Atlantic States Marine Fisheries Commission
Atlantic Croaker Technical Committee

Annual Review of Assessment Triggers 2012

Introduction

Amendment 1 to the Interstate Fishery Management Plan for Atlantic Croaker directs the Atlantic Croaker Stock Assessment Subcommittee (SASC) to conduct a benchmark stock assessment every five years (ASMFC 2005). In each non-assessment year, the Atlantic Croaker Technical Committee (TC) is required to conduct a set of "trigger" exercises to review Atlantic croaker data. The first trigger is the only hard trigger which, if activated, initiates an assessment in a non-assessment year. If the TC notices substantial changes in one or more of the remaining triggers, the TC can also request that a stock assessment be conducted.

Prior to 2010, the triggers were evaluated on a management area basis, using the mid- and south Atlantic management regions as defined in Amendment 1. The 2010 ASMFC assessment assumed a single, coastwide stock for Atlantic croaker, which was supported by the SEDAR review panel (ASMFC 2010). Following the recommendations of the stock assessment and TC, the South Atlantic State-Federal Fisheries Management Board approved Addendum I to Amendment I at its March 2011 meeting and established the Atlantic croaker stock as a single management unit, rather than the previously divided units (ASMFC 2011). The triggers are evaluated according to this single, coastwide unit.

Evaluation of Assessment Triggers

1. Relative percent change in landings

    a. A stock assessment will be triggered if the most recent year's commercial landings are less than 70% of the previous two years' average landings.

    Commercial landings data were obtained from the ACCSP Data Warehouse. Annual commercial landings of Atlantic croaker along the U.S. east coast have been variable since at least 1950 (Figure 1). Over the last decade, commercial landings have generally declined. In 2011, approximately 11.9 million pounds were landed by commercial fisheries (Table 1). This value represents 74.0% of the average of the previous two years' commercial landings (Average, 2009 – 2010 = 16.1 million pounds). Therefore, the trigger **is not** activated.

    b. A stock assessment will be triggered if the most recent year's recreational landings are less than 70% of the previous two years' average landings.

    Estimates of recreational fisheries statistics were provided by the MRFSS. Recreational harvest of Atlantic croaker (Type A + B1) from New Jersey to the east coast of Florida ranged from a low of 1.35 million pounds in 1982 to a high of 11.1

million pounds in 2001 during 1981 through 2011 (Figure 2). The recreational harvest totaled 2.7 million pounds in 2011 (Table 1). This value represents 55.8% of the average of the previous two years' recreational harvest (Average, 2009 – 2010 = 4.9 million pounds). As such, the trigger **is** activated.

2. Biological Data Monitoring

   a. The technical committee will compare the most recent year's mean length data from the recreational fishery to the average of the previous two years' mean lengths.

      For the 2012 trigger exercise, the recreational fishery average lengths were computed from the MRFSS length frequency data collected from New Jersey to the east coast of Florida during the MRFSS angler-intercept survey and represent harvested (Type A + B1) fish. The data, as processed, are weighted to account for the effects of non-random sampling of the catch across strata (see ASMFC 1994 for details).

      The average total length of Atlantic croaker harvested by recreational anglers in 2010 was 10.2 inches (Table 2). The average of the 2009 – 2010 recreational harvest average lengths was 9.8 inches. The average total length in 2011 increased by 4.08%, relative to the 2009 – 2010 average. The average lengths for the Mid-Atlantic and South Atlantic states differed, with an average 2011 length in the Mid-Atlantic of 10.3 inches versus 9.8 inches average length for the South Atlantic states (Table 2). These average lengths reflect a decrease in the Mid-Atlantic compared to 2009 - 10 (2.09%) but an increase in the South Atlantic (5.95%). These differences are likely due to differences in growth between the regions. Fish tend to reach larger sizes at higher latitudes in their range, which is common with other sciaenidae (red drum, spot).

   b. The technical committee will compare the most recent year's mean size (length and weight) data from the commercial fishery to the average of the previous two years' mean size (length and weight) data.

