the species ranked 12th in numerical abundance, constituting 1.0% of the total number, and 8th in weight, representing 2.8% of the total fish biomass for the 12-month period. This fish was present in South Edisto catches during the months of February through April, June, August, September, December, and January with the majority of the catch occurring in January (Table 53).

In the Cooper River, 583 Atlantic menhaden, with a total weight of 3.0 kg, were caught during the year (Table 14). In this estuary, the species ranked fourth in numerical abundance, constituting 5.6% of the total number, and 12th in weight, representing 2.2% of the total fish biomass for the 12-month period. This fish was caught every month but September in the Cooper River (Table 53). Peak catch occurred in June, when the majority of the year's total were captured.

Distribution and relative abundance of Atlantic menhaden at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 53.

Table 53. Numerical abundance of *Brevoortia tyrannus* collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February	36	3	56	95	13.0					
March	1	2	17	20	2.7				0	0.0
April	1	1	1	3	0.4					
May	5		1	6	0.8					
June		3	365	368	50.4					
July	1		66	67	9.2	2	3	11	16	17.4
August		2	17	19	2.6					
September		1		1	0.1					
October			12	12	1.6		1	5	6	6.5
November			1	1	0.1					
December		8	43	51	7.0					
1974										
January	5	79	4	88	12.0		10	60	70	76.1
Total Catch by Region	49	99	583	731		2	14	76	92	
Percent of Total Catch	6.5	13.5	80.0		100.0	2.2	15.4	82.3		100.0

Grand Total (All months and stations combined) = 823

Chloroscombrus chrysurus (Atlantic Bumper)

Total catch. During the year, 578 Atlantic bumper (Chloroscombrus chrysurus) with a total weight of 3.4 kg, were obtained at all stations combined (Table 7). This species ranked 10th in numerical abundance statewide, constituting 0.9% of the total number, and 20th in weight, representing 0.6% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Atlantic bumper collected in the estuaries during the year had a total length range of 38 - 132 mm and occurred over a bottom salinity range of 13.7 - 32.3°/oo and a bottom temperature range of 18.4 - 30.5 C (Table 8).

Length-frequency relationship. The length-frequency relationship for Atlantic bumper from all stations is summarized in Table 54. This species occurred in South Carolina estuaries from July to November and was abundant only in September and October. Total lengths ranged from 43 - 92 mm in August, 38 - 112 mm in September, and 38 - 132 mm in October.

Distribution and relative abundance. In the North Edisto River, 59 Atlantic bumper, with a total weight of 0.3 kg, were caught during the year (Table 10). In this estuary, the species ranked 13th in numerical abundance, constituting 0.2% of the total number, and 26th in weight, representing 0.2% of the total fish biomass for the 12-month period. This fish was caught in the North Edisto only in late summer and fall, between August and November, with peak abundance occurring in September (Table 55).

In the South Edisto River, 491 Atlantic bumper, with a total weight of 2.9 kg, were caught during the year (Table 12). In this estuary,

Table 54. Length-frequency relationship for Chloroscombrus chrysurus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
38 - 42								1	4			
43 - 47							3					
48 - 52						1						
53 - 57							2	2	1			
58 - 62								1	1			
63 - 67							5	3	1	1		
68 - 72							5	22	1			
73 - 77							2	47	3			
78 - 82							1	96	5			
83 - 87						1		59	3			
88 - 92							1	22	6			
93 - 97								8	4	1		
98 - 102								3	4	1		
103 - 107								2				
108 - 112								1	3	1		
113 - 117									2			
118 - 122									2			
123 - 127									3			
128 - 132									1			
Mean Total Length (mm)						67	65	81	89	92		

Table 55. Numerical abundance of Chloroscombrus chrysurus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March				0	0.0					
April				0	0.0				0	0.0
May				0	0.0					
June				0	0.0					
July				0	0.0		1	1	2	8.0
August	1	15	1	17	3.1					
September	46	466		512	92.5					
October	11	10		21	3.8	1	19	3	23	92.0
November	1		2	3	0.5					
December				0	0.0					
1974										
January				0	0.0				0	0.0
Total Catch by Region	59	491	3	553		1	20	4	25	
Percent of Total Catch	10.6	88.7	0.5		100.0	4.0	80.0	16.0		100.0

Grand Total (All months and stations combined) = 578

the species ranked fifth in numerical abundance, constituting 4.9% of the total number, and seventh in weight, representing 2.9% of the total fish biomass for the 12-month period. This fish was caught in the South Edisto only in late summer and early fall, between August and October, with the majority of the year's catch occurring in September (Table 55).

In the Cooper River, only 3 Atlantic bumper, together weighing <0.1 kg, were caught during the year in August and November (Table 14). In this estuary, the species ranked 27th in numerical abundance, constituting <0.1% of the total number, and 43rd in weight, representing <0.1% of the total fish biomass for the 12-month period.

Distribution and relative abundance of Atlantic bumper at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 55.

Alosa aestivalis (Blueback Herring)

Total catch. During the year, 462 blueback herring (Alosa aestivalis) with a total weight of 1.5 kg, were obtained at all stations combined (Table 7). This species ranked 11th in numerical abundance statewide, constituting 0.7% of the total number, and 33rd in weight, representing 0.3% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Blueback herring collected in the estuaries during the year had a total length range of 35 - 307 mm and occurred over a bottom salinity range of 0.1 - 25.1°/oo and a bottom temperature range of 11.5 - 29.0 C (Table 8).

Length-frequency relationship. The length-frequency relationship for blueback herring from all stations is summarized in Table 56. This species was present during 10 of the 12 months sampled. Total lengths ranged from 48 - 307 mm in February, 33 - 52 mm in July, and 53 - 82 mm in January, 1974. Those caught in February, ranging from 48 - 77 mm, were fish spawned the previous spring and were approximately ten months in age. All of those obtained from June through January were young-of-the-year. These young herring at a total length range of 33 - 62 mm in June can be further traced from 38 - 72 mm in August to 43 - 62 mm in October.

Distribution and relative abundance. In the North Edisto River, 66 blueback herring, with a total weight of 0.1 kg, were caught in one tow in February (Table 10 and Table 57). In this estuary, the species ranked 10th in numerical abundance, constituting 0.2% of the total number, and 36th in weight, representing 0.1% of the total fish biomass for the 12-month period.

In the South Edisto River, 16 blueback herring, with a total weight of <0.1 kg, were caught during the year (Table 12). In this estuary, the species ranked 19th in numerical abundance, constituting 0.2% of the total number, and 36th in weight, representing <0.1% of the total fish biomass for the 12-month period. This fish was present in South Edisto bottom trawl catches only during the 2-month period of August and September (Table 57).

In the Cooper River, 373 blueback herring, with a total weight of 1.4 kg, were caught during the year (Table 14). In this estuary, the species ranked eighth in numerical abundance, constituting 3.6% of the total number, and 16th in weight, representing 1.0% of the total

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
33 - 37					2	3						
38 - 42					3	4	9					
43 - 47					16	4	9		18			
48 - 52	1				20	1	7		27			
53 - 57	1				6		3	2	4			13
58 - 62	13				1			4	1		3	16
63 - 67	22						2					20
68 - 72	25						1				3	6
73 - 77	2											4
78 - 82												1
168 - 172	2											
173 - 177												
178 - 182												
278 - 282			1									
283 - 287												
288 - 292		1										
293 - 297												
298 - 302												
303 - 307	1											
Mean Total Length (mm)	134	190	180		48	41	48	58	50		65	63

Table 57. Numerical abundance of Alosa aestivalis collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February	66		2	68	14.9					
March			1	1	0.2					
April			1	1	0.2				0	0.0
May				0	0.0					
June			48	48	10.5					
July			17	17	3.7				0	0.0
August		12	19	31	6.8					
September		4	2	6	1.3					
October			57	57	12.5				0	0.0
November				0	0.0					
December			6	6	1.3					
1974										
January	___	___	220	220	48.4	___	7	___	7	100.0
Total Catch by Region	66	16	373	455		0	7	0	7	
Percent of Total Catch	14.5	3.5	81.9		100.0	0.0	100.0	0.0		100.0

Grand Total (All months and stations combined) = 462

fish biomass for the 12-month period. This fish occurred in Cooper River bottom trawl catches during 10 of the 12 months, with peak abundance occurring in the estuary in January (Table 57).

Distribution and relative abundance of blueback herring at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 57.

Trinectes maculatus (Hogchoker)

Total catch. During the year, 399 hogchoker (Trinectes maculatus) with a total weight of 3.5 kg, were obtained at all stations combined (Table 7). This species ranked 12th in numerical abundance statewide, constituting 0.6% of the total number, and 19th in weight, representing 0.6% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Hogchoker collected in the estuaries during the year had a total length range of 21 - 152 mm and occurred over a bottom salinity range of <0.1 - 32.3°/oo and a bottom temperature range of 6.6 - 30.5 C (Table 8).

