SEAMAP-SA

RESULTS OF TRAWLING EFFORTS IN THE COASTAL HABITAT OF THE SOUTH ATLANTIC BIGHT, 2002

Prepared By

SEAMAP - SA Shallow Water Trawl Survey

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INTRODUCTION

The Southeast Area Monitoring and Assessment Program - South Atlantic (SEAMAP-SA) Shallow Water Trawl Survey, funded by the National Marine Fisheries Service (NMFS) and conducted by the South Carolina Department of Natural Resources - Marine Resources Division (SCDNR-MRD), began in 1986. This survey provides long-term, fishery-independent data on seasonal abundance and biomass of all finfish, elasmobranchs, decapod and stomatopod crustaceans, sea turtles, horseshoe crabs, and cephalopods that are accessible by high-rise trawls. Additional data recorded for priority species include measurements of length or width for all priority species, sex and individual weights for sharks, sea turtles, and horseshoe crabs, and reproductive information on commercially important penaeid shrimp and blue crabs. Otolith and gonad samples were taken from three species of priority finfish.

Field data collected by the SEAMAP-SA Shallow Water Trawl Survey are available to users within a few weeks of collection. SEAMAP-SA trawl data collected from 1986 to the present are now available through the SEAMAP-SA Data Management Office at NMFS[1]. Management agencies and scientists currently have access to thirteen years (1990-2002) of comparable trawl data from near-shore coastal areas of the South Atlantic Bight.

This report summarizes information on species composition, abundance, and biomass from SEAMAP-SA trawls. Length-frequency distributions of commercially and ecologically important priority species, along with reproductive attributes of the commercially important penaeid species and ageing and maturity of selected sciaenids, are presented.

[1]Data are available through the SEAMAP Data Manager (NMFS Mississippi Laboratory, P.O. Box 1207, Pascagoula, MS 39568-1207).

Data Collection

Samples were taken by trawl from the coastal zone of the South Atlantic Bight (SAB) between Cape Hatteras, North Carolina, and Cape Canaveral, Florida (Figure 1). Multi-legged cruises were conducted in spring (early April - mid-May), summer (mid-July - early August), and fall (October - mid-November).

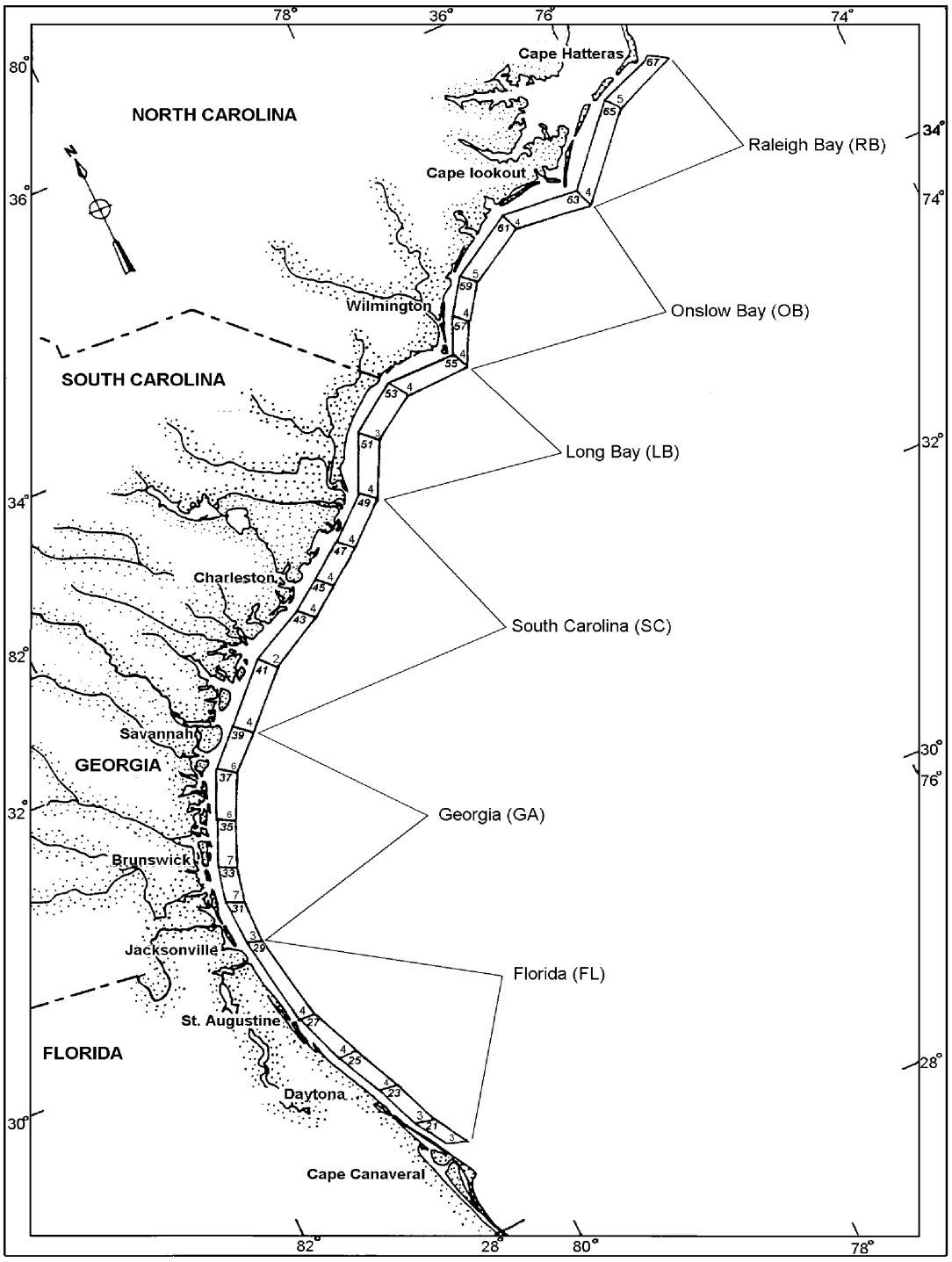

Figure 1. Strata sampled by the SEAMAP-SA Shallow Water Trawl Survey in 2002. Stratum number in indicated at the top of each rectangle and number of trawls towed is located in the lower portion of each stratum. (Strata are not drawn to scale.)

Stations were randomly selected from a pool of stations within each stratum. The number of stations sampled in each stratum was determined by optimal allocation. A total of 102 stations were sampled each season within twenty-four shallow water strata (Table 1), representing an increase from 78 stations previously sampled in those strata by the trawl survey (1990-2000). Strata were delineated by the 4 m depth contour inshore and the 10 m depth contour offshore. In previous years, stations were sampled in deeper strata with station depths ranging from 10 to 19 m in order to gather data on the reproductive condition of commercial penaeid shrimp. Those strata were abandoned in 2001 in order to intensify sampling in the more shallow depth-zone.

The R/V *Lady Lisa*, a 75-ft (23-m) wooden-hulled, double-rigged, St. Augustine shrimp trawler owned and operated by the South Carolina Department of Natural Resources (SCDNR), was used to tow paired 75-ft (22.9-m) mongoose-type Falcon trawl nets (manufactured by Beaufort Marine Supply; Beaufort, S.C.) without TED's. The body of the trawl was constructed of #15 twine with 1.875-in (47.6-mm) stretch mesh. The cod end of the net was constructed of #30 twine with 1.625-in (41.3-mm) stretch mesh and was protected by chafing gear of #84 twine with 4-in (10-cm) stretch "scallop" mesh. A 300 ft (91.4-m) three-lead bridle was attached to each of a pair of wooden chain doors which measured 10 ft x 40 in (3.0-m x 1.0-m), and to a tongue centered on the head-rope. The 86-ft (26.3-m) head-rope, excluding the tongue, had one large (60-cm) Norwegian "polyball" float attached top center of the net between the end of the tongue and the tongue bridle cable and two 9-in (22.3-cm) PVC foam floats located one-quarter of the distance from each end of the net webbing. A 1-ft chain drop-back was used to attach the 89-ft foot-rope to the trawl door. A 0.25-in (0.6-cm) tickler chain, which was 3.0-ft (0.9-m) shorter than the combined length of the foot-rope and drop-back, was connected to the door alongside the foot-rope.

Trawls were towed for twenty minutes, excluding wire-out and haul-back time, exclusively during daylight hours (1 hour after sunrise to 1 hour before sunset). Contents of each net were sorted separately to species, and total biomass and number of individuals were recorded for all species of finfish, elasmobranchs, decapod and stomatopod crustaceans, cephalopods, sea turtles, xiphosurans, and cannonball jellies. Only total biomass was recorded for all other miscellaneous invertebrates (excluding cannonball jellies) and algae, which were treated as two separate taxonomic groups.

Where large numbers of individuals of a species occurred in a collection, the entire catch was sorted and all individuals of that species were weighed, but only a randomly selected subsample was processed and total number was calculated. For trawl catches where visual estimation of weight of total catch per trawl exceeded 500 kg, the contents of each net were weighed prior to sorting and a randomly chosen subsample of the total catch was then sorted and processed.

In every collection, each of the priority species was weighed collectively and individuals were measured to the nearest centimeter (Appendix 1). For large collections of the priority species, a random subsample consisting of thirty to fifty individuals was weighed and measured. Depending on the species, measurements were recorded as total length, fork length, or carapace width.

Additional data were collected on individual specimens of penaeid shrimp (total length in mm, sex, female ovarian development, male spermatophore development, occurrence of mated females), blue crabs (carapace width in mm, individual weight, sex, presence and developmental stage of eggs), sharks (total and fork lengths in cm, individual weight, sex), horseshoe crabs (prosoma width and length in mm, individual weight, sex), and sea turtles (curved and straight lengths and widths in cm, individual weight, PIT and flipper tag numbers). Marine turtles were released in good condition according to NMFS permitting guidelines.

Gonad and otolith specimens were also collected during seasonal cruises. A representative sample of specimens from each centimeter size range within each stratum were measured to the nearest mm (TL and SL), weighed to the nearest gram, and assigned a sex and maturity code (Wenner et al., 1986). Sagittal otoliths and a representative series of gonadal tissue were removed, preserved, and transported to the laboratory at MRRI, where samples were processed (Walton, 1996). Results of data collected from specimens of *Cynoscion regalis, Menticirrhus americanus,* and *Micropogonias undulatus* are presented in this report.

Hydrographic data collected at each station included surface and bottom temperature and salinity measurements taken with a Seabird SBE-19 CTD profiler, sampling depth, and an estimate of wave height. Additionally, atmospheric data on air temperature, barometric pressure, precipitation, and wind speed and direction were also noted at each station.

Data Analysis

The SAB was separated into six regions for data analysis (Figure 1). Raleigh Bay (RB), Onslow Bay (OB) and Long Bay (LB) were each considered to be regions. South Carolina, excluding Long Bay (SC), Georgia (GA), and northern Florida (FL) were also treated as separate regions.

Data from the paired trawls were pooled for analysis to form a standard unit of effort (tow). In an effort to reduce the variability of the data, the method of allocating the number of stations within each stratum was changed from proportional allocation to optimal allocation (Thompson, 1992). The coefficient of variation (CV), expressed as a proportion, was used to compare relative amounts of variation in abundance among years and among species (Sokal and Rohlf, 1981). Density estimates, expressed as number of individuals or kilograms per hectare (ha), were standardized by dividing the mean catch per tow by the mean area (ha) swept by the combined trawls. Mean area swept by a net was calculated by multiplying the width of the net opening (13.5 m), as determined by Stender and Barans (1994), by the distance (m) trawled and dividing the product by 10,000 m^2/ha.

Results for priority species are presented and discussed individually in this report. Statistically significant differences in lengths of individuals among seasons and regions were determined using the non-parametric Kruskal-Wallis test (Sokal and Rohlf, 1981). Size differences among shark genders were determined to be statistically different with the non-parametric Wilcoxon test. Contingency tables using the G-statistic were used to determine if occurrence of ripe penaeid shrimp were independent of season and region.

Seasonal age-length keys for *Cynoscion regalis, Menticirrhus americanus,* and *Micropogonias undulatus* (Appendix 2) were generated and applied to expanded seasonal length-frequencies to determine the age composition of those species in SEAMAP-SA trawl samples.

RESULTS AND DISCUSSION

Hydrographic Measurements

Hydrographic patterns of temperature and salinity in the SAB are driven by four major influences which fluctuate seasonally: river run-off, the Gulf Stream, a southerly flowing coastal current, and atmospheric conditions. The warm, highly saline waters of the Gulf Stream, in close proximity to coastal waters off Florida and in Raleigh Bay, elevate temperatures and salinities in those areas (Pietrafesa et al., 1985). Most of the river run-off in the SAB occurs south of Cape Fear (Blanton and Atkinson, 1983; McClain et al., 1988). Water of lower salinity created by freshwater influx is pushed southward by the southerly flowing coastal current; however, this movement is impeded by the northerly flowing Gulf Stream off northern Florida (Blanton, 1981; Blanton and Atkinson, 1983). The result of this process is a concentration of lower salinity water off southern South Carolina and Georgia. Seasonal fluctuations in river run-off, atmospheric conditions, and migrations of the Gulf Stream dictate the magnitudes of these hydrographic patterns.

Typical seasonal and regional patterns of temperature and salinity were observed during the 2002 survey (Table 1), despite drought conditions in many areas of the SAB during summer 2002. Both annual and seasonal mean temperatures and mean salinities were slightly higher than the estimates calculated for 1990-1999 (SEAMAP-SA/SCMRD, 2000).

Table 1. Seasonal mean bottom temperatures (°C) and salinities (‰) from each region for 2002. Regions are abbreviated as follows: Raleigh Bay (RB), Onslow Bay (OB), Long Bay (LB), South Carolina (SC), Georgia (GA), and Florida (FL).

	RB	OB	LB	SC	GA	FL	ALL REGIONS
SPRING							
$\bar{x}$ Temperature	19.7	17.6	20.7	22.4	21.7	23.8	21.2
$\bar{x}$ Salinity	36.3	34.2	36.0	35.2	34.7	36.0	35.2
SUMMER							
$\bar{x}$ Temperature	24.5	27.8	28.2	29.3	28.8	24.3	27.5
$\bar{x}$ Salinity	36.5	35.8	35.4	34.9	35.5	36.4	35.7
FALL							
$\bar{x}$ Temperature	21.1	21.8	19.7	22.2	25.5	28.3	23.8
$\bar{x}$ Salinity	32.0	34.8	34.9	34.1	33.1	35.8	34.1
ALL SEASONS							
$\bar{x}$ Temperature	21.8	22.4	22.9	24.6	25.3	25.5	24.2
$\bar{x}$ Salinity	34.9	34.9	35.5	34.7	34.5	36.0	35.0

Species Composition

The 2002 sampling effort resulted in the collection of 171 species (Appendix 3). Trawls produced 111 species of finfish, 25 species of elasmobranchs, 32 species of decapod crustaceans, 2 species of stomatopod crustaceans, 3 genera of cephalopods, 2 species of marine turtles, and one species of xiphosuran.

The number of species collected varied seasonally (Table 2), with greatest diversity from trawls towed in spring. Summer, the season of peak abundance, produced the fewest species. Regionally, the greatest number of species was found in Onslow Bay and in waters off Georgia, whereas the lowest number of species was taken in Raleigh Bay.

Table 2. Summary of effort (number of trawl tows), diversity (number of species), abundance (number of individuals), biomass (kg), density of individuals (number/ha), and density of biomass (kg/ha), excluding miscellaneous invertebrates, cannonball jellies, and algae, by region and season.

	Effort	Diversity	Abundance		Density	
	(Tows)	(Species)	Individuals	Biomass	Individuals	Biomass
Region						
RALEIGH BAY	27	95	37279	6069.4	387.3	63.5
ONSLOW BAY	51	125	97535	6911.4	515.2	36.5
LONG BAY	33	110	28963	3849.2	240.2	31.9
S. CAROLINA	54	106	49479	3349.0	245.3	16.6
GEORGIA	87	124	50425	3232.4	159.3	10.2
FLORIDA	54	111	52227	4240.3	258.0	20.9
Season						
SPRING	102	139	104331	10668.2	279.9	28.6
SUMMER	102	116	112163	7178.0	295.0	18.9
FALL	102	135	99414	9805.5	265.9	26.2

Abundance, Biomass, and Density Estimates

The 2002 SEAMAP-South Atlantic Shallow Water Trawl Survey caught 315,908 individuals (CV=2.8; 1032 individuals/tow), with a biomass of 27,653 kg (90.4 kg/tow). Miscellaneous invertebrates, cannonball jellies, and algae contributed an additional 23,620 kg of biomass. The overall density of individuals (267 individuals/ha) in 2002 (excluding cannonball jellies) represents a decrease in abundance since 2001 (Figure 2). This decrease in abundance was accompanied by a decrease in variability.

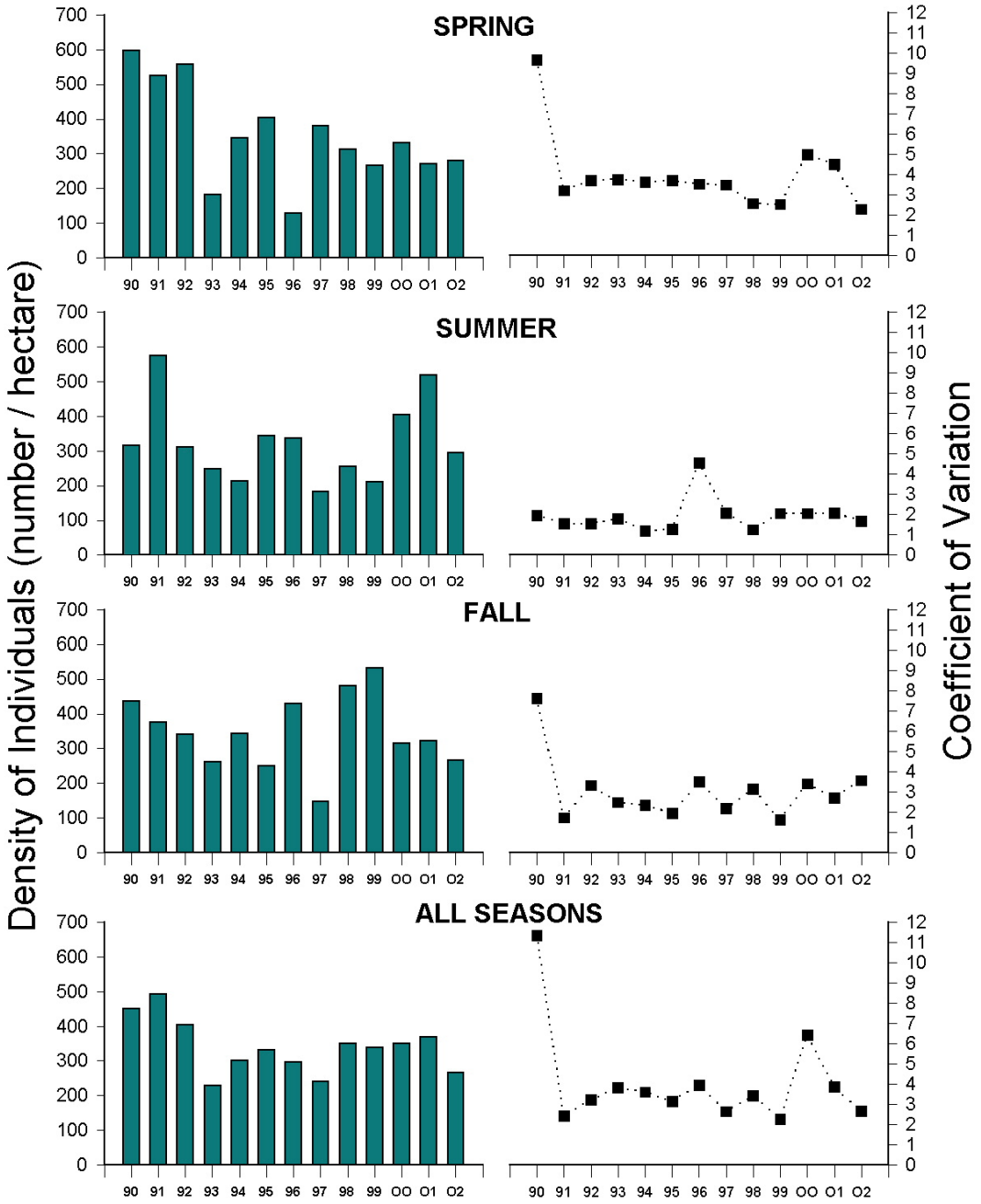

Figure 2. Annual and seasonal densities of abundance from inner strata.

In 2002, densities of individuals were highest in summer (Figure 2), whereas densities of biomass peaked in spring collections (Table 2). The highest regional density of individuals occurred in Onslow Bay, reflecting relatively large catches of sciaenids, whereas the highest density of biomass was observed in Raleigh Bay, the result of high abundance of the bullnose ray, *Myliobatis freminvillei*. Georgia had the lowest densities of individuals and biomass, whereas density of the cannonball jelly was greatest in that region.

Historically, patterns of abundance in the SAB generally reflect the abundance of two members of the sciaenid family, the spot, *Leiostomus xanthurus*, and the Atlantic croaker, *Micropogonias undulatus,* which have been consistent in their numerical dominance among years. These two species constituted approximately 24% of the total catch during the 2002 survey. The Atlantic croaker, *Micropogonias undulatus* was the most abundant species, followed by *Stenotomus* sp. and the spot, *Leiostomus xanthurus.* The white shrimp, *Litopenaeus setiferus,* ranked eighth overall and was the most abundant decapod crustacean collected, followed by the spider crab, *Libinia dubia* (Appendix 3). The Atlantic croaker, *Micropogonias undulatus,* ranked first in biomass, followed by the bullnose ray, *Myliobatis freminvillei* (Table 3).

Table 3. Regional and seasonal estimates of density of abundance (individuals/ha) and biomass (kg/ha), excluding miscellaneous invertebrates, cannonball jellies, and algae, for dominant species in 2002.

	All	Region						Season		
	Strata	**RB**	**OB**	**LB**	**SC**	**GA**	**FL**	**SPR**	**SUM**	**FAL**
Abundance										
Micropogonias undulatus	43.1	54.8	124.0	61.0	48.5	7.7	12.8	17.4	81.4	36.0
Stenotomus sp.	33.1	50.2	131.5	63.3	0.6	5.0	0.2	70.9	27.3	6.1
Leiostomus xanthurus	19.8	41.1	43.1	19.1	19.6	7.9	12.3	16.3	29.9	15.9
Chloroscombrus chrysurus	15.5	0	0.1	1.3	8.7	31.9	31.0	18.6	13.3	16.9
Lagodon rhomboides	13.9	8.7	64.0	17.2	5.7	0.2	1.2	11.1	12.4	20.3
Anchoa hepsetus	13.9	15.5	33.3	18.8	8.7	2.3	19.0	10.1	7.0	26.6
Menticirrhus americanus	10.0	38.8	5.4	3.9	9.3	7.1	12.3	6.5	8.2	16.8
Biomass										
Micropogonias undulatus	2.7	4.1	9.0	3.8	2.1	0.4	0.6	0.9	5.1	2.5
Myliobatis freminvillei	2.4	9.1	2.6	11.6	0.2	0.007	0.004	4.8	0	2.7
Caretta caretta	1.4	1.4	0.5	2.2	0.8	1.7	2.3	1.1	2.2	1.1
Stenotomus sp.	1.2	1.3	5.4	2.3	0.03	0.07	0.02	2.4	1.1	0.3
Rhinoptera bonasus	1.2	2.3	0.7	2.1	2.6	0.8	0.07	1.7	0.04	2.0
Leiostomus xanthurus	1.1	2.4	2.2	1.2	0.8	0.5	0.9	0.8	1.6	1.1
Menticirrhus americanus	1.0	4.8	0.7	0.4	0.6	0.5	1.1	0.5	0.6	1.9

Distribution and Abundance of Priority Finfish Species

Archosargus probatocephalus

The sheepshead, *Archosargus probatocephalus*, exhibited an increase in abundance in 2002. Catches of sheepshead peaked in 1992 and dropped to the lowest level in 2001 (Figure 3). Only 35 sheepshead (CV=8.5; 0.03 individuals/ha), weighing 114 kg, were taken in 2002. Sheepshead were taken only in spring and fall in 2002 and were most abundant in Raleigh Bay in spring (Table 4). Lengths ranged from 41-62 cm ($\bar{x}$ = 49.3), with larger individuals taken in spring.

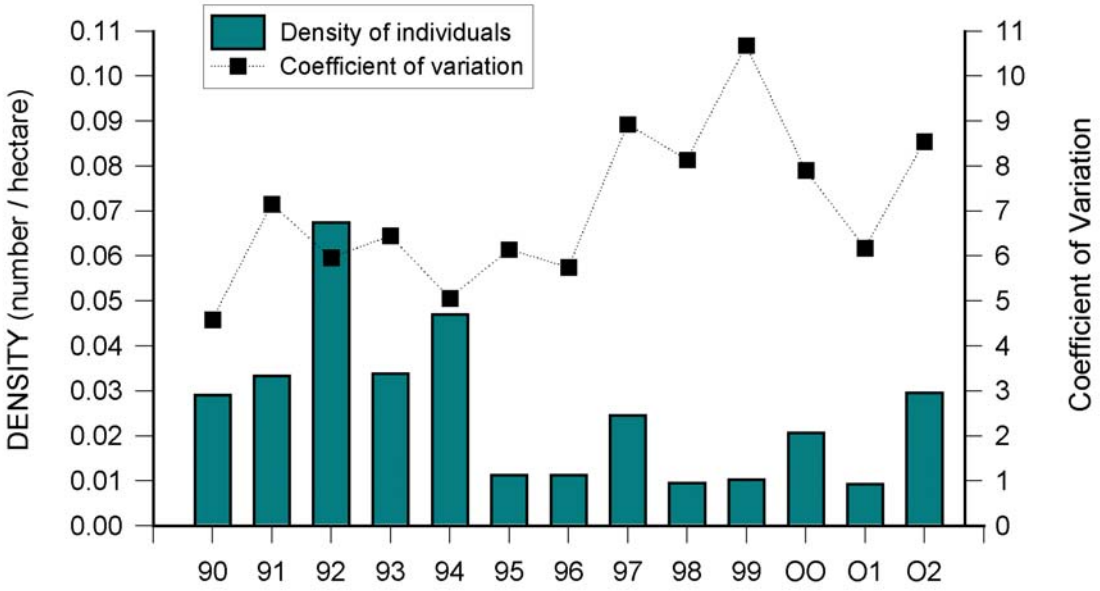

Figure 3. Annual densities of *Archosargus probatocephalus*

Table 4 . Estimates of density (number of individuals/hectare) in 2002.

Archosargus probatocephalus

	Spring	Summer	Fall	Region
Raleigh Bay	0.8	0	0	0.2
Onslow Bay	0	0	0.2	0.05
Long Bay	0.03	0	0	0.008
South Carolina	0	0	0	0
Georgia	0	0	0.01	0.003
Florida	0	0	0	0
Season	0.06	0	0.03	0.03

Brevoortia smithi

A total of only 4 yellowfin menhaden (CV=13.9; 0.003 individuals/ha), weighing 0.7 kg, were collected by the SEAMAP-SA Shallow Water Trawl Survey in 2002. Although density of individuals for this species peaked in 1991 (Figure 4), abundance of *Brevoortia smithi* is generally low in SEAMAP-SA trawl samples. In 2002, all yellowfin menhaden were caught in waters off Florida (Table 5). Fork lengths of *B. smithi* ranged from 16 to 25 cm ($\bar{x}$ = 21.5).

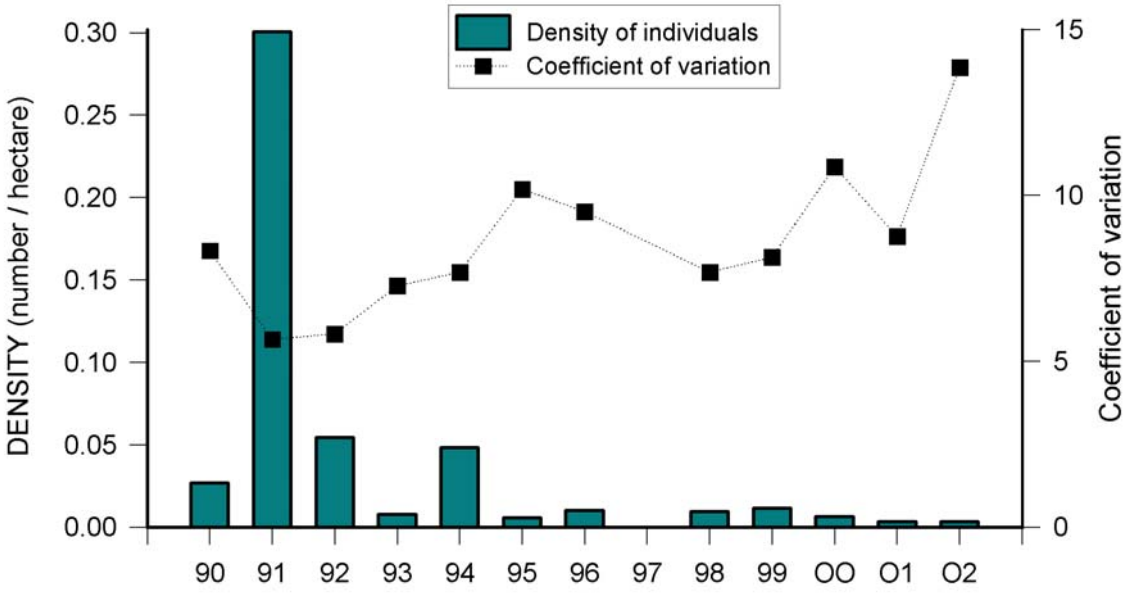

Figure 4. Annual densities of *Brevoortia smithi*

Table 5 . Estimates of density (number of individuals/hectare) in 2002.

Brevoortia smithi

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0	0
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0	0	0	0
Florida	0.05	0	0.02	0.02
Season	0.008	0	0.003	0.003

Brevoortia tyrannus

A total of 899 Atlantic menhaden (CV=10.3; 0.8 individuals/ha), weighing 37 kg (0.03 kg/ha), were taken in SEAMAP-SA trawls. Density of individuals was at the highest level in the history of the survey in 1990 (Figure 5), with much lower abundance observed during the subsequent twelve years. In 2002, density was greatest in spring and in waters off Georgia (Table 6).

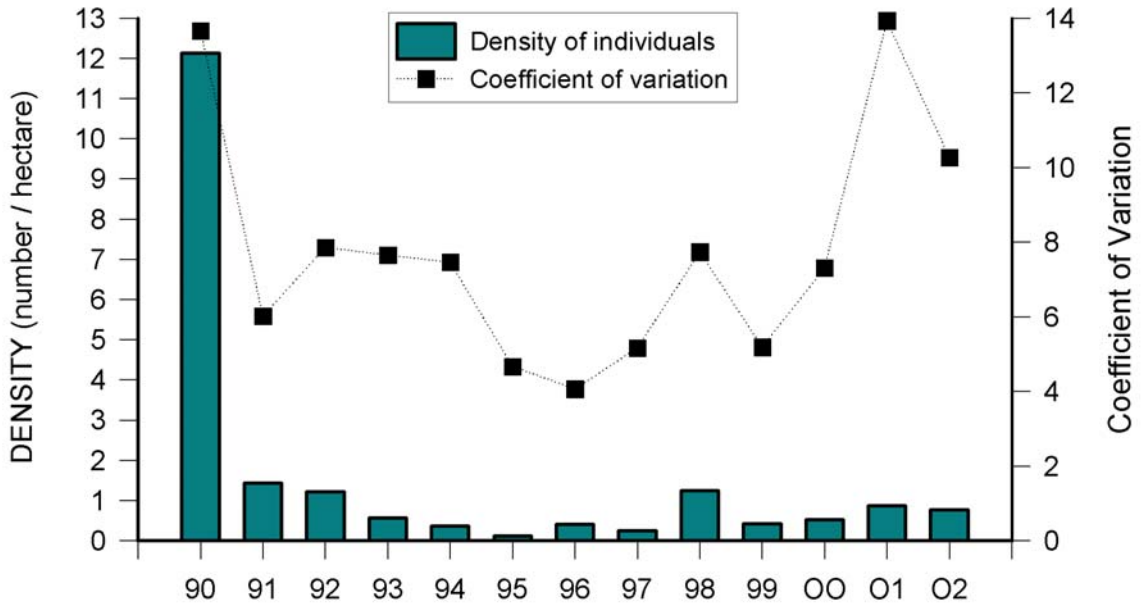

Figure 5. Annual densities of *Brevoortia tyrannus*

Table 6 . Estimates of density (number of individuals/hectare) in 2002.

Brevoortia tyrannus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0.09	0.02	0.07	0.06
Long Bay	0.2	0.8	0	0.3
South Carolina	0.8	0.1	0	0.3
Georgia	5.9	0.009	0	2.0
Florida	1.8	0.5	0.02	0.8
Season	2.2	0.2	0.01	0.8

Fork lengths of *Brevoortia tyrannus* ranged from 11 to 20 cm ($\bar{x}$ = 14.1). Length was significantly different among seasons ($X^2 = 102$, $p < 0.0001$). Mean length increased from spring to fall, an indication of juvenile growth (Figure 6). Length also varied significantly among regions ($X^2 = 267$, $p < 0.0001$). The mean length of Atlantic menhaden was greatest in collections in Onslow and Long Bays and smallest in waters off Georgia (Figure 7). The length-frequency distributions of Atlantic menhaden in the SAB were numerically dominated by individuals taken in spring when few large specimens were taken.