      The average total length of Atlantic croaker observed in 2011 was compared to the average of the 2009 and 2010 average lengths for major commercial gears using data provided by New Jersey, Maryland, Virginia, and North Carolina. The average length of Atlantic croaker samples from the commercial fisheries decreased in 2011 relative to the 2009 – 2010 average for all state-gear combinations evaluated except for the New Jersey gill net and the North Carolina ocean gill net and fly net fisheries (Table 2). The observed decreases in average length, compared to the previous two-year average, ranged from less than 0.1 to 0.8 inches.

      A similar comparison was performed for average weights, which found that changes in average length did not necessarily correlate with similar changes in average weight. The average weight of Atlantic croaker sampled from New Jersey's fisheries (gill net, trawl, and pound net) and North Carolina's ocean gill net fishery all increased, while all other fisheries reported a decline in the sampled average weight

(Table 3). The largest relative changes were seen in North Carolina's long haul (-36.77%) and inside gill net (-24.08%) fisheries.

c. The technical committee will monitor the overall age composition (proportion at age) and calculate the mean size at age for the age groups that are present in the state samples.

The proportion, mean length, and mean weight of commercial landings at age for Atlantic croaker were calculated for 2007–2011 using data provided by New Jersey, Maryland, Virginia, and North Carolina (Table 4). Note that lengths and weights were not always available for every aged fish. The majority of Atlantic croaker commercial landings in these states have been comprised of fish age 1 and older (Figure 3–Figure 6). There is evidence of a strong 2006 year-class in the New Jersey (Figure 3), Virginia (Figure 5), and North Carolina (Figure 6) age compositions. Maryland, Virginia, and North Carolina also showed evidence of a strong 2008 year class.

The average length and average weight at age of Atlantic croaker sampled from the commercial fisheries was variable during 2007–2011 within each state (Figure 7–Figure 14). The majority of the differences in average length at age within each state were less than 0.75 inches when comparing 2007-2011. In comparisons of average weight at age within states among 2007-2011, most of the differences were less than 0.15 pounds. Larger differences in average length and average weight at age among these years are often attributable to variation in sample sizes at age among years.

3. Commercial Fisheries Effort vs. Landings

a. The technical committee will monitor annual commercial fisheries effort and landings by state and gear to evaluate trends. As the reliability of the effort data improves, monitoring of annual effort and landings will be replaced by monitoring of CPUE (by state and gear).

The SASC for the 2010 assessment reviewed the available commercial fisheries effort data from the states and determined the data were insufficient to calculate a CPUE series for the commercial fisheries (ASMFC 2010). That SASC also noted that supplementary information needed to standardize effort data among the states is either unavailable or not consistently provided. The SASC concluded the commercial CPUE data were not adequate indicates of abundance for croaker.

Although the SASC concluded that the CPUE data were unreliable to use in the stock assessment to estimate overall abundance, the TC felt that the trends in effort and landings data were good indicators to monitor changes in the fishery and the populations. Annual commercial landings and associated effort for major gears in Virginia, North Carolina, and Florida were evaluated. Effort is measured as the number of trips and was only available for positive trips; that is, only trips that landed Atlantic croaker were included. Virginia's commercial landings of Atlantic croaker in the anchor and drift gill-net fisheries again decreased from the previous year, while haul seine and pound-net landings decreased in 2011 after increases in 2010 (Figure 15). Effort decreased in all of Virginia's gears from 2010 to 2011. Effort levels have

varied for the four fisheries over the years, with all indicating an overall decline in effort for the past five years. Landings-per-unit-effort stayed relatively level, with the exception of a sharp drop in the haul seine fishery.

Commercial landings and effort showed steep decreases in all but North Carolina's ocean gill-net and Florida's hook-and-line fisheries, which showed a slight uptick in what has been an overall declining trend over the past two decades (Figure 16).