Length-frequency relationship. The length-frequency relationship for hogchoker from all stations is summarized in Table 58. This species was present in South Carolina estuaries throughout the year. Total lengths ranged from 38 - 152 mm in April, 48 - 132 mm in July, and 18 - 152 mm in December. The hogchoker has an extended spawning season in the Carolinas, from at least May to August (Hildebrand and Cable, 1938). As a result young-of-the-year, probably the progeny of the previous year's late spawners, were present at the start of the study in February. This year-class can be traced from February to August, with

Table 58. Length-frequency relationship for *Trinectes maculatus* collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
18 - 22											1	
23 - 27							1					
28 - 32										1		
33 - 37		1							1	1	1	
38 - 42		2	3		1				1	3		
43 - 47			5	1	2				1	2	2	2
48 - 52	2	3	9	3	1	2			6	5	3	7
53 - 57		5	8	8	2	5	2	2	3	7	13	4
58 - 62	1	3	20	15	1	5	2		5	9	20	8
63 - 67		1	13	15	1	4	2		14	4	9	7
68 - 72		2	5		3		2	1	11	7	4	2
73 - 77					1			1	3	2	3	4
78 - 82			1			2		1				1
83 - 87					1	2					1	1
88 - 92					1							
93 - 97				1		1				1		1
98 - 102						1						
103 - 107						2		1	1			
108 - 112					1	1	1	3	1	1		
113 - 117							2	1	1			
118 - 122			1					1	2	1	1	
123 - 127			1		1			2	2			
128 - 132					1	2		3	2			
133 - 137									2			
138 - 142								1		1		
143 - 147								1				
148 - 152			1	1				1			1	
Mean Total Length (mm)	53	57	61	60	73	79	72	109	74	63	69	62

total lengths ranging from about 33 - 72 mm in March, 38 - 67 mm in June, and 53 - 72 mm in August. From August to October new recruits, apparently from the current year's spawning, first appeared in trawl catches. Further tracing of these young-of-the-year is difficult due to possible overlap in the fall between these fish and the earlier year-class, now a year old.

Distribution and relative abundance. In the North Edisto River, 63 hogchoker, with a total weight of 1.6 kg, were caught during the year (Table 10). In this estuary, the species ranked 11th in numerical abundance, constituting 0.2% of the total number, and 13th in weight, representing 0.9% of the total fish biomass for the 12-month period. This fish occurred in North Edisto bottom trawl catches in relatively low numbers during the 9-month period from April through December, but was absent during the colder months from January - March (Table 59).

In the South Edisto River, 204 hogchoker, with a total weight of 1.0 kg, were caught during the year (Table 12). In this estuary, the species ranked ninth in numerical abundance, constituting 2.0% of the total number, and 16th in weight, representing 1.0% of the total fish biomass for the 12-month period. This fish occurred in South Edisto bottom trawl catches throughout the year, with peak abundance occurring during November and December (Table 59).

In the Cooper River, 52 hogchoker, with a total weight of 0.3 kg, were caught during the year (Table 14). In this estuary, the species ranked 14th in numerical abundance, constituting 0.5% of the total number, and 26th in weight, representing 0.2% of the total fish biomass for the 12-month period. This fish occurred in Cooper River bottom

Table 59. Numerical abundance of Trinectes maculatus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February		3		3	0.9					
March		5	8	13	4.1					
April	2	8	22	32	10.0	10	18	10	38	43.2
May	10	1	3	14	4.4					
June	8	10		18	5.6					
July	11	10		21	6.6	4	1	4	9	10.2
August	3	1	7	11	3.4					
September	12	5	2	19	6.0					
October	8	11	5	24	7.5	14	2	7	23	26.1
November	4	42		46	14.4					
December	5	95	4	104	32.6					
1974										
January	____	13	1	14	4.4	7	____	11	18	20.4
Total Catch by Region	63	204	52	319		35	21	32	88	
Percent of Total Catch	19.7	63.9	16.3		100.0	39.8	23.9	36.4		100.0

Grand Total (All months and stations combined) = 407

trawl catches in relatively low numbers during 8 of the 12 months: March through May, August through October, and December through January (Table 59).

Distribution and relative abundance of hogchoker at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 59.

Symphurus plagiusa (Blackcheek Tonguefish)

The blackcheek tonguefish (Symphurus plagiusa) is the most common species of Symphurus on the Atlantic and Gulf coasts of the United States (Ginsburg, 1951) and ranges from New York to the Bahamas and Greater Antilles (Ginsburg, 1951; Böhlke and Chaplin, 1968; Topp and Hoff, 1972). This fish is the most abundant cynoglossid species in South Carolina inshore waters and is present in some life stage during all months of the year and in all major estuaries or coastal regions of the state (Tables 5 and 60). Fowler (1945) earlier observed wide distribution for this species in South Carolina coastal waters. Dahlberg and Odum (1970) and Hoese (1973) also found this species throughout the year in several Georgia estuaries.

Total catch. During the year, 362 blackcheek tonguefish with a total weight of 6.0 kg, were obtained at all stations combined (Table 7). This species ranked 13th in numerical abundance statewide, constituting 0.6% of the total number, and 14th in weight, representing 1.1% of the total fish biomass for the 12-month period.

Table 60. Length-frequency relationship for Symphurus plagiusa collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
53 - 57								1				
58 - 62												
63 - 67										1		
68 - 72			2								2	
73 - 77										1	3	
78 - 82			1							1	1	1
83 - 87		1	2			1			1		4	2
88 - 92			1			1				3	5	1
93 - 97	1		3		2		2	1	3		1	4
98 - 102	1	1	2	1		2	1	2			1	1
103 - 107	2	4	2		1	2		1	6		2	8
108 - 112	2	1	5	3		3		5	4	1	6	9
113 - 117	2	11	11	1	1			2	5	1	4	6
118 - 122	1	11	11			2			3	2	4	8
123 - 127	1	12	8			1			3	1	7	13
128 - 132	1	1	6	1					1	3	5	7
133 - 137	1	6	8							2	5	7
138 - 142		17	3						1	2	2	3
143 - 147	2	7	2	1							1	2
148 - 152			1	1								2
153 - 157		1										
Mean Total Length (mm)	118	115	118	121	102	107	97	107	112	114	115	124

Total length, temperature, and salinity ranges. Blackcheek tonguefish collected in the estuaries during the year had a total length range of 53 - 156 mm and occurred over a bottom salinity range of 0.1 - 34.2°/oo and a bottom temperature of 8.6 - 30.5 C (Table 8).

Length-frequency relationship. The length-frequency relationship for blackcheek tonguefish from all stations is summarized in Table 60. At various locations throughout its range, this species spawns at sea over extended periods of time. In North Carolina, Hildebrand and Cable (1930) found the spawning season extending from May to October, with the height of spawning probably occurring in June. In Florida, Topp and Hoff (1972) reported that spawning occurred as early as February and continued to September.

The smallest specimen in the present study was captured in September, suggesting that spawning and early recruitment in South Carolina occur during roughly the same season as in other southeastern Atlantic states (Table 60). Fish caught in February had total lengths ranging from 93 - 147 mm. Since blackcheek tonguefish growth rates were slow (Hildebrand and Cable, 1930), these fish were probably not results of the previous summer-fall spawning.

This species was present in South Carolina estuaries at modal lengths of 140 mm and 120 mm in March and April. From May through August, only a few small tonguefish were available to the trawl, possibly due to seaward migration for spawning, which occurs about this time (Hildebrand and Cable, 1930). In September newly-recruited young-of-the-year, represented by a single specimen at a total length of about 55 mm, once again appeared in the estuaries. Blackcheek tonguefish ranged in

total lengths from 63 - 142 mm in November, 73 - 152 mm in December, and 83 - 157 mm in January. Further interpretations of these data are difficult due to possible overlap of more than one year class.

Distribution and relative abundance. In the North Edisto River, 101 blackcheek tonguefish, with a total weight of 1.6 kg, were caught during the year (Table 10). In this estuary, the species ranked eighth in numerical abundance, constituting 0.4% of the total number, and 12th in weight, representing 1.0% of the total fish biomass for the 12-month period. This fish was present in the North Edisto during all months, with relatively even seasonal distribution (Table 61). Slight peaks in abundance were noted in April, December, and January.

In the South Edisto River, 147 blackcheek tonguefish, with a total weight of 2.6 kg, were caught during the year (Table 12). In this estuary, the species ranked 10th in numerical abundance, constituting 1.5% of the total number, and ninth in weight, representing 2.7% of the total fish biomass for the 12-month period. This fish was present in the South Edisto during 9 of the 12 months (Table 61). Low abundance during May - August coincides with probable seaward migration for spawning.

In the Cooper River, 38 blackcheek tonguefish, with a total weight of 0.6 kg, were caught during the year (Table 14). In this estuary, the species ranked 16th in numerical abundance, constituting 0.4% of the total number, and 22nd in weight, representing 0.4% of the total fish biomass for the 12-month period. This fish was present in the Cooper River during 8 of the 12 months (Table 61).

Table 61. Numerical abundance of Symphurus plagiusa collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February	5	2	7	14	4.9					
March	5	64	2	71	24.8					
April	34	13	1	48	16.8	1	13	1	15	19.7
May	5		3	8	2.8					
June	4	2		6	2.1					
July	4			4	1.4	5	1	3	9	11.8
August	2		1	3	1.0					
September	3	6	3	12	4.2					
October	1	2	15	18	6.3	3		7	10	13.1
November	4	14		18	6.3					
December	14	37		51	17.8					
1974										
January	20	7	6	33	11.5	14		28	42	55.3
Total Catch by Region	101	147	38	286		23	14	39	76	
Percent of Total Catch	35.3	51.3	13.2		100.0	30.3	18.4	51.3		100.0

Grand Total (All months and stations combined) = 362

Distribution and relative abundance of blackcheek tonguefish at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 61.

Dorosoma petenense (Threadfin Shad)

Total catch. During the year, 327 threadfin shad (Dorosoma petenense) with a total weight of 0.9 kg, were captured at all stations combined (Table 7). This species ranked 14th in numerical abundance statewide, constituting 0.5% of the total number, and 36th in weight, representing 0.2% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Threadfin shad collected in the estuaries during the year had a total length range of 36 - 134 mm and occurred over a bottom salinity range of 0.1 - 32.3°/oo and a bottom temperature range of 16.6 - 29.9 C (Table 8).