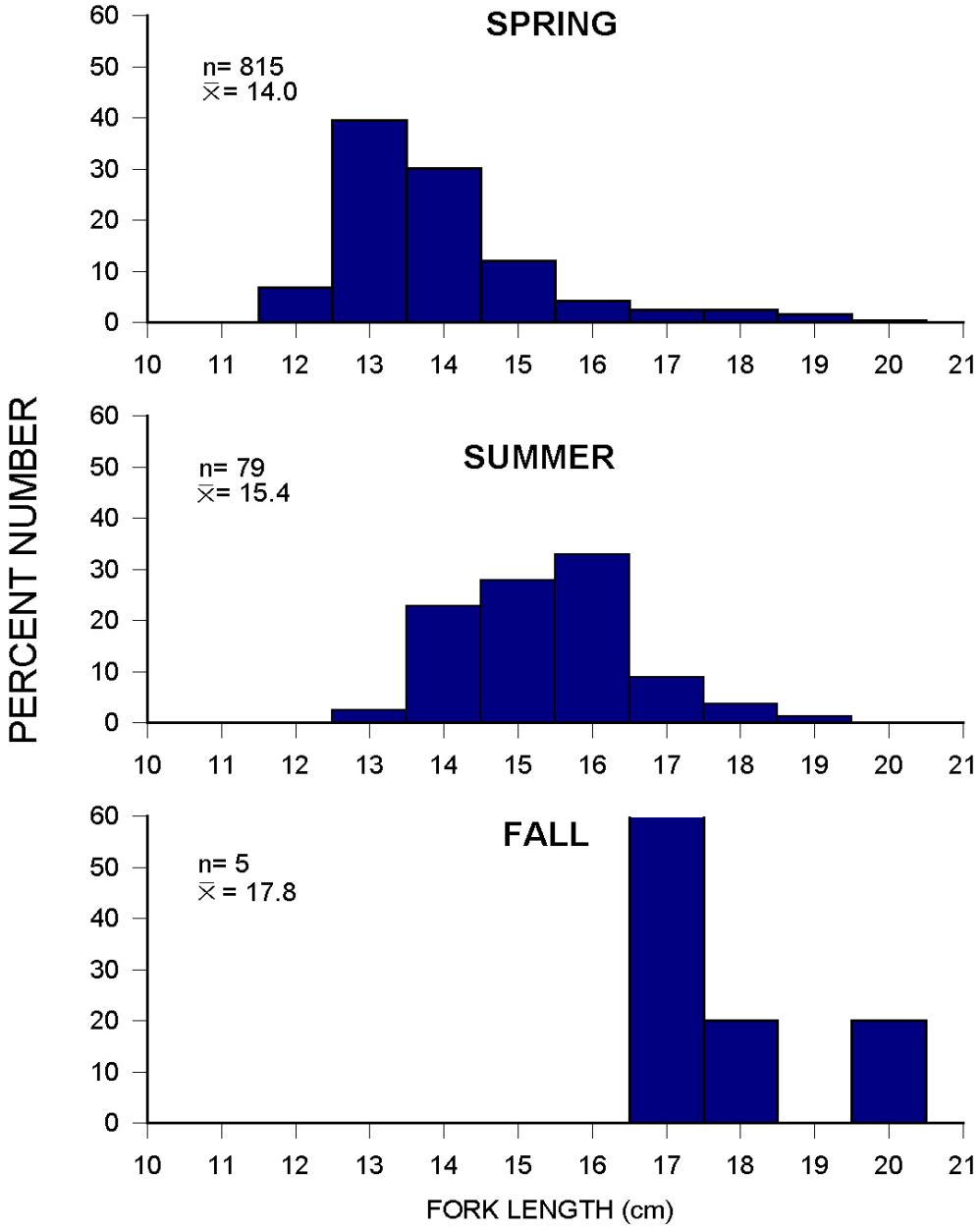

Figure 6. Seasonal length-frequencies of *Brevoortia tyrannus* in 2002.

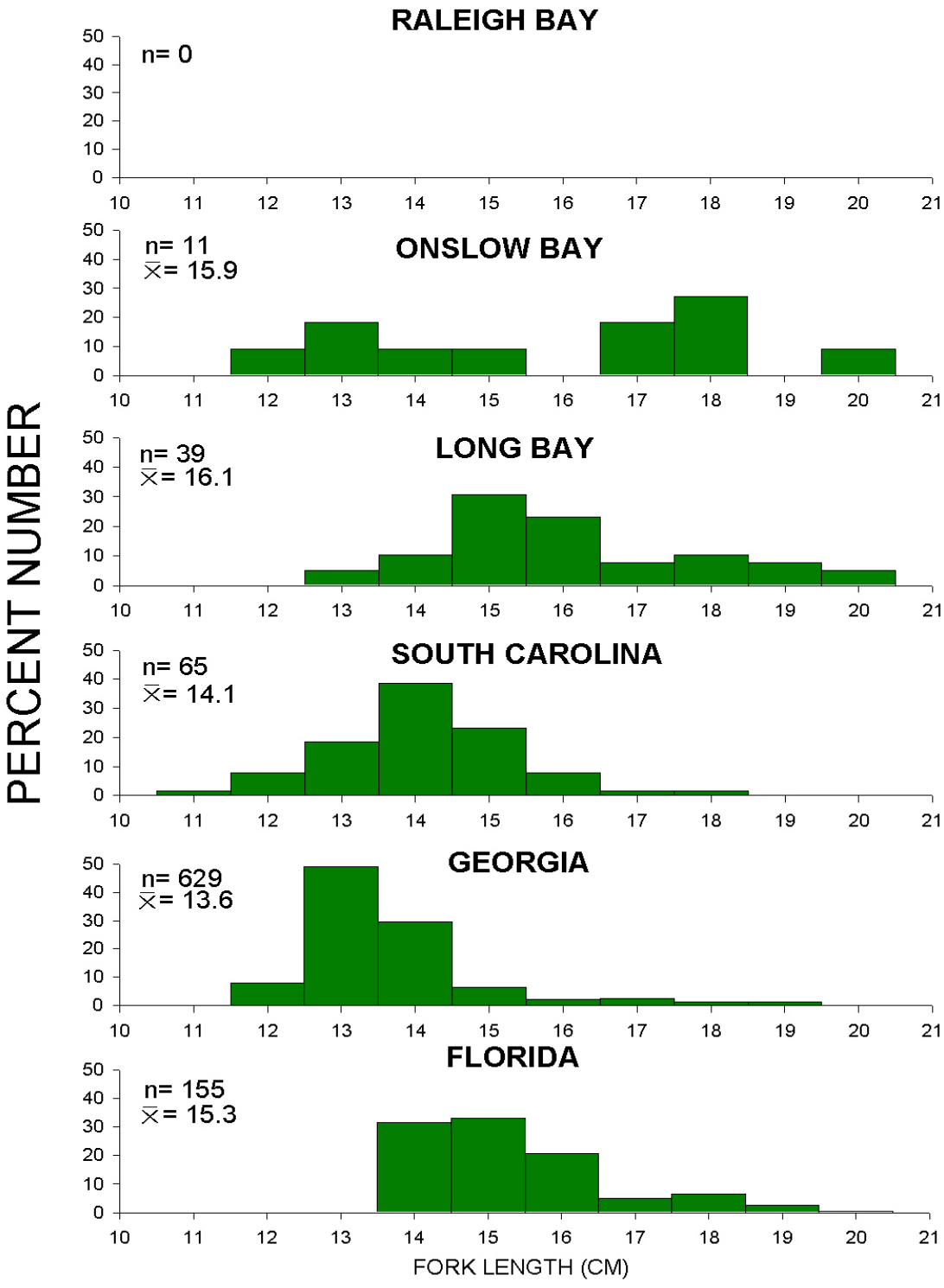

Figure 7. Regional length-frequencies of *Brevoortia tyrannus* in 2002

Centropristis striata

A total of 56 black sea bass (CV=4.9; 0.05 individuals/ha), weighing 3 kg (0.003 kg/ha), were collected in 2002. The density of abundance in 2002 represented the lowest density in the history of the survey (Figure 8). Black sea bass were taken in all regions; however, density was greatest in Onslow Bay (Table 7). Total lengths of *Centropristis striata* ranged from 8 to 22 cm ($\bar{x}$ = 14.4).

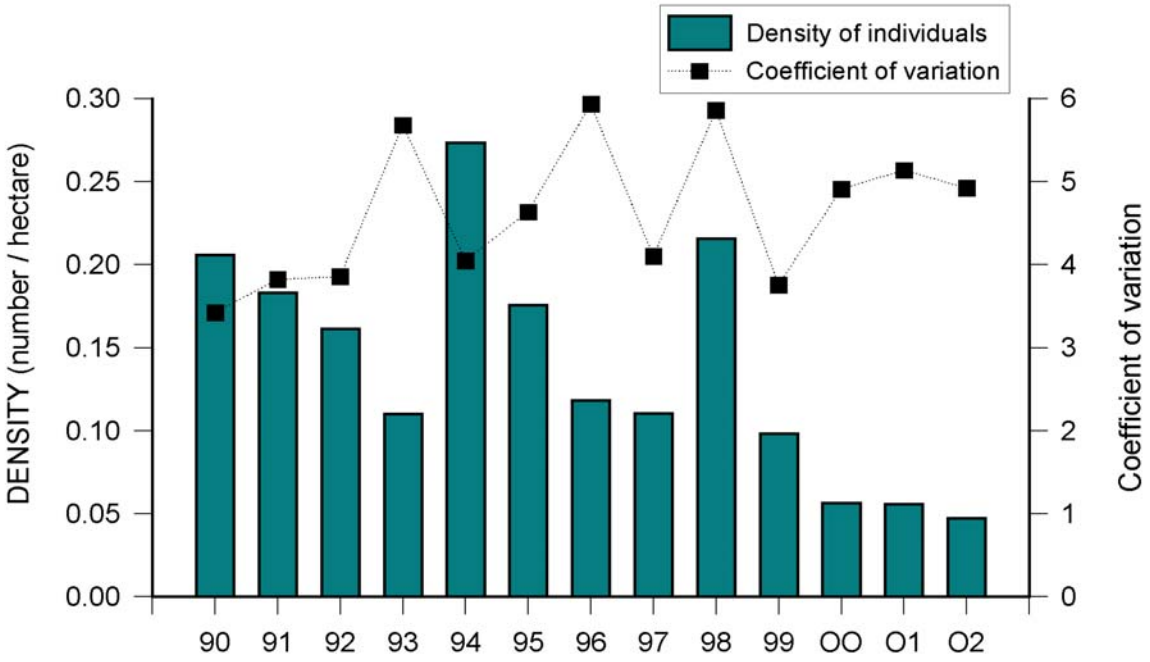

Figure 8. Annual densities of *Centropristis striata*

Table 7 . Estimates of density (number of individuals/hectare) in 2002.

Centropristis striata

	Spring	Summer	Fall	Region
Raleigh Bay	0.07	0	0.03	0.03
Onslow Bay	0.2	0.2	0.2	0.2
Long Bay	0.05	0.05	0.2	0.08
South Carolina	0.03	0	0.02	0.01
Georgia	0.02	0.009	0	0.01
Florida	0.02	0	0	0.005
Season	0.06	0.04	0.05	0.05

Chaetodipterus faber

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 1,717 Atlantic spadefish (CV=5.1 1.5 individuals/ha), weighing 86 kg (0.07 kg/ha). Density of individuals peaked in 1991, with a general decline in abundance in subsequent years to the lowest level of abundance observed in 2001 (Figure 9). Density was greatest in fall (Table 8). Atlantic spadefish were most abundant in Raleigh Bay and in waters off Florida. Total lengths of *Chaetodipterus faber* ranged from 5 to 20 cm ($\bar{x}$ = 9.9).

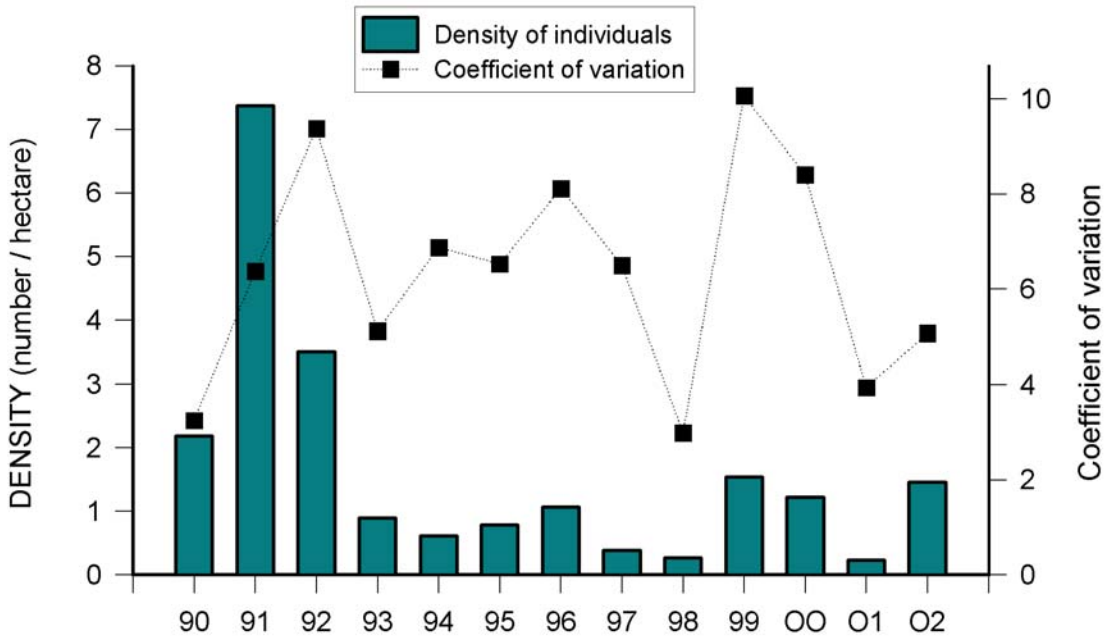

Figure 9. Annual densities of *Chaetodipterus faber*

Table 8 . Estimates of density (number of individuals/hectare) in 2002.

Chaetodipterus faber

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	5.9	2.3
Onslow Bay	0.02	0.06	3.6	1.2
Long Bay	0	0	0	0
South Carolina	0.02	4.1	1.0	1.7
Georgia	0.05	0.2	4.5	1.6
Florida	0.4	0.06	6.3	2.2
Season	0.09	0.8	3.7	1.5

Cynoscion nebulosus

The spotted seatrout, *Cynoscion nebulosus*, has been a rare species in SEAMAP-SA Shallow Water Trawl Survey collections (Figure 10). In the history of the trawl survey only nine specimens have been collected, all in shallow strata. No spotted seatrout were collected in 2002.

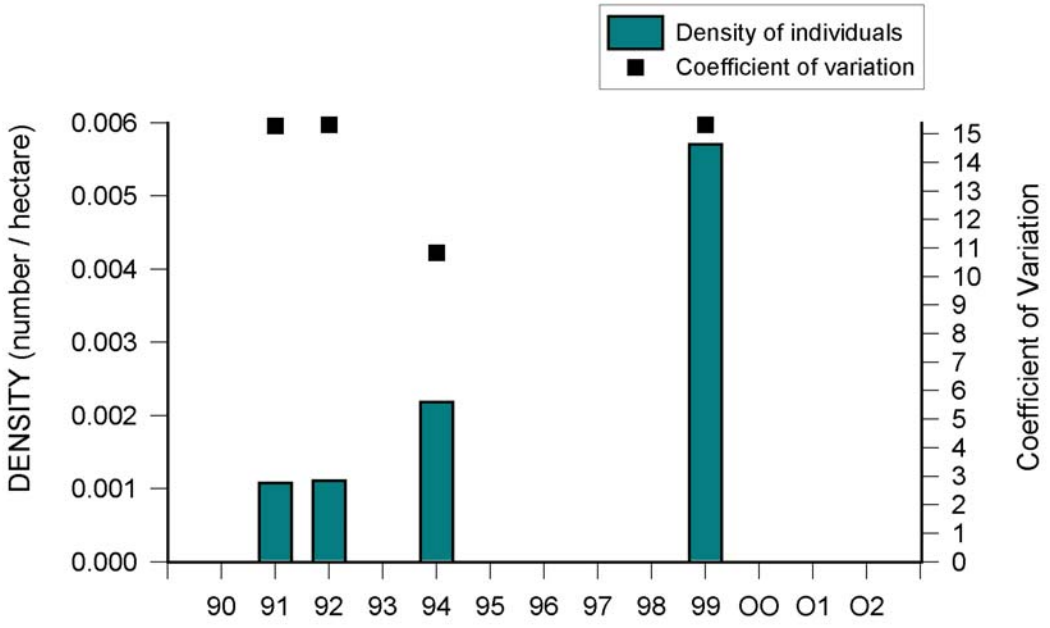

Figure 10. Annual densities of *Cynoscion nebulosus*

Cynoscion regalis

In 2002, SEAMAP strata yielded a total of 3,307 weakfish (CV=4.3; 2.8 individuals/ha), weighing 298 kg (0.3 kg/ha). The density of abundance in 2002 represented the lowest annual density taken by the survey (Figure 11). In 2002, density was lowest in spring and increased in spring and fall (Table 9). Weakfish were most abundant in the northern portion of the SAB, with density of individuals decreasing with decreasing latitude.

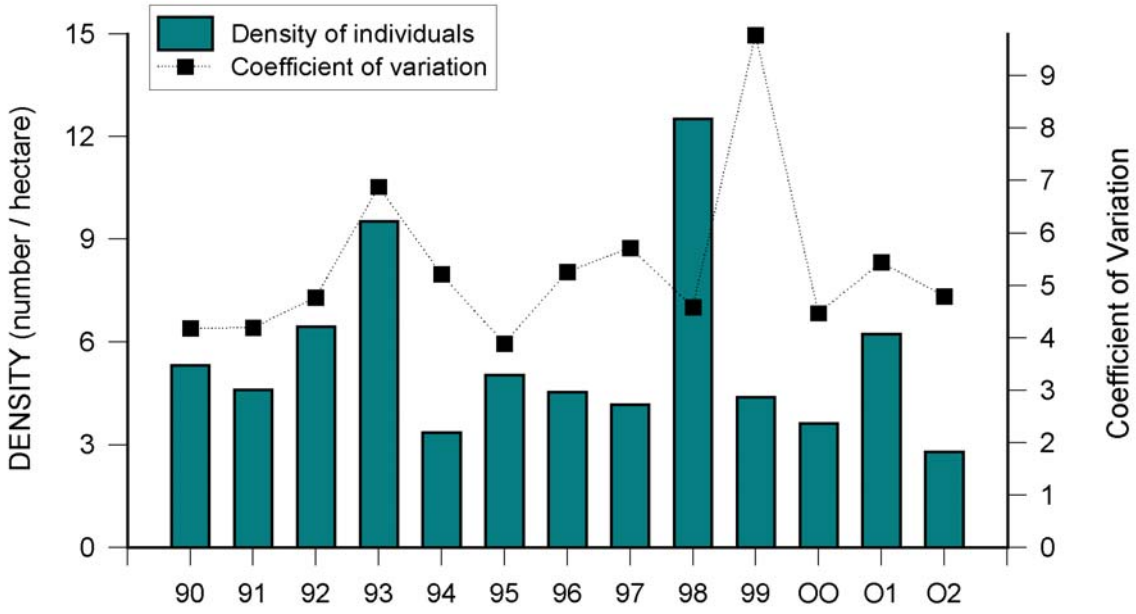

Figure 11. Annual densities of *Cynoscion regalis*

Table 9 . Estimates of density (number of individuals/hectare) in 2002.

Cynoscion regalis

	Spring	Summer	Fall	Region
Raleigh Bay	0.1	0	45.2	17.3
Onslow Bay	4.2	2.6	1.4	2.8
Long Bay	0.2	2.4	0.3	0.9
South Carolina	1.4	5.8	1.1	2.7
Georgia	0.5	0.9	1.0	0.8
Florida	2.4	0.7	0.1	1.0
Season	1.6	2.1	5.2	2.8

A total of 467 otolith (spring=155, summer=121, fall=191) and 97 gonad samples from weakfish were taken in 2002. Weakfish of age 0 constituted the largest percentage (70%) of the individuals sampled, followed by age 1 (25%), age 2 (3%), and age 3 (1%) individuals. Weakfish collected in SEAMAP trawl samples ranged from 97 to 268 mm TL for age 0 fish, 137 to 377 mm TL for age 1, 182 to 480 mm TL for age 2, and 283 to 408 mm TL for age 3 individuals. No specimens older than age 3 were taken in SEAMAP trawl samples.

Total lengths of *Cynoscion regalis* ranged from 8 to 48 cm ($\bar{x}$ = 20.3). Length was significantly different among seasons ($X^2 = 903$, $p < 0.0001$). Mean length decreased from spring to summer, indicating the recruitment of YOY individuals, and increased in fall as the result of subsequent juvenile growth (Figure 12). The percentage of age 0 fish increased seasonally from less than 1% in spring to 58% of the weakfish sampled in fall. The spring length-frequency distribution comprised mostly age 1 fish (82%). The inclusion of smaller specimens in summer collections resulted in a length-frequency distribution representing mostly age 1 fish that were spawned late and age 0 specimens.

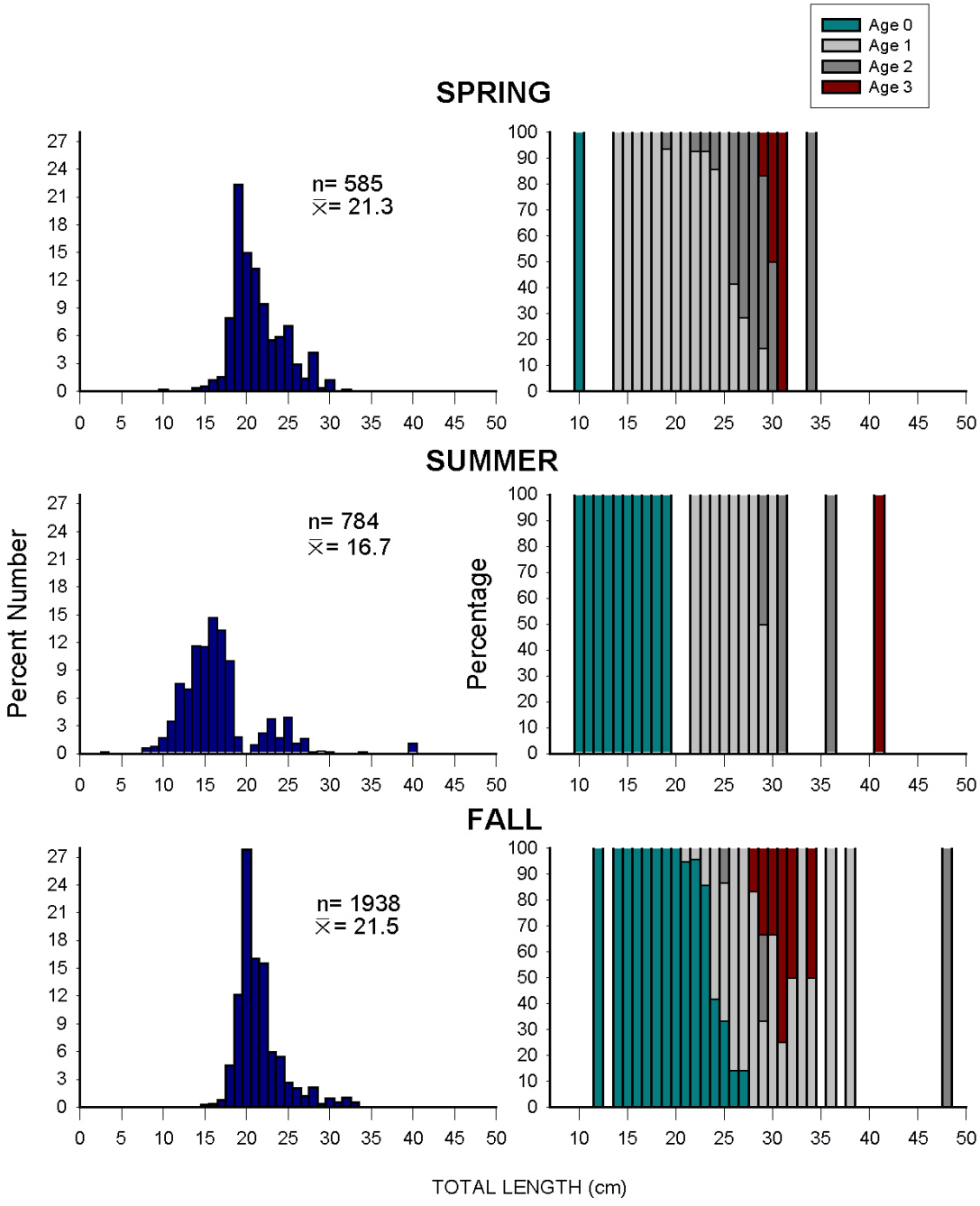

Figure 12. Seasonal length-frequencies and age composition of *Cynoscion regalis* in 2002.

Mean length also varied significantly among regions ($X^2 = 641$, $p < 0.0001$), with larger mean lengths occurring in Raleigh Bay and off Florida (Figure 13). In all regions, the majority of specimens caught in spring were determined to be age 1, whereas in summer most individuals were age 0. Fall catches were dominated by age 0 fish in Raleigh Bay, South Carolina, and Georgia. Age 1 fish were most abundant in fall trawls in Onslow Bay, Long Bay, and off Florida.

Age composition was very similar among male and female weakfish. More than 83% (spring: 95%, summer: 84%, fall: 79%) of the individuals sampled were female. Only 46% (spring: 80%, summer: 20%, fall: 46%) of the females had developing or mature ovaries, whereas more than 99% of the males were reproductively mature.

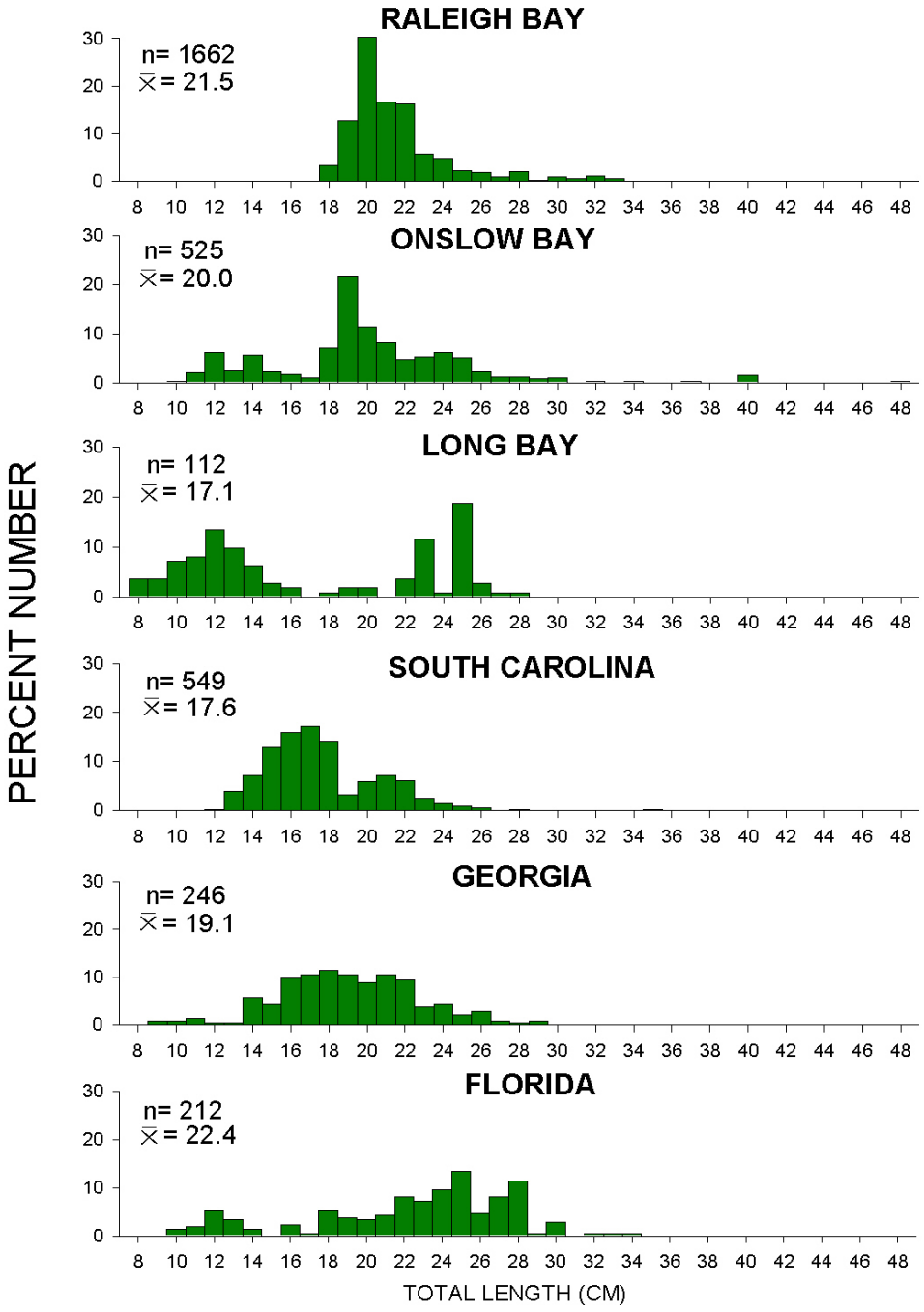

Figure 13. Regional length-frequencies of *Cynoscion regalis* in 2002

Leiostomus xanthurus

Leiostomus xanthurus was the third most abundant species collected by SEAMAP-SA Shallow Water Trawl Survey in 2002. The 23,360 (CV=3.4; 19.8 individuals/ha) spot collected weighed 1,311 kg (1.1 kg/ha) and constituted 7% of the total number of individuals taken in SEAMAP trawls in 2002. Density of individuals peaked in 1990 and 1991 and reached its lowest level in 2002 (Figure 14). In 2002, the greatest seasonal density of abundance occurred in summer (Table 10). The greatest regional densities were observed in the northern South Atlantic Bight.

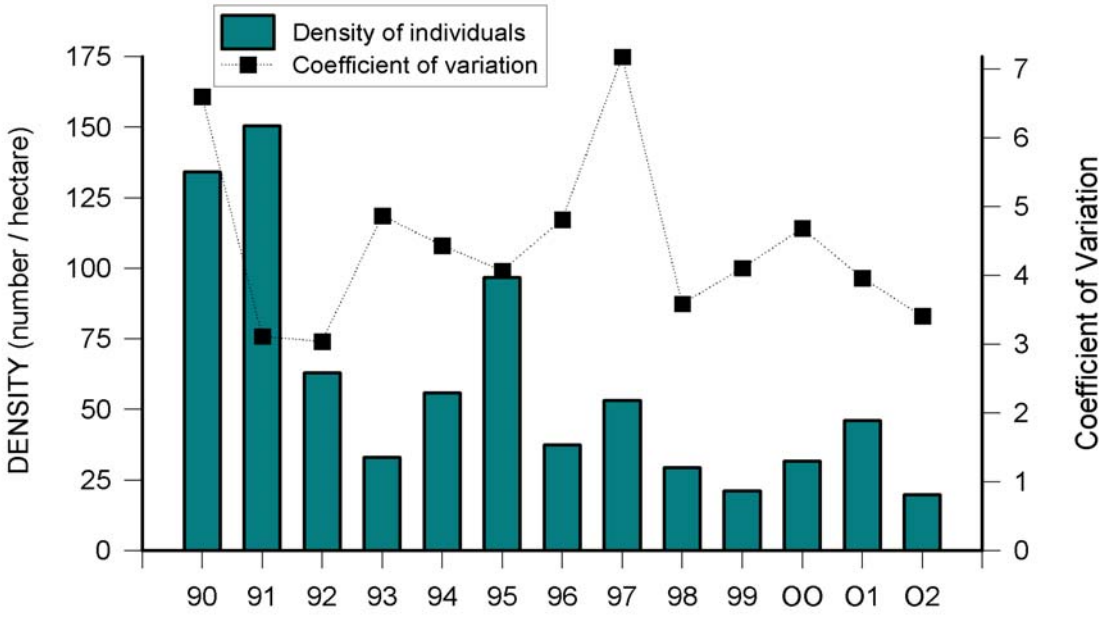

Figure 14. Annual densities of *Leiostomus xanthurus*

Table 10 . Estimates of density (number of individuals/hectare) in 2002.