Effort in Florida's commercial cast-net fishery has shown an overall increase over the available time series, although the decrease seen in 2010 remained level in 2011. Landings have been on a downward trend since 2008 (Figure 17). Both effort and landings in Florida's commercial hook-and-line fishery generally increased from the beginning of the time series to a peak in 2000, after which the fishery's landings and efforts decreased and have been variable.

4. Recreational Catch Rates

Amendment 1 specifies that the recreational fishery CPUE index will be calculated based on directed trips (ASMFC 2005). In the 2010 stock assessment, recreational fishery CPUE was calculated using the directed trips method and the method of Stephens and MacCall (2004; ASMFC 2010). However, the MRFSS index was not used in the final configuration of the stock assessment model. The SASC and SEDAR review panel for that assessment were concerned about the reliability of the directed trips-based methods as it may under-represent trips that did not catch Atlantic croaker. The SASC was concerned that the Stephens and MacCall method resulted in unrealistic species associations and a large number of positive trips being rejected in the analysis. The SEDAR review panel recommended that stratifying the data into subareas based on expected species associations would alleviate this problem.

The language in Amendment 1 also states that recreational fishery CPUE indices will be calculated for each state (ASMFC 2005); however, the TC feels the MRFSS data are insufficient for calculating state-specific catch rates.

For the 2011 trigger exercise, recreational fishery catch rates were calculated using the directed trips approach, a modification of the Stephens and MacCall method, and the Jacquard Index, which is a similar approach used during the 2005 stock assessment (K. Drew, ASMFC, pers. comm.). The TC evaluated the methods but was not comfortable presenting a recreational CPUE index that was not endorsed by a peer review panel.

5. Surveys

The SASC for the 2010 assessment carried out a thorough evaluation of fisheries-independent surveys along the U.S. Atlantic Coast that have encountered Atlantic croaker (ASMFC 2010). The purpose was to evaluate how each survey represents and characterizes the Atlantic croaker population. For each survey, the SASC considered the length of the time series, sample timing and spatial coverage, catchability/availability to the survey gear, changes in sampling methodology, and survey design. Out of thirty-one surveys examined, four were selected for use in the assessment model. The surveys chosen were the NMFS Bottom Trawl Survey, VIMS Juvenile Fish and Blue Crab Trawl Survey, SEAMAP-South Atlantic Coastal Survey, and the North Carolina Pamlico Sound

Survey, also known as Program 195 (P195). These surveys cover a large area or sample the core area, have demonstrated regular encounters with Atlantic croaker, and have collected sufficient sample sizes to develop frequency distributions. Table 5 provides a brief description of these surveys and how they were used to develop indices for Atlantic croaker. A summary and time series of additional surveys considered during the stock assessment and used in previous trigger exercises is also included (Table 6).

All four main indices were calculated using the same methods and data subsets that were used for the 2010 ASMFC assessment, with the exception of the NMFS and the VIMS indices. For the 2010 assessment, which considered data through 2008, the NMFS index was calculated using data collected in the fall (inshore) component of the survey and was based on stratification by depth and latitude (ASMFC 2010). Based on a recommendation by the review panel, only observations from the mid- and deep-depth strata were included in the calculations. The modifications to the NMFS Bottom Trawl Survey in 2009 included changes to the survey vessel, trawling gear, tow speed and duration, station allocation, and fishing protocols (Miller et al. 2010; NEFSC 2010). The shallow and mid-depth strata of the inshore series are no longer sampled. Thus data collected in 2009 and later cannot be stratified by depth using the NMFS strata designations. Species-specific calibration factors were estimated to allow conversion of catch rates between the new and old survey vessels (Miller et al. 2010). For this trigger exercise, the 2011 NMFS fall index was calculated based on stratification by latitude only and the recommended calibration factor for Atlantic croaker (1.134) was applied to convert the 2009 – 2011 index values into units of measure equivalent to data collected prior to 2009. With the same level of latitudinal pooling and use of the same strata, the long term trends should be relatively comparable. The next stock assessment will consider any impacts of the change in vessel and protocol on the long term trends.

