SEAMAP-SA

RESULTS OF TRAWLING EFFORTS IN THE COASTAL HABITAT OF THE SOUTH ATLANTIC BIGHT, 2007

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INTRODUCTION

The Southeast Area Monitoring and Assessment Program - South Atlantic (SEAMAP-SA) Coastal 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 blue crab, sharks, sea turtles, and horseshoe crabs, and reproductive information on commercially important penaeid shrimp and blue crabs.

Field data collected by the SEAMAP-SA Coastal Survey, formerly referred to as 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. Management agencies and scientists currently have access to eighteen years (1990-2007) 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.

METHODS AND MATERIALS

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 (April-May), summer (July), and fall (October).

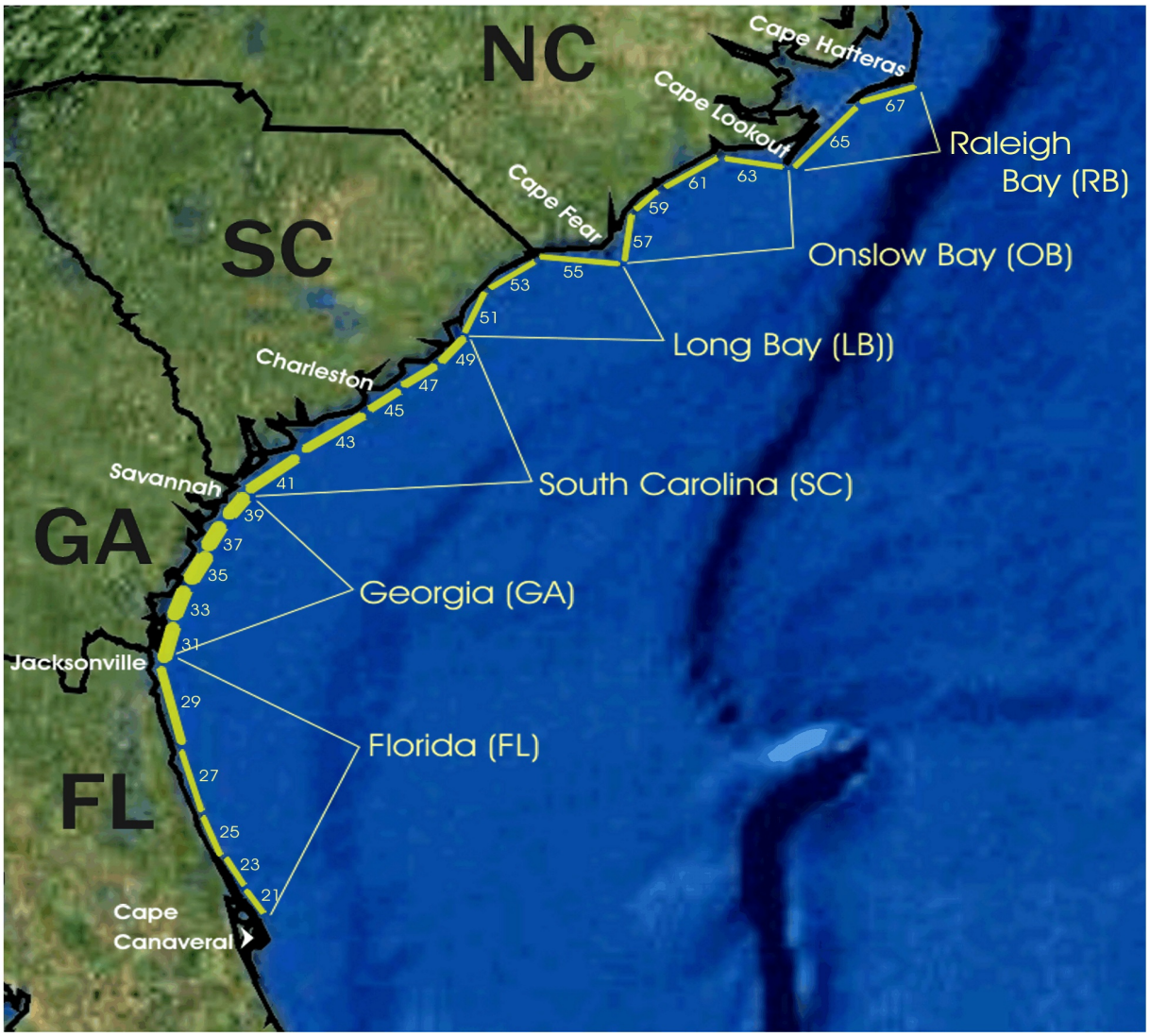

Figure 1. Strata sampled by the SEAMAP-SA Coastal Survey.
(Strata are not drawn to scale)

Stations were randomly selected from a pool of stations within each stratum. A total of 102 stations were sampled each season within twenty-four shallow water strata. Strata were delineated by the 4 m depth contour inshore and the 10 m depth contour offshore. In previous years (1989-2000), stations were also sampled in deeper strata with station depths ranging from 10 to 19 m in order to gather data on the reproductive condition of commercially important 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). Each net was processed separately and assigned a unique collection number. Contents of each net were sorted to species or genus, 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 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 large trawl catches, 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 majority of priority species was weighed collectively and individuals were measured to the nearest centimeter. For large collections of any of the priority species, a random subsample consisting of thirty to fifty individuals was weighed and measured.

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 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.

The collection of gonad and otolith specimens from three sciaenid species was discontinued due to insufficiency of allocated funds.

Hydrographic data collected at each station included surface to bottom temperature and salinity measurements taken with a Seabird SBE-19plus 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, including northern Florida south to the St. Johns River (GA), and Florida from the St. Johns River to Cape Canaveral (FL) were also treated as separate regions. Each region contains from 2 to 5 strata that are sampled seasonally.

In an effort to reduce the variability of the data, in 2001 the method of allocating the number of stations within each stratum was changed from proportional allocation to optimal allocation (Thompson, 1992). With the optimal allocation scheme the number of stations sampled within each stratum is determined annually. In 2007 the number of stations sampled in each stratum ranged from 3 to 6.

Data from the paired trawls were pooled for analysis to form a standard unit of effort (tow). 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 tested for statistical differences 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.

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 2007 survey (Table 1). Both annual and seasonal mean temperatures and mean salinities were slightly higher than the estimates calculated for 1989-2007 ($\bar{x}$ = 22.9 C, 34.4 ‰), probably due to drought conditions along the southeastern US.

Table 1. Seasonal mean bottom temperatures (°C) and salinities (‰) from each region for 2007. 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	18.3	18.8	19.4	20.3	19.7	21.0	19.8
$\bar{x}$ Salinity	35.7	35.5	35.1	34.6	33.8	36.2	35.0
SUMMER							
$\bar{x}$ Temperature	26.4	27.1	28.7	28.3	28.9	26.5	27.8
$\bar{x}$ Salinity	35.4	36.0	35.7	34.8	34.8	36.4	35.4
FALL							
$\bar{x}$ Temperature	26.1	25.3	22.9	19.8	23.0	26.6	23.6
$\bar{x}$ Salinity	35.8	36.0	36.0	35.4	34.3	35.4	35.3
ALL SEASONS							
$\bar{x}$ Temperature	23.6	23.7	23.7	22.8	23.9	24.7	23.7
$\bar{x}$ Salinity	35.6	35.8	35.6	34.9	34.3	36.0	35.2

Species Composition

The 2007 sampling effort resulted in the collection of 167 species (Appendix 1). Trawls produced 104 species of finfish, 25 species of elasmobranchs, 29 species of decapod crustaceans, 2 species of stomatopod crustaceans, 3 genera of cephalopods, 3 species of marine turtles, and one species of xiphosuran.

The number of species collected did not vary much seasonally (Table 2). Greatest diversity was found in trawls towed in fall. Regionally, the greatest diversity was found 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	24	84	90123	20077	1135.9	127.0
ONSLOW BAY	45	111	124246	10972	789.5	69.7
LONG BAY	39	107	57502	3612	403.1	25.3
S. CAROLINA	66	117	54381	4796	226.6	20.0
GEORGIA	75	122	98787	6452	377.4	24.6
FLORIDA	57	102	119241	8392	596.2	42.0
Season						
SPRING	102	128	196727	21800	531.6	58.9
SUMMER	102	123	214190	11980	605.3	33.9
FALL	102	131	133363	10521	373.7	29.5

Abundance, Biomass, and Density Estimates

The 2007 SEAMAP-South Atlantic Coastal Survey caught 684,302 individuals (CV=13.0; 2236 individuals/tow), with a biomass of 34,585 kg (113.0 kg/tow). Miscellaneous invertebrates, cannonball jellies, and algae contributed an additional 14,017 kg of biomass. The overall density of individuals (633 individuals/ha) in 2007 (excluding cannonball jellies) exceeded the peak in abundance observed in 2005 (Figure 2). This increase was accompanied by an increase in variability.

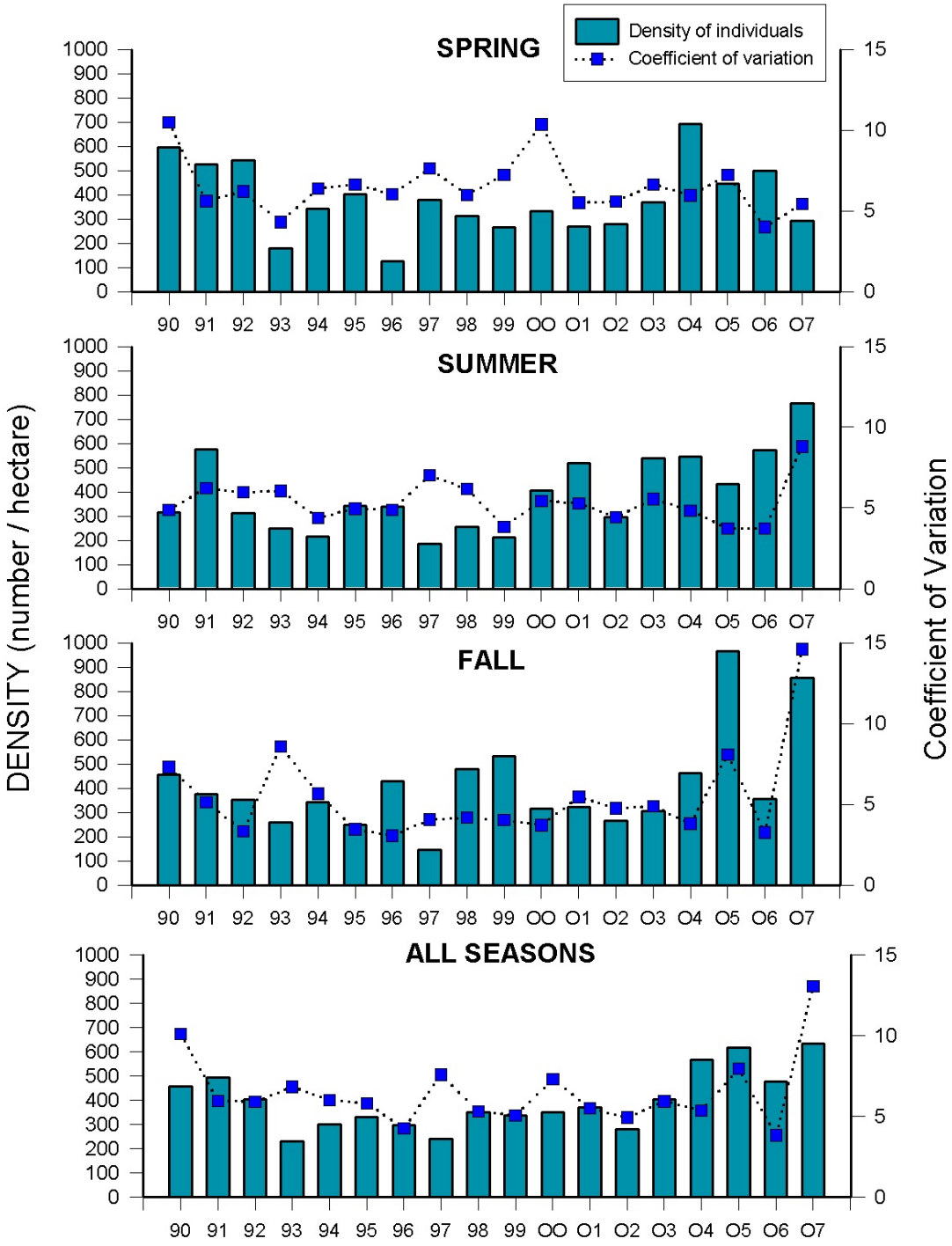

Figure 2. Annual and seasonal densities of abundance and variability.

In 2007, density of individuals peaked in summer collections, whereas density of biomass was greatest in spring (Table 2). The highest regional densities of individuals and biomass occurred in Raleigh Bay, reflecting relatively large catches of sciaenids. South Carolina and Georgia had the lowest densities of individuals and biomass.

Historically, patterns of abundance in the SAB generally reflect the abundance of two members of the sciaenid family, the Atlantic croaker, *Micropogonias undulatus,* and the spot, *Leiostomus xanthurus,* which have been consistent in their numerical dominance among years. In 2007, however, these two species constituted only 11% of the total catch. The Atlantic bumper*, Chloroscombrus chrysurus,* ranked first in both abundance and biomass, making up 56% of abundance and 14% of biomass. The overall increase in abundance and variability in 2007 can be attributed to the contribution of this species to the catch. Other numerically dominant species included the Atlantic croaker, *Micropogonias undulatus;* the scup, *Stenotomus sp*; the spot*, Leiostomus xanthurus*; the white shrimp, *Litopenaeus setiferus;* and the butterfish*, Peprilus triacanthus* (Table 3). After the Atlantic bumper, the Atlantic croaker, and spot, elasmobranchs and the southern kingfish constituted the largest component of 2007 biomass.

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 2007.

	All	Region						Season		
	Strata	**RB**	**OB**	**LB**	**SC**	**GA**	**FL**	**SPR**	**SUM**	**FAL**
Abundance										
Chloroscombrus chrysurus	351.6	0.3	0.4	3.2	30.0	129.4	1697.0	3.6	422.4	642.4
Micropogonias undulatus	49.3	37.5	142.5	60.6	23.5	18.9	45.3	41.2	74.7	32.6
Stenotomus sp.	23.2	70.0	86.5	37.9	0.1	2.0	4.4	24.9	29.7	15.2
Leiostomus xanthurus	21.4	20.1	46.2	35.2	21.6	4.8	14.2	25.1	25.5	13.6
Litopenaeus setiferus	21.1	4.4	11.4	1.4	48.4	22.2	14.9	14.8	9.0	39.4
Peprilus triacanthus	17.4	186.9	5.0	2.1	3.9	4.7	4.0	49.3	1.3	0.5
Biomass										
Chloroscombrus chrysurus	4.5	0.002	0.009	0.04	0.2	1.4	22.3	0.1	1.7	11.9
Micropogonias undulatus	3.4	2.4	9.4	3.7	1.3	0.9	4.4	2.2	5.4	2.6
Leiostomus xanthurus	2.9	0.9	7.8	8.4	1.4	0.3	1.1	1.4	3.8	3.5
Rhinoptera bonasus	2.0	0.05	0.2	0.01	5.0	3.1	0.6	4.0	0.01	2.0
Menticirrhus americanus	1.6	1.4	0.2	5.5	1.2	0.9	1.6	3.0	0.8	1.1
Myliobatis freminvillei	1.5	5.4	1.6	5.9	0.2	0.04	0.07	4.3	0.02	0.005

Distribution and Abundance of Priority Finfish Species

Archosargus probatocephalus

The sheepshead, *Archosargus probatocephalus*, exhibited a decrease in abundance in 2007. Catches of sheepshead peaked in 1992 and dropped to the lowest level in 2003 (Figure 4). Only 18 sheepshead (CV=8.3; 0.02 individuals/ha), weighing a total of 58 kg, were taken in 2007. Sheepshead were most abundant in Raleigh Bay in spring (Table 4). Fork lengths ranged from 24 to 57 cm. The mean length (48.8 cm) was smaller than the record mean length noted in 2006.

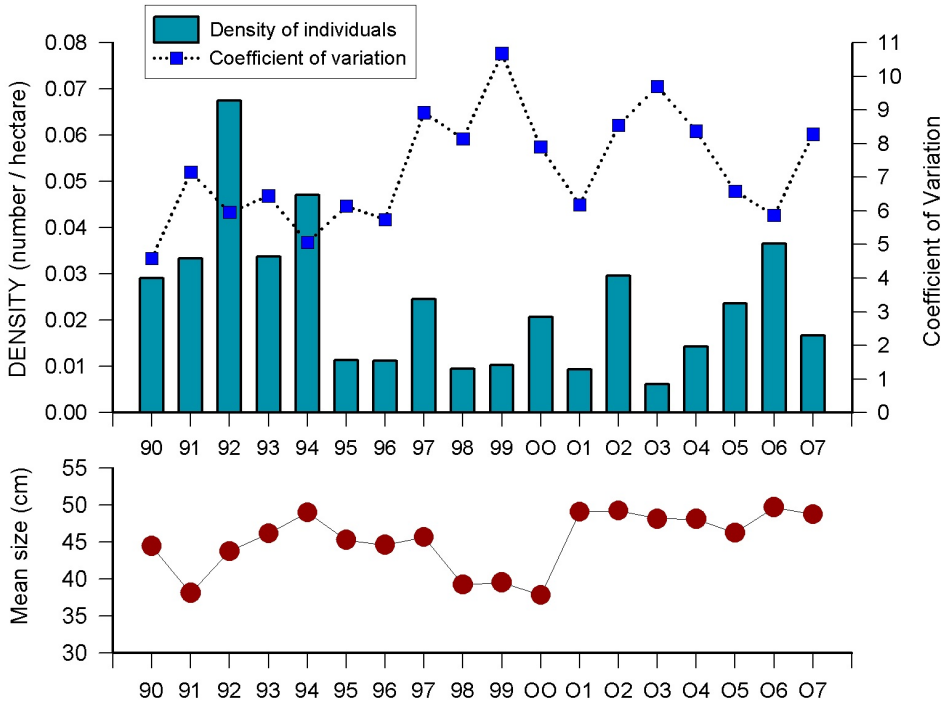

Figure 3. Annual density, variability, and mean size of *Archosargus probatocephalus*

Table 4 . Estimates of density (number of individuals/hectare) in 2007.

Archosargus probatocephalus

	Spring	Summer	Fall	Region
Raleigh Bay	0.514	0	0.041	0.189
Onslow Bay	0.038	0	0	0.013
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0	0	0	0
Florida	0.015	0	0	0.005
Season	0.044	0	0.003	0.167

Brevoortia smithi

Only seven yellowfin menhaden (CV=13.0; 0.0009 individuals/ha), weighing 0.2 kg, was collected by the SEAMAP-SA Coastal Survey in 2007. Although density of individuals was relatively high in 1991 (Figure 4), abundance of *Brevoortia smithi* has been low in SEAMAP-SA trawl samples. In 2007, all yellowfin menhaden was caught in waters off Florida (Table 5).

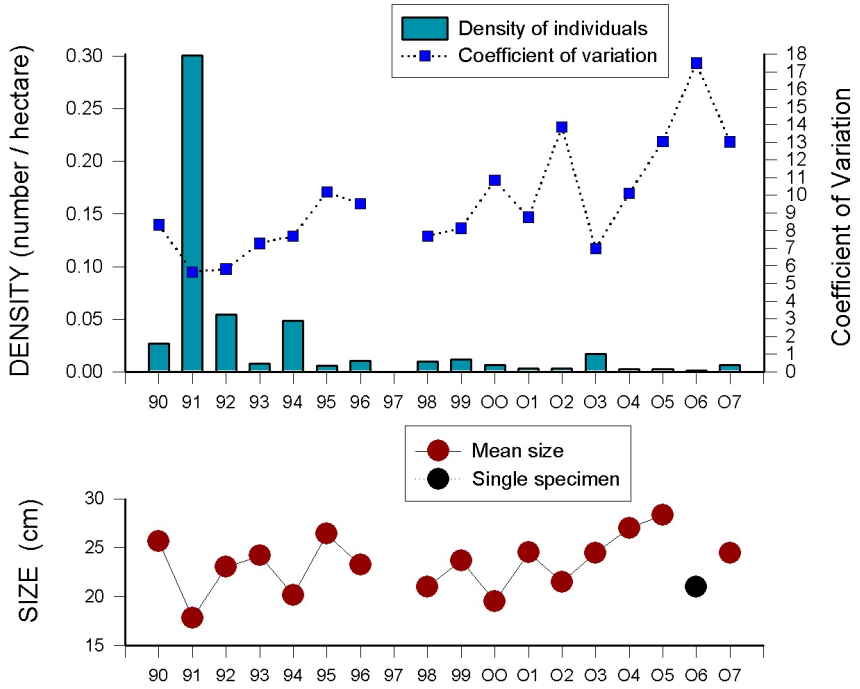

Figure 4. Annual density, variability, and size of *Brevoortia smithi*

Table 5 . Estimates of density (number of individuals/hectare) in 2007.

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	0.015	0.077	0.015	0.035
Season	0.002	0.013	0.002	0.006

Brevoortia tyrannus

A total of 292 Atlantic menhaden (CV=10.9; 0.3 individuals/ha), weighing 15 kg (0.01 kg/ha), were taken in SEAMAP-SA trawls. Density of individuals in 2007 was the lowest abundance since 1995 (Figure 5). The decrease in abundance resulted in an increase in variability in 2007. Although mean length also increased in 2007, there has been a general decrease in mean size since 1999. In 2007, density was greatest in spring and in waters off Georgia (Table 6). Fork lengths of *Brevoortia tyrannus* ranged from 11 to 24 cm ($\bar{x}$ = 24.4).

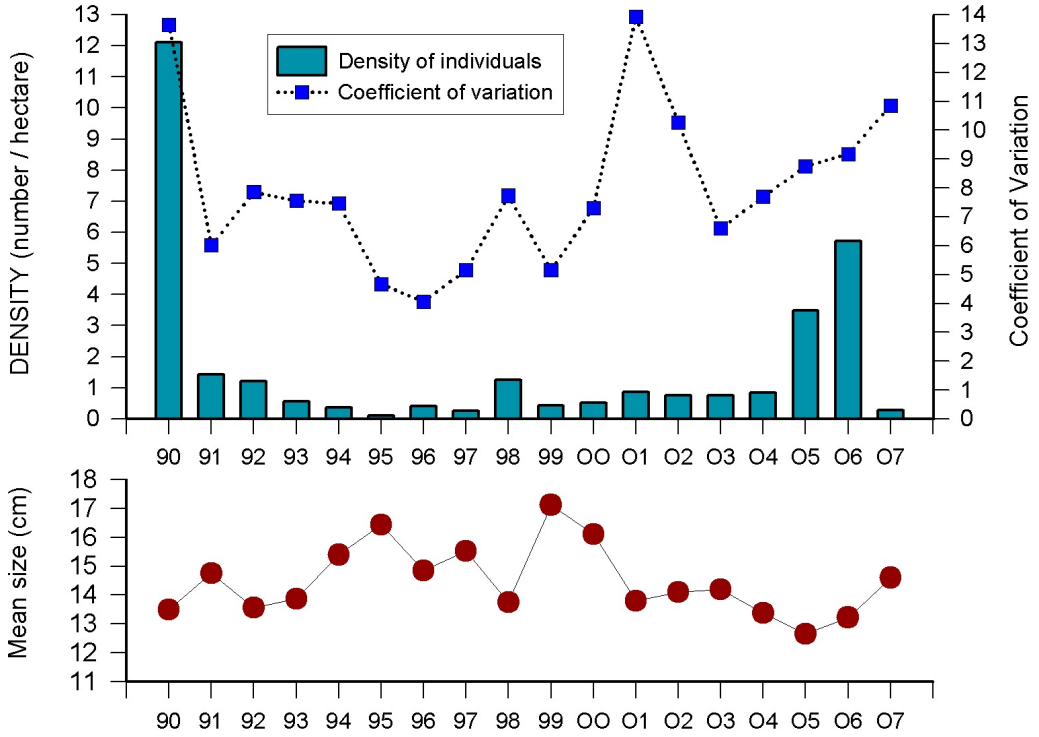

Figure 5. Annual density, variability, and mean size of *Brevoortia tyrannus*

Table 6 . Estimates of density (number of individuals/hectare) in 2007.

Brevoortia tyrannus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0.320	0.153	0	0.159
Long Bay	0	0.021	0	0.007
South Carolina	0.012	0	0	0.004
Georgia	1.843	0	0	0.661
Florida	1.379	0	0	0.460
Season	0.706	0.022	0	0.270

Centropristis striata

A total of 36 black sea bass (CV=6.4; 0.03 individuals/ha), weighing 4 kg (0.003 kg/ha), were collected in 2007. The density of abundance in 2007 represented the lowest density of abundance recorded by the Coastal Survey (Figure 6). Density was greatest in Raleigh and Onslow Bays (Table 6). Black sea bass were absent from collections made in waters off Florida. Total lengths of *Centropristis striata* ranged from 11 to 25 cm ($\bar{x}$ = 17.8).

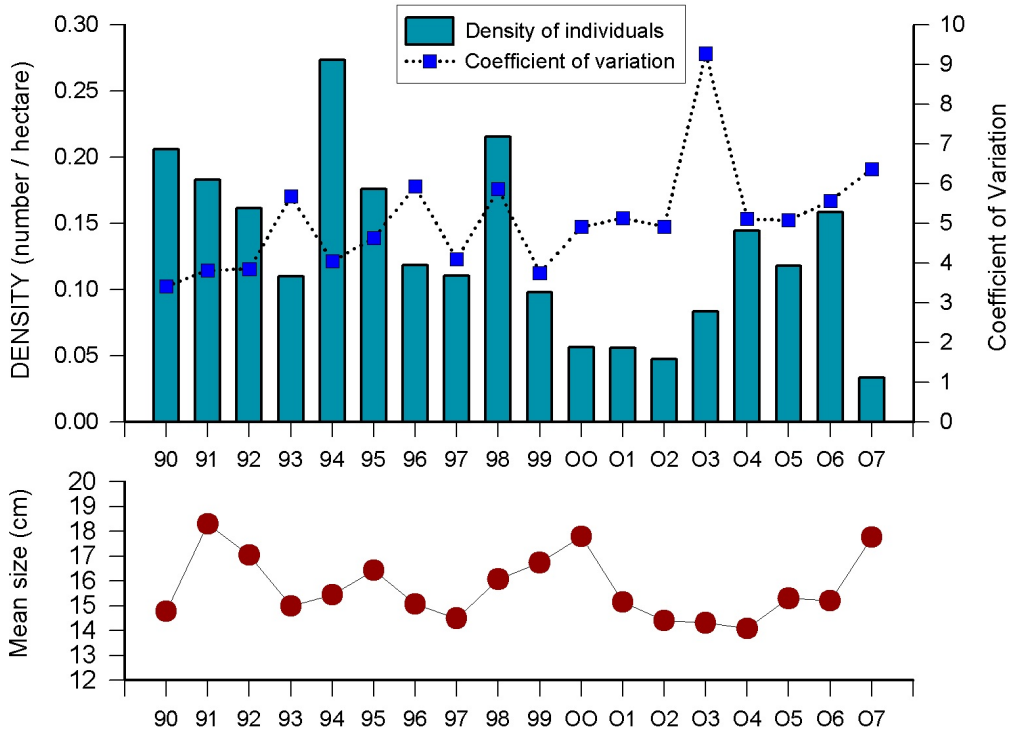

Figure 6. Annual density, variability, and mean size of *Centropristis striata*

Table 7 . Estimates of density (number of individuals/hectare) in 2007.

Centropristis striata

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.143	0.207	0.113
Onslow Bay	0.226	0.038	0.077	0.114
Long Bay	0.126	0	0.021	0.049
South Carolina	0.012	0	0	0.004
Georgia	0	0	0.012	0.004
Florida	0	0	0	0
Season	0.046	0.015	0.028	0.033

Chaetodipterus faber

SEAMAP-SA Coastal Survey strata yielded a total of 786 Atlantic spadefish (CV=3.8; 0.7 individuals/ha), weighing 38 kg (0.03 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 7). Atlantic spadefish density decreased in 2007. Density was greatest in fall (Table 8). Atlantic spadefish were most abundant in waters off Georgia. Total lengths of *Chaetodipterus faber* ranged from 5 to 16 cm ($\bar{x}$ = 10.0).

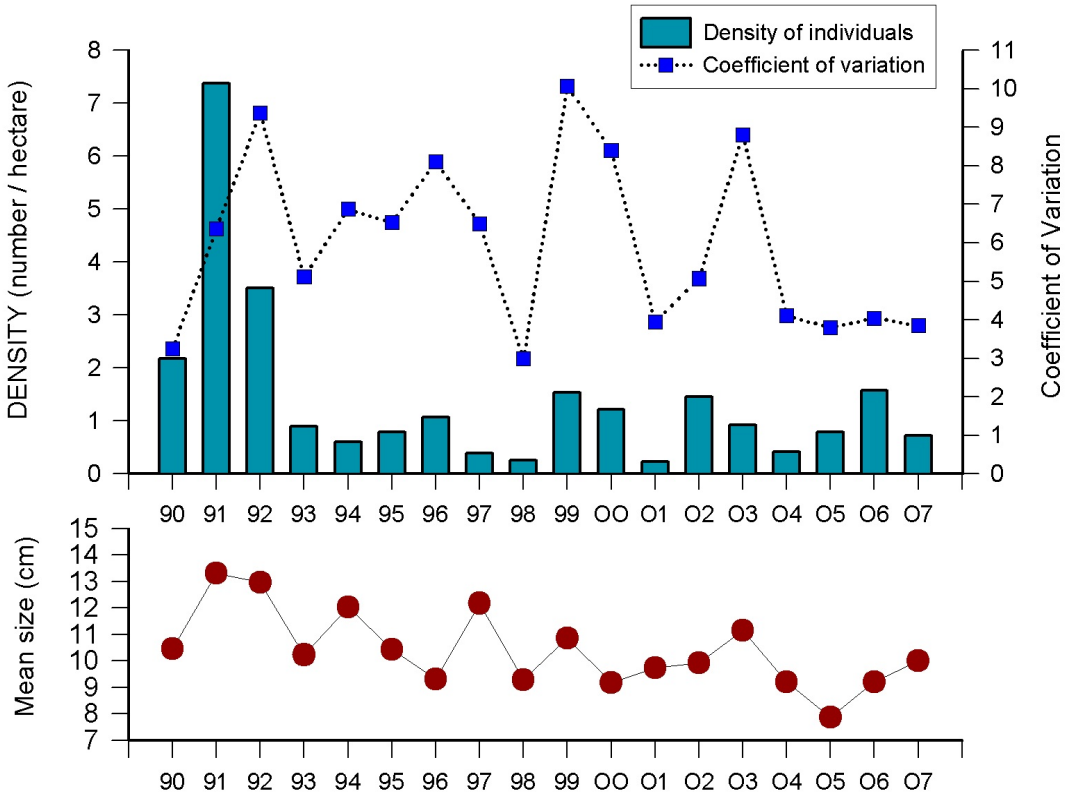

Figure 7. Annual density, variability, and mean size of *Chaetodipterus faber*

Table 8 . Estimates of density (number of individuals/hectare) in 2007.

