Annual Report North Carolina CRFL Projects

Project No: 2143-09

Project Title: **North Carolina Division of Marine Fisheries Five-Year Project for Reoccurring Funds from the Marine Resource Fund**

Grant Duration: Start Date: 1 July 2007 End Date: 30 June 2012

Period Covered by This Report:
Start Date: 1 July 2009 End Date: 30 June 2010

Project Costs:

Proposed	CRFL: $	Grantee:	Total: $
This Period	CRFL: $	Grantee:	Total: $

Study/Job Title: **Job 4: Fisheries Independent Assessment Program**

Study/Job Objectives:

Objectives:

The Fisheries Reform Act of 1997 established a process for preparing coastal Fisheries Management Plans (FMP) in North Carolina. The goal of these plans is to ensure the long-term viability of the state's economically important species or fisheries. The purpose of this study is to augment the North Carolina Division of Marine Fisheries (NCDMF) ability to collect and analyze essential data used to produce the FMPs for recreationally important species and to help determine overfishing status, levels of spawning stock biomass, mortality, recruitment, and sustainable harvest levels which form the basis for all management actions recommended in FMPs. Specific objectives are:

1. To calculate annual indices of abundance in major North Carolina rivers and Atlantic Ocean for the following target species: American shad (*Alosa sapidissima*), Atlantic croaker (*Micropogonias undulatus*), bluefish (*Pomatomus saltatrix*), red drum (*Sciaenops ocellatus*), southern flounder (*Paralichthys lethostigma*), southern kingfish (*Menticirrhus americanus),* Spanish mackerel (*Scomberomorus maculates*), spot (*Leiostomus xanthurus*), spotted seatrout (*Cynoscion nebulosus*), striped bass (*Morone saxatilis*), and weakfish (*Cynoscion regalis*). Catch per unit effort (CPUE) data from fishery independent surveys that standardizes effort will provide an unbiased relative index of abundance to track stock status. Target species may vary by river system.

2. To supplement samples for age, growth, and reproduction studies in order to determine age structure, sex ratios, and relative cohort size for the target species.

3. To evaluate catch rates and species distribution for identifying and resolving management problems in five North Carolina river systems and the Atlantic Ocean.

4. To characterize habitat use in those five river systems.

The goal is to maintain long-term fisheries independent surveys that will provide data on CPUE, catch composition, abundance, size, age, maturity, and mortality in the Neuse, Pamlico, Pungo, New, and Cape Fear rivers and Atlantic Ocean for important recreational species. Maintaining the integrity of and adding to existing times series will provide for improved stock assessments and, through more effective FMPs, the long-term viability of the recreational finfish fisheries.

Activity This Period (by River System):

Approach:
With the initiation of CRFL funds, ongoing Fisheries Independent Assessment (FIA) sampling in the Neuse, Pamlico and Pungo rivers continued with no break in coverage beginning in October 2007. Similar sampling in the two other rivers (New and Cape Fear) and the Atlantic Ocean had not occurred prior to CRFL funding and thus study personnel and equipment had to be procured and constructed as well as field testing a comparable sampling design suited to the southern area of the state. Thus, actual field sampling in the southern area did not begin until May 2008.

While the CRFL funds are awarded on a fiscal year basis the target species catch rates (and most assessments) are computed on an annual or calendar year basis. This progress report documents the sampling completed from July 2009 through June 2010. In addition, annual catch rates, species composition, and other statistics for 2009 (all systems) are computed. Each subsequent progress report will be similarly formatted, covering the previous calendar year. Data from adjacent river systems are reported on in the aggregate (Pamlico area and southern area).

The FIA employed a stratified-random sampling design based on area and water depth for each system. Sampling in the estuarine waters was divided into three regions: Pamlico/Pungo Region included areas of Pamlico River from Washington, North Carolina to the mouth of the Pamlico Sound (south of Wade Point) and the upper portion of the Pungo River from Haystack Point and west to Belhaven and south to Jordan Creek; Neuse Region included the Neuse River from New Bern to Oriental, North Carolina (from Old House Point south to Sandy Point); and Southern Region included New and Cape Fear rivers. Each region was overlaid with a one-minute by one-minute grid system (equivalent to one square nautical mile) and delineated into shallow (≤6 feet) and deep (>6 feet) strata using bathymetric data from NOAA navigational charts and field observations. NCDMF staff also considered such factors as obstructions to fishing, safety, and accessibility when evaluating each grid for inclusion in the sampling. After grid delineation, each of the two regions was further segregated into four similar sized areas to insure that samples were evenly distributed throughout each region (Figure 1). In the Pamlico/Pungo region areas were assigned as follows: upper Pamlico (Washington, NC to Ragged Pt.), middle Pamlico (Ragged Pt. to Gum Pt.), lower Pamlico (Gum Pt. to Wades Pt.), and Pungo (Haystack Pt. south to Sandy Pt). In the Neuse region areas were assigned as follows: upper Neuse (New Bern to Bay Pt.), upper-middle Neuse (Bay Pt. to Kennel Beach), lower-middle Neuse (Kennel Beach to Wilkinson Pt.), and lower Neuse (Wilkinson Pt. to Gum Thicket Shoal). The New River included an upper portion from Wilson Bay to Hines Point (line extending eastward to French's Creek) and a lower portion from Hines Point to the intersection of New River and the Intracoastal Waterway. The Cape Fear River was considered as one area from the northern end of US Army Corps of Engineer's Island 13 south to the mouth of the river.

The SAS procedure PLAN was used to randomly select sampling grids within each area (SAS Institute 1985). Sampling gear consists of an array of nets consisting of 30-yard segments of 3, 3½, 4, 4½, 5, 5½, 6, and 6½ inch stretched mesh webbing (240 yards of gill net per sample).

Catches from the array of gill nets combined together comprise a single sample. Gear was typically deployed within an hour of sunset and fished the following morning to keep all soak times at a standard 12 hours.

Physical and environmental conditions including surface and bottom water temperature (^{o}C), salinity (ppt), dissolved oxygen (mg/L), bottom composition, and a qualitative assessment of sediment size were recorded upon retrieval of the nets on each sampling trip. All attached submerged aquatic vegetation (SAV) in the immediate sample area was identified to species and density of coverage was estimated visually when possible. Additional habitat data recorded included distance from shore, presence or absence of sea grass or shell, and substrate type. All finfish groups were enumerated and an aggregate weight (nearest 0.01 kilogram (kg)) was obtained for most species. Individuals were measured to the nearest millimeter fork length (FL) or total length (TL) according to morphology of the species. Selected species were retained and taken to the lab where age structures (otoliths and/or scales) were removed, sex, and maturity stage of gonads were determined. Stomach content was also recorded for several species. Live Atlantic sturgeon (*Acipenser oxyrhncus*), red drum, and striped bass captured in good condition were to be tagged and released in support of other Division studies.

Catch rates of target species were calculated annually and expressed as an overall catch per unit effort (CPUE) along with corresponding length class distributions. The overall CPUE gives an estimate of abundance showing availability of each species to the study, while the length distribution shows the size structure of each species for a given year. The overall CPUE was defined as the number of a species of fish captured per sample and was further expressed as the number of a species of fish at length per sample, with a sample being one array of nets. Due to disproportionate sizes of each strata and region, the final CPUE estimate was weighted. The length frequency distribution for each species was weighted by strata and number caught to determine the contribution of each size class to the final weighted CPUE. The total area of each region by strata was quantified using the one-minute by one-minute grid system and then used to weight the observed catches for calculating the abundance indices. The weighting factors by region and strata for the three regions are:

Pamlico/Pungo River 1: Shallow water - 44 square nautical miles
Pamlico/Pungo River 2: Deep water - 38 square nautical miles
Neuse River 1: Shallow water - 36 square nautical miles
Neuse River 2: Deep water – 31 square nautical miles
New River 1: Shallow water - 12 square nautical miles
New River 2: Deep water - 12 square nautical miles
Cape Fear River: Shallow water - 14 square nautical miles

The core samples taken each month (n=32) were used in the calculations of the annual weighted CPUE index (see Appendix 1 for additional details).

The Atlantic Ocean was separated into three areas including the Topsail Area which was designated from a line extending southwest off New River Inlet south to a line extending southwest off Rich's Inlet; Masonboro Area extended from Rich's Inlet to Frying Pan Shoals; and Brunswick Area extended from Frying Pan Shoals to the North Carolina/South Carolina border.

The SAS procedure PLAN was used to randomly select sampling grids within each area (SAS Institute 1985). Sampling gear consists of an array of nets consisting of 30-yard segments of 2

½, 3, 3½, 4, 4½, 5, 5½, 6, and 6½ inch stretched mesh webbing (270 yards of gill net per sample). Catches from the array of gill nets combined together comprise a single sample. Gear was typically deployed within an hour of sunset and fished the following morning to keep all soak times at a standard 12 hours during from October through March and two hours from April through September (sampling was modified in July 2008).

The Atlantic Ocean CPUE was defined as the number of a species of fish captured per sample hour and was further expressed as the number of a species of fish at length per sample hour. Due to disproportionate sizes of each strata and region, the final CPUE estimate was weighted. The total area of each region by strata was quantified using the one-minute by one-minute grid system and then used to weight the observed catches for calculating the abundance indices. The weighting factors by region and for the three areas are:

Topsail: 86 square nautical miles
Masonboro: 76 square nautical miles
Brunswick: 90 square nautical miles.

Details for the calculation of the CPUE are given in Appendix 1.

Results:

Pamlico/Pungo and Neuse Rivers Sampling Results:

For the Neuse and Pamlico/Pungo rivers 32 samples were completed (8 areas x twice a month x 2 samples-shallow and deep) each full month (Figure 1 and Table 1). With the winter hiatus in sampling (15 December- 15 February), a total of 320 samples were obtained yearly. Samples collected in 2009 included 80 shallow and 80 deep samples in Pamlico/Pungo rivers, and 80 shallow and 80 deep samples in Neuse River (Table 1).

Pamlico/Pungo and Neuse Rivers Environmental Data Results:

In 2009 the annual average salinities were similar in Pamlico/Pungo (mean: 12.5 ppt; range: 0.1-21.1 ppt) and Neuse rivers (mean: 12.3 ppt; range: 0.1-23.0 ppt) (Table 2). The highest mean salinity occurred during October for Pamlico/Pungo rivers (15.5 ppt) and during July for Neuse River (15.6 ppt) while the lowest average salinities occurred in May for Pamlico/Pungo rivers (9.7 ppt) and in April for Neuse River (7.5 ppt). Water temperatures were similar in both areas, with temperatures ranging from 3.0-32.7 ^{o}C in Pamlico/Pungo rivers and 6.6-32.6 ^{o}C in Neuse River. The coldest mean monthly water temperatures occurred during February for both areas. The warmest mean water temperatures occurred during August for both Pamlico/Pungo rivers and Neuse River. The lowest mean dissolved oxygen level occurred in June for Pamlico/Pungo rivers at 4.7 mg/L and in July for Neuse River at 5.1 mg/L. Dissolved oxygen levels were similar in both regions throughout the sample year and were generally lower from May-September when water temperatures were highest.

Pamlico/Pungo and Neuse Rivers Species Composition:

In 2009 22,863 individuals, including 51 fish species were captured from 320 samples (Table 3). Atlantic menhaden (*Brevoortia tyrannus*) was the most abundant species and accounted for

54.3% of the total catch by number. Target species represented 20.2% of the total catch by number and included American shad (0.2%), Atlantic croaker (1.5%), bluefish (7.8%), red drum (2.4%), southern flounder (2.9%), southern kingfish (<0.1%), Spanish mackerel (0.8%), spot (1.5%), spotted seatrout (1.4%), striped bass (1.5%), and weakfish (0.2%). Anadromous species such as hickory shad (*A. mediocris*, 1.1%) were available to the survey for a short period of time during their spring spawning migrations. Cownose ray (*Rhinoptera bonasus*, 4.8%) was the most common shark/ray species. Invertebrate species of interest included blue crab (*Callinectes sapidus*, 2.1%) and horseshoe crab (*Limulus polyphemus*, <0.1%). Other species of interest present were striped mullet (*Mugil cephalus*, 3.8%) and summer flounder (*Paralichthys dentatus*, <0.1%).

Pamlico/Pungo and Neuse Rivers Species Habitat Use:

Species abundance and weighted CPUE estimates for both regions demonstrated higher catch rates in shallow water habitat (≤6 ft) versus deep water habitat (>6 ft) for most of the target species (Table 4). From the 160 shallow and 160 deep samples collected in 2009 (shallow: deep ratio) Atlantic croaker (2.08:0.12), red drum (3.24:0.20), southern flounder (3.46:0.72), spot (1.84:0.28) and striped bass (1.44:0.61) were more abundant in shallow water habitats. Bluefish (1.65:8.88), southern kingfish (0.00:0.05) and Spanish mackerel (0.01:1.17) were more abundant in deep water habitats. American shad (0.14:0.16), spotted seatrout (1.02:0.98) and weakfish (0.10:0.11) were more evenly distributed between shallow and deep water habitats.

From the 160 Pamlico/Pungo and 160 Neuse samples collected in 2009 (Pamlico/Pungo: Neuse) American shad (0.19:0.09), Atlantic croaker (1.42:0.87), southern flounder (2.49:1.83), spotted seatrout (1.13:0.85) and striped bass (1.18:0.90) were all more abundant in the Pamlico/Pungo rivers. Bluefish (2.36:8.22), red drum (1.66:2.05) and weakfish (0.05:0.17) were more abundant in the Neuse River. Southern kingfish (0.01:0.04), Spanish mackerel (0.52:0.57) and spot (1.10:1.13) were more evenly distributed between regions.

Pamlico/Pungo and Neuse Rivers Gill Net Mortality and Regulatory Bycatch:

In 2009 mortality rates for most target species in large mesh gill nets (≥5” stretch mesh) were highest during summer and decreased with decreasing water temperatures in the spring/fall and winter periods (Table 5). The spring/fall and summer periods had the highest mortality rates for red drum (14-34%), southern flounder (0-14%), spotted seatrout (36-60%) and striped bass (68-73%). For all seasons the lowest species mortality rates were for southern flounder (0-14%). While mortality rates were generally lowest in winter, fewer fish were collected during this period. Sublegal red drum (<18” TL) had the highest mortality rates in summer (20%) and lowest in spring/fall (0%). Red drum over the legal size limit (>27” TL) had mortality rates of 0% in spring/fall and 60% in summer; although it should be noted these results are based on a low sample number (n=11), with no individuals captured in winter. No sub-legal spotted seatrout (<14” TL) were taken in large mesh gill nets during 2009. Four sub-legal striped bass (<18” TL) and two sub-legal weakfish (<12” TL) were taken in large mesh gill nets during 2009.

In 2009 overall mortality rates by season for small mesh gill nets (<5” stretch mesh) were slightly higher for most target species (Table 6) when compared to the corresponding mortality rates for large mesh gill nets. Mortality rates were highest during spring/fall and summer seasons for Atlantic croaker (25-53%), bluefish (86-90%), red drum (45-61%), spotted seatrout (57-75%), striped bass (60-84%) and weakfish (80-91%). Southern flounder mortality rates

were the lowest ranging from 0-28%. Sub-legal fish taken in small mesh gill nets made up a larger percentage of the overall catch, and generally had higher mortality rates, than did sub-legal fish taken in large mesh gill nets. Sub-legal red drum accounted for 68% of all red drum captured and mortality rates ranged from 30-59% by season. For all seasons combined, dead sub-legal red drum accounted for 31% of all red drum captured in small mesh gill nets. Eleven red drum were captured above the legal size limit with an overall 9% mortality (n=11). Small mesh gill net mortality rates for sub-legal striped bass varied by season (47-91%). Sub-legal striped bass comprised 50% of all striped bass captured. Undersized southern flounder (<14" TL) accounted for 90% of all southern flounder in small mesh captured. Mortality ranged from a high of 43% in summer to a low of 0% in winter. Twenty undersized spotted seatrout were taken by small mesh gill net samples during 2009. Mortality rates were high for sub-legal weakfish during all periods (100%; n=3).

Pamlico/Pungo and Neuse Rivers Weighted CPUE and Weighted Size Class Distribution:

In 2009 American shad had an annual weighted CPUE of 0.15 individuals per sample (Table 7). Lengths ranged from 293-473 mm TL (Figure 2).

In 2009 Atlantic croaker had an annual weighted CPUE of 1.17 individuals per sample (Table 7) and was the fourth highest target species. Lengths ranged from 104-365 mm TL (Figure 3).

In 2009 bluefish was the most abundant target species captured with a weighted CPUE of 5.00 individuals per sample (Table 7). Bluefish ranged from 109-808 mm FL, with a mean length of 277 mm FL (Figure 4).

In 2009 red drum had a weighted CPUE of 1.83 individuals per sample and was the third highest target species. Red drum ranged in length from 220-1,250 mm FL, with most individuals between 330-550 mm FL (Table 7; Figure 5).

In 2009 southern flounder was the second most abundant target species with an annual weighted CPUE of 2.19 individuals per sample (Table 7). Overall lengths ranged from 120-529 mm TL, with a mean length of 320 mm TL (Figure 6).

In 2009 southern kingfish had an annual weighted CPUE of 0.02 individuals per sample (Table 7). Lengths ranged from 234-342 mm TL. Due to low sample sizes length frequency was not provided for southern kingfish.

In 2009 Spanish mackerel had an annual weighted CPUE of 0.54 individuals per sample (Table 7). Lengths ranged from 178-568 mm TL (Figure 7).

In 2009 spot was the fifth most abundant target species taken in the study with an annual weighted CPUE of 1.11 individuals per sample (Table 7). Sizes ranged from 85-330 mm FL with over 90% of the individuals ranging from 200-250 mm (Figure 8).

In 2009, spotted seatrout weighted catch rates were 1.00 individuals per sample (Table 7). Sizes ranged from 230-660 mm FL, with a mean length of 424 mm FL (Figure 9).

In 2009 striped bass was the sixth most abundant target species captured with a weighted CPUE of 1.06 individuals per sample (Table 7). Striped bass ranged from 178-655 mm FL, with a mean length of 453 mm FL (Figure 10).

In 2009 weakfish annual weighted CPUE was 0.10 individuals per sample (Table 7). Sizes ranged from 218-511 mm FL, with a mean length of 364 mm FL (Figure 11).

Annual weighted CPUE for target species from 2003 to 2009 for the Pamlico/Pungo and Neuse rivers in Figure 12 provide species abundance trends through time. Among the target species Atlantic croaker, bluefish, Spanish mackerel and spotted seatrout have increased in recent years while spot, red drum, striped bass and weakfish have remained relatively steady. Southern flounder experienced an increased CPUE in 2008 but in 2009 returned to levels seen in previous years.

Pamlico/Pungo and Neuse Rivers Collection of Age Structures and Tagging

From February 15, 2009 through December 15th, 2009 717 specimens were processed and sent to the age and growth laboratory in Morehead City for analysis. In all, 717 age structures (otoliths and/or scales) along with fish length and weight (kg) measurements were collected (Table 12). Age samples collected are incorporated into existing aging programs for each species. When appropriate sex and maturity stages were macroscopically determined from gonads and incorporated into existing life history programs. Age samples for American shad, Atlantic croaker, bluefish, red drum, southern flounder, spot, spotted seatrout, Spanish mackerel, striped mullet, and weakfish are available for annual age-length keys. Also, 117 red drum and 48 striped bass were tagged throughout these rivers.