Length-frequency relationship. The length-frequency relationship for threadfin shad from all stations is summarized in Table 62. Some life history stage of this species is present during most of the year. Total lengths ranged from 68 - 137 mm in February, 33 - 122 mm in July, and 38 - 102 mm in January.

Distribution and relative abundance. In the North Edisto River, only 10 threadfin shad, with a total weight of 0.1 kg, were caught during the year (Table 10). In this estuary, the species ranked 27th in numerical abundance, constituting <0.1% of the total number, and 46th in weight, representing <0.1% of the total fish biomass for the

Table 62. Length-frequency relationship for Dorosoma petenense collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973											1974
	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
33 - 37						1						
38 - 42												2
43 - 47												5
48 - 52						2	1					20
53 - 57						4	1					13
58 - 62						5	1				1	11
63 - 67						1						4
68 - 72	1	1				2						5
73 - 77												2
78 - 82	2		1						1			1
83 - 87	1											
88 - 92	3		3		1	5						
93 - 97	3					13						
98 - 102	1					7	1					1
103 - 107	1					4	1					
108 - 112	1											
113 - 117					1							
118 - 122	1					1						
123 - 127												
128 - 132	2		1									
133 - 137	1											
Mean Total Length (mm)	100	70	96		102	84	74		80		60	62

12-month period. This fish was present in North Edisto bottom trawl catches only during February, July, and October (Table 63).

In the South Edisto River, this fish was completely absent from all bottom trawl catches throughout the year (Table 63).

In the Cooper River, 286 threadfin shad, with a total weight of 0.7 kg, were caught during the year (Table 14). In this estuary, the species ranked 10th in numerical abundance, constituting 2.8% of the total number, and 19th in weight, representing 0.5% of the total fish biomass for the 12-month period. With the exception of March and May, this fish was present in Cooper River bottom trawl catches from December through August, with peak abundance in January (Table 63).

Distribution and relative abundance of threadfin shad at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 63.

Anchoa hepsetus (Striped Anchovy)

Total catch. During the year, 216 striped anchovy (Anchoa hepsetus) with a total weight of 1.7 kg, were obtained at all stations combined (Table 7). This species ranked 15th in numerical abundance statewide, constituting 0.3% of the total number, and 30th in weight, representing 0.3% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Striped anchovy collected in the estuaries during the year had a total length range of 58 - 140 mm and occurred over a bottom salinity range of 8.8 - 34.4°/oo and a bottom temperature range of 16.9 - 30.5 C (Table 8).

Table 63. Numerical abundance of Dorosoma petenense collected by bottom trawl monthly in the North Edisto, South Edisto and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February	5		12	17	5.7					
March				0	0.0					
April			1	1	0.3		2	2	4	12.9
May				0	0.0					
June			2	2	0.7					
July	4		12	16	5.4	7	18	2	27	87.1
August			2	2	0.7					
September				0	0.0					
October	1			1	0.3				0	0.0
November				0	0.0					
December			1	1	0.3					
1974										
January			256	256	86.2				0	0.0
Total Catch by Region	10	0	286	296		7	20	4	31	
Percent of Total Catch	3.4	0.0	96.6		100.0	22.6	64.5	12.9		100.0

Grand Total (All months and stations combined) = 327

Length-frequency relationship. The length-frequency relationship for striped anchovy from all stations is summarized in Table 64. This species was most prevalent in the fall of the year, with total lengths ranging from 63 - 122 mm in September, 73 - 132 mm in October, and 78 - 132 mm in November.

Distribution and relative abundance. In the North Edisto River, 39 striped anchovy, with a total weight of 0.2 kg, were caught during the year (Table 10). In this estuary, the species ranked 17th in numerical abundance, constituting 0.1% of the total number and 28th in weight, representing 0.2% of the total fish biomass for the 12-month period. This fish was present in North Edisto bottom trawl catches in small numbers from May to November (Table 65).

In the South Edisto River, 79 striped anchovy, with a total weight of 0.7 kg, were caught during the year (Table 12). In this estuary, the species ranked 13th in numerical abundance, constituting 0.8% of the total number, and 18th in weight, representing 0.7% of the total fish biomass for the 12-month period. This fish was present in South Edisto bottom trawl catches only during fall months, from September - November (Table 65).

In the Cooper River, 32 striped anchovy, with a total weight of 0.3 kg, were caught during the year (Table 14). In this estuary, the species ranked 17th in numerical abundance, constituting 0.3% of the total number, and 27th in weight, representing 0.2% of the total fish biomass for the 12-month period. This fish occurred in Cooper River bottom trawl catches in low numbers during 4 months: May, September, October, and December (Table 65).

Table 64. Length-frequency relationship for Anchoa hepsetus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
58 - 62											1	
63 - 67								2				
68 - 72						2						
73 - 77								2	1			
78 - 82							1		7	3		
83 - 87								2	16	4		
88 - 92								2	26	3		
93 - 97							1	1	27	4		
98 - 102				2				2	14	4		
103 - 107				9				4	3	10	1	
108 - 112				6				4	8	10	1	
113 - 117				2				1	8	6		
118 - 122				4				1	1	2		
123 - 127			1	1	3				1			
128 - 132				1					1	1		
133 - 137												
138 - 142			1									
Mean Total Length (mm)			132	111	125	70	87	96	95	103	92	

Table 65. Numerical abundance of Anchoa hepsetus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March				0	0.0					
April				0	0.0		2		2	3.0
May	12		25	37	24.7					
June	3			3	2.0					
July	1			1	0.7			2	2	3.0
August	1			1	0.7					
September	13	2	3	18	12.0					
October	8	72	2	82	54.6	14	42	6	62	93.9
November	1	5		6	4.0					
December			2	2	1.3					
1974										
January				0	0.0				0	0.0
Total Catch by Region	39	79	32	150		14	44	8	66	
Percent of Total Catch	26.0	52.7	21.3		100.0	21.2	66.6	12.1		100.0

Grand Total (All months and stations combined) = 216

Distribution and relative abundance of striped anchovy at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 65.

Opisthonema oglinum (Atlantic Thread Herring)

Total catch. During the year, 214 Atlantic thread herring (Opisthonema oglinum) with a total weight of 1.6 kg, were obtained at all stations combined (Table 7). This species ranked 16th in numerical abundance statewide, constituting 0.3% of the total number, and 32nd in weight, representing 0.3% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Atlantic thread herring collected in the estuaries during the year had a total length range of 40 - 174 mm and occurred over a bottom salinity range of 0.1 - 34.2°/oo and a bottom temperature range of 12.7 - 30.1 C (Table 8).

Length-frequency relationship. The length-frequency relationship for Atlantic thread herring from all stations is summarized in Table 66. This species was only present in the estuaries from August to January. Total lengths ranged from 43 - 82 mm in August and 38 - 177 mm in October, with a single specimen in January at 138 mm.

Distribution and relative abundance. In the North Edisto River, 26 Atlantic thread herring, with a total weight of 0.2 kg, were caught during the year (Table 10). In this estuary, the species ranked 20th in numerical abundance, constituting 0.1% of the total number, and 30th in weight, representing 0.1% of the total fish biomass for the

Table 66. Length-frequency relationship for Opisthonema oglinum collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
38 - 42								2	1			
43 - 47							1	15				
48 - 52								16	1			
53 - 57								3				
58 - 62								2				
63 - 67												
68 - 72												
73 - 77							1					
78 - 82							4					
83 - 87									7			
88 - 92									14	2		
93 - 97								5	17	1		
98 - 102								8	4	3		
103 - 107								4	4	1		
108 - 112												
113 - 117								2				
118 - 122												
123 - 127												
128 - 132												
133 - 137												
138 - 142												1
143 - 147												
148 - 152												
153 - 157									1			
158 - 162												
163 - 167												
168 - 172								2				
173 - 177									1			
Mean Total Length (mm)							73	66	90	97		140

12-month period. This fish was present in low numbers in North Edisto bottom trawl catches from late summer through fall, August - November (Table 67).

In the South Edisto River, only four Atlantic thread herring were collected during the year, two each in August and September (Table 67). Together these fish weighed 0.1 kg (Table 12). In this estuary, the species ranked 26th in numerical abundance, constituting < 0.1% of the total number, and 26th in weight, representing 0.1% of the total fish biomass for the 12-month period.

In the Cooper River, 45 Atlantic thread herring, with a total weight of 0.1 kg, were caught during the year (Table 14). In this estuary, the species ranked 15th in numerical abundance, constituting 0.4% of the total number, and 32nd in weight, representing 0.1% of the total fish biomass for the 12-month period. This fish was present in small numbers in Cooper River bottom trawl catches and only appeared during August - October (Table 67).

Distribution and relative abundance of Atlantic thread herring at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 67.

Trichiurus lepturus (Atlantic Cutlassfish)

Total catch. Over the 12-month period, 189 Atlantic cutlassfish (Trichiurus lepturus) with a total weight of 7.6 kg, were obtained at all stations combined (Table 7). This species ranked 17th in numerical abundance statewide, constituting 0.3% of the total number, and 13th in weight, representing 1.4% of the total fish biomass for the 12-month period.