Leiostomus xanthurus

	Spring	Summer	Fall	Region
Raleigh Bay	27.4	0.06	86.7	41.1
Onslow Bay	45.6	63.9	18.1	43.1
Long Bay	10.4	36.0	10.8	19.1
South Carolina	17.4	30.4	11.1	19.6
Georgia	1.1	19.8	2.6	7.9
Florida	9.4	23.5	3.3	12.3
Season	16.3	29.9	15.9	19.8

Fork lengths of spot from the SEAMAP-SA survey ranged from 7 to 25 cm, with a mean length of 15.0 cm. Lengths varied significantly among seasons ($X^2 = 761$, $p < 0.0001$). Mean length increased from summer to fall, the result of juvenile growth (Figure 15). Length also varied significantly among regions ($X^2 = 38612$, $p < 0.0001$). The mean length of spot was greatest in waters off Florida (Figure 16). The length-frequency distribution of spot represents primarily specimens captured during the summer cruises in all regions, except Raleigh Bay

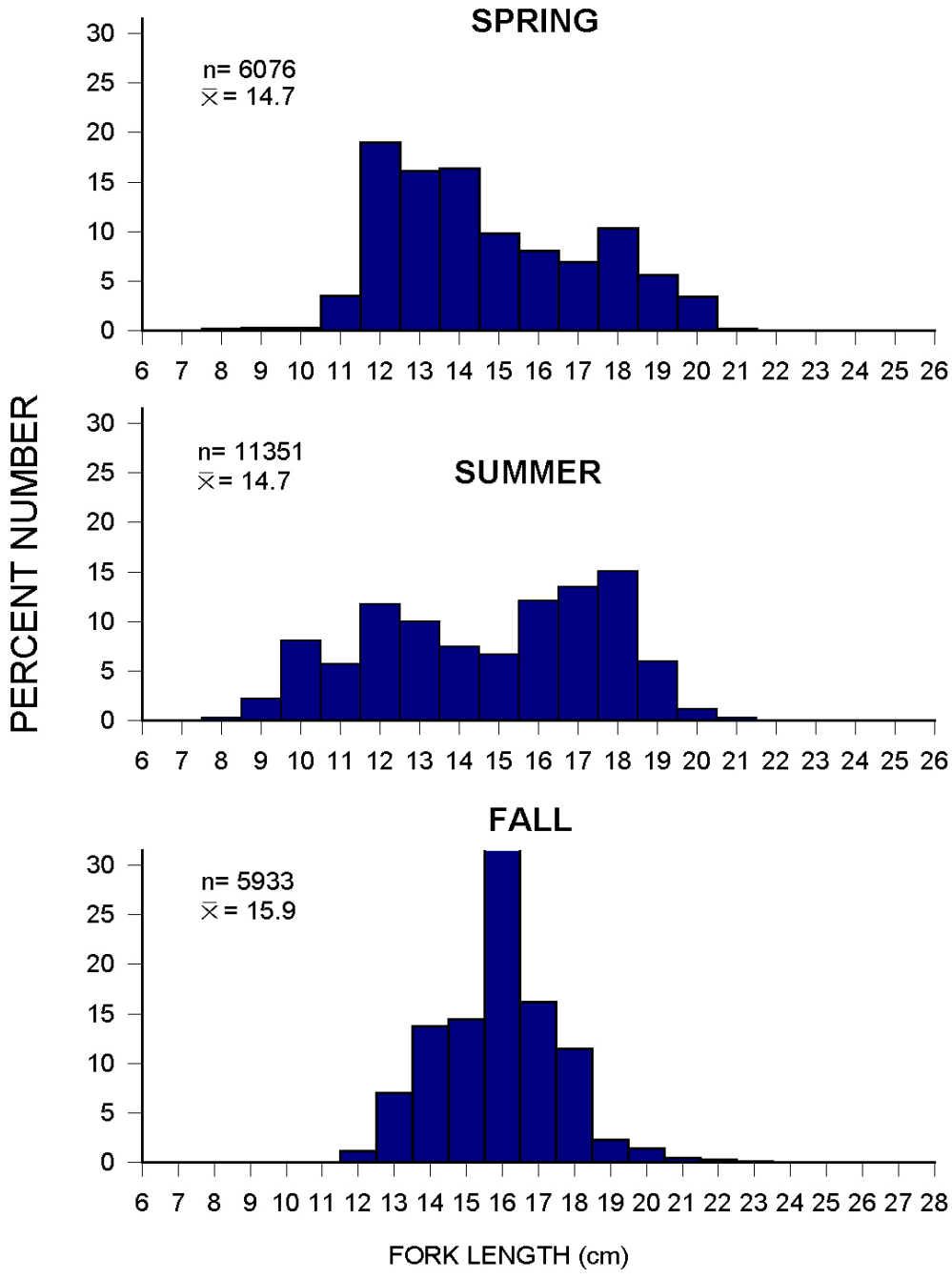

Figure 15. Seasonal length-frequencies of *Leiostomus xanthurus* in 2002

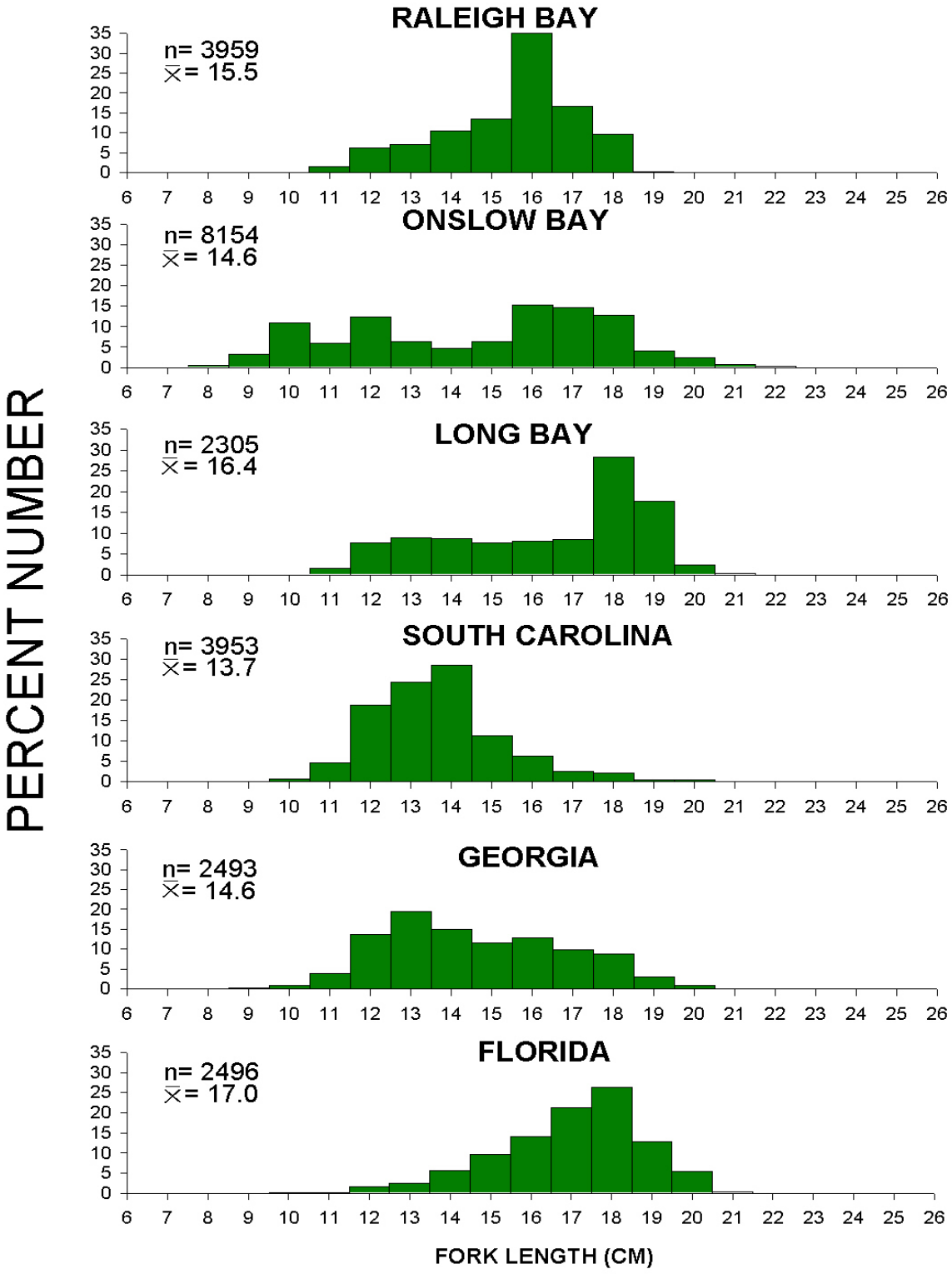

Figure 16. Regional length-frequencies of *Leiostomus xanthurus* in 2002

Menticirrhus americanus

SEAMAP-SA Shallow Water Trawl Survey strata produced a total of 11,840 southern kingfish (CV=5.0; 10.0 individuals/ha), weighing 1137 kg (1.0 kg/ha). Although density of individuals does not fluctuate a great deal annually, density did increase in 2002, to the greatest level since 1996 (Figure 17). Density was greatest in fall and in Raleigh Bay (Table 11). The southern kingfish exhibited the highest percent occurrence of all priority species, being present in approximately 65% of all tows.

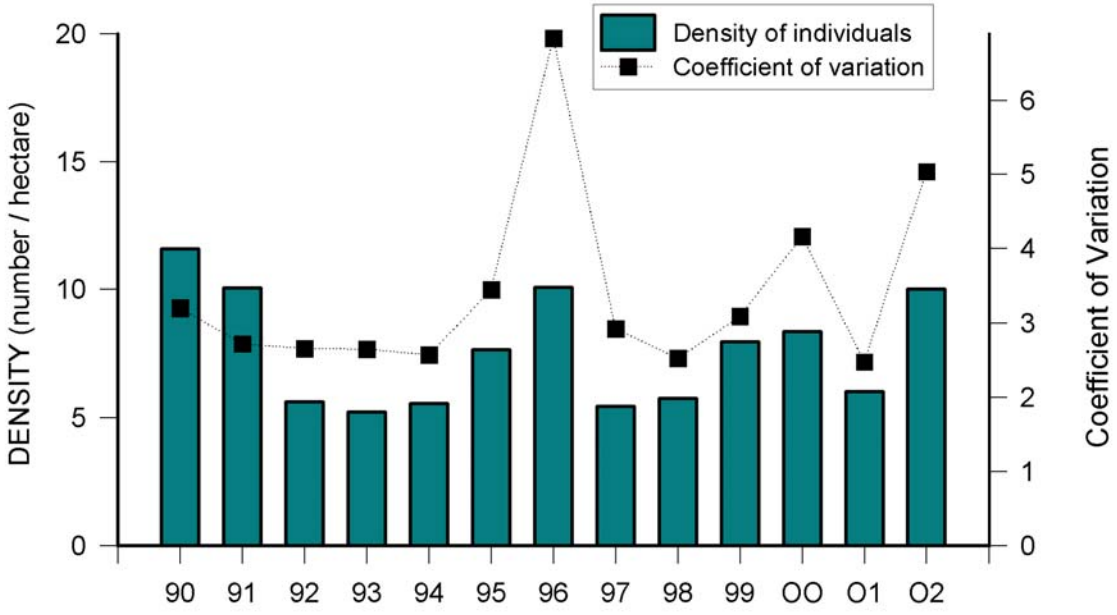

Figure 17. Annual densities of *Menticirrhus americanus*

Table 11 . Estimates of density (number of individuals/hectare) in 2002.

Menticirrhus americanus

	Spring	Summer	Fall	Region
Raleigh Bay	18.3	0.03	87.7	38.8
Onslow Bay	2.5	2.1	12.0	5.4
Long Bay	8.9	1.5	1.4	3.9
South Carolina	4.5	7.4	16.3	9.3
Georgia	5.8	11.0	4.4	7.1
Florida	7.3	18.0	11.2	12.3
Season	6.5	8.2	16.8	10.0

In 2002, a total of 1302 otolith (spring=439, summer=363, fall=500) and 196 gonad samples were taken from southern kingfish. The majority of the southern kingfish sampled were ages 0 (48%) and 1 (42%), followed by age 2 (6%), age 3 (3%), and age 4 specimens (2%) Only one age 5 fish was sampled. *Menticirrhus americanus* ranged from 77 to 326 mm TL for age 0, from 81 to 342 mm TL for age 1, from 204 to 360 for age 2, from 227 to 353 mm TL for age 3, and from 246 to 365 mm TL for age 4. Only one age 5 individual (297 cm) was taken in SEAMAP trawl samples.

Total lengths of *Menticirrhus americanus* ranged from 8 to 37 cm ($\bar{x}$ = 20.5). Length was significantly different among seasons (X^2 = 1677, $p < 0.0001$). Mean length decreased from spring to summer, indicating the recruitment of YOY individuals, and increased in fall as the result of subsequent juvenile growth (Figure 18). The percentage of age 0 fish increased from none in spring to 59% of the southern kingfish sampled in summer, followed by a decrease to 41% in fall. The spring length-frequency distribution comprised mostly age 1 fish. The inclusion of smaller specimens in summer collections resulted in a length-frequency distribution representing mostly age 1 fish that were spawned late and age 0 specimens.

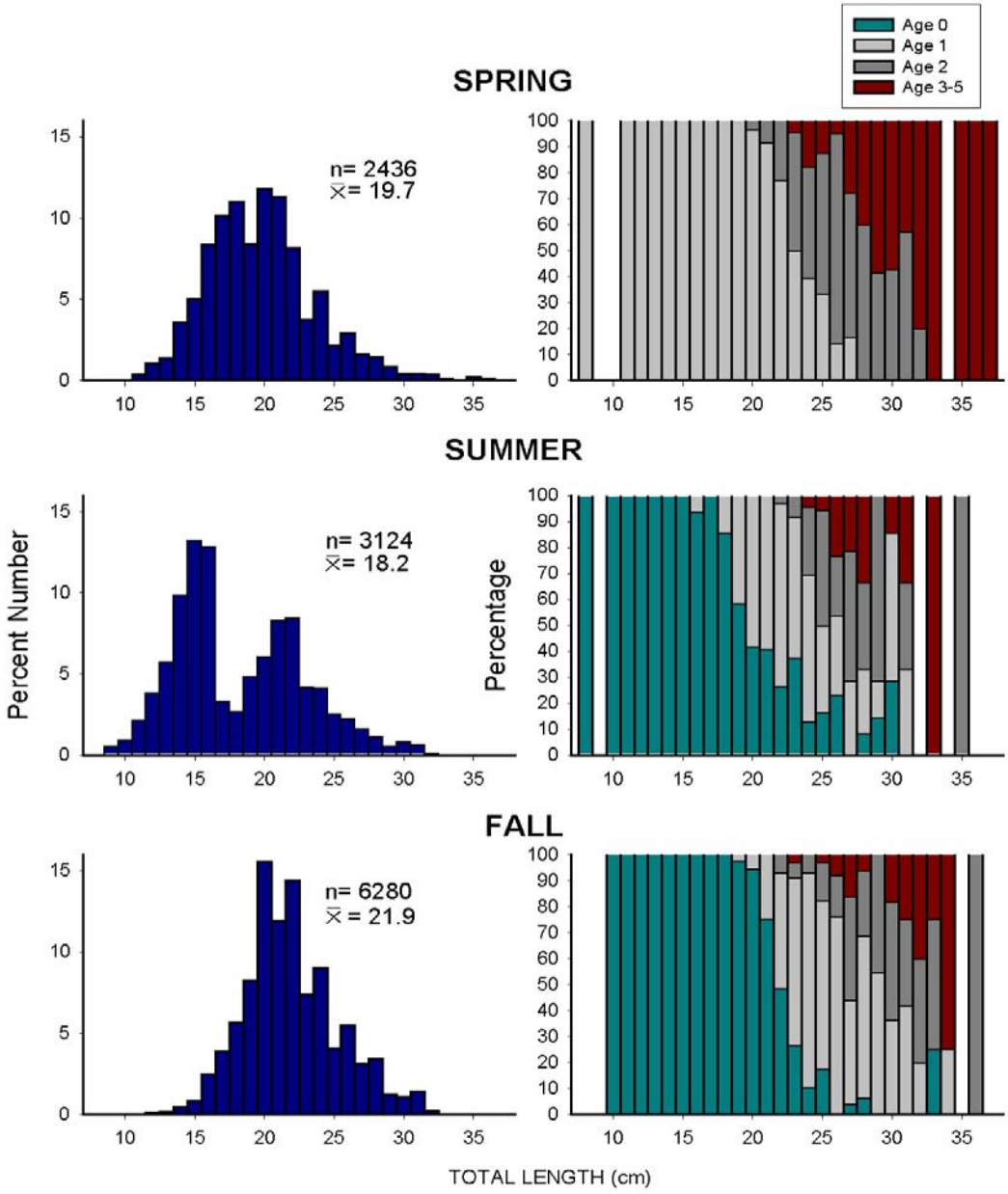

Figure 18. Seasonal length-frequencies and age composition of *Menticirrhus americanus* in 2002

Length also varied significantly among regions ($X^2 = 2486$, $p < 0.0001$), with greatest mean length observed in Raleigh and Onslow Bays (Figure 19). In all regions, age 1 individuals made up the greatest percentage of the population in spring, whereas in summer age 1 was the dominant year-class only in Onslow Bay, Long Bay, and off Florida. Summer trawls made in Raleigh and Onslow Bays produced individuals that were primarily age 1, whereas in waters off South Carolina, Georgia, and Florida, age 0 specimens constituted the majority of the southern kingfish. In fall, the majority of the specimens collected in Raleigh Bay were age 1 and in all other regions were primarily age 0.

Age composition was very similar among male and female southern kingfish. More than 86% (spring: 48%, summer: 88%, fall: 99%) of the individuals sampled were female. Many of the females (52%) (spring: 64%, summer: 49%, fall: 48%) had developing or mature ovaries and all the males were reproductively mature as well.

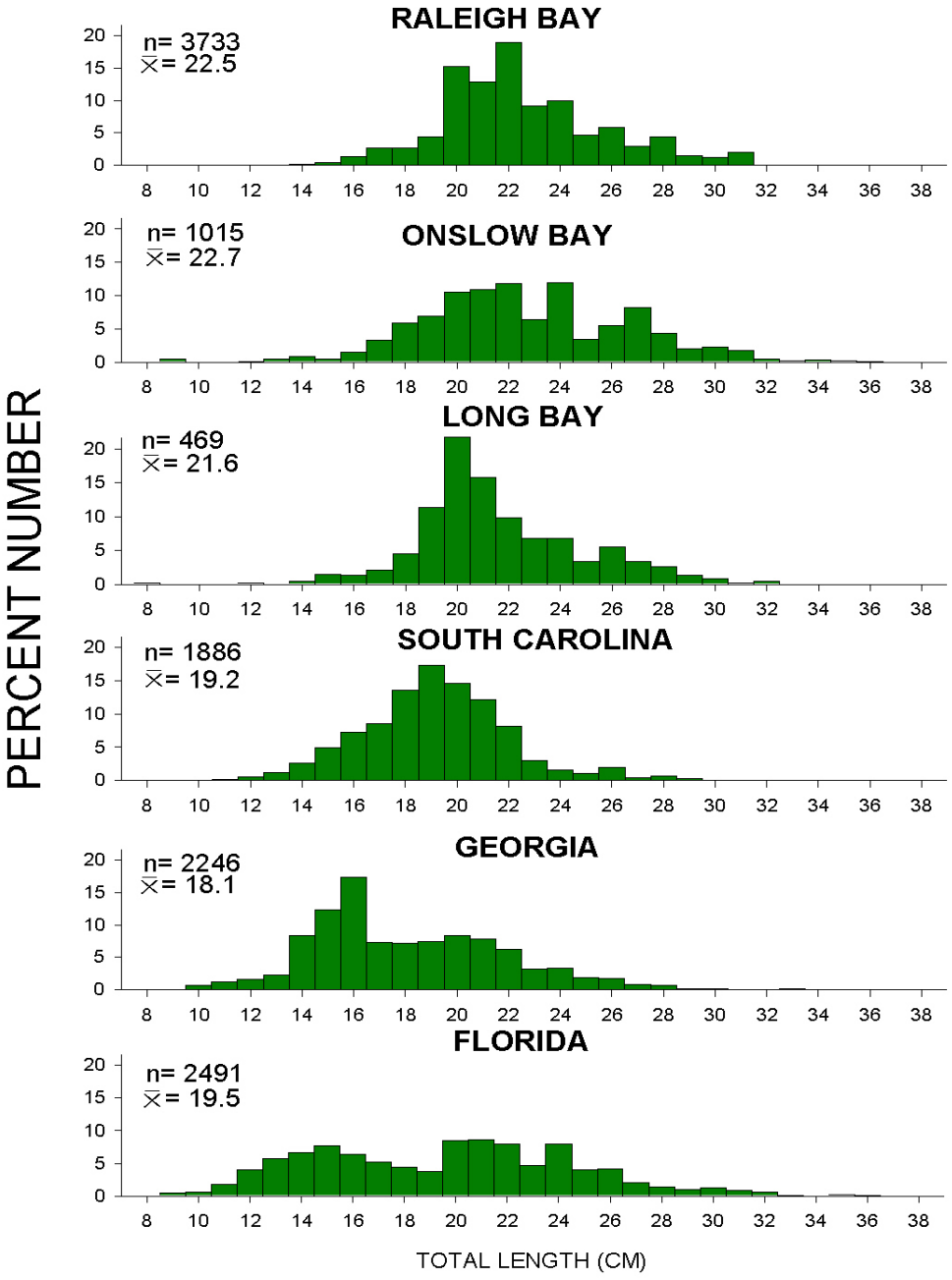

Figure 19. Regional length-frequencies of *Menticirrhus americanus* in 2002

Menticirrhus littoralis

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 233 gulf kingfish (CV=3.9; 0.2 individuals/ha), weighing 43 kg (0.04kg/ha) in 2002. Density of individuals for *Menticirrhus littoralis* peaked in 1996 and 2000, with 2002 estimates ranking third (Figure 20). In 2002 density was greatest in summer and Gulf kingfish were most abundant in Florida waters (Table 12). Total lengths of *Menticirrhus littoralis* ranged from 15 to 39 cm ($\bar{x}$ = 25.3), with greatest mean length in fall.

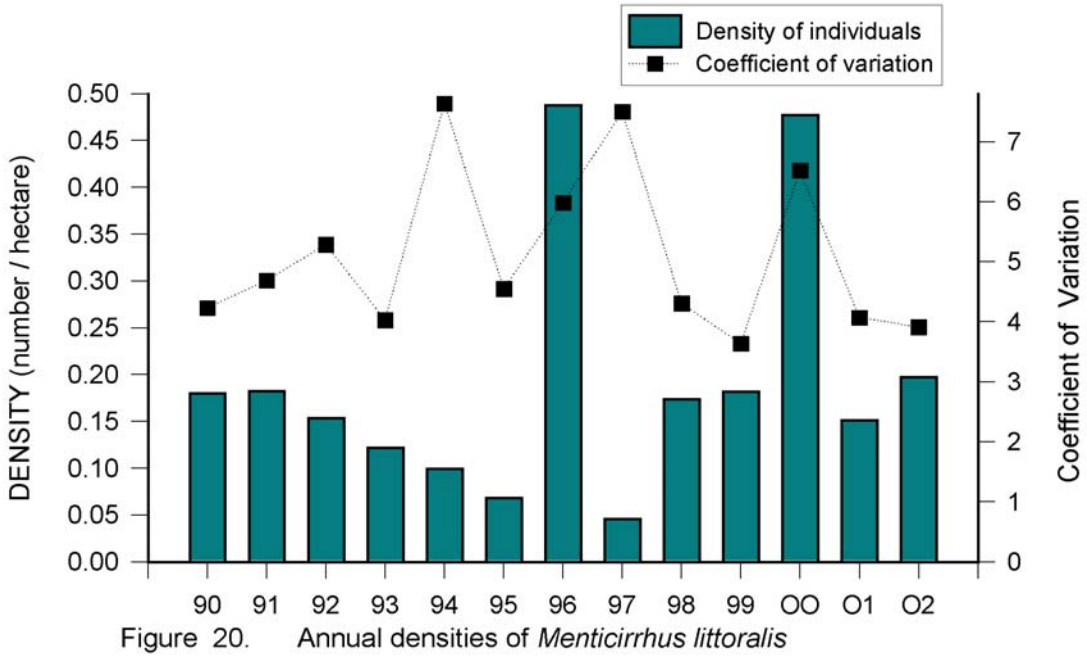

Figure 20. Annual densities of *Menticirrhus littoralis*

Table 12 . Estimates of density (number of individuals/hectare) in 2002.

Menticirrhus littoralis

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0.2	0.07
Long Bay	0	0	0	0
South Carolina	0	0.2	0.05	0.07
Georgia	0	0.1	0	0.03
Florida	0.9	1.6	0.3	1.0
Season	0.2	0.4	0.1	0.2

Menticirrhus saxatilis

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 970 northern kingfish (CV=7.4; 0.8 individuals/ha), weighing 138 kg (0.1 kg/ha) in 2002. Density of individuals reached a record level in 2002, after several years of generally low abundance (Figure 21). Density was greatest in fall (Table 13). Northern kingfish were not taken in Long Bay and Georgia waters. Density of individuals was greatest in Raleigh Bay. Total lengths of *Menticirrhus saxatilis* ranged from 10 to 33 cm ($\bar{x}$ = 24.6), with greatest mean length in fall and off South Carolina.

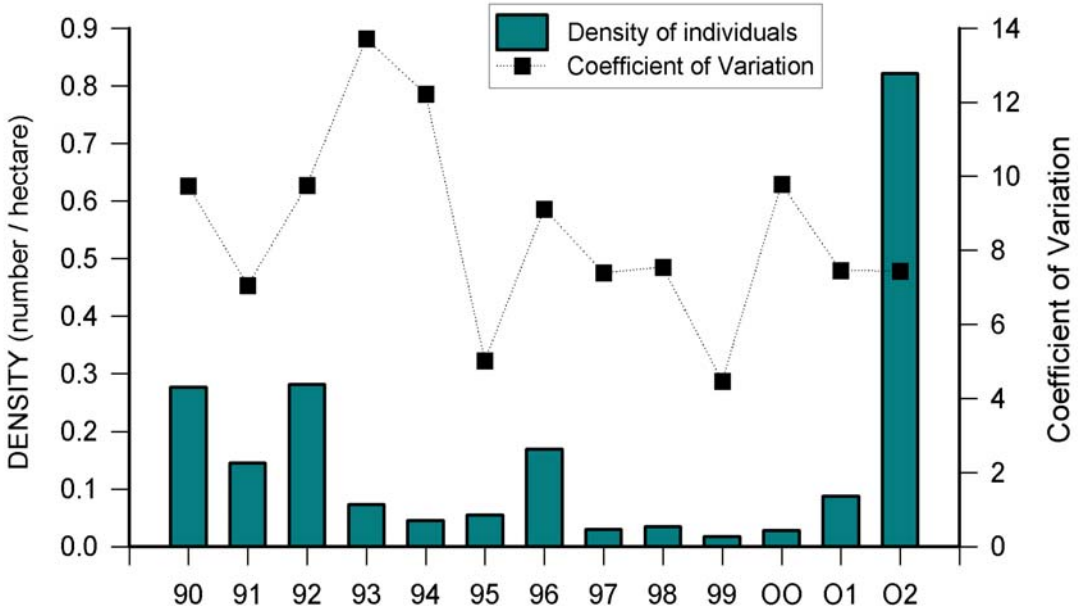

Figure 21. Annual densities of *Menticirrhus saxatilis*

Table 13 . Estimates of density (number of individuals/hectare) in 2002.

Menticirrhus saxatilis

	Spring	Summer	Fall	Region
Raleigh Bay	3.7	0.03	21.5	9.3
Onslow Bay	0.02	0.4	0.7	0.4
Long Bay	0	0	0	0
South Carolina	0	0	0.03	0.01
Georgia	0	0	0	0
Florida	0.05	0	0.02	0.02
Season	0.3	0.07	2.2	0.8

Micropogonias undulatus

Micropogonias undulatus was the most abundant species collected in SEAMAP-SA trawl samples in 2002. The 50,914 individuals (CV=4.5), weighing 3,231 kg, made up16% of the total number of specimens taken in SEAMAP strata. Density estimates for the entire SAB were 43.1 individuals/ha and 2.7 kg/ha, a decrease from 2001 and well below the peak years of 1991-1992 (Figure 22). With the exception of Raleigh Bay, seasonal densities of individuals were greatest in summer. Regional densities were highest in Onslow Bay, primarily due to large catches of Atlantic croaker in summer (Table 14).

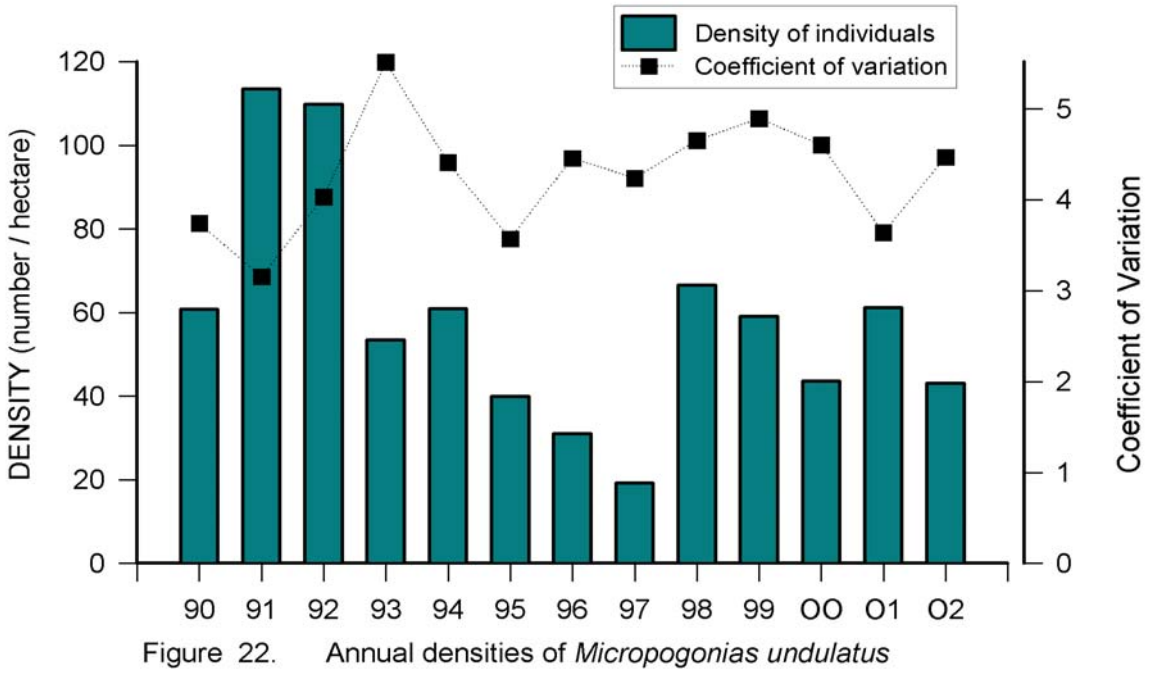

Figure 22. Annual densities of *Micropogonias undulatus*

Table 14. Estimates of density (number of individuals/hectare) in 2002.

Micropogonias undulatus

	Spring	Summer	Fall	Region
Raleigh Bay	0.07	0.2	143.6	54.8
Onslow Bay	90.5	233.2	43.5	124.0
Long Bay	3.8	90.4	87.5	61.0
South Carolina	4.5	125.4	16.7	48.5
Georgia	1.2	14.9	7.0	7.7
Florida	0.4	33.6	2.9	12.8
Season	17.4	81.4	36.0	43.1

In 2002, a total of 552 otolith (spring=98, summer=220, fall=234) and 114 gonad samples were taken from Atlantic croaker. The majority of the Atlantic croaker sampled were age 0 (48%) and age 1 (30%). Other age-classes included age 2 (15%), age 3 (<1%), age 4 (7%), and a single age 7 specimen. Atlantic croaker ranged from 75 to 238 mm TL for age 0, from 118 to 265 mm TL for age 1, from 175 to 236 for age 2, from 205 to 330 mm TL for age 3 and from 208 to 231 TL for age 4 individuals. Only one age 7 fish (372 mm) was taken in SEAMAP trawl samples.

Total lengths of Atlantic croaker ranged from 6 to 37 cm ($\bar{x}$ = 18.1 cm). Lengths differed significantly among seasons ($X^2 = 2090$, $p < 0.0001$). The mean length of Atlantic croaker increased from spring to fall (Figure 23). Seasonally, the percentage of age 0 fish increased from 2% in spring to 84% in summer, whereas YOY decreased to 14% of the Atlantic croaker sampled in fall. The spring length-frequency distribution comprised mostly age 1 (75%) and age 2 (18%) fish. The inclusion of smaller specimens in summer collections resulted in a length-frequency distribution representing mostly age 0 fish (59%), with ages 1-4 also present in trawl samples. Fall collections consisted of mostly age 0, age 1, and a few larger specimens.

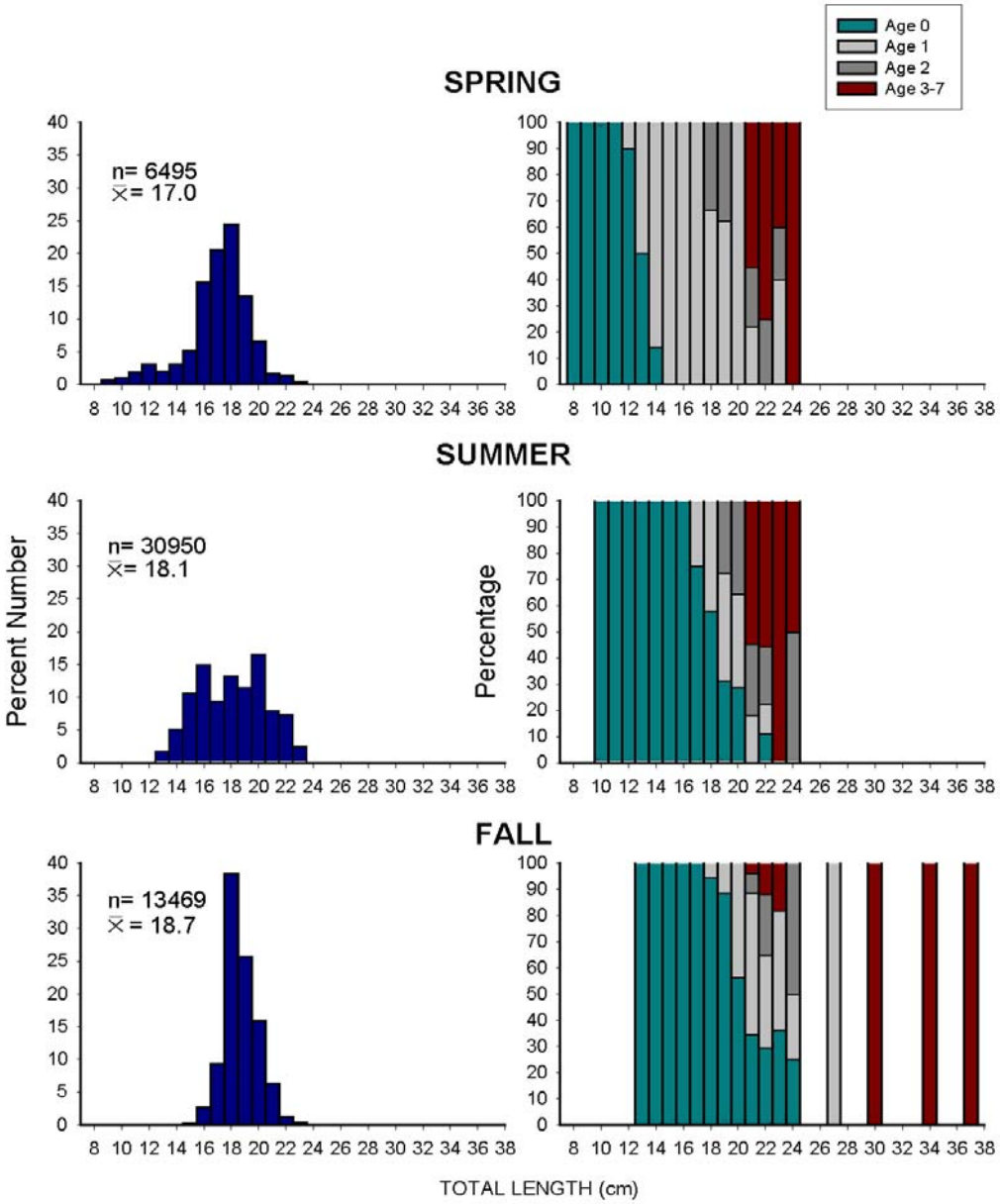

Figure 23. Seasonal length-frequencies and age composition of *Micropogonias undulatus* in 2002

Length also varied significantly among regions ($X^2 = 18897$, $p < 0.0001$), and mean lengths ranged from 15.9 cm off South Carolina to 19.1 cm in Onslow Bay (Figure 24). In strata off North Carolina, age 1 made up the greatest percentage of the population, whereas in waters off South Carolina, Georgia, and Florida age 0 specimens were more numerous.