New and Cape Fear Rivers Results:

For the Southern Region (New and Cape Fear rivers) 12 samples were completed (New River 2 areas x twice a month x 2 samples-shallow and deep and Cape Fear - 1 area x twice a month x 2 shallow samples) most months (Table 13). Seventy-six samples were collected from the New River in 2009 with 38 from the upper and 38 from the lower (Figure 13). Forty-two samples were collected from the Cape Fear River. In the first half of 2010, all sampling targets have been reached.

New and Cape Fear Rivers Environmental Data Results:

Environmental parameters were similar among the two river systems in the Southern Region in 2009 (Table 14). Salinities averaged 16.3 ppt and ranged from 2.4 to 31.5 ppt. The highest mean salinity occurred in July in the New (20.2 ppt) and the Cape Fear rivers (22.3 ppt). The lowest mean salinity occurred in December in the New (6.9 ppt) and Cape Fear rivers (6.4 ppt). The water temperature in the two river systems averaged 22.0 ^{o}C and ranged from 7.8 to 32.9 ^{o}C. The warmest mean water temperature occurred in August in the New (30.4 ^{o}C) and Cape Fear rivers (30.0 ^{o}C). The coldest mean water temperature occurred in February in the New River (9.3 ^{o}C) and in March in Cape Fear River (10.9 ^{o}C). The dissolved oxygen averaged 6.7 mg/L and ranged from 1.5 to 12.1 mg/L. The highest mean dissolved oxygen occurred in December in the New River (10.9 mg/L) and in March in Cape Fear River (9.8 mg/L). The lowest mean dissolved oxygen occurred in July in both the New (5.1 mg/L) and Cape Fear Rivers (4.8 mg/L). The New River typically had lower minimum and higher maximum dissolved oxygen levels than the Cape Fear River from May to October.

New and Cape Fear Rivers Species Composition:

In 2009, 4,771 individuals including 52 fish species were observed (Table 15). The most abundant species was Atlantic menhaden (1,810) and accounted for 37.9% of the total number of individuals. The targeted species accounted 31.0% of the total number of individuals and included American shad (<0.1%), Atlantic croaker (2.0%), bluefish (6.7%), red drum (9.1%), southern flounder (8.6%), southern kingfish (0.4%), Spanish mackerel (0.5%), spot (1.0%), spotted seatrout (2.5%), striped bass (0.1%), and weakfish (<0.1%). The most abundant shark/ray species was the Atlantic sharpnose shark (*Rhizoprionodon terraenovae,* 2.2%). Invertebrate species of interest included blue crab (13.1%), Florida stone crab (*Menippe mercenaria*, <0.1%), and horseshoe crab (0.2%). Other species of interest include Atlantic sturgeon (*Acipenser oxyrhynchus*) (<0.1%), summer flounder (0.1%), striped mullet (3.9%) and loggerhead seaturtle (*Caretta Caretta*,<0.1%).

New and Cape Fear Rivers Habitat Use:

The ratio of weighted CPUE for targeted species (shallow water habitats:deep water habitats) were usually similar among habitats although a higher number of targeted species had higher weighted CPUEs in deep water habitats (Table 16). Atlantic croaker (0.93:0.53), red drum (5.04:0.84), spotted seatrout (1.20:0.61), spot (0.43:0.42), southern kingfish (0.23: 0.00), and striped bass (0.04:0.00) had higher CPUEs in shallow water habitats. Bluefish (1.08:6.16), southern flounder (3.35:3.74), Spanish mackerel (0.00:0.68), and weakfish (0.01:0.03) had higher CPUEs in deep water habitats.

New and Cape Fear Rivers Gill Net Mortality and Regulatory Bycatch:

The small mesh gill nets (<5 inch stretched mesh) had a higher number of individuals and species caught than larger mesh gill nets (>= 5 inch stretched mesh, Table 17 and 18). In small mesh nets, the mortality rate for target species was usually higher over all seasons (Table 18). Atlantic croaker caught in small mesh nets ranged from 32% (spring and fall) to 42% (summer). Bluefish had high mortality rates over all seasons ranging from a low of 69% to a high of 72%. Red drum mortality rates were lowest in the winter (14%) and increased during the rest of the year (24-55%) in both mesh sizes. Southern flounder had mortalities less than 15% over all seasons in large and small mesh gillnets. Few southern kingfish were caught in large mesh gillnets. Southern kingfish caught in small mesh gillnets ranged from 67% in the summer and 80% during April, May, October and November. Spanish mackerel had the highest mortality rates (96-100%) of any species across gears and seasons. The majority of the spot were observed in the small mesh nets, with the highest mortality occurring in the summer (32%). Only two spot were observed in large mesh nets. Three spotted seatrout were observed in large mesh nets. Spotted seatrout caught in small mesh nets had high mortalities (39-59%). Three striped bass were caught in the Southern Region, no mortalities were observed. One death of a legal sized weakfish occurred in the large mesh gillnet during the winter.

A total of 2,044 individuals from the targeted species was caught in 2009. Four of the targeted species (red drum, southern flounder, Spanish mackerel, and weakfish) were under or over legal size limits. Most undersized individuals were red drum in small mesh gill nets (286 fish). These undersized red drum had mortalities ranging from 45% in May, October, and November to a high of 56% mortality in June, July, August, and September. Southern flounder (262) typically had low discard mortality rates in both mesh sizes. The highest discard mortality rate occurred in small mesh gill nets during April, May, October and November (12 %). Spanish

mackerel had two discards of undersized fish in both small and large mesh gillnets during the summer. One sub-legal weakfish was discarded from the large mesh gillnets during the winter.

New and Cape Fear Rivers Weighted CPUE and Weighted Size Class Distribution:

American shad had an annual weighted CPUE of 0.01 individuals per sample in 2009 (Table 19). Only one American shad was caught at 429 mm FL.

Atlantic croaker was the eighth most abundant fish species and had an annual weighted CPUE of 0.79 individuals per sample in 2009 (Table 19). Atlantic croaker had a mean size of 216 mm TL and ranged from 125 to 337 mm TL (Figure 14).

Bluefish were the forth most abundant fish species and had an annual weighted CPUE of 2.66 individuals per sample in 2009 (Table 19). Bluefish had a mean size of 328 mm FL and ranged from 141 to 695 mm FL (Figure 15).

Red drum was the second most abundant fish species and had an annual weighted CPUE of 3.63 individuals per sample in 2009 (Table 19). Red drum had a mean size of 421 mm FL and ranged from 263 to 749 mm FL (Figure 16).

Southern flounder was the third most abundant fish species and had an annual weighted CPUE of 3.42 individuals per sample in 2009 (Table 19). Southern flounder had a mean size of 316 mm TL and ranged from 161 to 689 mm TL (Figure 17).

Southern kingfish had an annual weighted CPUE of 0.16 individuals per sample in 2009. Only eighteen southern kingfish were caught (Table 19). The lengths ranged from 260 to 402 mm TL (Figure 18).

Spanish mackerel had an annual weighted CPUE of 0.21 individuals per sample in 2009 (Table 19). Spanish mackerel had a mean size of 416 mm FL and ranged from 230 to 538 mm FL (Figure 19).

Spot had an annual weighted CPUE of 0.42 individuals per sample in 2009 (Table 19). Spot had a mean size of 217 mm FL and ranged from 136 to 287 mm FL (Figure 20).

Spotted seatrout was the sixth most abundant fish species and had an annual weighted CPUE of 1.02 individuals per sample in 2009 (Table 19). Spotted seatrout had a mean size of 447 mm FL and ranged from 301 to 650 mm FL (Figure 21).

Striped bass had an annual weighted CPUE of 0.03 individuals per sample in 2009 (Table 19). Only three striped bass were caught with lengths ranging from 508 to 754 mm FL.

Weakfish had an annual weighted CPUE of 0.02 individuals per sample in 2009 (Table 19). Only two weakfish were caught with lengths of 285 and 369 mm FL.

New and Cape Fear Rivers Collection of Age Structures and Tagging

From May through December 15th, 2009, 879 specimens were processed and sent to the age and growth laboratory in Morehead City for analysis. Age structures (otoliths and/or scales) were taken from American shad, Atlantic croaker, bluefish, red drum, southern flounder,

southern kingfish, Spanish mackerel, spot, spotted seatrout, striped mullet, and weakfish along with fish length and weight (kg) measurements (Table 20). Age samples collected were incorporated into existing aging programs for each species. When appropriate sex and maturity stages were macroscopically determined from gonads and incorporated into existing life history programs. One striped bass and one Atlantic sturgeon were tagged in the Cape Fear River, as well as 143 red drum in the New and Cape Fear rivers. One blacktip shark (*Carcharhinus limbatus*) and one dusky shark (*Carcharhinus obscurus*) were tagged in a cooperative agreement with National Marine Fisheries Service COASTSPAN Project.

Atlantic Ocean Results:

For the Atlantic Ocean, 24 samples were completed in 2009 (3 areas twice per quarter, Table 21). The samples were stratified into three areas : Topsail, Masonboro, and Brunswick (Figure 22). In the first half of 2010, all sampling targets (n=12) have been reached.

Atlantic Ocean Environmental Data Results:

The salinities in the Atlantic Ocean averaged 31.8 ppt on the sampling days (Table 22). The highest average salinity occurred in the Spring sampling period (April-June, 33.3 ppt). The lowest average salinity occurred in the Winter sampling period (January-March, 28.8 ppt). The average temperature was 18.9 ^{o}C. The highest average temperature occurred in the Summer sampling period (July-September, 28.7 ^{o}C). The lowest average temperature occurred in the Winter sampling period (10.5 ^{o}C). The average dissolved oxygen level was 7.3 mg/L. The highest mean dissolved oxygen level occurred in Fall period (9.5 mg/L). The lowest mean dissolved oxygen occurred in Spring sampling period (5.6 mg/L).

Atlantic Ocean Species Composition:

A total of 2,820 individuals was captured in 2009 including individuals from 53 fish species (Tables 23). Spiny dogfish accounted for the greatest number of individuals (1036). Bluefish accounted for the highest number of individuals for the targeted species (273). Totals for the other targeted species included: Atlantic croaker (29), southern flounder (6), southern kingfish (139), Spanish mackerel (71), spot (52), spotted seatrout (2), and weakfish (57). Sharks and rays accounted for 1,557 individuals (55.2%). Invertebrate species of interest included: horseshoe crab (11) and white shrimp (4). Other species of interest included black sea bass (2), Gulf flounder (1), smooth dogfish (97), summer flounder (4). Several sea birds were also incidentally captured including common loon (15) and double-crested cormorant (2).

Atlantic Ocean Gill Net Mortality and Regulatory Bycatch:

Very few target species were observed in the large mesh gill nets (18 fish, Table 24). The small mesh gill nets captured 628 individuals of the targeted species (Table 25). Gill net mortality in small mesh gill nets varied by species but most species had an at net mortality rate greater than 50%. Atlantic croaker caught in the small mesh gillnets had the highest mortality rate during the summer (58%) and lowest rate in the fall (0%). No Atlantic croaker were caught in the large mesh gillnets. Bluefish caught had the highest mortality rates in the fall (98%) and in the spring (88%) and relatively high rate in the summer (83%). Soak times in the spring and summer are shorter than the fall and summer. Only seven legal southern flounder were caught; no mortalities were observed across seasons and gear. Only three southern kingfish were caught

in the spring and experienced 100% mortality; however the majority of the catch was landed in the fall with a mortality rate of 61%. Spanish mackerel experienced 100% mortality rates over all seasons. Spot had lowest mortality rate in the summer (64%) and increased to 80% in the fall. Only two spotted seatrout were caught and experienced no mortality in the fall. Weakfish had a mortality rate of 38% in the fall.

A total of 34 fish were below legal size limits for three of the targeted species (southern flounder, Spanish mackerel, and weakfish). Sub-legal southern flounder experienced no mortality at the net. Only three sub-legal Spanish mackerel were caught, 100% mortality was observed in the spring and summer. Sub-legal weakfish were caught in large (6 fish) and small mesh gillnets (24 fish). Sub-legal weakfish mortality rates ranged from 80 to 100% in the large mesh gillnets and 59 to 100% in the small mesh gillnets.

Atlantic Ocean Weighted CPUE Estimates and Weighted Size Class Distribution:

No American shad were caught in ocean.

Atlantic croaker had an annual weighted CPUE of 0.97 individuals per sample (Table 26). Atlantic croaker had a mean size of 215 mm TL and ranged from 144 to 252 mm TL (Figure 23).

Bluefish were the third most abundant fish species and had an annual weighted CPUE of individuals per 8.96 sample (Table 26). Bluefish had a mean size 277 mm FL and ranged from 198 to 395 mm FL (Figure 24).

No red drum were caught in the ocean.

Southern flounder had an annual weighted CPUE of 0.23 individuals per sample (Table 26). Southern flounder had a mean size of 357 mm TL ranged from 201 to 427 mm TL (Figure 25).

Southern kingfish were the sixth most abundant fish species and had an annual weighted CPUE of 3.86 individuals per sample (Table 26). Southern kingfish had a mean size of 287 mm TL and ranged from 241 to 346 mm TL (Figure 26).

Spanish mackerel were the eighth most abundant fish species and had an annual weighted CPUE of 2.82 individuals per sample (Table 26). Spanish mackerel had a mean size of 380 mm FL and ranged from 283 to 551 mm FL (Figure 27).

Spot were the tenth most abundant fish species and had an annual weighted CPUE of 2.25 individuals per sample (Table 26). Spot had a mean size of 187 mm FL and ranged from 170 to 223 mm FL (Figure 28).

Spotted seatrout had an annual weighted CPUE of 0.11 individuals per sample (Table 27). Two spotted seatrout were caught at 291 and 296 mm FL.

No striped bass were caught in the ocean.

Weakfish were the ninth most abundant fish species and had an annual weighted CPUE of 1.88 individuals per sample (Table 26). Weakfish had a mean size of 250 mm Fl and ranged from 167 to 330 mm FL (Figure 29).

Atlantic Ocean Collection of Age Structures and Tagging

From May through December 2009, 286 specimens were processed and sent to the age and growth laboratory in Morehead City for analysis. Age structures (otoliths and/or scales) were taken from Atlantic croaker, bluefish, Gulf flounder, southern flounder, southern kingfish, Spanish mackerel, spot, spotted seatrout, striped mullet, and weakfish along with fish length and weight (kg) measurements (Table 27). Age samples collected were incorporated into existing aging programs for each species. When appropriate sex and maturity stages were macroscopically determined from gonads and incorporated into existing life history programs.

Neither red drum nor striped bass were captured or tagged in the ocean. Two spinner sharks (*Carcharhinus brevipinna*), two blacktip sharks (*Carcharhinus limbatus*), and two bonnethead sharks (*Sphyrna tiburo*) were tagged in a cooperative agreement with National Marine Fisheries Service COASTSPAN Project. Four Atlantic sturgeon were tagged in the Atlantic Ocean off Brunswick County.

Sea Turtle Interactions:

In July 2009, one loggerhead turtle was caught and released with no signs of injury in the Pamlico River. In August 2009, one loggerhead turtle was caught and released with no signs of injury in the New River. To minimize future interactions and limit future alterations of sampling, sampling protocol in the Southern Region and Atlantic Ocean was changed to have staff in close proximity of the gillnets while nets were set. Staff remains with gill nets from June through September to immediately remove any sea turtles entangled in gill nets.

Deviations:

Pamlico/Pungo and Neuse Rivers:
None, all sampling requirements were successfully completed.

New and Cape Fear Rivers:
In April 2009 the sampling regime for the New River was deviated from due to budget restrictions.

Atlantic Ocean:
None, all sampling requirements were successfully completed.

Planned Activities:

Neuse, Pamlico, and Pungo Rivers:
Completion of 32 samples each month, equipment maintenance, data recording and quality control measures, review, and analysis of 2010 data to be reported in 2011 CRFL Progress Report.

New and Cape Fear Rivers:
Completion of 12 samples each month, equipment maintenance, data recording and quality control measures, review, and analysis of 2010 data to be reported in 2011 CRFL Progress Report.

Atlantic Ocean:
Completion of 6 samples quarterly, equipment maintenance, data recording and quality control measures, review, and analysis of 2010 data to be reported in 2011 CRFL Progress Report.

Benefits:

The Fisheries Reform Act of North Carolina requires that North Carolina develop fishery management plans for all commercially and recreationally significant species. The primary benefit of this kind of survey will be realized in the development of fishery management plans once enough years of data are collected to develop long-term indices of abundance. This project will provide independent data to tune and calibrate stock assessments, provide age samples to describe age composition, estimate length and age at maturity, describe species habitat utilization patterns, and define management units for fishery management plans. Data from this project have been used in the development of a state FMP for spotted seatrout and will be used in upcoming FMP revisions for estuarine striped bass, southern flounder and blue crabs. Recent Atlantic States Marine Fisheries Commission (ASMFC) stock assessments for Atlantic croaker and red drum have incorporated FIA indices into their assessments. Annual abundance indices are now provided as part of the ASMFC compliance reports for horseshoe crabs, Atlantic sturgeon, bluefish, red drum, and weakfish.

Habitat data, which includes distance from shore, presence or absence of sea grass or shell, and substrate type, have been recorded during this study. Habitat data of this type is an important factor in the Division's analysis to establish Strategic Habitat Areas (SHA) designations. This study has documented capture location and habitat data from 162 samples in 2009 that captured over 80 species of fish and several species of invertebrates. The SHA designation process can combine abundance data with habitat maps to determine the benefit of protecting certain habitats. Currently SHAs are being designated using the MARXAN program which utilizes decision-based algorithms. The more data that can be provided to the model, the more likely the results of the model will accomplish the goals of establishing the SHA designation process.

Age and growth studies of several species and tagging studies have been benefited by this program. Aging samples were collected over a wide area and broad time frame to provide information on age composition, seasonal growth patterns, sex ratios, and seasonal maturity throughout the state. Tagging studies conducted in North Carolina now have consistent sampling effort to mark and recapture a variety of fishes including Atlantic sturgeon, red drum, striped bass, and a variety of shark species. This information can be used to describe migration patterns for these species as well as define stock structure and management units for North Carolina and federal fishery management plans. Although the current time frame only encompasses three years of data for the FIA program, overtime the data collected in FIA program will provide North Carolina with a sampling program to provide critical data for successful and sustainable fisheries management.

Table 1. Number of gill net samples collected from February 2009 - June 2010, in Pamlico/Pungo and Neuse rivers, NC. A sample consisted of an array (240-yards) of nets set for 12 hours. Results are broken down by region, area, and depth (shallow ≤6 ft and deep >6 ft).