The fall components of the NMFS and SEAMAP surveys have primarily encountered age-1 Atlantic croaker. The NMFS index varied from year to year with no obvious trend from 1972 to 1993 (Figure 18). After 1993, the index has remained variable but with an overall increasing trend through the end of the time series. Since 2003, the NMFS index exceeded the time-series average, except for 2008. The SEAMAP index has been variable and without trend over the survey time series (Figure 19). The SEAMAP index, which only includes the fall data, saw a drastic decrease (70%) from 2010 to 2011; however, the SEAMAP index calculated from the entire data set (spring, summer and fall) increased 146% to the highest value in the time series (Table 6).

Data from the VIMS and NC P195 surveys were used to develop young-of-year indices for Atlantic croaker. The VIMS index used in the 2010 stock assessment was modified to allow for the estimation of confidence intervals, which was not reliable under the former calculation method. To produce the new index, the delta-lognormal mean of the catches within each stratum were calculated following Fletcher (2008) and using the Cox formulation of the mean (at the stratum level); the variance of the index was estimated using a bootstrap approach. The index varied without trend from the beginning of the time series through 2006 (Figure 20), with small spikes in 1991 and 1997. From 2007 to 2009, the VIMS index exhibited an increasing trend, spiking in 2009. The plot (Figure 20) shows both the VIMS index with and without the Bay tows included, which

contributed to the large spike in 2009. In 2011 the VIMS index continued to decrease and fell below the time-series average.

The young-of-year index derived from the NC P195 survey varied without trend over the survey time series (Figure 21). The index increased slightly in 2008 followed by a small decrease in 2009. The NC P195 index spiked again in 2010, while the 2011 index decreased to 2009 levels. The index has been below the time-series average for five of the last seven years.

Summary

According to Amendment 1, the trigger is tripped if the recreational or commercial landings fall below 70% of the previous two years' average landings. For 2011, the recreational landings tripped, falling to 55.8% of the previous two years' average. Thus, this would trigger an update or benchmark stock assessment. However, given the following pros and cons of performing a stock assessment, **the TC does not recommend the Board initiate a stock assessment, whether update or benchmark, at this time**.

a. Reasons supporting an update or benchmark assessment in 2013:
    1. The recreational landing trigger was tripped, and the TC has observed a continued downward trend of the commercial landings and some of the length and weight triggers.
    2. An update assessment would update the F-reference point to see where current relative F is in relation to the reference point.
    3. Although the peer review did not accept the last stock assessment's biomass estimates, the update would provide the best estimate of the biomass trend.
    4. A benchmark assessment could provide changes to the model sturcutre and incorporation of new data sources, which may result in peer-review approved estimates of biomass and F
b. Reasons against an update or benchmark assessment in 2013:
    1. The last peer-reviewed stock assessment did not accept the biomass estimate or corresponding biomass reference point, so an update will not provide a peer-reviewed value.
    2. As with the previous assessment, the shrimp trawl bycatch is not quantifiable. This was the biggest concern and issue in the last stock assessment and prevented the peer review from accepting the biomass estimates.
    3. A rushed benchmark assessment may not fully address the concerns of the previous peer review. In addition, a shorter time frame between benchmarks limits model improvements.
    4. The NCDMF has secured funding to perform a study on inshore and near-shore shrimp trawl bycatch to characterize total catch, species catch, size composition of targeted and non-targeted species (to include Atlantic Croaker). These data are expected to be available for the next benchmark stock assessment, which will begin in 2014/15, and will be valuable data to improve shrimp trawl bycatch estimates.

5. There are no other methods, in which the TC is confident, to estimate biomass from other data sources or indices.
6. Bait fishery landings cannot be accurately quantified for Atlantic croaker (specifically the species composition in New Jersey and Virginia; some information available from North Carolina).
7. Time is needed to quantify the switch from MRFSS to MRIP estimates.