Age composition was very similar among male and female Atlantic croaker. More than 89% (spring: 93%, summer: 78%, fall: 95%) of the individuals sampled were female. The percentage of females with developing or mature ovaries increased from less than 1% in spring to 44% in summer and 100% in fall. Few male croaker were found to be reproductively mature in spring (0.4%), whereas all male specimens taken in summer and fall were found to be developing or mature.

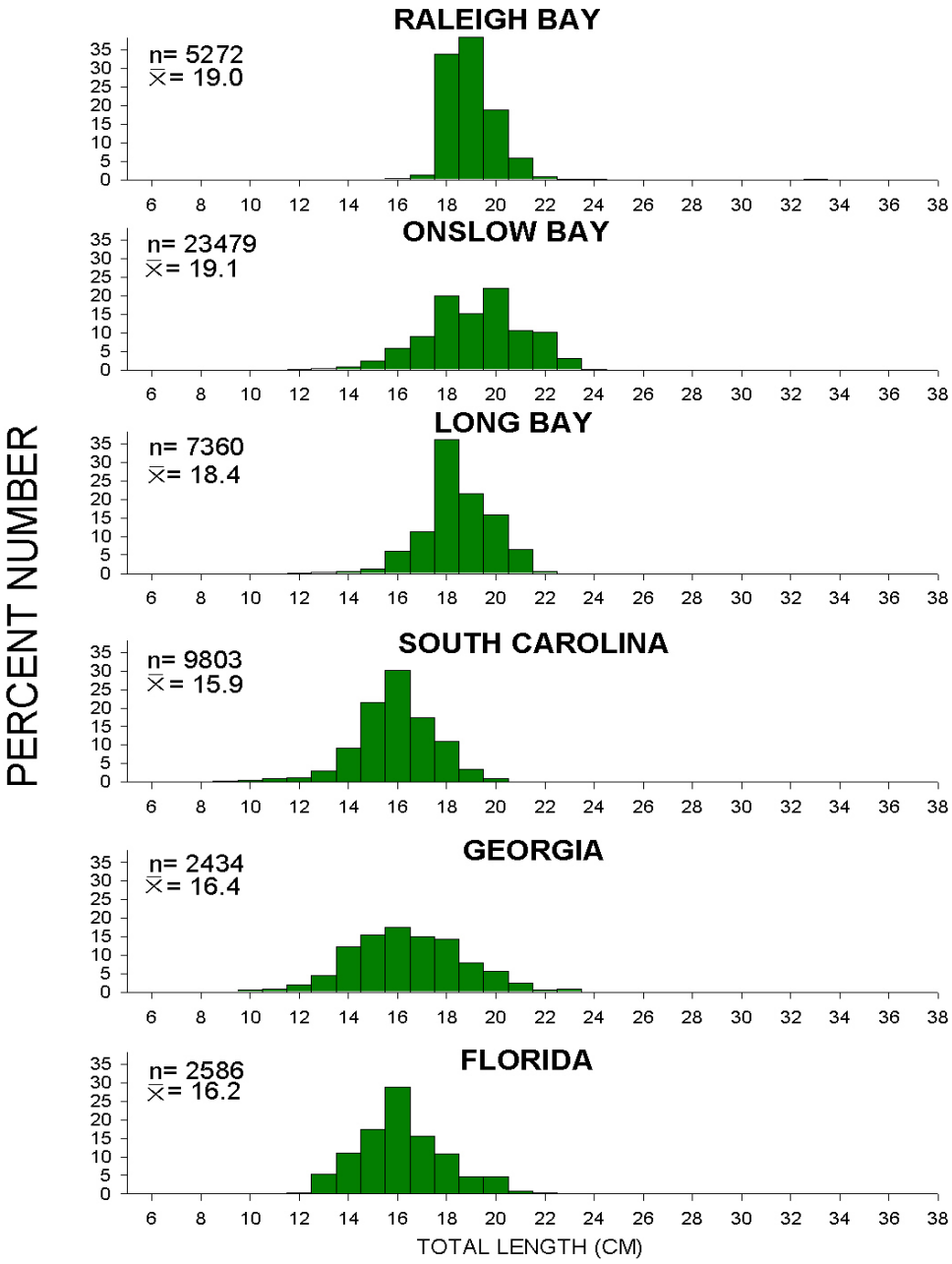

Figure 24. Regional length-frequencies of *Micropogonias undulatus* in 2002

Mycteroperca microlepis

The gag grouper, *Mycteroperca microlepis*, has been rare in SEAMAP-SA Shallow Water Trawl Survey collections (SEAMAP-SA/SCMRD, 2000). Only three individuals have been taken by the survey. No gag grouper were collected in 2002 (Figure 25).

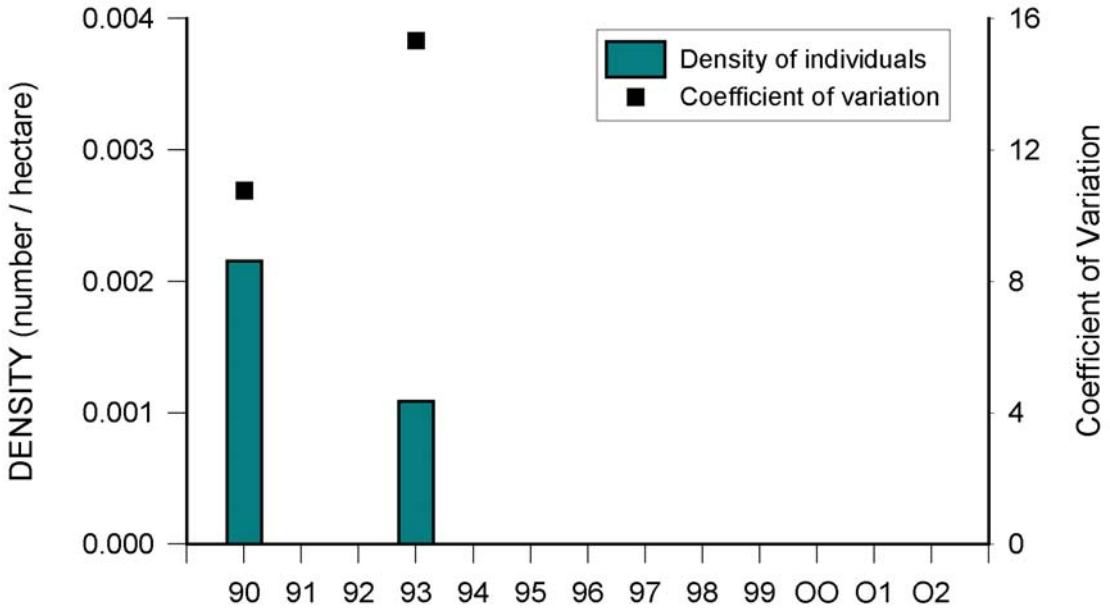

Figure 25. Annual densities of *Mycteroperca microlepis*

Paralichthys albigutta

The gulf flounder, *Paralichthys albigutta*, generally exhibits low abundance in SEAMAP-SA Shallow Water Trawl Survey collections. A total of 38 individuals (CV=7.1; 0.03 individuals/ha), weighing 6 kg (0.005 kg/ha), were taken in 2002. Density of abundance of gulf flounder in 2002 was exceeded only by the peak in 1992 (Figure 26). Gulf flounder were most abundant in summer in Onslow Bay (Table 15). Lengths ranged from 13 to 39 cm ($\bar{x}$ = 23.8), with greatest mean length in fall and in Raleigh Bay.

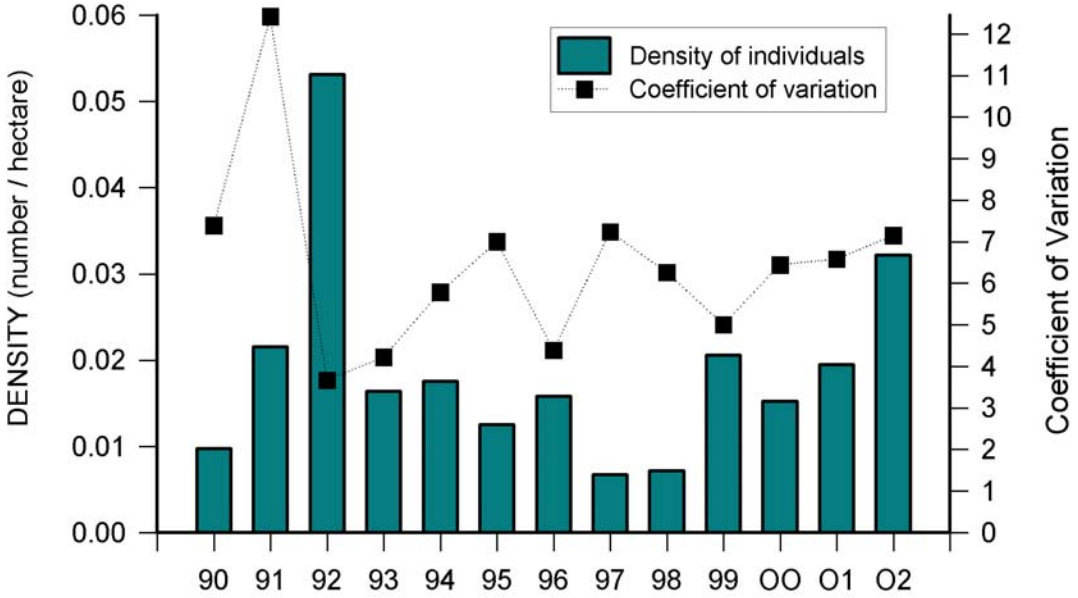

Figure 26. Annual densities of *Paralichthys albigutta*

Table 15. Estimates of density (number of individuals/hectare) in 2002.

Paralichthys albigutta

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.06	0.08	0.05
Onslow Bay	0	0.2	0.1	0.1
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0	0.07	0.01	0.03
Florida	0.02	0.03	0.02	0.02
Season	0.003	0.07	0.03	0.03

Paralichthys dentatus

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 258 summer flounder (CV=3.2; 0.2 individuals/ha), weighing 39 kg (0.03 kg/ha). Although the density of abundance in 2002 was the third lowest in the history of the survey, density of individuals has not varied much annually, with the exception of a peak in abundance in 1992 (Figure 27). Density was greatest in fall (Table 16). Summer flounder were most abundant in the northern portion of the SAB, with density of individuals decreasing with decreasing latitude. Total lengths of *Paralichthys dentatus* ranged from 11 to 44 cm ($\bar{x}$ = 24.4). Seasonal mean length was lowest in summer when the majority of smaller specimens were taken. Greatest regional mean length occurred in Florida.

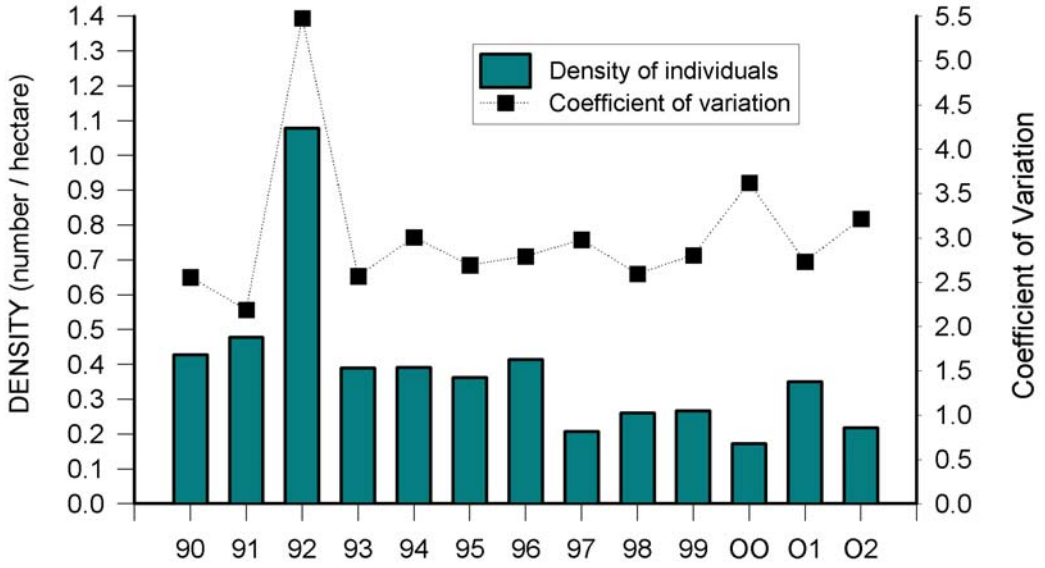

Figure 27. Annual densities of *Paralichthys dentatus*

Table 16. Estimates of density (number of individuals/hectare) in 2002.

Paralichthys dentatus

	Spring	Summer	Fall	Region
Raleigh Bay	0.8	0.09	1.5	0.9
Onslow Bay	0.3	0.3	0.7	0.4
Long Bay	0.1	0.07	0.3	0.2
South Carolina	0.1	0.06	0.3	0.2
Georgia	0.05	0.2	0.03	0.1
Florida	0.03	0.01	0.08	0.04
Season	0.2	0.2	0.4	0.2

Paralichthys lethostigma

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 77 southern flounder (CV=3.7; 0.07 individuals/ha), weighing 28 kg (0.02 kg/ha) in 2002. Although the density of individuals has not varied much annually, the 2002 estimate was the second highest to be recorded (Figure 28). Density was greatest in fall, although densities did not vary a great deal seasonally or regionally (Table 17). Total lengths of *Paralichthys lethostigma* ranged from 23 to 49 cm ($\bar{x}$ = 31.3).

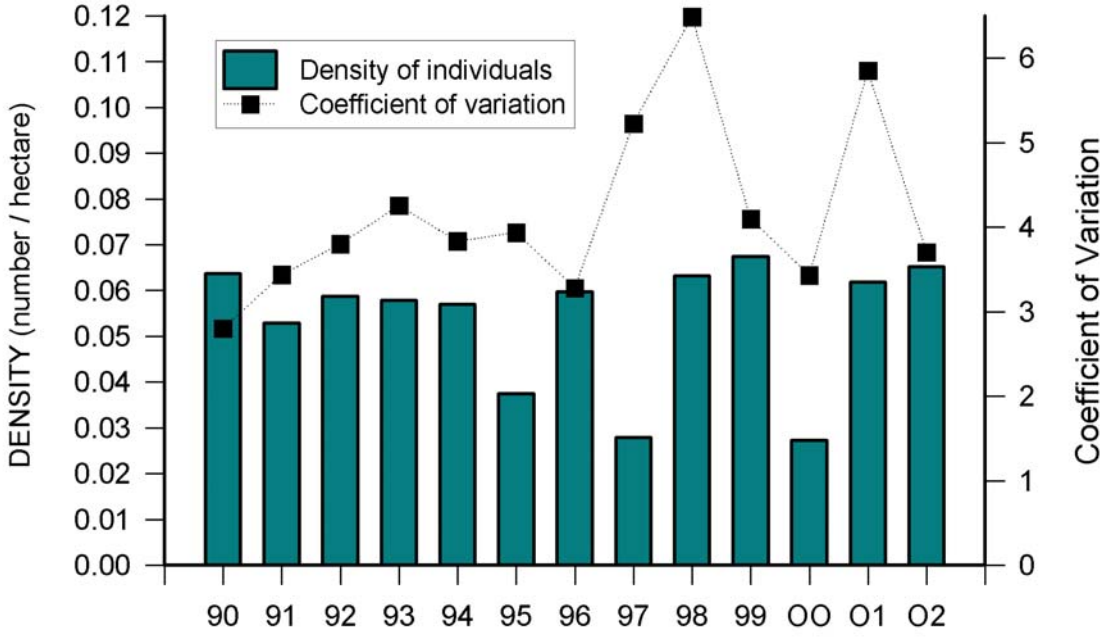

Figure 28. Annual densities of *Paralichthys lethostigma*

Table 17. Estimates of density (number of individuals/hectare) in 2002.

Paralichthys lethostigma

	Spring	Summer	Fall	Region
Raleigh Bay	0.07	0	0.1	0.07
Onslow Bay	0.08	0.06	0.08	0.07
Long Bay	0.03	0.2	0.05	0.08
South Carolina	0.04	0.2	0.03	0.08
Georgia	0	0.03	0.1	0.06
Florida	0.2	0.03	0	0.06
Season	0.06	0.07	0.08	0.07

Peprilus alepidotus

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 5,660 harvestfish (CV=5.4; 4.8 individuals/ha), weighing 251 kg (0.2 kg/ha). Density of individuals in 2002 represents an increase in abundance from 2001 (Figure 29). Annual peaks in abundance reflect large catches of harvestfish in fall collections (SEAMAP-SA/SCMRD, 2000). Harvestfish were most abundant in Onslow Bay in fall (Table 18).

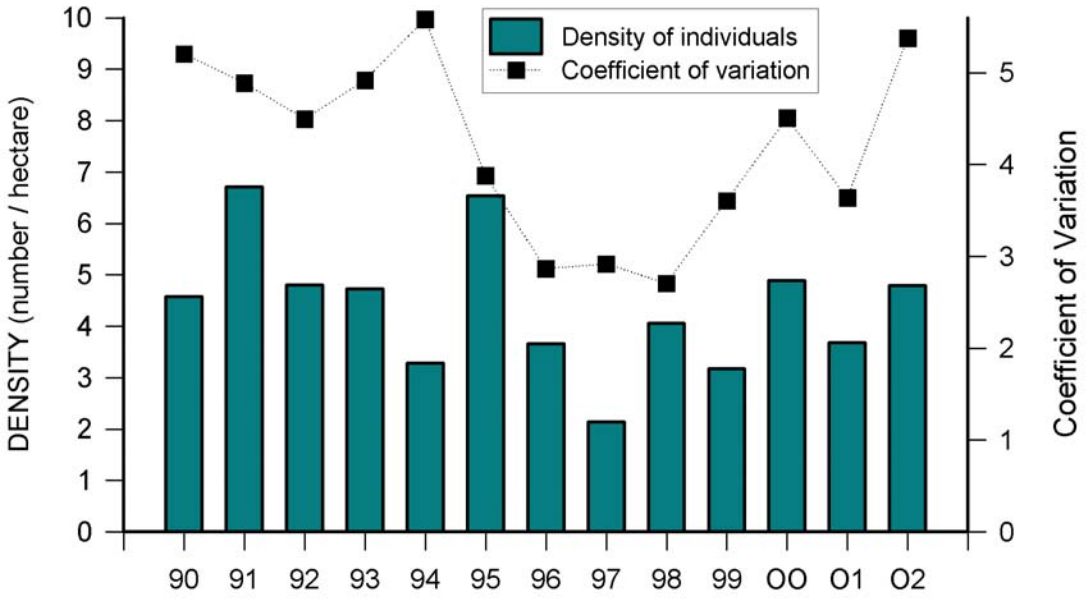

Figure 29. Annual densities of *Peprilus alepidotus*

Table 18 . Estimates of density (number of individuals/hectare) in 2002.

Peprilus alepidotus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	18.4	7.0
Onslow Bay	2.4	0.4	24.8	8.9
Long Bay	0.8	1.5	0.8	1.0
South Carolina	1.5	1.9	4.8	2.7
Georgia	1.6	2.4	16.3	6.7
Florida	2.3	2.2	3.0	2.5
Season	1.6	1.7	11.8	4.8

Fork lengths of *Peprilus alepidotus* ranged from 2 to 20 cm ($\bar{x}$ = 9.9). Length was significantly different among seasons (X^2 = 839, $p < 0.0001$). Mean length decreased from spring to fall (Figure 30). Mean length also varied significantly among regions (X^2 = 1401, $p < 0.0001$). Mean lengths of harvestfish were greatest in collections from Long Bay and South Carolina (Figure 31).

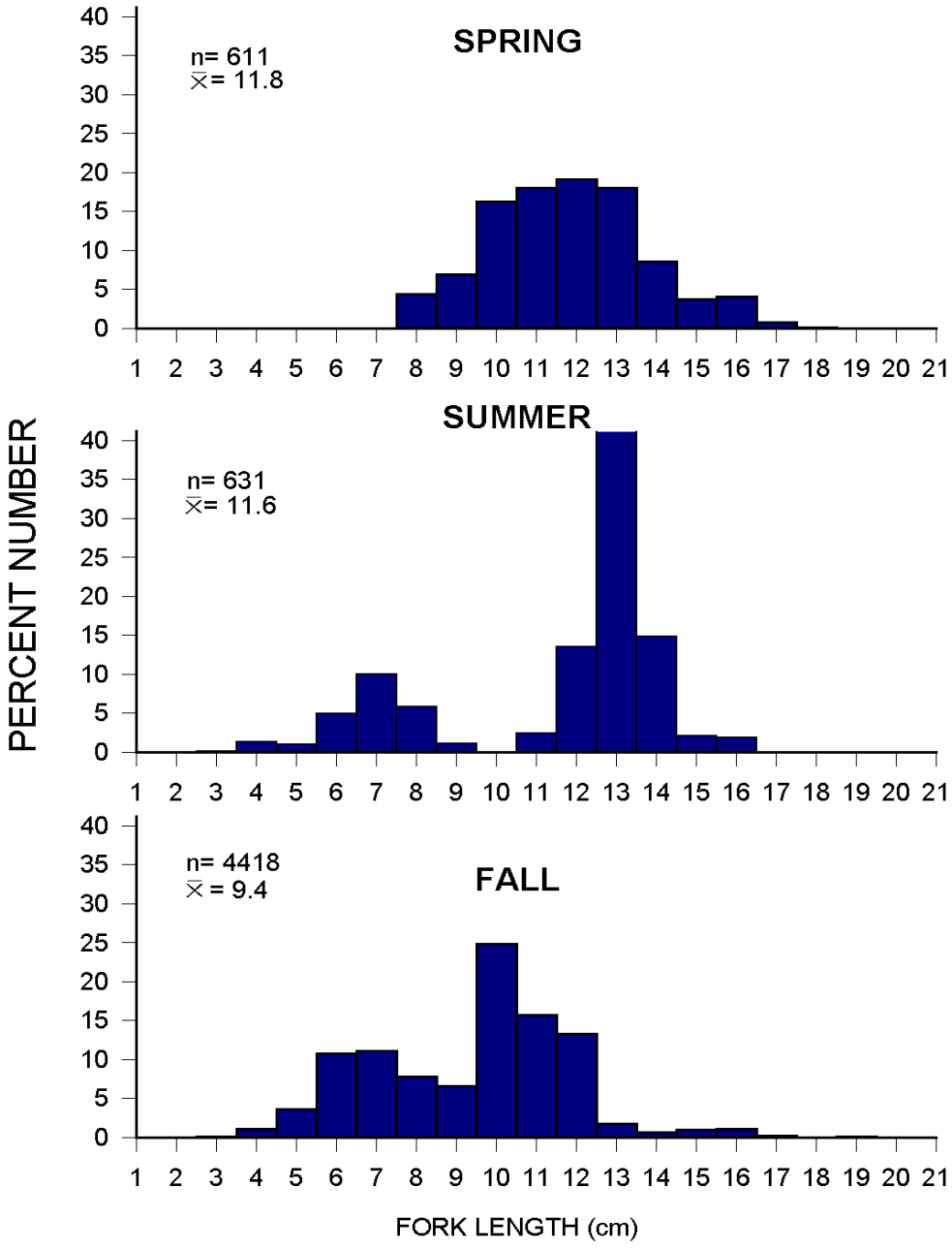

Figure 30. Seasonal length-frequencies of *Peprilus alepidotus* in 2002

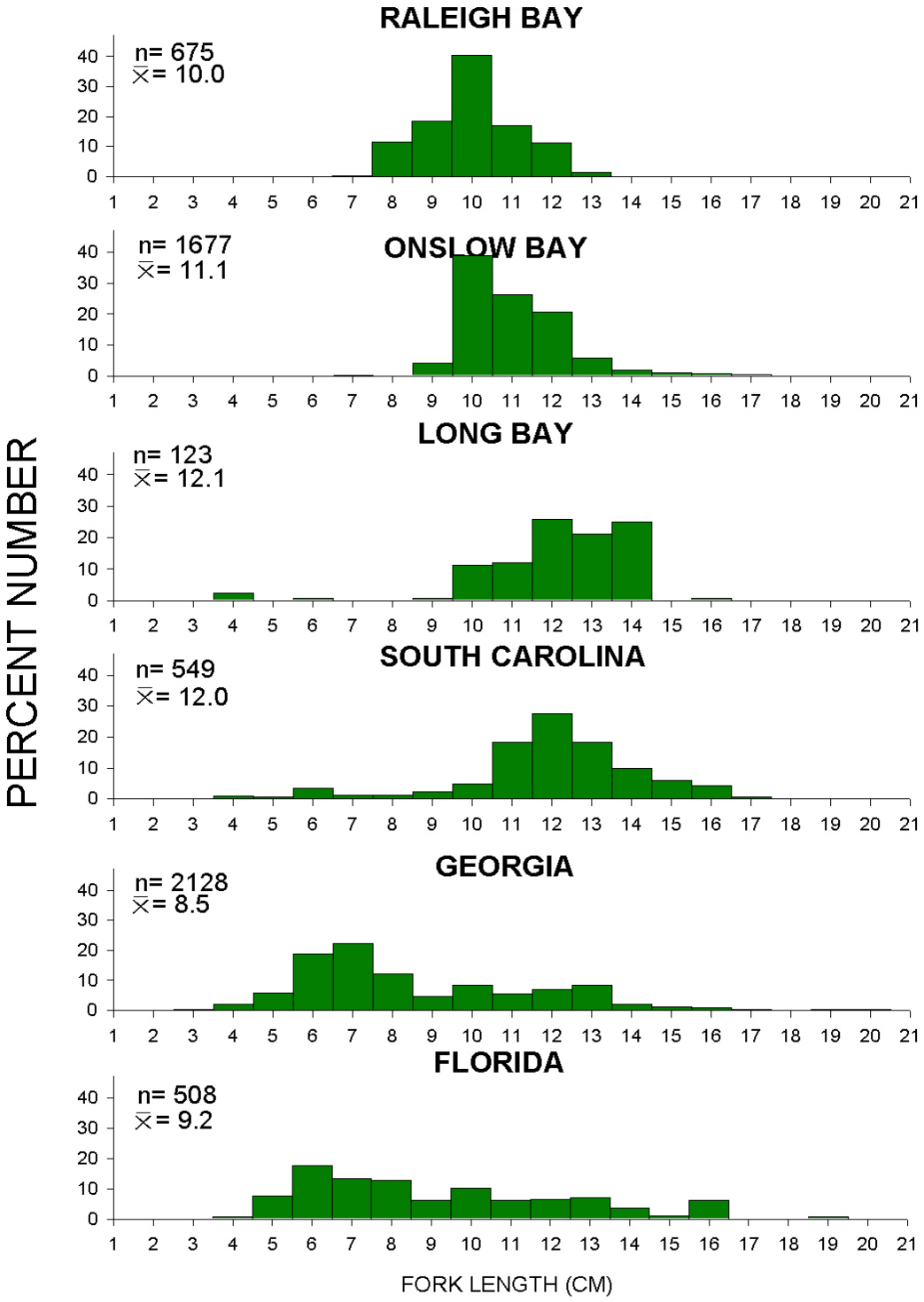

Figure 31. Regional length-frequencies of *Peprilus alepidotus* in 2002

Peprilus triacanthus

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 4,044 *Peprilus triacanthus* (CV=4.4; 3.4 individuals/ha), weighing 145 kg (0.1 kg/ha), in 2002. Density of individuals peaked in 2001 and in 2002 dropped to the lowest level since 1997 (Figure 32). Seasonal density was greatest in spring (Table 19). Raleigh Bay exhibited the highest regional density. Butterfish are generally most abundant in the northern portion of the SAB, with density decreasing with decreasing latitude (SEAMAP-SA/SCMRD, 2000).

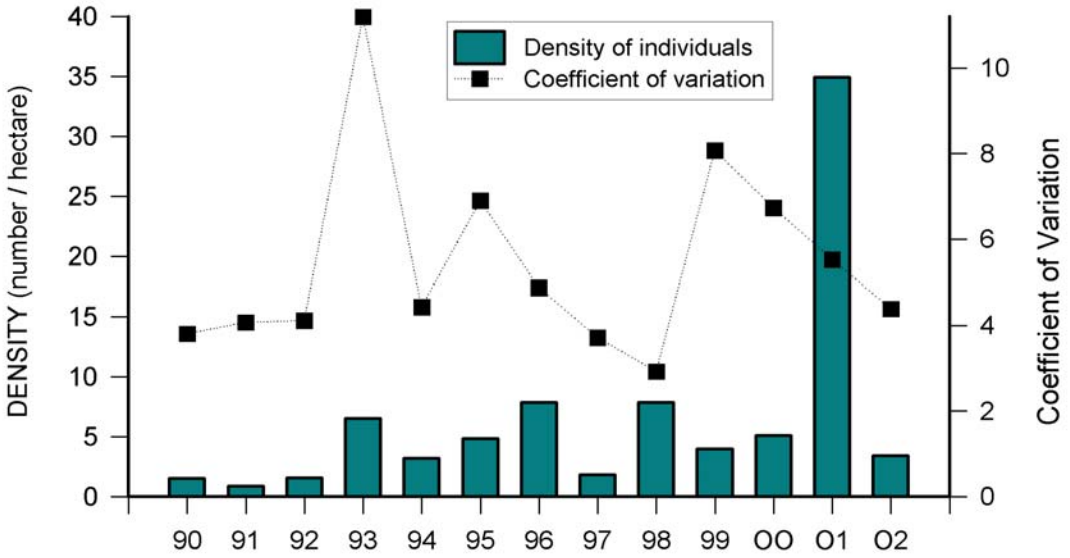

Figure 32. Annual densities of *Peprilus triacanthus*

Table 19 . Estimates of density (number of individuals/hectare) in 2002.

Peprilus triacanthus

	Spring	Summer	Fall	Region
Raleigh Bay	5.2	0	33.7	14.4
Onslow Bay	7.1	0.5	0.02	2.6
Long Bay	4.6	0.2	0	1.6
South Carolina	15.3	8.0	0.1	7.9
Georgia	2.4	0.7	0.2	1.1
Florida	0.2	0.5	0	0.2
Season	5.7	1.8	3.4	3.4

Fork lengths of *Peprilus triacanthus* ranged from 2 to 18 cm ($\bar{x}$ = 10.7). Length was significantly different among seasons ($X^2 = 2905$, $p < 0.0001$). Mean length increased from spring to summer (Figure 33). Mean length also varied significantly among regions ($X^2 = 1737$, $p < 0.0001$). Mean lengths of butterfish were greatest in collections from Raleigh Bay and Florida (Figure 34).