Table 67. Numerical abundance of Opisthonema oglinum collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March				0	0.0					
April				0	0.0				0	0.0
May				0	0.0					
June				0	0.0					
July				0	0.0				0	0.0
August	3	2	1	6	8.0					
September	12	2	41	55	73.3					
October	4		3	7	9.3		41	2	43	30.9
November	7			7	9.3					
December				0	0.0					
1974										
January				0	0.0	1	95		96	69.0
Total Catch by Region	26	4	45	75		1	136	2	139	
Percent of Total Catch	34.7	5.3	60.0		100.0	0.7	97.8	1.4		100.0

Grand Total (All months and stations combined) = 214

Total length, temperature, and salinity ranges. Atlantic cutlassfish collected in the estuaries during the year had a total length range of 136 - 667 mm and occurred over a bottom salinity range of 0.7 - 34.4°/oo and a bottom temperature range of 16.2 - 30.6 C (Table 8).

Length-frequency relationship. The length-frequency relationship for Atlantic cutlassfish from all stations is summarized in Table 68. This species occurred during warmer months of the year in South Carolina estuaries. Atlantic cutlassfish first appeared in April at a total length of 121 - 380 mm. These fish can be further traced from a modal length of 290 mm in May to a modal length of 450 mm in July.

Distribution and relative abundance. In the North Edisto River, 73 Atlantic cutlassfish, with a total weight of 3.5 kg, were caught during the year (Table 10). In this estuary, the species ranked ninth in numerical abundance, constituting 0.3% of the total number, and 10th in weight, representing 2.0% of the total fish biomass for the 12-month period. This fish was present in North Edisto bottom trawl catches only during the summer (June - August), with peak abundance in June (Table 69).

In the South Edisto River, five Atlantic cutlassfish, with a total weight of 0.2 kg, were caught during the year (Table 12). In this estuary, the species ranked 25th in numerical abundance, constituting 0.1% of the total number, and 23rd in weight, representing 0.2% of the total fish biomass for the 12-month period. This fish was present in the South Edisto bottom trawl catches in low numbers, and only during the summer months of June and August (Table 69).

In the Cooper River, 25 Atlantic cutlassfish, with a total weight of 0.6 kg, were caught during the year (Table 14). In this estuary, the

Table 68. Length-frequency relationship for Trichiurus lepturus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
121 - 140			1									
141 - 160												
161 - 180												
181 - 100						1						
201 - 220			5									
221 - 240			1			1						
241 - 260			3	2								
261 - 280			2	3								
281 - 300			3	7								
301 - 320			1	7			1					
321 - 340				1	3		1					
341 - 360				1	7		1					
361 - 380			2	1	14	1						
381 - 400					21		1					
401 - 420					10							
421 - 440				1	4	2	1					
441 - 460					1	10						
461 - 480					1	6						
481 - 500						4	1					
501 - 520						1						
521 - 540						1	1					
541 - 560							4					
561 - 580						1		1				
581 - 600						2						
601 - 620							1					
621 - 640												
641 - 660												
661 - 680						2						
Mean Total Length (mm)			150	197	279	364	363	463				

Table 69. Numerical abundance of Trichiurus lepturus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March				0	0.0					
April				0	0.0	3		51	54	62.8
May			22	22	21.4					
June	63	1	2	66	64.1					
July	1			1	1.0	1	2	29	32	37.2
August	9	4		13	12.6					
September			1	1	1.0					
October				0	0.0				0	0.0
November				0	0.0					
December				0	0.0					
1974										
January				0	0.0				0	0.0
Total Catch by Region	73	5	25	103		4	2	80	86	
Percent of Total Catch	70.9	4.8	24.3		100.0	4.6	2.3	93.1		100.0

Grand Total (All months and stations combined) = 189

species ranked 18th in numerical abundance, constituting 0.2% of the total number, and 21st in weight, representing 0.5% of the total fish biomass for the 12-month period. This fish was present in Cooper River bottom trawl catches in early summer and fall, during May, June, and September (Table 69).

Distribution and relative abundance of Atlantic cutlassfish at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 69.

Peprilus alepidotus (Harvestfish)

Total catch. During the year, 151 harvestfish (Peprilus alepidotus) with a total weight of 1.8 kg, were obtained at all stations combined (Table 7). This species ranked 18th in numerical abundance statewide, constituting 0.2% of the total number, and 28th in weight, representing 0.3% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Harvestfish collected in the estuaries during the year had a total length range of 20 - 131 mm and occurred over a bottom salinity range of 0.9 - 33.2°/oo and a bottom temperature range of 17.4 - 30.1 C (Table 8).

Length-frequency relationship. The length-frequency relationship for harvestfish from all stations is summarized in Table 70. This fish was present in South Carolina estuaries primarily from July to December, with individuals obtained occasionally during April and May. Total lengths ranged from 18 - 62 mm in July, 33 - 132 mm in September, and 83 - 112 mm in November.

Table 70. Length-frequency relationship for Peprilus alepidotus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
18 - 22						1						
23 - 27												
28 - 32			1			1						
33 - 37						5		1	3			
38 - 42						10	2	1	7			
43 - 47			1			9			4			
48 - 52						4	1	1	6			
53 - 57						3	2	2	1			
58 - 62						1	6	3	2			
63 - 67							9	7	1			
68 - 72							9	2	1			
73 - 77							3	2				
78 - 82							3	4				
83 - 87							2	4		1		
88 - 92								1		2		
93 - 97				1				3	1	1		
98 - 102				1				1	1	2		
103 - 107								1	1	1	2	
108 - 112								2	1	1	2	
113 - 117												
118 - 122								1			1	
123 - 127								1			1	
128 - 132								1				
Mean Total Length (mm)			37	97		43	51	78	55	102	112	

Distribution and relative abundance. In the North Edisto River, 60 harvestfish, with a total weight of 0.9 kg, were caught during the year (Table 10). In this estuary, the species ranked 12th in numerical abundance, constituting 0.2% of the total number, and 17th in weight, representing 0.5% of the total fish biomass for the 12-month period. This fish was present in North Edisto bottom trawl catches during 8 months of the year (Table 71). Harvestfish were absent during the coldest winter months, from January - March and unaccountably in June.

In the South Edisto River, this fish was completely absent from all bottom trawl catches at all stations throughout the year (Table 71).

In the Cooper River, 55 harvestfish, with a total weight of 0.7 kg, were caught during the year (Table 14). In this estuary, the species ranked 12th in numerical abundance constituting 0.5% of the total number, and 18th in weight, representing 0.5% of the total fish biomass for the 12-month period. This fish was present in Cooper River bottom trawls in May and July - November (Table 71). Harvestfish were absent from catches during the colder months, from December until early spring.

Distribution and relative abundance of harvestfish at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 71.

Arius felis (Sea Catfish)

Total catch. During the year, 90 sea catfish (Arius felis) with a total weight of 10.0 kg, were obtained at all stations combined (Table 7). This species ranked 19th in numerical abundance statewide, constituting 0.1% of the total number, and 10th in weight, representing

Table 71. Numerical abundance of Peprilus alepidotus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March				0	0.0					
April	2			2	1.7				0	0.0
May	3		5	8	6.9					
June				0	0.0					
July	5		2	7	6.1	5	3	18	26	72.2
August	23		13	36	31.3					
September	17		24	41	36.5					
October	3		5	8	6.9			10	10	27.8
November	1		7	8	6.9					
December	6			6	5.2					
1974										
January				0	0.0				0	0.0
Total Catch by Region	60	0	55	115		5	3	28	36	
Percent of Total Catch	52.2	0.0	47.8		100.0	13.9	8.3	77.8		100.0

Grand Total (All months and stations combined) = 151

1.8% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Sea catfish collected in the estuaries during the year had a total length range of 58 - 296 mm and occurred over a bottom salinity range of 0.2 - 33.2°/oo and a bottom temperature range of 16.8 - 30.5 C (Table 8).

Length-frequency relationship. The length-frequency relationship for the sea catfish from all stations is summarized in Table 72. Total lengths ranged from 148 - 267 mm in May, 153 - 282 mm in July, and 58 - 252 mm in September.

Distribution and relative abundance. In the North Edisto River, 63 sea catfish, with a total weight of 7.4 kg, were caught during the year (Table 10). In this estuary, the species ranked 11th in numerical abundance, constituting 0.2% of the total number, and sixth in weight, representing 4.3% of the total fish biomass for the 12-month period. This fish was present in North Edisto bottom trawl catches from May - October, with the majority of the catch occurring from late spring to mid-summer (Table 73).

In the South Edisto River, only six sea catfish with a total weight of 0.3 kg, were caught during the year (Table 12). In this estuary, the species ranked 24th in numerical abundance, constituting 0.1% of the total number, and 19th in weight, representing 0.3% of the total fish biomass for the 12-month period. This fish was present in small numbers in South Edisto bottom trawl catches in May and July - October (Table 73).

In the Cooper River, only three sea catfish, with a total weight of 0.4 kg, were caught during the year (Table 14), two in May and one

Table 72. Length-frequency relationship for *Arius felis* collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
58 - 62								1				
63 - 67												
68 - 72												
73 - 77												
78 - 82							1					
83 - 87							1					
88 - 92												
93 - 97												
98 - 102									1			
103 - 107												
108 - 112												
113 - 117												
118 - 122									2			
123 - 127												
128 - 132									1			
133 - 137												
138 - 142												
143 - 147												
148 - 152				1								
153 - 157						1						
158 - 162				1								
163 - 167				3	1							
168 - 172				4								
173 - 177				2	3							
178 - 182				1	1	2		1				
183 - 187					3	4						
188 - 192				2	4	2						
193 - 197				1		1						
198 - 202					1	1						
203 - 207			1									
208 - 212						2						
213 - 217				1		2						
218 - 222					1	1						

Table 72. (Continued.)