Rather, **the TC recommends the Board task the TC with further developing a management and assessment trigger package, by which if tripped, the TC would review the data and provide a recommendation to the Board on the best path forward.** This option would give the Board additional management tools to monitor and react to changes in the croaker fishery and stock, as the TC could evaluate the available data and recommend whether an assessment or management changes would be most effective. At its meeting in June in Charleston, SC, the TC reviewed possible methods for designing management/assessment triggers for Atlantic croaker, using some of the methods to develop the spot triggers included in the Omnibus Amendment as well as methods used by NC DMF to develop a stoplight approach for managing blue crab. These methods can afford the Board additional options while providing a comprehensive look at the status of the fishery and stock; however, they will take additional time to develop.

The TC has concerns about the decrease in landings seen over the past decade but, the fishery-independent indices do not indicate the stock is currently in trouble. Thus, **the TC is not recommending the Board initiate any management measures; however, the TC would support the Board in developing management measures, should the Board decide to begin that process**. Some management options for the Board would include coastwide measures like a minimum size or harvest limits; a maximum coastwide quota based on some level of past landings (75^{th} percentile, one standard deviation above the mean, etc.) or possible use of a fishery-independent index; or allocating a quota among the states.

Finally, **the TC has included a list of research needs for the next stock assessment**, should Board members have the option or ability in the next three years to support such studies. The research needs include:

a. Bait landings composition
b. Shrimp trawl bycatch research (NC, other states, federal)
c. Genetic studies for stock distribution (north/south break?)
d. Movement (tagging or telemetry research)
e. Effort (fishing pressure) by gear description

References

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Table 1. Comparison of Atlantic croaker commercial landings and recreational harvest estimates from the most recent year, 2011, to the average of the estimates from the previous two years, 2009 and 2010.

Fisheries Data	Pounds		2011 as % of 2009–2010 Avg.
	Avg., 2009–2010	2011	
Commercial Landings	16,075,029	11,891,861	74.0
Recreational Harvest	4,873,357	2,718,328	55.8

Table 2. Comparison of the average total length (inches) of Atlantic croaker observed in the most recent year, 2011, to the average of the average lengths of the previous two years, 2009 and 2010, by fishery, region or state, and gear.

Fishery	State	Gear	Average Length (in)		Percent Change (%)
			Avg., 2009–2010	2011	
Recreational	NJ–East FL	All	9.8	10.2	4.08
Recreational	M. Atlantic (NJ-VA)	All	10.5	10.3	-2.09
Recreational	S. Atlantic (NC-E. FL)	All	9.3	9.8	5.95
Commercial	New Jersey	Gill Net	12.1	12.2	1.07
Commercial	New Jersey	Trawl	11.2	11.2	-0.45
Commercial	Maryland	Pound Net	11.6	11.1	-4.31
Commercial	Virginia	Haul Seine	10.6	10.2	-3.77
Commercial	Virginia	Pound Net	12.4	12.2	-1.61
Commercial	Virginia	Sink/Anchor Gill Net	12.4	11.7	-5.65
Commercial	North Carolina	Long Haul	10.6	9.4	-11.32
Commercial	North Carolina	Inside Gill Net	10.6	9.9	-6.60
Commercial	North Carolina	Ocean Gill Net	12.1	12.3	1.65
Commercial	North Carolina	Fly Net	11.2	11.4	1.79

Table 3. Comparison of the average weight (pounds) of Atlantic croaker observed in the most recent year, 2011, to the average of the average weights of the previous two years, 2009 and 2010, by fishery, state, and gear.

Fishery	State	Gear	Average Weight (lb)		Percent Change (%)
			Avg., 2009–2010	2011	
Commercial	New Jersey	Gill Net	0.89	0.94	5.62
Commercial	New Jersey	Trawl	0.64	0.69	7.81
Commercial	Maryland	Pound Net	0.75	0.80	6.67
Commercial	Virginia	Haul Seine	0.56	0.51	-10.28
Commercial	Virginia	Pound Net	0.97	0.86	-11.34
Commercial	Virginia	Sink/Anchor Gill Net	0.91	0.75	-17.71
Commercial	North Carolina	Long Haul	0.56	0.36	-36.77
Commercial	North Carolina	Inside Gill Net	0.60	0.45	-24.08
Commercial	North Carolina	Ocean Gill Net	0.74	0.79	6.50
Commercial	North Carolina	Fly Net	0.61	0.60	-0.66

Table 4. Number of Atlantic croaker age samples collected from commercial landings, by state, 2007–2011.