			Pamlico/Pungo rivers					Neuse River				
			Area					Area				
Year	Month	Stratum	1	2	3	4	All	1	2	3	4	All
2009	Feb	Shallow	1	1	1	1	4	1	1	1	1	4
		Deep	1	1	1	1	4	1	1	1	1	4
	Mar	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Apr	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	May	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Jun	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Jul	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Aug	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Sep	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Oct	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Nov	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Dec	Shallow	1	1	1	1	4	1	1	1	1	4
		Deep	1	1	1	1	4	1	1	1	1	4
	All	Shallow	20	20	20	20	80	20	20	20	20	80
		Deep	20	20	20	20	80	20	20	20	20	80
	Total		40	40	40	40	160	40	40	40	40	160
2010	Feb	Shallow	1	1	1	1	4	1	1	1	1	4
		Deep	1	1	1	1	4	1	1	1	1	4
	Mar	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Apr	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	May	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
	Jun	Shallow	2	2	2	2	8	2	2	2	2	8
		Deep	2	2	2	2	8	2	2	2	2	8
2010	All	Shallow	9	9	9	9	36	9	9	9	9	36
		Deep	9	9	9	9	36	9	9	9	9	36
	Total		18	18	18	18	72	18	18	18	18	72

Table 2. Environmental data collected during 2009 by river (Pamlico/Pungo and Neuse rivers) and month from the Fisheries Independent Assessment Program.

			Salinity (ppt)			DO (mg/L)			Temp. (°C)		
Year	River	Month	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
2009	Neuse	Feb	11.8	6.0	18.0	11.8	9.6	13.5	8.8	6.6	11.1
		Mar	8.4	0.1	16.3	10.3	2.7	14.5	11.7	6.7	16.5
		Apr	7.5	0.7	17.8	7.1	1.2	10.1	19.4	13.4	25.7
		May	11.7	3.5	18.3	5.6	2.0	9.8	22.2	18.4	24.9
		Jun	11.9	4.1	18.1	5.1	0.1	9.5	26.3	23.6	30.8
		Jul	15.6	11.0	19.1	5.1	1.5	7.3	27.6	25.7	29.9
		Aug	14.3	4.6	19.7	6.8	0.1	14.9	29.0	26.9	32.6
		Sep	14.7	4.9	21.2	5.4	0.2	10.4	25.6	22.9	29.0
		Oct	14.6	10.5	20.7	6.7	4.4	9.9	19.4	14.0	22.5
		Nov	12.8	3.1	23.0	8.6	2.8	13.0	17.4	14.8	19.8
		Dec	10.8	2.8	16.7	8.8	6.0	10.8	13.3	11.7	14.7
All			12.3	0.1	23.0	7.1	0.1	14.9	21.0	6.6	32.6
2009	Pamlico/Pungo	Feb	13.4	3.0	18.8	10.1	9.1	13.4	8.1	3.0	9.9
		Mar	10.1	1.6	18.1	9.7	6.0	13.1	12.0	5.4	16.2
		Apr	10.2	3.0	16.5	7.4	0.4	12.0	19.0	12.2	26.2
		May	9.7	3.3	14.3	6.2	0.1	11.1	22.6	18.6	26.2
		Jun	10.6	2.2	16.4	4.7	1.3	8.1	27.1	24.6	30.0
		Jul	14.5	11.5	16.8	5.2	3.3	8.1	27.4	25.1	30.3
		Aug	12.6	9.7	16.3	5.3	0.4	10.0	29.1	26.7	32.7
		Sep	15.2	9.7	19.5	7.1	1.1	11.9	25.5	21.4	28.5
		Oct	15.5	9.0	19.3	9.5	3.2	14.0	19.4	11.6	23.9
		Nov	14.3	2.8	21.1	7.0	4.5	9.4	16.6	15.1	18.4
		Dec	11.0	0.1	17.2	8.5	6.7	9.9	11.6	9.2	13.4
All			12.5	0.1	21.1	7.1	0.1	14.0	20.9	3.0	32.7

Table 3. Species composition from Pamlico/Pungo and Neuse rivers from the Fisheries Independent Assessment Program for 2009 (n=320).

		Number		Biomass (kg)	
Species	Common Name	Total	Percent	Total	Percent
Brevoortia tyrannus	Atlantic menhaden	12,410	54.3	1,250.0	15.5
Pomatomus saltatrix	bluefish	1,784	7.8	672.9	8.3
Dorosoma cepedianum	gizzard shad	1,562	6.8	812.5	10.1
Rhinoptera bonasus	cownose ray	1,107	4.8	.	.
Lepisosteus osseus	longnose gar	991	4.3	1,855.8	23.0
Mugil cephalus	striped mullet	870	3.8	564.5	7.0
Paralichthys lethostigma	southern flounder	658	2.9	297.2	3.7
Sciaenops ocellatus	red drum	557	2.4	889.9	11.0
Callinectes sapidus	blue crab	482	2.1	83.3	1.0
Micropogonias undulatus	Atlantic croaker	344	1.5	90.1	1.1
Leiostomus xanthurus	spot	339	1.5	70.7	0.9
Morone saxatilis	striped bass	332	1.5	450.6	5.6
Cynoscion nebulosus	spotted seatrout	316	1.4	283.4	3.5
Alosa mediocris	hickory shad	250	1.1	132.7	1.6
Scomberomorus maculatus	Spanish mackerel	189	0.8	114.4	1.4
Morone americana	white perch	96	0.4	34.9	0.4
Ameiurus catus	white catfish	89	0.4	88.3	1.1
Lagodon rhomboides	pinfish	88	0.4	7.6	0.1
Alosa sapidissima	American shad	46	0.2	56.9	0.7
Pogonias cromis	black drum	41	0.2	54.9	0.7
Elops saurus	ladyfish	38	0.2	8.5	0.1
Cynoscion regalis	weakfish	35	0.2	21.2	0.3
Amia calva	bowfin	31	0.1	65.4	0.8
Moxostoma	Moxostoma suckers	27	0.1	34.2	0.4
Dasyatis sabina	Atlantic stingray	26	0.1	.	.
Bairdiella chrysoura	silver perch	19	0.1	1.4	<0.1
Micropterus salmoides	largemouth bass	17	0.1	14.2	0.2
Archosargus probatocephalus	sheepshead	15	0.1	7.1	0.1
Peprilus alepidotus	harvestfish	12	0.1	2.3	<0.1
Trinectes maculatus	hogchoker	10	<0.1	0.8	<0.1
Alosa pseudoharengus	alewife	9	<0.1	2.0	<0.1
Menticirrhus americanus	southern kingfish	9	<0.1	2.5	<0.1
Ictalurus punctatus	channel catfish	7	<0.1	11.9	0.1
Petromyzon marinus	sea Lamprey	6	<0.1	0.2	<0.1
Cyprinus carpio	common carp	6	<0.1	31.6	0.4
Trachinotus carolinus	Florida pompano	5	<0.1	0.8	<0.1
Limulus polyphemus	horseshoe crab	4	<0.1	5.6	0.1

Table 3 (cont.)

		Number		Biomass (kg)	
Species	Common Name	Total	Percent	Total	Percent
Farfantepenaeus aztecus	brown shrimp	4	<0.1	0.1	<0.1
Chaetodipterus faber	Atlantic spadefish	4	<0.1	0.9	<0.1
Litopenaeus setiferus	white shrimp	2	<0.1	0.2	<0.1
Ictalurus furcatus	blue catfish	2	<0.1	4.9	0.1
Pylodictus olivaris	flathead catfish	2	<0.1	4.9	0.1
Chelydra serpentina	common snapping turtle	2	<0.1	21.0	0.3
Ascipenser oxyrhynchus	Atlantic sturgeon	1	<0.1	2.5	<0.1
Anchoa mitchilli	bay anchovy	1	<0.1	0.0	<0.1
Synodus foetens	inshore lizardfish	1	<0.1	0.2	<0.1
Moxostoma anisurum	silver redhorse	1	<0.1	0.4	<0.1
Ameiurus natalis	yellow bullhead	1	<0.1	1.0	<0.1
Ameiurus nebulosus	brown bullhead	1	<0.1	1.0	<0.1
Prionotus carolinus	northern searobin	1	<0.1	0.1	<0.1
Lepomis gibbosus	pumpkinseed	1	<0.1	0.1	<0.1
Perca flavescens	yellow perch	1	<0.1	0.2	<0.1
Orthopristis chrysoptera	pigfish	1	<0.1	0.4	<0.1
Larimus fasciatus	banded drum	1	<0.1	0.2	<0.1
Astroscopus spp.	Astroscopus stargazers	1	<0.1	0.4	<0.1
Paralichthys dentatus	summer flounder	1	<0.1	0.5	<0.1
Chrysemys scripta	yellowbelly turtle	1	<0.1	2.8	<0.1
Trachemys scripta	common slider	1	<0.1	1.3	<0.1
Caretta caretta	loggerhead	1	<0.1	.	.
Alligator mississipiensis	American alligator	1	<0.1	4.8	0.1
Podylimbus podiceps	pied billed grebe	1	<0.1	.	.
Phalacrocorax Auritus	double-crested cormorant	1	<0.1	.	.
Aythya Affinis	lesser scaup duck	1	0.0	0.9	<0.1
Cnidaria	jellyfish	.	.	.	.

Table 4. Species abundance and weighted CPUE (# fish per sample) by region (Pamlico/Pungo and Neuse rivers) and water depth for target species from Fisheries Independent Assessment Program in 2009. Shallow ≤ 6 feet and deep > 6 feet.

		Shallow[1]			Deep[1]			Combined[2]		
Common name	River	Total number	CPUE	PSE	Total number	CPUE	PSE	Total number	CPUE	PSE
American shad	Neuse	7	0.88	65	8	0.10	66	15	0.09	44
	Pamlico/Pungo	14	0.18	67	17	0.21	29	31	0.19	37
	Combined	21	0.14	50	25	0.16	25	46	0.15	27
Atlantic croaker	Neuse	126	1.58	22	4	0.05	49	130	0.87	21
	Pamlico/Pungo	200	2.50	22	14	0.18	54	214	1.42	21
	Combined	326	2.08	16	18	0.12	42	344	1.17	16
Bluefish	Neuse	225	2.81	34	1160	14.50	35	1,385	8.22	29
	Pamlico/Pungo	56	0.70	29	343	4.29	28	399	2.36	24
	Combined	281	1.65	27	1503	8.88	27	1,784	5.00	22
Red drum	Neuse	285	3.56	15	23	0.29	27	308	2.05	14
	Pamlico/Pungo	238	2.98	17	11	0.14	46	249	1.66	16
	Combined	523	3.24	11	34	0.20	25	557	1.83	11
Southern flounder	Neuse	242	3.03	22	35	0.44	26	277	1.83	20
	Pamlico/Pungo	305	3.81	15	76	0.95	20	381	2.49	13
	Combined	547	3.46	13	111	0.72	17	658	2.19	11
Southern kingfish	Neuse	0	0.00	.	7	0.09	55	7	0.04	50
	Pamlico/Pungo	0	0.00	.	2	0.03	70	2	0.01	100
	Combined	0	0.00	.	9	0.05	40	9	0.02	50
Spanish mackerel	Neuse	0	0.00	.	99	1.24	45	99	0.57	46
	Pamlico/Pungo	1	0.01	100	89	1.11	29	90	0.52	29
	Combined	1	0.01	100	188	1.17	26	189	0.54	26
Spot	Neuse	142	1.78	18	31	0.39	25	173	1.13	16
	Pamlico/Pungo	151	1.89	21	15	0.19	30	166	1.10	20
	Combined	293	1.84	15	46	0.28	18	342	1.11	13
Spotted seatrout	Neuse	63	0.79	25	73	0.91	38	136	0.85	22
	Pamlico/Pungo	97	1.21	38	83	1.04	26	180	1.13	25

Table 4 (cont.)

Common name	River	Shallow[1]			Deep[1]			Combined[2]		
		Total number	CPUE	PSE	Total number	CPUE	PSE	Total number	CPUE	PSE
	Combined	160	1.02	26	156	0.98	21	316	1.00	17
Striped bass	Neuse	88	1.10	28	54	0.68	49	142	0.90	26
	Pamlico/Pungo	138	1.73	19	44	0.55	35	182	1.18	16
	Combined	226	1.44	16	98	0.61	30	324	1.06	14
Weakfish	Neuse	12	0.15	43	15	0.19	38	27	0.17	29
	Pamlico/Pungo	4	0.05	49	4	0.05	49	8	0.05	40
	Combined	16	0.10	30	19	0.11	27	35	0.10	20

1- 80 shallow and 80 deep samples collected and 160 deep samples collected from combined systems
2- 160 samples from the Neuse and 160 samples from the Pamlico/Pungo, 320 combined samples collected during sampling period

Table 5. Mortality rates for target species at net retrieval (12 hour soak times) in large mesh gill nets (≥5" stretch mesh) for 2009 in the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar). *

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	8	100	.	.	.	.
	Atlantic croaker	3	33	.	.	.	.
	Bluefish	80	91	.	.	.	.
	Red drum	44	14	9	0	6	0
	Southern flounder	103	0	54	0	.	.
	Southern kingfish	1	0	.	.	.	.
	Spanish mackerel	1	100	0	.	.	.
	Spot	5	60	.	.	.	.
	Spotted seatrout	14	36	0	.	.	.
	Striped bass	44	68	1	0	.	.
	Weakfish	3	33	1	0	.	.
Summer	American shad	0	.	.	.	.	.
	Atlantic croaker	18	18	.	.	.	.
	Bluefish	488	84	.	.	.	.
	Red drum	53	34	10	20	5	60
	Southern flounder	134	14	50	14	.	.
	Southern kingfish	3	100	.	.	.	.
	Spanish mackerel	6	100	2	100	.	.
	Spot	4	25	.	.	.	.
	Spotted seatrout	5	60	0	.	.	.
	Striped bass	15	73	2	50	.	.
	Weakfish	3	67	1	100	.	.
Winter	American shad	15	80	.	.	.	.
	Atlantic croaker	0	.	.	.	.	.
	Bluefish	1	100	.	.	.	.
	Red drum	15	27	7	14	0	.
	Southern flounder	28	0	16	0	.	.
	Southern kingfish	0	.	.	.	.	.
	Spanish mackerel	0	.	.	.	.	.
	Spot	0	.	.	.	.	.
	Spotted seatrout	2	0	0	.	.	.
	Striped bass	37	27	1	0	.	.
	Weakfish	1	100	0	.	.	.

*Size Limits
No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 14" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum (12" TL minimum prior to 9/2009); Striped bass – 18" TL minimum, Spanish mackerel-12" FL minimum

Table 6. Mortality rates for target species at net retrieval (12 hour soak times) in small mesh gill nets (<5" stretch mesh) for 2009 in the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers). Mortality rates are reported overall and for regulatory discards due to size limits*. Separate mortality rates are reported for the three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	6	67	.	.	.	.
	Atlantic croaker	36	25	.	.	.	.
	Bluefish	222	86	.	.	.	.
	Red drum	218	45	166	45	2	0
	Southern flounder	93	2	80	3	.	.
	Southern kingfish	3	33	.	.	.	.
	Spanish mackerel	8	88	0	.	.	.
	Spot	151	19	.	.	.	.
	Spotted seatrout	206	57	0 (8)†	0 (62) †	.	.
	Striped bass	126	60	72	63	.	.
	Weakfish	15	80	2	100	.	.
Summer	American shad	0	.	.	.	.	.
	Atlantic croaker	241	53	.	.	.	.
	Bluefish	773	90	.	.	.	.
	Red drum	158	61	75	59	9	11
	Southern flounder	282	28	258	29	.	.
	Southern kingfish	2	100	.	.	.	.
	Spanish mackerel	174	99	3	100	.	.
	Spot	154	32	.	.	.	.
	Spotted seatrout	75	75	2 (12) †	50 (75) †	.	.
	Striped bass	55	84	23	91	.	.
	Weakfish	10	91	1	100	.	.
Winter	American shad	9	67	.	.	.	.
	Atlantic croaker	1	100	.	.	.	.
	Bluefish	1	0	.	.	.	.
	Red drum	65	32	60	30	0	.
	Southern flounder	13	0	13	0	.	.
	Southern kingfish	0	.	.	.	.	.
	Spanish mackerel	0	.	.	.	.	.
	Spot	0	.	.	.	.	.
	Spotted seatrout	13	31	0	.	.	.
	Striped bass	47	34	19	47	.	.
	Weakfish	2	100	0	.	.	.

*Size Limits
No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 14" TL minimum; Weakfish – 12" TL minimum; †Spotted seatrout – 14" TL minimum (12" TL minimum prior to 9/2009); Striped bass – 18" TL minimum, Spanish mackerel-12" FL minimum

Table 7. Annual weighted CPUE, total number collected (n), mean size (mm), and size range (mm) for target species during 2009 in the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers).

Common name	CPUE	PSE	Number	Mean size (mm)	Size range (mm)
American shad	0.15	27	46	426	293-473
Atlantic croaker	1.17	16	344	254	104-365
Bluefish	5.00	22	1,784	277	109-808
Red drum	1.83	11	557	456	220-1,250
Southern flounder	2.19	11	658	320	120-529
Southern kingfish	0.02	50	9	283	234-342
Spanish mackerel	0.54	26	189	390	178-568
Spot	1.11	13	342	221	85-330
Spotted seatrout	1.00	17	316	424	230-660
Striped bass	1.06	14	324	453	178-655
Weakfish	0.10	20	35	364	218-511

Table 8. Number of specimens collected from the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) for age determination by species in 2009.

Species	Neuse	Pamlico/Pungo	Total
American shad	11	21	32
Atlantic croaker	38	43	81
Bluefish	16	13	29
Northern kingfish	0	0	0
Red drum	34	45	79
Summer flounder	1	0	1
Southern flounder	40	72	112
Southern kingfish	2	0	2
Spanish mackerel	13	18	31
Spot	50	35	85
Spotted seatrout	67	93	160
Striped bass	13	26	39
Striped mullet	25	18	43
Weakfish	20	3	23
Total	330	387	717

Table 13. Gill net samples collected from February 2009 – June 2010, in New and Cape Fear rivers, NC. A sample consisted of an array (240-yards) of nets set. Results are broken down by river, area, and depth (shallow <6 ft and deep >6 ft).

			New River			Cape Fear	
			Area			Area	
Year	Month	Stratum	1	2	All	1	All
2009	Feb	Shallow	1	1	2	2	2
		Deep	1	1	2		
	Mar	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Apr	Shallow	1	1	2	6	6
		Deep	1	1	2		
	May	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Jun	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Jul	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Aug	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Sep	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Oct	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Nov	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Dec	Shallow	1	1	2	2	2
		Deep	1	1	2		
	All	Shallow	19	19	38	42	42
		Deep	19	19	38		
	Total		38	38	76	42	42
2010	Feb	Shallow	1	1	2	2	2
		Deep	1	1	2		
	Mar	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Apr	Shallow	2	2	4	4	4
		Deep	2	2	4		
	May	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Jun	Shallow	2	2	4	4	4
		Deep	2	2	4		
	Total		18	18	36	18	18

Table 14. Environmental data collected during 2009 for New and Cape Fear rivers by month from the Fisheries Independent Assessment Program.