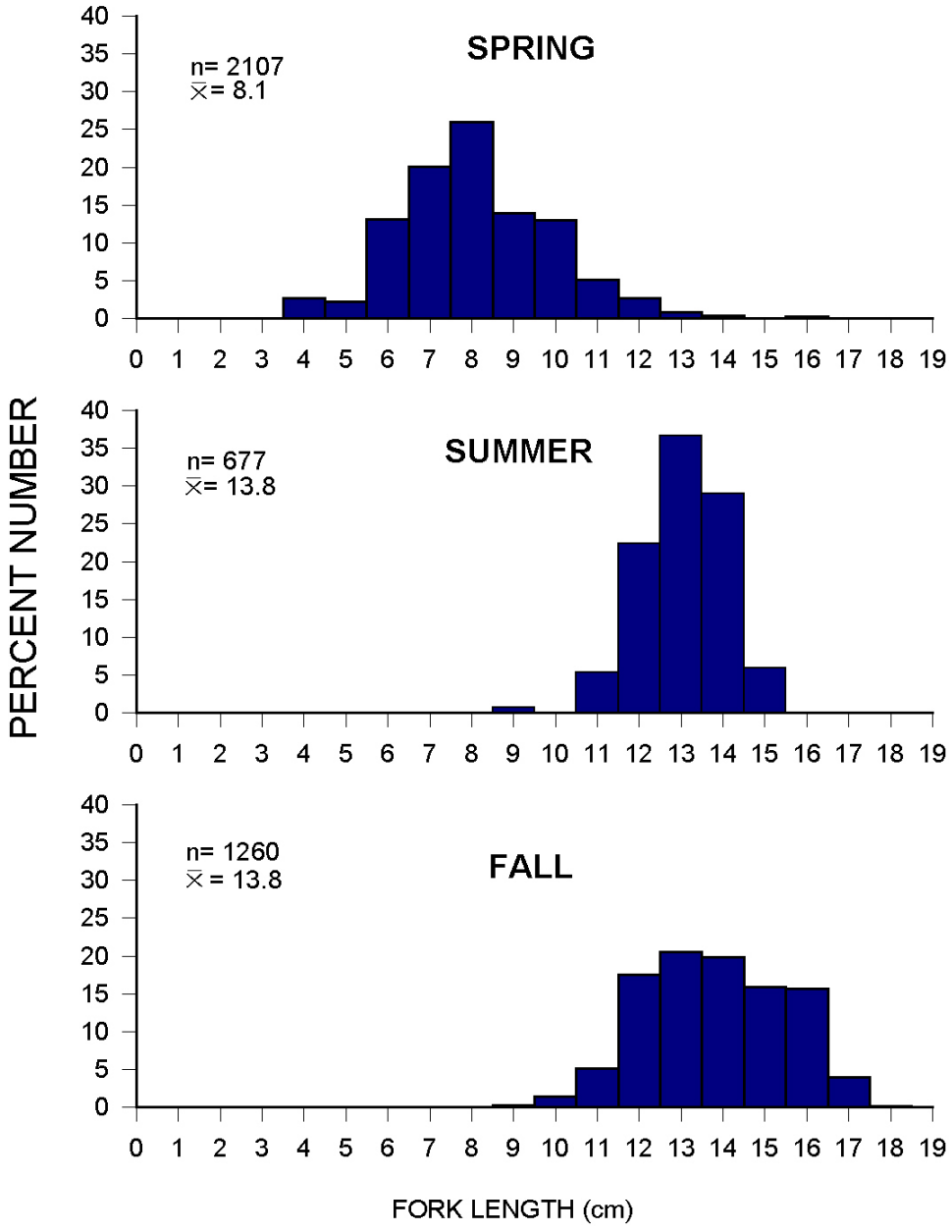

Figure 33. Seasonal length-frequencies of *Peprilus triacanthus* in 2002

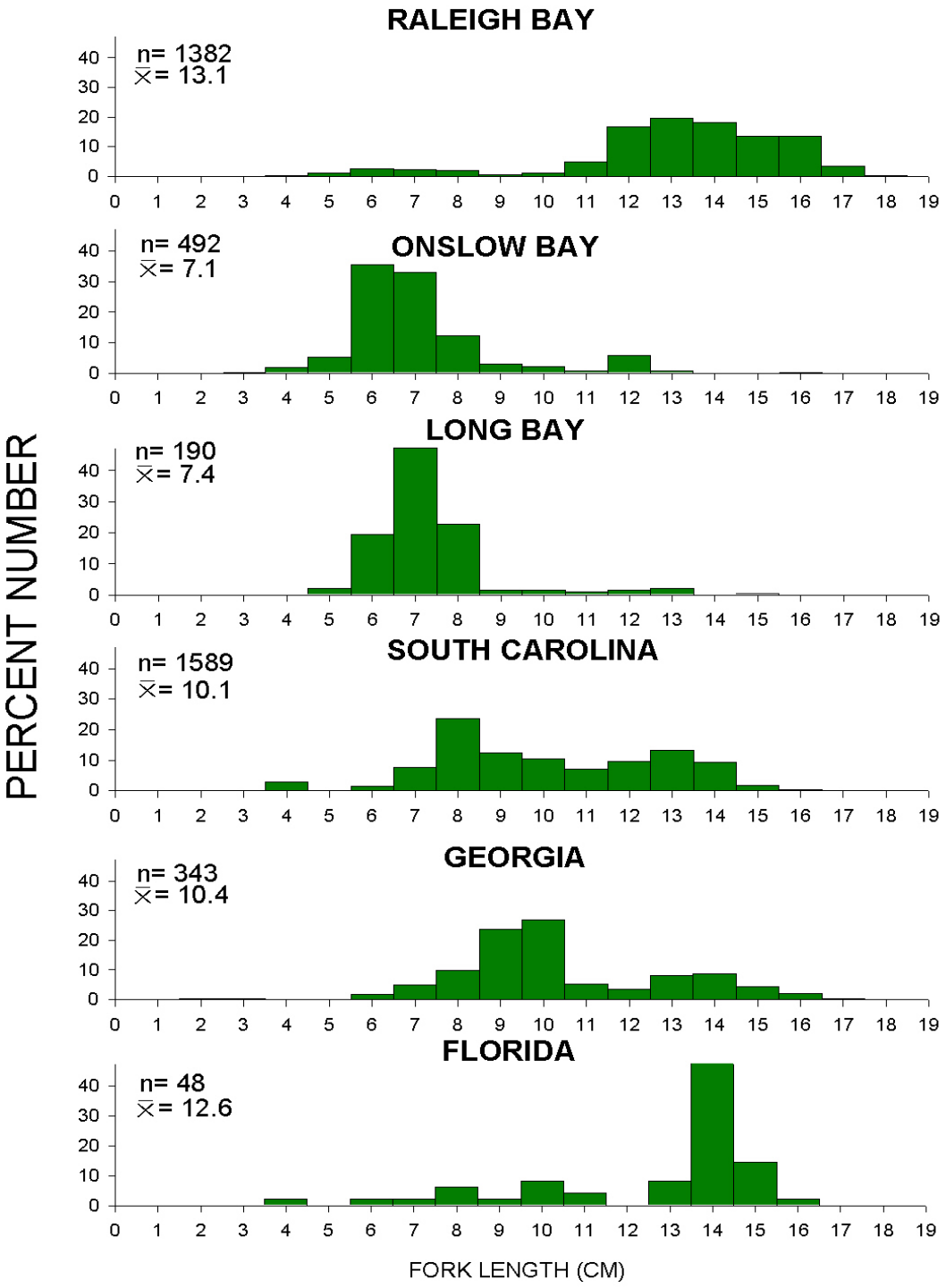

Figure 34. Regional length-frequencies of *Peprilus triacanthus* in 2002

Pogonias cromis

The black drum, *Pogonias cromis*, has been a rare species in SEAMAP-SA Shallow Water Trawl Survey collections (SEAMAP-SA/SCMRD, 2000). Eleven (CV=14.5; 0.009 individuals/ha) black drum, weighing 1.6 kg (0.001 kg/ha), were collected in 2002 (Figure 35). All individuals were taken in fall trawls (Table 20). Total lengths of *Pogonias cromis* ranged from 21 to 23 cm ($\bar{x}$ = 21.3).

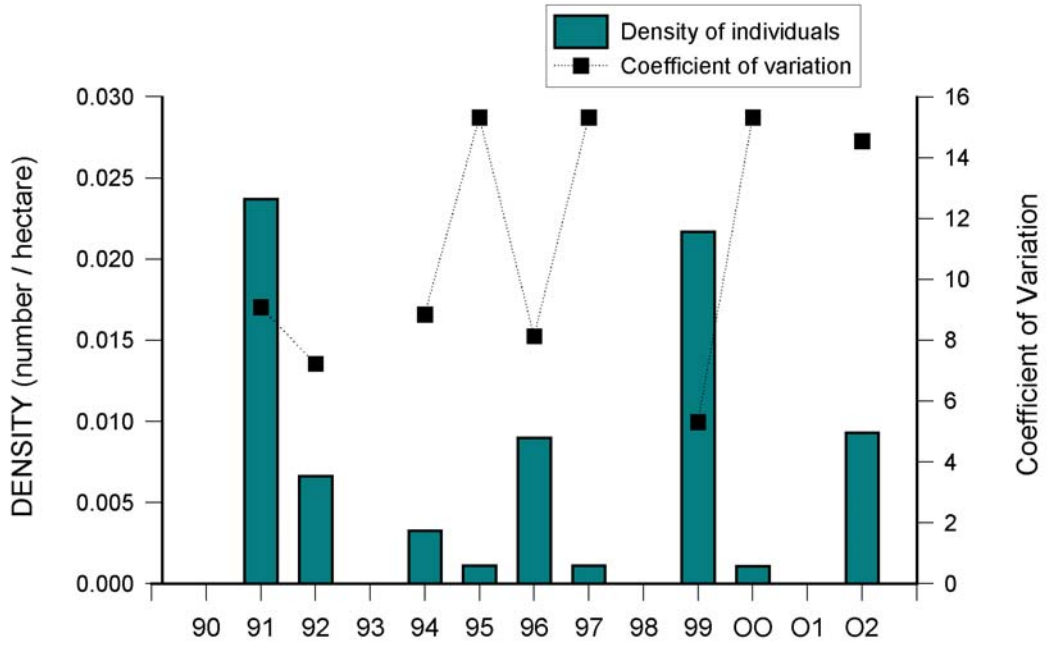

Figure 35. Annual densities of *Pogonias cromis*

Table 20 . Estimates of density (number of individuals/hectare) in 2002.

Pogonias cromis

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0.2	0.09
Onslow Bay	0	0	0	0
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0	0	0.01	0.003
Florida	0	0	0.02	0.005
Season	0	0	0.03	0.009

Pomatomus saltatrix

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 1,750 bluefish (CV=5.3; 1.5 individuals/ha), weighing 148 kg (0.1 kg/ha). Density in 2002 was the highest observed since 1995 (Figure 36). In 2002, density was greatest in spring and fall (Table 21). Bluefish were most abundant in the northern portion of the SAB, with density of individuals decreasing with decreasing latitude.

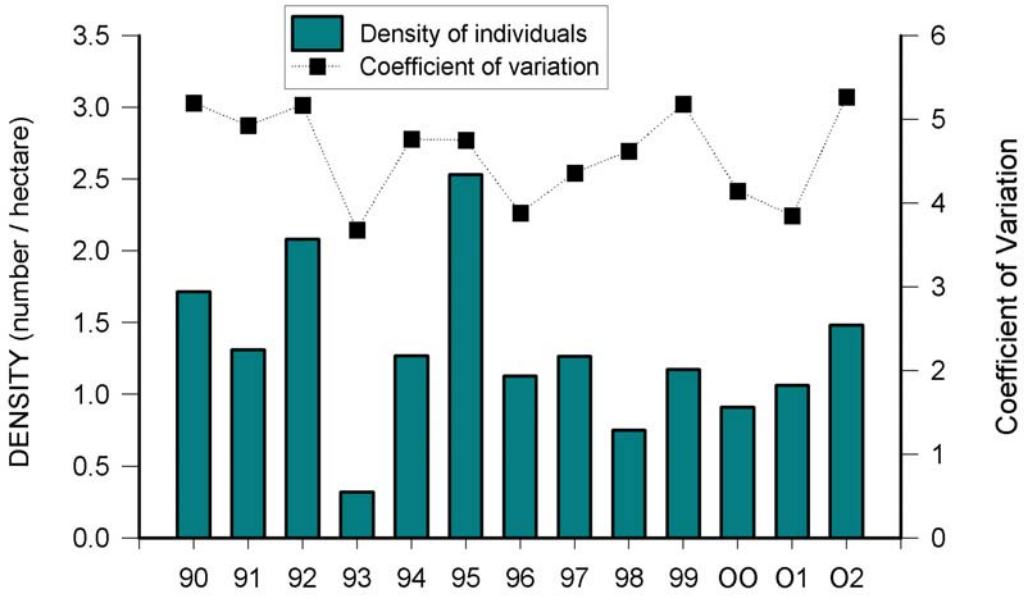

Figure 36. Annual densities of *Pomatomus saltatrix*

Table 21 . Estimates of density (number of individuals/hectare) in 2002.

Pomatomus saltatrix

	Spring	Summer	Fall	Region
Raleigh Bay	3.5	0	13.2	6.1
Onslow Bay	9.5	0.5	4.3	4.8
Long Bay	2.0	0.5	2.2	1.6
South Carolina	0.2	0.03	0.2	0.2
Georgia	0.2	0	0.04	0.07
Florida	0.05	0.07	0.03	0.05
Season	2.2	0.2	2.3	1.5

Fork lengths of *Pomatomus saltatrix* ranged from 10 to 31 cm ($\bar{x}$ = 18.3). Length was significantly different among seasons (X^2 =116, p < 0.0001). Mean length increase from spring to fall (Figure 37). Length also varied significantly among regions (X^2 =227, p < 0.0001), with larger fish occurring in the southern portion of the SAB (Figure 38). Mean lengths of bluefish were greatest in collections from waters off South Carolina and Florida.

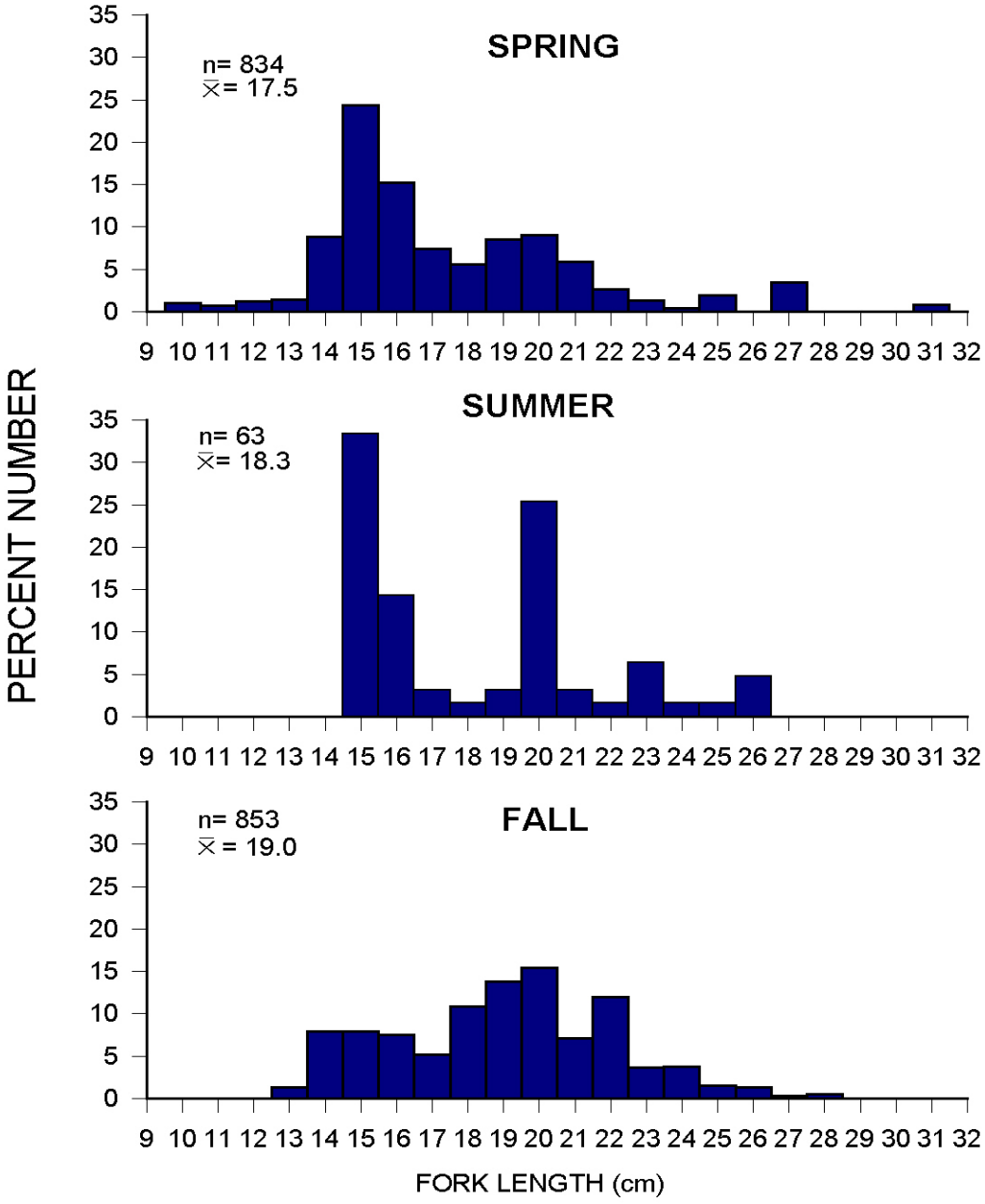

Figure 37. Seasonal length-frequencies of *Pomatomus saltatrix* in 2002

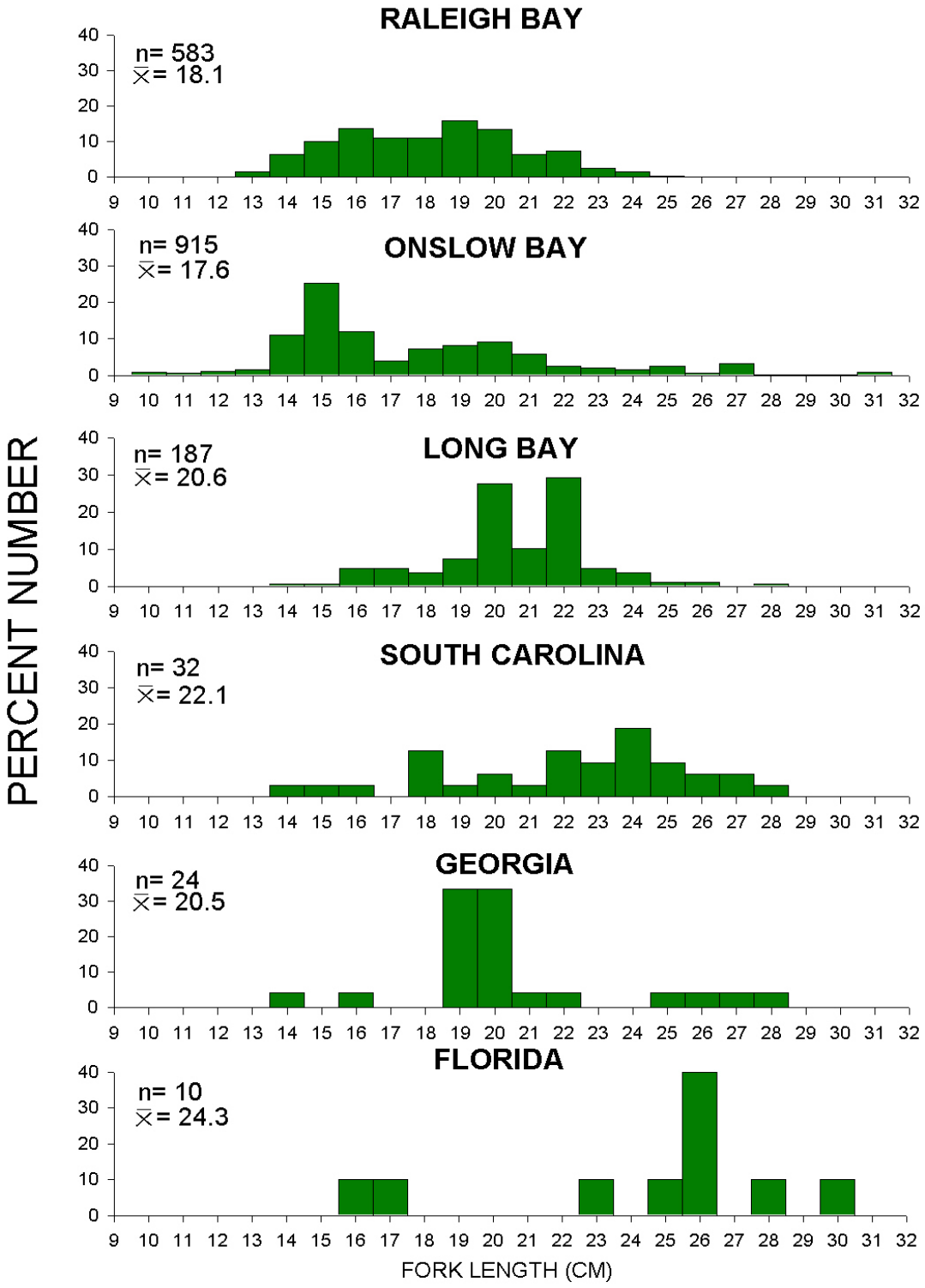

Figure 38. Regional length-frequencies of *Pomatomus saltatrix* in 2002

Sciaenops ocellatus

The red drum has been a very rare species in SEAMAP-SA trawls (SEAMAP-SA/SCMRD, 2000). In 2002, no red drum were taken in SEAMAP collections (Figure 39).

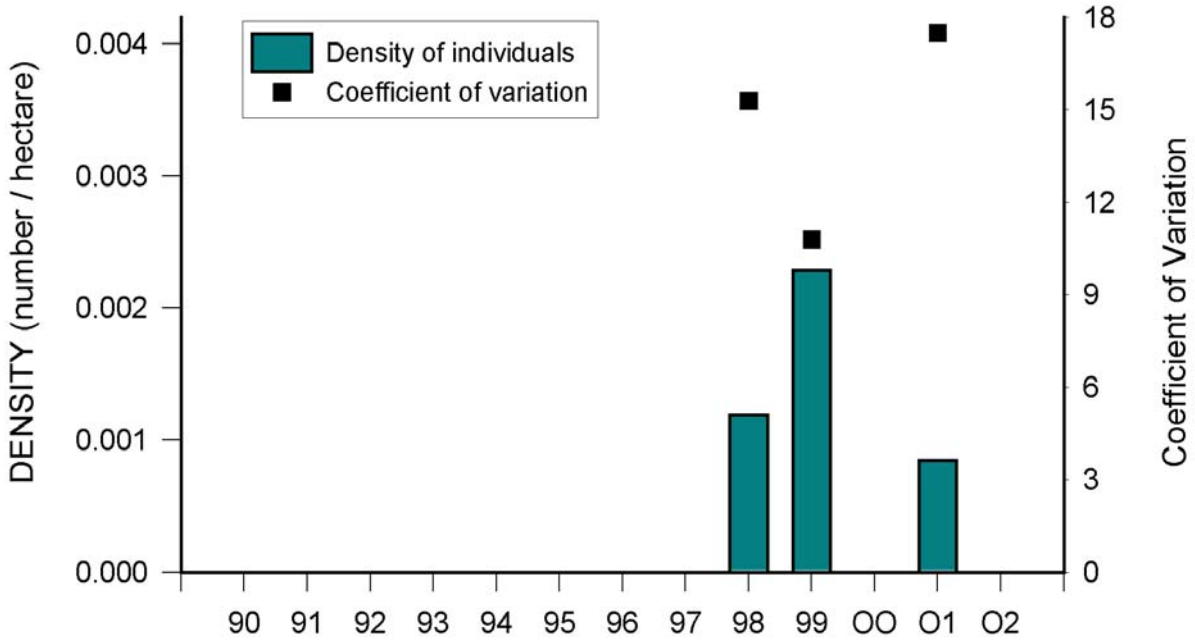

Figure 39. Annual densities of *Sciaenops ocellatus*

Scomberomorus cavalla

The 292 (CV=3.8; 0.2 individuals/ha) king mackerel collected from SEAMAP-SA Shallow Water Trawl Survey strata in 2002 weighed 15 kg (0.01 kg/ha). The density of king mackerel in 2002 was the lowest estimate since 1991 (Figure 40). In 2002, density was greatest in fall (Table 22). King mackerel tend to be most abundant in fall in the southern SAB (SEAMAP-SA/SCMRD, 2000). Greatest density of king mackerel occurred in Onslow Bay, as well as in waters off Florida in 2002.

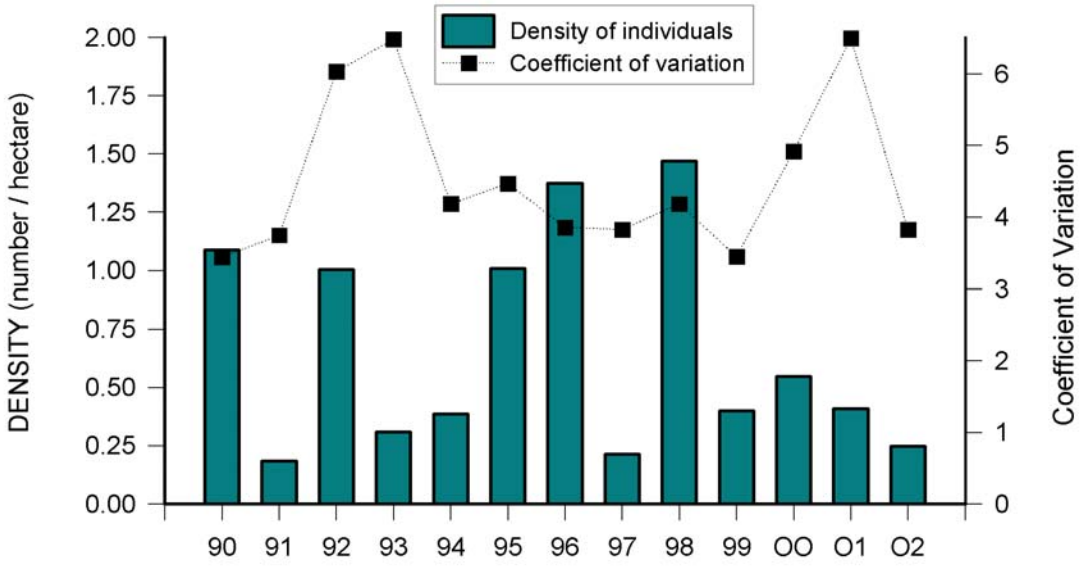

Figure 40. Annual densities of *Scomberomorus cavalla*

Table 22 . Estimates of density (number of individuals/hectare) in 2002.

Scomberomorus cavalla

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0.2	1.6	0.6
Long Bay	0	0.07	0.02	0.03
South Carolina	0.2	0.2	0.3	0.2
Georgia	0.04	0.009	0.2	0.1
Florida	0.08	0.6	0.8	0.5
Season	0.06	0.2	0.5	0.2

Fork lengths of *Scomberomorus cavalla* ranged from 4 to 51 cm ($\bar{x}$ = 14.9) and represented two year-classes. Annual cohorts of king mackerel are spawned in spring and summer (Finucane et al., 1986) and reach mean lengths greater than 40 cm by the end of their first year (Collins et al., 1989). Lengths were significantly different among seasons ($X^2 = 100$, $p < 0.0001$) and mean length deceased from spring to fall, as the result of recruitment of YOY (Figure 41). The fish less than 15 cm and greater than 34 cm in summer suggest that recruitment was beginning and that a few specimens from the age 2 year class were still present. Lengths varied significantly among regions ($X^2 = 163$, $p < 0.0001$), with Florida waters producing the greatest mean length and mean size decreasing northward (Figure 42).

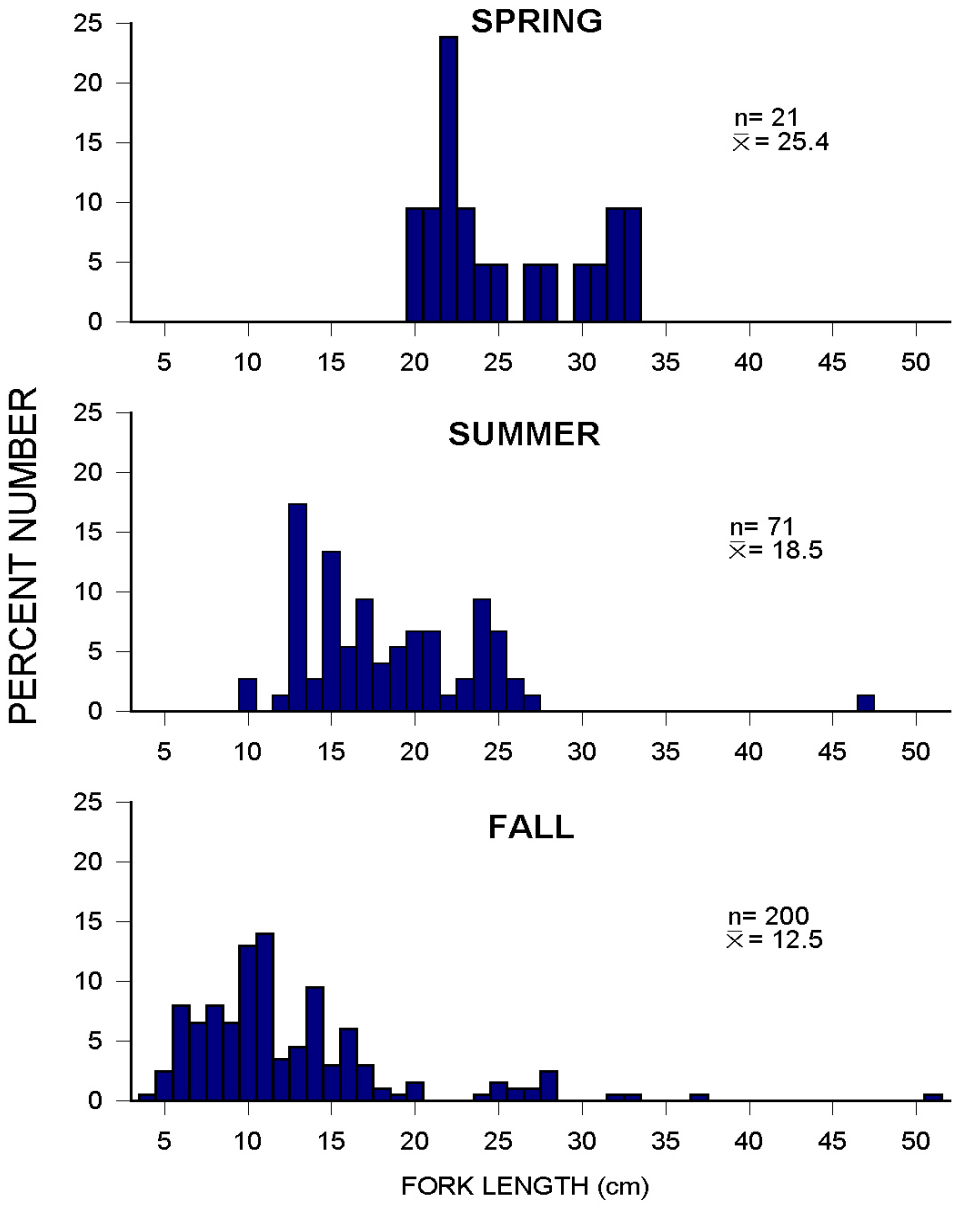

Figure 41. Seasonal length-frequencies of *Scomberomorus cavalla* in 2002

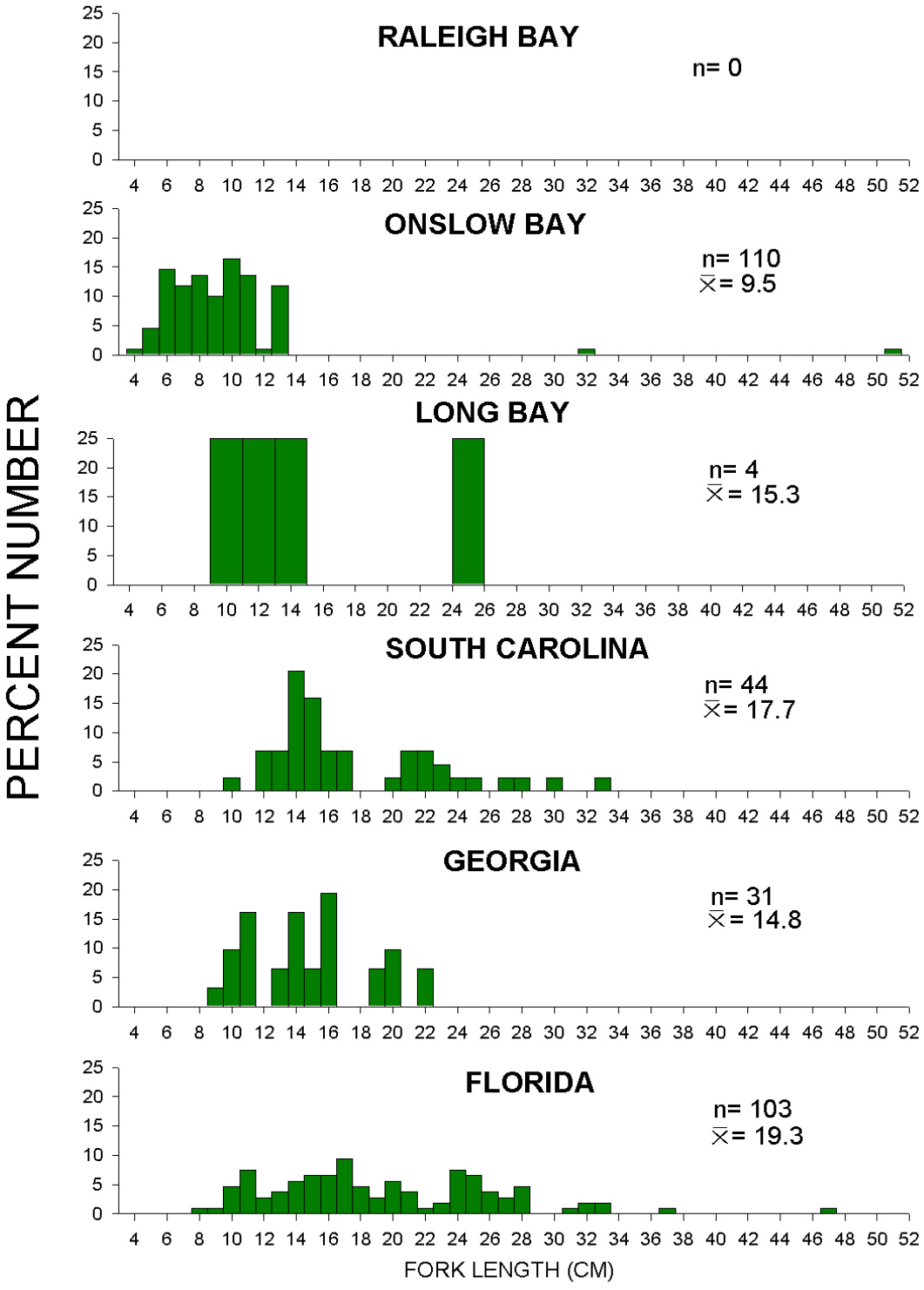

Figure 42. Regional length-frequencies of *Scomberomorus cavalla* in 2002

Scomberomorus maculatus

Sampling in 2002 produced 1,463 Spanish mackerel that weighed a total of 135 kg (CV=3.3; 1.2 individuals/ha; 0.1 kg/ha). The density of individuals of Spanish mackerel in 2002 decreased from the level observed in 2001 (Figure 43). Highest density of Spanish mackerel is generally found in the southern SAB, off Georgia and Florida (SEAMAP-SA/SCMRD, 2000); however, in 2002 a large number of Spanish mackerel were taken in summer in Onslow and Long Bays (Table 23).