Chaetodipterus faber

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.036	3.222	0.996
Onslow Bay	0.056	0	1.602	0.546
Long Bay	0.126	0.062	0.619	0.266
South Carolina	0	0.942	0.556	0.496
Georgia	0.405	0.703	2.203	1.093
Florida	0.300	0.062	2.257	0.890
Season	0.176	0.368	1.524	0.727

Cynoscion nebulosus

The spotted seatrout, *Cynoscion nebulosus*, has been a rare species in SEAMAP-SA Coastal Survey collections (Figure 8). In 2007, no specimens were taken.

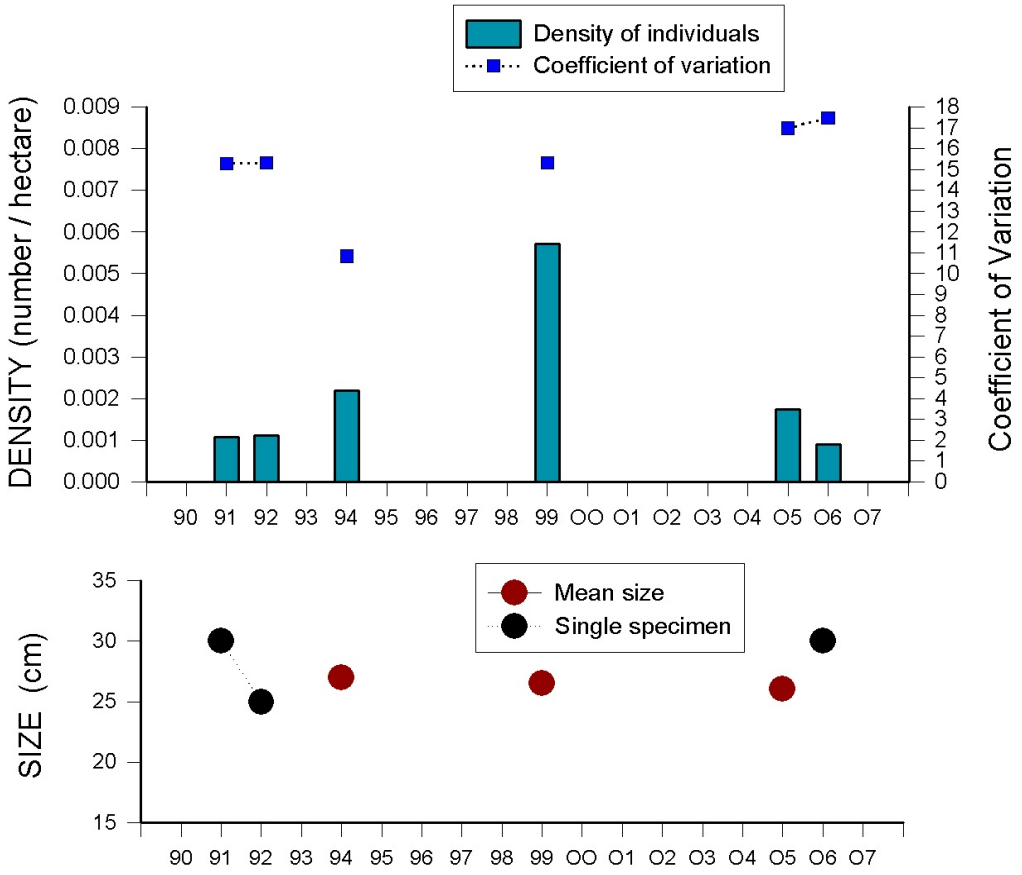

Figure 8. Annual density, variability, and size of *Cynoscion nebulosus*

Cynoscion regalis

In 2007, SEAMAP strata yielded a total of 4377 weakfish (CV=3.9; 4.0 individuals/ha), weighing 316 kg (0.3 kg/ha). The density of abundance in 2007 decreased for a second year from the record abundance recorded in 2005 (Figure 9). In 2007, density was greatest in spring and lowest in fall collections (Table 9). Weakfish were most abundant in the northern portion of the SAB, with greatest density of individuals found in Raleigh Bay.

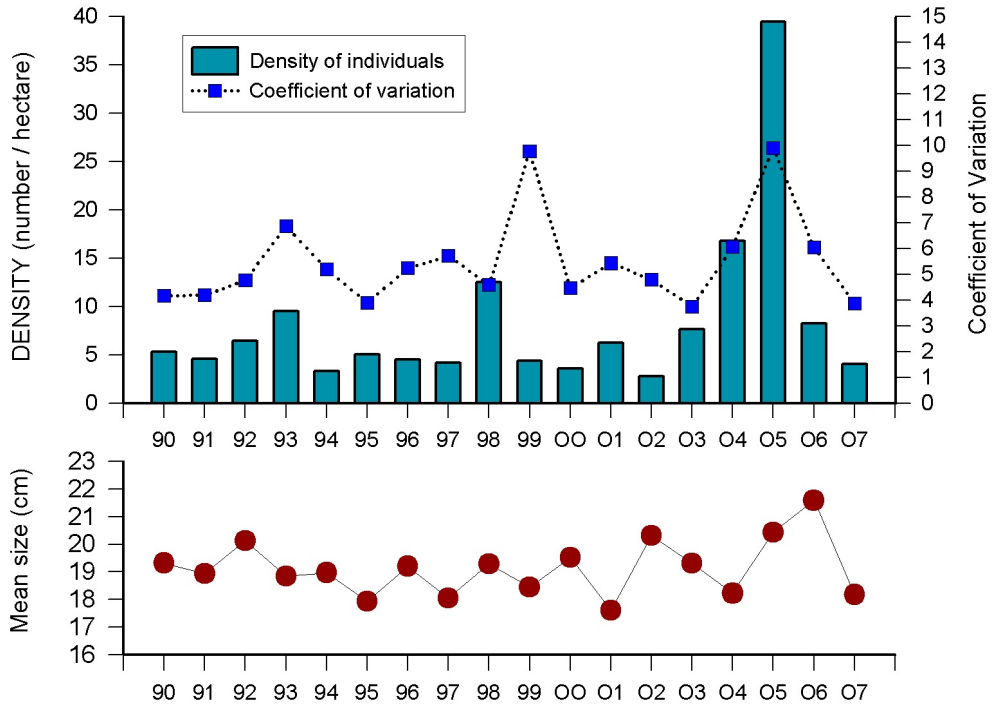

Figure 9. Annual density, variability, and mean size of *Cynoscion regalis*

Table 9 . Estimates of density (number of individuals/hectare) in 2007.

Cynoscion regalis

	Spring	Summer	Fall	Region
Raleigh Bay	43.382	6.701	0.041	17.255
Onslow Bay	7.450	6.291	1.911	5.241
Long Bay	1.047	3.785	0	1.626
South Carolina	0.835	3.517	6.968	3.745
Georgia	0.692	4.363	2.768	2.518
Florida	0.615	0.585	4.601	1.965
Season	4.416	3.601	3.162	4.050

Total lengths of *Cynoscion regalis* ranged from 7 to 36 cm ($\bar{x}$ = 18.2 cm). Length was significantly different among seasons ($X^2 = 509$, $p < 0.0001$).Mean length was smallest in summer due to recruitment of YOY. The largest seasonal mean length was noted in fall, the result of juvenile growth (Figure 10). Mean lengths also varied significantly among regions ($X^2 = 776$, $p < 0.0001$), with larger mean lengths occurring in Onslow Bay (Figure 11).

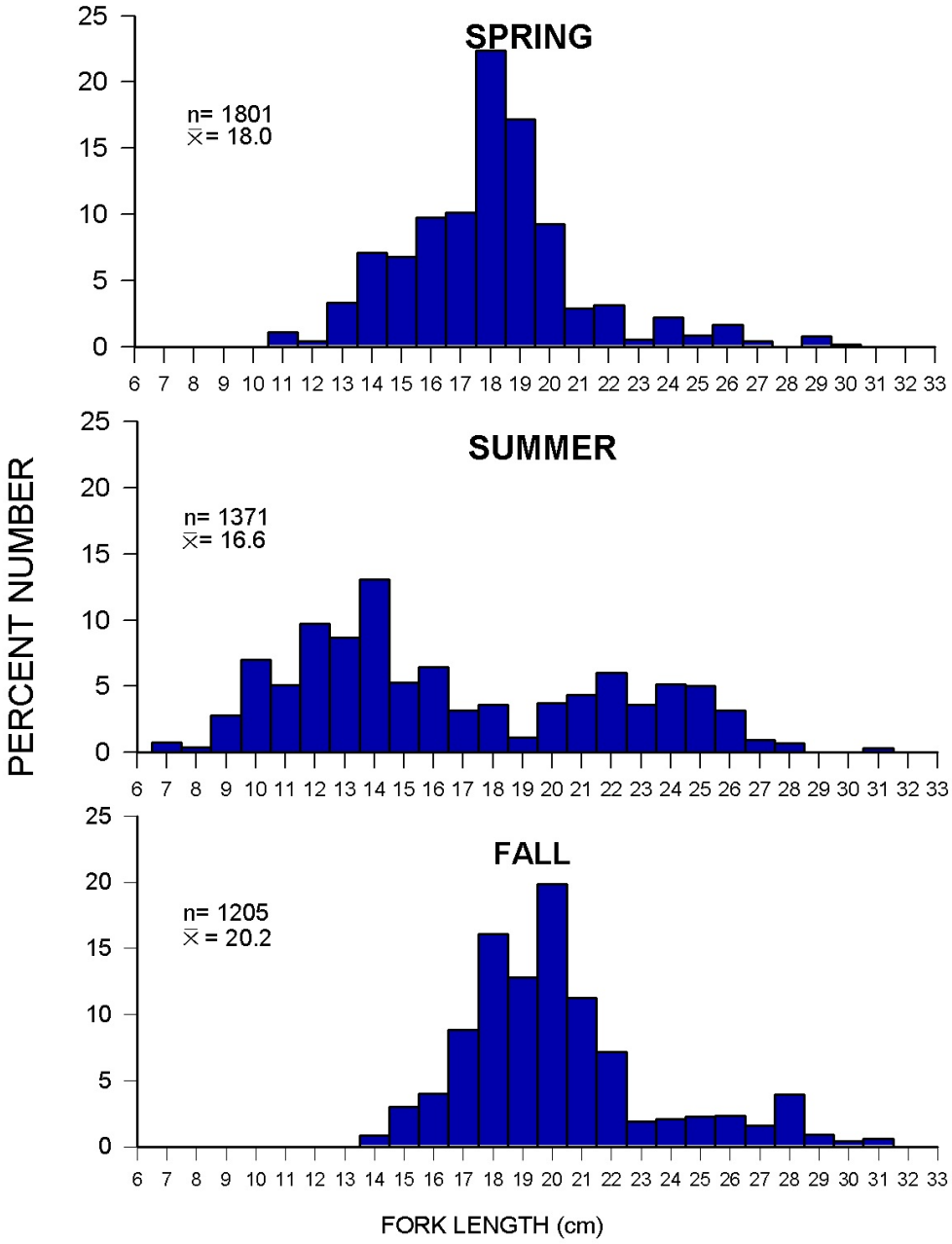

Figure 10. Seasonal length-frequencies of *Cynoscion regalis* in 2007

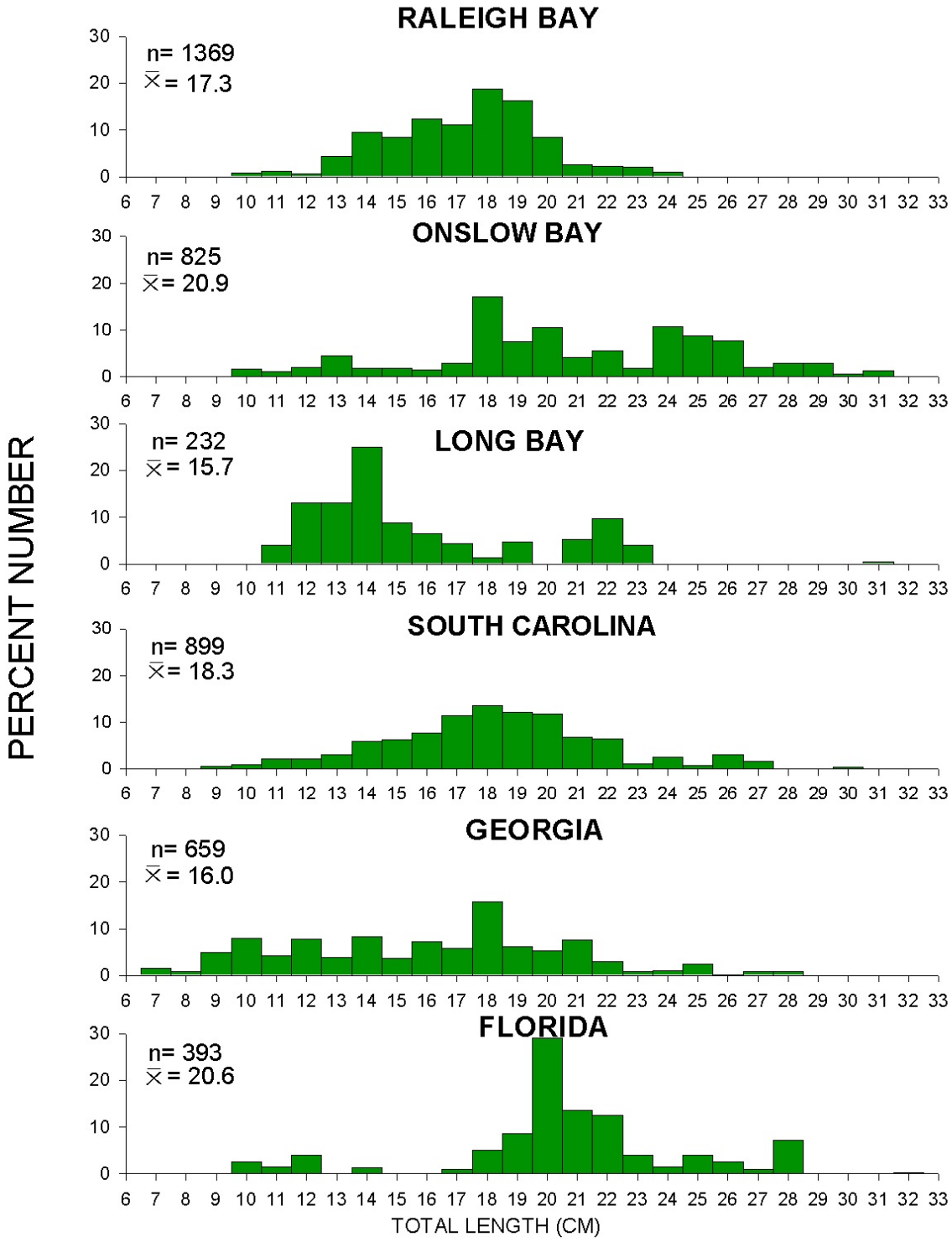

Figure 11. Regional length-frequencies of *Cynoscion regalis* in 2007

Leiostomus xanthurus

Leiostomus xanthurus was the fourth most abundant species collected by the SEAMAP-SA Coastal Survey in 2007. The 23,165 (CV=3.4; 21.4 individuals/ha) spot collected weighed 3113 kg (2.8 kg/ha). Density of individuals of spot was the lowest estimate since 2002 (Figure 12). In 2007, the seasonal density of abundance was greatest in spring. The greatest regional density was observed in Onslow Bay (Table 10). Despite the decrease in abundance, spot exhibited the fourth highest percent occurrence of all species, being present in approximately 66% of all tows.

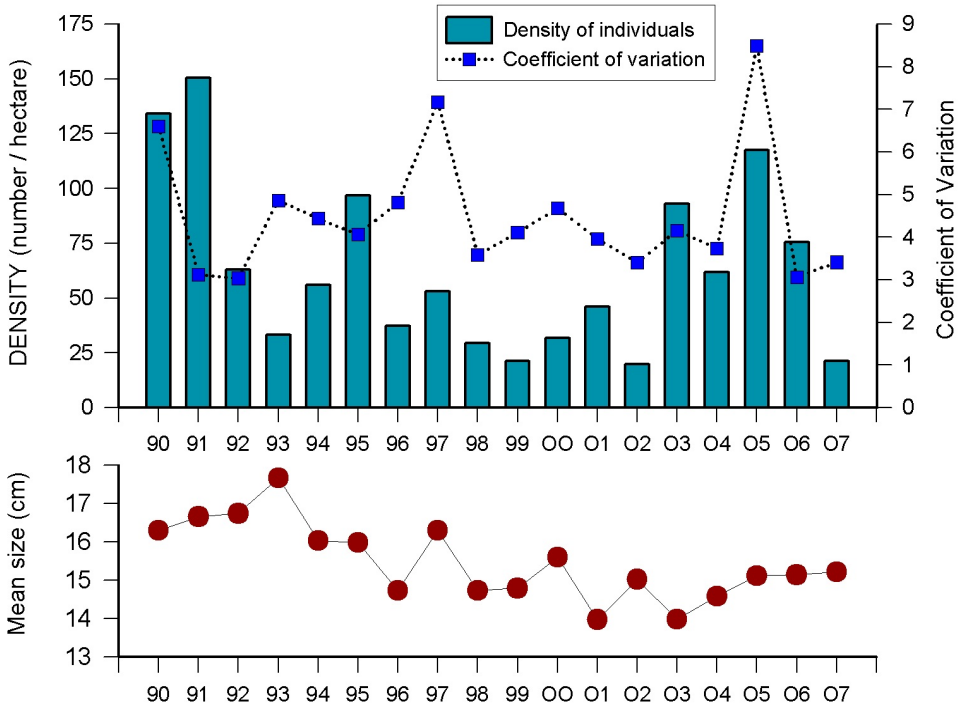

Figure 12. Annual density, variability, and mean size of *Leiostomus xanthurus*

Table 10 . Estimates of density (number of individuals/hectare) in 2007.

Leiostomus xanthurus

	Spring	Summer	Fall	Region
Raleigh Bay	28.028	28.273	1.652	20.066
Onslow Bay	80.182	38.241	19.286	46.166
Long Bay	68.462	31.982	4.400	35.143
South Carolina	8.386	25.300	31.437	21.590
Georgia	0.053	13.077	2.318	4.841
Florida	4.511	24.942	13.496	14.210
Season	24.215	23.508	12.358	21.433

Total centerline lengths of spot from the SEAMAP-SA survey ranged from 7 to 26 cm, with a mean length of 15.2 cm. Lengths varied significantly among seasons ($X^2 = 4887$, $p < 0.0001$). Mean length decreased from spring to summer and increased from summer to fall, the result of juvenile growth (Figure 13). Length also varied significantly among regions ($X^2 = 3439$, $p < 0.0001$). The mean length of spot was greatest in waters off Florida (Figure 14).

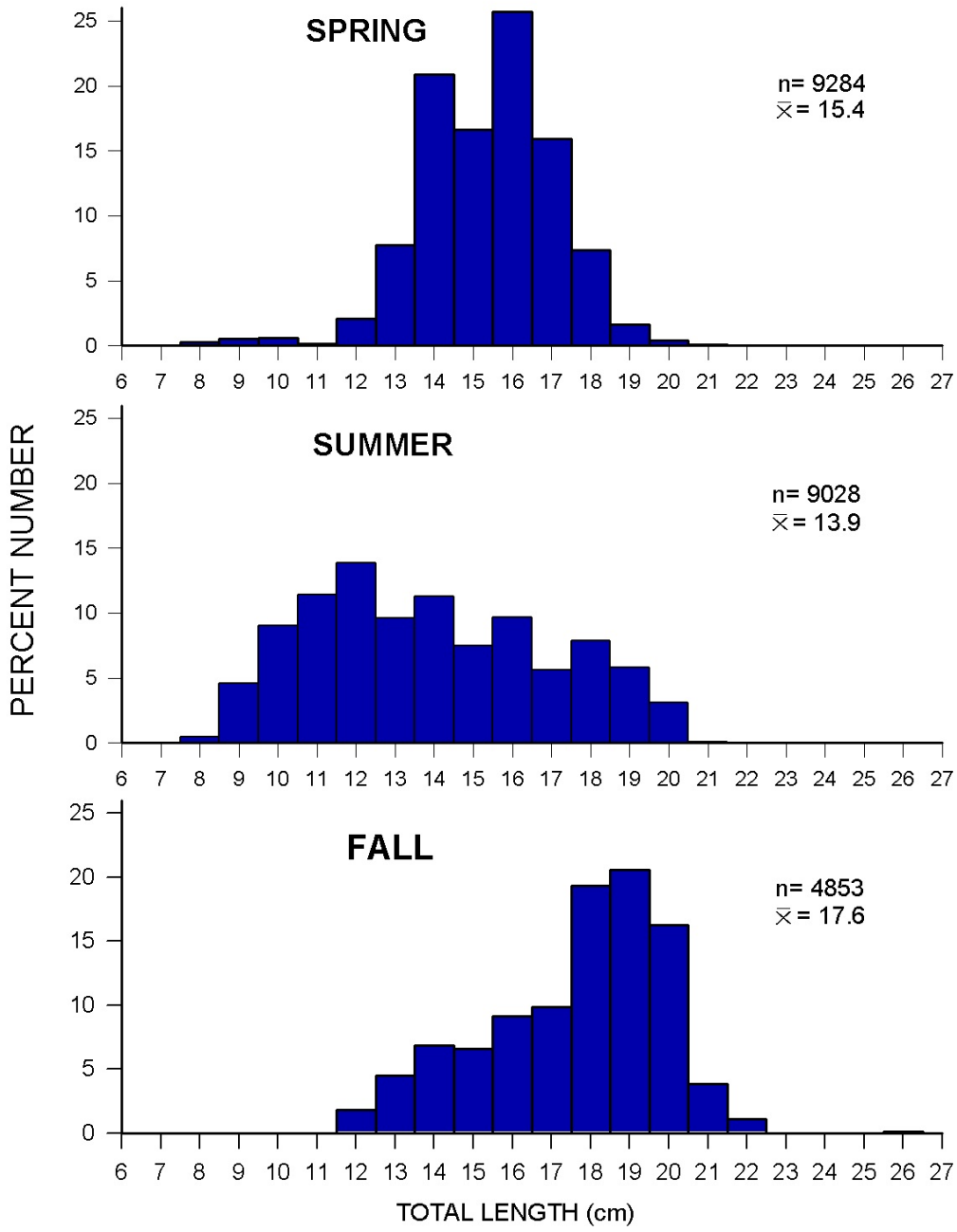

Figure 13. Seasonal length-frequencies of *Leiostomus xanthurus* in 2007

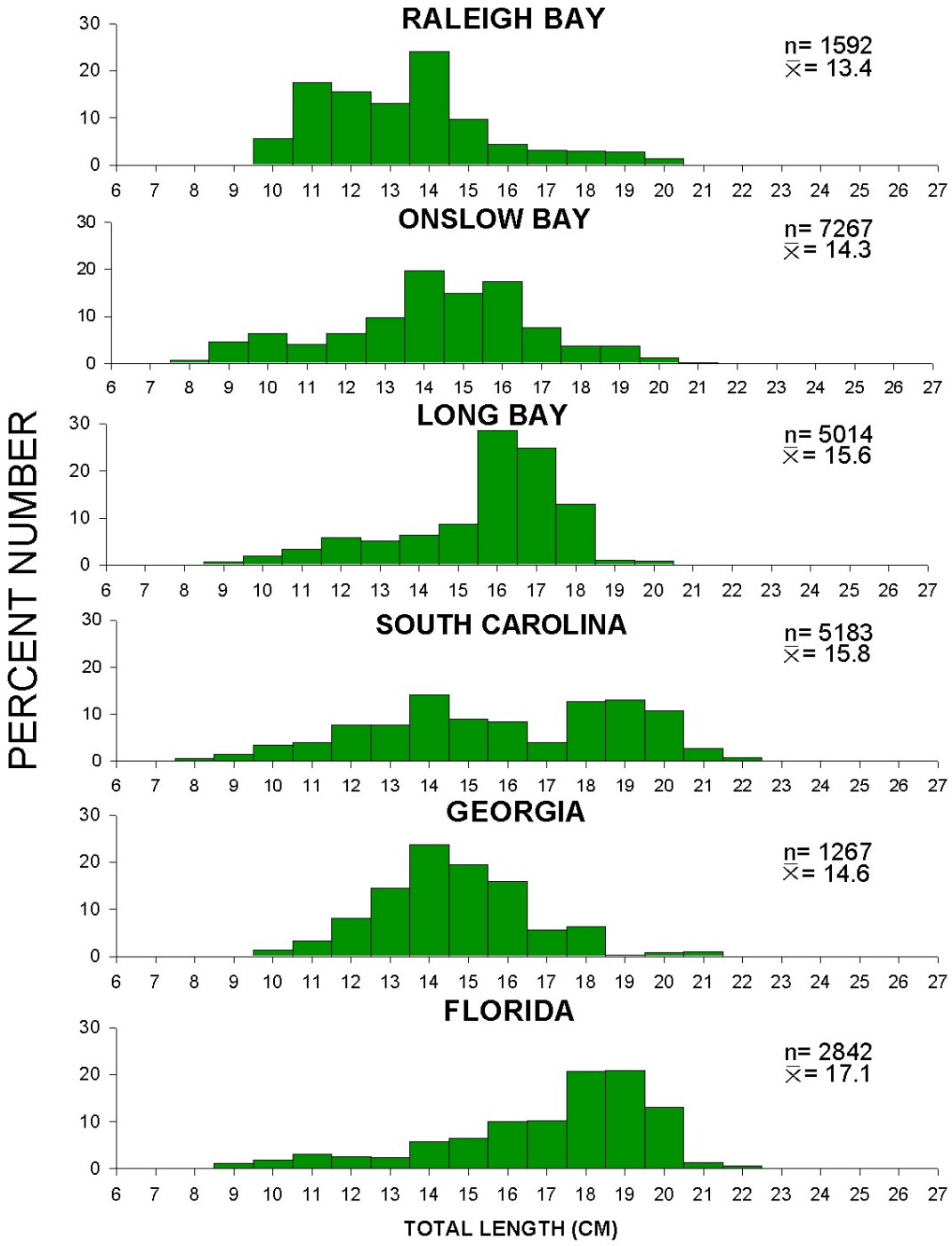

Figure 14. Regional length-frequencies of *Leiostomus xanthurus* in 2007

Menticirrhus americanus

SEAMAP-SA Coastal Survey strata produced a total of 10,892 southern kingfish (CV=2.5; 10.1 individuals/ha), weighing 1778 kg (1.6 kg/ha). In 2007, density of individuals decreased, as did variability and mean length (Figure 15). Density was greatest in fall and in Raleigh Bay (Table 11). The southern kingfish exhibited the highest percent occurrence of all species, being present in approximately 74% of all tows.

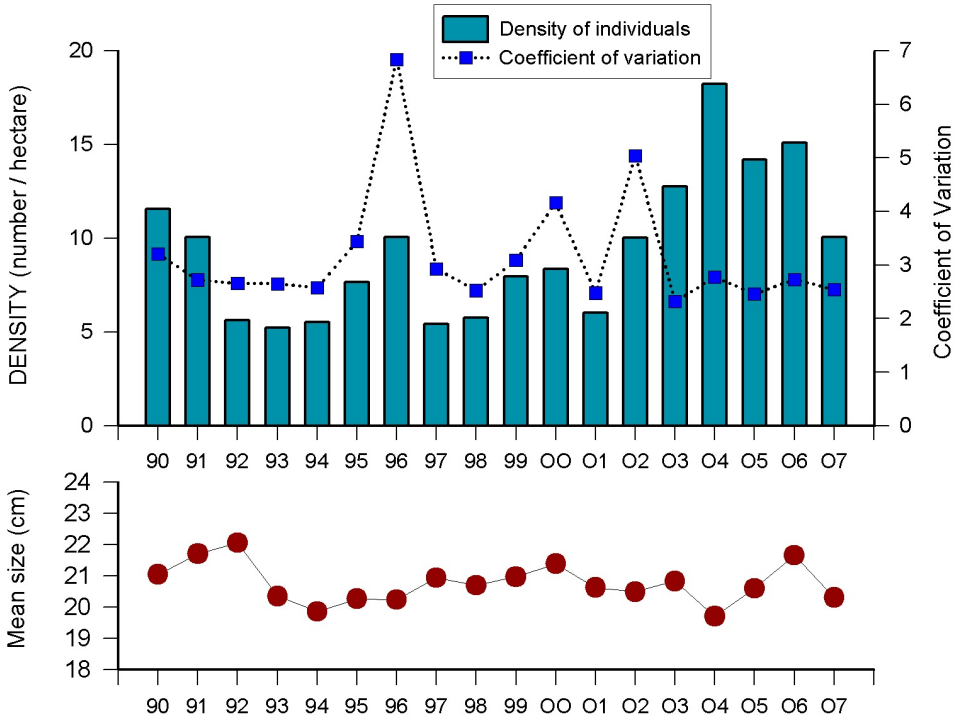

Figure 15. Annual density, variability, and mean size of *Menticirrhus americanus*

Table 11 . Estimates of density (number of individuals/hectare) in 2007.

Menticirrhus americanus

	Spring	Summer	Fall	Region
Raleigh Bay	39.085	3.153	9.583	17.444
Onslow Bay	2.370	0.686	3.514	2.185
Long Bay	1.172	3.764	2.200	2.383
South Carolina	8.558	10.728	22.737	13.950
Georgia	9.044	10.920	12.951	10.920
Florida	14.134	13.010	12.147	13.085
Season	9.735	8.364	11.242	10.077

Total lengths of *Menticirrhus americanus* ranged from 9 to 37 cm ($\bar{x}$ = 20.3). Although length was significantly different among seasons ($X^2 = 81$, $p < 0.0001$), seasonal mean lengths did not vary a great deal (Figure 16). Length also varied significantly among regions ($X^2 = 794$, $p < 0.0001$), with greatest mean length taken in waters off Florida (Figure 17).