			Salinity (ppt)			DO (mg/L)			Temp. (°C)		
River	Year	Season	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
New	2009	Feb	15.0	7.4	20.8	9.0	7.8	9.9	9.3	7.8	10.8
		Mar	19.6	10.6	31.2	7.3	4.8	10.3	16.1	13.5	19.2
		Apr	19.0	11.9	29.8	6.5	5.1	7.9	19.8	18.3	21.2
		May	18.6	13.2	31.2	6.2	4.3	7.6	22.6	19.5	25.0
		Jun	19.3	11.1	26.4	5.3	3.0	7.1	28.6	25.9	31.2
		Jul	20.2	11.0	30.8	5.1	3.3	7.5	29.5	27.9	31.0
		Aug	13.3	8.0	17.8	5.3	1.5	8.2	30.4	28.6	32.9
		Sep	17.1	4.1	30.5	6.2	3.2	8.7	25.2	23.6	26.5
		Oct	14.6	9.2	23.6	7.6	5.0	11.0	19.0	13.7	23.3
		Nov	14.0	3.5	24.2	8.7	7.4	11.0	17.2	15.4	19.0
		Dec	6.9	3.1	10.0	10.9	9.9	12.1	11.9	8.6	14.2
	All		16.6	3.1	31.2	6.8	1.5	12.1	22.0	7.8	32.9
Cape Fear	2009	Feb	14.2	11.1	15.9	8.7	8.1	9.2	11.2	10.5	12.0
		Mar	8.4	4.8	12.0	9.8	8.2	11.5	10.9	8.0	12.9
		Apr	13.7	2.4	28.7	6.7	5.6	9.5	20.6	15.7	24.4
		May	18.0	11.1	23.5	6.0	5.1	7.5	24.7	23.5	26.4
		Jun	14.2	10.7	20.0	5.0	4.3	6.0	28.1	26.8	29.1
		Jul	22.3	16.4	29.8	4.8	4.2	5.5	28.3	27.2	29.2
		Aug	22.1	13.5	31.5	5.5	4.8	6.7	30.0	29.2	30.9
		Sep	15.8	12.1	21.5	5.1	3.7	7.0	25.8	23.1	28.2
		Oct	17.9	12.3	21.8	7.4	6.0	8.4	21.6	19.8	23.3
		Nov	16.4	6.7	28.4	8.2	5.2	8.8	17.5	15.4	19.5
		Dec	6.4	3.6	10.8	7.6	6.9	8.5	13.6	13.3	14.1
	All		15.8	2.4	31.5	6.6	3.7	11.5	21.9	8.0	30.9
Combined	2009	Feb	14.8	7.4	20.8	8.9	7.8	9.9	9.9	7.8	12.0
		Mar	15.8	4.8	31.2	8.0	4.8	11.5	14.4	8.0	19.2
		Apr	15.8	2.4	29.8	6.6	5.1	9.5	20.3	15.7	24.4
		May	18.4	11.1	31.2	6.2	4.3	7.6	23.3	19.5	26.4
		Jun	17.6	10.7	26.4	5.2	3.0	7.1	28.4	25.9	31.2
		Jul	20.9	11.0	30.8	5.0	3.3	7.5	29.1	27.2	31.0
		Aug	16.2	8.0	31.5	5.3	1.5	8.2	30.2	28.6	32.9
		Sep	16.7	4.1	30.5	5.8	3.2	8.7	25.4	23.1	28.2
		Oct	15.7	9.2	23.6	7.6	5.0	11.0	19.9	13.7	23.3
		Nov	14.8	3.5	28.4	8.6	5.2	11.0	17.3	15.4	19.5
		Dec	6.7	3.1	10.8	9.8	6.9	12.1	12.5	8.6	14.2
	All		16.3	2.4	31.5	6.7	1.5	12.1	22.0	7.8	32.9

Table 15. Species compositions observed in the Fisheries Independent Assessment Program from the New and Cape Fear rivers during 2009 (n=64).

		Number		Biomass (kg)	
Species	Common Name	Total	Percent	Total	Percent
Brevoortia tyrannus	Atlantic menhaden	1,810	37.9	137.5	6.5
Callinectes sapidus	blue crab	623	13.1	89.0	4.2
Sciaenops ocellatus	red drum	435	9.1	435.2	20.5
Paralichthys lethostigma	southern flounder	410	8.6	170.6	8
Pomatomus saltatrix	bluefish	320	6.7	181.6	8.6
Mugil cephalus	striped mullet	188	3.9	113.6	5.4
Cynoscion nebulosus	spotted seatrout	119	2.5	119.3	5.6
Rhizoprionodon terraenovae	Atlantic sharpnose shark	106	2.2	36.6	1.7
Micropogonias undulatus	Atlantic croaker	94	2	14.1	0.7
Dorosoma cepedianum	gizzard shad	74	1.6	37.8	1.8
Pogonias cromis	black drum	63	1.3	75.9	3.6
Elops saurus	ladyfish	59	1.2	44.9	2.1
Lepisosteus osseus	longnose gar	55	1.2	128.7	6.1
Sphyrna tiburo	bonnethead shark	52	1.1	250.7	11.8
Leiostomus xanthurus	spot	50	1	8.7	0.4
Gymnura micrura	smooth butterfly ray	44	0.9	18.8	0.9
Majidae	spider crabs	28	0.6	4	0.2
Scomberomorus maculatus	Spanish mackerel	26	0.5	20.9	1
Dasyatis sabina	Atlantic stingray	23	0.5	18.8	0.9
Archosargus probatocephalus	sheepshead	21	0.4	18.4	0.9
Lagodon rhomboides	pinfish	18	0.4	1.7	0.1
Menticirrhus americanus	southern kingfish	18	0.4	7.7	0.4
Chaetodipterus faber	Atlantic spadefish	11	0.2	2.5	0.1
Malaclemys terrapin	diamondback turtle	10	0.2	3.9	0.2
Limulus polyphemus	horseshoe crab	9	0.2	18.1	0.9
Alosa mediocris	hickory shad	8	0.2	3.5	0.2
Caranx hippos	crevalle jack	8	0.2	2.3	0.1
Paralichthys dentatus	summer flounder	6	0.1	2.1	0.1
Dasyatis say	bluntnose stingray	5	0.1	20.1	0.9
Rhinoptera bonasus	cownose ray	5	0.1	6.1	0.3
Ictalurus furcatus	blue catfish	5	0.1	11.6	0.5
Trachinotus carolinus	Florida pompano	5	0.1	5.8	0.3
Lobotes surinamensis	tripletail	5	0.1	10.4	0.5
Carcharhinus plumbeus	sandbar shark	4	0.1	6.8	0.3
Rachycentron canadum	cobia	4	0.1	3.2	0.2

Continued

		Number		Biomass (kg)	
Species	Common Name	Total	Percent	Total	Percent
Selene vomer	lookdown	4	0.1	0.3	<0.1
Orthopristis chrysoptera	pigfish	4	0.1	0.9	<0.1
Podilymbus podiceps	pied billed grebe	4	0.1	*	*
Carcharhinus limbatus	blacktip shark	3	0.1	11.8	0.6
Morone saxatilis	striped bass	3	0.1	12.2	0.6
Selene setapinnis	Atlantic moonfish	3	0.1	0.1	<0.1
Peprilus alepidotus	harvestfish	3	0.1	0.2	<0.1
Cancer irroratus	Atlantic rock crab	2	<0.1	0.5	<0.1
Menippe mercenaria	Florida stone crab	2	<0.1	0.5	<0.1
Dasyatis americana	southern stingray	2	<0.1	2.8	0.1
Cynoscion regalis	weakfish	2	<0.1	0.8	<0.1
Penaeus setiferus	white shrimp	1	<0.1	0.02	<0.1
Callinectes similis	lesser blue crab	1	<0.1	0.05	<0.1
Ginglymostoma cirratum	nurse shark	1	<0.1	44.7	2.1
Carcharhinus obscurus	dusky shark	1	<0.1	2.3	0.1
Sphyrna zygaena	smooth hammerhead	1	<0.1	2.5	0.1
Acipenser oxyrhynchus	Atlantic sturgeon	1	<0.1	1.4	0.1
Amia calva	bowfin	1	<0.1	1.2	0.1
Megalops atlanticus	tarpon	1	<0.1	3.2	0.2
Anguilla rostrata	American eel	1	<0.1	0.2	<0.1
Alosa sapidissima	American shad	1	<0.1	1.2	0.1
Alosa aestivalis	blueback herring	1	<0.1	0.1	<0.1
Ameiurus catus	white catfish	1	<0.1	0.9	<0.1
Bagre marinus	gafftopsail catfish	1	<0.1	1	<0.1
Bairdiella chrysoura	silver perch	1	<0.1	0.1	<0.1
Trinectes maculatus	hogchoker	1	<0.1	0.1	<0.1
Caretta caretta	loggerhead	1	<0.1	*	*
Gavia Immer	common loon	1	<0.1	2	0.1
Phalacrocorax auritus	double-crested cormorant	1	<0.1	2.2	0.1
Total		4,771	100	2,123.2	100

*Noted but count and/or weight was not recorded.

Table 16. Species abundance and weighted CPUE (# fish per sample) in the Southern Region (New and Cape Fear rivers) and water depth for target species from Fisheries Independent Assessment Program in 2009. Shallow ≤ 6 feet and deep > 6 feet.

		Shallow			Deep			Combined		
Common Name	River	Total Number	CPUE	PSE	Total Number	CPUE	PSE	Total Number	CPUE	PSE
American shad	New	1	0.03	100	0	0	.	1	0.01	100
	Cape Fear	0	0	.				0		
	Combined	1	0.01	100	0	0	.	1	0.01	100
Atlantic croaker	New	45	1.18	27	20	0.53	32	65	0.86	22
	Cape Fear	29	0.69	23				29	0.69	23
	Combined	74	0.93	19	20	0.53	32	94	0.79	16
bluefish	New	49	1.29	35	234	6.16	43	283	3.72	36
	Cape Fear	37	0.88	31				37	0.88	31
	Combined	86	1.08	24	234	6.16	43	320	2.66	32
red drum	New	365	9.61	24	32	0.84	60	397	5.22	24
	Cape Fear	38	0.90	39				38	0.90	39
	Combined	403	5.04	24	32	0.84	60	435	3.63	21
southern flounder	New	222	5.84	24	142	3.74	23	364	4.79	17
	Cape Fear	46	1.10	20				46	1.10	20
	Combined	268	3.35	22	142	3.74	23	410	3.42	15
southern kingfish	New	1	0.03	100	0	0	.	1	0.01	100
	Cape Fear	17	0.40	33				17	0.40	33
	Combined	18	0.23	33	0	0	.	18	0.16	31
Spanish mackerel	New	0	0	.	26	0.68	55	26	0.34	56
	Cape Fear	0	0	.				0	0	.
	Combined	0	0	.	26	0.68	55	26	0.21	57
spot	New	26	0.68	28	16	0.42	39	42	0.55	23
	Cape Fear	8	0.19	54				8	0.19	54
	Combined	34	0.43	25	16	0.42	39	50	0.42	21
spotted seatrout	New	26	0.68	45	23	0.61	27	49	0.64	27
	Cape Fear	70	1.67	22				70	1.67	22
	Combined	96	1.20	21	23	0.61	27	119	1.02	18
striped bass	New	0	0	.	0	0	.	0	0	.
	Cape Fear	3	0.07	74				3	0.07	74
	Combined	3	0.04	74	0	0	.	3	0.03	67
weakfish	New	1	0.03	100	1	0.03	100	2	0.03	70
	Cape Fear	0	0	.				0	0	.
	Combined	1	0.01	100	1	0.03	100	2	0.02	50

Table 17. Mortality rates for target species at net retrieval in large mesh gill nets (≥5" stretch mesh) for 2009 in the Fisheries Independent Assessment Program (New and Cape Fear rivers). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	0					
	Atlantic croaker	2	0				
	bluefish	20	55				
	red drum*	47	26	6	33	2	0
	southern flounder*	75	0	12	0		
	southern kingfish	1	0				
	Spanish mackerel*	0					
	spot	0					
	spotted seatrout*	7	14				
	striped bass*	1	0				
	weakfish*	1	0				
Summer	American shad	0					
	Atlantic croaker	9	50				
	bluefish	35	60				
	red drum*	38	34	5	20		
	southern flounder*	43	0	5	0		
	southern kingfish	2	100				
	Spanish mackerel*	2	100	1	100		
	spot	2	0				
	spotted seatrout*	3	67				
	striped bass*	0					
	weakfish*	0					
Winter	American shad	0					
	Atlantic croaker	0					
	bluefish	0					
	red drum*	7	14	3	0		
	southern flounder*	24	0	7	0		
	southern kingfish	0					
	Spanish mackerel*	0					
	spot	0					
	spotted seatrout*	3	67				
	striped bass*	2	0				
	weakfish*	1	100	1	100		

*Size Limits
No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 14" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum (12" TL minimum prior to 9/2009); Striped bass – No harvest in Cape Fear River and 18" TL minimum in the New River, Spanish mackerel-12" TL minimum

Table 18. Mortality rates for target species at net retrieval in small mesh gill nets (≤5" stretch mesh) for 2009 in the Fisheries Independent Assessment Program (New and Cape Fear rivers). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the three seasons spring/fall (Apr-May; Oct-Nov), summer (Jun-Sep), and winter (Dec 1-15; Feb 15-Mar).

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead	Number over legal collected	Percent over legal dead
Spring/Fall	American shad	0					
	Atlantic croaker	19	32				
	bluefish	96	69				
	red drum*	143	43	116	45		
	southern flounder*	123	12	108	12		
	southern kingfish	11	80				
	Spanish mackerel*	0					
	spot	25	26				
	spotted seatrout*	57	39				
	striped bass*	0					
	weakfish*	0					
Summer	American shad	0					
	Atlantic croaker	64	42				
	bluefish	169	72				
	red drum*	154	55	129	56		
	southern flounder*	118	5	108	5		
	southern kingfish	3	67				
	Spanish mackerel*	24	96	1	100		
	spot	22	32				
	spotted seatrout*	34	59				
	striped bass*	0					
	weakfish*	0					
Winter	American shad	0					
	Atlantic croaker	0					
	bluefish	0					
	red drum*	46	24	41	27		
	southern flounder*	27	0	22	0		
	southern kingfish	1	0				
	Spanish mackerel*	0					
	spot	1	0				
	spotted seatrout*	15	27				
	striped bass*	0					
	weakfish*	0					

*Size Limits

No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 14" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum (12" TL minimum prior to 9/2009); Striped bass – No harvest in Cape Fear River and 18" TL minimum in the New River, Spanish mackerel-12" TL minimum

Table 19. Annual weighted CPUE, total number collected (n), mean size (mm), and size range (mm) for target species during 2009 in the Fisheries Independent Assessment Program (New and Cape Fear rivers).

Year	Common name	CPUE	PSE	Number	Mean size (mm)	Size range (mm)
2009	American shad	0.01	100	1	429	429-429
	Atlantic croaker	0.79	16	94	216	125-337
	bluefish	2.66	32	320	328	141-695
	red drum	3.63	21	435	421	263-749
	southern flounder	3.42	15	410	316	161-689
	southern kingfish	0.16	31	18	335	260-402
	Spanish mackerel	0.21	57	26	416	230-538
	spot	0.42	21	50	217	136-287
	spotted seatrout	1.02	18	119	447	301-650
	striped bass	0.03	67	3	662	508-754
	weakfish	0.02	50	2	327	285-369

Table 20. Number of specimens collected from the Fisheries Independent Assessment Program (New and Cape Fear rivers) for age determination by species in 2009.

Year	Common name	Sample Number
2009	American shad	1
	Atlantic croaker	57
	bluefish	132
	red drum	138
	southern flounder	221
	southern kingfish	15
	Spanish mackerel	25
	spot	30
	spotted seatrout	110
	striped mullet	148
	weakfish	2
Total		879

Table 21. Gill net samples collected from May 2009 to June 2010 in the Atlantic Ocean. A sample consisted of an array of nets (270-yards). Results are broken down by area. Winter=January-March, Spring=April-June, Summer=July-September, Fall=October-December.

		Area			
Year	Season	Topsail	Masonboro	Brunswick	Combined
2009	Winter	2	2	2	6
	Spring	2	2	2	6
	Summer	2	2	2	6
	Fall	2	2	2	6
2010	Winter	2	2	2	6
	Spring	2	2	2	6
Total		12	12	12	36

Table 22. Environmental data collected during 2009 for the Atlantic Ocean by month from the Fisheries Independent Assessment Program. Spring=April-June, Summer=July-September, Fall=October-December.

		Salinity (ppt)			DO (mg/L)			Temperature (C)		
Area	Season	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Topsail	Winter	28.8	28.0	29.4	8.0	7.5	8.6	13.7	13.2	14.9
	Spring	32.0	31.3	32.7	5.6	5.4	5.8	26.7	25.3	27.6
	Summer	33.1	32.7	33.7	5.9	5.4	6.4	28.7	28.1	29.8
	Fall	31.0	30.4	31.4	9.5	9.2	9.7	11.8	11.4	12.1
	All	31.2	28.0	33.7	7.3	5.4	9.7	20.3	11.4	29.8
Masonboro	Winter	31.9	30.8	32.4	8.0	7.8	8.2	11.2	10.9	11.5
	Spring	33.0	32.5	21.1	6.1	5.8	6.4	21.1	20.7	21.5
	Summer	30.5	29.3	31.6	7.2	6.8	7.3	24.9	24.7	25.2
	Fall	31.5	31.3	31.8	7.6	7.3	8.0	16.9	16.7	17.2
	All	31.7	29.3	33.3	7.2	5.8	8.2	18.5	10.9	25.2
Brunswick	Winter	32.7	32.5	32.7	7.9	7.6	8.1	10.5	10.0	10.9
	Spring	33.3	33.1	33.3	5.8	5.6	5.9	24.4	24.1	25.1
	Summer	32.6	32.4	32.8	6.6	6.0	7.2	25.1	24.8	25.7
	Fall	31.7	31.0	32.0	9.5	9.4	9.6	12.0	11.8	12.3
	All	32.5	31.0	33.3	7.5	5.6	9.6	18.0	10.0	25.7
Combined	Winter	31.1	28.0	32.7	8.0	7.5	8.6	11.8	10.0	14.9
	Spring	32.8	31.3	33.3	5.8	5.4	6.4	24.1	20.7	27.6
	Summer	32.0	29.3	33.7	6.6	5.4	7.3	26.2	24.7	29.8
	Fall	31.4	30.4	32.0	8.9	7.3	9.7	13.6	11.4	17.2
	All	31.8	28.0	33.7	7.3	5.4	9.7	18.9	10.0	29.8

Table 23. Species composition from Atlantic Ocean from the Fisheries Independent Assessment Program for 2009.