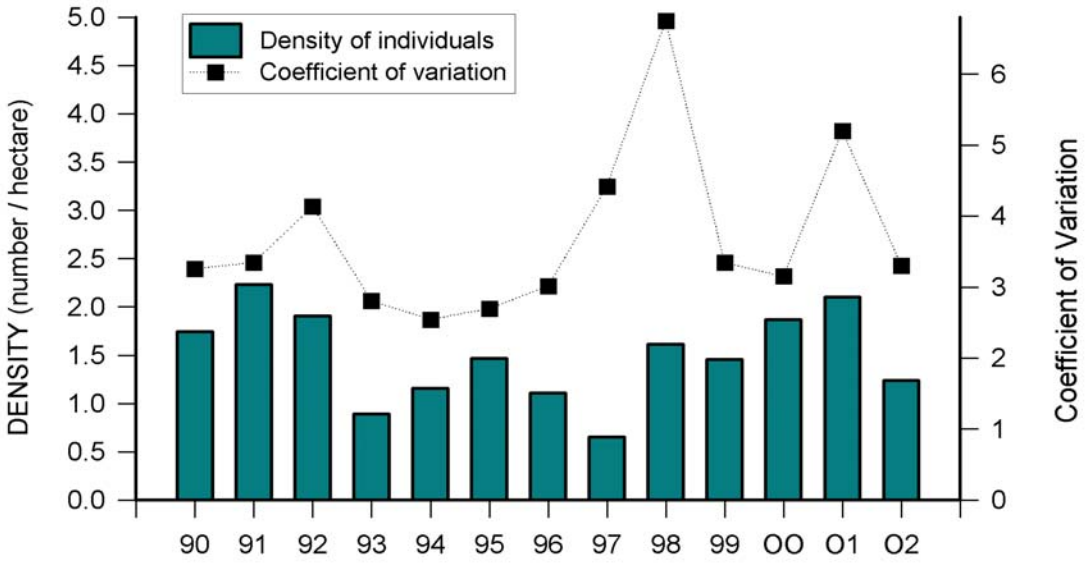

Figure 43. Annual densities of *Scomberomorus maculatus*

Table 23. Estimates of density (number of individuals/hectare) in 2002.

Scomberomorus maculatus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	1.4	0.6
Onslow Bay	0.06	4.6	0.6	1.8
Long Bay	0	3.6	0.2	1.3
South Carolina	0.8	1.6	0.5	1.0
Georgia	1.5	1.7	1.7	1.6
Florida	0.9	1.3	0.6	1.0
Season	0.8	2.2	0.9	1.2

Fork lengths of Spanish mackerel ranged from 5 to 43 cm ($\bar{x}$ = 19.8 cm). Lengths differed significantly among seasons (X^2 = 534, $p < 0.0001$). Mean length decreased from spring to summer, indicating the recruitment of YOY individuals, and increased in fall as the result of subsequent juvenile growth (Figure 44). By the end of their first year, Spanish mackerel reach lengths greater than 30 cm (Powell, 1975). Specimens collected in spring were generally fish ending their first year. Summer collections contained primarily newly recruited YOY with a few representatives of the previous year-class still present. Fall collections were made up of fish from two year-classes. Length also varied significantly among regions (X^2 = 409, $p < 0.0001$), and mean lengths ranged from a low of 14.5 cm in Long Bay to 23.5 cm off Florida (Figure 45).

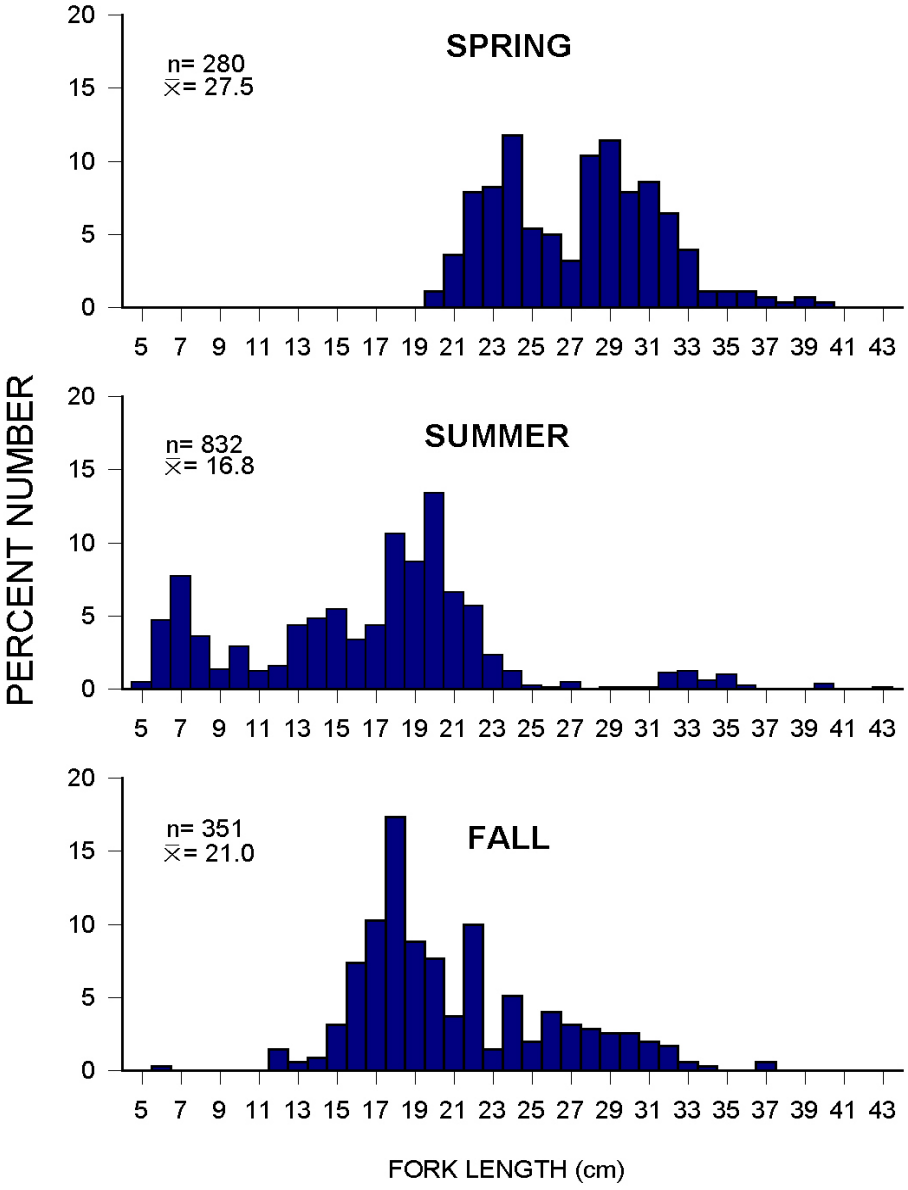

Figure 44. Seasonal length-frequencies of *Scomberomorus maculatus* in 2002

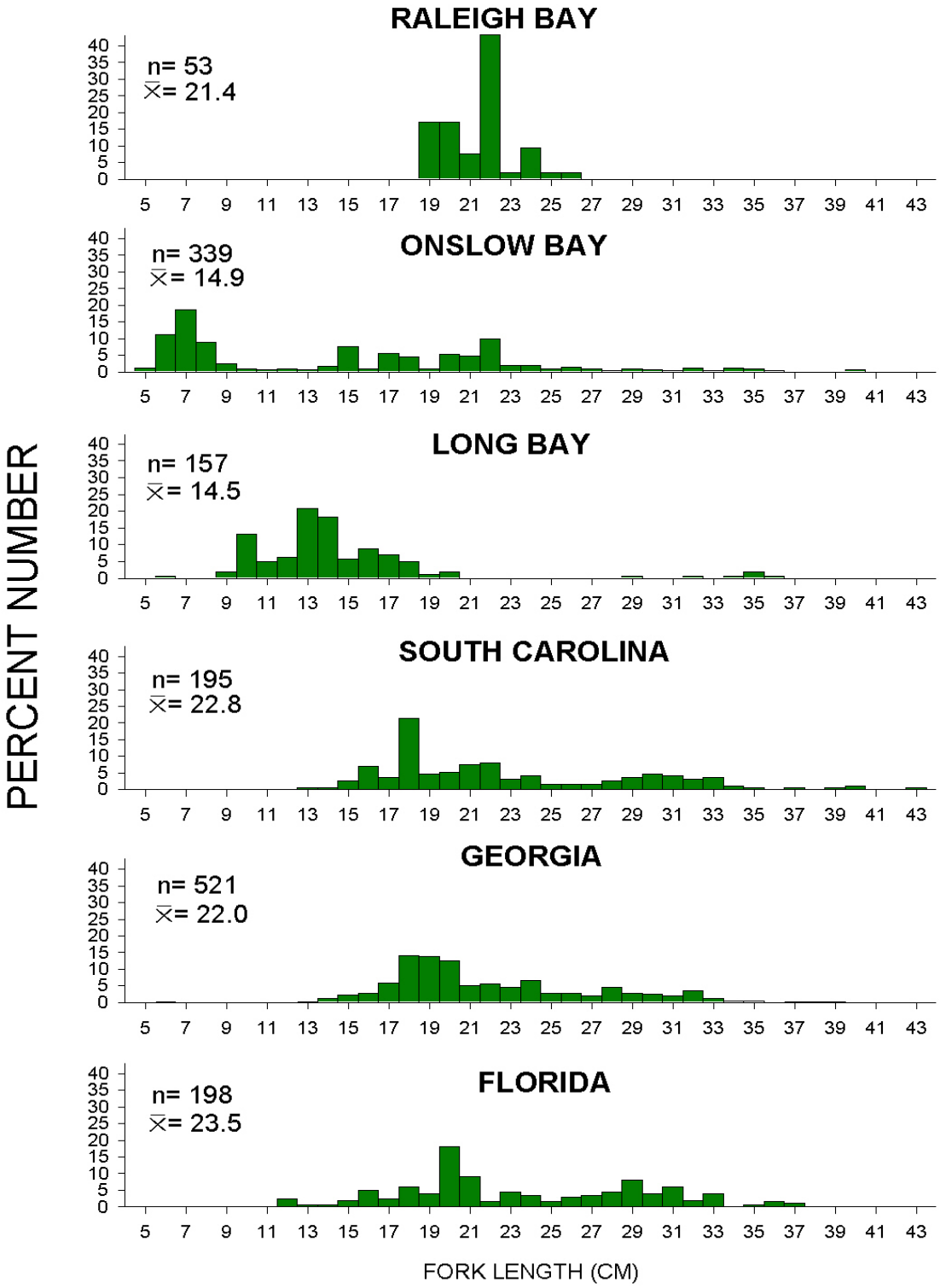

Figure 45. Regional length-frequencies of *Scomberomorus maculatus* in 2002

Callinectes sapidus

SEAMAP-SA Shallow Water Trawl Survey strata yielded a total of 77 (CV=5.2; 0.07 individuals/ha) blue crabs, weighing 11 kg (0.009 kg/ha). Overall density of *C. sapidus* peaked in 1990, followed by several years of low abundance and a secondary peak in 1999 (Figure 46). The density observed in 2002 represents the lowest annual density of blue crab in the history of the survey. In 2002, the highest seasonal density was observed during summer cruises and the greatest regional density of individuals occurred in Onslow Bay (Table 24). No blue crabs were taken in waters off South Carolina or Florida. Carapace widths of *C. sapidus* ranged from 6 to 17 cm ($\bar{x}$ = 13.2).

Males constituted only 7% of the blue crab catch. The tendency of males to inhabit lower salinity estuarine waters explains their lesser importance in offshore catches (Low et al., 1987). Mature female blue crab dominated catches, with approximately 27% of females being ovigerous. Non-ovigerous females outnumbered ovigerous females in all seasons and in all regions, except Long Bay, where only four crabs were taken.

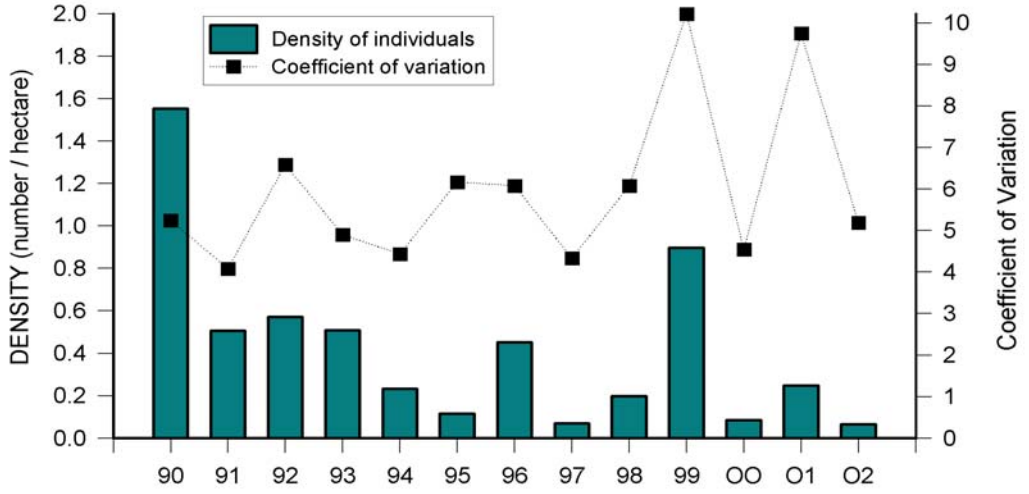

Figure 46. Annual densities of *Callinectes sapidus*

Table 24 . Estimates of density (number of individuals/hectare) in 2002.

Callinectes sapidus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.09	0.05	0.05
Onslow Bay	0.09	0.7	0.08	0.3
Long Bay	0	0.1	0	0.03
South Carolina	0	0	0	0
Georgia	0.009	0.08	0	0.03
Florida	0	0	0	0
Season	0.02	0.2	0.02	0.07

Farfantepenaeus aztecus

The brown shrimp, formerly *Penaeus aztecus* (Perez-Farfante and Kensley, 1997), ranked third among decapod crustaceans, with 3,957 specimens (CV=3.7; 3.3 individuals/ha) collected, weighing 79 kg (0.07 kg/ha). The estimate of density of brown shrimp in 2002 represents a considerable drop in abundance from the previous two years (Figure 47). Summer collections produced the highest seasonal density (Table 25). The greatest regional density of brown shrimp occurred in Onslow Bay. The overall seasonal pattern of abundance of brown shrimp includes small spring catches, followed by larger summer catches, and moderately-sized fall catches (SEAMAP-SA/SCMRD, 2000).

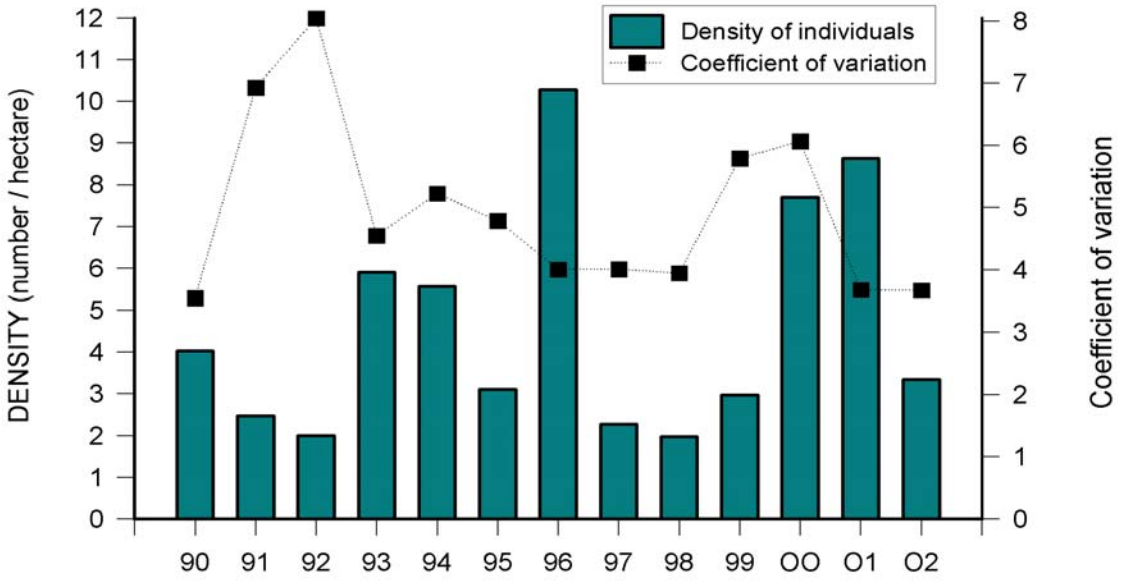

Figure 47. Annual densities of *Farfantepenaeus aztecus*

Table 25 . Estimates of density (number of individuals/hectare) in 2002.

Farfantepenaeus aztecus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	9.7	3.7
Onslow Bay	0	16.4	4.9	7.1
Long Bay	0	4.8	0	1.6
South Carolina	0	15.0	0.6	5.2
Georgia	0.06	8.1	0.2	2.8
Florida	0.2	1.6	0	0.6
Season	0.06	8.5	1.9	3.3

Total lengths of *F. aztecus* ranged from 7 to 20 cm with a mean length of 12.8 cm. Total lengths differed significantly among seasons (X^2 =593, $p < 0.0001$) Mean length increased from spring to fall (Figure 48). Lengths were also significantly different among regions (X^2 =583, $p < 0.0001$). Mean lengths ranged from 11.5 cm in Long Bay to 14.4 cm in Raleigh Bay (Figure 49).

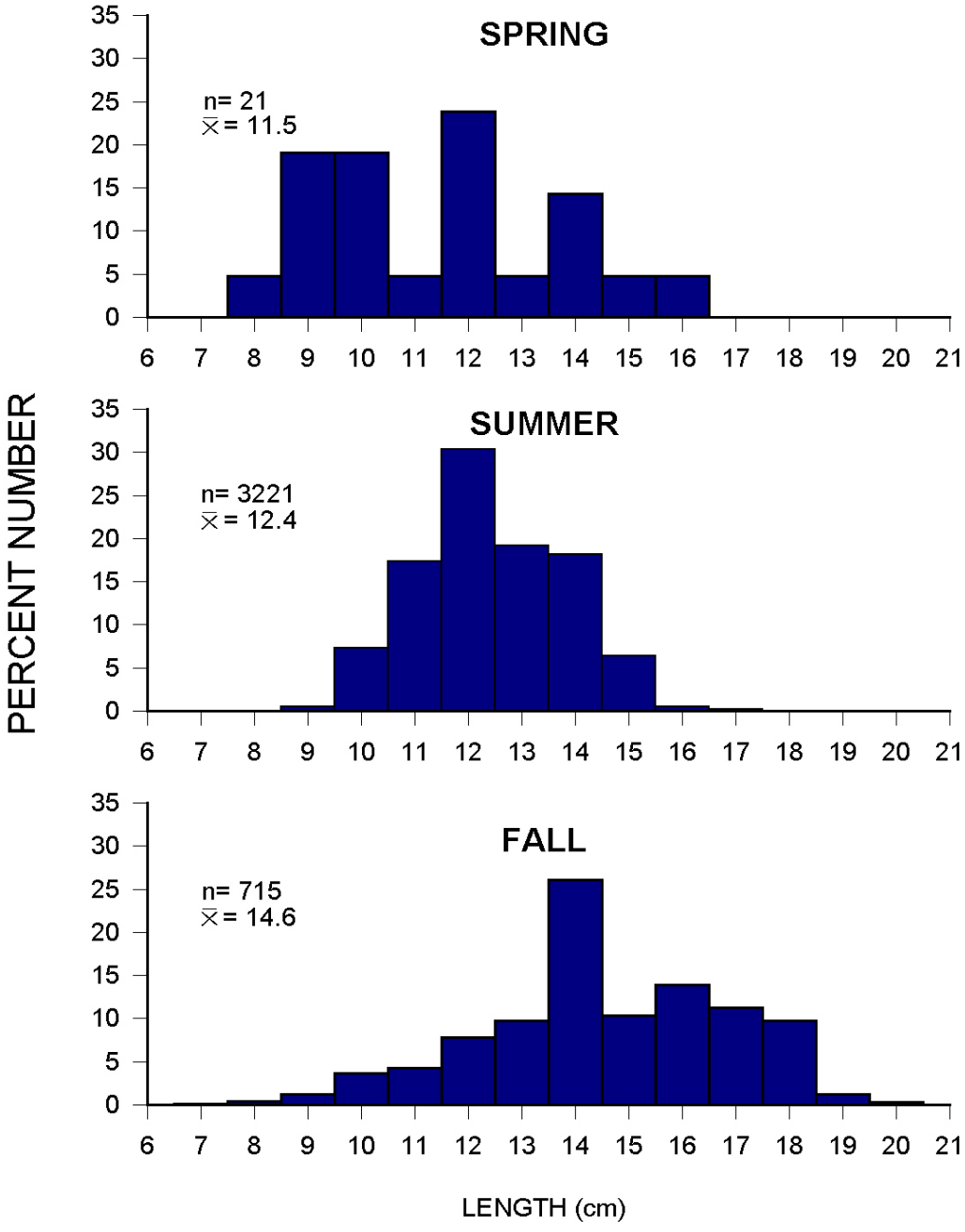

Figure 48. Seasonal length-frequencies of *Farfantepenaeus aztecus* in 2002

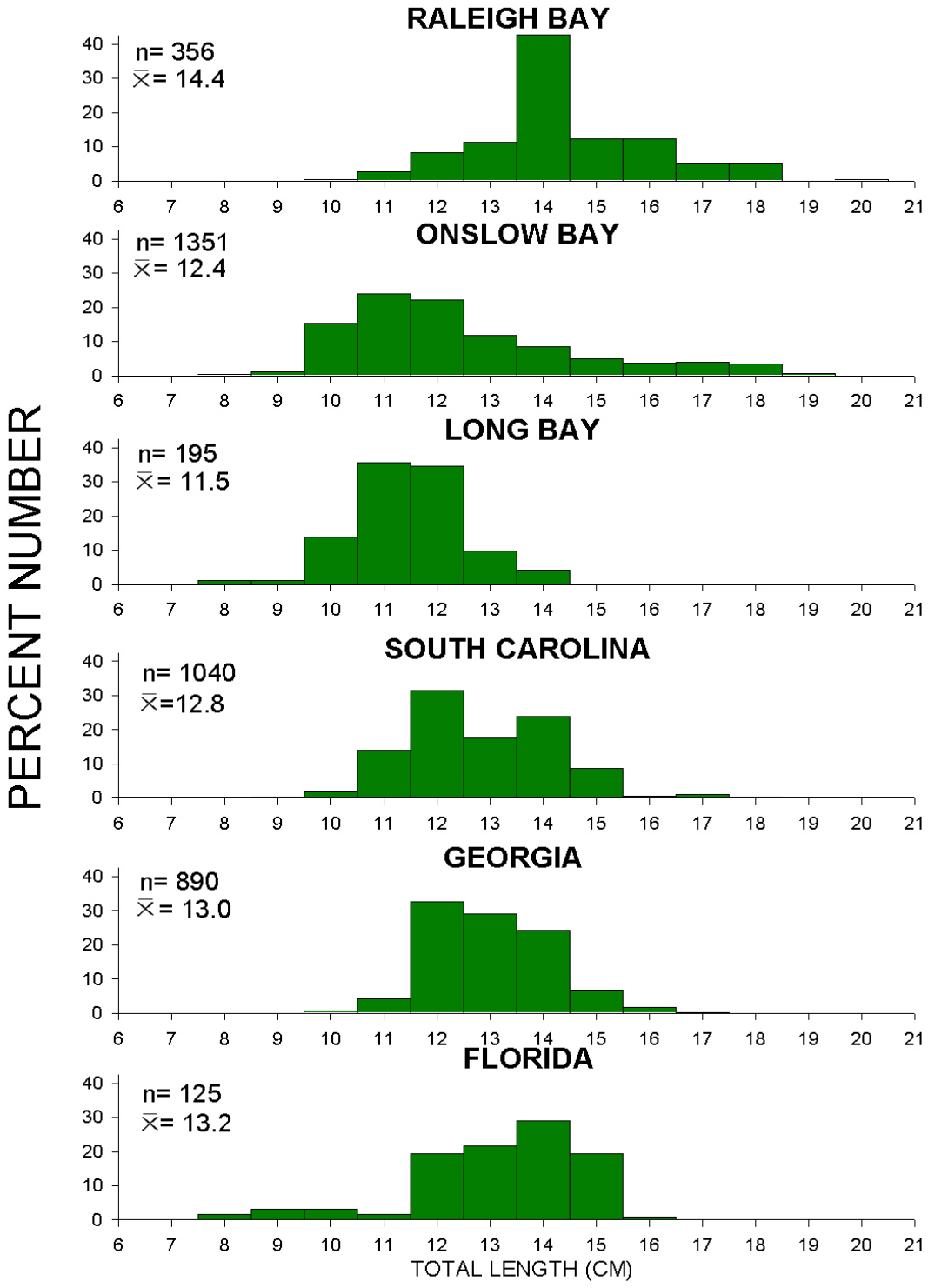

Figure 49. Regional length-frequencies of *Farfantepenaeus aztecus* in 2002

Only 9% of the male brown shrimp had fully developed spermatophores (ripe), and less than 1% of the females had ripe ovaries. Spermatophore development was not independent of season ($G = 47$, $p < 0.0001$) or region ($G = 350$, $p < 0.0001$). Although the majority of males with fully developed spermatophores were taken in summer (83%), those taken in fall contributed more to the composition of spermatophore development within that season (Figure 50). Only three females with ripe ovaries were sampled in 2002 and only 1% of the female brown shrimp were found to be mated.

Occurrence of black gill disease in brown shrimp was observed and recorded. Presence of black gill disease was found in less than 1% of the brown shrimp and only in fall 2002. Infestation of brown shrimp occurred in the southern portion of the SAB, in waters off South Carolina and Georgia.

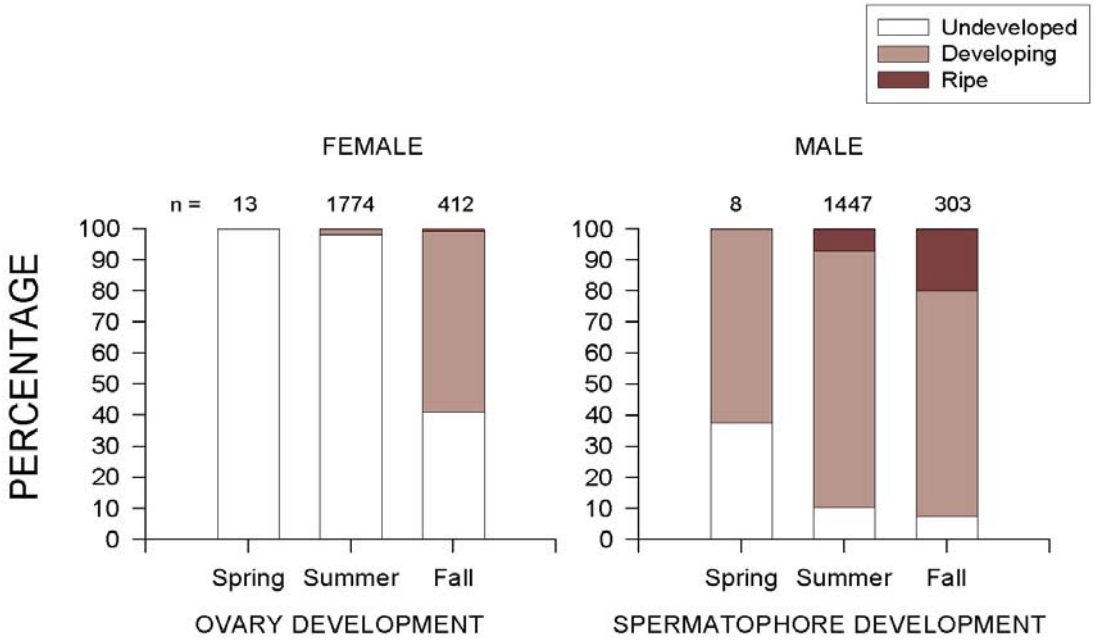

Figure 50. Gonadal development of *Farfantepenaeus aztecus* in 2002

Farfantepenaeus duorarum

The pink shrimp, formerly *Penaeus duorarum* (Perez-Farfante and Kensley, 1997), was the least abundant commercially important penaeid shrimp species collected in 2002. The 1,025 specimens (CV=7.3; 0.9 individuals/ha) taken from SEAMAP trawls weighed 15 kg (0.01 kg/ha). Density of individuals in 2002 represents the highest abundance since 1997 (Figure 51). In 2002, abundance was greatest in spring collections in Onslow Bay. No pink shrimp were taken south of Onslow Bay in summer or fall (Table 26).

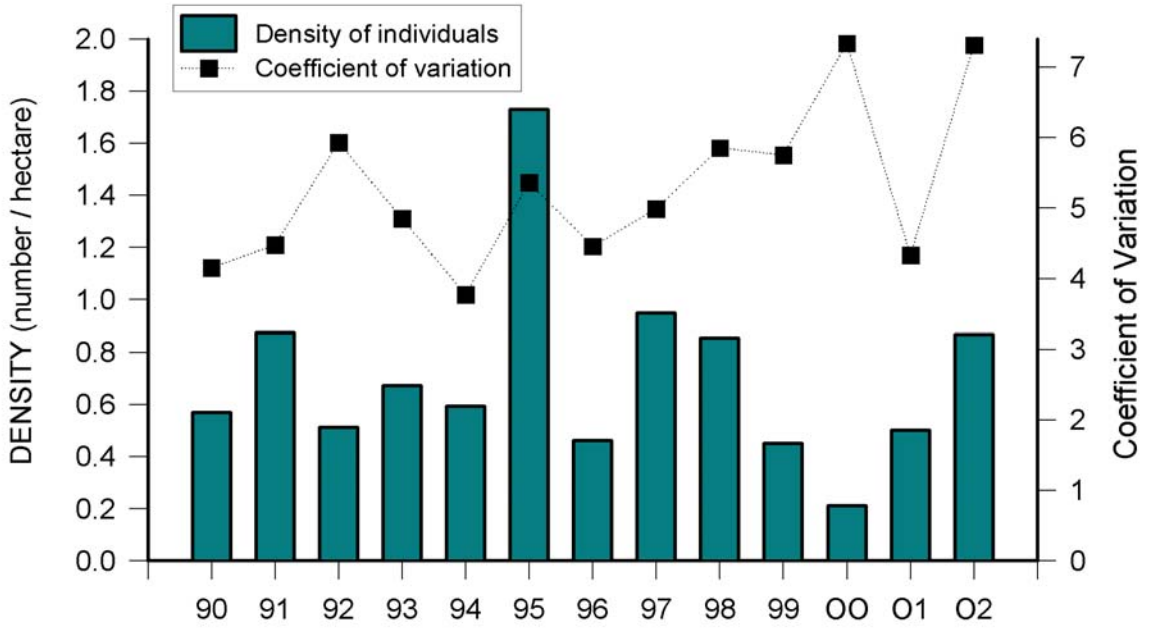

Figure 51. Annual densities of *Farfantepenaeus duorarum*

Table 26 . Estimates of density (number of individuals/hectare) in 2002.

Farfantepenaeus duorarum

	Spring	Summer	Fall	Region
Raleigh Bay	0.2	0.06	0.05	0.1
Onslow Bay	12.9	0.06	0.3	4.5
Long Bay	0.1	0	0	0.04
South Carolina	1.5	0	0	0.5
Georgia	0.5	0	0	0.2
Florida	0	0	0	0
Season	2.7	0.02	0.05	0.9

Total length of pink shrimp ranged from 8 to 17 cm ($\bar{x}$ =11.5 cm). Total lengths varied significantly among seasons (X^2=7.4, $p < 0.05$). Mean length was greatest in summer (12.0 cm) and decreased in fall (10.7 cm) (Figure 52). Total length differed significantly among regions (X^2 =20, $p < 0.001$). Regionally, mean lengths ranged from 11.4 cm in Onslow Bay to 12.1 cm in Raleigh Bay (Figure 53).