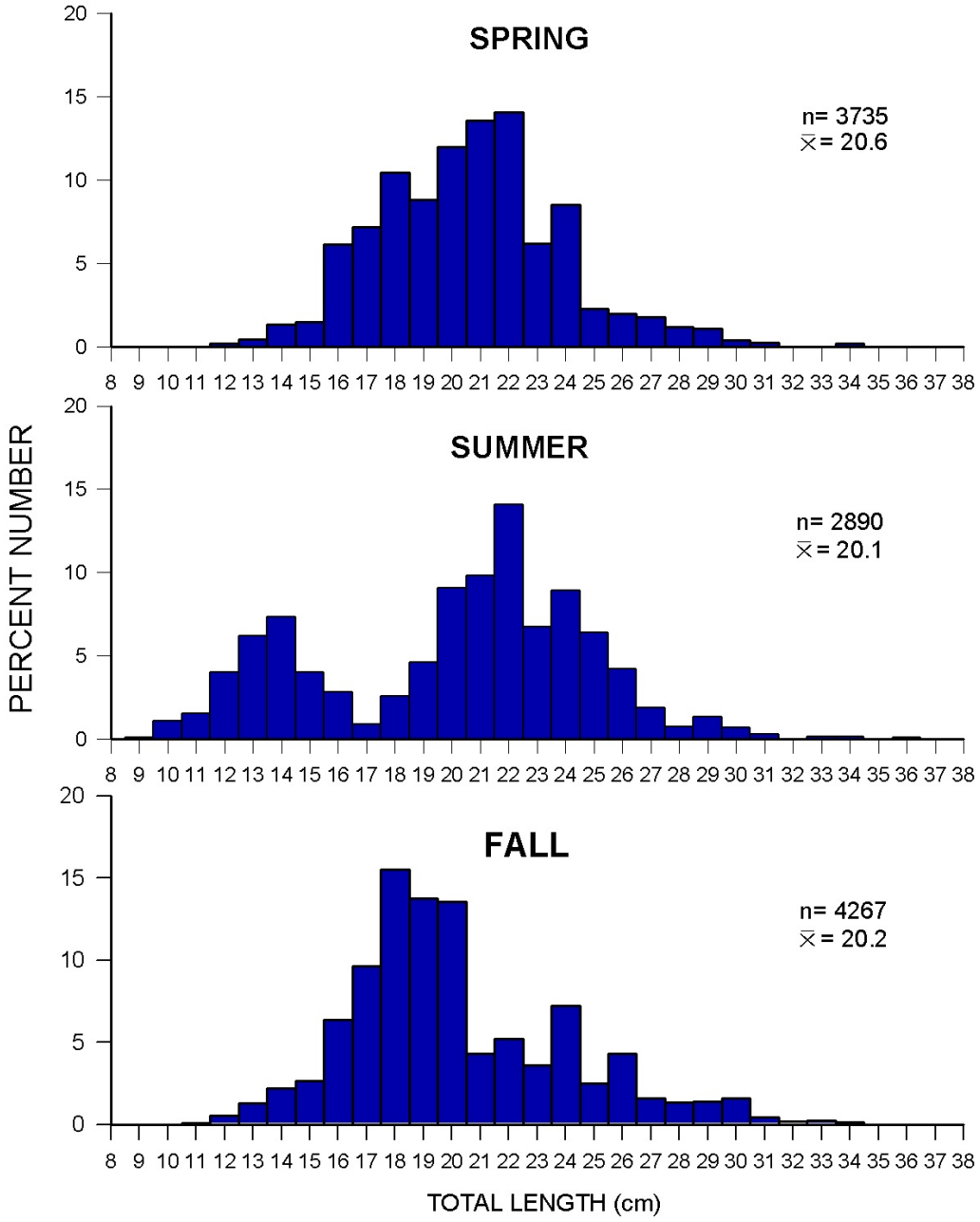

Figure 16. Seasonal length-frequencies of *Menticirrhus americanus* in 2007

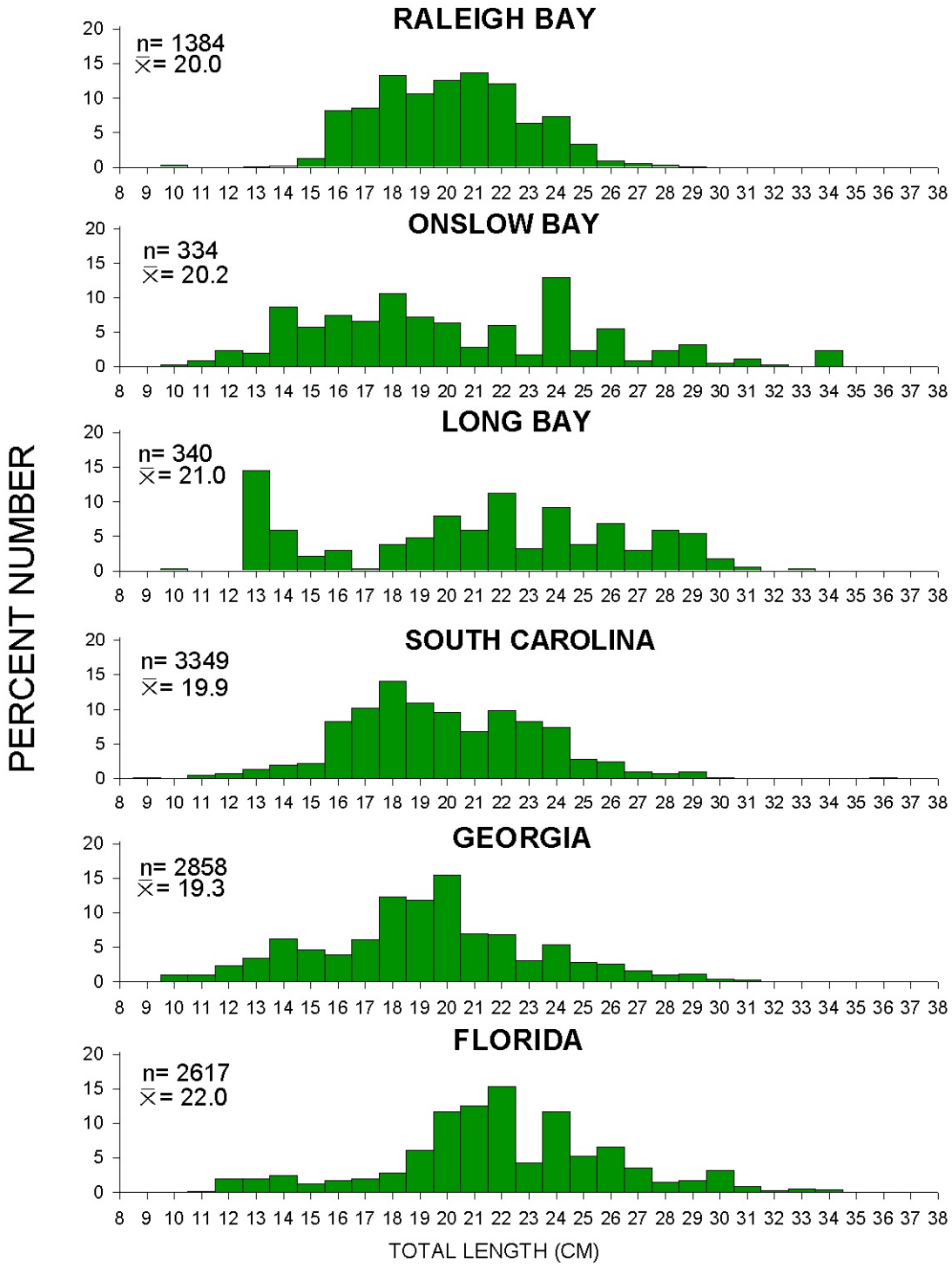

Figure 17. Regional length-frequencies of *Menticirrhus americanus* in 2007

Menticirrhus littoralis

SEAMAP-SA Coastal Survey strata yielded a total of 201 Gulf kingfish (CV=5.2; 0.2 individuals/ha), weighing 47 kg (0.04 kg/ha) in 2007. Density of individuals for *Menticirrhus littoralis* decreased again in 2007, after the peak in abundance in 2003-2005 (Figure 18). Density was greatest in fall and Gulf kingfish were most abundant in Florida waters (Table 12). Total lengths of *Menticirrhus littoralis* ranged from 20 to 39 cm, with a mean length of 27.8 cm, the greatest annual mean length recorded by the survey.

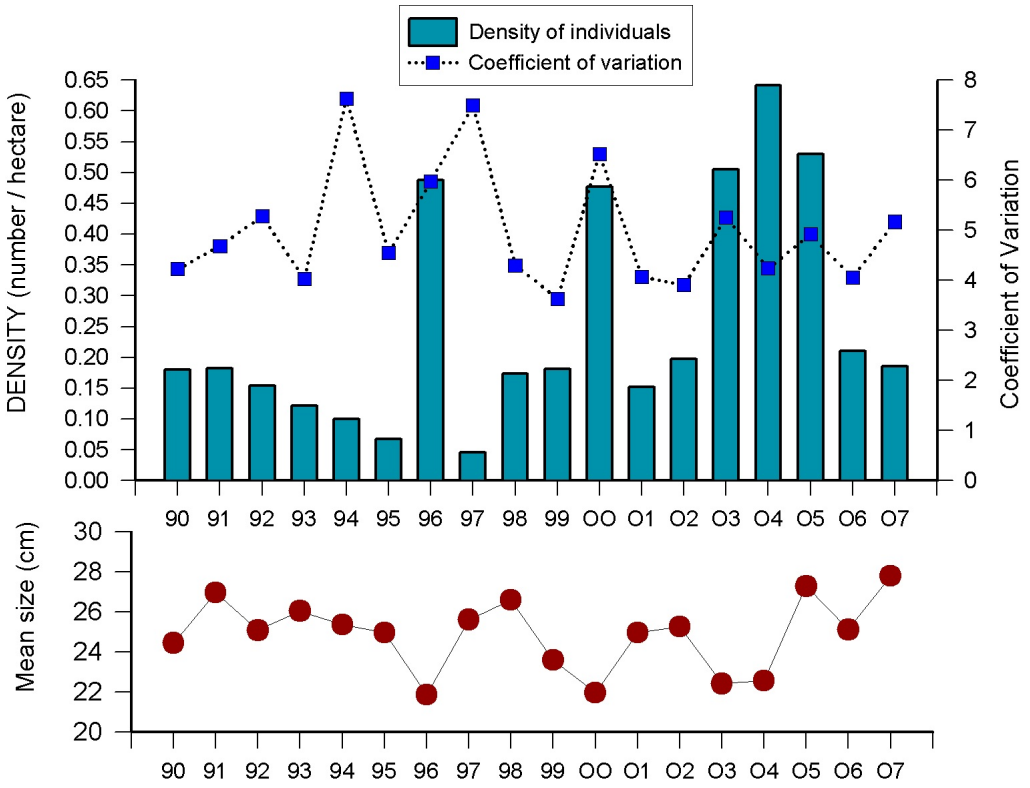

Figure 18. Annual density, variability, and mean size of *Menticirrhus littoralis*

Table 12 . Estimates of density (number of individuals/hectare) in 2007.

Menticirrhus littoralis

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0.019	0.006
Long Bay	0	0	0.107	0.035
South Carolina	0.012	0	0.303	0.104
Georgia	0.011	0.012	0.127	0.050
Florida	1.019	0.354	0.967	0.785
Season	0.174	0.064	0.289	0.186

Menticirrhus saxatilis

SEAMAP-SA Coastal Survey strata yielded 22 northern kingfish (CV=10.5; 0.02 individuals/ha), weighing 2 kg (0.002 kg/ha) in 2007. Density of abundance decreased in 2007 (Figure 19). Northern kingfish were taken in spring in Raleigh Bay and Georgia, and in summer in Onslow Bay (Table 13). None were collected during the fall cruise. Total lengths ranged from 13 to 26 cm ($\bar{x}$ = 21.5).

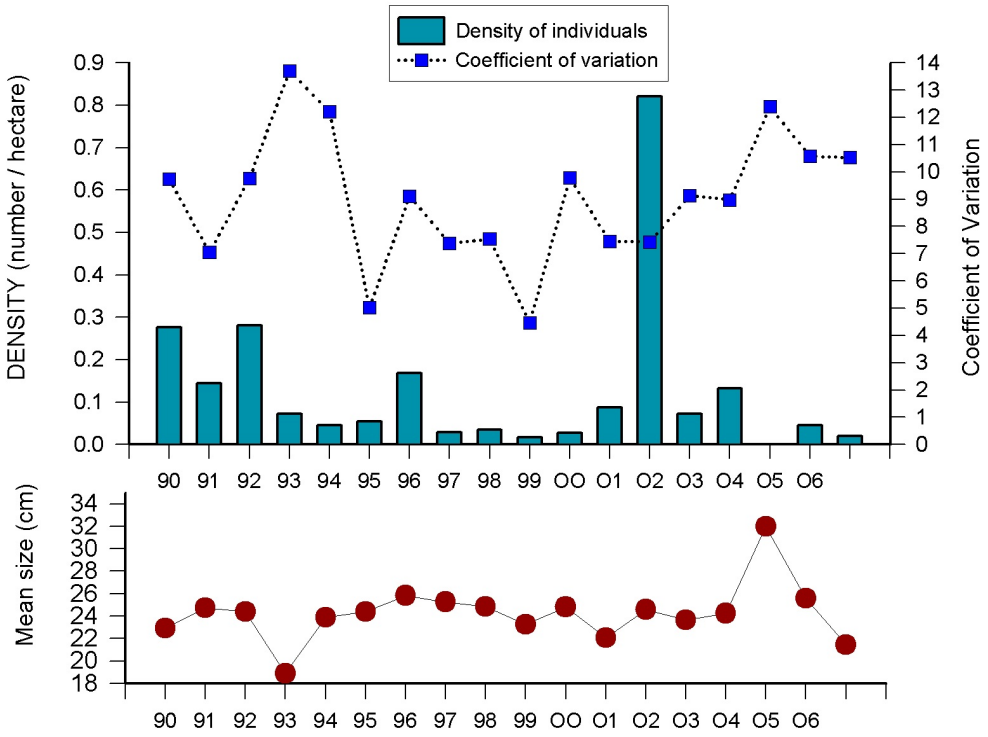

Figure 19. Annual density, variability, and mean size of *Menticirrhus saxatilis*

Table 13 . Estimates of density (number of individuals/hectare) in 2007.

Menticirrhus saxatilis

	Spring	Summer	Fall	Region
Raleigh Bay	0.404	0	0	0.139
Onslow Bay	0	0.095	0	0.032
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0.064	0	0	0.023
Florida	0	0	0	0
Season	0.042	0.012	0	0.020

Micropogonias undulatus

Micropogonias undulatus was the second most abundant species collected in SEAMAP-SA trawl samples in 2007. Despite that fact, the 53,282 individuals (CV=4.5), weighing 3650 kg, made up only 8% of the total number of specimens taken in SEAMAP strata. Density estimates decreased from 2006 (Figure 20). Seasonal densities of individuals were greatest in summer. Regional densities were highest in the northern portion of the SAB, especially in Onslow Bay (Table 14).

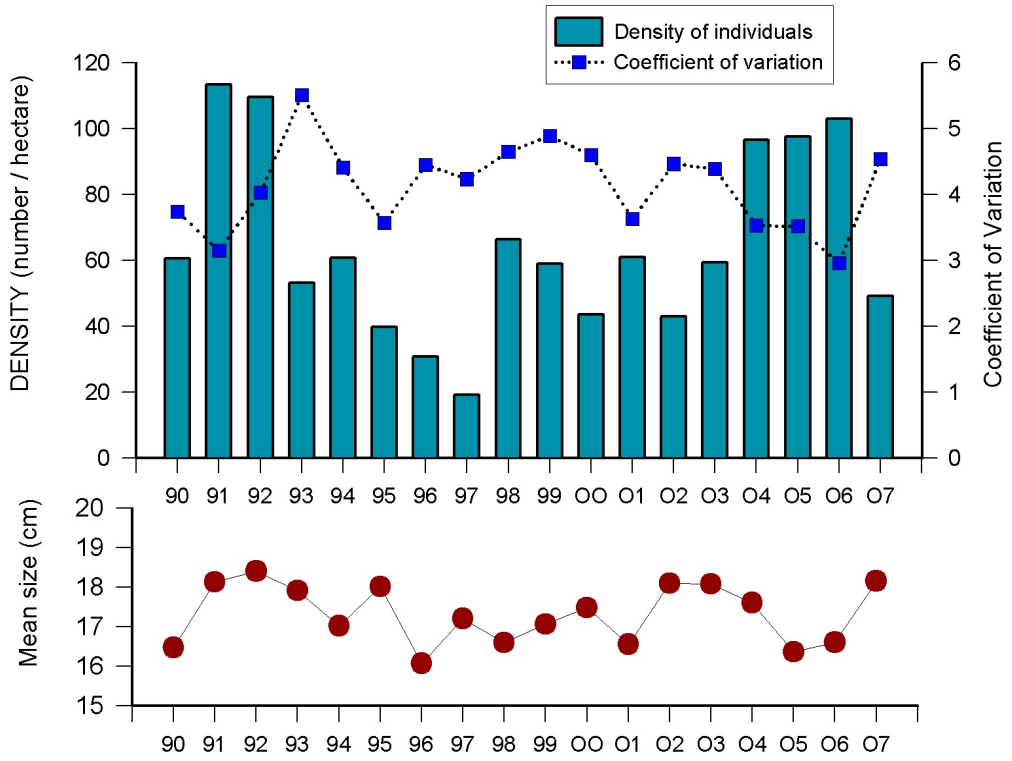

Figure 20. Annual density, variability, and mean size of *Micropogonias undulatus*

Table 14. Estimates of density (number of individuals/hectare) in 2007.

Micropogonias undulatus

	Spring	Summer	Fall	Region
Raleigh Bay	11.461	86.397	10.285	37.459
Onslow Bay	229.203	91.905	104.714	142.483
Long Bay	26.108	132.961	21.465	60.600
South Carolina	17.743	27.988	24.912	23.506
Georgia	0.224	32.045	26.768	18.883
Florida	0.330	122.907	9.466	43.254
Season	40.851	66.377	30.097	49.297

Total lengths of Atlantic croaker ranged from 7 to 26 cm ($\bar{x}$ = 18.2 cm). Lengths differed significantly among seasons (X^2 =3830, $p < 0.0001$). Mean length increased from spring to fall (Figure 21). Length also varied significantly among regions (X^2 =18690, $p < 0.0001$), and mean lengths ranged from 15.9 cm off Georgia to 21.6 cm in Florida waters (Figure 22)

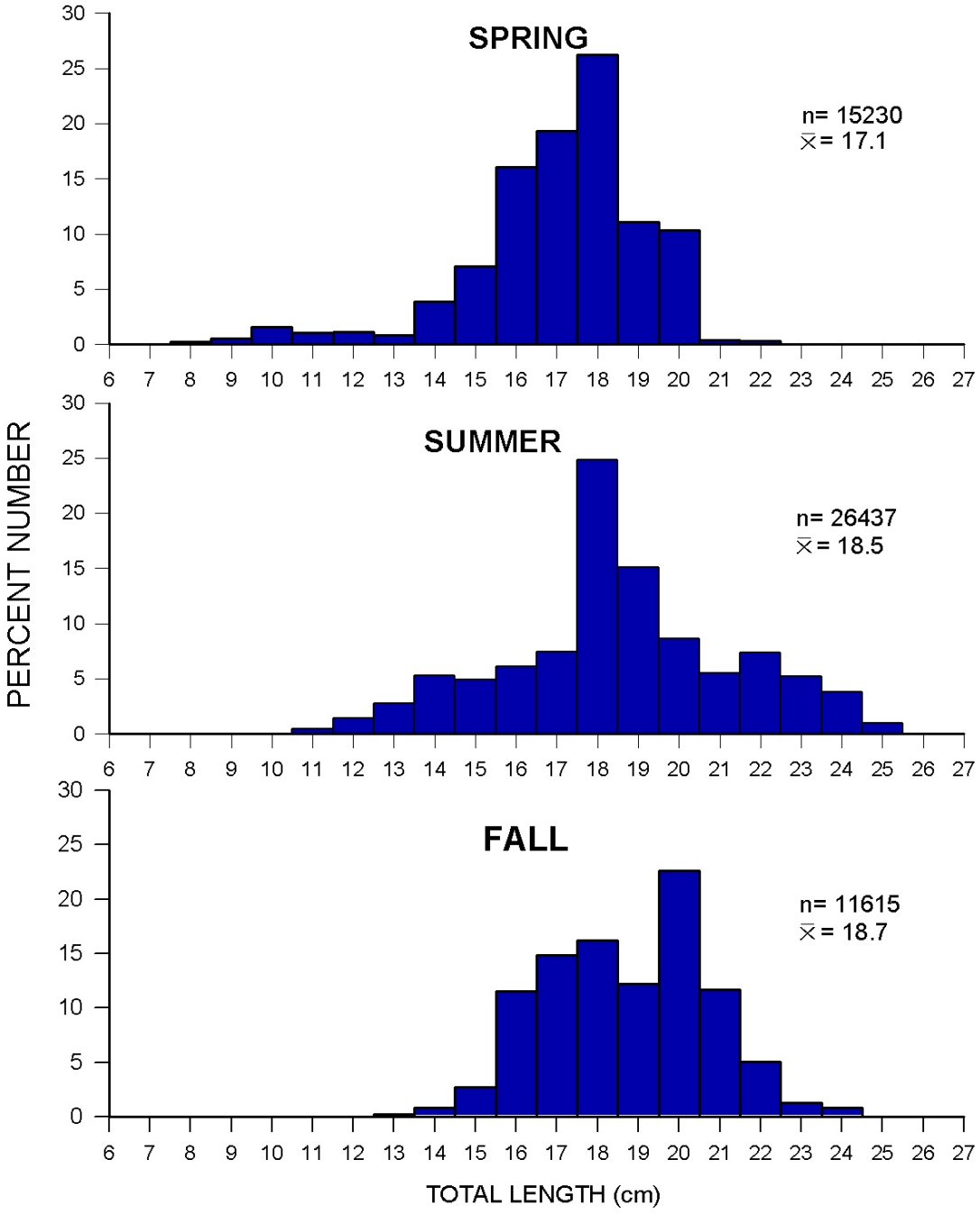

Figure 21. Seasonal length-frequencies of *Micropogonias undulatus* in 2007

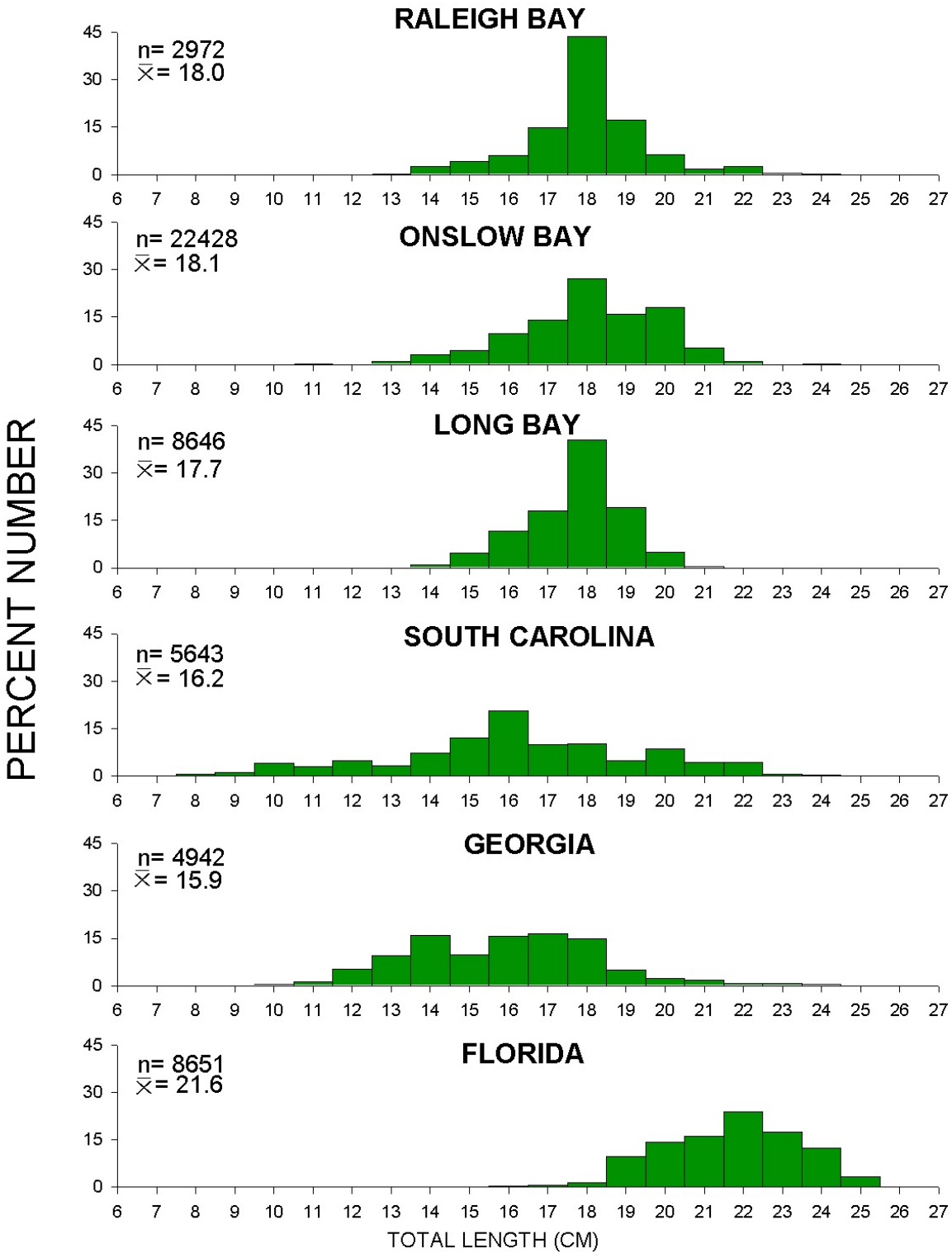

Figure 22. Regional length-frequencies of *Micropogonias undulatus* in 2007

Mycteroperca microlepis

The gag grouper, *Mycteroperca microlepis*, has been rare in SEAMAP-SA Coastal Survey collections (SEAMAP-SA/SCMRD, 2000). Only three individuals have been taken by the survey. No gag grouper were collected in 2007 (Figure 23).

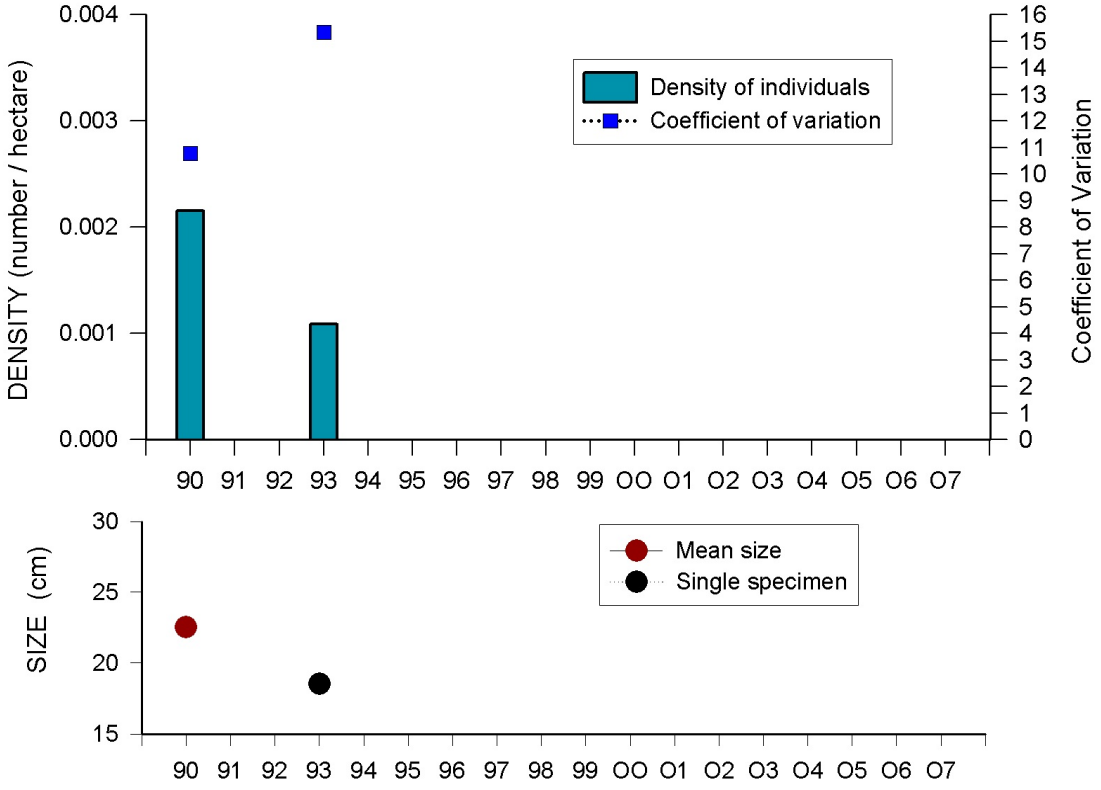

Figure 23. Annual density, variability, and size of *Mycteroperca microlepis*

Paralichthys albigutta

The gulf flounder, *Paralichthys albigutta*, generally exhibits low abundance in SEAMAP-SA Coastal Survey collections. A total of 31 individuals (CV=6.6; 0.03 individuals/ha), weighing 7 kg (0.006 kg/ha), were taken in 2007. Density of abundance of gulf flounder increased in 2007 (Figure 24). Gulf flounder were absent from spring collections and were most abundant in fall and in Onslow Bay (Table 15). Lengths ranged from 18 to 35 cm ($\bar{x}$ = 26.0).

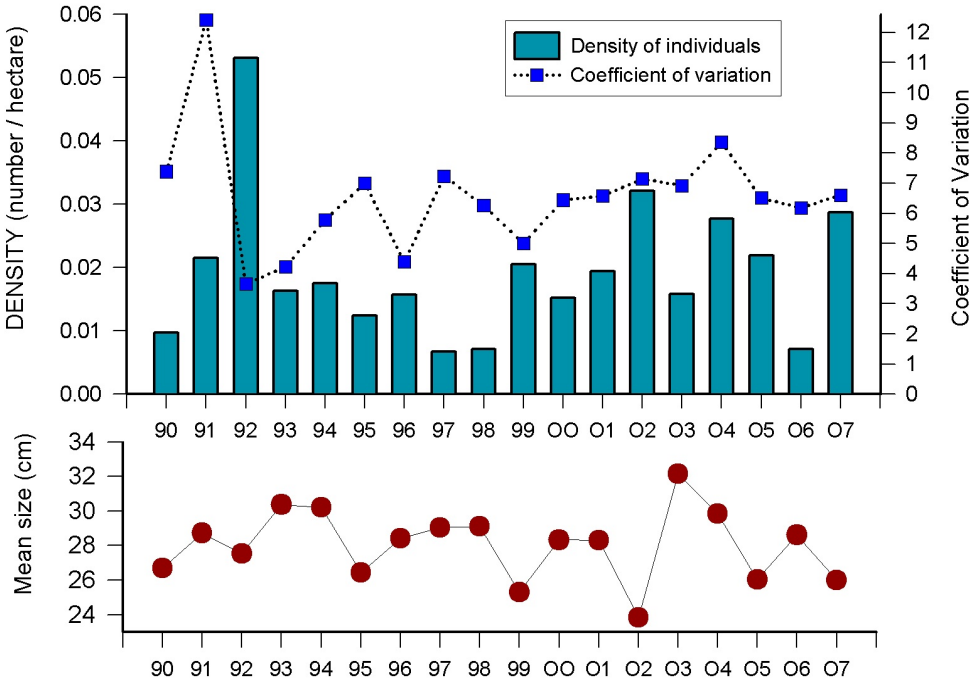

Figure 24. Annual density, variability, and mean size of *Paralichthys albigutta*

Table 15. Estimates of density (number of individuals/hectare) in 2007.

Paralichthys albigutta

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0.210	0.154	0.121
Long Bay	0	0	0	0
South Carolina	0	0.013	0.051	0.021
Georgia	0	0.012	0.058	0.023
Florida	0	0	0.015	0.005
Season	0	0.035	0.047	0.029

Paralichthys dentatus

SEAMAP-SA Coastal Survey strata yielded a total of 210 summer flounder (CV=2.9; 0.2 individuals/ha), weighing 35 kg (0.03 kg/ha). The density of abundance decreased in 2007 (Figure 25). Density was greatest in summer (Table 16). Summer flounder were most abundant in the Raleigh Bay. Total lengths of *Paralichthys dentatus* ranged from 10 to 42 cm ($\bar{x}$ = 25.0).