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
223 - 227					1	1						
228 - 232					1	2						
233 - 237					2	7						
238 - 242			1									
243 - 247				1	1	2						
248 - 252				1	1	1		1				
253 - 257			1	1	2	2						
258 - 262						3						
263 - 267				2		1						
268 - 272					1							
273 - 277												
278 - 282			1			1						
283 - 287												
288 - 292												
293 - 297			1									
Mean Total Length (mm)			255	195	209	267	82	163	118			

Table 73. Numerical abundance of Arius felis collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March				0	0.0					
April				0	0.0	1		4	5	27.8
May	18	1	2	21	29.2					
June	14			14	19.4					
July	27	2		29	40.3	3		9	12	66.7
August	1	1		2	2.8					
September	2	1		3	4.2					
October	1	1	1	3	4.2			1	1	5.6
November				0	0.0					
December				0	0.0					
1974										
January				0	0.0				0	0.0
Total Catch by Region	63	6	3	72		4	0	14	18	
Percent of Total Catch	87.5	8.3	4.2		100.0	22.2	0.0	77.8		10

Grand Total (All months and stations combined) = 90

in October (Table 73). In this estuary, the species ranked 27th in numerical abundance, constituting <0.1% of the total number, and 24th in weight, representing 0.3% of the total fish biomass for the 12-month period.

Distribution and relative abundance of sea catfish at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 73.

Ictalurus punctatus (Channel Catfish)

Total catch. During the year, 77 channel catfish (Ictalurus punctatus) with a total weight of 3.2 kg, were obtained at all stations combined (Table 7). This species ranked 20th in numerical abundance statewide, constituting 0.1% of the total number, and 23rd in weight, representing 0.6% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Channel catfish collected in the estuaries during the year had a total length range of 56 - 234 mm and occurred over a very low bottom salinity range of 0.1 - 0.2°/oo and a bottom temperature range of 8.7 - 27.8 C (Table 8).

Length-frequency relationship. The length-frequency relationship for channel catfish from all stations is summarized in Table 74. This species occurred during 7 of the 12 months sampled. Total lengths ranged from 203 - 222 mm in February, 113 - 227 mm in June, and 53 - 227 mm in December. During November and December two year-classes were probably present.

Distribution and relative abundance. In the North Edisto River, only one channel catfish, with a total weight of 0.3 kg, was caught during

Table 74. Length-frequency relationship for Ictalurus punctatus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
53 - 57										1	1	
58 - 62											2	
63 - 67										1	7	
68 - 72											1	
73 - 77											5	
78 - 82											2	
83 - 87											1	
88 - 92											2	
93 - 97											1	
98 - 102										1	1	
103 - 107											1	
108 - 112											5	
113 - 117					1					1	3	
118 122										2	3	
123 - 127			1								1	
178 - 182		1										
183 - 187											1	
188 - 192											2	
193 - 197		1									1	
198 - 202										1	1	
203 - 207	1									1		
208 - 212	2		1								3	
213 - 217		3										
218 - 222	2									2		
223 - 227		1			1						2	
228 - 232												
233 - 237		1										
> 250				1								
Mean Total Length (mm)	213	212	167	>250	170					132	118	

the year (Table 10). This specimen was taken in May (Table 75). In this estuary, the species ranked 35th in numerical abundance, constituting <0.1% of the total number, and 27th in weight, representing 0.2% of the total fish biomass for the 12-month period.

In the South Edisto River, 61 channel catfish, with a total weight of 1.9 kg, were caught during the year (Table 12). In this estuary, the species ranked 14th in numerical abundance, constituting 0.6% of the total number, and 13th in weight, representing 2.0% of the total fish biomass for the 12-month period. This fish was present in South Edisto bottom trawl catches during the months of June, November, and December (Table 75).

In the Cooper River, 15 channel catfish, with a total weight of 1.0 kg, were caught during the year (Table 14). In this estuary, the species ranked 20th in numerical abundance, constituting 0.1% of the total number, and 17th in weight, representing 0.8% of the total fish biomass for the 12-month period. This fish was present in some Cooper River bottom trawl catches in small numbers from February - April (Table 75).

No channel catfish appeared at any time during the year in catches from 16 additional stations trawled quarterly in the northern, Charleston, and southern regions of the state (Table 75).

Opsanus tau (Oyster Toadfish)

Total catch. During the year, 76 oyster toadfish (Opsanus tau) with a total weight of 4.1 kg, were obtained at all stations combined (Table 7). This species ranked 21st in numerical abundance statewide, constituting 0.1% of the total number, and 17th in weight, representing 0.8% of the total fish biomass for the 12-month period.

Table 75. Numerical abundance of Ictalurus punctatus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February			5	5	6.5					
March			8	8	10.4					
April			2	2	2.6					
May	1			1	1.3	NO SPECIMENS ENCOUNTERED DURING				
June		2		2	2.6					
July				0	0.0	QUARTERLY SAMPLING.				
August				0	0.0					
September				0	0.0					
October				0	0.0					
November		10		10	13.0					
December		49		49	63.6					
1974										
January				0	0.0					
Total Catch by Region	1	61	15	77						
Percent of Total Catch	1.3	79.2	19.5		100.0					

Grand Total (All months and stations combined) = 77

Total length, temperature, and salinity ranges. Oyster toadfish collected in the estuaries during the year had a total length range of 23 - 245 mm and occurred over a bottom salinity range of 2.0 - 34.2°/oo and a bottom temperature range of 11.6 - 30.4 C (Table 8).

Length-frequency relationship. The length-frequency relationship for oyster toadfish from all stations is summarized in Table 76. With the exception of February, this species was present at some life stage throughout the year. Total lengths ranged from 58 - 347 mm in May, 23 - 172 mm in July, and 33 - 217 mm in October.

Distribution and relative abundance. In the North Edisto River, 19 oyster toadfish, with a total weight of 0.3 kg, were caught during the year (Table 10). In this estuary, the species ranked 22nd in numerical abundance, constituting 0.1% of the total number, and 24th in weight, representing 0.2% of the total fish biomass for the 12-month period. This fish was present in North Edisto catches in small numbers during 8 months of the year (Table 77).

In the South Edisto River, only two oyster toadfish, with a total weight of 0.1 kg, were caught during the year (Table 12), one in April and one in June (Table 77). In this estuary, the species ranked 28th in numerical abundance, constituting < 0.1% of the total number, and 33rd in weight, representing < 0.1% of the total fish biomass for the 12-month period.

In the Cooper River, 24 oyster toadfish, with a total weight of 3.1 kg, were caught during the year (Table 14). In this estuary, the species ranked 19th in numerical abundance, constituting 0.2% of the total number, and 11th in weight, representing 2.3% of the total fish biomass for the 12-month period. This fish was present in Cooper River

Table 76. Length-frequency relationship for Opsanus tau collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
23 - 27						5						
28 - 32						3						
33 - 37									1			
38 - 42									1			
43 - 47									1			
48 - 52						1			1		1	
53 - 57		1	1			1						
58 - 62				1		1	1				2	
63 - 67												
68 - 72									1			
73 - 77						1			3			
78 - 82					1	1						
83 - 87			1			1			2			
88 - 92								1				
93 - 97				1		2						
98 - 102				1		3	1					
103 - 107				1	1			1				
108 - 112			1	1		1						
113 - 117			1	1								
118 - 122				1							1	
123 - 127						1			1			
128 - 132									1		1	
133 - 137			1	1						1		
138 - 142												
143 - 147												
148 - 152												
153 - 157												
158 - 162												
163 - 167												
168 - 172						1						
173 - 177								1				
178 - 182												
183 - 187				2								

Table 76. (Continued.)

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan
188 - 192				1					2			
193 - 197												
198 - 202												
203 - 207				1					1			1
208 - 212										1		1
213 - 217				1					1			1
338 - 342			1									
343 - 347				1								
Mean Total Length (mm)		55	123	147	92	69	80	123	106	172	84	110

Table 77. Numerical abundance of Opsanus tau collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March	1			1	2.2					
April	3	1	1	5	11.1		1		1	3.2
May	5		9	14	31.1					
June	1	1		2	4.4					
July			4	4	8.9	3	13	2	18	58.0
August	2			2	4.4					
September	3			3	6.7					
October			4	4	8.9	2	10		12	38.7
November	1		1	2	4.4					
December	3		2	5	11.1					
1974										
January			3	3	6.7				0	0.0
Total Catch by Region	19	2	24	45		5	24	2	31	
Percent of Total Catch	42.2	4.4	53.3		100.0	16.1	77.4	6.4		100.0

Grand Total (All months and stations combined) = 76

bottom trawl catches in relatively low numbers during 7 months of the year (Table 77).

Distribution and relative abundance of oyster toadfish at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 77.

Larimus fasciatus (Banded Drum)

Total catch. During the year, 75 banded drum (Larimus fasciatus) with a total weight of 2.1 kg, were obtained at all stations combined (Table 7). This species ranked 22nd in numerical abundance statewide, constituting 0.1% of the total number, and 26th in weight, representing 0.4% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Banded drum collected in the estuaries during the year had a total length range of 37 - 146 mm and occurred over a bottom salinity range of 12.9 - 34.2°/oo and a bottom temperature range of 16.0 - 30.5 C (Table 8).

Length-frequency relationship. The length-frequency relationship for banded drum from all stations is summarized in Table 78. This species occurred in the estuaries from July to December. Total lengths ranged from 33 - 147 mm in July, 63 - 107 mm in September, and 48 - 147 mm in November.