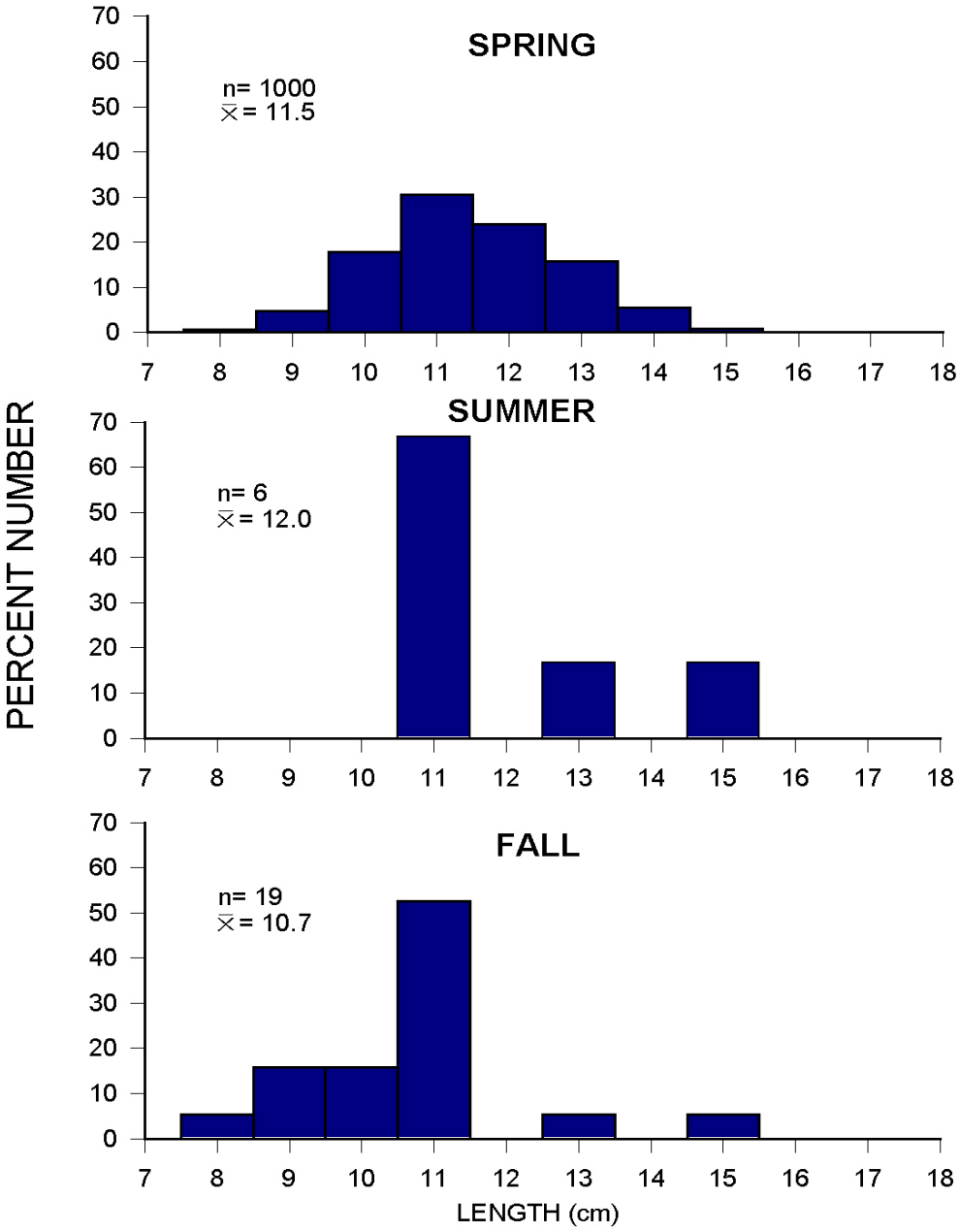

Figure 52. Seasonal length-frequencies of *Farfantepenaeus duorarum* in 2002

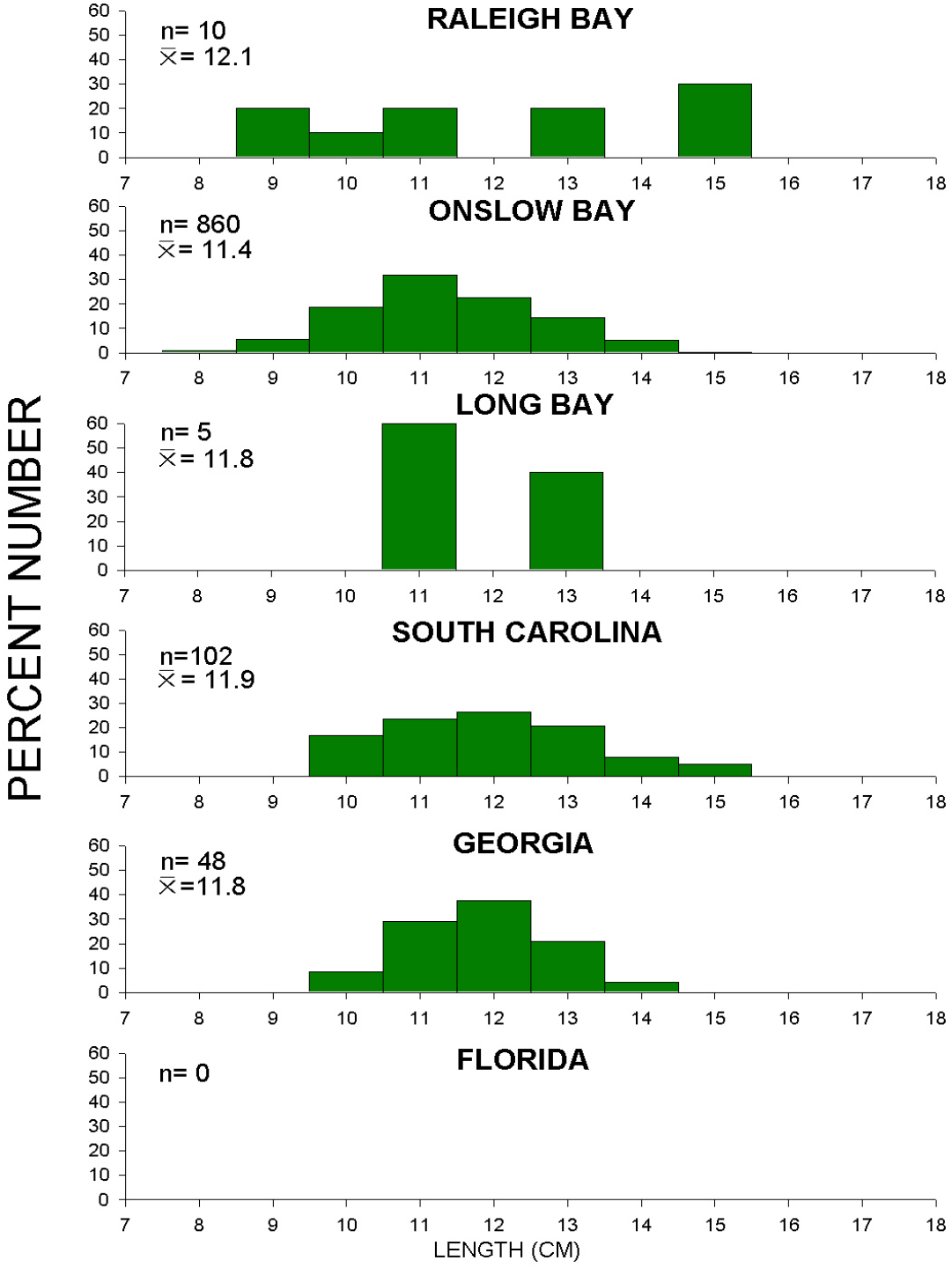

Figure 53. Regional length-frequencies of *Farfantepenaeus duorarum* in 2002

In SEAMAP-SA Shallow Water Trawl Survey strata approximately 10% of male pink shrimp sampled had fully developed spermatophores (Figure 54). Spermatophore development was not independent of season ($G = 15$, $p < 0.005$), but was independent of region ($G = 7$, $p > 0.05$). Burukovskii and Bulanenkov (1971) reported that spawning activity of pink shrimp in North Carolina waters peaked in spring. No ripe female pink shrimp were collected in 2002; however, approximately 5% of the total number of female pink shrimp sampled were mated. Like brown shrimp, copulation in pink shrimp may occur regardless of developmental stage of the ovaries (Perez-Farfante, 1969). Presence of black gill disease was not noted in any pink shrimp.

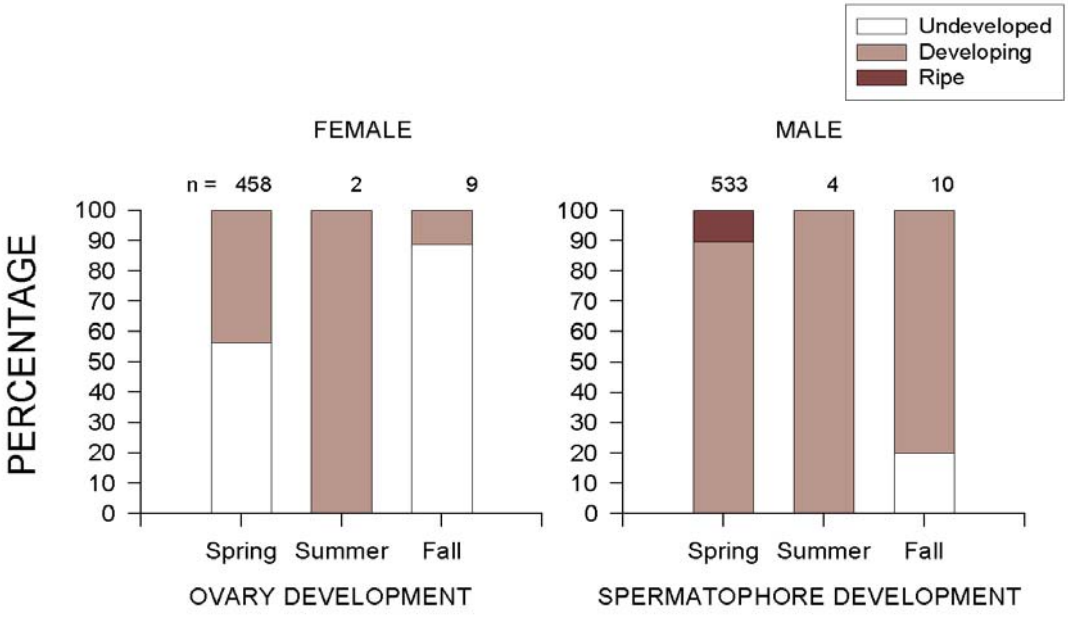

Figure 54. Gonadal development of *Farfantepenaeus duorarum* in 2002

Litopenaeus setiferus

The white shrimp, formerly *Penaeus setiferus* (Perez-Farfante and Kensley, 1997), was the most abundant decapod crustacean species taken in 2002 by the SEAMAP-SA Trawl Survey and ranked eighth in abundance overall, with 10,858 (CV=5.0; 9.2 individuals/ha), weighing 283 kg (0.2 kg/ha). Although the annual density of abundance of *L. setiferus* in 1999 was the greatest annual density in the history of the survey, abundance decreased in each subsequent year (Figure 55). In 2002, density was highest in fall collections (Table 27). Greatest regional densities of abundance were found in Onslow Bay and off Florida.

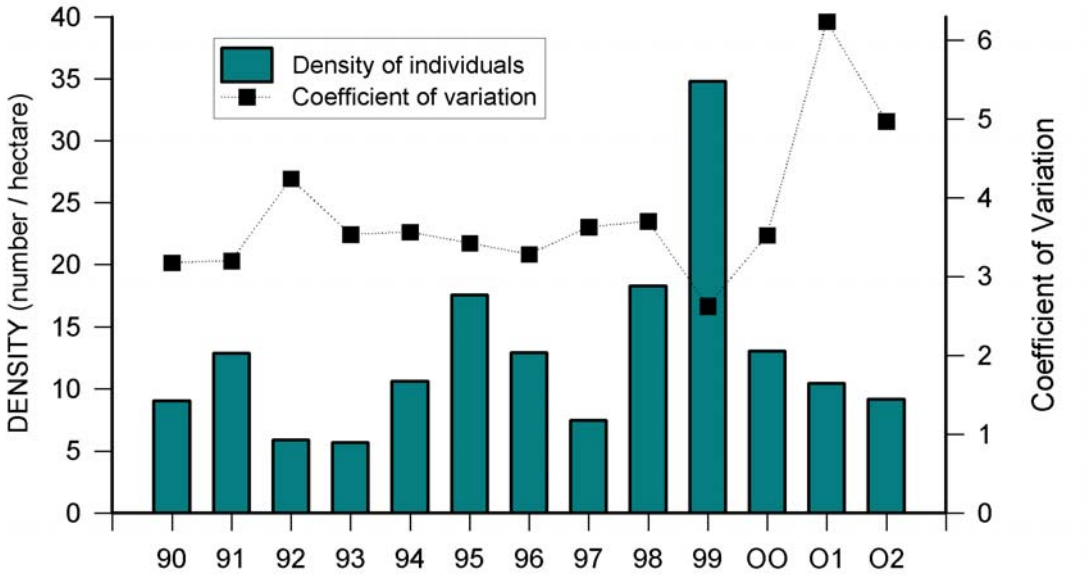

Figure 55. Annual densities of *Litopenaeus setiferus*

Table 27 . Estimates of density (number of individuals/hectare) in 2002.

Litopenaeus setiferus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0.8	0.3
Onslow Bay	0.5	0.2	47.0	15.2
Long Bay	0.2	0.6	0.6	0.5
South Carolina	9.0	6.0	13.7	9.5
Georgia	10.6	3.6	8.1	7.4
Florida	1.0	20.5	31.9	17.9
Season	4.9	6.0	18.0	9.2

Total lengths of *L. setiferus* ranged from 8 to 19 cm, with a mean length of 14.7 cm. There was a significant difference in mean length among seasons (X^2 =920, $p < 0.0001$) (Figure 56), with mean length greatest in spring. Smaller YOY individuals began moving out of the estuaries in summer and continued to do so into the fall. Regional mean lengths also differed significantly (X^2 = 1704, $p < 0.0001$). Florida produced the smallest mean length (14.1 cm) and Long Bay the greatest (16.6 cm) (Figure 57).

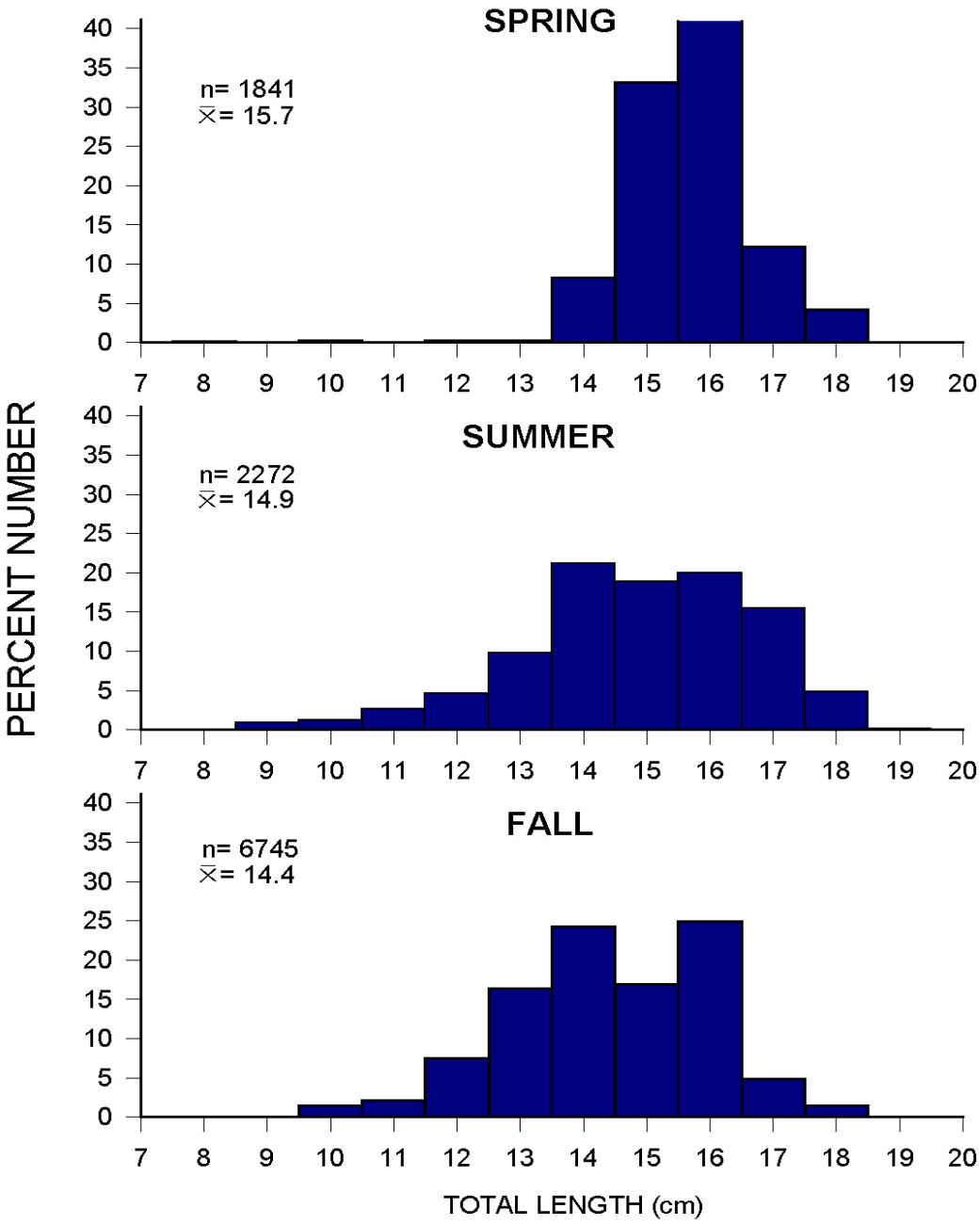

Figure 56. Seasonal length-frequencies of *Litopenaeus setiferus* in 2002

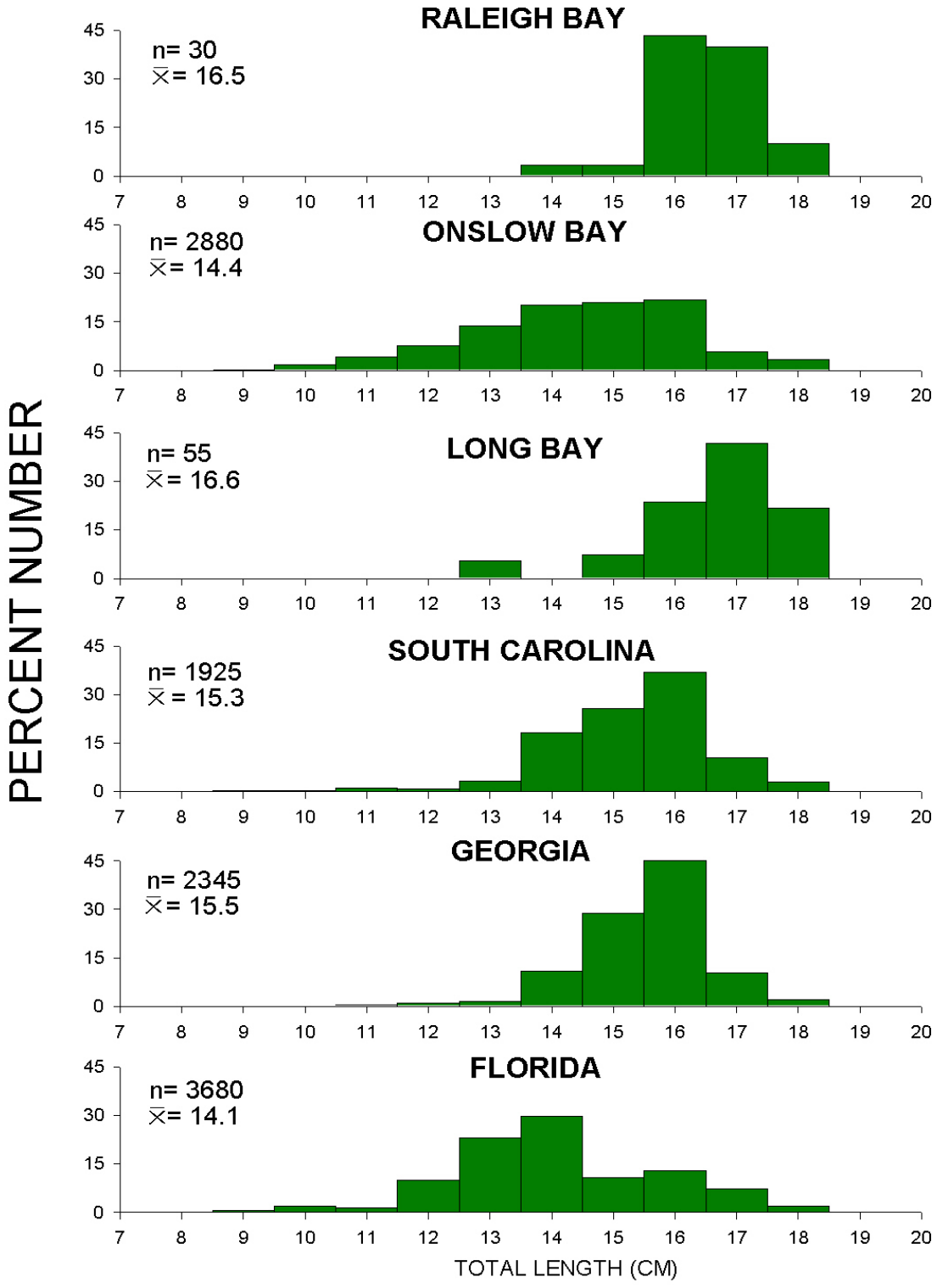

Figure 57. Regional length-frequencies of *Litopenaeus setiferus* in 2002

White shrimp are reported to spawn from May through September in the SAB (Lindner and Anderson, 1956; Williams, 1984). Although the majority of males with fully developed spermatophores were taken in summer (57%), those taken in spring contributed more to the composition of spermatophore development within that season (Figure 58). Very few males with fully developed spermatophores were taken in fall, when the majority (59%) of the males taken were collected. The ratio of males with fully developed spermatophores to those with spermatophores not yet fully developed was not independent of seasons ($G = 2923$, $p < 0.0001$) or regions ($G = 1039$, $p < 0.0001$). Only 11% of females collected in SEAMAP-SA Shallow Water Trawl Survey strata had ripe ovaries, and none of the white shrimp females collected were ripe in fall, when 66% of the females were taken. The ratio of ripe to nonripe females was not independent of season ($G = 4437$, $p < 0.0001$) or region ($G = 1372$, $p < 0.0001$). The majority of ripe females were taken in summer (54%). Only 1% of the females taken in SEAMAP-SA trawls were mated.

Occurrence of black gill disease in commercially important penaeids was observed and recorded. White shrimp exhibited the greatest level of infestation, at 6%. All white shrimp with black gill disease were taken in fall trawls (14% of white shrimp taken in fall). Infestation of white shrimp occurred primarily in the southern portion of the SAB and was greatest in white shrimp taken off Florida. Black gill disease was equally represented among male and female white shrimp (1:1).

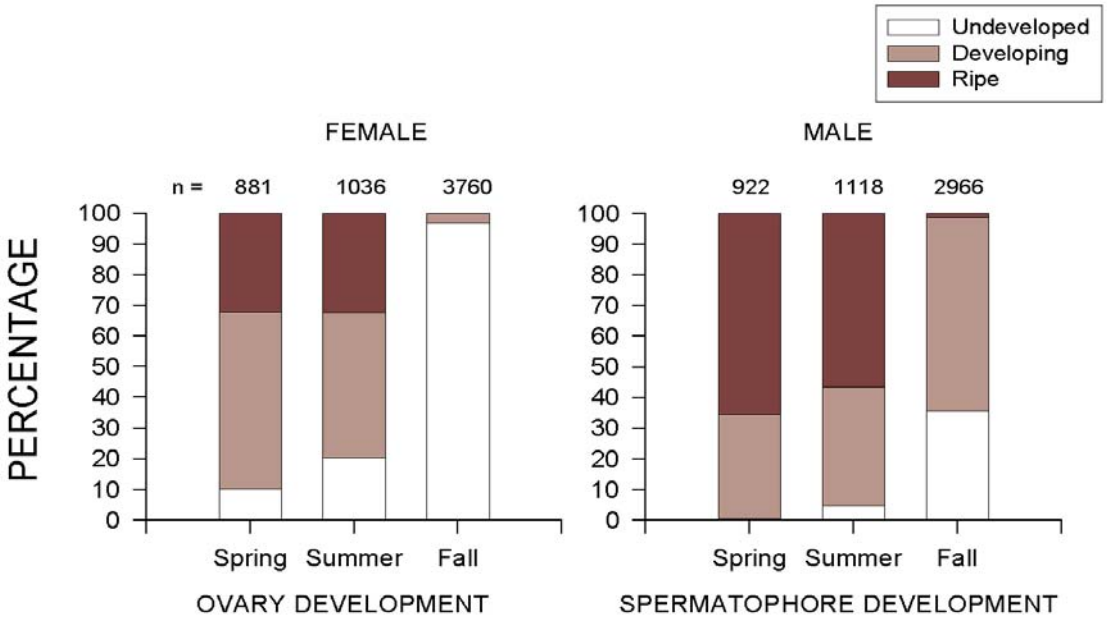

Figure 58. Gonadal development of *Litopenaeus setiferus* in 2002

Distribution and Abundance of Sharks

In 2002 SEAMAP-SA Shallow Water Trawl Survey collected twelve species of sharks (Table 28). The overall abundance of sharks was high, exceeded only in 1990. The Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, was the most abundant shark, making up approximately 38% of the shark specimens collected. The bonnethead shark, *Sphyrna tiburo,* ranked second in abundance, followed by the smooth dogfish, *Mustelus canis*. The other nine species contributed less than 2% to the overall number of sharks collected.

Table 28. Sharks taken by the SEAMAP-SA Shallow Water Trawl Survey in 2002.

Rank	Common name	Species name	Number
1	Atlantic sharpnose	*Rhizoprionodon terraenovae*	1228
2	Bonnethead	*Sphyrna tiburo*	968
3	Smooth dogfish	*Mustelus canis*	949
4	Scalloped hammerhead	*Sphyrna lewini*	16
5	Blacknose shark	*Carcharhinus acronotus*	13
6	Atlantic angel shark	*Squatina dumerili*	10
7	Spinner shark	*Carcharhinus brevipinna*	8
8	Sand tiger shark	*Odontaspis taurus*	4
9	Blacktip shark	*Carcharhinus limbatus*	3
10	Spiny dogfish	*Squalus acanthias*	2
11	Thresher shark	*Alopias vulpinus*	2
12	Dusky shark	*Carcharhinus obscurus*	1

Mustelus canis

The smooth dogfish, *Mustelus canis,* was the third most abundant shark species (n=949; 0.8 individuals/ha; CV=7.8) collected during the 2002 SEAMAP-SA Shallow Water Trawl Survey. Densities of abundance were the highest since the peak observed in 1990 (Figure 59). With the exception of three individuals taken in fall collections in Raleigh Bay, this species was collected in spring. Smooth dogfish were almost exclusive to the northern SAB. Only a single individual was taken south of Long Bay (Table 29).

Female *M. canis* outnumbered males (1.2 : 1.0). Typical of sharks in general (Hoenig and Gruber, 1990), females were significantly larger than males ($X^2 = 8$, $p < 0.0001$). Total lengths of the smooth dogfish ranged from 30 to 123 cm for females ($\bar{x} = 67.8$ cm, n = 242) and 35 to 105 cm for males ($\bar{x} = 64.9$ cm, n = 202). Mean length was greatest in Raleigh Bay for both females and males in spring and regional variations in total length of *M. canis* were found to be significant (females: $X^2 = 30$, $p < 0.0001$; males: $X^2 = 33$, $p < 0.0001$).

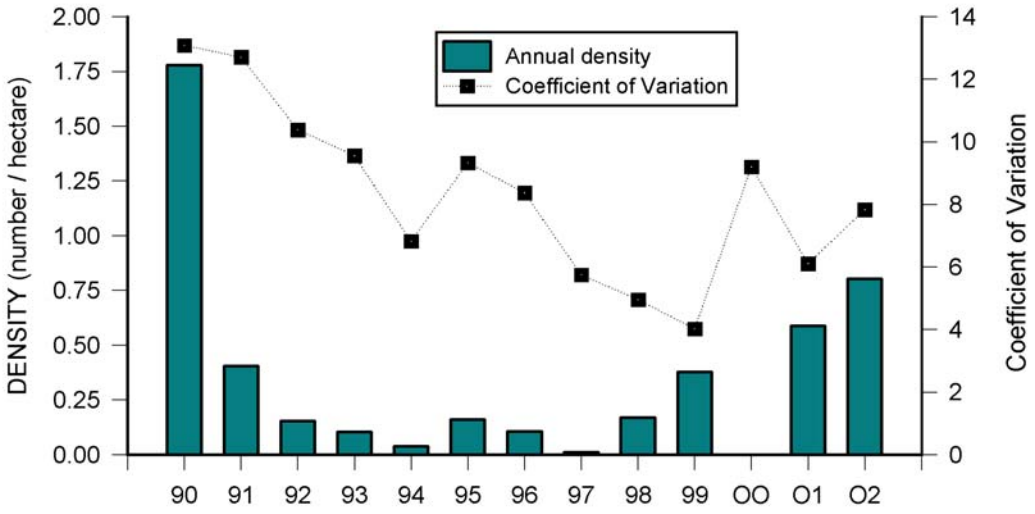

Figure 59. Annual densities of *Mustelus canis*

Table 29 . Estimates of density (number of individuals/hectare) in 2002.

Mustelus canis

	Spring	Summer	Fall	Region
Raleigh Bay	12.8	0	0.08	3.8
Onslow Bay	8.6	0	0	2.9
Long Bay	0.6	0	0	0.2
South Carolina	0.02	0	0	0.005
Georgia	0	0	0	0
Florida	0	0	0	0
Season	2.5	0	0.008	0.8

Rhizoprionodon terraenovae

The Atlantic sharpnose shark was the most abundant shark species collected in 2002 (n=1228; 1.0 individuals/ha; CV=2.7). The density of abundance of *R. terraenovae* in 2002 was the greatest in the history of the survey, with a secondary peak observed in 1997 (Figure 60). In 2002, Atlantic sharpnose were taken in all regions and all seasons. The highest densities of abundance were taken in summer (Table 30).

Females ranged in size from 27 to 102 cm total length ($\bar{x}$ = 46.1 cm, n =481), whereas males ranged from 28 to 102 cm ($\bar{x}$ = 55.7 cm, n = 655). Lengths of both sexes differed significantly among seasons (females: $X^2 = 137$, $p < 0.0001$; males: $X^2 = 275$, $p < 0.0001$). Regional lengths were significantly different among females ($X^2 = 75$, $p < 0.0001$), but not male Atlantic sharpnose ($X^2 = 75$, $p > 0.05$).

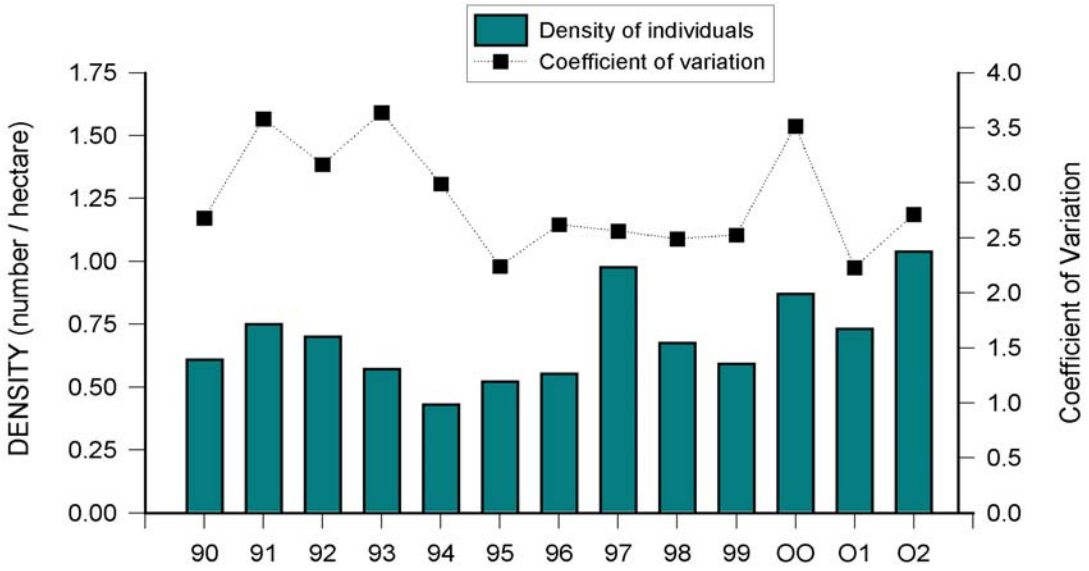

Figure 60. Annual densities of *Rhizoprionodon terraenovae*

Table 30 . Estimates of density (number of individuals/hectare) in 2002.

Rhizoprionodon terraenovae

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.2	0.03	0.08
Onslow Bay	0.6	1.0	0.4	0.7
Long Bay	1.5	2.2	0.5	1.4
South Carolina	1.2	2.2	0.6	1.3
Georgia	0.7	3.2	0.3	1.4
Florida	0.3	1.1	1.6	1.0
Season	0.7	1.9	0.6	1.0

Sphyrna tiburo

The bonnethead shark, *Sphyrna tiburo,* ranked second in abundance (n=968; 0.8 individuals/ha; CV=6.2) among sharks in 2002. The density of abundance in 2002 represents the greatest abundance in the history of the survey (Figure 61). Density was greatest in spring and decreased in summer and fall (Table 31). Abundance was greatest in the southern SAB. Waters off Florida yielded the highest density in every season, whereas no bonnethead sharks were taken in Raleigh Bay in any season.