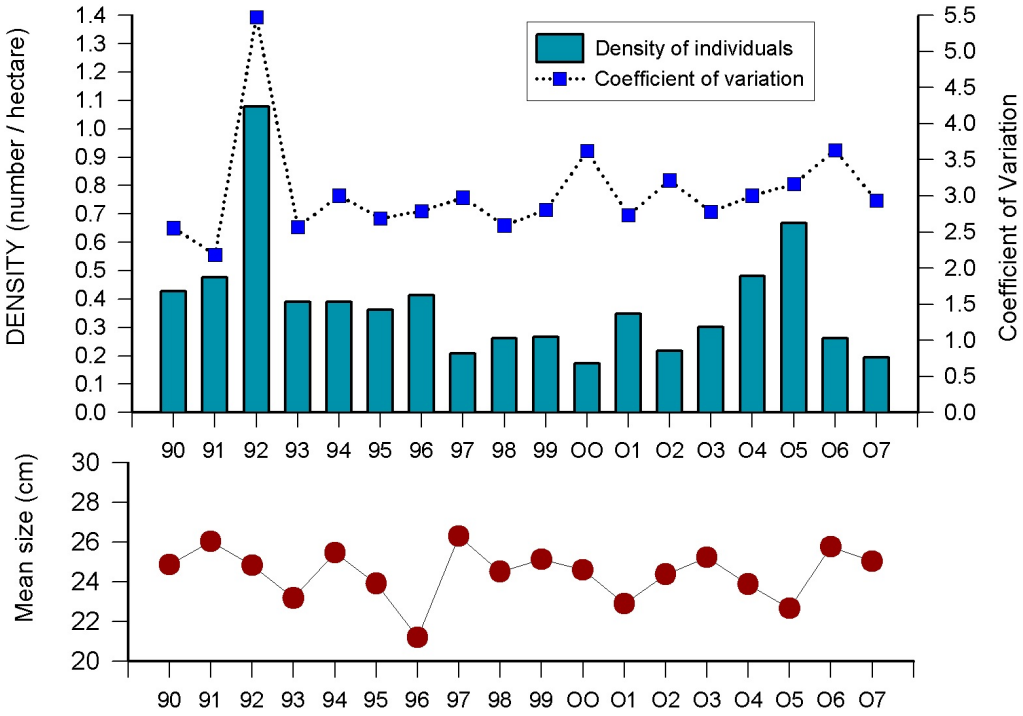

Figure 25. Annual density, variability, and mean size of *Paralichthys dentatus*

Table 16. Estimates of density (number of individuals/hectare) in 2007.

Paralichthys dentatus

	Spring	Summer	Fall	Region
Raleigh Bay	0.33	0.968	0.207	0.517
Onslow Bay	0.01	0.477	0.714	0.400
Long Bay	0.10	0.208	0.150	0.154
South Carolina	0.03	0.264	0.341	0.212
Georgia	0.01	0.210	0.046	0.084
Florida	0.01	0.154	0	0.055
Season	0.05	0.311	0.214	0.194

Paralichthys lethostigma

SEAMAP-SA Coastal Survey strata yielded a total of 40 southern flounder (CV=5.7; 0.04 individuals/ha), weighing 17 kg (0.02 kg/ha) in 2007. In 2007, density of individuals again decreased from the peak in abundance observed in 2004 (Figure 26). Seasonal density was greatest in summer and fall (Table 17). Southern flounder were most abundant in Florida. Total lengths of *Paralichthys lethostigma* ranged from 24 to 57 cm ($\bar{x}$ = 33.8).

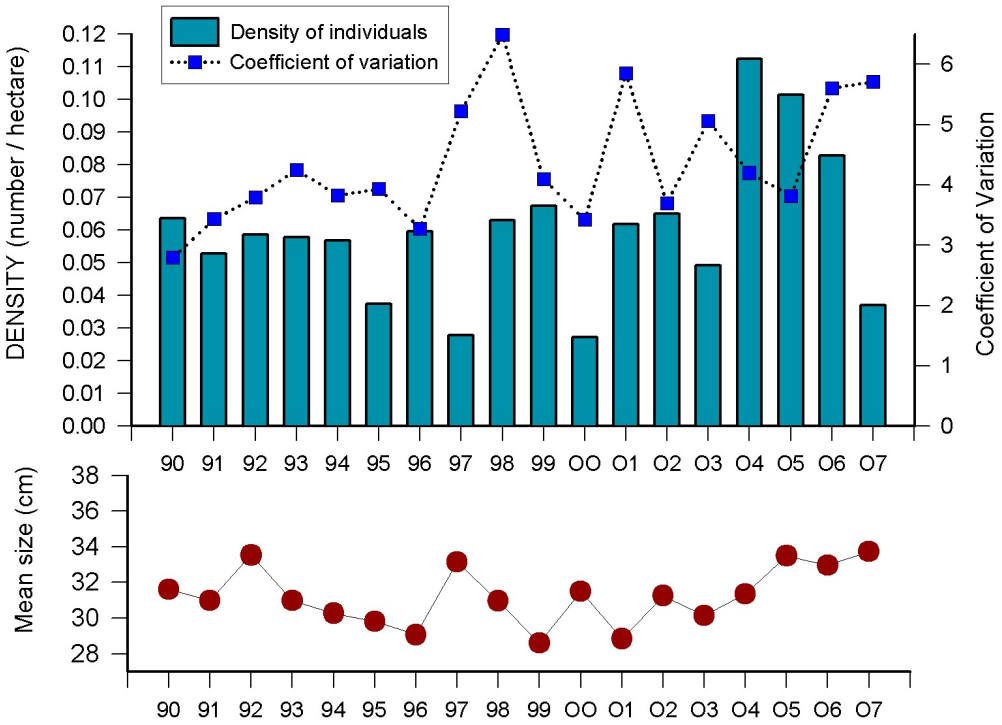

Figure 26. Annual density, variability, and mean size of *Paralichthys lethostigma*

Table 17. Estimates of density (number of individuals/hectare) in 2007.

Paralichthys lethostigma

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.036	0	0.013
Onslow Bay	0.13	0.038	0	0.057
Long Bay	0	0	0.021	0.007
South Carolina	0.01	0	0.076	0.029
Georgia	0.03	0	0	0.011
Florida	0.22	0.062	0	0.095
Season	0.07	0.020	0.020	0.037

Peprilus paru

SEAMAP-SA Coastal Survey strata yielded a total of 10,864 *Peprilus paru* (CV=3.0; 10.1 individuals/ha), weighing 1235 kg (1.1 kg/ha). Density of individuals in 2007 represents the second greatest abundance recorded (Figure 27). Annual peaks in abundance reflect large catches of harvestfish in summer and fall collections (SEAMAP-SA/SCMRD, 2000). In 2007, harvestfish were most abundant in Florida waters in the summer (Table 18).

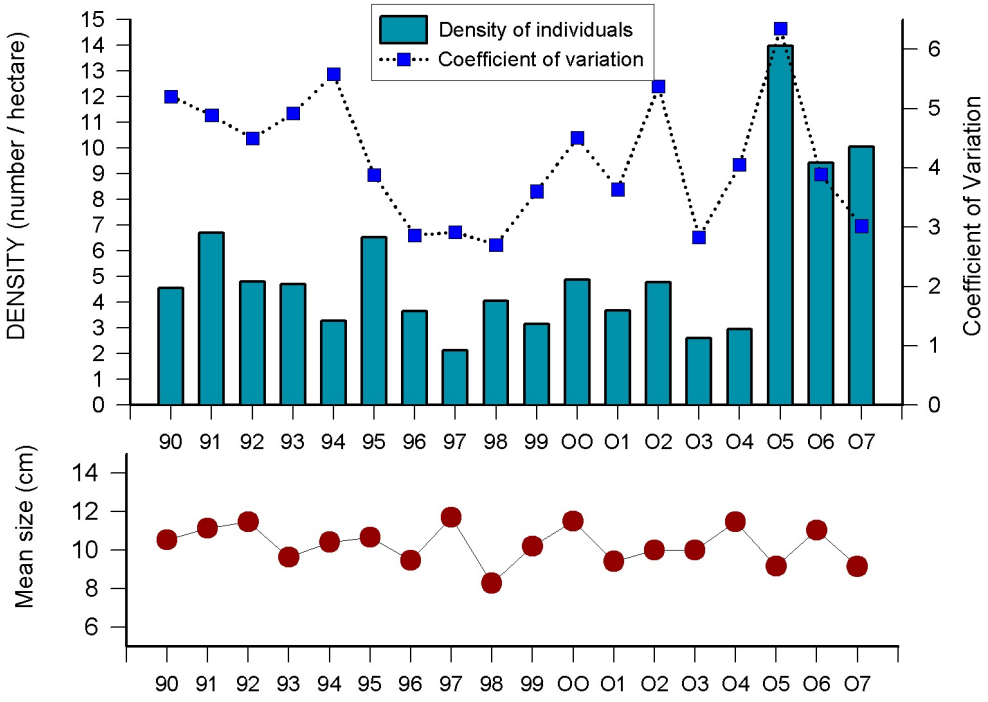

Figure 27. Annual density, variability, and mean size of *Peprilis paru*

Table 18 . Estimates of density (number of individuals/hectare) in 2007.

Peprilus paru

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.788	6.402	2.231
Onslow Bay	21.1	3.317	16.294	13.602
Long Bay	2.6	5.157	2.285	3.371
South Carolina	3.2	6.783	3.199	4.395
Georgia	0.6	23.886	9.111	10.664
Florida	1.3	37.951	24.353	21.094
Season	4.5	15.225	10.679	10.052

Fork lengths of *Peprilus paru* ranged from 3 to 20 cm ($\bar{x}$ = 9.1). Length was significantly different among seasons (X^2 = 4309, $p < 0.0001$). Mean length decreased from spring to summer due to the recruitment of YOY, and increased from summer to fall, the result of juvenile growth (Figure 28). Mean length also varied significantly among regions (X^2 = 3703, $p < 0.0001$). Mean length of harvestfish was greatest in collections from Onslow Bay (Figure 29).

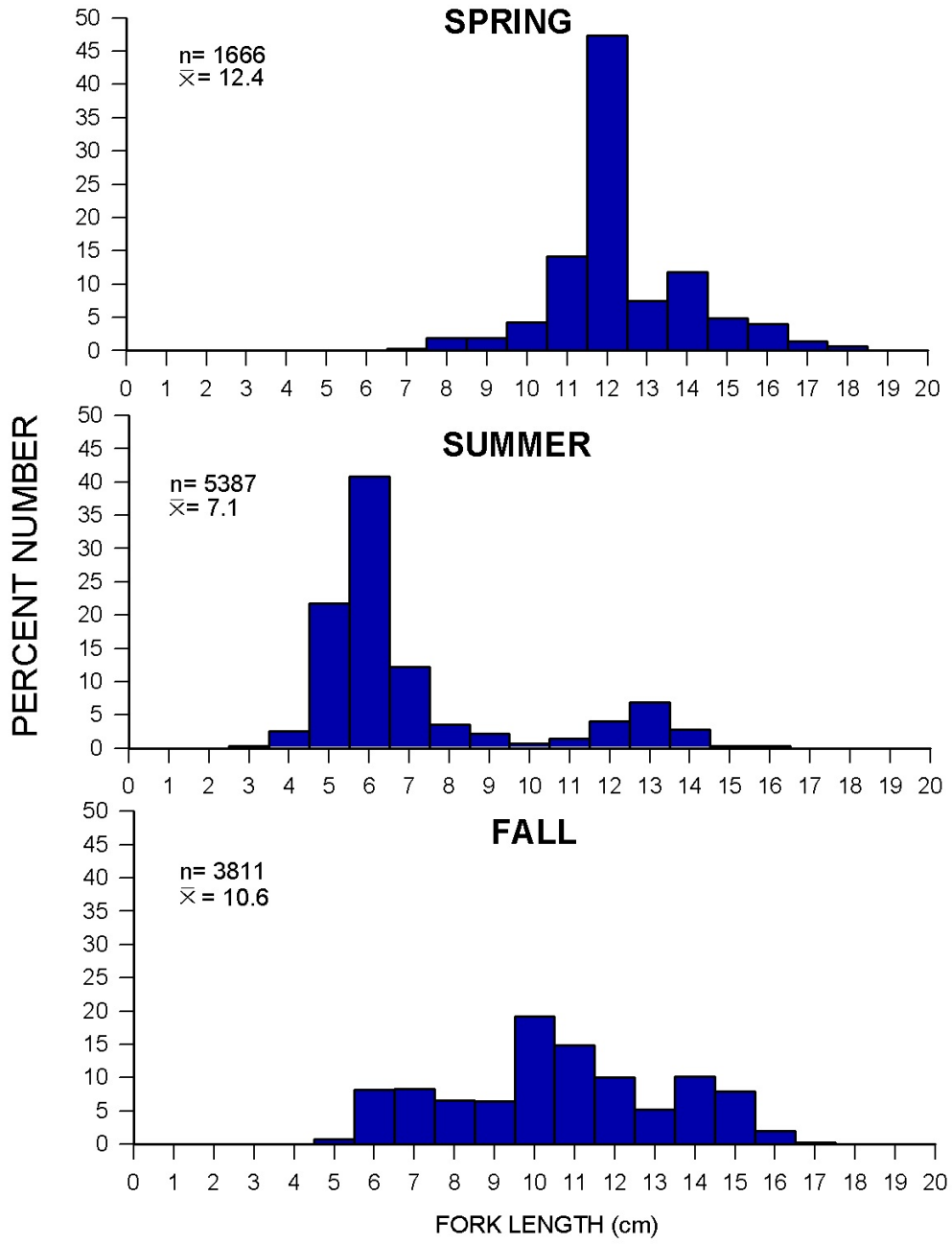

Figure 28. Seasonal length-frequencies of *Peprilus paru* in 2007

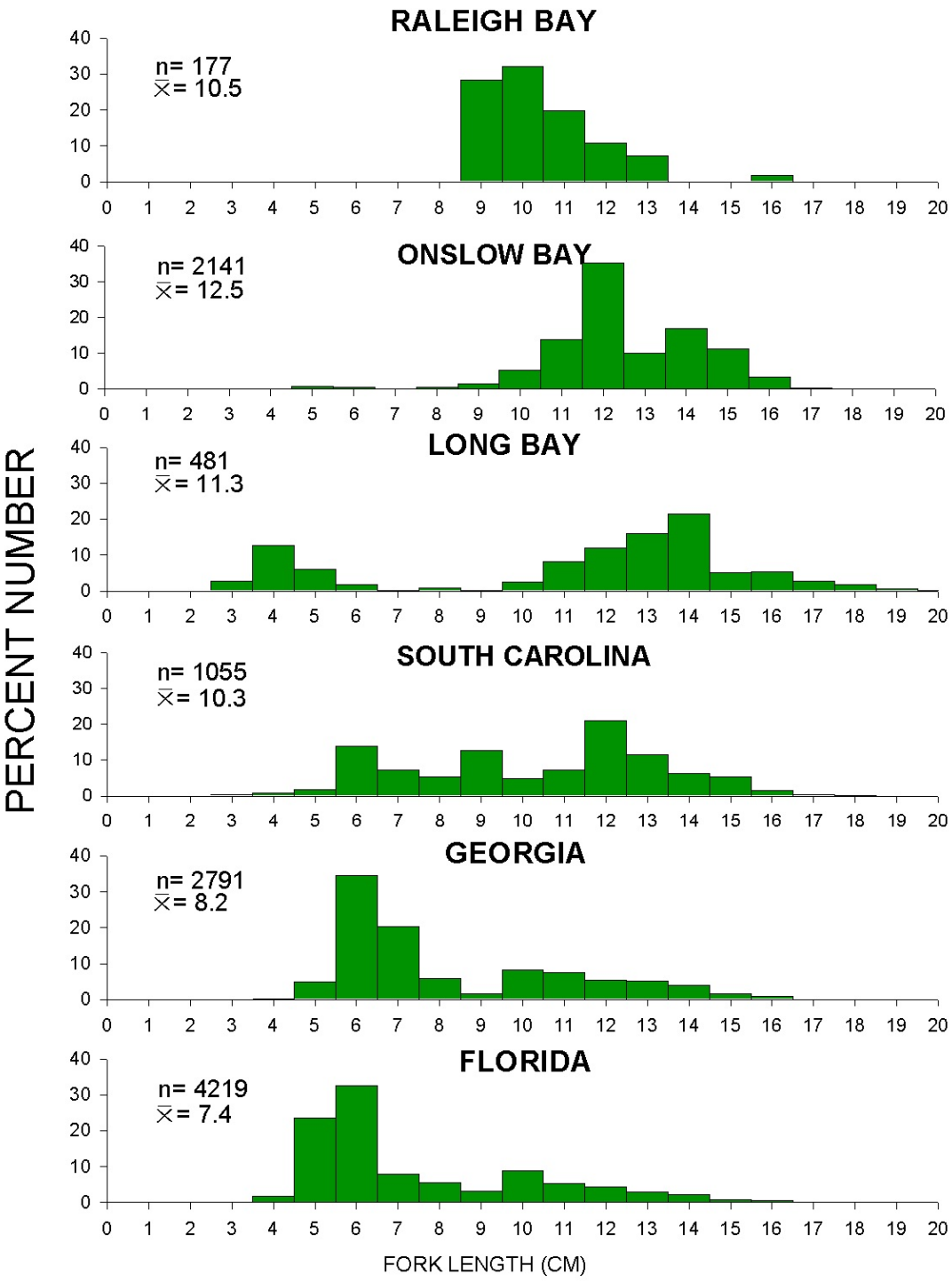

Figure 29. Regional length-frequencies of *Peprilus paru* in 2007

Peprilus triacanthus

SEAMAP-SA Coastal Survey strata yielded a total of 18,851 *Peprilus triacanthus* (CV=10.0; 17.4 individuals/ha), weighing 801 kg (0.7 kg/ha), in 2007. Density of individuals increased in 2007 (Figure 30). 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).

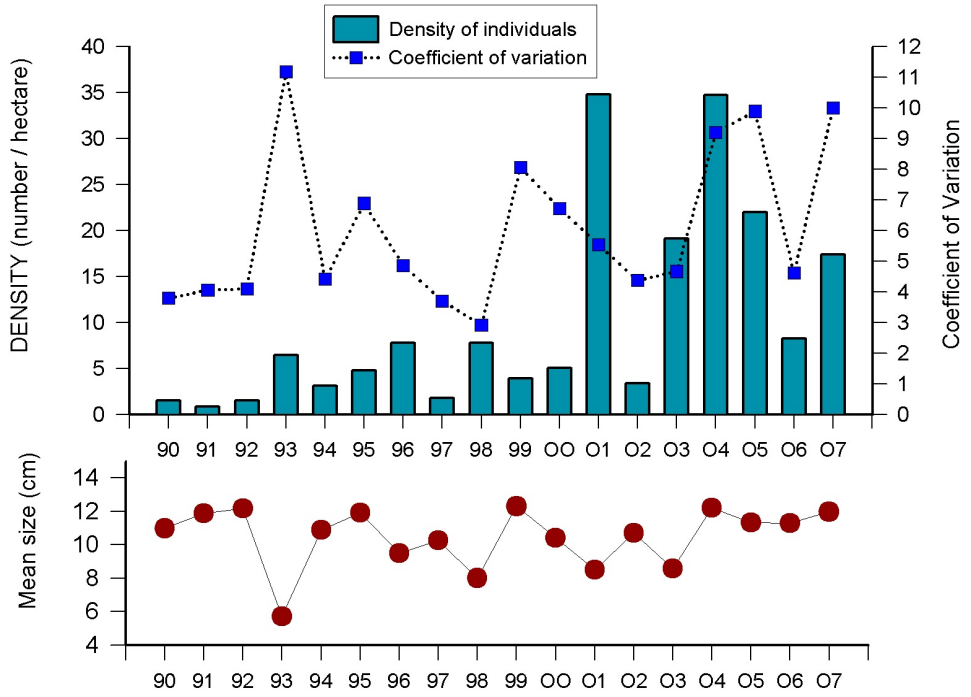

Figure 30. Annual density, variability, and mean size of *Peprilis triacanthus*

Table 19 . Estimates of density (number of individuals/hectare) in 2007.

Peprilus triacanthus

	Spring	Summer	Fall	Region
Raleigh Bay	543.620	0.143	0.743	186.804
Onslow Bay	13.583	0.591	0.560	4.968
Long Bay	5.632	0.561	0.128	2.117
South Carolina	8.264	2.236	1.088	3.903
Georgia	12.538	0.185	0.300	4.654
Florida	8.963	2.971	0	3.955
Season	49.278	1.182	0.445	17.441

Fork lengths of *Peprilus triacanthus* ranged from 3 to 18 cm ($\bar{x}$ = 12.0). Length was significantly different among seasons ($X^2 = 723$, $p < 0.0001$). Mean length was greatest in fall (Figure 31). Mean length also varied significantly among regions ($X^2 = 5271$, $p < 0.0001$). Mean lengths of butterfish were greatest in collections from Raleigh Bay (Figure 32).

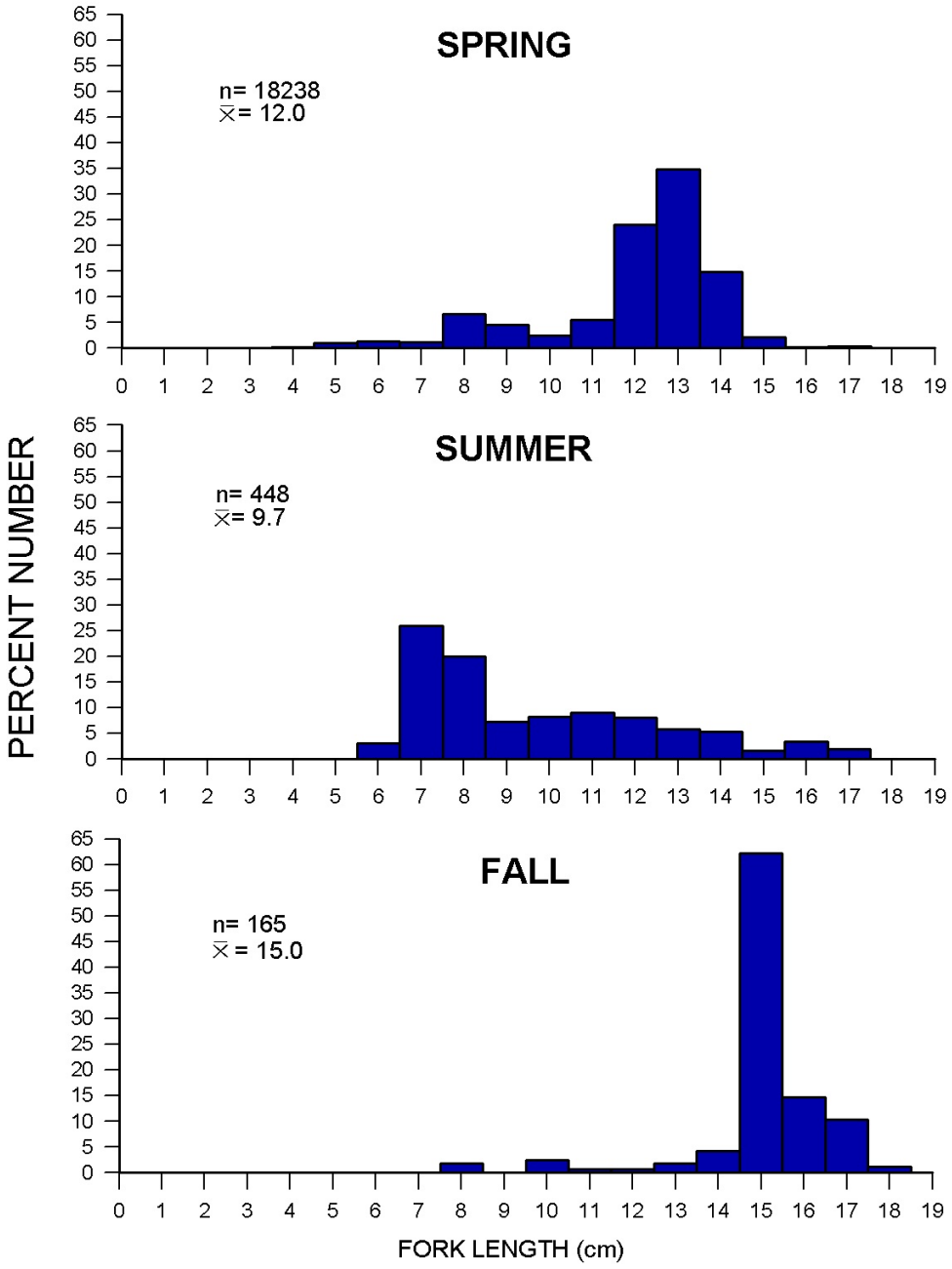

Figure 31. Seasonal length-frequencies of *Peprilus triacanthus* in 2007

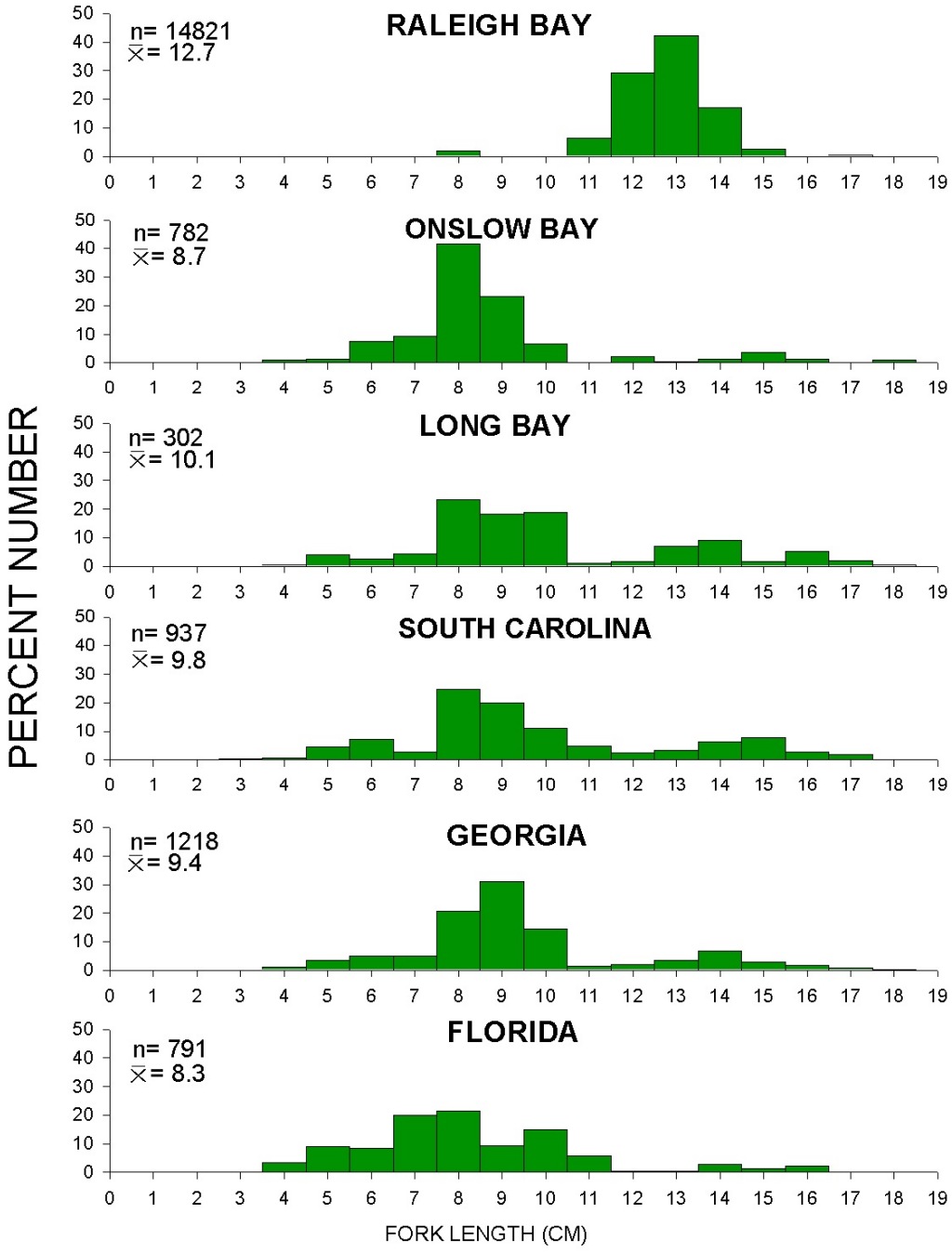

Figure 32. Regional length-frequencies of *Peprilus triacanthus* in 2007

Pogonias cromis

The black drum, *Pogonias cromis*, has been a relatively rare species in SEAMAP-SA Coastal Survey collections (SEAMAP-SA/SCMRD, 2000). In 2007 a total of 3 (CV=10.1; 0.003 individuals/ha) black drum were taken in SEAMAP trawls (Figure 33). All black drum were collected in Onslow Bay and in waters off Georgia (Table 20). No black drum were collected in summer. Total lengths of *Pogonias cromis* ranged from 201 to 129 cm ($\bar{x}$ = 57.3).

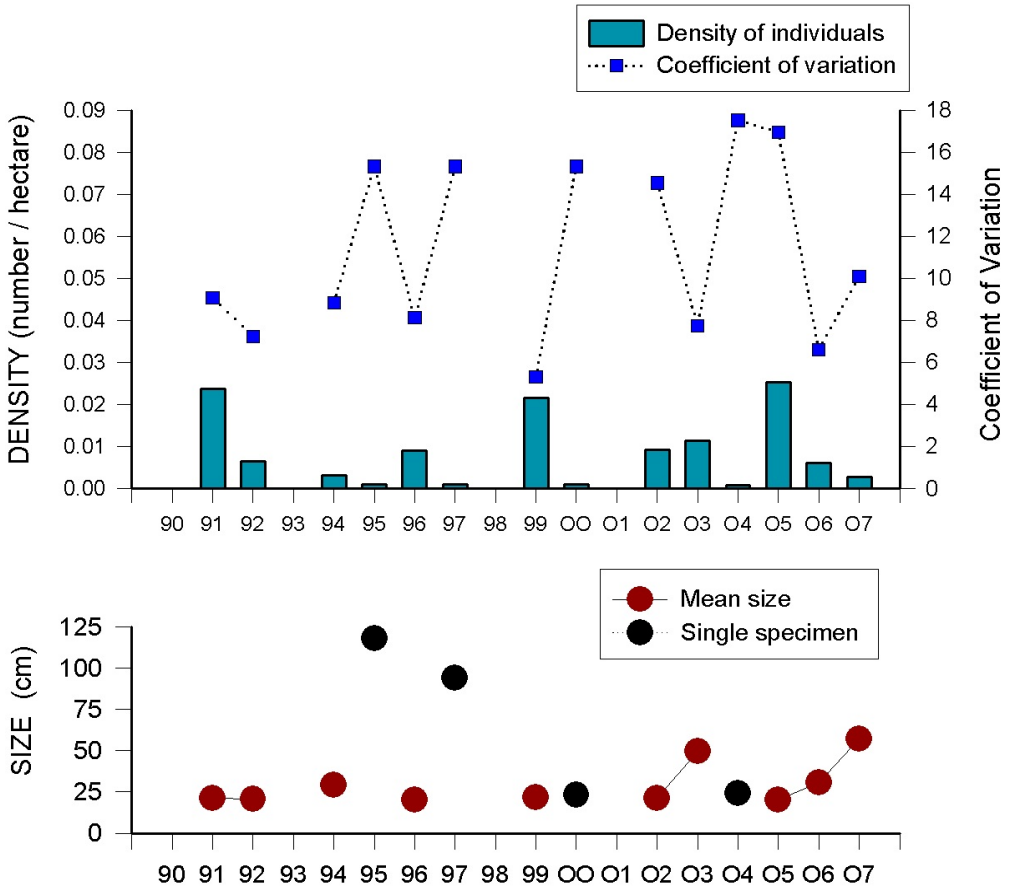

Figure 33. Annual density, variability, and size of *Pogonias cromis*

Table 20. Estimates of density (number of individuals/hectare) in 2007.