Distribution and relative abundance. In the North Edisto River, 50 banded drum, with a total weight of 0.4 kg, were caught during the year (Table 10). In this estuary, the species ranked 14th in numerical abundance, constituting 0.2% of the total number, and 22nd in weight,

Table 78. Length-frequency relationship for Larimus fasciatus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
33 - 37						1						
38 - 42												
43 - 47									1			
48 - 52									1	1		
53 - 57									2	1		
58 - 62											1	
63 - 67								1		1	9	
68 - 72							1				6	
73 - 77												
78 - 82								4	1		1	
83 - 87								5				
88 - 92								5				
93 - 97								9				
98 - 102								6	1			
103 - 107								1				
108 - 112												
113 - 117												
118 - 122												
123 - 127												
128 - 132						4						
133 - 137						4						
138 - 142						6						
143 - 147						1				1		
Mean Total Length (mm)						130	70	91	64	79	67	

representing 0.3% of the total fish biomass for the 12-month period. This fish was only present in North Edisto bottom trawl catches during the second half of the year, from July - December (Table 79).

In the South Edisto River, only six banded drum, with a total weight of 0.1 kg, were caught during the year (Table 12). In this estuary, the species ranked 24th in numerical abundance, constituting 0.1% of the total number, and 31st in weight, representing 0.1% of the total fish biomass for the 12-month period. This fish was present in South Edisto bottom trawl catches only in low numbers from September through December (Table 79).

In the Cooper River, banded drum were completely absent from all bottom trawl catches at all stations throughout the year (Table 79).

Distribution and relative abundance of banded drum at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 79.

Menticirrhus americanus (Southern Kingfish)

Total catch. During the year, 75 southern kingfish (Menticirrhus americanus) with a total weight of 1.8 kg, were obtained at all stations combined (Table 7). This species ranked 22nd in numerical abundance statewide, constituting 0.1% of the total number, and 27th in weight, representing 0.3% of the total fish biomass for the 12-month period.

Total length, temperature, and salinity ranges. Southern kingfish collected in the estuaries during the year had a total length range of 43 - 271 mm and occurred over a bottom salinity range of 0.9 - 34.2°/oo and a bottom temperature range of 9.2 - 30.1 C (Table 8).

Table 79. Numerical abundance of Larimus fasciatus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February				0	0.0					
March				0	0.0					
April				0	0.0				0	0.0
May				0	0.0					
June				0	0.0					
July	1			1	1.8			15	15	78.9
August	1			1	1.8					
September	30	1		31	55.4					
October	1	1		2	3.6	4			4	21.1
November	1	3		4	7.1					
December	16	1		17	30.4					
1974										
January				0	0.0				0	0.0
Total Catch by Region	50	6	0	56		4	0	15	19	
Percent of Total Catch	89.3	10.7	0.0		100.0	21.1	0.0	78.9		100.0

Grand Total (All months and stations combined) = 75

Length-frequency relationship. The length-frequency relationship for southern kingfish from all stations is summarized in Table 80. This species was present in South Carolina estuaries at some life stage throughout the year. Total lengths ranged from 108 - 197 mm in May, 43 - 167 mm in July, and 63 - 167 mm in September.

Distribution and relative abundance. In the North Edisto River, 47 southern kingfish with a total weight of 1.2 kg, were caught during the year (Table 10). In this estuary, the species ranked 16th in numerical abundance, constituting 0.2% of the total number, and 14th in weight, representing 0.7% of the total fish biomass for the 12-month period. This fish was present in small numbers throughout the year (except August) in North Edisto bottom trawl catches (Table 81).

In the South Edisto River, 17 southern kingfish, with a total weight of 0.2 kg, were caught during the year (Table 12). In this estuary, the species ranked 18th in numerical abundance, constituting 0.2% of the total number, and 20th in weight, representing 0.2% of the total fish biomass for the 12-month period. Small numbers of this fish were occasionally present in South Edisto bottom trawl catches during the year (Table 81).

In the Cooper River, only three southern kingfish, with a total weight of 0.1 kg, were caught during the year (Table 14), one in August and two in October (Table 81). In this estuary, the species ranked 27th in numerical abundance, constituting $<0.1\%$ of the total number, and 30th in weight, representing 0.1% of the total fish biomass for the 12-month period.

Distribution and relative abundance of southern kingfish at additional stations trawled quarterly in the northern, Charleston, and southern regions of the state are also summarized in Table 81.

Table 80. Length-frequency relationship for Menticirrhus americanus collected by bottom trawl in South Carolina estuaries (all stations combined) from February, 1973 through January, 1974.

Total Length Interval (mm)	Month											
	1973 Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1974 Jan.
43 - 47						2						
48 - 52					1	1						
53 - 57												
58 - 62												
63 - 67								1		1		
68 - 72						2	1				1	
73 - 77								2		1		
78 - 82									1			
83 - 87						2		1				
88 - 92						1		1				
93 - 97						1		1				
98 - 102								2	1			1
103 - 107								2				1
108 - 112				1				1	1			
113 - 117									1			
118 - 122				2					1	1		
123 - 127				1				1	1			
128 - 132				1				2				
133 - 137		1		1				2	1			
138 - 142								2	1	1		1
143 - 147									1			-
148 - 152			2					1	1			1
153 - 157	1				1							
158 - 162									1			
163 - 167						1		1				
168 - 172					1							1
173 - 177												1
178 - 182									2			
183 - 187					1					1		
188 - 192												
193 - 197				1					1			
268 - 272												1
Mean Total Length (mm)	155	135	150	134	140	80	70	113	138	117	70	157

Table 81. Numerical abundance of Menticirrhus americanus collected by bottom trawl monthly in the North Edisto, South Edisto, and Cooper Rivers and quarterly in other South Carolina coastal regions from February, 1973 through January, 1974.

Month	Monthly Sampling (Intensive Phase)					Quarterly Sampling (Extensive Phase)				
	North Edisto	South Edisto	Cooper River	Total Catch by Month	Percent of Total Catch	Northern Region	Charleston Region	Southern Region	Total Catch by Quarter	Percent of Total Catch
1973										
February	1			1	1.5					
March	1			1	1.5					
April	1	1		2	2.9				0	0.0
May	7			7	10.4					
June	4			4	5.9					
July	7			7	10.4			2	2	25.0
August			1	1	1.5					
September	7	13		20	29.8					
October	12		2	14	20.9	1			1	12.5
November	4	2		6	8.9					
December	1			1	1.5					
1974										
January	2	1		3	4.5			5	5	62.5
Total Catch by Region	47	17	3	67		1	0	7	8	
Percent of Total Catch	70.1	25.4	4.5		100.0	12.5	0.0	87.5		100.0

Grand Total (All months and stations combined) = 75

DISCUSSION

A total of 62,684 fish, representing 83 species from 46 families, was caught by bottom trawl in South Carolina estuaries during the 12-month sampling period from February, 1973 through January, 1974. However, the vast majority of the total catch was comprised of but a few species. Stellifer lanceolatus (star drum) was the most abundant and with Anchoa mitchilli (bay anchovy), the second most numerous species, accounted for over one-half of the total number of fish caught during the year. These two species, along with Micropogon undulatus (Atlantic croaker) and Leiostomus xanthurus (spot), in turn made up 80.5% of the total number caught. Only 18 species were each able to contribute >0.1% of the total number of fish caught. The remaining 70 species least frequently encountered, when combined, accounted for only 2.0% of the total catch.

The six most numerous species were all sciaenids, with the exception of one engraulid, Anchoa mitchilli, which ranked second. Ranked in decreasing order of abundance, these sciaenids were: Stellifer lanceolatus > Micropogon undulatus > Leiostomus xanthurus > Cynoscion regalis (weakfish) > Bairdiella chrysura (silver perch). The low number of Menticirrhus americanus collected (Table 7) was somewhat surprising, considering the relatively greater numbers of this species collected by earlier South Carolina investigators (Bearden, 1963).

Contributions to the total catch in terms of weight were spread over a slightly larger number of species, with nine species constituting 80.6% of the total catch by weight. Fourteen species each contributed >1.0% of the total catch biomass.

Except for Ictalurus catus (white catfish), the six most abundant species by weight were once again sciaenids. Ranked in decreasing order of abundance, these sciaenids were: Stellifer lanceolatus > Micropogon undulatus > Leiostomus xanthurus > Bairdiella chrysura > Cynoscion regalis. Because it is small even as an adult, Anchoa mitchilli, though numerous, contributed only 3.5% of the total catch biomass.

Many of the most common species were present during much, or all, of the year, but displayed seasonal variations in abundance. For Stellifer lanceolatus, our length-frequency data (Table 9) indicate that both young and adults were present in South Carolina estuaries during the summer spawning season. For the remaining four common sciaenids, changes in seasonal abundance were more dramatic and in all cases were influenced by migrations to offshore waters for spawning. Two of these sciaenids were fall-winter spawners and two were spring-summer spawners. Thus, Micropogon undulatus (a fall-winter spawner) was present primarily from April to October, followed by offshore migration from November to March, with earliest recruitment of young-of-the-year into bottom trawl catches occurring in January at a total length of about 20 mm. Leiostomus xanthurus was most abundant in the estuaries from April to August, with movement offshore beginning in September for winter spawning, followed by return of new recruits probably in February and March. These young-of-the-year spot first became vulnerable to our bottom trawls upon assuming a benthic mode in April at total lengths of 18 - 42 mm. After spring-summer spawning, Cynoscion regalis was most abundant during midsummer to fall, with migration offshore beginning in late fall, followed by return to the coastal nursery grounds in spring. Recruitment of progeny, as reflected in bottom trawl catches, followed in June at total lengths of 23 - 52 mm. Bairdiella chrysura, a late spring-early summer spawner,

was most abundant from late summer to January with first recruitment into trawl catches during July at total lengths of 33 - 87 mm.