Although the mean length of female bonnetheads ($\bar{x}$ = 58.4 cm, n = 295) was smaller than that of males ($\bar{x}$ = 60.7 cm, n = 310), the difference was not significant ($X^2 = 3$, $p > 0.05$). Total lengths of female *S. tiburo* ranged from 32 to 123 cm, whereas males ranged from 31 to 115 cm. Seasonal lengths differed significantly (females: $X^2 = 58$, $p < 0.0001$; males: $X^2 = 18$, $p < 0.0001$). Mean lengths of both sexes were greatest in summer. Total lengths also varied significantly among regions (females: $X^2 = 119$, $p < 0.0001$; males:($X^2 = 124$, $p < 0.0001$). Greatest mean length of males and females occurred in Long Bay and smallest mean length of both sexes occurred off Florida.

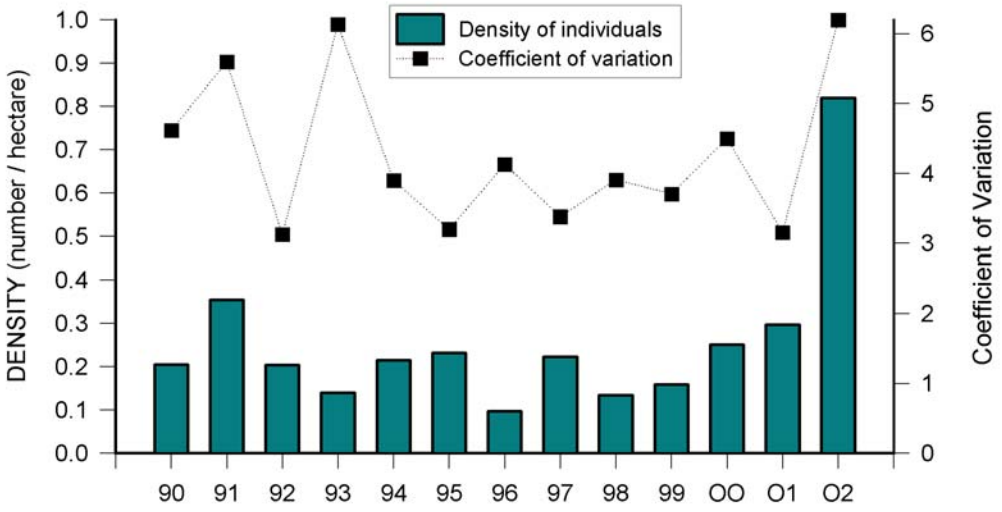

Figure 61. Annual densities of *Sphyrna tiburo*

Table 31 . Estimates of density (number of individuals/hectare) in 2002.

Sphyrna tiburo

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0.05	0	0.02
Long Bay	0.2	0.4	0.02	0.2
South Carolina	0.4	0.3	0.2	0.3
Georgia	0.2	0.2	0.2	0.2
Florida	8.6	2.2	1.4	4.0
Season	1.7	0.6	0.4	0.8

Caretta caretta

The loggerhead turtle, *Caretta caretta*, was the most abundant sea turtle caught in SEAMAP trawls. In 2002, thirty-three loggerhead (CV=3.6; 0.03 individuals/ha), weighing 1659 kg (1.4 kg/ha), were taken in SEAMAP trawls. Although the abundance of the loggerhead turtle has fluctuated annually, abundance of this sea turtle has generally increased, with the 2002 estimate being the highest recorded (Figure 62). In 2002, the seasonal density of abundance of *C. caretta* was greatest in summer. Regionally, density was greater in the southern portion of the SAB, especially off Georgia and Florida. The majority of the loggerhead sea turtles taken in SEAMAP collections are considered to be sub-adults, based on size (Dodd, 1988).

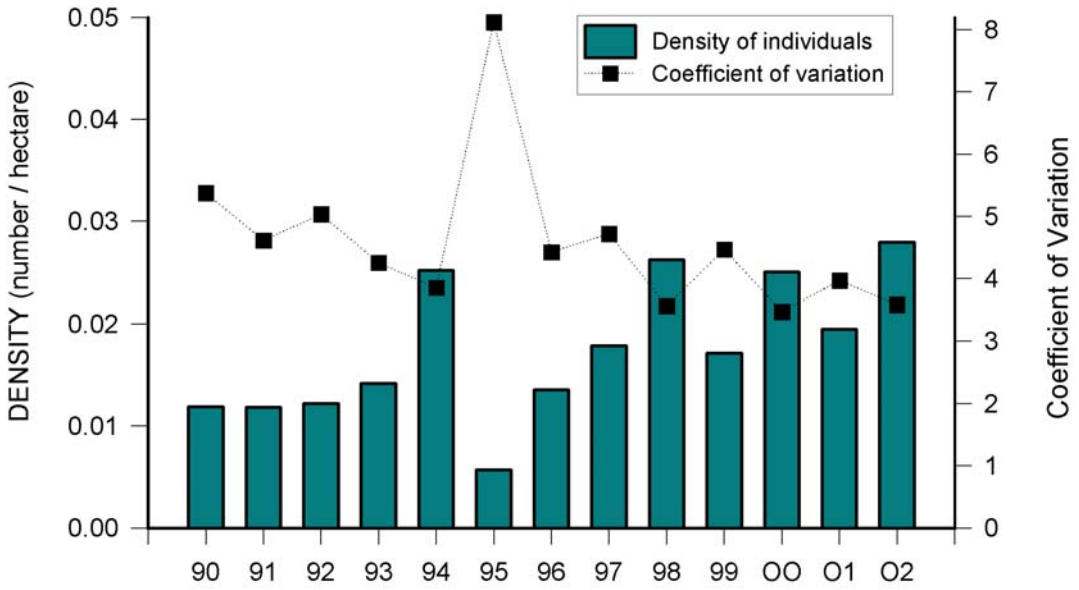

Figure 62. Annual densities of *Caretta caretta*

Table 32. Estimates of density (number of individuals/hectare) in 2002.

Caretta caretta

	Spring	Summer	Fall	Region
Raleigh Bay	0.07	0	0	0.02
Onslow Bay	0.02	0.02	0	0.01
Long Bay	0.03	0.02	0.02	0.02
South Carolina	0	0	0.05	0.01
Georgia	0.03	0.08	0.02	0.04
Florida	0.03	0.08	0.03	0.05
Season	0.02	0.04	0.02	0.03

Lepidochelys kempi

Densities of *L. kempi* peaked in 1999 (Figure 63). In 2002, only 4 Kemp's ridley turtles were taken in SEAMAP trawls (CV=8.8; 0.003 individuals/ha). No Kemp's ridley turtles were taken in spring. All individuals occurred in waters off South Carolina and Georgia (Table 33).

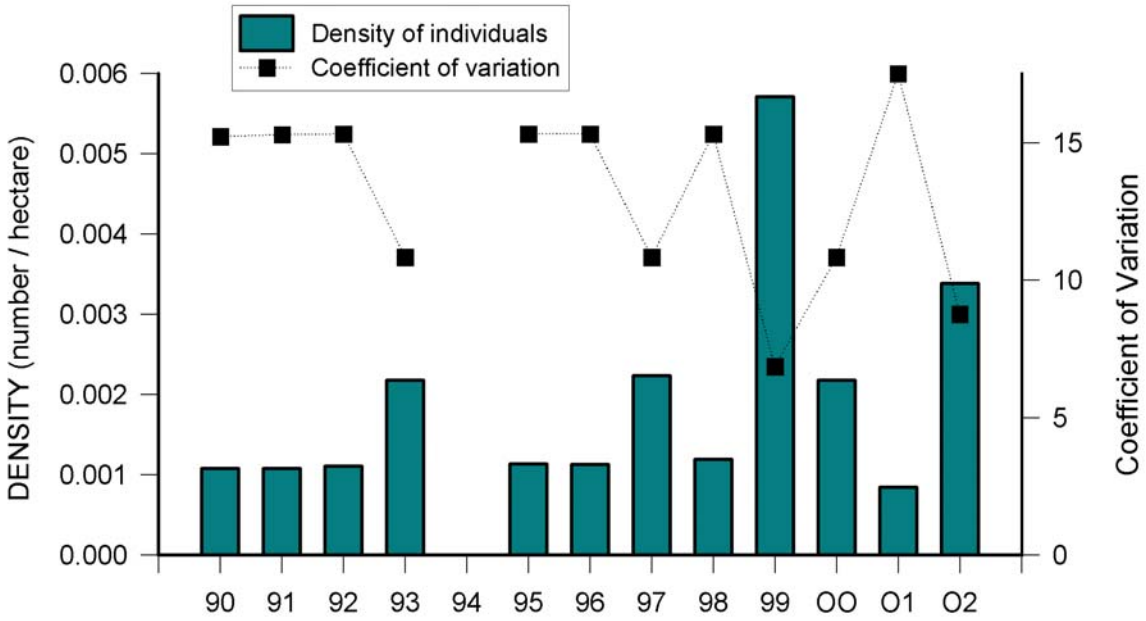

Figure 63. Annual densities of *Lepidochelys kempi*

Table 33. Estimates of density (number of individuals/hectare) in 2002.

Lepidochelys kempi

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0	0
Long Bay	0	0	0	0
South Carolina	0	0	0.02	0.005
Georgia	0	0.03	0	0.01
Florida	0	0	0	0
Season	0	0.008	0.003	0.003

Distribution and Abundance of Horseshoe Crabs

Limulus polyphemus

A total of 12 horseshoe crabs (CV=5.8; 0.01 individuals/ha) were collected by the SEAMAP-SA Shallow Water Trawl Survey in 2002. Density of individuals in 2002 decreased from the estimate recorded in 2001 (Figure 64). In 2002, density of abundance was greatest in spring (Table 34). Horseshoe crabs were taken in all regions, except Long Bay. Abundance was greatest in Onslow Bay.

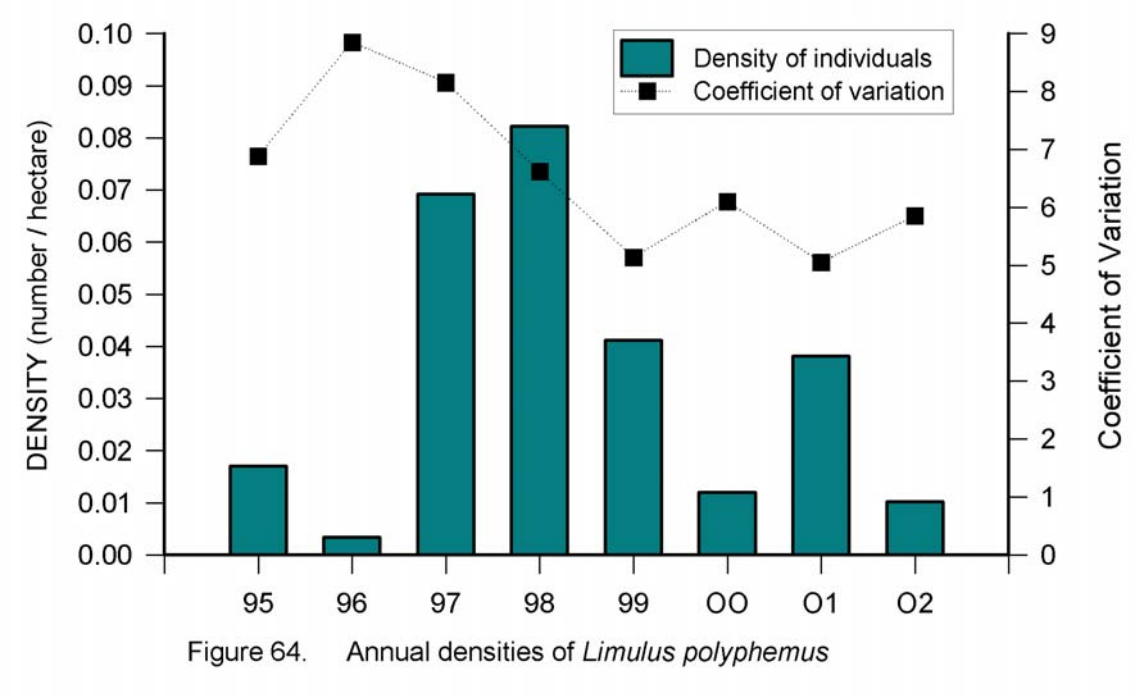

Figure 64. Annual densities of *Limulus polyphemus*

Table 34. Estimates of density (number of individuals/hectare) in 2002.

Limulus polyphemus

	Spring	Summer	Fall	Region
Raleigh Bay	0.07	0	0	0.02
Onslow Bay	0.05	0.03	0.02	0.03
Long Bay	0	0	0	0
South Carolina	0.02	0	0	0.005
Georgia	0.09	0	0	0.003
Florida	0	0.03	0	0.01
Season	0.02	0.01	0.003	0.01

Distribution and Abundance of Cannonball Jellies

In 2001, the cannonball jelly, having been identified as a major component of overall biomass and a species of increasing commercial importance, was separated from other miscellaneous invertebrates and the abundance and biomass of *Stomolophus meleagris* was recorded for the first time by the SEAMAP - South Atlantic Shallow Water Trawl Survey.

The cannonball jelly was the most abundant species collected in SEAMAP-SA trawl samples in 2002 and had the greatest total biomass of all enumerated species. The 61,205 individuals (51.8 individuals/ha; CV=8.0), weighing 14,281 kg (12.1 kg/ha), made up 16% of the total number of specimens taken in SEAMAP-SA Shallow Water Trawl Survey strata and 28% of the biomass. With the exception of Georgia and Raleigh Bay, seasonal densities of individuals were greatest in spring (Table 35). *Stomolophus meleagris* was taken in all regions; however none were taken in summer trawls in Raleigh Bay or off Florida. Regional densities were highest off South Carolina and Georgia.

Table 35. Estimates of density (number of individuals/hectare) in 2002.

Stomolophus meleagris

	Spring	Summer	Fall	Region
Raleigh Bay	0.1	0	0.1	0.08
Onslow Bay	50.5	0.7	0.9	17.9
Long Bay	5.8	3.5	0.1	3.1
South Carolina	245.8	46.3	5.6	100.6
Georgia	123.2	199.3	15.6	114.1
Florida	12.7	0	2.8	5.0
Season	92.6	64.2	6.0	51.8

ACKNOWLEDGMENTS

We appreciate the administrative assistance of Dale Theiling, David Cupka, Wayne Waltz, and David Whitaker and the recommendations of the SEAMAP-SA Committee and the Shallow Water Trawl Workgroup. Jeff Jacobs, Paul Tucker, Mike Schwarz, Rob Dunlap, and Randy Beatty were instrumental in the successful completion of SEAMAP-SA Shallow Water Trawl Survey cruises through their able operation of the R/V *Lady Lisa*. Brian Casey and Stephen Carmody assisted with field efforts.

APPLICATIONS OF DATA AND SPECIMENS AND DATA FROM THE SEAMAP-SA SHALLOW WATER TRAWL SURVEY IN 2002

Stock Assessment/VPA:

Brevoortia tyrannus
Cynoscion regalis
Micropogonias undulatus
Paralichthys lethostigma

Genetics / Stock Identification Studies:

Cynoscion nothus
Larimus fasciatus
Loligo spp.
Micropogonias undulatus
Paralichthys lethostigma

Taxonomy:

Sphyrna lewini

Life History (Age/Growth, Reproduction):

Balistes capriscus
Cynoscion regalis
Diplectrum formosum
Haemulon aurolineatum
Lutjanus campechanus
Menticirrhus americanus
Menticirrhus littoralis
Menticirrhus saxatilis
Micropogonias undulatus
Pomatomus saltatrix

Educational/Graduate Student Research:

Anchoa hepsetus, Lolliguncula brevis, and *Stellifer lanceolatus* specimens for fatty acid profile of marine mammal diet

Data requested by state agencies:

Specimens of invertebrate species for catalogue of voucher specimens -SCDNR/MRRI -SERTC
Blue crab sponge crab abundance - SCDNR-Crustacean Management Section
Shrimp abundance summary - SCDNR-Crustacean Management Section
Incidence of black gill disease in commercial penaeid shrimp - SCDNR - Crustacean Management Section
Sea turtle data (2002) - SCDNR / Office of Fisheries Management
2002 SEAMAP-SA data collected in North Carolina waters - NC Division of Marine Fisheries
2002 SEAMAP-SA data collected in Georgia waters - GADNR
Sea turtle data collected in Georgia waters(2002) - GADNR
2002 SEAMAP-SA data collected in Florida waters - Florida Fish and Wildlife Conservation Commission
Sea turtle data collected in Florida waters(2002) - FFWCC - Endangered Species Division

Data requested by federal agencies:

Sea turtle data (2002) - NOAA SEFSC
Sea turtle data (2002) - Cooperative Marine Turtle Tagging Program
Shark data (2002) - NMFS, Narrangansett Lab
Shark data (2002) - NMFS, Highly Migratory Species, Silver Spring, MD
Data collected off Canaveral National Seashore (2002) - National Park Service

Data requested by other agencies:

Sea turtle data (1989-2002) - LGL Ecological Research Associates, Inc.

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Appendix 1. Size statistics of priority finfish and decapod species from all SEAMAP-SA collections in 2002.

FINFISH	MEAN LENGTH/WIDTH (CM)	SIZE EXTREMES (CM)
Archosargus probatocephalus	49.3	41 - 62
Brevoortia smithi	21.5	16 - 25
Brevoortia tyrannus	14.1	11 - 20
Centropristis striata	14.4	8 - 22
Chaetodipterus faber	9.9	5 - 29
Cynoscion nebulosus	*	
Cynoscion regalis	20.3	8 - 48
Leiostomus xanthurus	15.0	7 - 25
Menticirrhus americanus	20.5	8 - 37
Menticirrhus littoralis	25.3	15 - 39
Menticirrhus saxatilis	24.6	10 - 33
Micropogonias undulatus	18.1	6 - 37
Mycteroperca microlepis	*	
Paralichthys albigutta	23.8	13 - 39
Paralichthys dentatus	24.4	11 - 44
Paralichthys lethostigma	31.3	23 - 49
Peprilus alepidotus	9.9	2 - 20
Peprilus triacanthus	10.7	2 - 18
Pogonias cromis	21.3	21 - 23
Pomatomus saltatrix	18.3	10 - 31
Sciaenops ocellatus	*	
Scomberomorus cavalla	14.9	4 - 51
Scomberomorus maculatus	19.8	5 - 43
DECAPOD CRUSTACEANS		
Farfantepenaeus aztecus	12.8	7 - 20
Farfantepenaeus duorarum	11.5	8 - 17
Litopenaeus setiferus	14.7	8 - 19
Callinectes sapidus	13.2	6 - 17

* No specimens of *Cynoscion nebulosus, Mycteroperca microlepis,* or *Sciaenops ocellatus* were collected.

Appendix 2. Seasonal age-length keys for weakfish, southern kingfish, and Atlantic croaker taken in SEAMAP-SA trawls in 2002.

Cynoscion regalis

SPRING 2002					
TL	N	Age 0	Age 1	Age 2	Age 3
10	1	1.00			
14	2		1.00		
15	2		1.00		
16	5		1.00		
17	4		1.00		
18	12		1.00		
19	16		0.94	0.06	
20	16		1.00		
21	15		1.00		
22	14		0.93	0.07	
23	14		0.93	0.07	
24	14		0.86	0.14	
25	9		1.00		
26	12		0.42	0.58	
27	7		0.29	0.71	
28	2			1.00	
29	6		0.17	0.67	0.17
30	2			0.50	0.50
31	1				1.00
34	1			1.00	

SUMMER 2002					
TL	N	Age 0	Age 1	Age 2	Age 3
10	2	1.00			
11	9	1.00			
12	7	1.00			
13	12	1.00			
14	13	1.00			
15	10	1.00			
16	10	1.00			
17	11	1.00			
18	5	1.00			
19	2	1.00			
22	2		1.00		
23	11		1.00		
24	4		1.00		
25	5		1.00		
26	7		1.00		
27	2		1.00		
28	3		1.00		
29	2		0.50	0.50	
30	1		1.00		
31	1			1.00	
36	1			1.00	
41	1				1.00

FALL 2002					
TL	N	Age 0	Age 1	Age 2	Age 3
12	1	1.00			
14	2	1.00			
15	3	1.00			
16	3	1.00			
17	5	1.00			
18	14	1.00			
19	16	1.00			
20	16	1.00			
21	19	0.95	0.05		
22	23	0.96	0.04		
23	21	0.86	0.14		
24	12	0.42	0.58		
25	15	0.33	0.53	0.13	
26	7	0.14	0.86		
27	7	0.14	0.86		
28	6		0.83		0.17
29	6		0.33	0.33	0.33
30	3		0.67		0.33
31	4		0.25		0.75
32	2		0.50		0.50
33	1		1.00		
34	2		0.50		0.50
36	1		1.00		
38	1		1.00		
48	1			1.00	

Appendix 2. cont'd

Menticirrhus americanus

Seasonal age-length keys

SPRING 2002							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5
8	1		1.00				
11	7		1.00				
12	7		1.00				
13	12		1.00				
14	19		1.00				
15	20		1.00				
16	29		1.00				
17	29		1.00				
18	33		1.00				
19	28		1.00				
20	30		0.97	0.03			
21	36		0.92	0.08			
22	26		0.77	0.23			
23	22		0.50	0.45	0.05		
24	28		0.39	0.43	0.18		
25	24		0.33	0.54	0.08	0.04	
26	21		0.14	0.81		0.05	
27	18		0.17	0.56	0.17	0.11	
28	10			0.60	0.10	0.30	
29	12			0.42	0.50	0.08	
30	7			0.43	0.43		0.14
31	7			0.57	0.14	0.29	
32	5			0.20	0.60	0.20	
33	1				1.00		
35	3				1.00		
36	1					1.00	
37	1					1.00	

SUMMER 2002							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5
8	1	1.00					
10	3	1.00					
11	4	1.00					
12	14	1.00					
13	22	1.00					
14	22	1.00					
15	18	1.00					
16	16	0.94	0.06				
17	11	1.00					
18	14	0.86	0.14				
19	24	0.58	0.42				
20	24	0.42	0.58				
21	27	0.41	0.59				
22	34	0.26	0.71	0.03			
23	24	0.38	0.54	0.08			
24	23	0.13	0.57	0.26	0.04		
25	18	0.17	0.33	0.44	0.06		
26	13	0.23	0.31	0.23	0.15	0.08	
27	14		0.29	0.50	0.14	0.07	
28	12	0.08	0.25	0.33	0.33		
29	7	0.14	0.14	0.71			
30	7	0.29	0.57		0.14		
31	6		0.33	0.33	0.17	0.17	
33	1				1.00		
35	1			1.00			

FALL 2002							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5
10	1	1.00					
11	2	1.00					
12	6	1.00					
13	7	1.00					
14	14	1.00					
15	26	1.00					
16	30	1.00					
17	33	1.00					
18	31	1.00					
19	41	0.98	0.02				
20	36	0.94	0.06				
21	32	0.75	0.25				
22	29	0.48	0.45	0.07			
23	34	0.26	0.65	0.06	0.03		
24	29	0.10	0.83	0.07			
25	34	0.18	0.65	0.15		0.03	
26	25		0.76	0.16	0.04	0.04	
27	25	0.04	0.40	0.40	0.12	0.04	
28	16	0.06	0.63	0.25	0.06		
29	11		0.55	0.45			
30	11		0.36	0.45	0.09	0.09	
31	12		0.42	0.33	0.25		
32	5		0.20	0.40	0.40		
33	4	0.25		0.50	0.25		
34	4		0.25		0.75		
36	1			1.00			

Appendix 2. cont'd

Micropogonias undulatus

Seasonal age-length keys

SPRING 2002							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 7
8	2	1.00					
9	1	1.00					
10	1	1.00					
11	5	1.00					
12	10	0.90	0.10				
13	8	0.50	0.50				
14	7	0.14	0.86				
15	9		1.00				
16	10		1.00				
17	5		1.00				
18	9		0.67	0.33			
19	8		0.63	0.38			
20	4		1.00				
21	9		0.22	0.22	0.44	0.11	
22	4			0.25	0.25	0.50	
23	5		0.40	0.20	0.20	0.20	
24	1				1.00		

SUMMER 2002							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 7
10	2	1.00					
11	4	1.00					
12	8	1.00					
13	18	1.00					
14	22	1.00					
15	20	1.00					
16	26	1.00					
17	24	0.75	0.25				
18	26	0.58	0.42				
19	29	0.31	0.41	0.28			
20	14	0.29	0.36	0.36			
21	11		0.18	0.27	0.36	0.18	
22	9	0.11	0.11	0.22	0.33	0.22	
23	4					1.00	
24	2			0.50	0.50		

FALL 2002							
TL	N	Age 0	Age 1	Age 2	Age 3	Age 4	Age 7
13	2	1.00					
14	6	1.00					
15	7	1.00					
16	20	1.00					
17	32	1.00					
18	36	0.94	0.06				
19	35	0.89	0.11				
20	32	0.56	0.44				
21	26	0.35	0.54	0.08	0.04		
22	17	0.29	0.35	0.24	0.06	0.06	
23	11	0.36	0.45		0.18		
24	4	0.25	0.25	0.50			
27	1		1.00				
30	1				1.00		
34	1				1.00		
37	1						1.00

Appendix 3. Number of individuals and biomass (kg) for all species collected in 2002.

Rank	Species Name	Total Number	Total Weight
1	*Micropogonias undulatus*	50914	3230.545
2	*Stenotomus sp.*	39101	1459.963
3	*Leiostomus xanthurus*	23360	1311.243
4	*Chloroscombrus chrysurus*	18307	485.021
5	*Lagodon rhomboides*	16474	800.926
6	*Anchoa hepsetus*	16378	131.974
7	*Menticirrhus americanus*	11840	1137.425
8	*Litopenaeus setiferus*	10858	283.092
9	*Larimus fasciatus*	9692	451.733
10	*Trichiurus lepturus*	9192	530.896
11	*Cynoscion nothus*	8770	572.508
12	*Lolliguncula brevis*	8479	101.580
13	*Stellifer lanceolatus*	8258	151.006
14	*Libinia dubia*	5884	41.094
15	*Peprilus alepidotus*	5660	250.780
16	*Synodus foetens*	5424	392.840
17	*Loligo sp.*	5285	63.333
18	*Orthopristis chrysoptera*	5068	337.004
19	*Selene setapinnis*	4976	134.874
20	*Peprilus triacanthus*	4044	144.658
21	*Farfantepenaeus aztecus*	3957	79.035
22	*Opisthonema oglinum*	3355	93.042
23	*Cynoscion regalis*	3307	298.116
24	*Prionotus carolinus*	2796	33.471
25	*Anchoa mitchilli*	2119	3.290
26	*Ovalipes stephensoni*	2023	12.744
27	*Bairdiella chrysoura*	1925	85.040
28	*Pomatomus saltatrix*	1750	147.859
29	*Chaetodipterus faber*	1717	86.178
30	*Scomberomorus maculatus*	1462	135.144
31	*Rhizoprionodon terraenovae*	1228	948.862

Rank	Species Name	Total Number	Total Weight
32	*Portunus gibbesii*	1044	8.518
33	*Farfantepenaeus duorarum*	1025	14.932
34	*Myliobatis freminvillei*	983	2812.077
35	*Menticirrhus saxatilis*	970	137.595
36	*Sphyrna tiburo*	968	818.278
37	*Mustelus canis*	949	924.973
38	*Brevoortia tyrannus*	899	37.245
39	*Prionotus scitulus*	818	17.738
40	*Sphyraena guachancho*	762	65.615
41	*Callinectes similis*	732	11.009
42	*Etropus crossotus*	701	12.404
43	*Citharichthys macrops*	684	13.307
44	*Sphoeroides maculatus*	672	46.931
45	*Selene vomer*	650	25.594
46	*Raja eglanteria*	595	455.105
47	*Gymnura micrura*	502	468.015
48	*Trinectes maculatus*	491	14.181
49	*Decapterus punctatus*	469	31.420
50	*Ancylopsetta quadrocellata*	463	19.170
51	*Eucinostomus sp.*	455	7.203
52	*Arenaeus cribrarius*	388	8.394
53	*Urophycis regius*	379	8.556
54	*Rhinoptera bonasus*	333	1397.002
55	*Dasyatis sayi*	322	533.108
56	*Chilomycterus schoepfi*	318	82.809
57	*Squilla empusa*	315	4.928
58	*Scomberomorus cavalla*	292	15.205
59	*Caranx crysos*	288	20.718
60	*Prionotus evolans*	278	12.341
61	*Paralichthys dentatus*	258	39.462
62	*Scophthalmus aquosus*	256	6.723
63	*Menticirrhus littoralis*	233	42.595
64	*Anchoa lyolepis*	232	0.611
65	*Rimapenaeus constrictus*	227	1.054
66	*Sardinella aurita*	186	1.071

Rank	Species Name	Total Number	Total Weight
67	*Squilla neglecta*	169	2.879
68	*Portunus spinimanus*	162	2.692
69	*Ovalipes ocellatus*	155	2.802
70	*Bagre marinus*	140	13.310
71	*Libinia emarginata*	124	3.074
72	*Harengula jaguana*	114	1.937
73	*Xiphopenaeus kroyeri*	95	0.525
74	*Prionotus salmonicolor*	92	2.267
75	*Symphurus plagiusa*	90	2.897
76	*Prionotus tribulus*	89	2.319
77	*Gymnura altavela*	78	1092.460
78	*Citharichthys spilopterus*	78	1.600
79	*Hepatus epheliticus*	78	1.517
80	*Paralichthys lethostigma*	77	27.907
81	*Callinectes sapidus*	77	10.628
82	*Persephona mediterranea*	77	1.084
83	*Etropus cyclosquamus*	76	0.888
84	*Callinectes ornatus*	74	0.915
85	*Centropristis philadelphica*	73	4.045
86	*Dasyatis sabina*	69	20.190
87	*Mobula hypostoma*	63	683.480
88	*Haemulon aurolineatum*	61	3.543
89	*Trachinotus carolinus*	57	12.880
90	*Centropristis striata*	56	3.056
91	*Pagurus pollicaris*	56	1.430
92	*Echeneis naucrates*	51	6.708
93	*Stephanolepis hispidus*	48	0.641
94	*Syngnathus springeri*	47	1.520
95	*Arius felis*	46	10.857
96	*Selar crumenophthalmus*	39	0.785
97	*Paralichthys albigutta*	38	6.310
98	*Dasyatis americana*	37	54.130
99	*Archosargus probatocephalus*	35	114.320
100	*Alectis ciliarius*	34	0.807
101	*Caretta caretta*	33	1659.840

Rank	Species Name	Total Number	Total Weight
102	*Diplectrum formosum*	32	2.184
103	*Lutjanus synagris*	30	0.742
104	*Trachurus lathami*	29	0.270
105	*Urophycis floridanus*	27	0.887
106	*Syacium papillosum*	26	1.242
107	*Dasyatis centroura*	24	540.035
108	*Menippe mercenaria*	24	2.486
109	*Caranx hippos*	21	0.793
110	*Sphyrna lewini*	16	115.886
111	*Hippocampus erectus*	16	0.134
112	*Aetobatus narinari*	14	269.220
113	*Carcharhinus acronotus*	13	148.640
114	*Limulus polyphemus*	12	30.445
115	*Etrumeus teres*	11	0.019
116	*Pogonias cromis*	11	1.621
117	*Mugil curema*	11	0.338
118	*Squatina dumeril*	10	92.490
119	*Pilumnus sayi*	10	0.056
120	*Astroscopus guttatus*	9	0.292
121	*Carcharhinus brevipinna*	8	23.430
122	*Aluterus schoepfi*	6	0.954
123	*Upeneus parvus*	6	0.175
124	*Lysmata wurdemanni*	6	0.004
125	*Rhinobatos lentiginosus*	5	2.076
126	*Pagurus longicarpus*	5	0.012
127	*Odontaspis taurus*	4	350.000
128	*Brevoortia smithi*	4	0.682
129	*Hypleurochilus geminatus*	4	0.024
130	*Lepidochelys kempi*	4	46.540
131	*Sicyonia brevirostris*	4	0.045
132	*Neopanope sayi*	4	0.013
133	*Carcharhinus limbatus*	3	70.945
134	*Narcine brasiliensis*	3	1.475
135	*Acipenser oxyrhynchus*	3	80.870
136	*Ogcocephalus rostellum*	3	0.012

Rank	Species Name	Total Number	Total Weight
137	*Rachycentron canadum*	3	8.955
138	*Oligoplites saurus*	3	0.164
139	*Aluterus monoceros*	3	0.537
140	*Ophidion welshi*	3	0.115
141	*Petrochirus diogenes*	3	0.599
142	*Calappa flammea*	3	0.404
143	*Portunus sayi*	3	0.021
144	*Squalus acanthias*	2	3.870
145	*Elops saurus*	2	0.657
146	*Mugil cephalus*	2	0.230
147	*Gobiosoma bosci*	2	0.002
148	*Scorpaena brasiliensis*	2	0.194
149	*Dactylopterus volitans*	2	0.008
150	*Lagocephalus laevigatus*	2	0.280
151	*Alopias vulpinus*	2	37.550
152	*Cancer irroratus*	2	0.009
153	*Panopeus herbstii*	2	0.006
154	*Octopus vulgaris*	2	0.360
155	*Loligo plei*	2	0.077
156	*Carcharhinus obscurus*	1	3.950
157	*Opsanus tau*	1	0.080
158	*Porichthys plectrodon*	1	0.032
159	*Ophidion holbrooki*	1	0.064
160	*Ophidion marginatum*	1	0.012
161	*Syngnathus louisianae*	1	0.010
162	*Seriola zonata*	1	0.028
163	*Lutjanus campechanus*	1	0.027
164	*Lutjanus griseus*	1	0.038
165	*Astroscopus y-graecum*	1	0.362
166	*Scomber japonicus*	1	0.131
167	*Balistes capriscus*	1	0.503
168	*Acanthostracion quadricornis*	1	0.014
169	*Porcellana sayana*	1	0.001
170	*Albunea paretii*	1	0.006
171	*Planes minutus*	1	0.004