Pogonias cromis

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0.019	0	0	0.006
Long Bay	0	0	0	0
South Carolina	0	0	0	0
Georgia	0	0	0.023	0.008
Florida	0	0	0	0
Season	0.003	0	0.005	0.003

Pomatomus saltatrix

SEAMAP-SA Coastal Survey strata yielded a total of 1,434 bluefish (CV=4.7; 1.3 individuals/ha), weighing 156 kg (0.1 kg/ha). Density in 2007 continued to decrease from the record abundance observed in 2004 (Figure 34). In 2007, bluefish were most abundant in Onslow and Raleigh Bays in spring (Table 21).

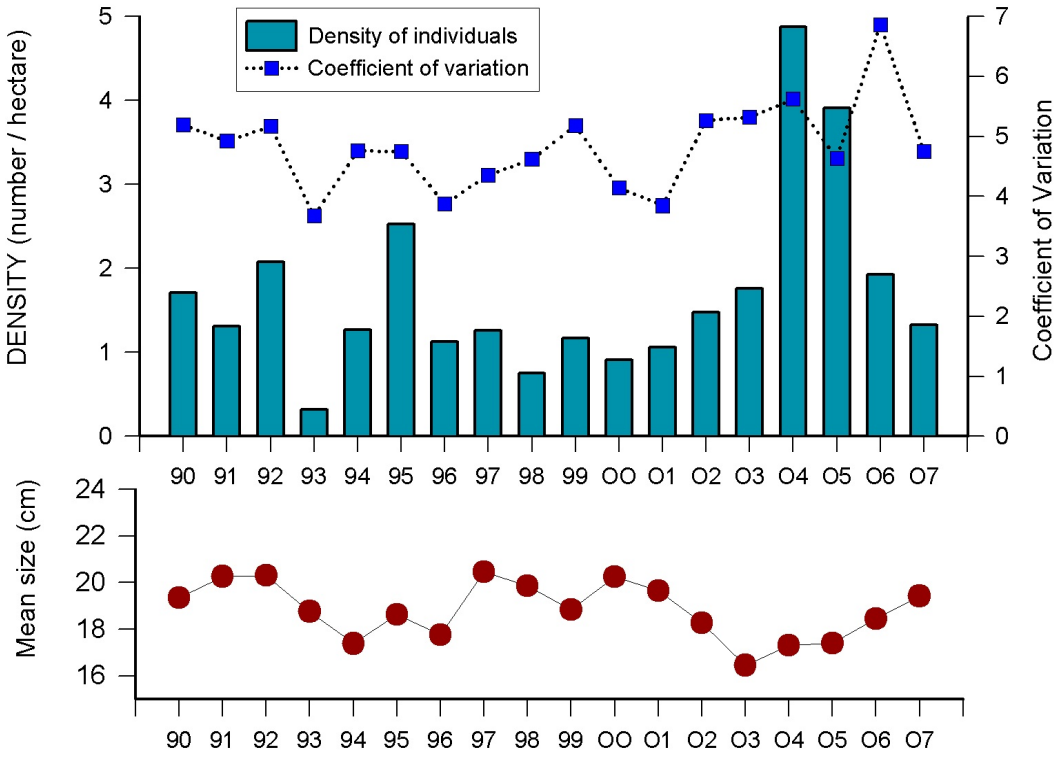

Figure 34. Annual density, variability, and mean size of *Pomatomus saltatrix*

Table 21. Estimates of density (number of individuals/hectare) in 2007.

Pomatomus saltatrix

	Spring	Summer	Fall	Region
Raleigh Bay	13.114	0.609	0.372	4.827
Onslow Bay	11.909	0.496	0.270	4.275
Long Bay	1.361	0.187	0.085	0.547
South Carolina	1.326	0.138	0.316	0.600
Georgia	0.671	0.111	0.081	0.302
Florida	0	0.154	0.982	0.385
Season	3.116	0.216	0.322	1.327

Fork lengths of *Pomatomus saltatrix* ranged from 10 to 33 cm ($\bar{x}$ = 19.4). Length was significantly different among seasons (X^2 =287, $p < 0.0001$). Mean length increased from spring to fall, an indication juvenile growth (Figure 35). Length also varied significantly among regions (X^2 = 415, $p < 0.0001$), with larger fish occurring in the southern portion of the SAB, especially in Florida waters (Figure 36).

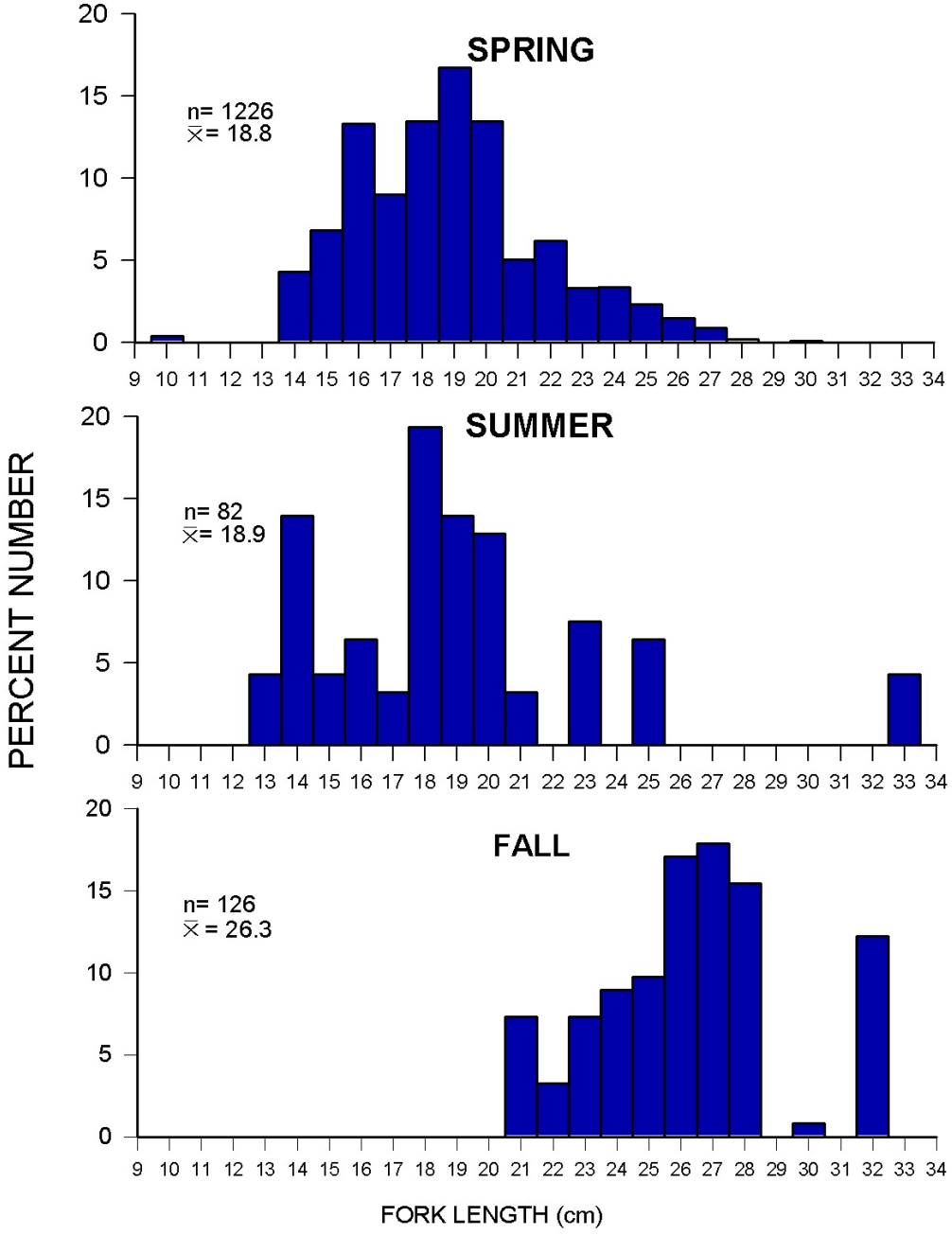

Figure 35. Seasonal length-frequencies of *Pomatomus saltatrix* in 2007

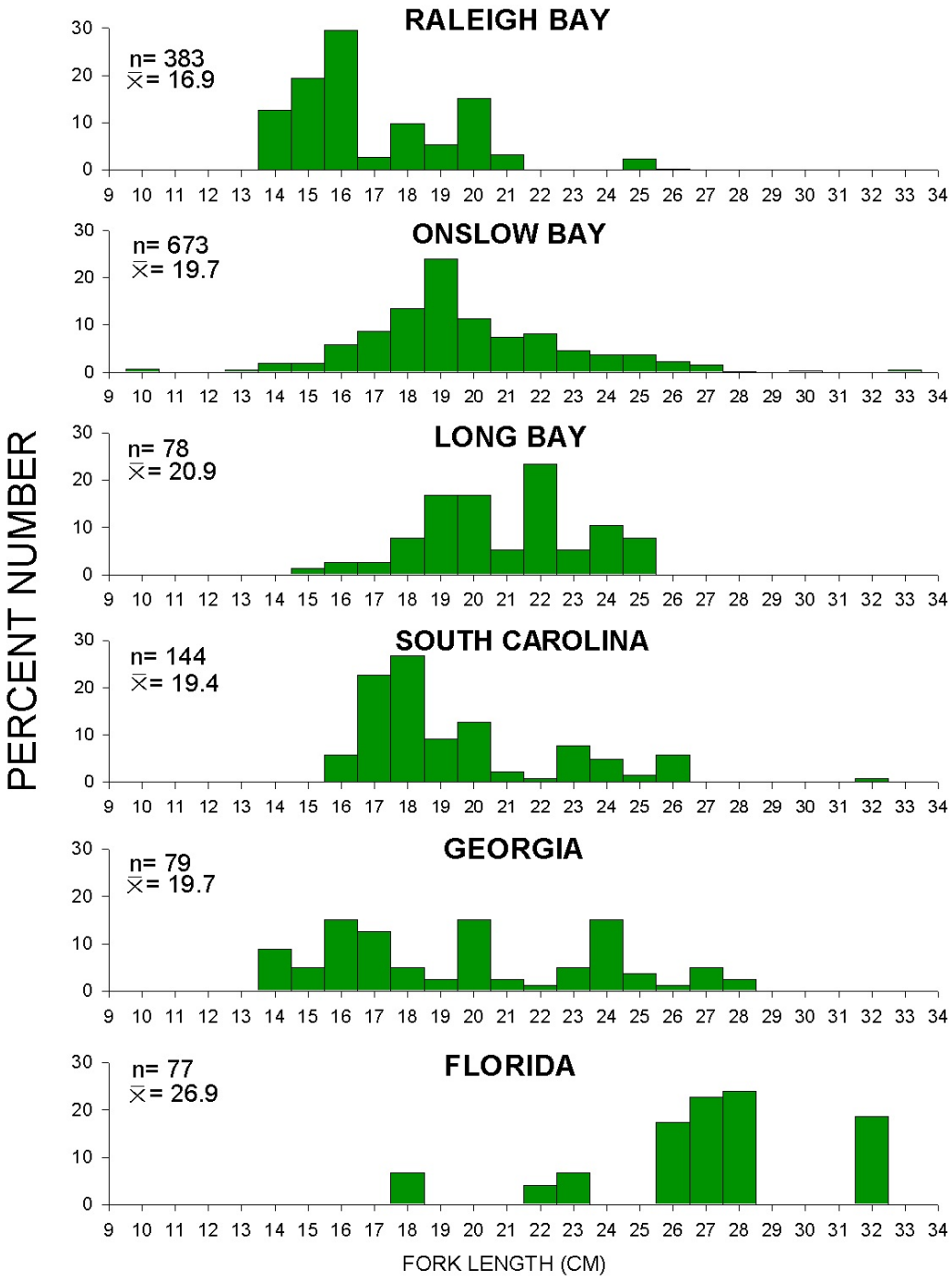

Figure 36. Regional length-frequencies of *Pomatomus saltatrix* in 2007

Sciaenops ocellatus

The red drum has been a very rare species in SEAMAP-SA trawls (SEAMAP-SA/SCMRD, 2000). In the history of the trawl survey only six specimens have been collected (ranging from northern Georgia to southern Long Bay). In 2007, no red drum was taken in SEAMAP collections (Figure 37).

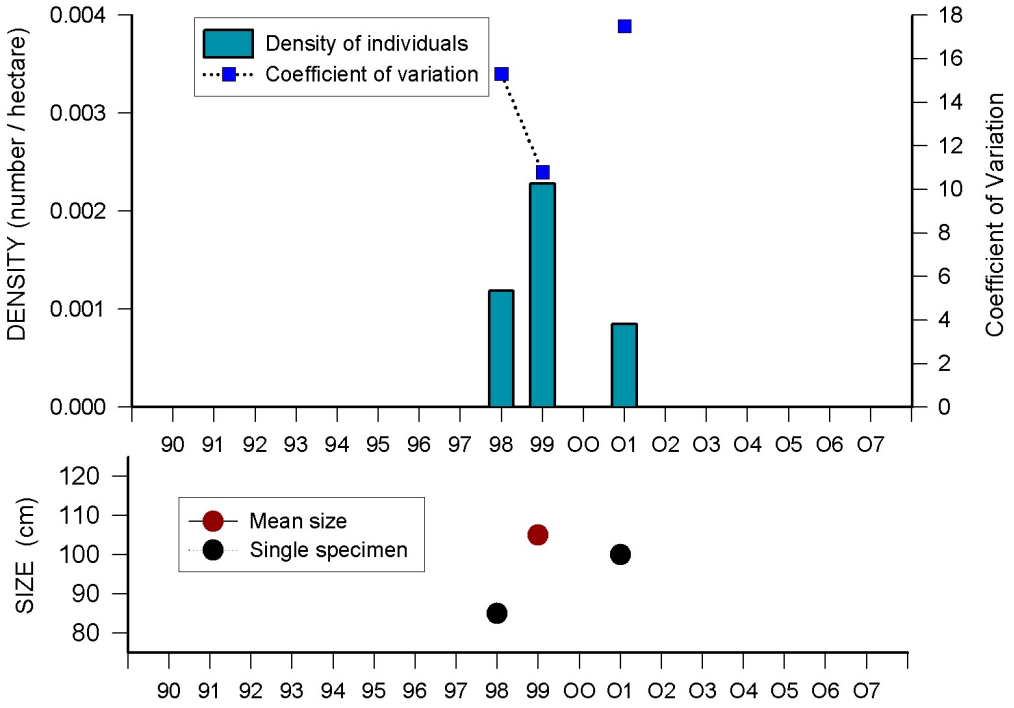

Figure 37. Annual density, variability, and size of *Sciaenops ocellatus*

Scomberomorus cavalla

The 745 (CV=4.0; 0.7 individuals/ha) king mackerel collected from SEAMAP-SA Coastal Survey strata in 2007 weighed 46 kg (0.04 kg/ha). The density of king mackerel increased slightly in 2007 (Figure 38). Abundance was greatest in summer trawls (Table 22). Greatest density of king mackerel occurred in Florida waters. King mackerel tend to be most abundant in fall in the southern SAB (SEAMAP-SA/SCMRD, 2000).

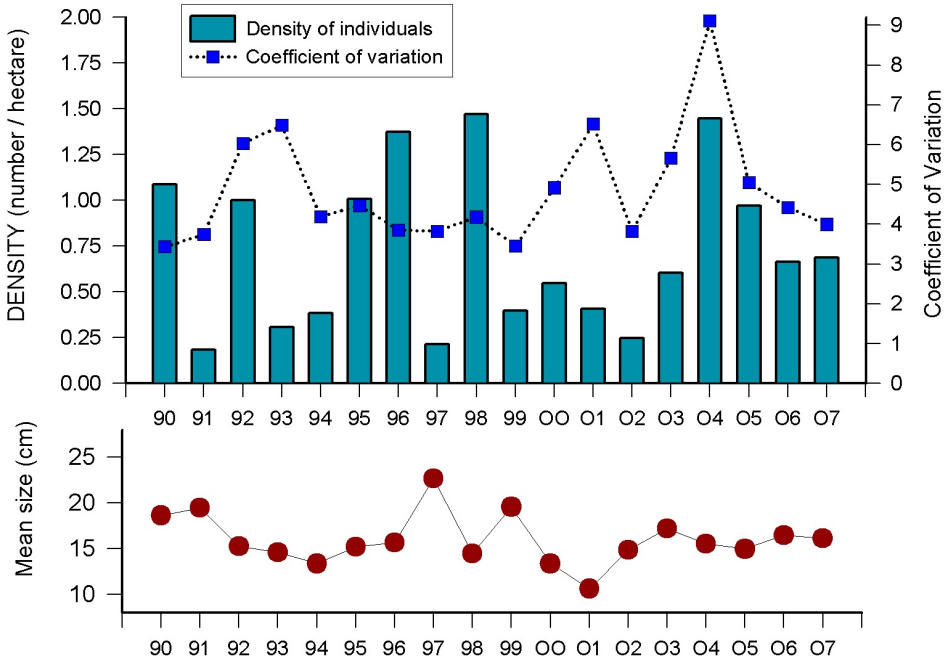

Figure 38. Annual density, variability, and mean size of *Scomberomorus cavalla*

Table 22 . Estimates of density (number of individuals/hectare) in 2007.

Scomberomorus cavalla

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.251	0	0.088
Onslow Bay	0	0.419	0.154	0.191
Long Bay	0	0.083	0.085	0.056
South Carolina	0.025	0.955	0.303	0.425
Georgia	0	0.148	0.657	0.264
Florida	0.045	7.298	0.762	2.645
Season	0.013	1.560	0.388	0.689

Fork lengths of *Scomberomorus cavalla* ranged from 6 to 98 cm ($\bar{x}$ = 16.1). Lengths were significantly different among seasons ($X^2 = 49$, $p < 0.0001$) and mean length deceased from spring to summer, as the result of recruitment of YOY (Figure 39). The fish less than 15 cm and greater than 34 cm in summer suggest that recruitment was beginning and that a few specimens in older year classes were still present. Lengths varied significantly among regions ($X^2 = 128$, $p < 0.0001$), with greatest mean length in Long Bay and South Carolina (Figure 40).

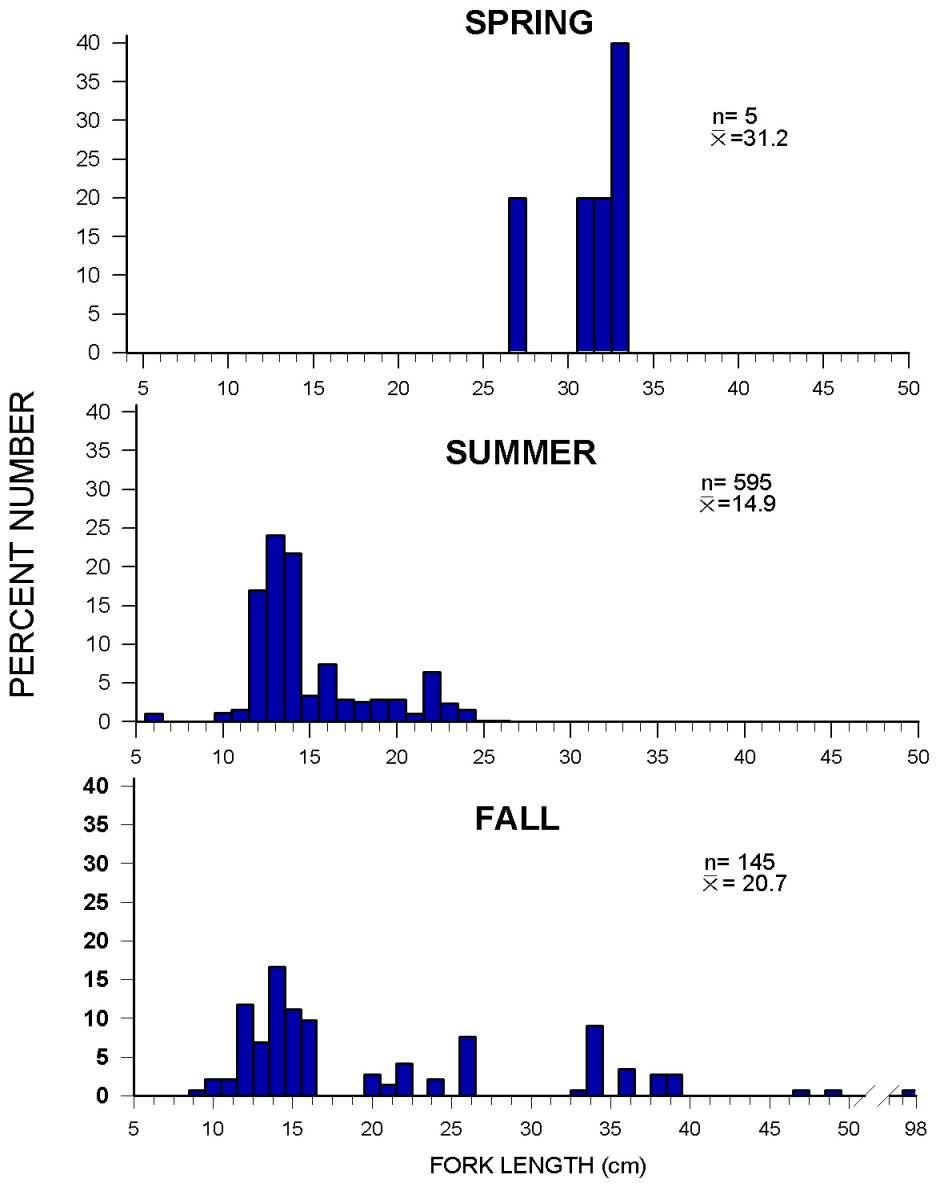

Figure 39. Seasonal length-frequencies of *Scomberomorus cavalla* in 2007

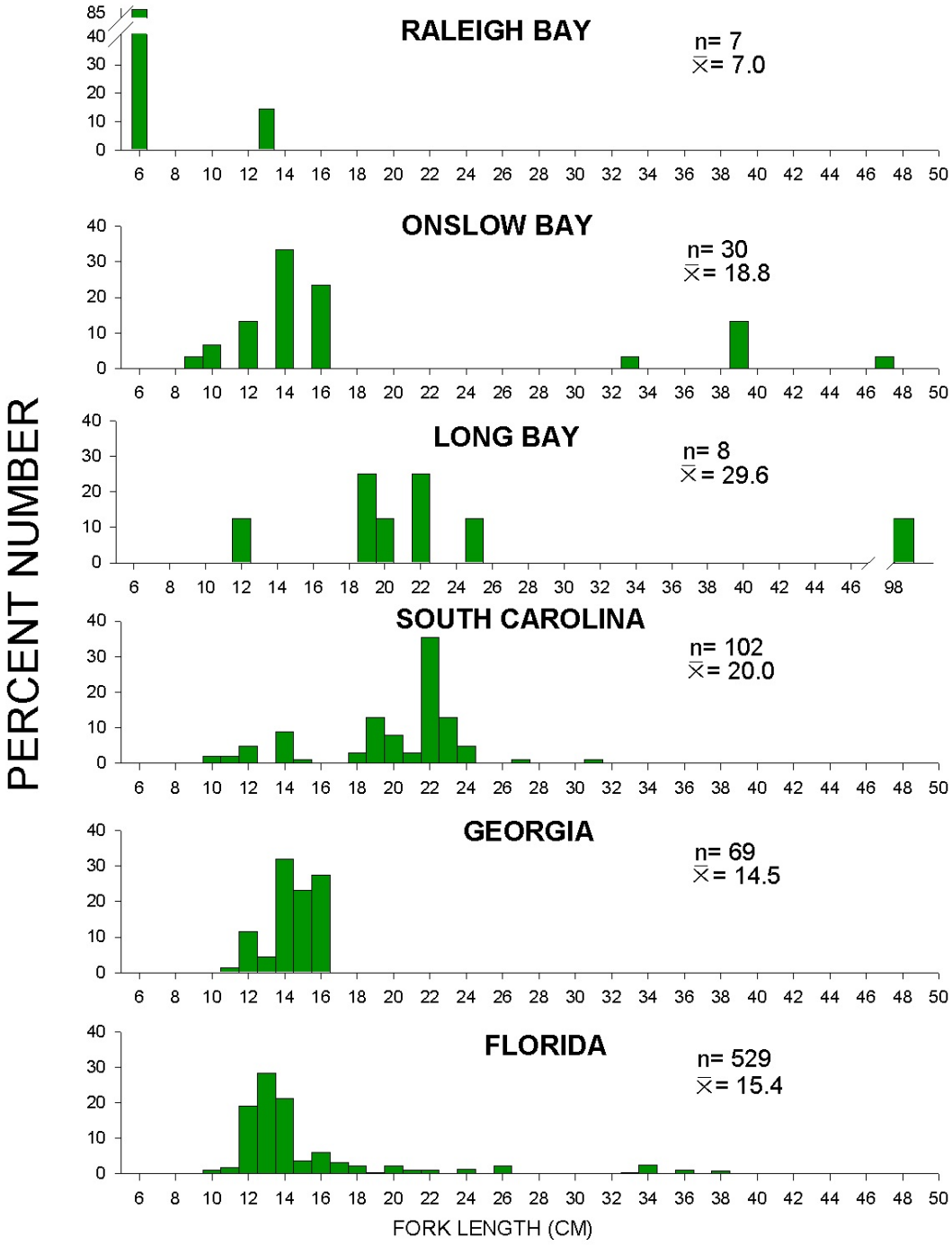

Figure 40. Regional length-frequencies of *Scomberomorus cavalla* in 2007

Scomberomorus maculatus

Sampling in 2007 produced 1,619 Spanish mackerel that weighed a total of 764 kg (CV=2.6; 1.4 individuals/ha; 0.7 kg/ha). The density of individuals of Spanish mackerel in 2007 decreased from the level observed in 2006 (Figure 41). Seasonal abundance was greatest in summer (Table 23). Highest density of Spanish mackerel is generally found in the southern SAB (SEAMAP-SA/SCMRD, 2000), as was the case in 2006.

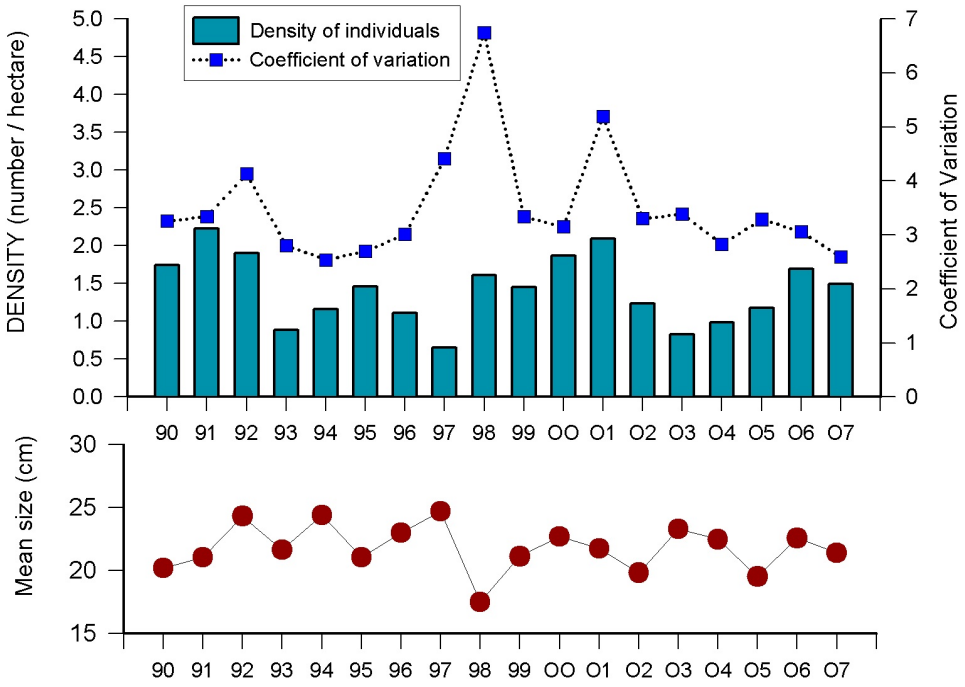

Figure 41. Annual density, variability, and mean size of *Scomberomorus maculatus*

Table 23. Estimates of density (number of individuals/hectare) in 2007.

Scomberomorus maculatus

	Spring	Summer	Fall	Region
Raleigh Bay	0	1.147	0	0.403
Onslow Bay	0.320	1.106	0.521	0.648
Long Bay	0.209	2.433	0.534	1.065
South Carolina	0.516	3.216	0.455	1.391
Georgia	1.917	3.278	1.338	2.147
Florida	1.289	4.603	0.762	2.185
Season	0.895	2.798	0.686	1.498

Fork lengths of Spanish mackerel ranged from 6 to 47 cm ($\bar{x}$ = 21.4 cm). Lengths differed significantly among seasons ($X^2 = 560$, $p < 0.0001$). Mean length decreased from spring to summer, as the result of recruitment of YOY (Figure 42). By the end of their first year, Spanish mackerel reach lengths greater than 30 cm (Powell, 1975). Specimens collected in spring were generally those ending their first year. Summer and fall collections contained primarily newly recruited YOY with a few representatives of the previous year-class still present. Length also varied significantly among regions ($X^2 = 81$, $p < 0.0001$), and mean lengths ranged from a low of 13.7 cm in Raleigh Bay to a high of 22.3 cm in waters off Florida (Figure 43).