		Number		Biomass (kg)	
Species	Common name	Total	Percent	Total	Percent
Squalus acanthias	spiny dogfish	1,036	36.7	2,735.1	58.1
Peprilus triacanthus	butterfish	282	10.0	26.9	0.6
Pomatomus saltatrix	bluefish	273	9.7	66.9	1.4
Rhizoprionodon terraenovae	Atlantic sharpnose	263	9.3	604.6	12.8
Brevoorita Tyrannus	Atlantic menhaden	184	6.5	33.2	0.7
Menticirrhus americanus	southern kingfish	139	4.9	22.4	0.5
Mustelus canis	smooth dogfish	97	3.4	434.65	9.2
Scomberomorus regalis	Spanish mackerel	71	2.5	38.55	0.8
Cynoscion regalis	weakfish	57	2.0	9.5	0.2
Leiostomus xanthurus	spot	52	1.8	5.45	0.1
Sphyrna tiburo	bonnethead shark	42	1.5	149.8	3.2
Raja eglanteria	clearnose skate	36	1.3	38.9	0.8
Chloroscombrus chrysurus	Atlantic bumper	36	1.3	2.6	0.1
Carcharhinus limbatus	blacktip shark	32	1.1	209.3	4.4
Micropogonias undulatus	Atlantic croaker	29	1.0	3.5	0.1
Carcharhinus acronotus	blacknose shark	26	0.9	191.5	4.1
Dorosoma petenense	threadfin shad	16	0.6	1.7	<0.1
Gavia Immer	common loon	15	0.5	*	*
Majidae	spider crab	12	0.4	1.45	<0.1
Limulus polyphemus	horseshoe crab	11	0.4	14.45	0.3
Lagodon rhomboides	pinfish	11	0.4	0.75	<0.1
Gymnura micrura	smooth butterfly ray	7	0.2	5.6	0.1
Paralichthys lethostigma	southern flounder	6	0.2	3.25	0.1
Alosa mediocris	hickory shad	5	0.2	2	<0.1
Stenotomus caprinus	longspine porgy	5	0.2	0.4	<0.1
Larimus fasciatus	banded drum	5	0.2	0.7	<0.1
Penaeus setiferus	white shrimp	4	0.1	0.2	<0.1
Dasyatis sabina	Atlantic stingray	4	0.1	3.1	0.1
Myliobatis freminvillei	bullnose ray	4	0.1	20.8	0.4
Acipenser oxyrinchus	Atlantic sturgeon	4	0.1	8.3	0.2
Peprilus paru	harvestfish	4	0.1	0.35	<0.1
Paralichthys dentatus	summer flounder	4	0.1	0.9	<0.1
Scophthalmus aquosus	windowpane flounder	4	0.1	0.5	<0.1
Portunus spinimanus	blotched crab	3	0.1	0.1	<0.1
Carcharhinus isodon	finetooth shark	3	0.1	27	0.6
Synodus foetens	inshore lizardfish	3	0.1	0.95	<0.1
Trachinotus carolinus	Florida pompano	3	0.1	1.9	<0.1
Carcharhinus brevipinna	spinner shark	2	0.1	10.3	0.2
Rhinoptera bonasus	cownose ray	2	0.1	2.25	<0.1
Urophycis earllii	Carolina hake	2	0.1	0.8	<0.1
Centropristis striata	black sea bass	2	0.1	0.45	<0.1

Continued

Species	Common name	Number		Biomass (kg)	
		Total	Percent	Total	Percent
Selene setapinnis	moonfish	2	0.1	0.2	<0.1
Orthopristis chrysoptera	pigfish	2	0.1	0.4	<0.1
Cynoscion nebulosus	spotted seatrout	2	0.1	0.55	<0.1
Phalacrocorax auritus	double crested cormorant	2	0.1	*	*
Calappa flammea	flame box crab	1	<0.1	0.2	<0.1
Arenaeus cribarius	speckled crab	1	<0.1	0.05	<0.1
Carcharhinus altimus	bignose shark	1	<0.1	9.8	0.2
Sphyrna lewini	scalloped hammerhead	1	<0.1	4	0.1
Dasyatis americana	southern stingray	1	<0.1	6.4	0.1
Urophycis spp.	hake sp.	1	<0.1	0.3	<0.1
Prionotus evolans	striped searobin	1	<0.1	0.25	<0.1
Rachycentron canadum	cobia	1	<0.1	0.4	<0.1
Echeneidae	remora	1	<0.1	0.2	<0.1
Caranx hippos	crevalle jack	1	<0.1	0.45	<0.1
Caranx crysos	blue runner	1	<0.1	0.4	<0.1
Atchosargus probatocephalus	sheepshead	1	<0.1	1.1	<0.1
Cynoscion nothus	silver seatrout	1	<0.1	0.15	<0.1
Chaetodipterus faber	spadefish	1	<0.1	0.25	<0.1
Paralichthys albigutta	Gulf flounder	1	<0.1	0.65	<0.1
Trinectes maculatus	hogchoker	1	<0.1	0.05	<0.1

*Noted but count and/or weight was not recorded.

Table 24. Mortality rates for target species at net retrieval in large mesh gill nets (≥5" stretch mesh) for 2009 in the Fisheries Independent Assessment Program (Atlantic Ocean). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the four seasons winter (January-March), spring (May and June), summer (July-September), and fall (October-December).*

Season	Common name	Total Number	Percent dead	Number sub-legal collected	Percent sub-legal dead
Winter	American shad	0			
	Atlantic croaker	0			
	bluefish	0			
	red drum*	0			
	southern flounder*	1	0		
	southern kingfish	0			
	Spanish mackerel*	0			
	spot	0			
	spotted seatrout*	0			
	striped bass*	0			
	weakfish*	0			
Spring	American shad	0			
	Atlantic croaker	0			
	bluefish	2	100		
	red drum*	0			
	southern flounder*	1	0		
	southern kingfish	1	100		
	Spanish mackerel*	0			
	spot	0			
	spotted seatrout*	0			
	striped bass*	0			
	weakfish*	0			
Summer	American shad	0			
	Atlantic croaker	0			
	bluefish	4	100		
	red drum*	0			
	southern flounder*	0			
	southern kingfish	0			
	Spanish mackerel*	0			
	spot	0			
	spotted seatrout*	0			
	striped bass*	0			
	weakfish*	0		1	100
Fall	American shad	0			
	Atlantic croaker	0			
	bluefish	2	50		

Continued

Season	Common name	Total Number	Percent dead	Number	sub-legal collected	Percent sub-legal dead
Fall	red drum*	0				
	southern flounder*	2	0			
	southern kingfish	0				
	Spanish mackerel*	0				
	spot	0				
	spotted seatrout*	0				
	striped bass*	0				
	Weakfish*	0			5	80

*Size Limits
No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 14" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum (12" TL minimum prior to 9/2009); Striped bass – 18" TL minimum, Spanish mackerel-12" TL minimum

Table 25. Mortality rates for target species at net retrieval in small mesh gill nets (≤5" stretch mesh) for 2009 in the Fisheries Independent Assessment Program (Atlantic Ocean). Mortality rates are reported overall and for regulatory discards due to size limits. Separate mortality rates are reported for the four seasons winter (January-March), spring (May and June), summer (July-September), and fall (October-December).*

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead
Winter	American shad	0			
	Atlantic croaker	1	0		
	bluefish	0			
	red drum*	0			
	southern flounder*	0			
	southern kingfish	3	100		
	Spanish mackerel*	0			
	spot	0			
	spotted seatrout*	0			
	striped bass*	0			
	weakfish*	0			
Spring	American shad	0			
	Atlantic croaker	1	0		
	bluefish	8	88		
	red drum*	0			
	southern flounder*	1	0		
	southern kingfish	3	100		
	Spanish mackerel*	4	100	2	100
	spot	0			
	spotted seatrout*	0			
	striped bass*	0			
	weakfish*	0		1	100
Summer	American shad	0			
	Atlantic croaker	12	58		
	bluefish	109	83		
	red drum*	0			
	southern flounder*	0			
	southern kingfish	1	0		
	Spanish mackerel*	64	100	1	100
	spot	11	64		
	spotted seatrout*	0			
	striped bass*	0			
	weakfish*	1	100	1	100
Fall	American shad	0			
	Atlantic croaker	15	0		
	bluefish	148	98		

Continued

Season	Common name	Number collected	Percent dead	Number sub-legal collected	Percent sub-legal dead
Fall	red drum*	0			
	southern flounder*	0		1	0
	southern kingfish	131	61		
	Spanish mackerel*	0			
	spot	41	80		
	spotted seatrout*	2	0		
	striped bass*	0			
	weakfish*	25	38	22	59

*Size Limits
No size limit for American shad, southern kingfish, Atlantic croaker, bluefish, or spot.; Red drum – 18" TL minimum and 27" TL maximum; Southern flounder – 14" TL minimum; Weakfish – 12" TL minimum; Spotted seatrout – 14" TL minimum (12" TL minimum prior to 9/2009); Striped bass – 18" TL minimum, Spanish mackerel-12" TL minimum

Table 26. Annual weighted CPUE and the associated PSE, total number collected by area, mean size (mm), and size range (mm) for target species in 2009 in the Fisheries Independent Assessment Program (Atlantic Ocean).

			Total number				
Common name	CPUE	PSE	Topsail	Masonboro	Brunswick	Mean size (mm)	Size range (mm)
American shad	0	.	0	0	0		
Atlantic croaker	0.97	41	7	22	0	215	144-252
bluefish	8.96	55	6	162	105	277	198-395
red drum	0	.	0	0	0		
southern flounder	0.23	57	2	3	1	357	201-427
southern kingfish	3.86	87	7	130	2	287	241-346
Spanish mackerel	2.82	53	4	17	51	380	283-551
spot	2.25	56	29	23	0	187	170-223
spotted seatrout	0.11	100	2	0	0	294	291-296
striped bass	0	.	0	0	0		
weakfish	1.88	65	13	44	0	250	167-330

Table 27. Number of specimens collected from the Fisheries Independent Assessment Program (Atlantic Ocean) for age determination by species in 2009.

Year	Common name	Total
2009	Atlantic croaker	27
	bluefish	52
	Gulf flounder	1
	southern flounder	6
	southern kingfish	40
	Spanish mackerel	59
	spot	38
	spotted seatrout	2
	striped mullet	7
	weakfish	54
Total		286

Table 28. Protected species interactions from July 1, 2009 - June 30, 2010 in the Fisheries Independent Assessment Program (All Areas).

Date	Species	Condition	Water depth (feet)	Location	Latitude	Longitude	Stretch mesh (in)
7/8/2009	Loggerhead	alive	6.2	Pamlico River	352725	765245	6
8/18/2009	Loggerhead	alive	6.6	New River	343615	772552	5

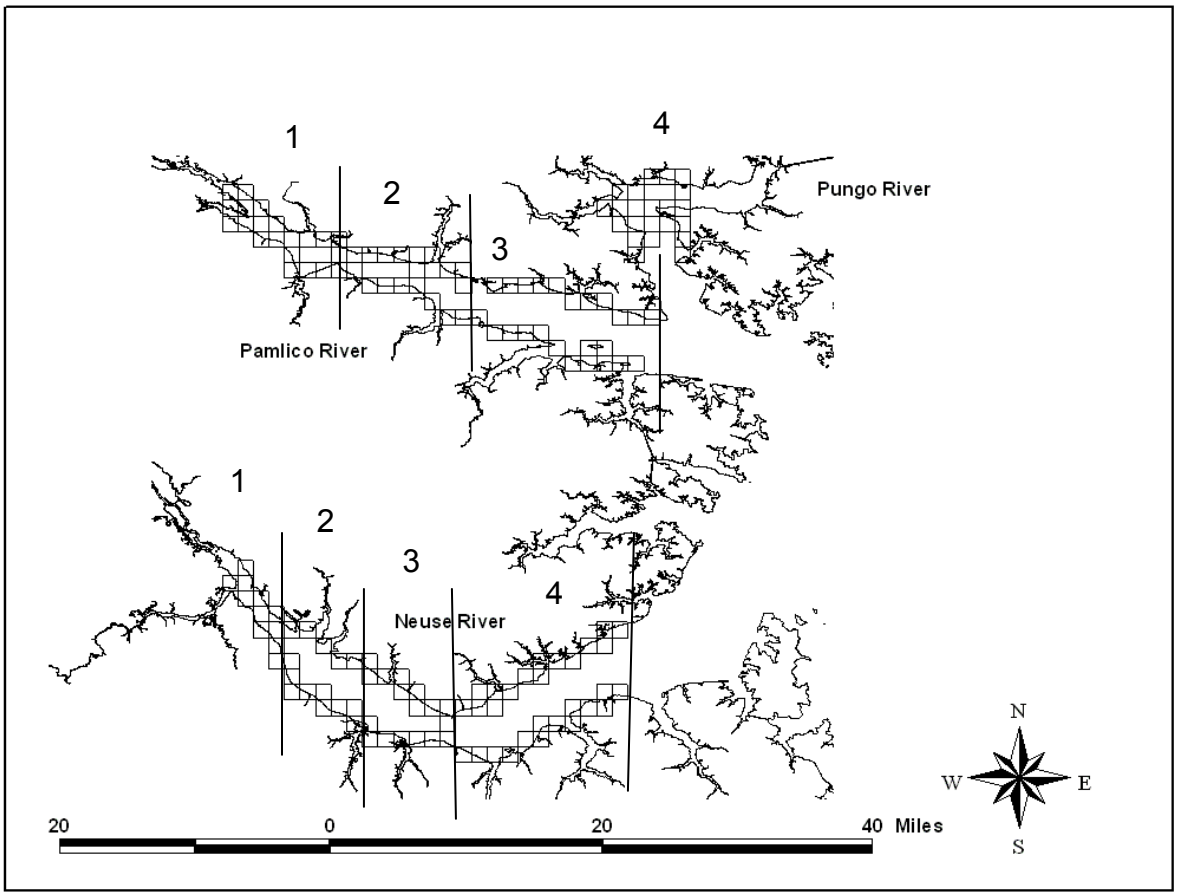

Figure 1. The sample regions and grid system for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) of North Carolina during 2009 with areas numbered (Pamlico/Pungo: 1-Upper, 2-Middle, 3-Lower, 4- Pungo; Neuse: 1-Upper, 2-Upper-middle, 3-Lower-middle, 4-Lower).

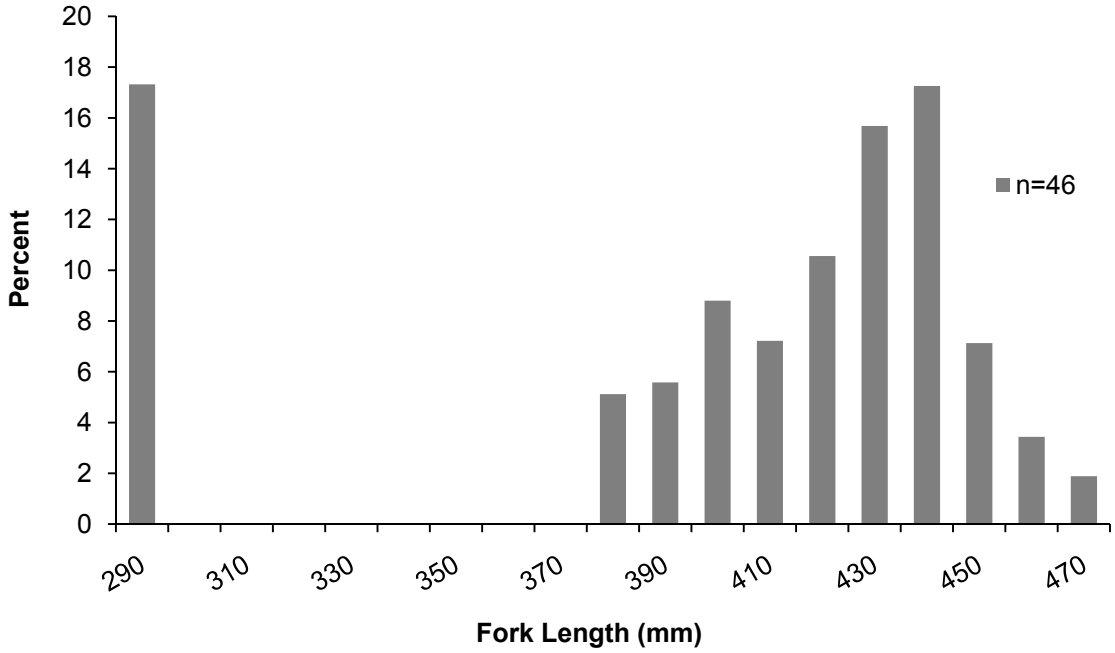

Figure 2. American shad (*Alosa sapidissima*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

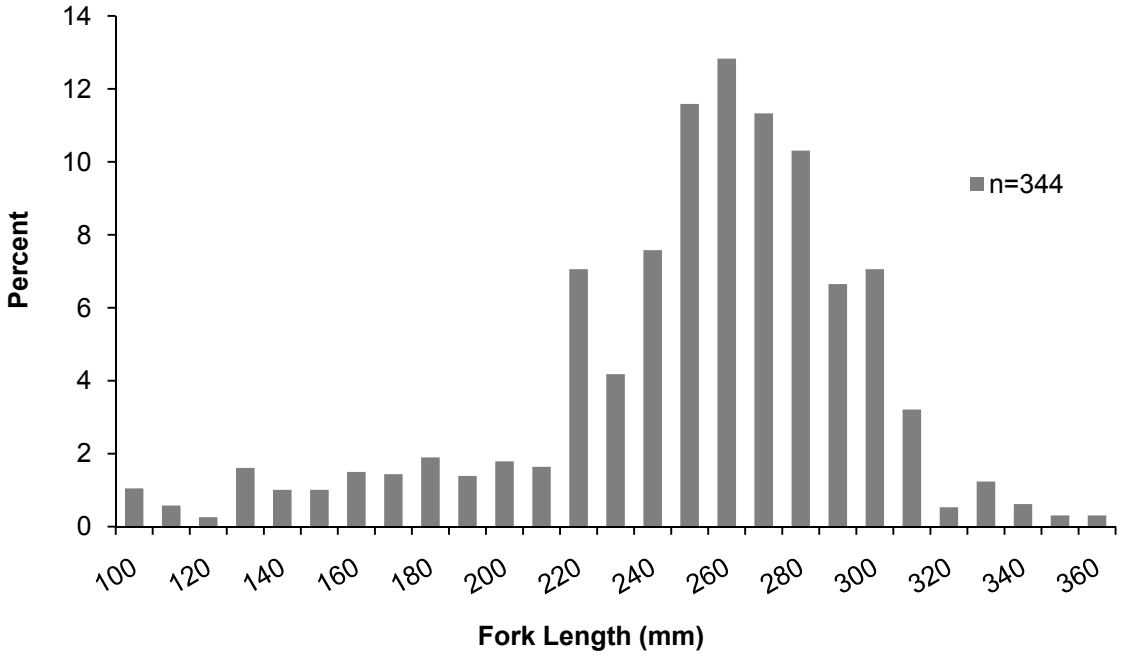

Figure 3. Atlantic croaker (*Micropogonias undulatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