Seasonal distribution patterns varied considerably among the remaining three most common species. Anchoa mitchilli was present throughout the year, with recruitment of young-of-the-year into bottom trawls beginning in July at a total length of about 20 mm. Ictalurus catus was the most residential of the frequently-occurring species and was present throughout the year, with recruitment into trawl catches in July at total lengths of 28 - 67 mm. Urophycis regius (spotted hake) exhibited one of the most dramatic seasonal patterns, being present in reasonable numbers from February to May but abruptly disappearing before June and presumably remaining in deeper waters outside South Carolina estuaries through December. Recruitment of young-of-the-year for this gadid was first observed in January at a total length of about 65 mm.

Times of recruitment and total lengths at which these new recruits first appeared were based throughout this report on vulnerability to capture by the 2.5-cm (1-inch) stretch mesh bottom trawls. Therefore, for most species utilizing South Carolina estuaries as nursery grounds, planktonic larval and postlarval stages were probably present from several weeks to as much as two months prior to appearance of the new recruits in the trawl catches.

Of the three rivers sampled intensively, the North Edisto system exhibited the greatest diversity, with 62 species caught during the year. The benthic fish community in the North Edisto was dominated numerically by Stellifer lanceolatus, followed by an Anchoa mitchilli - Leiostomus xanthurus - Micropogon undulatus assemblage. The gadid Urophycis regius, the sciaenids Cynoscion regalis and Bairdiella chrysura, and the

cynoglossid Symphurus plagiusa (blackcheek tonguefish) also occurred frequently.

The benthic fish community in the South Edisto River was represented by 47 species. Bottom waters again were dominated numerically by Stellifer lanceolatus, followed by a Micropogon undulatus - Ictalurus catus - Anchoa mitchilli assemblage. Chloroscombrus chrysurus (Atlantic bumper), Urophycis regius, Cynoscion regalis, Leiostomus xanthurus, Trinectes maculatus (hogchoker), Symphurus plagiusa, and Bairdiella chrysura also occurred often.

The benthic fish community in the Cooper River was represented by 57 species. In terms of numerical abundance, bottom waters were dominated almost equally by Stellifer lanceolatus and Micropogon undulatus, followed by an Anchoa mitchilli - Brevoortia tyrannus (Atlantic menhaden) - Urophycis regius assemblage (replacing the supporting sciaenid assemblage found in the North Edisto River). Cynoscion regalis and Leiostomus xanthurus, along with Alosa aestivalis (blueback herring), Ictalurus catus, Dorosoma petenense (threadfin shad), and Bairdiella chrysura, also were common.

Stations were selected to indicate present conditions of benthic ichthyofauna in the major estuaries of South Carolina. These estuaries generally fall into one of two groups: those with source waters originating well above the fall-line and those represented by coastal plain rivers. The former rivers, such as the South Edisto and Cooper, are subject to spring freshets and floods and carry heavy sediment loads. The latter, such as the North Edisto River, as a rule do not experience large variations in freshwater discharge and do not contain large quantities of suspended sediments.

The North Edisto was selected for intensive trawling because this river is an excellent example of a high-salinity estuary, characteristically mixo-polyhaline (Venice System, 1958). Although this water course has no major freshwater inflow, a large area of intermediate salinities is present. This estuary is relatively pristine and contains large shrimp nursery grounds and many oyster leases. The river has minor connections with the South Edisto. Stations were selected to represent areas in both the main trunk of the river and its tributaries.

The South Edisto was selected for intensive trawling because this river is adjacent to the North Edisto but, unlike the North Edisto, it has a large drainage basin responsible for considerable freshwater inflow. As a result the South Edisto, in contrast to the North Edisto, provides for study an excellent example of a low-salinity estuary, with the upper half characteristically mixo-oligohaline and the seaward half mixo-mesohaline (Venice System, 1958). Stations were selected to represent the entire salinity gradient from the river mouth upriver to locations well above the permanent freshwater line. The South Edisto is a prime nursery ground for blue crabs, shrimp, and coastal migrant fishes (principally sciaenids and clupeids) and, like the North Edisto, remains relatively pristine.

Because both branches of the Edisto have been less affected by man's activities than many of the other major estuaries in South Carolina, data gathered during this study will provide added insight into conditions of estuarine fish populations in unpolluted coastal ecosystems and will establish base line data prior to further possible utilization of these estuaries by industries and municipalities.

The Cooper River was also selected for intensive trawling for a number of reasons. This study should provide useful base line data

for the Cooper River estuary which is experiencing continuously increasing pressure from extensive port and industrial development. These Cooper River data are also timely since the U. S. Army Corps of Engineers has proposed a plan to redivert freshwater supplied by the Santee-Cooper impoundment from the Cooper River to the Santee River to alleviate heavy silting in Charleston Harbor. This river system bisects the South Carolina coastal zone and, therefore, geographically provides a reference river for use in contrasting data from various other estuaries across the state. This mixohaline (Venice System, 1958) ecosystem provides study areas represented by (1) marine species in open water at the mouth of Charleston Harbor, (2) an estuarine community in the extensive and often fluctuating zone of intermediate salinities, and finally (3) upriver an aquatic zone above the permanent freshwater line, typified by an ictalurid - clupeid - anguillid assemblage over live bottom with submergent aquatic plants dominated by Anacharis canadensis and Ceratophyllum demersum.

Trawling during this initial study was restricted to flood stage during daylight hours in order to minimize the number of extraneous variables influencing the catch data. Additional bottom trawl studies are currently being conducted during all tide stages, day and night, at some of the same stations occupied during this investigation. These 25-hour studies are designed to provide information concerning tidal and day-night effects on bottom trawl catches in South Carolina estuaries.

The significance of sampling location siting in terms of its influence on observed versus actual species composition, relative abundance, geographic distribution, and length-frequency relationships should be considered. In field investigations such as this one, such observations are, to some extent, influenced by the locations selected for monitoring. Thus, the species found and their relative abundances

are affected by the distribution of stations which vary in salinity, water depth, bottom type and other physical, chemical, and even biological parameters. For this reason, great effort was made to select stations that would reflect the wide array of environmental conditions found in South Carolina estuaries. In those estuaries having freshwater lines, attempt was made to locate stations at the estuary mouths, at intermediate salinities, and below and above freshwater lines. Stations were located over all water depths and bottom types characteristically found in South Carolina's rivers, bays, and sounds. Two completely freshwater stations (i.e. < 0.5°/oo salinity year round) were included, one on the South Edisto (Snuggedy Swamp) and one on the Cooper River transect ("The Tee").

As with station siting, the significance of gear selectivity in terms of its effect on observed versus actual species composition should also be considered. Data in this report were limited to findings from bottom trawling. As a result, these data have emphasis placed on benthic fishes, particularly the sciaenids, and not on pelagic species, most notably the clupeids and engraulids. During the South Carolina Estuarine Survey Program, midwater trawl tows were also conducted during all seasons at North and South Edisto and Cooper River stations. If midwater catch data had been included in this report, its influence would have been appreciable on that portion of the results in which species were ranked in decreasing order of abundance statewide and individually in the North Edisto, South Edisto, and Cooper Rivers. For example, Stellifer lanceolatus was ranked statewide as the most abundant estuarine fish species based on these bottom trawl data, followed by

Anchoa mitchilli. However, in midwater trawls at these same stations, Anchoa mitchilli dominated heavily while Stellifer lanceolatus, characteristically a bottom-dweller (Hildebrand and Cable, 1934) was noticeably absent. If rankings were based on composite bottom and midwater catch data, Anchoa mitchilli would displace Stellifer lanceolatus as the most common estuarine fish species collected during the year.

For the same reason several other pelagic species common to South Carolina have been treated superficially in this presentation. However, more detailed discussions are available elsewhere, particularly for the state's anadromous fish stocks composed primarily of Alosa aestivalis (blueback herring), Alosa sapidissima (American shad), Alosa mediocris (hickory shad), and Morone saxatilis (striped bass) (Curtis, 1971; 1972).

In addition, some fish species known to frequent South Carolina estuaries were either caught infrequently or did not appear at all during this study. No seining was conducted along beaches or shallow littoral zones of rivers, and no collections were made in small creeks. Thus many groups, such as cyprinids, atherinids, mugilids, blenniids, and gobiids, are reported in disproportionately low numbers. Some information is available elsewhere on species common to South Carolina beaches and areas immediately adjacent to marshes (Cupka, 1972) and on species frequenting some small creeks (Turner and Johnson, 1974).

Since this investigation is a result of an estuarine research program, no trawl sampling was conducted offshore. Had such sampling been included, the overall species composition described in this report could have been altered appreciably. Some information on species common to South Carolina offshore areas is available elsewhere (Struhsaker, 1969; Bearden and McKenzie, 1971). Also a number of the relatively

common game species such as Pogonias cromis (black drum), Cynoscion nebulosus (spotted seatrout), Sciaenops ocellatus (red drum), Pomatomus saltatrix (bluefish), Elops saurus (ladyfish), and Archosargus probatocephalus (sheepshead), which frequent South Carolina estuaries, were not taken in large numbers because of their habitat preferences as well as their mobility as adults.