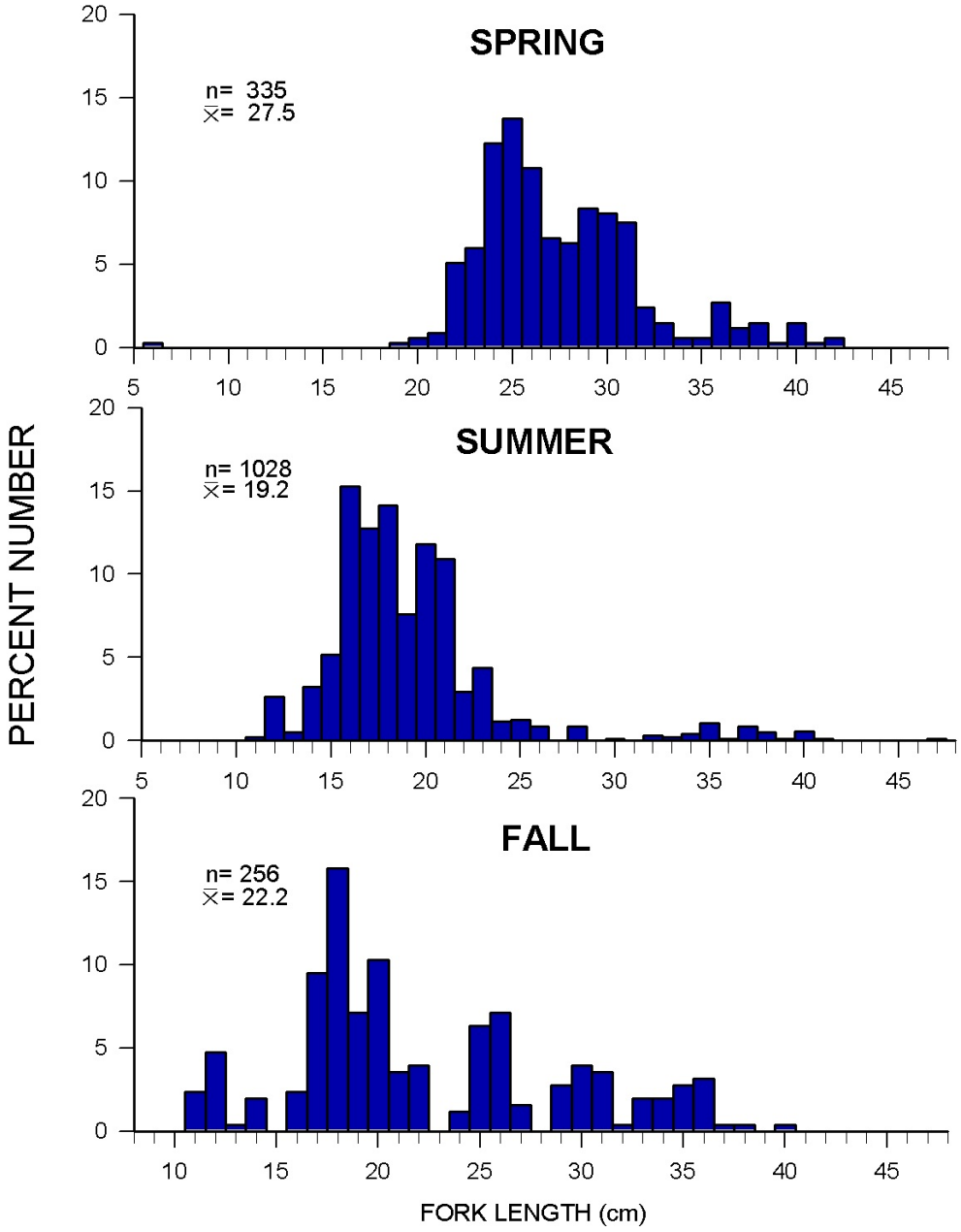

Figure 42. Seasonal length-frequencies of *Scomberomorus maculatus* in 2007

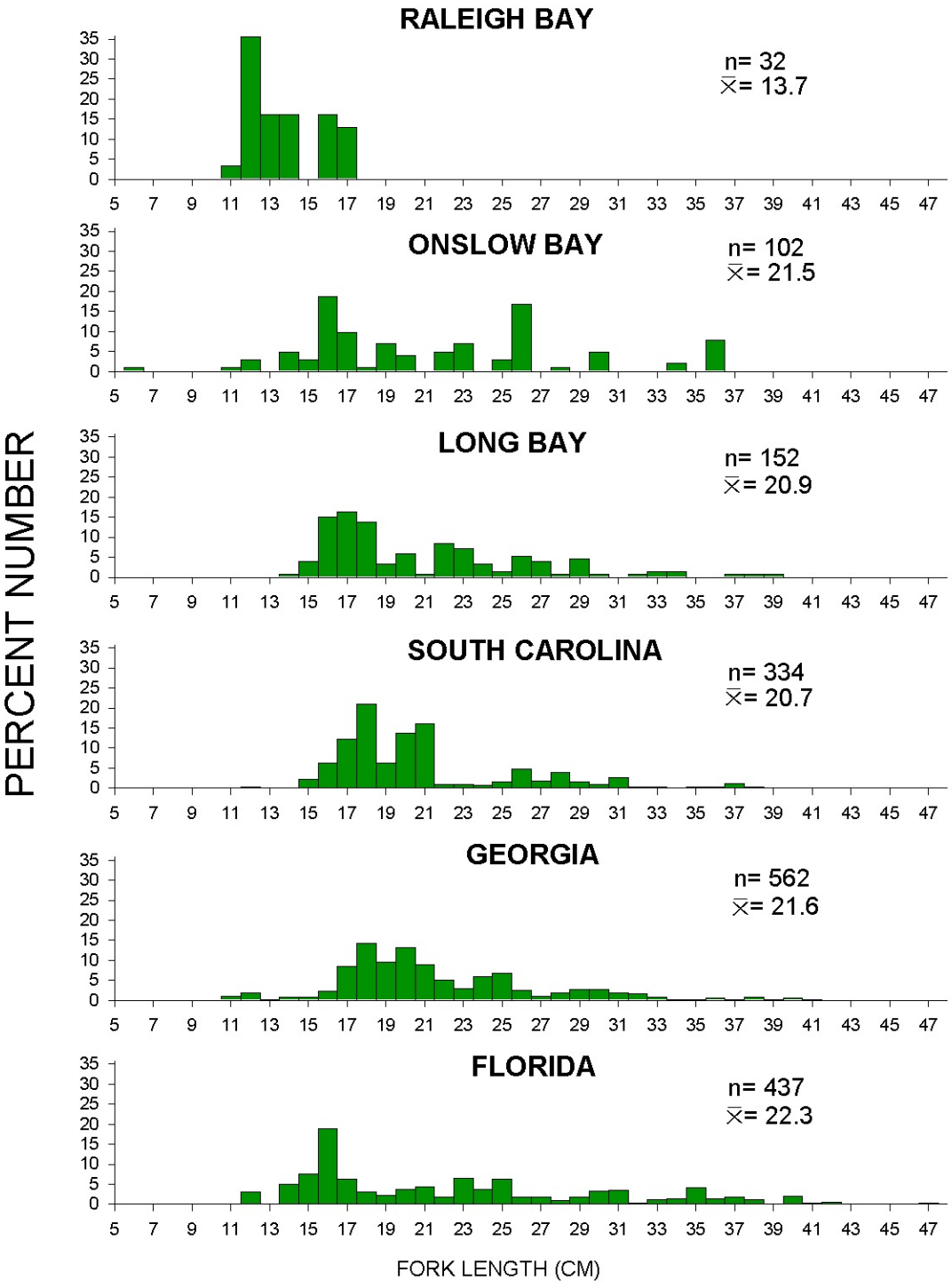

Figure 43. Regional length-frequencies of *Scomberomorus maculatus* in 2007

Callinectes sapidus

SEAMAP-SA Coastal Survey strata yielded a total of 66 (CV=7.5; 0.06 individuals/ha) blue crabs, weighing 9 kg (0.008 kg/ha). Overall density of *C. sapidus* peaked in 1990, followed by several years of low abundance and secondary peaks in 1999 and 2004 (Figure 44). In 2007, abundance of blue crabs reached the lowest level yet recorded by the survey. Tthe highest seasonal density was observed during summer cruises and the greatest regional density of individuals occurred in Onslow Bay (Table 24). Carapace widths of *C. sapidus* ranged from 6 to18 cm ($\bar{x}$ = 13.0).

Males constituted 14% 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 over 34% of females being ovigerous. Ovigerous females outnumbered non-ovigerous females in spring, but not in summer or fall.

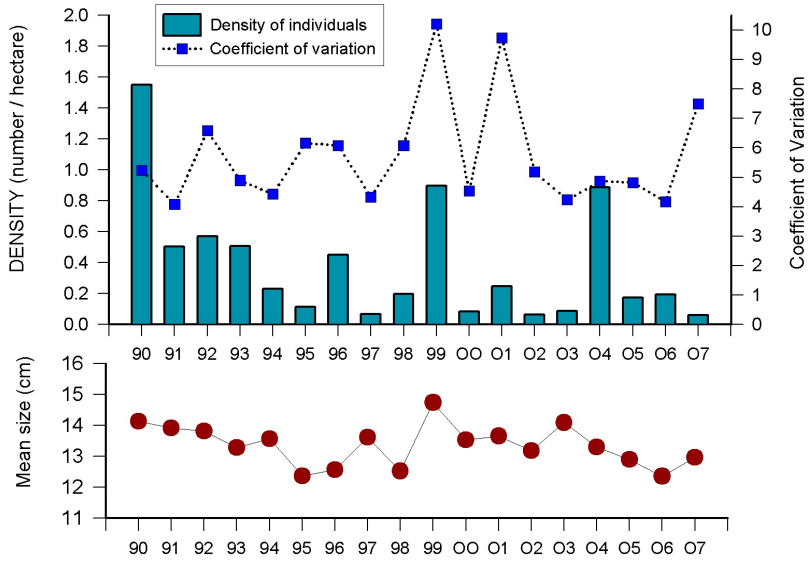

Figure 44. Annual density, variability, and mean size of *Callinectes sapidus*

Table 24 . Estimates of density (number of individuals/hectare) in 2007.

Callinectes sapidus

	Spring	Summer	Fall	Region
Raleigh Bay	0	0.179	0	0.063
Onslow Bay	0	0.724	0	0.241
Long Bay	0.021	0	0	0.007
South Carolina	0.111	0	0.063	0.058
Georgia	0.021	0.062	0	0.027
Florida	0.015	0	0	0.005
Season	0.035	0.136	0.014	0.061

Farfantepenaeus aztecus

The brown shrimp was the second most abundant decapod crustacean species taken in 2007 by the SEAMAP-SA Trawl Survey, with 8,490 individuals (CV=4.8; 7.9 individuals/ha), weighing 146 kg (0.1 kg/ha). The estimate of density of brown shrimp in 2007 again decreased from the peak in abundance recorded in 2005 (Figure 45). Summer collections produced the highest seasonal density (Table 25). 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). The greatest regional density of brown shrimp occurred in waters off South Carolina and Georgia.

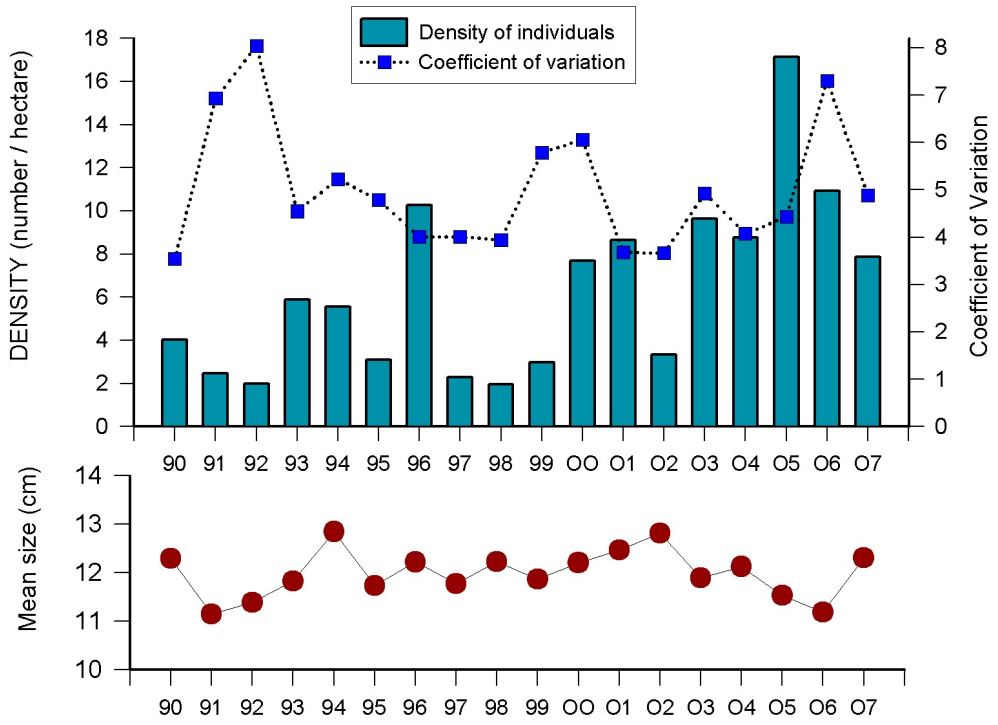

Figure 45. Annual density, variability, and mean size of *Farfantepenaeus aztecus*

Table 25 . Estimates of density (number of individuals/hectare) in 2007.

Farfantepenaeus aztecus

	Spring	Summer	Fall	Region
Raleigh Bay	0	5.268	0.165	1.903
Onslow Bay	0.339	21.961	6.699	9.637
Long Bay	0	0.250	0.021	0.091
South Carolina	0.356	28.641	1.631	10.156
Georgia	0.107	44.949	0.669	14.195
Florida	0.914	9.161	0	3.280
Season	0.319	22.137	1.510	7.855

Total lengths of *F. aztecus* ranged from 8 to 18 cm with a mean length of 12.3 cm. Total lengths differed significantly among seasons (X^2 =201, $p < 0.0001$). Mean length increased from spring to fall (Figure 46). Lengths were also significantly different among regions (X^2 =1181, $p < 0.0001$). Mean lengths ranged from 11.3 cm in Raleigh Bay to 13.4 cm in waters off Florida (Figure 47).

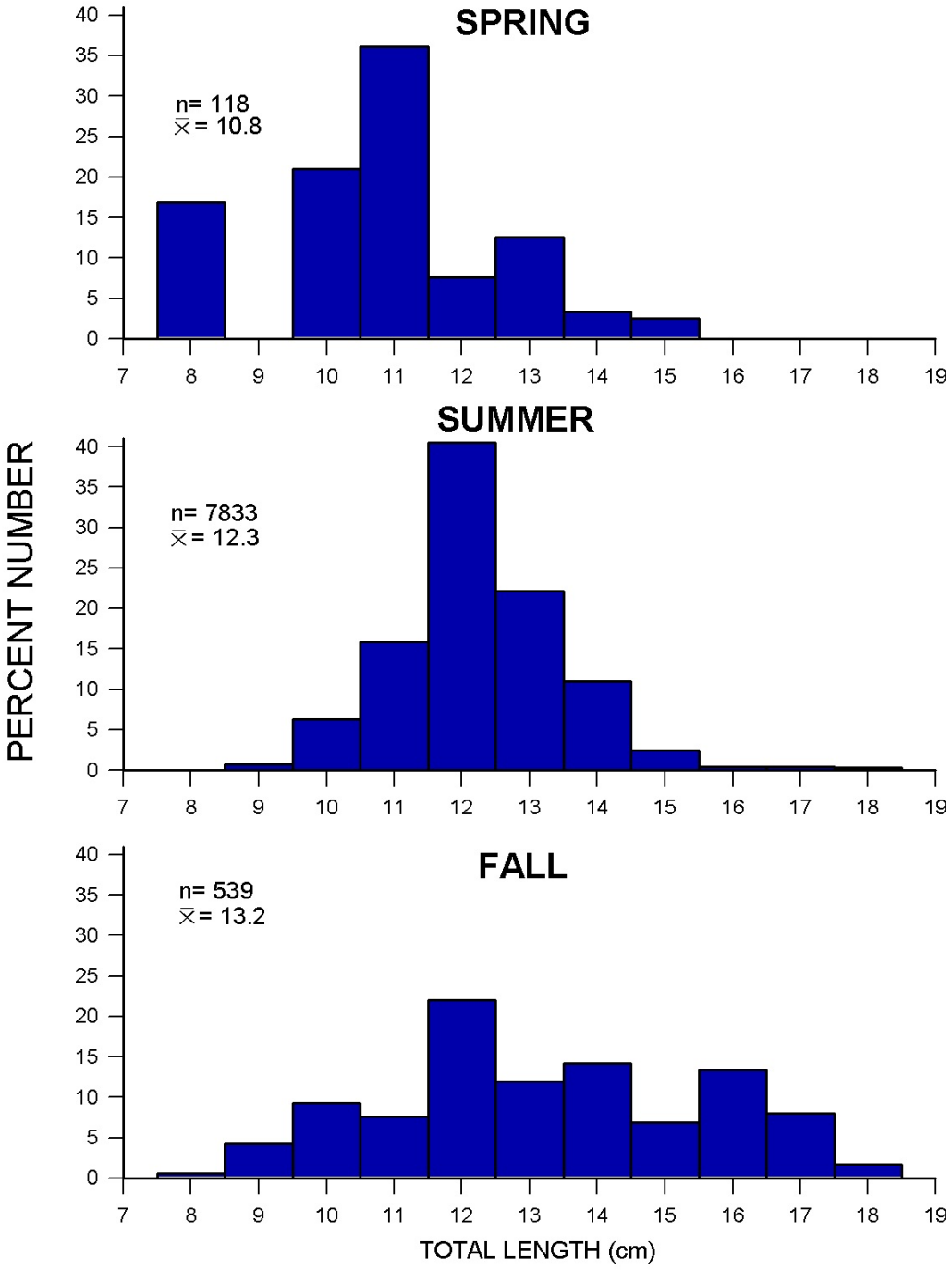

Figure 46. Seasonal length-frequencies of *Farfantepenaeus aztecus* in 2007

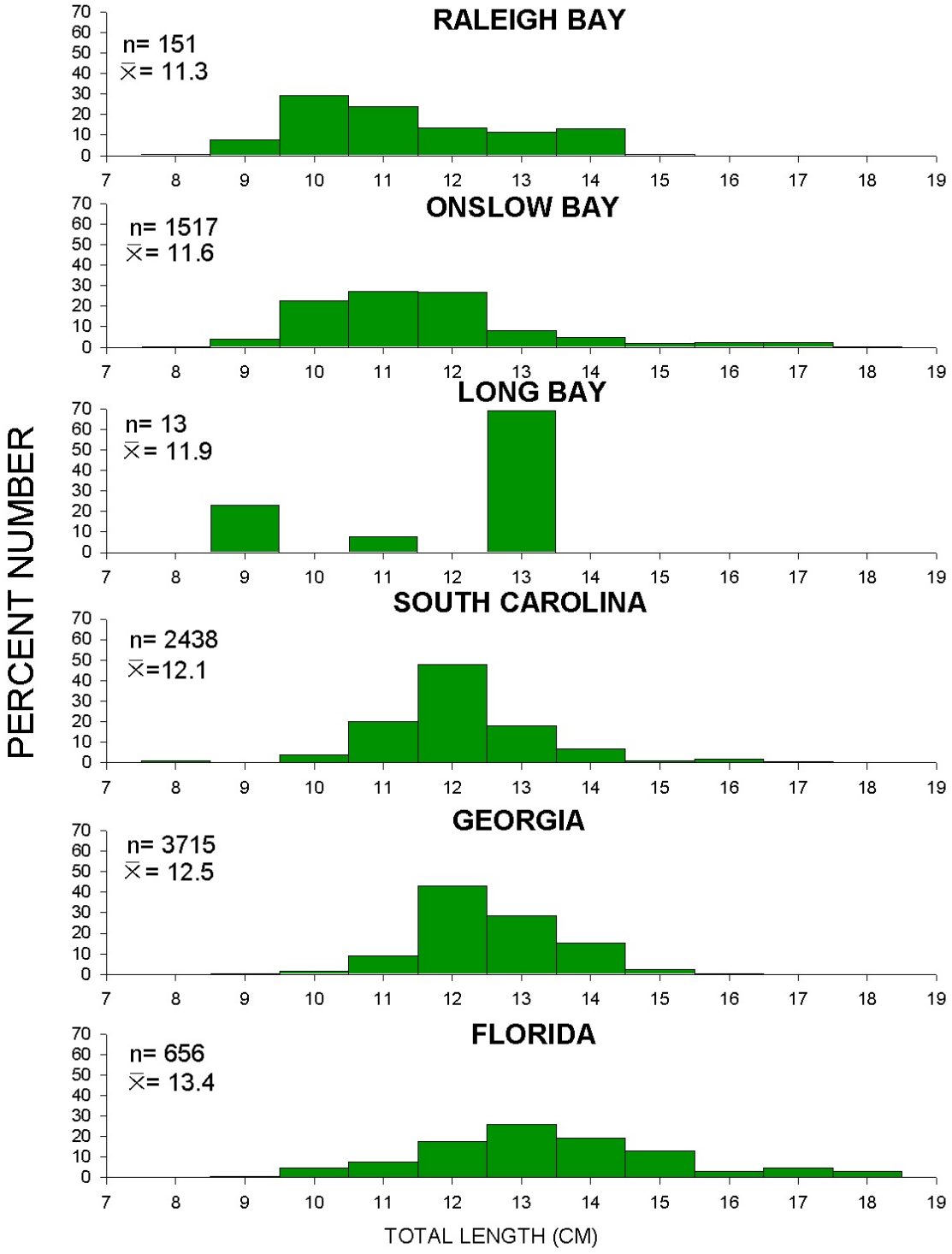

Figure 47. Regional length-frequencies of *Farfantepenaeus aztecus* in 2007

More than 52% of the brown shrimp sampled were female. Less than 1% of female brown shrimp with ripe ovaries were sampled in 2007 and less than 1% of the female brown shrimp were found to be mated. The majority of female brown shrimp had undeveloped ovaries (Figure 50). Less than 5% of the male brown shrimp had fully developed spermatophores (ripe). Spermatophore development was not independent of season ($G = 78$, $p < 0.0001$) or region ($G = 506$, $p < 0.0001$). The majority of males with developing spermatophores were taken in summer and fall.

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. Infestation of brown shrimp occurred in both summer and fall and in Long Bay (n=1), South Carolina (n=1) and Georgia (n=3).

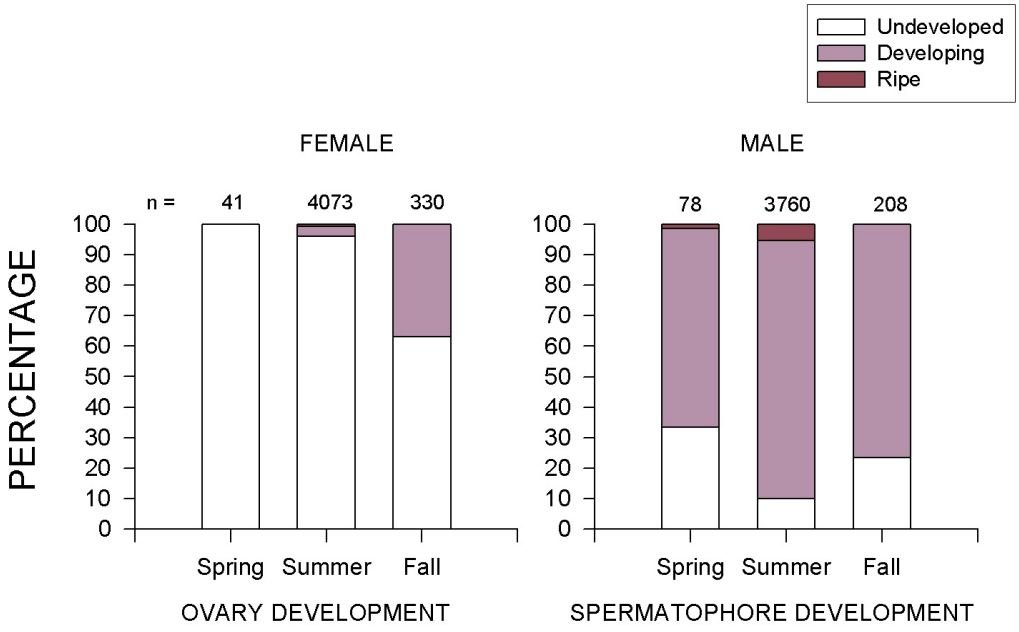

Figure 48. Gonadal development of *Farfantepenaeus aztecus* in 2007

Farfantepenaeus duorarum

The pink shrimp was the least abundant commercially important penaeid shrimp species collected in 2007. The 161 specimens (CV=7.3; 0.1 individuals/ha) taken from SEAMAP trawls weighed 3 kg (0.003 kg/ha). Density of individuals decreased in 2007 to a level only slightly higher than the record low recorded in 2005 (Figure 49). In 2007, abundance was greatest in summer collections in Raleigh Bay (Table 26).

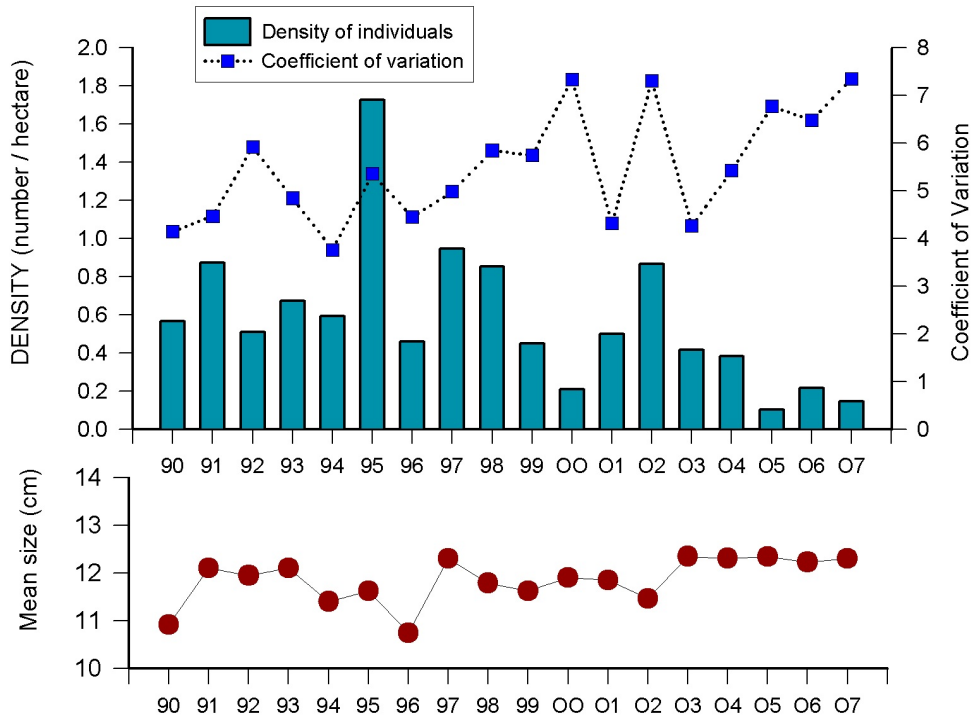

Figure 49. Annual density, variability, and mean size of *Farfantepenaeus duorarum*

Table 26 . Estimates of density (number of individuals/hectare) in 2007.

Farfantepenaeus duorarum

	Spring	Summer	Fall	Region
Raleigh Bay	0	1.290	0	0.454
Onslow Bay	1.129	0	0	0.381
Long Bay	0	0	0	0
South Carolina	0.295	0	0	0.100
Georgia	0.075	0	0.392	0.157
Florida	0	0	0	0
Season	0.246	0.102	0.095	0.149

Total length of pink shrimp ranged from 10 to 16 cm ($\bar{x}$ =12.3 cm). Total lengths differed significantly among seasons (X^2 =91, $p < 0.0001$). Mean length increased from spring to fall (Figure 50). Total length differed significantly among regions (X^2 =102, $p < 0.0001$). Regionally, mean lengths ranged from 10.6 cm in Onslow Bay to 14.5 cm in Georgia (Figure 51). Pink shrimp were absent from Long Bay and Florida waters.