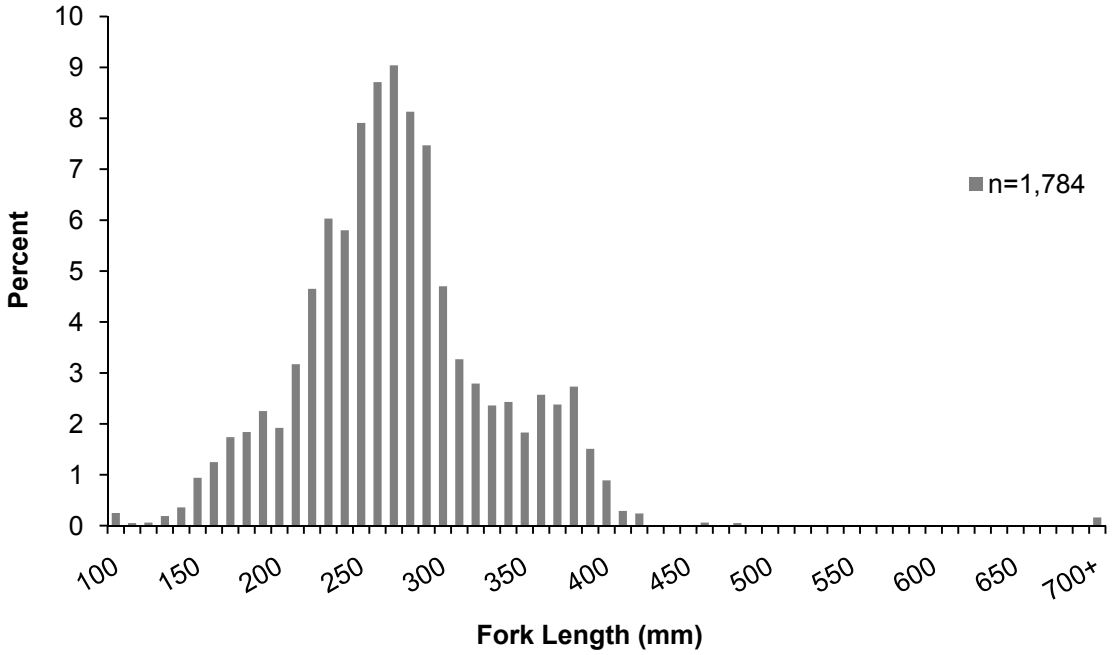

Figure 4. Bluefish (*Pomatomus saltatrix*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

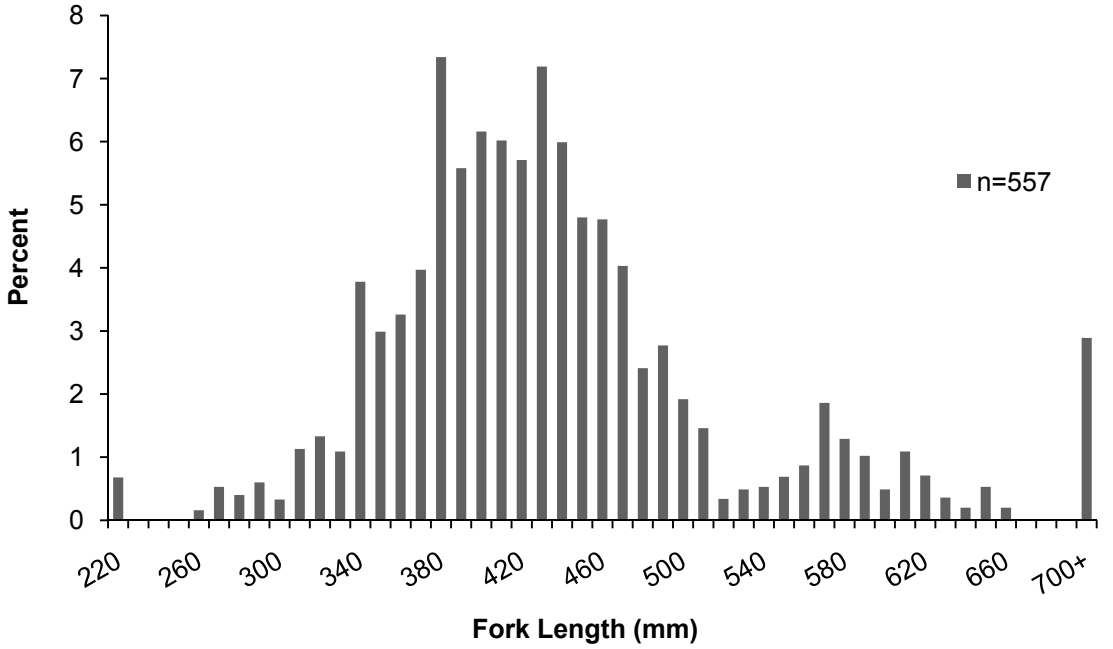

Figure 5. Red drum (*Sciaenops ocellatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

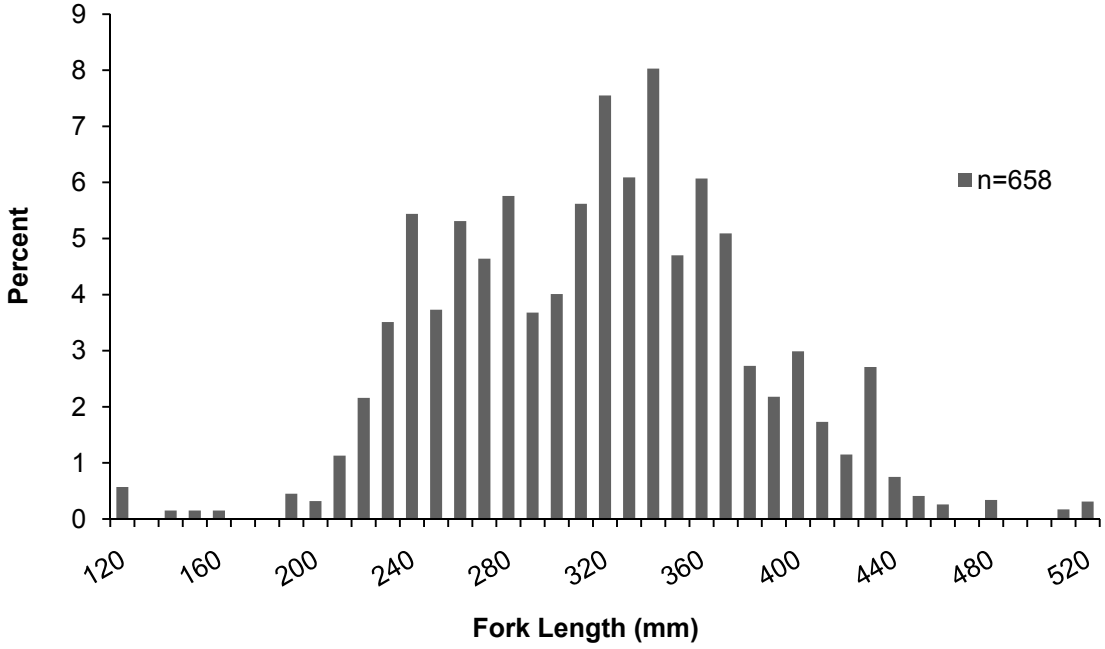

Figure 6. Southern flounder (*Paralichthys lethostigma*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

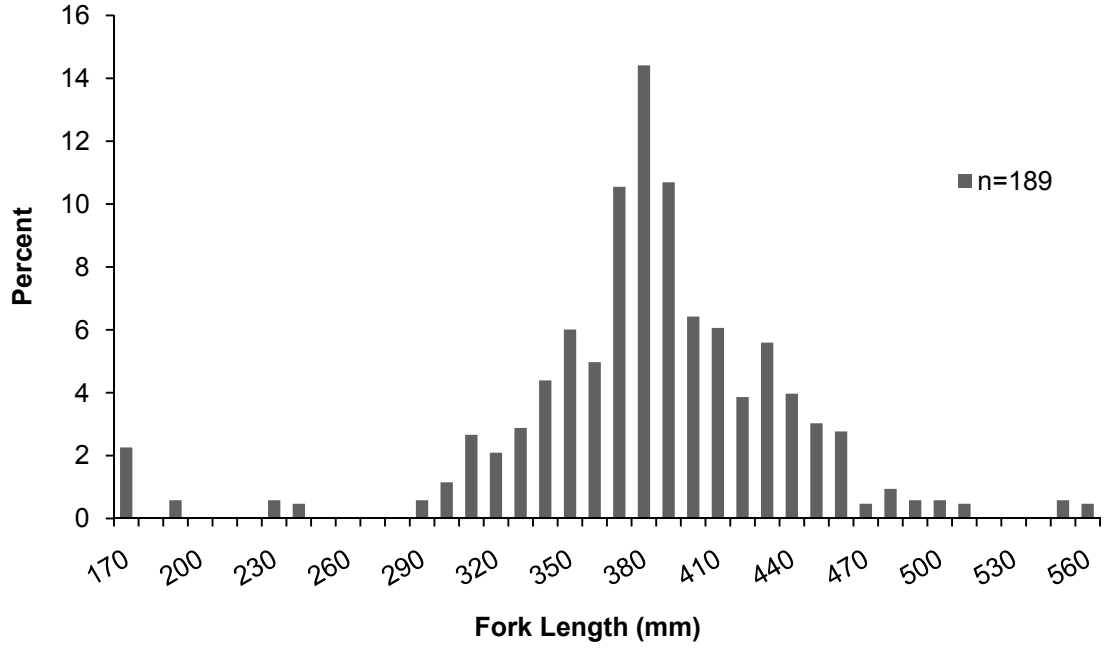

Figure 7. Spanish mackerel (*Scomberomorus maculatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

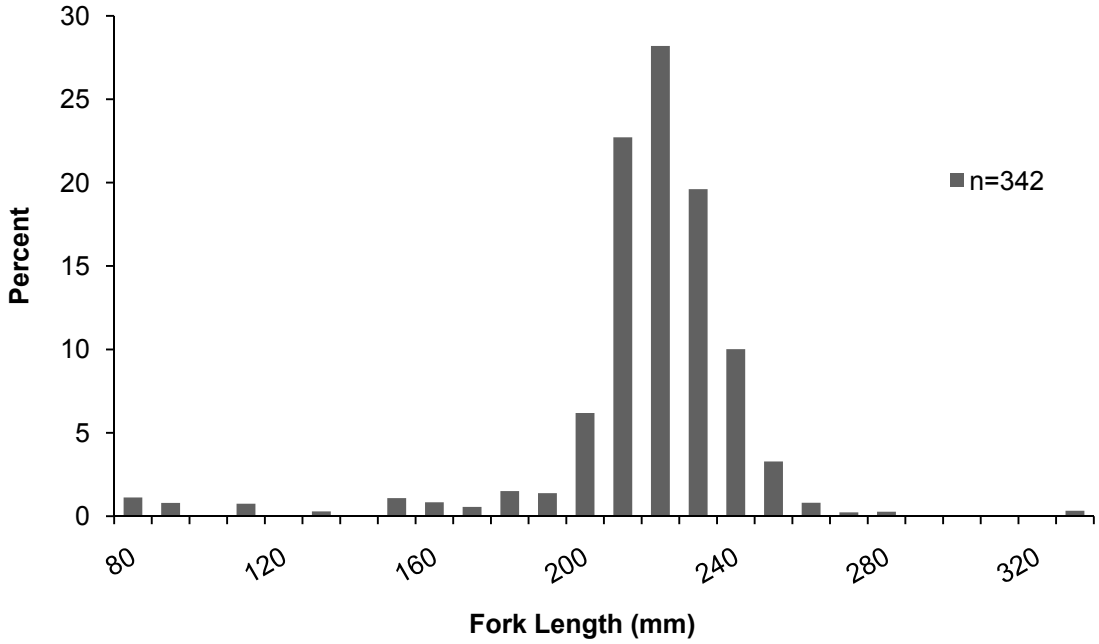

Figure 8. Spot (*Leiostomus xanthurus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

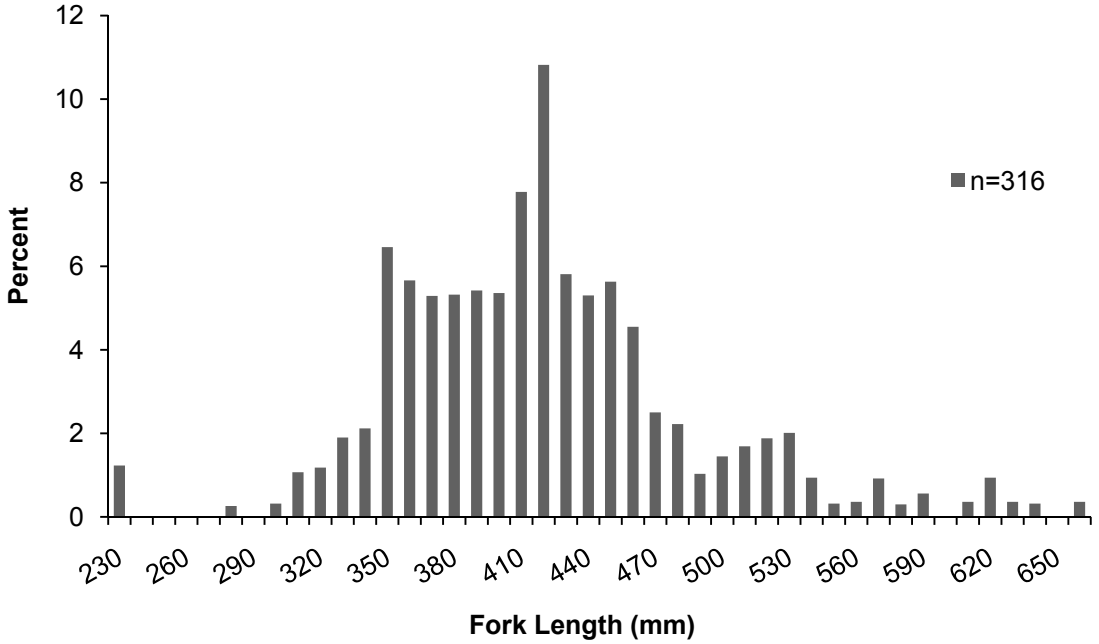

Figure 9. Spotted seatrout (*Cynoscion nebulosus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

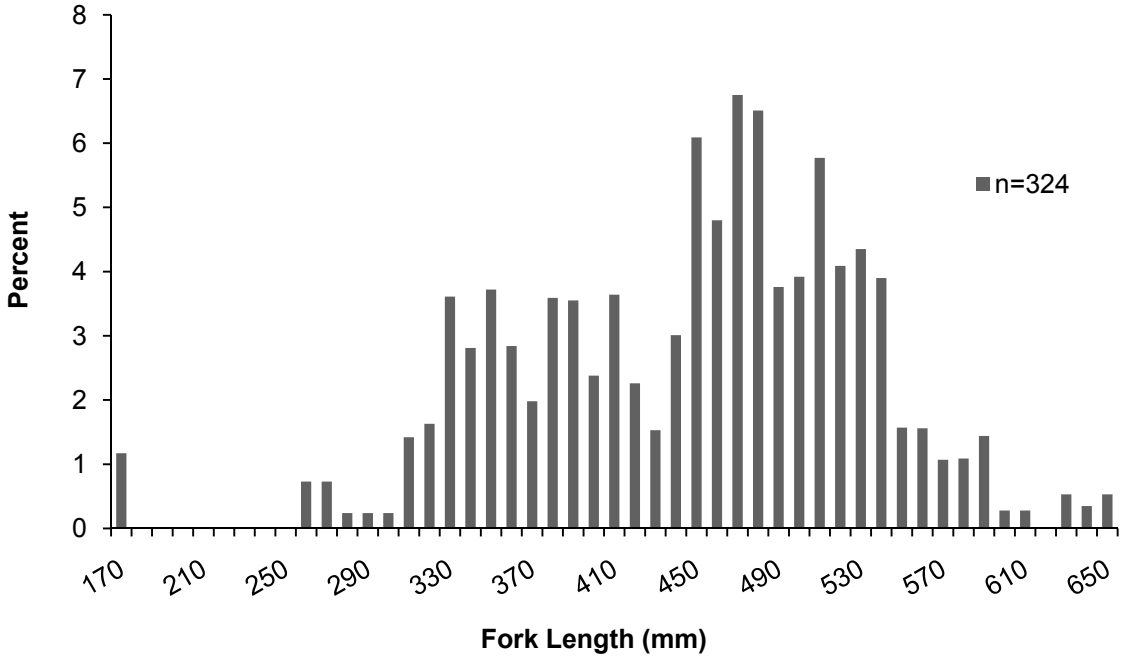

Figure 10. Striped bass (*Morone saxatilis*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

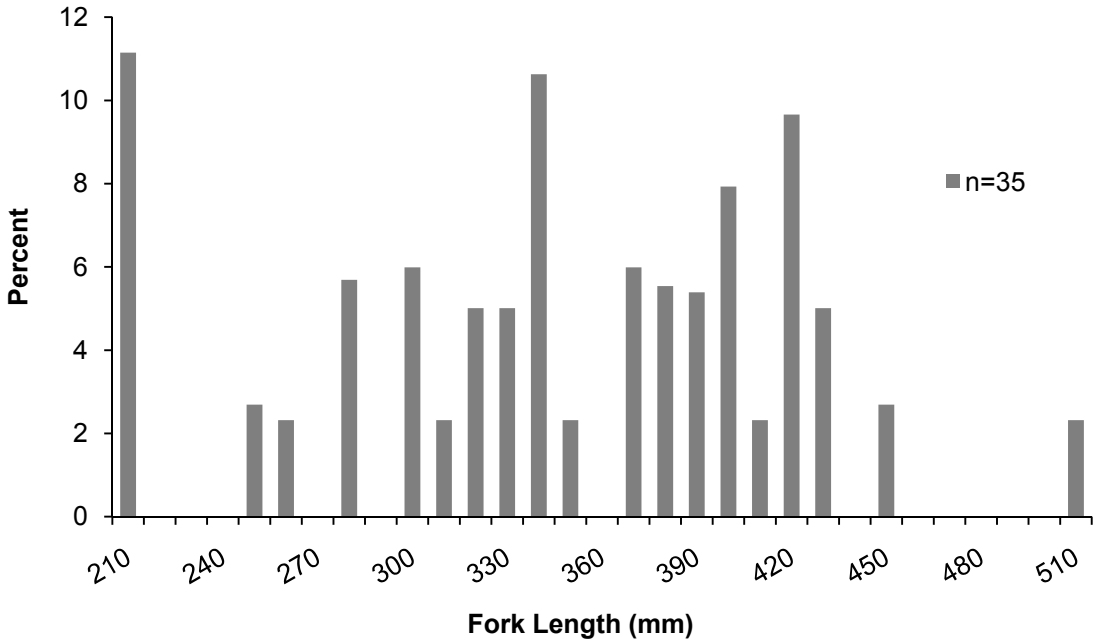

Figure 11. Weakfish (*Cynoscion regalis*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers) 2009.