The reader should keep several additional points in mind when reviewing these data. While the majority of the South Carolina coastal zone was covered in this study, no sampling was conducted north of Winyah Bay. Some data on fish species inhabiting this northernmost portion of the state are available elsewhere (Cupka, 1972). The length-frequency tables were based on statewide cruises (i.e. data from 33 stations) during April, July, and October, 1973 and January, 1974 and on monthly cruises (i.e. data from 17 stations) encompassing the North and South Edisto and Cooper Rivers during remaining months. Therefore, conclusions concerning changes in relative abundances from month to month should not be drawn directly from the length-frequency tables. For this type information, the reader should consult instead the tables presenting numbers for each fish species occurring monthly and quarterly at stations in each estuary. Also, these results are limited to a single annual cycle, during which meteorological conditions at times fluctuated atypically. Just prior to the start of cruises in February, 1973, South Carolina coastal counties recorded the heaviest snowfalls the eastern portion of the state had experienced for the past several decades. Consequent freshwater runoff during spring, 1973, along with heavy rains in early summer (June), undoubtedly influenced estuarine hydrography and in turn, distribution and movements of fish populations during the first

six months of this study. Also, during the final quarter (Winter, 1973 - 1974) unusually mild temperatures prevailed. Thus, the results may not reflect in every case the anticipated length-frequency, relative abundance, and distribution patterns generally exhibited by fish populations common to South Carolina estuaries. For this reason, these studies are being continued over a number of additional annual cycles. The initial data are presented at this time to provide a base to which future information can be added.

The bottom salinity range over which each species was found (Table 8) provides an approximate expression of the steno- or euryhaline nature of that species in South Carolina estuaries. However, single "strays" transported to atypical habitats can greatly extend the salinity ranges reported (Table 8), and these exceptions do not necessarily reflect the salinity range preferred by the majority of that population. On the other hand, the ranges as reported do offer minimum estimates of salinity extremes that can be physiologically tolerated, at least for short periods, by many of the fish species utilizing South Carolina estuarine habitat during all or portions of their life cycles.

With few exceptions, the 23 most common species were all able to at least enter the North and South Edisto and Cooper River estuaries. However, some species were limited to the river mouths (strictly marine forms) or to stations considerably upriver (strictly freshwater species). Interesting exceptions were Dorosoma petenense (threadfin shad) and Peprilus alepidotus (harvestfish), neither of which occurred in any South Edisto catches, and Larimus fasciatus (banded drum), which was never caught at any Cooper River station, including the mouth of Charleston Harbor.

However, the differences in salinity regimes between the North Edisto (high salinity only), the South Edisto, and Cooper Rivers apparently influenced considerably the extent to which various benthic fish species were able to penetrate each of these estuaries. For example, Anchoa mitchilli and Cynoscion regalis were both widely distributed at all stations in the North Edisto (Tables 18 and 33), but in the South Edisto and Cooper Rivers their numbers decreased with increasing distance inland (Tables 19, 20, 34, and 35). Two other common species, Stellifer lanceolatus and Leiostomus xanthurus, also frequented the entire North Edisto estuary (Tables 11 and 28) but were unable to penetrate the freshwater lines on either the South Edisto or Cooper Rivers (Tables 13, 15, 29, and 30).

Urophycis regius was the most stenohaline of the frequently-encountered marine species and occurred only in high salinities. This species was widely distributed in the North Edisto (Table 48) but was unable to penetrate further inland than the mouths of the South Edisto and Cooper Rivers (Tables 49 and 50). Ictalurus catus occupied the opposite salinity extreme. This catfish was absent from the North Edisto, with the exception of a single individual caught at one station upriver (Table 43). In the South Edisto and Cooper Rivers, however, the species was able to occupy stations from freshwater seaward to within a few miles of the estuary mouths (Tables 44 and 45).

The relatively small, fine-mesh bottom trawls were geared generally toward capture of small fish. As a result, for species having life cycles of three or more years, the portions of population structures represented by older, and subsequently larger, fish often are not evident on most of the length-frequency tables presented (e.g. Cynoscion regalis).

Absence of older fish from the trawl catches could not always be attributed to migrations from the estuaries. The absence of large adult fish in the catches during some portions of the year (e.g. Leiostomus xanthurus) was probably due, at least in part, to avoidance of, or escapement from, the small 6-m (20-ft) trawl. Also, body sizes for adults of some species, especially Anchoa mitchilli, were critically close to the mesh size utilized and, at times, escapement through the mesh was observed during haul back of the trawl as the catch approached the surface.

Length-frequency, relative abundance, and seasonal distribution patterns obtained for most species generally compare favorably with results obtained in earlier estuarine studies in the Carolinas and Georgia (Welsh and Breder, 1923; Hildebrand and Cable, 1930; 1934; 1938; Carlander, 1969; Miller and Jorgenson, 1969; Struhsaker, 1969; Dahlberg and Odum, 1970; Dahlberg, 1971; Hoese, 1973). Data which varied appreciably from earlier findings were so noted in the treatment of results for each species.

SUMMARY

In February, 1973 the South Carolina Wildlife and Marine Resources Department initiated a major statewide estuarine research program. This "Environmental Base Line Study of South Carolina Estuaries" has as broad objectives the determination of basic biological, chemical, and physical characteristics of the major estuaries of South Carolina, the seasonal changes in these characteristics and their interactions over a several-year period.

This report presents data on relative abundance, seasonal distribution, and length-frequency relationships for 88 fish species captured by bottom trawl in South Carolina estuaries during the 12-month period from February, 1973 through January, 1974.

Thirty-three stations were occupied statewide on a quarterly basis. Seventeen of these stations also were occupied monthly in the North and South Edisto and Cooper Rivers. All trawling was accomplished with the R/V ANITA, a 16-m (52-ft) shallow-draft vessel rigged as a stern trawler. Twenty-minute tows were made against flood tide during daylight with 6-m (20-ft) semiballoon otter trawls, 2.5-cm (1-inch) stretch mesh.

Tables summarizing the entire year's catch statewide are presented, including all species, their rankings in order of abundance by total numbers and weights, and the percent of the total number and weight contributed to the year's catch by each species. Similar tables are presented for the North Edisto, South Edisto, and Cooper Rivers individually and species rankings between these three estuaries sampled intensively are compared.

Total length ranges, bottom temperature and salinity ranges, and primary locations at which each species occurred are also reported.

For the eight most common fishes, numbers caught throughout the year are individually reported by species, presenting catch per month at each station in each estuary or coastal region of the state.

For an additional 15 fishes collected in moderate abundance, numbers caught throughout the year are individually reported by species, presenting catch per month with data for all stations combined within each estuary or coastal region of the state.

Length-frequency relationships are also described for the 23 fish species most commonly captured by bottom trawl. For each of these species a single table is presented combining length-frequency data for all stations across the South Carolina coastal zone.

Available literature on length-frequency relationships and seasonal abundance and distribution for the benthic fish species most commonly encountered in South Carolina estuaries is reviewed briefly.

A total of 62,684 fish, representing 88 species from 46 families, was caught by bottom trawl in South Carolina estuaries during the 12-month sampling period. However, the vast majority of the total catch was comprised of but a few species. Stellifer lanceolatus was most abundant and, with Anchoa mitchilli (the second most numerous species), accounted for over one-half of the total number of fish caught during the year. These two species, along with Micropogon undulatus and Leiostomus xanthurus, in turn made up 80.5% of the total number caught. Only 18 species were each able to contribute > 0.1% of the total number of fish caught. The remaining 70 species least frequently encountered, when combined, accounted for only 2.0% of the total number.

The six most numerous species were all sciaenids, with the exception of one engraulid, Anchoa mitchilli, which ranked second. Ranked

in decreasing order of abundance, these sciaenids were: Stellifer lanceolatus > Micropogon undulatus > Leiostomus xanthurus > Cynoscion regalis > Bairdiella chrysura.

Contributions to the total catch in terms of weight were spread over a slightly larger number of species, with nine species constituting 80.6% of the total catch by weight. Fourteen species each contributed > 1.0% of the total catch biomass.

Except for Ictalurus catus, the six most abundant species by weight were once again sciaenids. Ranked in decreasing order of abundance, these sciaenids were: Stellifer lanceolatus > Micropogon undulatus > Leiostomus xanthurus > Bairdiella chrysura > Cynoscion regalis. Because it is small even as an adult, Anchoa mitchilli, though numerous, contributed only 3.5% of the total catch biomass.

Of the three rivers sampled intensively, the North Edisto system exhibited the greatest diversity, with 62 species collected by bottom trawl during the year. The benthic fish community in the North Edisto was dominated by Stellifer lanceolatus, followed by an Anchoa mitchilli - Leiostomus xanthurus - Micropogon undulatus assemblage. The gadid Urophycis regius, the sciaenids Cynoscion regalis and Bairdiella chrysura, and the cynoglossid Symphurus plagiusa also occurred frequently.

The benthic fish community in the South Edisto River was represented by 47 species. Bottom waters were again dominated by Stellifer lanceolatus, followed by a Micropogon undulatus - Ictalurus catus - Anchoa mitchilli assemblage. Chloroscombrus chrysurus, Urophycis regius, Cynoscion regalis, Leiostomus xanthurus, Trinectes maculatus, Symphurus plagiusa, and Bairdiella chrysura also occurred often.

The benthic fish community in the Cooper River was represented by 57 species. Bottom waters were dominated almost equally by Stellifer lanceolatus and Micropogon undulatus, followed by an Anchoa mitchilli - Brevoortia tyrannus - Urophycis regius assemblage (replacing the supporting sciaenid assemblage found in the North Edisto River). Cynoscion regalis and Leiostomus xanthurus, along with Alosa aestivalis, Ictalurus catus, Dorosoma petenense, and Bairdiella chrysura also were common.

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