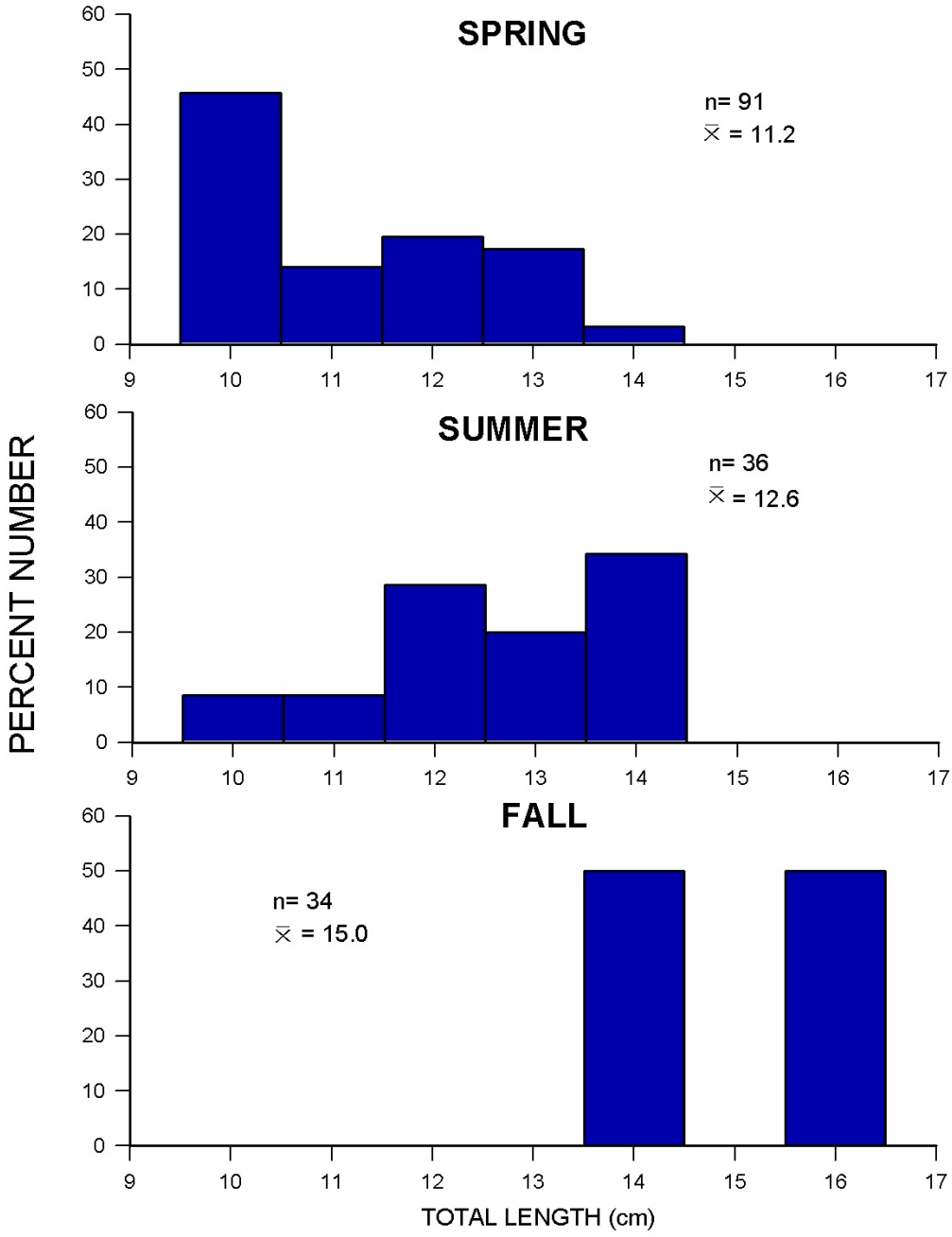

Figure 50. Seasonal length-frequencies of *Farfantepenaeus duorarum* in 2007

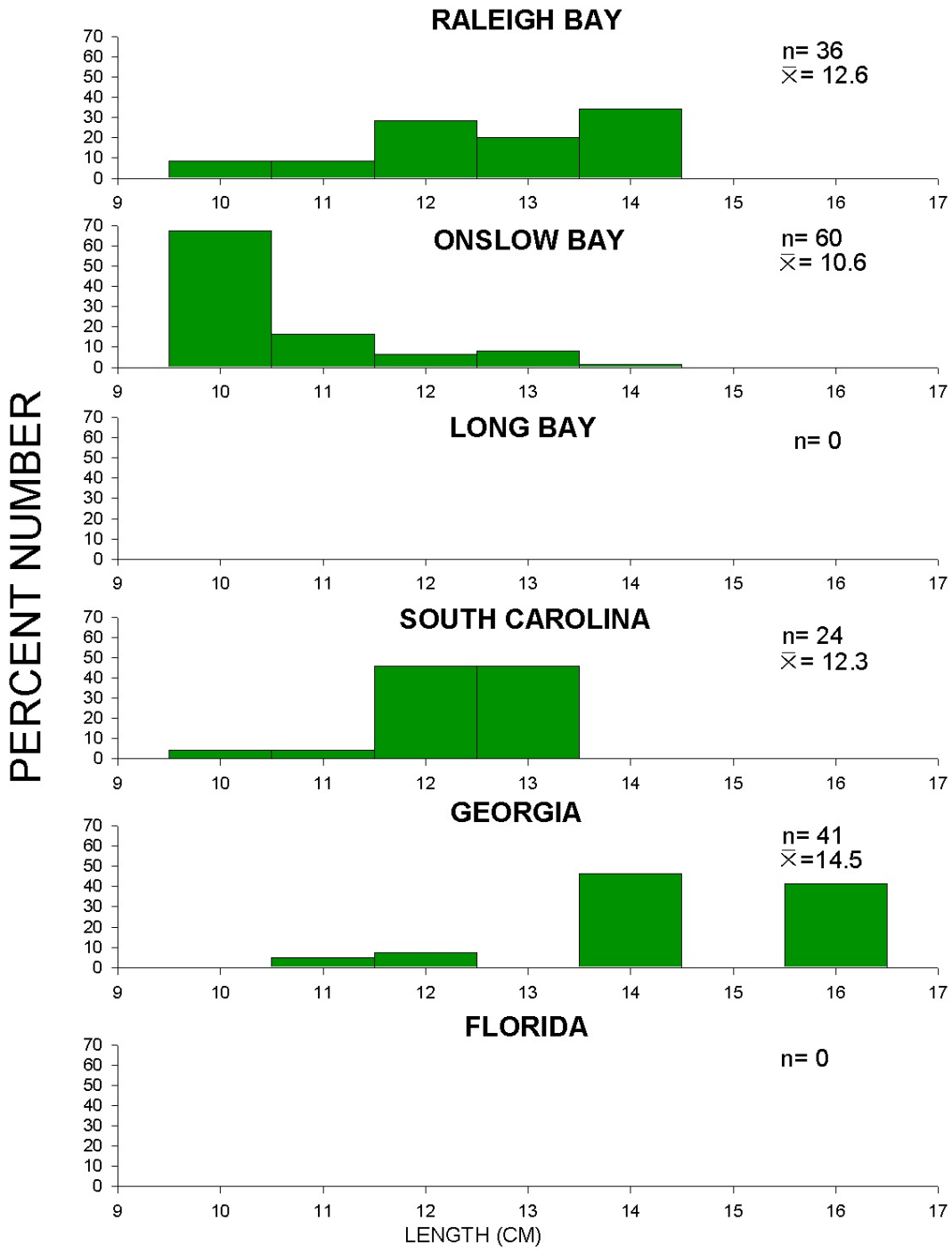

Figure 51. Regional length-frequencies of *Farfantepenaeus duorarum* in 2007

In SEAMAP-SA Coastal Survey strata over 59% of all pink shrimp were found to be female. No ripe female pink shrimp were collected in 2007 (Figure 54) and none were found to be mated. Approximately 4% of male pink shrimp sampled had fully developed spermatophores. All male pink shrimp with fully developed spermatophores were taken in spring. The majority of male specimens had developing spermatophores. Spermatophore development was independent of season ($G = 0.4$, $p > 0.05$), but was not independent of region ($G = 14$, $p < 0.01$). Presence of black gill disease was not noted in any pink shrimp.

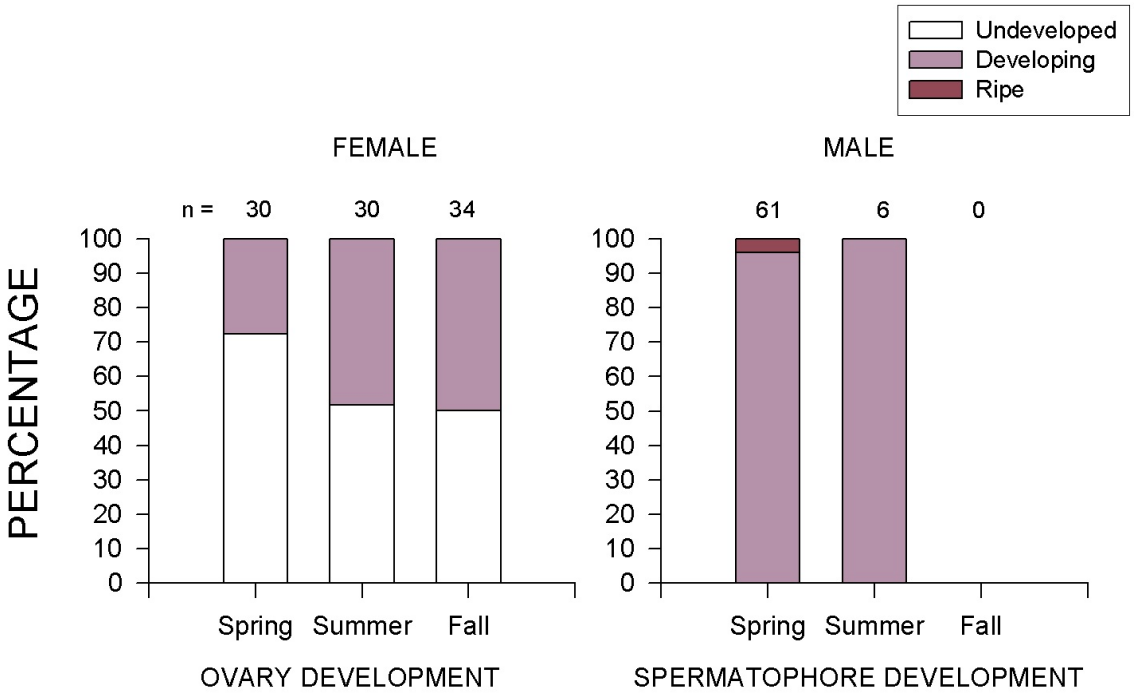

Figure 52. Gonadal development of *Farfantepenaeus duorarum* in 2007

Litopenaeus setiferus

The white shrimp ranked first among decapod crustaceans, with 22,753 specimens (CV=3.9; 21.1 individuals/ha) collected, weighing 1108 kg (1.0 kg/ha). The 2007 estimate of density decreased from the previous year (Figure 53). Greatest seasonal density was found in fall (Table 27). Regional density was greatest in South Carolina waters (Table 27).

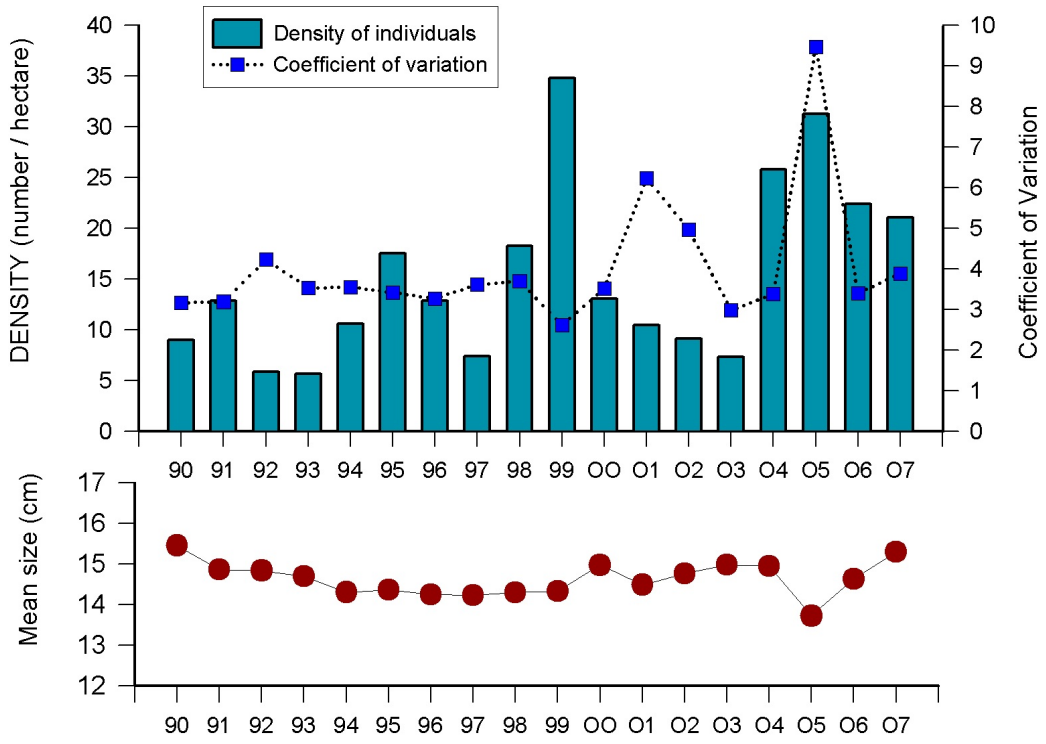

Figure 53. Annual density, variability, and mean size of *Litopenaeus setiferus*

Table 27 . Estimates of density (number of individuals/hectare) in 2007.

Litopenaeus setiferus

	Spring	Summer	Fall	Region
Raleigh Bay	8.890	3.834	0	4.399
Onslow Bay	8.805	3.069	22.510	11.403
Long Bay	3.769	0	0.513	1.430
South Carolina	30.377	6.620	108.929	48.383
Georgia	17.311	13.311	35.798	22.196
Florida	7.359	20.400	17.071	14.905
Season	14.807	9.044	39.435	21.051

Total lengths of *L. setiferus* ranged from 7 to 20 cm, with a mean length of 15.3 cm. There was a significant difference in mean length among seasons (X^2 =962, $p < 0.01$), with mean length greatest in summer (Figure 54). Regional mean lengths also differed significantly ($X^2 = 571$, $p < 0.0001$). Onslow Bay produced the smallest mean length (14.8 cm) and Raleigh and Long Bays the greatest (16.2 cm) (Figure 55).

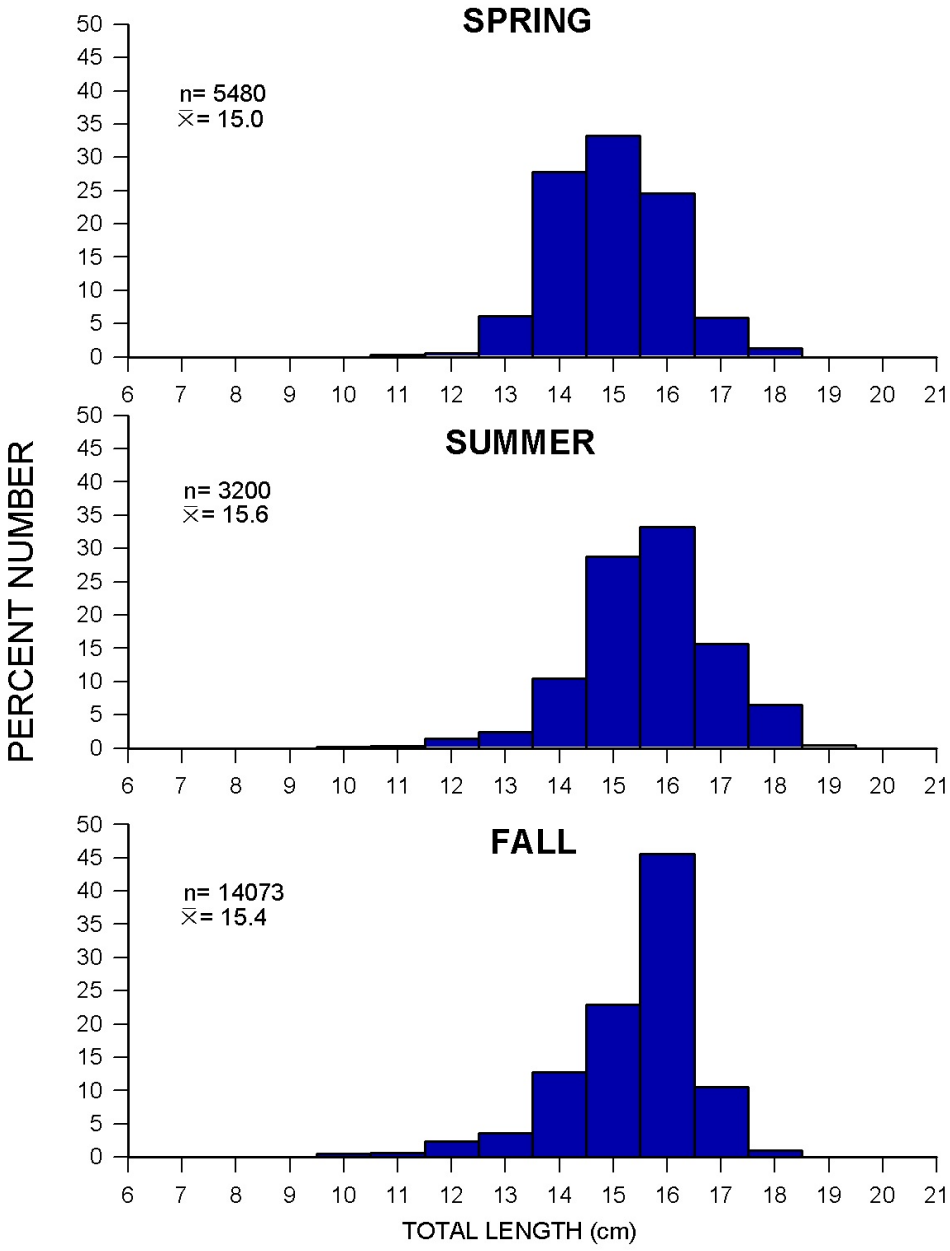

Figure 54. Seasonal length-frequencies of *Litopenaeus setiferus* in 2007

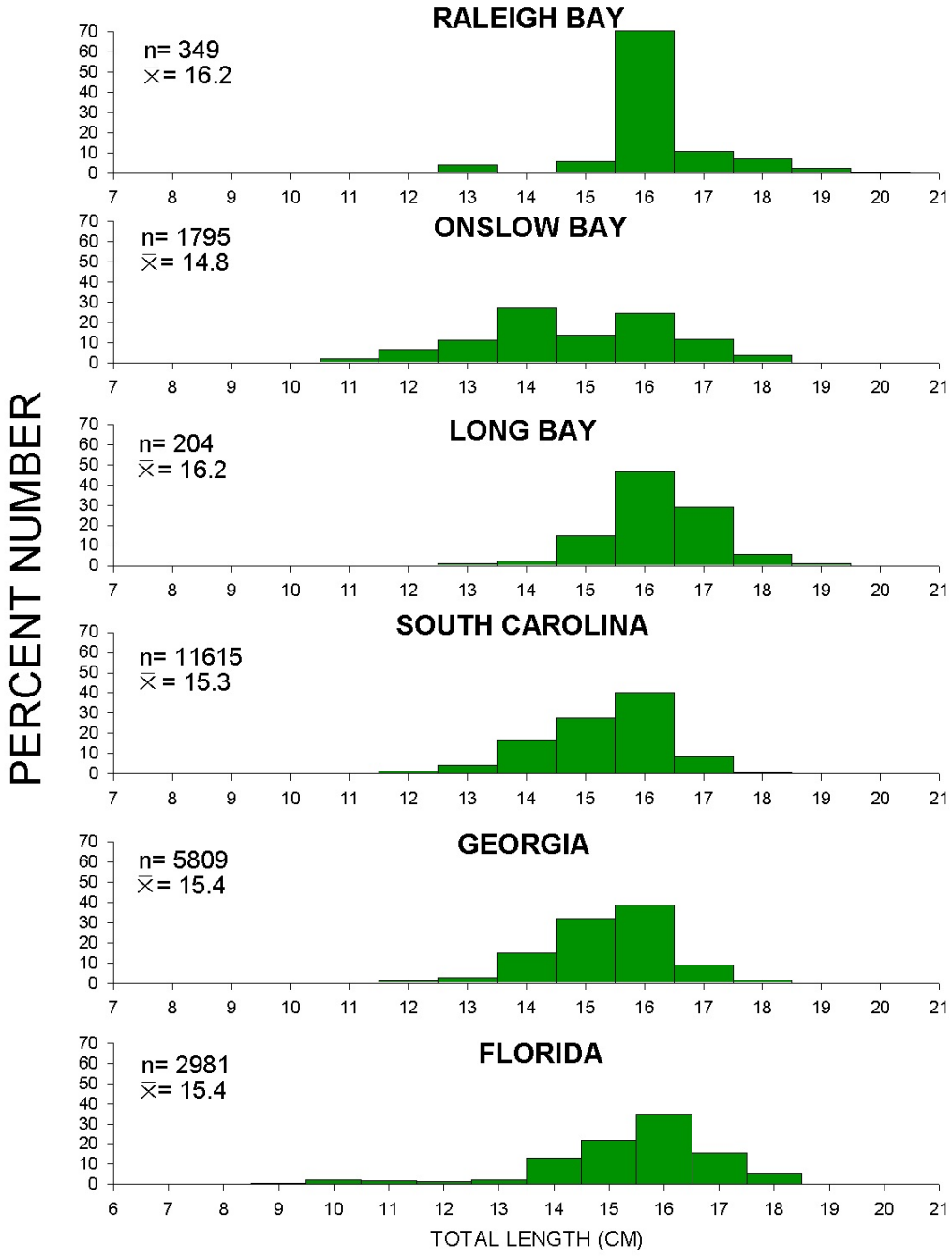

Figure 55. Regional length-frequencies of *Litopenaeus setiferus* in 2007

The majority of the white shrimp sampled (54%) were male (Figure 58). The majority of males with fully developed spermatophores were taken in spring. Approximately 23% of males were found to have fully developed spermatophores. The ratio of males with fully developed spermatophores to those with spermatophores not yet fully developed was not independent of seasons ($G = 6696$, $p < 0.0001$) or regions ($G = 1237$, $p < 0.0001$).

Approximately 11% of females collected in SEAMAP-SA Coastal Survey strata had ripe ovaries, but none of the white shrimp females collected was ripe in fall, when 66% of the females were taken. The majority of ripe females were taken in spring. The ratio of ripe to nonripe females was not independent of season ($G = 9598$, $p < 0.0001$) or region ($G = 1217$, $p < 0.0001$). Less than 1% of the females taken in SEAMAP-SA trawls were mated. White shrimp are reported to spawn from May through September in the SAB (Lindner and Anderson, 1956; Williams, 1984).

Occurrence of black gill disease in commercially important penaeids was observed and recorded. More than 3% were found to be infected. All white shrimp with black gill disease were taken in fall trawls. Infestation of white shrimp was absent from trawls made in Raleigh Bay and Florida. The majority of the records of black gill disease (80%) were in Georgia waters.

Figure 56. Gonadal development of *Litopenaeus setiferus* in 2007

Distribution and Abundance of Sharks

In 2007, the SEAMAP-SA Coastal Survey collected twelve species of sharks (Table 28) The Atlantic sharpnose shark, *Rhizoprionodon terraenovae,* was the most abundant shark, making up approximately 63% of the shark specimens collected. The bonnethead shark, *Sphyrna tiburo*, ranked second in abundance (24%), followed by the smooth dogfish, *Mustelus canis* (7%). The remaining nine species contributed only 6% to the overall number of sharks collected.

Table 28 Sharks taken by the SEAMAP-SA Coastal Survey in 2007.

Rank	Common name	Species name	Number
1	Atlantic sharpnose	*Rhizoprionodon terraenovae*	1470
2	Bonnethead	*Sphyrna tiburo*	562
3	Smooth dogfish	*Mustelus canis*	163
4	Atlantic angel shark	*Squatina dumerili*	56
5	Blacknose shark	*Carcharhinus acronotus*	37
6	Scalloped hammerhead	*Sphyrna lewini*	21
7	Spinner shark	*Carcharhinus brevipinna*	17
8	Blacktip shark	*Carcharhinus limbatus*	12
9	Sand tiger shark	*Odontaspis taurus*	2
10	Finetooth shark	*Carcharhinus isodon*	2
11	Nurse shark	*Ginglymostoma cirratum*	1
12	Dusky shark	*Carcharhinus obscurus*	1

Mustelus canis

The smooth dogfish, *Mustelus canis,* ranked third in abundance (n=163; 0.15 individuals/ha; CV=10.8) among sharks in 2007. The 2007 density of abundance decreased sharply (Figure 57). Most of the individuals were taken in spring; a single individual was collected during the summer cruise. Smooth dogfish were taken in all regions except Florida, with greatest abundance in Raleigh Bay (Table 29).

Male *M. canis* outnumbered females (1.2 : 1.0). Size differences between sexes were not found to be significant ($X^2 = 3$, $p > 0.05$). Total lengths of the smooth dogfish ranged from 30 to 102 cm for males ($\bar{x}$ = 71.0 cm) and from 52 to 100 cm for females ($\bar{x}$ = 80.8 cm). Regional mean length was greatest in Raleigh Bay.

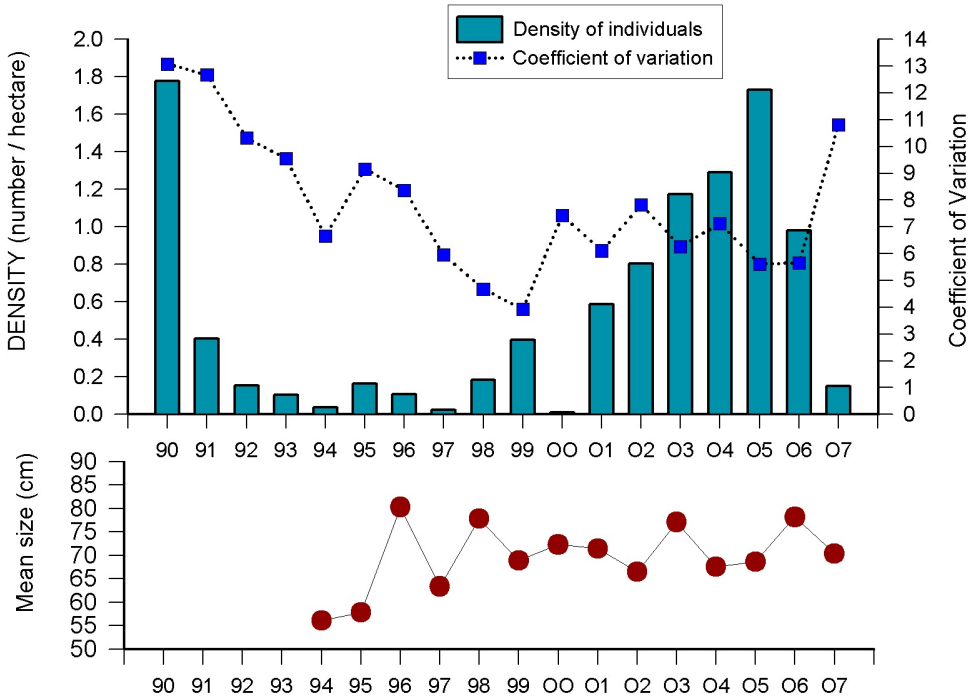

Figure 57. Annual density, variability, and mean size of *Mustelus canis*

Table 29 . Estimates of density (number of individuals/hectare) in 2007.

Mustelus canis

	Spring	Summer	Fall	Region
Onslow Bay	4.665	0	0	1.601
Long Bay	0.357	0.019	0	0.127
South Carolina	0.209	0	0	0.070
Georgia	0.061	0	0	0.021
Raleigh Bay	0.011	0	0	0.004
Florida	0	0	0	0
Season	0.415	0.002	0	0.151

Rhizoprionodon terraenovae

The Atlantic sharpnose shark was the most abundant shark species collected in 2007 (n=1470; 1.4 individuals/ha; CV=2.0). The density of abundance of *R. terraenovae* decreased in 2007 from the record level of abundance recorded in 2006 (Figure 58). In 2007, Atlantic sharpnose were taken in all regions and all seasons. The highest densities of abundance were taken in summer and in Raleigh Bay (Table 30). The Atlantic sharpnose shark was present in 68% of all tows.

Male Atlantic sharpnose outnumbered females (1.3:1); however, size was found to differ significantly among sexes (X^2 =86, $p < 0.0001$). Males ranged in size from 31 to 107 cm ($\bar{x}$ = 54.1 cm), and the size of females ranged from 30 to 101 cm total length ($\bar{x}$ = 44.4 cm). Mean length was smallest in summer collections, when the greatest number of individuals were taken. Regional mean lengths were greatest in Raleigh Bay and in waters off South Carolina.

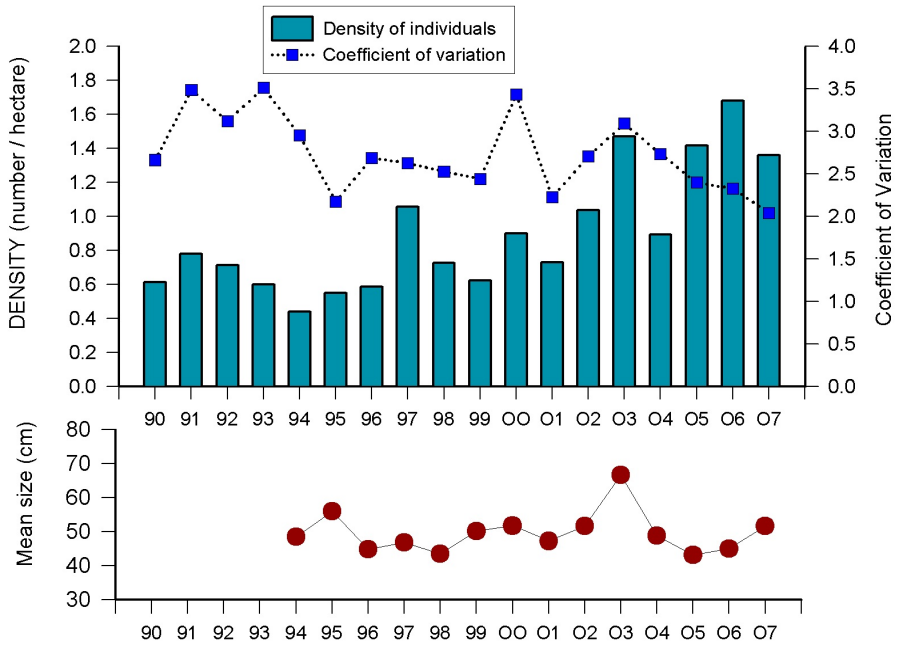

Figure 58. Annual density, variability, and mean size of *Rhizoprionodon terraenovae*

Table 30 . Estimates of density (number of individuals/hectare) in 2007.

Rhizoprionodon terraenovae

	Spring	Summer	Fall	Region
Raleigh Bay	0.110	0.968	1.735	0.907
Onslow Bay	0.978	3.546	1.120	1.880
Long Bay	1.256	2.807	1.132	1.738
South Carolina	1.707	2.186	0.569	1.491
Georgia	0.266	1.935	0.565	0.883
Florida	0.015	3.095	0.923	1.325
Season	0.670	2.157	0.755	1.360

Sphyrna tiburo

The bonnethead shark, *Sphyrna tiburo,* was the second most abundant shark species (n=562; 0.5 individuals/ha; CV=3.9) collected during the 2007 SEAMAP-SA Coastal Survey. Abundance declined sharply from the record numbers taken in 2006 (Figure 59). Density was greatest in summer and fall (Table 31). Waters off Florida yielded the highest regional density. No bonnethead sharks were taken in Raleigh or Onslow Bay in any season.

Males outnumbered female bonnetheads (1.71), and were significantly larger than females (X^2 = 11.1, $p < 0.001$). Total lengths of male *S. tiburo* ranged from 29 to 102 cm ($\bar{x}$ = 67.4 cm), whereas females ranged from 32 to 126 cm ($\bar{x}$ = 60.0 cm). Greatest mean lengths occurred summer and in Long Bay, with mean length decreasing southward.

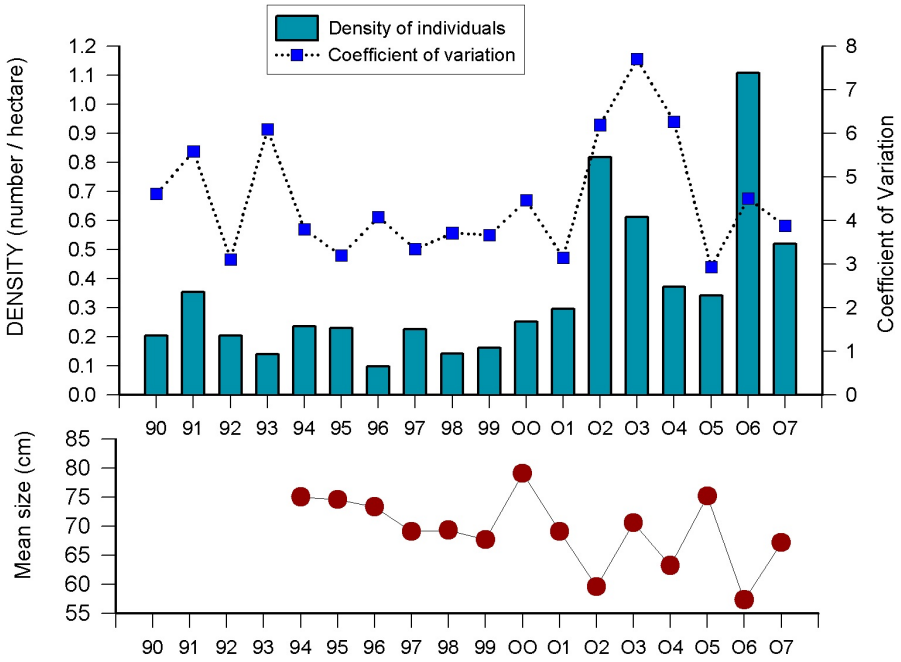

Figure 59. Annual density, variability, and mean size of *Spyrna tiburo*

Table 31 . Estimates of density (number of individuals/hectare) in 2007.