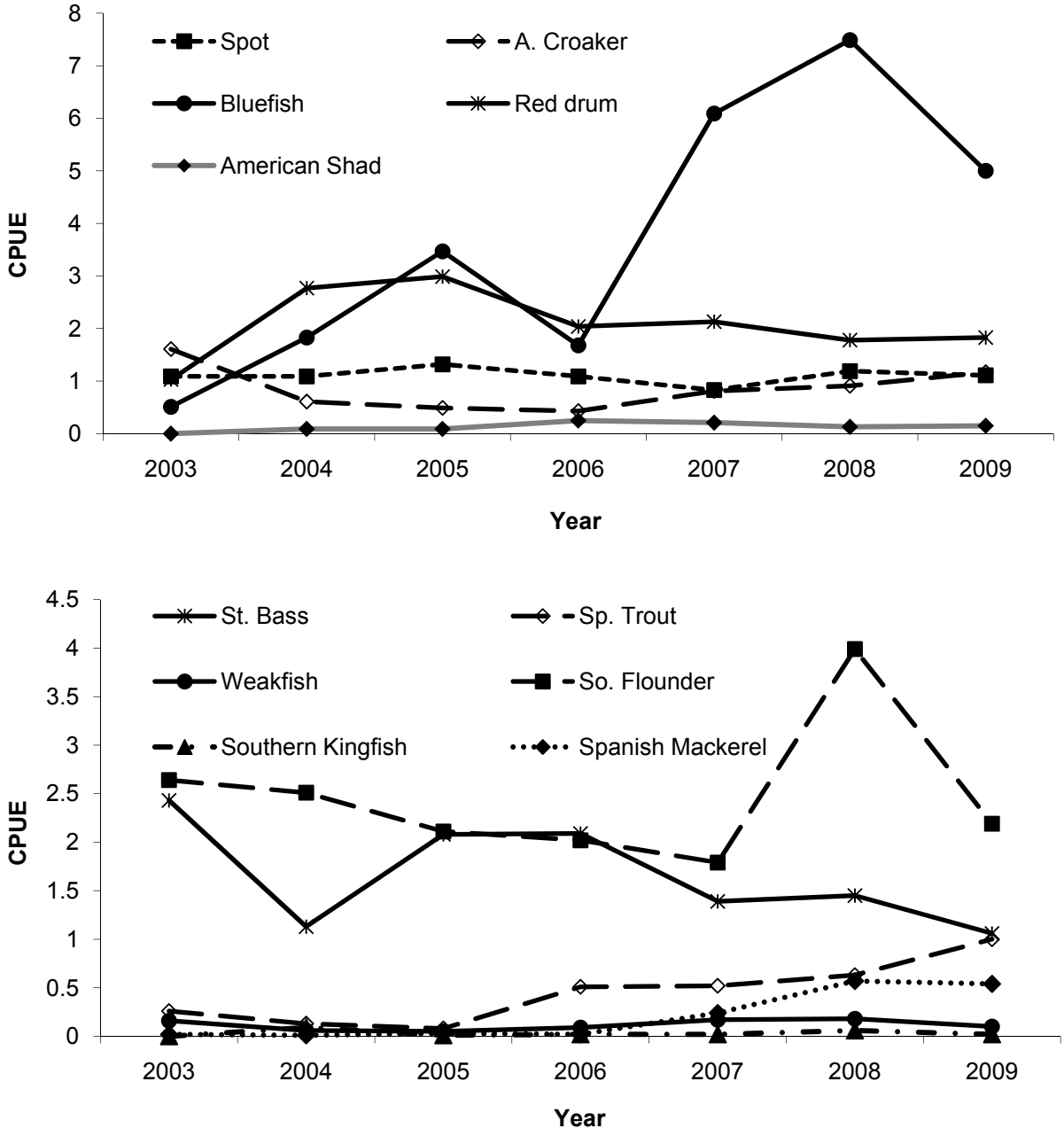

Figure 12. Annual weighted CPUE for target species from 2003 to 2009 in the Fisheries Independent Assessment Program (Pamlico/Pungo and Neuse rivers).

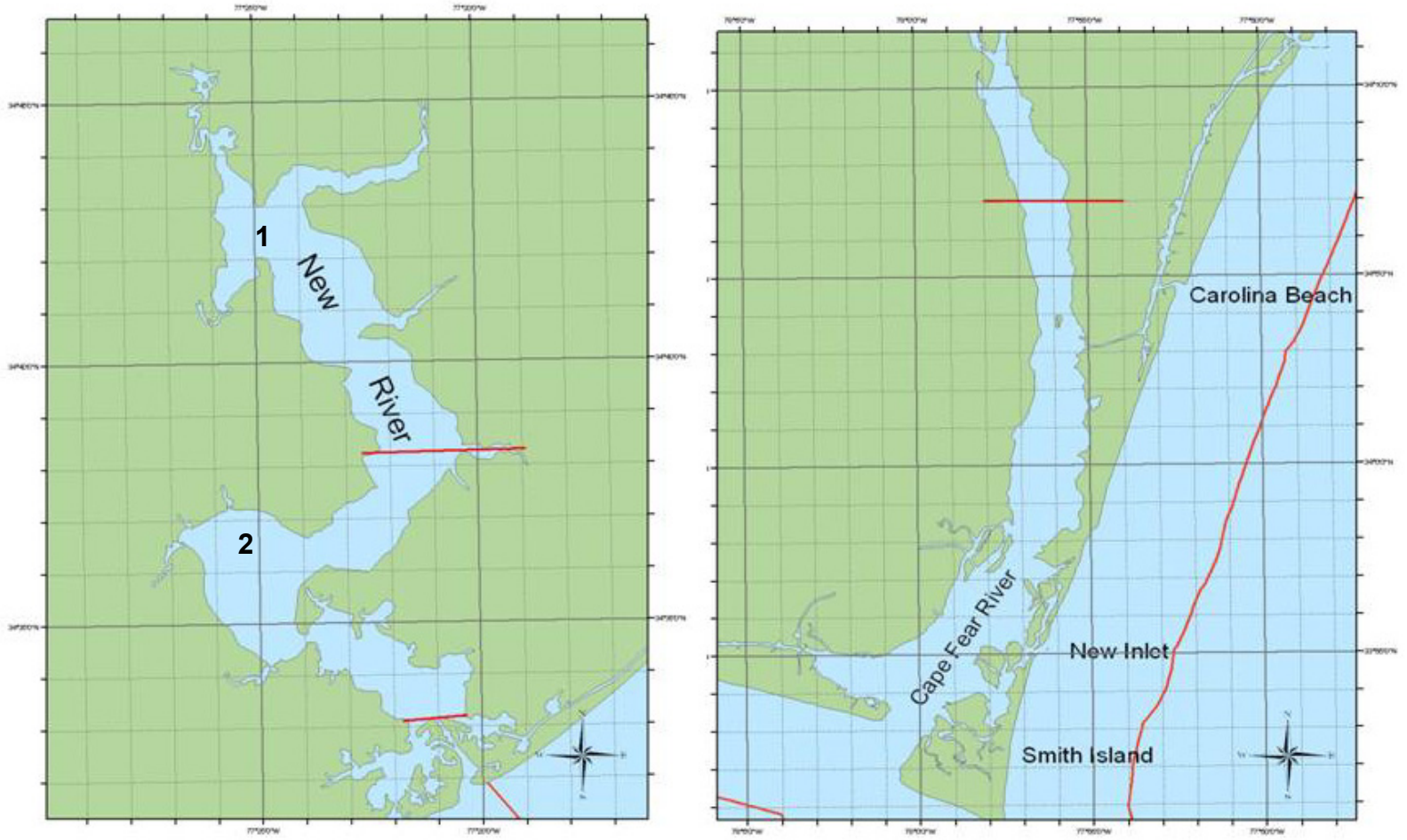

Figure 13. The sample regions and grid system for the Fisheries Independent Assessment Program (New and Cape Fear rivers) of North Carolina during 2009 with areas numbered (New: 1-Upper, 2-Lower; Cape Fear).

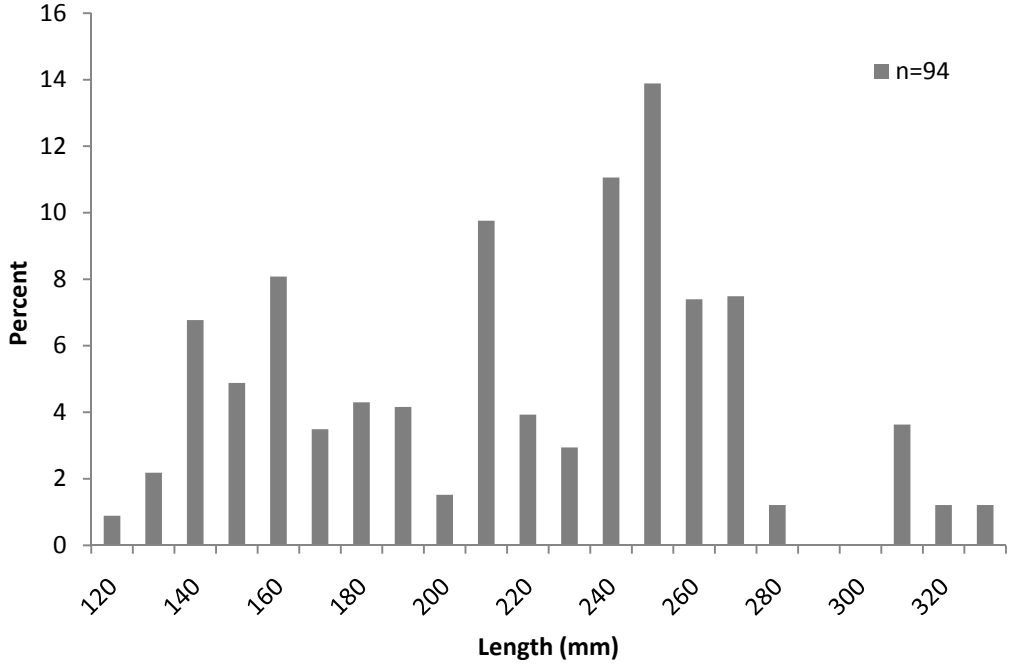

Figure 14. Atlantic croaker (*Micropogonias undulatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

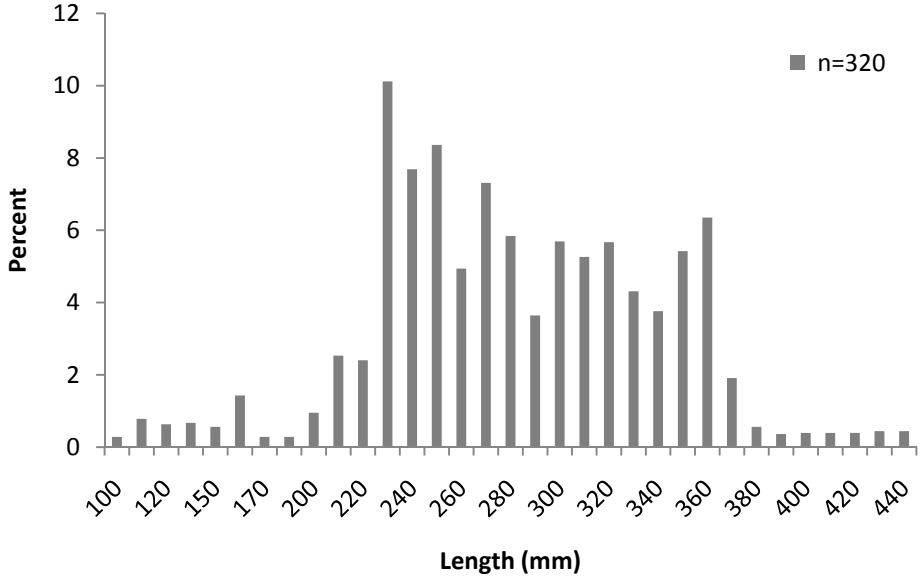

Figure 15. Bluefish (*Pomatomus saltatrix*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

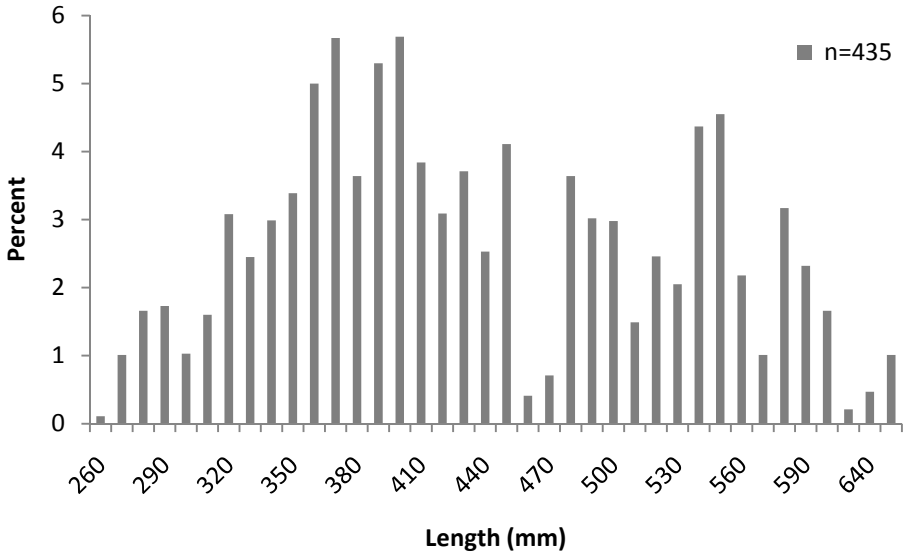

Figure 16. Red drum (*Sciaenops ocellatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

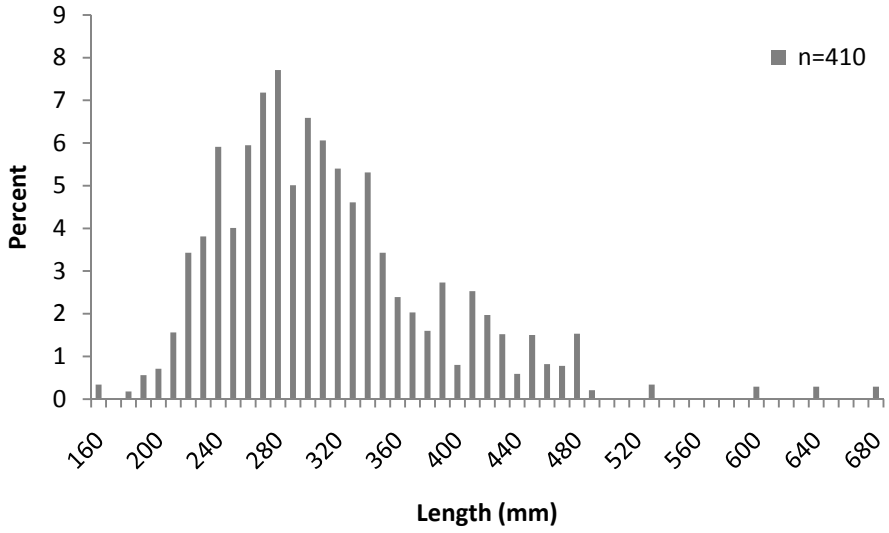

Figure 17. Southern flounder (*Paralichthys lethostigma*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

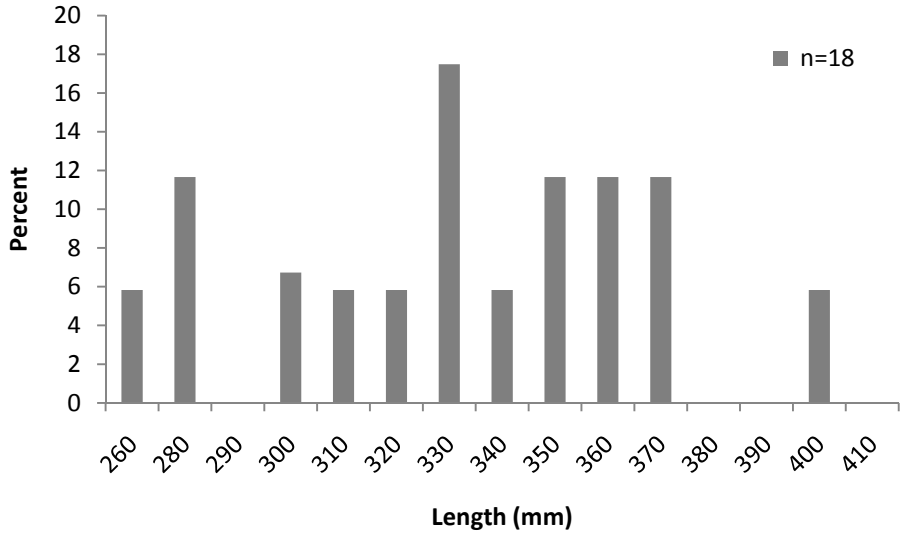

Figure 18. Southern kingfish (*Menticirrhus americanus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

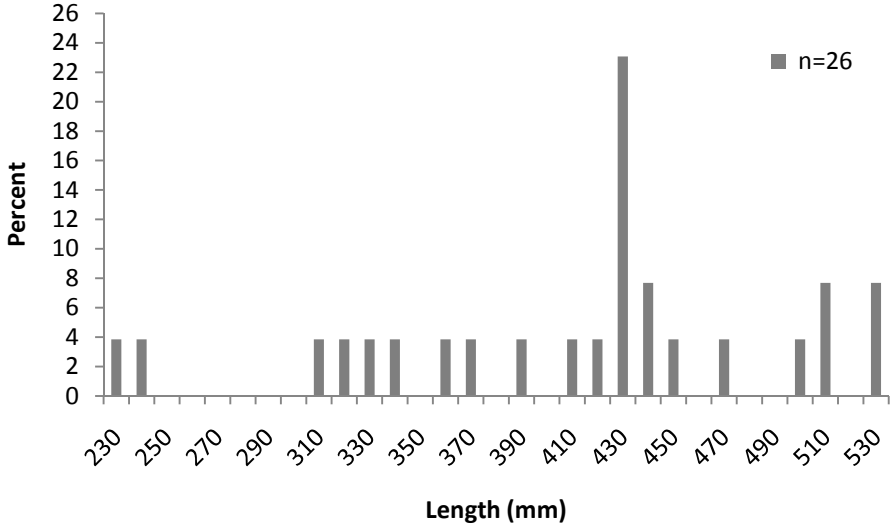

Figure 19. Spanish mackerel (*Scomberomorous maculatus)* length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

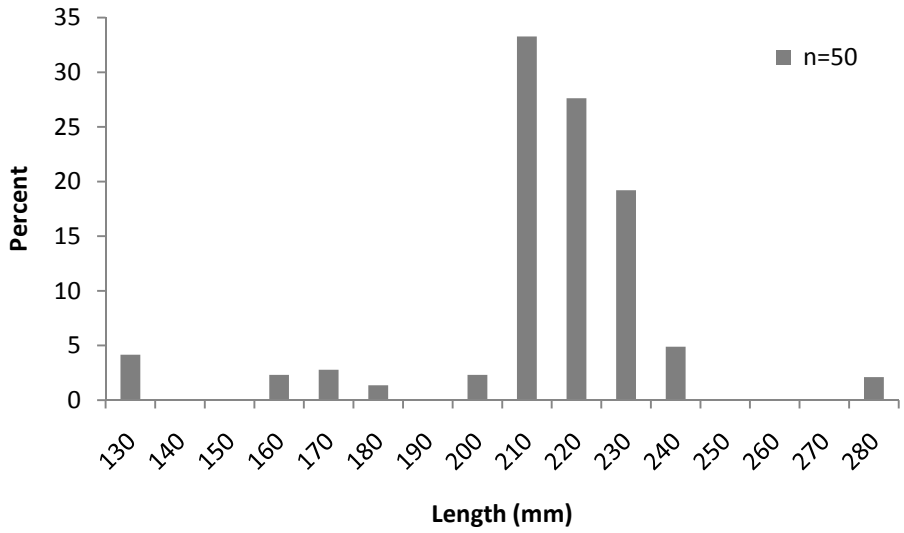

Figure 20. Spot (*Leiostomus xanthurus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

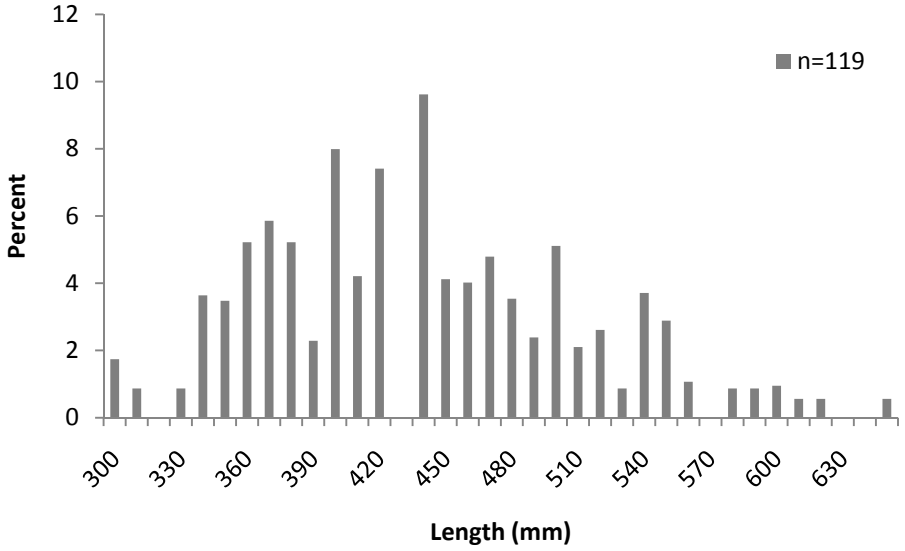

Figure 21. Spotted seatrout (*Cynoscion nebulosus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (New and Cape Fear rivers) in 2009.

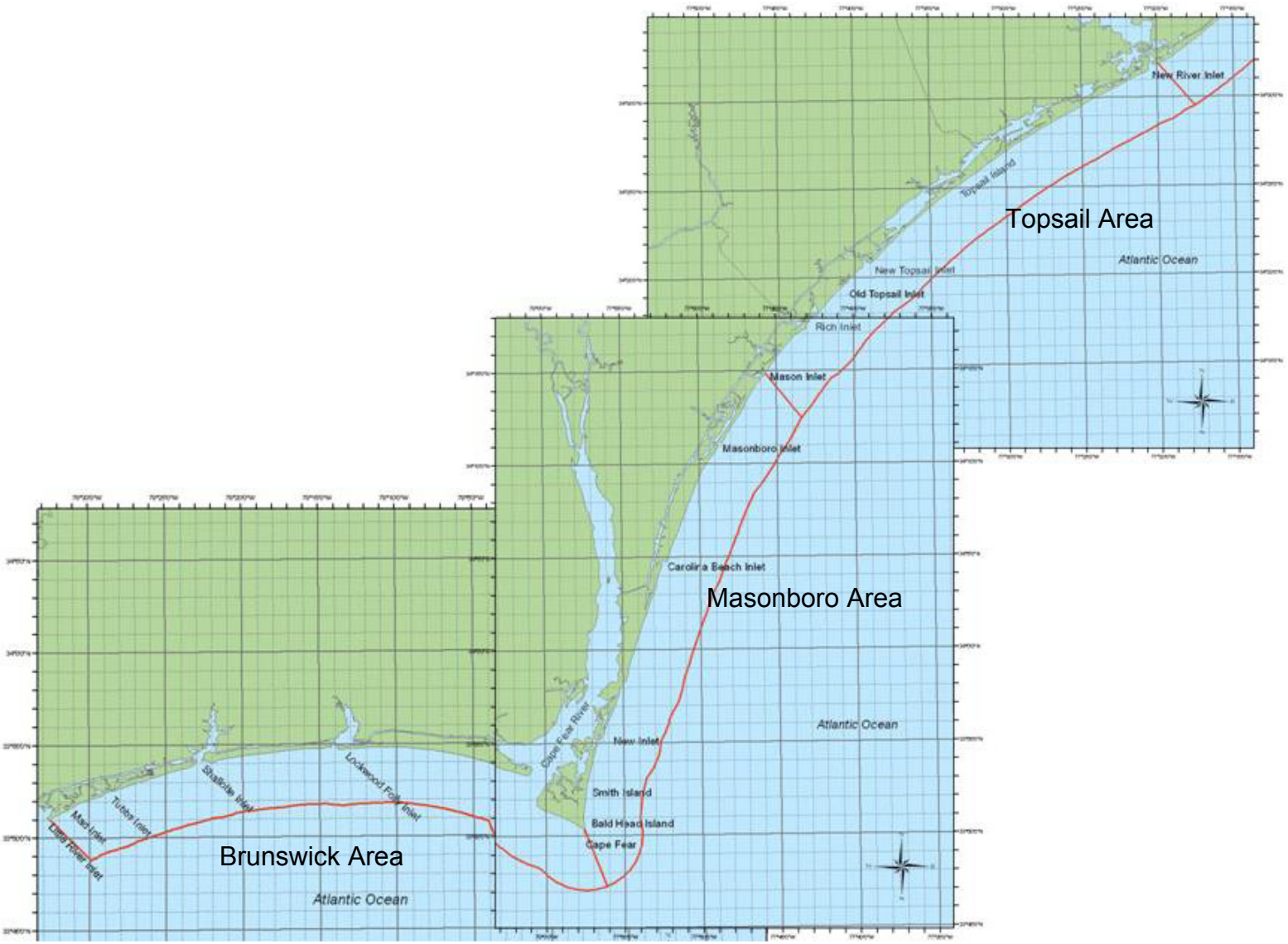

Figure 22. The sample regions and grid system for the Fisheries Independent Assessment Program (Atlantic Ocean) of North Carolina during 2009 including the Topsail, Masonboro, and Brunswick areas.

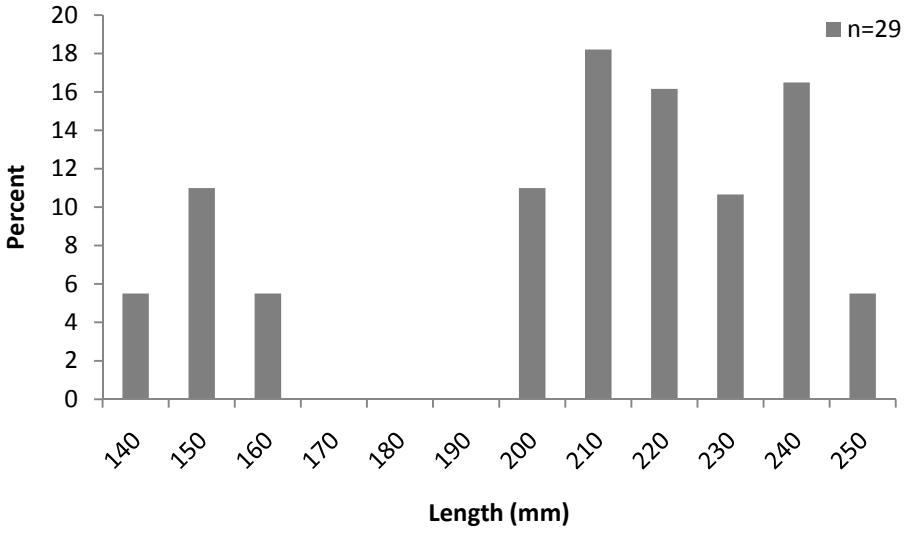

Figure 23. Atlantic croaker (*Micropogonias undulatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2009.

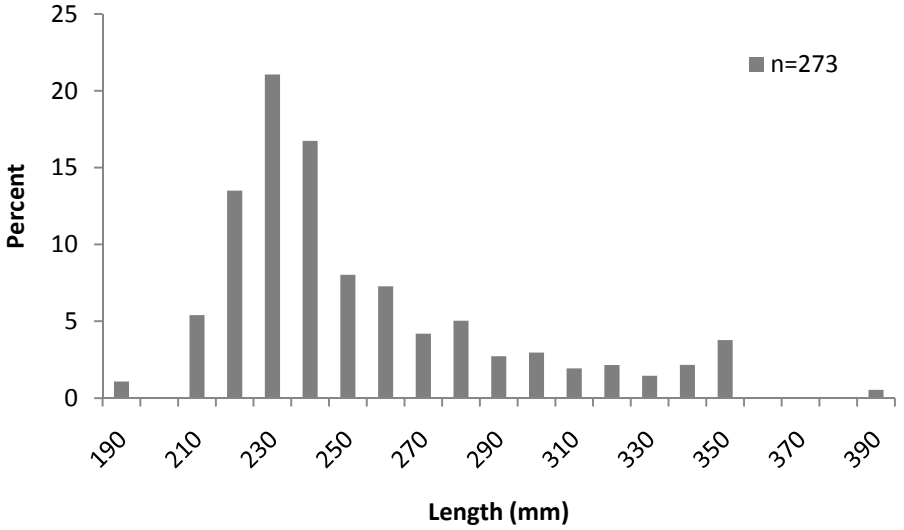

Figure 24. Bluefish (*Pomatomus saltatrix*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2009.

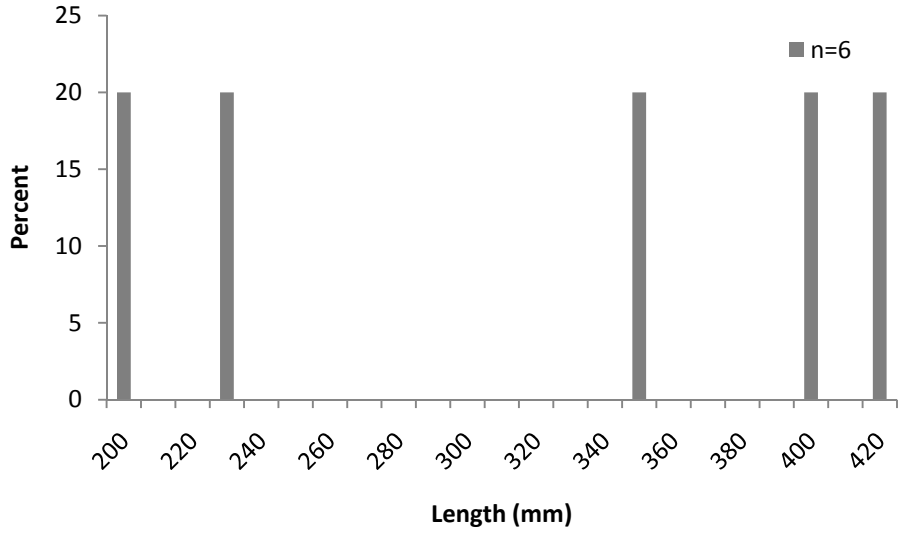

Figure 25. Southern flounder (*Paralichthys lethostigma*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2009.

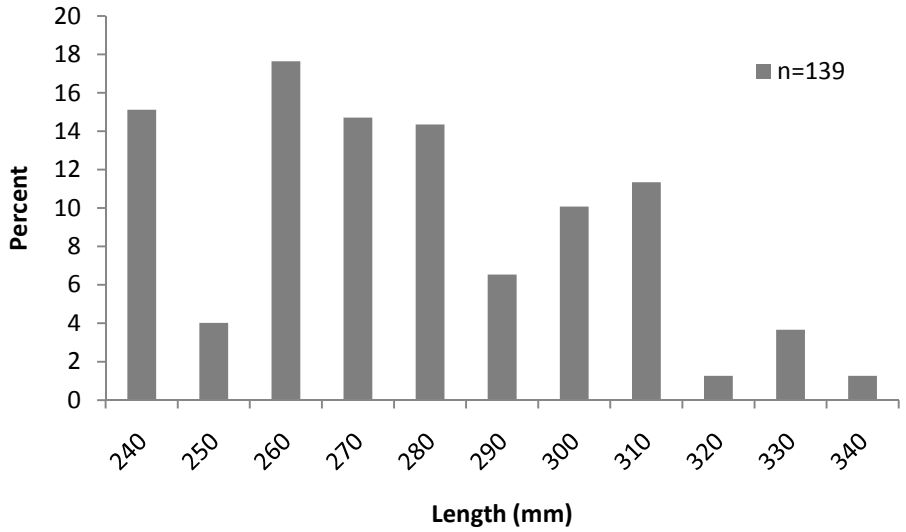

Figure 26. Southern kingfish (*Menticirrhus americanus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2009.

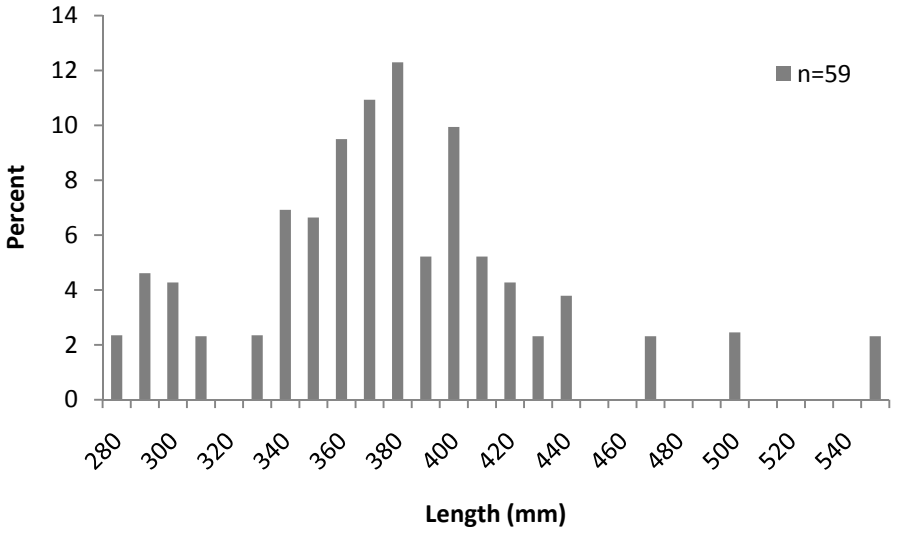

Figure 27. Spanish mackerel (*Scomberomorus maculatus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2009.

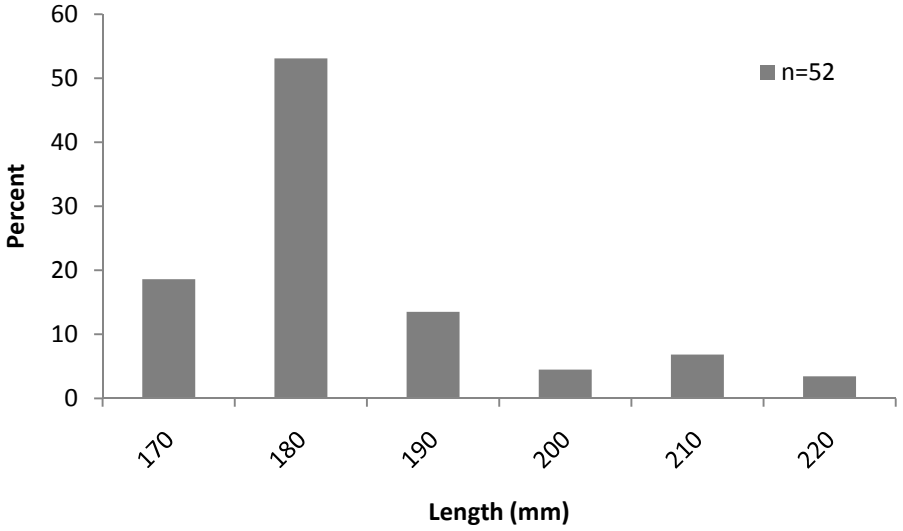

Figure 28. Spot (*Leiostomous xanthurus*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2009.

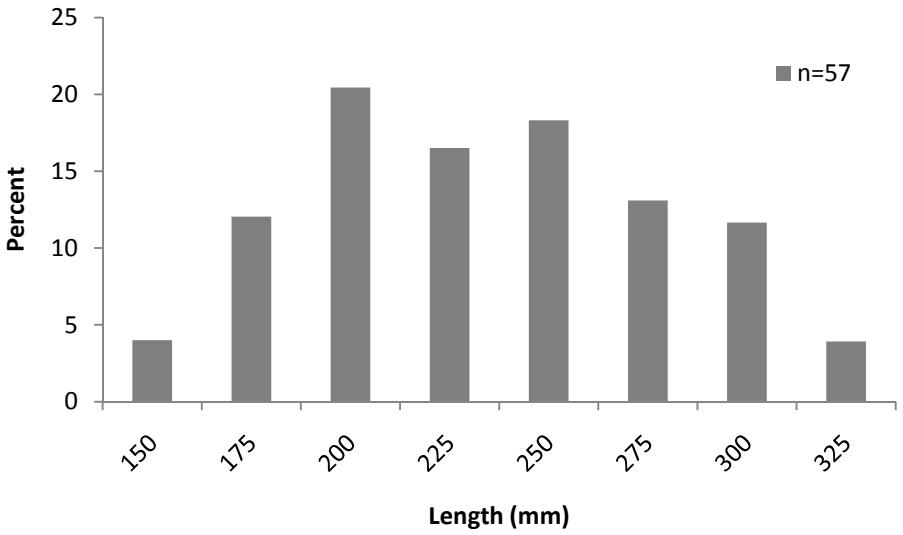

Figure 29. Weakfish (*Cynoscion regalis*) length distribution (%) weighted by strata and number caught for the Fisheries Independent Assessment Program (Atlantic Ocean) in 2009.

Appendix 1.

The following procedures were followed to produce the weighted CPUE estimates by length and age. The annual abundance index calculation for each target species was as follows:

1) Pool all of a species records across mesh sizes for each sample.
2) Compute a length frequency distribution for that species to obtain a number at each size class ($S_{szclass}$). In cases where subsampling occurred the total number of measured fish was expanded to the total catch. Any non-measurable fish (i.e. parts) were distributed proportionately across all size classes of a given species.
3) Sum all the $S_{szclass}$ for all strata by region ($T_{szclass\ by\ SR}$).
4) For all strata by region divide the $T_{szclass}$ by the total number of sampling trips that occurred (T_{SR}) to obtain a catch estimate by size class (mean and standard deviation) for each strata by region ($S_{szclass\ by\ SR}$). All effort, including samples with zero catch, was factored into the index.
5) Multiply the $S_{szclass\ by\ SR}$ by the total number of grids occurring in all strata by region ($TG_{by\ SR}$) to obtain a weighted estimate for each size class ($WS_{szclass\ by\ SR}$).
6) Sum all $WS_{szclass\ by\ SR}$ by species (SW_{all}).
7) Divide SW_{all} by the total number of grids in all areas sampled to obtain a project-wide weight catch at length estimate for each species.
8) The overall annual CPUE by species is calculated by summing the catch-at-length estimates for each species across all available lengths.