Sphyrna tiburo

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0	0	0
Long Bay	0.251	0.665	0.021	0.315
South Carolina	0.491	0.691	0.101	0.429
Georgia	0.043	0.419	0.092	0.176
Florida	0.570	1.817	3.106	1.840
Season	0.234	0.584	0.568	0.520

Caretta caretta

The loggerhead turtle, *Caretta caretta*, was the most abundant sea turtle caught in SEAMAP trawls. Fifteen loggerhead turtles (CV=5.1; 0.01 individuals/ha), weighing 881 kg (0.8 kg/ha), were taken in 2007. The 2007 estimate of density represents a decrease in abundance from 2007 (Figure 60). In 2007, the seasonal density was greatest in summer (Table 32). Regionally, density was greatest in waters off Florida. The majority of the loggerhead sea turtles taken in SEAMAP collections are considered to be sub-adults, based on size (Dodd, 1988).

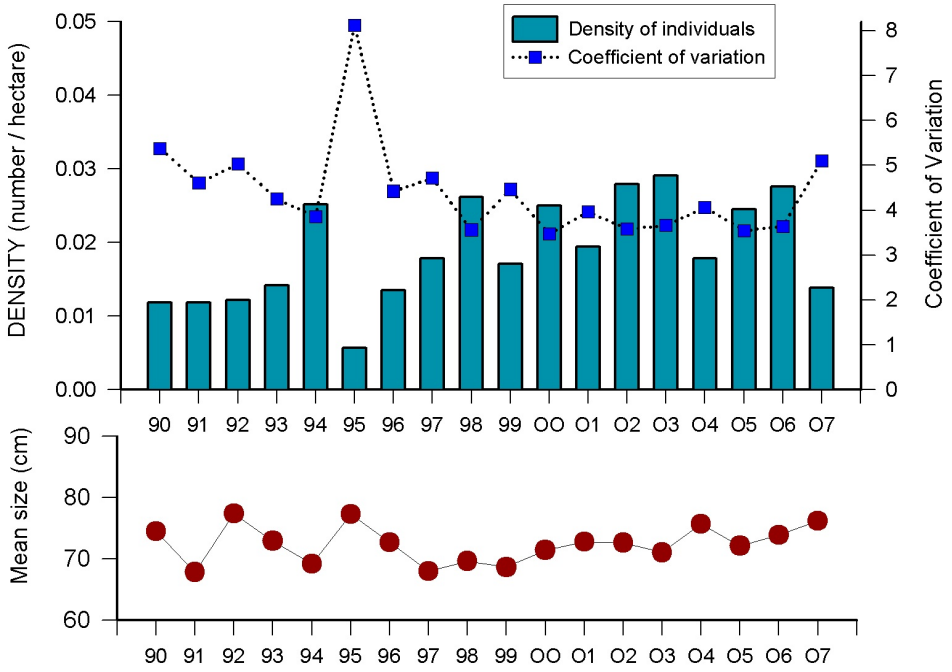

Figure 60. Annual density, variability, and mean size of *Caretta caretta*

Table 32. Estimates of density (number of individuals/hectare) in 2007.

Caretta caretta

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0	0.019	0	0.006
Long Bay	0	0.021	0.021	0.014
South Carolina	0	0.025	0	0.008
Georgia	0.011	0.037	0.012	0.019
Florida	0.030	0.031	0.015	0.025
Season	0.008	0.025	0.008	0.013

Chelonia mydas

The green turtle has been a very rare species in SEAMAP-SA trawls. A single green turtle was taken in 2007 (Figure 63). Only seven green turtles have been taken in previous years.

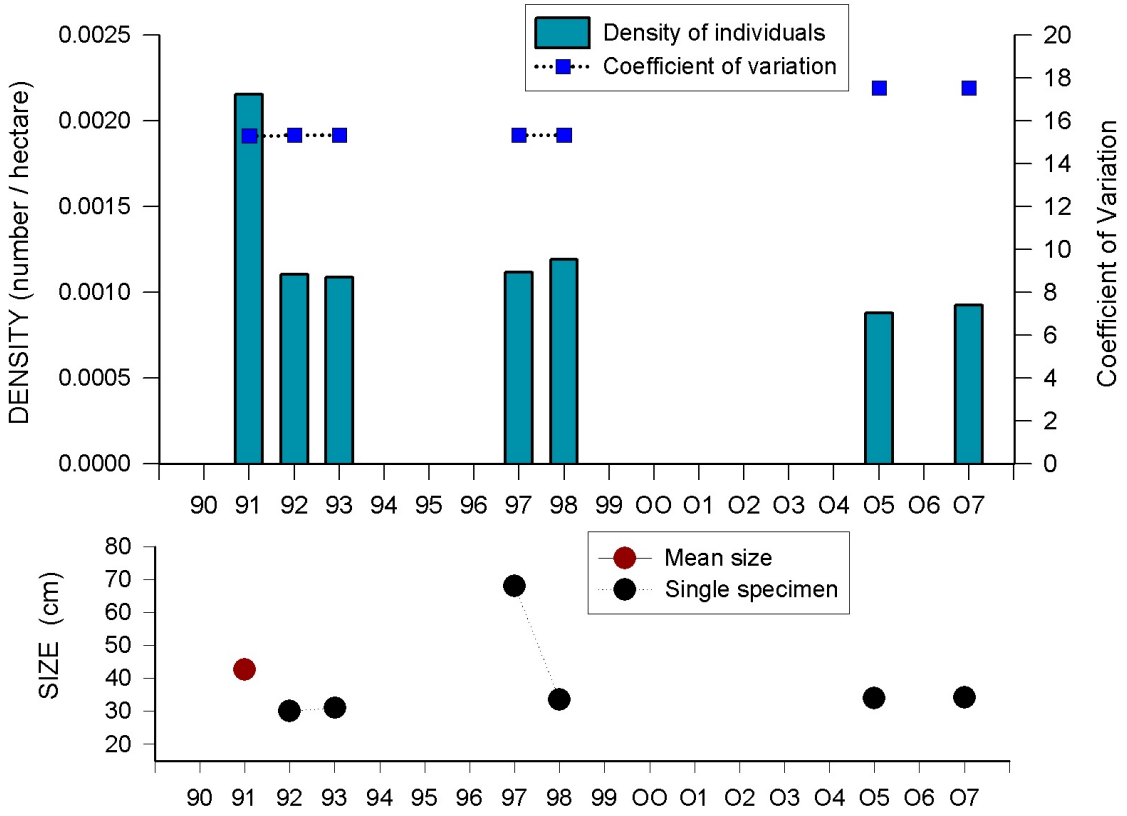

Figure 61. Annual density, variability, and size of *Chelonia mydas*

Dermochelys coriacea

The leatherback turtle has also been a very rare species in SEAMAP-SA trawls. In 2007, no leatherback turtles were taken in SEAMAP collections (Figure 62. Only six leatherback turtles have been taken previously.

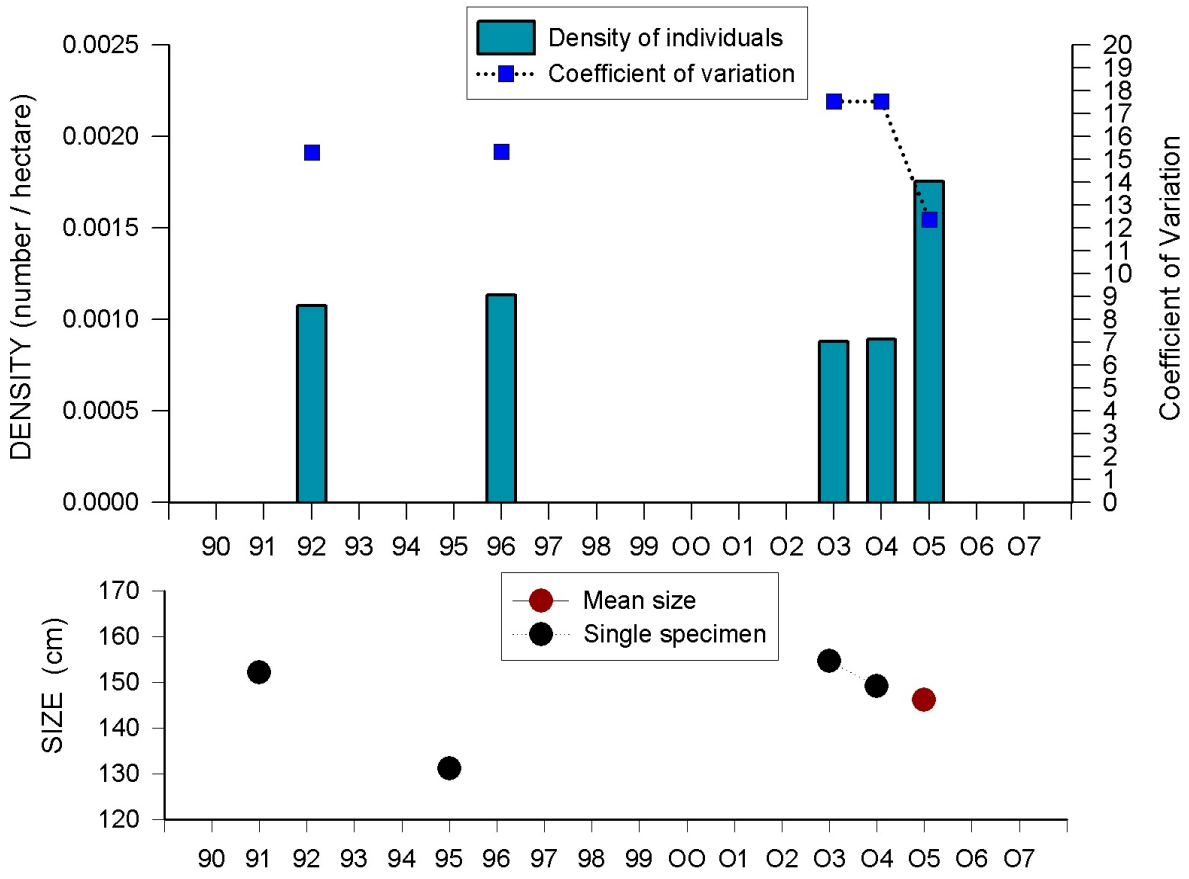

Figure 62. Annual density, variability, and size of *Dermochelys coriacea*

Lepidochelys kempi

In 2007, six Kemp's ridley turtles were taken in SEAMAP trawls (CV=7.2; 0.006 individuals/ha). The estimate of density of *L. kempi* increased in 2007 (Figure 63). Kemp's ridley turtles were taken in all seasons, but were absent from trawls made in Raleigh Bay, Long Bay, and in Florida waters (Table 33).

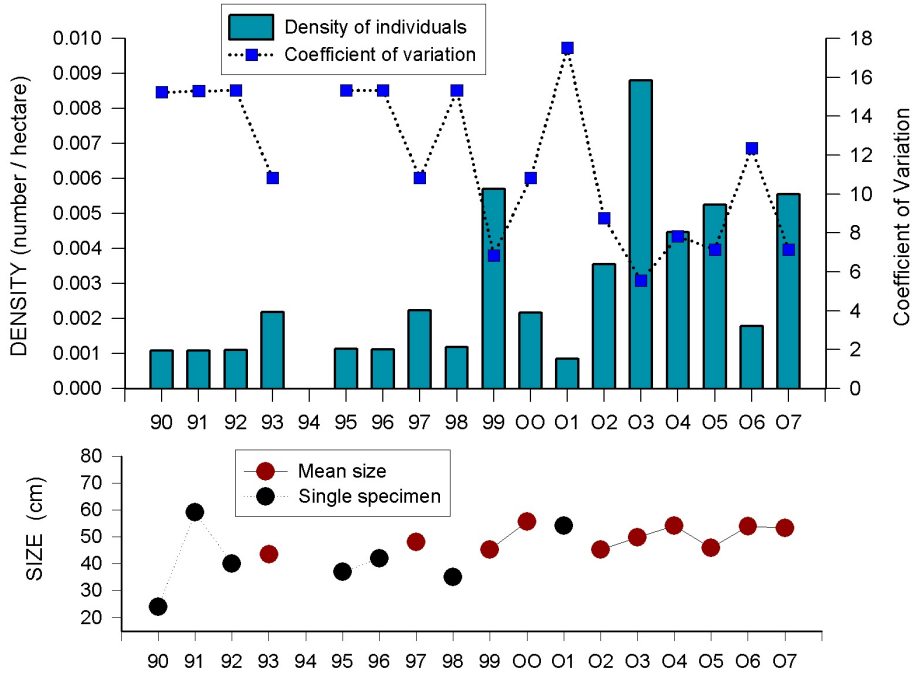

Figure 63. Annual density, variability, and size of *Lepidochelys kempi*

Table 33. Estimates of density (number of individuals/hectare) in 2007.

Lepidochelys kempi

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0	0
Onslow Bay	0.019	0	0.019	0.013
Long Bay	0	0	0	0
South Carolina	0	0	0.013	0.004
Georgia	0	0.012	0.023	0.011
Florida	0	0	0	0
Season	0.003	0.003	0.011	0.006

Limulus polyphemus

A total of 256 horseshoe crabs (CV=5.5; 0.2 individuals/ha) were collected by the SEAMAP-SA Coastal Survey in 2007. Density of individuals in 2007 continued to decrease from the record abundance recorded in 2005 (Figure 64). In 2007, horseshoe crabs were taken in all regions and seasons (Table 34). Abundance was greatest in fall trawls and in waters off South Carolina and Georgia.

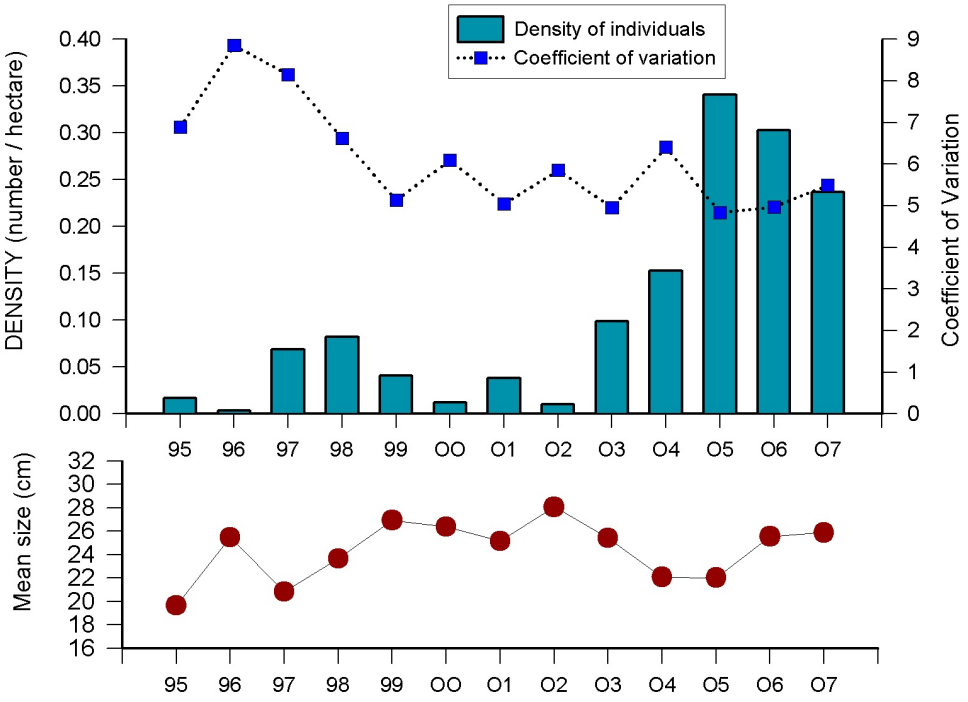

Figure 64. Annual density, variability, and mean size of *Limulus polyphemus*

Table 34. Estimates of density (number of individuals/hectare) in 2007.

Limulus polyphemus

	Spring	Summer	Fall	Region
Raleigh Bay	0.551	0	0	0.189
Onslow Bay	0.038	0	0	0.013
Long Bay	0.021	0	0	0.007
South Carolina	0.172	0	1.239	0.467
Georgia	0.053	0.025	1.338	0.470
Florida	0.030	0	0.015	0.015
Season	0.105	0.006	0.602	1.766

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 Coastal Survey. Cannonball jellies are not, however, considered to be priority species.

The 15,287 individuals (14.1 individuals/ha; CV=9.5, weighing 4214 kg (3.8 kg/ha), represented a slight decrease in abundance in 2007 (Figure 65). Seasonal density was greatest in fall (Table 35). *Stomolophus meleagris* was taken in all regions, with highest regional density off South Carolina.

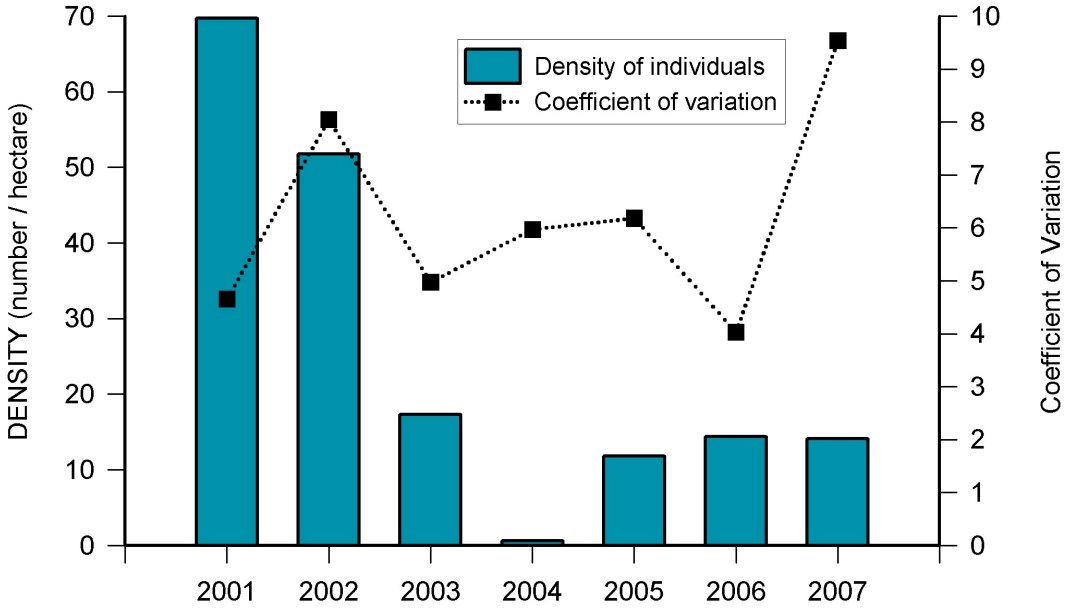

Figure 65. Annual densities of *Stomolophus meleagris*

Table 35. Estimates of density (number of individuals/hectare) in 2007.

Stomolophus meleagris

	Spring	Summer	Fall	Region
Raleigh Bay	0	0	0.041	0.013
Onslow Bay	0.527	0	2.085	0.864
Long Bay	0.126	0.707	0.683	0.505
South Carolina	6.581	1.181	130.009	45.451
Georgia	0.756	0.974	38.104	13.197
Florida	8.319	0	2.315	3.565
Season	3.232	0.585	38.906	4.430

ACKNOWLEDGMENTS

We appreciate the recommendations of the SEAMAP-SA Committee and the Shallow Water Trawl Workgroup. Jeff Jacobs, Rob Dunlap, and Bobby Schrimpf were instrumental in the successful completion of SEAMAP-SA Coastal Survey cruises through their able operation of the R/V *Lady Lisa*. Henry DaVega, Charlie Molnar, Ezra Lilly, Kevin Kolmos, and Mark Stratton assisted with field efforts. Rich Lynch, Glenn Ulrich, and Steve Burns kept the crew well-fed and productive.

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Appendix 1. Number of individuals and biomass (kg) for all species collected in 2007.

Rank	Species Name	Total Number	Total Weight (kg)
1	Chloroscombrus chrysurus	380063	4876.490
2	Micropogonias undulatus	53282	3649.699
3	Stenotomus sp.	25129	1003.217
4	Leiostomus xanthurus	23165	3113.303
5	Litopenaeus setiferus	22753	1108.175
6	Peprilus triacanthus	18851	800.956
7	Selene setapinnis	14419	241.586
8	Opisthonema oglinum	12140	273.358
9	Trichiurus lepturus	12036	943.109
10	Menticirrhus americanus	10892	1777.907
11	Peprilus alepidotus	10864	1234.519
12	Anchoa hepsetus	10472	65.229
13	Lolliguncula brevis	9645	116.993
14	Lagodon rhomboides	8741	484.801
15	Larimus fasciatus	8503	485.911
16	Farfantepenaeus aztecus	8490	145.557
17	Stellifer lanceolatus	6665	131.302
18	Cynoscion nothus	5297	255.177
19	Cynoscion regalis	4377	316.174
20	Loligo sp.	4164	54.075
21	Synodus foetens	3576	309.105
22	Prionotus carolinus	1943	31.439
23	Orthopristis chrysoptera	1832	174.502
24	Libinia dubia	1750	8.227
25	Scomberomorus maculatus	1619	764.024

Rank	Species Name	Total Number	Total Weight (kg)
26	Rhizoprionodon terraenovae	1470	1137.545
27	Pomatomus saltatrix	1434	155.915
28	Anchoa mitchilli	1419	2.654
29	Portunus gibbesii	1209	8.303
30	Anchoa lyolepis	1075	1.631
31	Bairdiella chrysoura	864	48.035
32	Selene vomer	839	101.627
33	Chaetodipterus faber	786	38.317
34	Ovalipes stephensoni	782	5.552
35	Scomberomorus cavalla	745	46.076
36	Myliobatis freminvillei	661	1583.817
37	Prionotus scitulus	599	13.848
38	Trinectes maculatus	597	21.356
39	Sphyrna tiburo	562	782.419
40	Gymnura micrura	558	339.885
41	Ovalipes ocellatus	504	5.265
42	Etropus crossotus	478	11.036
43	Xiphopenaeus kroyeri	473	4.253
44	Urophycis regius	465	12.056
45	Callinectes similis	464	5.938
46	Citharichthys macrops	441	9.015
47	Prionotus evolans	383	11.369
48	Dasyatis sayi	356	424.816
49	Squilla empusa	329	4.940
50	Scophthalmus aquosus	327	8.461
51	Sphyraena guachancho	304	32.169
52	Brevoortia tyrannus	292	15.140
53	Rhinoptera bonasus	291	2182.976

Rank	Species Name	Total Number	Total Weight (kg)
54	Decapterus punctatus	282	17.014
55	Raja eglanteria	275	219.205
56	Eucinostomus sp.	264	4.480
57	Limulus polyphemus	256	146.738
58	Caranx crysos	254	16.561
59	Harengula jaguana	215	8.857
60	Paralichthys dentatus	210	35.024
61	Menticirrhus littoralis	201	46.947
62	Ancylopsetta quadrocellata	180	8.337
63	Chilomycterus schoepfi	166	40.760
64	Mustelus canis	163	257.392
65	Sardinella aurita	162	1.875
66	Farfantepenaeus duorarum	161	3.309
67	Squilla neglecta	121	1.654
68	Libinia emarginata	121	1.362
69	Dasyatis sabina	100	47.533
70	Trachurus lathami	96	4.141
71	Trachinotus carolinus	93	18.000
72	Prionotus salmonicolor	92	1.599
73	Callinectes sapidus	66	8.863
74	Prionotus tribulus	62	2.798
75	Symphurus plagiusa	61	2.495
76	Callinectes ornatus	61	0.863
77	Squatina dumeril	56	619.292
78	Persephona mediterranea	55	0.611
79	Arenaeus cribrarius	51	1.002
80	Echeneis naucrates	50	7.987
81	Centropristis philadelphica	50	2.230
82	Decapterus macarellus	47	2.459

Rank	Species Name	Total Number	Total Weight (kg)
83	Sphoeroides maculatus	44	2.766
84	Trachinocephalus myops	44	1.308
85	Portunus spinimanus	44	0.598
86	Paralichthys lethostigma	40	16.837
87	Dasyatis americana	39	112.888
88	Carcharhinus acronotus	37	377.215
89	Centropristis striata	36	3.808
90	Paralichthys albigutta	31	7.040
91	Pagurus pollicaris	31	0.791
92	Hepatus epheliticus	31	0.635
93	Rimapenaeus constrictus	30	0.162
94	Bagre marinus	29	4.271
95	Citharichthys spilopterus	28	0.474
96	Stephanolepis hispidus	28	0.286
97	Gymnura altavela	27	821.384
98	Diplectrum formosum	25	1.613
99	Caranx hippos	23	1.653
100	Menticirrhus saxatilis	22	2.299
101	Sphyrna lewini	21	29.881
102	Archosargus probatocephalus	18	58.074
103	Mobula hypostoma	17	282.590
104	Carcharhinus brevipinna	17	115.935
105	Upeneus parvus	17	0.713
106	Menippe mercenaria	16	0.928
107	Caretta caretta	15	880.500
108	Neopanope sayi	14	0.024
109	Dasyatis centroura	13	391.480
110	Aetobatus narinari	13	115.466
111	Rachycentron canadum	13	18.983

Rank	Species Name	Total Number	Total Weight (kg)
112	Carcharhinus limbatus	12	90.507
113	Alectis ciliarius	10	0.436
114	Etropus cyclosquamus	10	0.132
115	Arius felis	9	1.762
116	Etrumeus teres	8	0.025
117	Pilumnus sayi	8	0.023
118	Brevoortia smithi	7	1.798
119	Rhinobatos lentiginosus	7	1.429
120	Opsanus tau	7	0.322
121	Lepidochelys kempi	6	134.050
122	Chelonia mydas	6	24.245
123	Lagocephalus laevigatus	6	0.152
124	Ogcocephalus rostellum	6	0.044
125	Urophycis floridanus	5	0.265
126	Aluterus schoepfi	5	0.096
127	Syngnathus louisianae	5	0.038
128	Selar crumenophthalmus	5	0.026
129	Calappa flammea	4	0.874
130	Urophycis earlli	4	0.322
131	Umbrina coroides	4	0.208
132	Hypsoblennius hentzi	4	0.033
133	Porcellana sigsbeiana	4	0.005
134	Pogonias cromis	3	31.349
135	Octopus vulgaris	3	1.101
136	Lutjanus griseus	3	0.223
137	Lutjanus synagris	3	0.173
138	Charybdis hellerii	3	0.090
139	Syngnathus fuscus	3	0.038
140	Hypleurochilus geminatus	3	0.013

Rank	Species Name	Total Number	Total Weight (kg)
141	Lysmata wurdemanni	3	0.003
142	Odontaspis taurus	2	90.400
143	Carcharhinus isodon	2	2.440
144	Astroscopus y-graecum	2	0.036
145	Portunus sayi	2	0.029
146	Scomber japonicus	2	0.014
147	Pagurus longicarpus	2	0.003
148	Ginglymostoma cirratum	1	40.000
149	Acipenser oxyrhynchus	1	14.210
150	Carcharhinus obscurus	1	6.900
151	Narcine brasiliensis	1	0.573
152	Ophichthus gomesi	1	0.200
153	Acanthostracion quadricornis	1	0.186
154	Lutjanus analis	1	0.085
155	Paralichthys squamilentus	1	0.064
156	Pagurus impressus	1	0.048
157	Syacium papillosum	1	0.044
158	Conodon nobilis	1	0.036
159	Porichthys plectrodon	1	0.035
160	Achirus lineatus	1	0.034
161	Scorpaena brasiliensis	1	0.033
162	Balistes capriscus	1	0.028
163	Hyporhampus meeki	1	0.027
164	Seriola zonata	1	0.022
165	Lutjanus campechanus	1	0.016
166	Cancer irroratus	1	0.014
167	Gobiosoma bosci	1	0.001

Appendix 2. Applications of data and specimens from the SEAMAP-South Atlantic Coastal Survey in 2007

Stock Assessment/VPA:

Cynoscion regalis
Leiostomus xanthurus
Menticirrhus americanus
Micropogonias undulatus
Mustelus canis
Pomatomus saltatrix

Life History (Age/Growth, Reproduction):

Cynoscion regalis
Leiostomus xanthurus
Menticirrhus americanus
Menticirrhus littoralis
Menticirrhus saxatilis
Micropogonias undulatus
Paralichthys albigutta
Paralichthys lethostigma
Pomatomus saltatrix
Sphyrna tiburo

Data requested by state agencies:

- Shrimp abundance summary - SCDNR-Crustacean Management Section
- Hardhead and gafftopsail catfish, spot, croaker, southern kingfish, northern kingfish, and weakfish CPUE - SCDNR- OFM.
- Sea turtle data (2007) - SCDNR / Office of Fisheries Management
- 2007 SEAMAP-SA data collected in North Carolina waters - NC Division of Marine Fisheries
- 2000-2002 SEAMAP-SA data collected in North Carolina waters - NC Division of Marine Fisheries
- 2007 SEAMAP-SA data collected in Georgia waters - GADNR
- Sea turtle data collected in Georgia waters(2007) - GADNR
- 2007 SEAMAP-SA data collected in Florida waters - Florida Fish and Wildlife Conservation Commission
- Sea turtle data collected in Florida waters(2007) - FFWCC - Endangered Species Division
- Cannonball jelly abundance data (1994-2007) for correlation with Leatherback sea turtle sightings-/SCDNR- Endangered Species Office

Data requested by federal agencies:

- Sea turtle data (2007) - NOAA SERO
- Sea turtle data (2007) - Cooperative Marine Turtle Tagging Program
- Shark data (2007) - NMFS, Highly Migratory Species, Silver Spring, MD
- Data collected off Canaveral National Seashore (2007) - National Park Service
- Sea turtle data (1989-2007) - NOAA/NMFS Sea Turtle Expert Working Group

Appendix 3. SEAMAP-SA Coastal Survey Permits

The SEAMAP - South Atlantic Coastal Survey applies for required permits each year. In 2007, the survey operated in compliance with the following:

Federal Permits

Letter of Acknowledgment from USDOC/NOAA/NMFS Southeast Regional Office (variance from size, bag, and seasonal limits for monitored stocks and exemption from federal TED requirements as long as limited tow times are maintained).

Letter of Acknowledgment (LOA-SHK-07-03) from USDOC/NOAA/NMFS Office of Sustainable Fisheries (allows research trawling activity that includes take of shark species).

Permit #1405 from USDOC/NOAA/NMFS Office of Protected Resources (authorizes specified research on marine turtle species collected as a result of otherwise permitted trawling activities).

USDOC/NOAA/NMFS Section 6 Cooperative Agreement (recognizes South Carolina Department of Natural Resources' actions under section 6© of the Endangered Species Act).

CANA-2005-SCI-0003 issued by USDOI/NPS Canaveral National Seashore (authorizes trawling activities in the coastal waters adjacent to the park).

STATE PERMITS

North Carolina Division of Marine Fisheries Scientific/Educational Permit (Permit Number 706572).

South Carolina Department of Natural Resources Scientific Collection Permit.

State of Georgia Department of Natural Resources Scientific Collecting Permit (29-WTN-07-42).

Florida Fish and Wildlife Conservation Commission Special Activities License (SAL 07SR-051).

Florida Fish and Wildlife Conservation Commission / Imperiled Species Management Marine Turtle Permit (TP# 064).