State	Number Age Samples				
	2007	2008	2009	2010	2011
New Jersey	338	497	558	749	261
Maryland	277	306	222	344	296
Virginia	344	546	512	451	425
North Carolina	336	739	709	703	
SEAMAP					

Table 5. Summary of information describing the fisheries-independent surveys and how their data were subset to develop indices for Atlantic croaker.

Index	Agency	Program	Survey Design	Sampling Area	Subset Used for Index		
					Season	Area	Size/Age
NMFS	NEFSC	Bottom Trawl Survey	Stratified random	Cape Hatteras to Cape Cod, inshore (fall)	Fall	strata 3180–3440, excluding shallow strata (NJ-NC)	Age 1+
SEAMAP	SCDNR	South Atlantic Coastal Survey (trawl)	Stratified random	Cape Hatteras to Cape Canaveral, coastal waters	Fall		Age 1+
VIMS	VIMS	Juvenile Fish and Blue Crab Trawl Survey	Mixed	Chesapeake Bay and tributaries	Spring		YOY
NC P195	NCDMF	Pamlico Sound Survey (Program 195)	Stratified random	Pamlico Croatan, Roanoke Sounds, and lower Neuse and Pamlico rivers	Spring	excludes Pungo R. stratum	YOY

Table 6. Time series of all indices considered for use in the Atlantic Croaker 2010 stock assessment.

Year	SEAMAP all Weight	SEAMAP Fall Weight	NMFS Fall Number	VIMS Spring DLN	VIMS Spring DLN-Rivers only	NCDMF 120 Numbers	NCDMF 195-Spring Numbers	MDDNR CBT GM	MDDNR BCT GM	FLFWCC 21.3m seine Numbers	FLFWCC 183m seine Numbers	FLFWCC 6.1m trawl Numbers
1972	x	x	0.18	x	x	x	x	x	x	x	x	x
1973	x	x	11.18	x	x	78.04	x	x	x	x	x	x
1974	x	x	18.85	x	x	38.92	x	x	x	x	x	x
1975	x	x	57.25	x	x	30.05	x	x	x	x	x	x
1976	x	x	109.55	x	x	34.27	x	x	x	x	x	x
1977	x	x	65.12	x	x	3.62	x	x	x	x	x	x
1978	x	x	45.77	x	x	24.38	x	x	x	x	x	x
1979	x	x	5.42	x	x	48.24	x	x	x	x	x	x
1980	x	x	5.70	x	x	64.28	x	x	x	x	x	x
1981	x	x	45.48	x	x	16.52	x	x	x	x	x	x
1982	x	x	12.43	x	x	48.33	x	x	x	x	x	x
1983	x	x	24.73	x	x	92.65	x	x	x	x	x	x
1984	x	x	146.80	x	x	60.32	x	x	x	x	x	x
1985	x	x	70.83	x	x	27.74	x	x	x	x	x	x
1986	x	x	75.79	x	x	21.95	x	x	x	x	x	x
1987	x	x	94.12	x	x	52.15	105.77	x	x	x	x	x
1988	x	x	7.69	0.95	0.27	25.28	75.88	x	x	x	x	x
1989	x	x	115.52	14.14	1.43	24.15	125.80	1.01	0.83	x	x	x
1990	12.18	7.72	64.17	6.40	0.60	19.01	355.53	0.11	0.18	x	x	x
1991	29.71	24.53	2.24	28.39	4.93	8.60	266.03	3.09	4.06	x	x	x
1992	25.69	4.32	19.42	2.80	2.17	20.04	65.90	0.91	1.28	x	x	x
1993	13.36	18.68	3.72	7.22	3.27	55.23	437.62	2.02	3.67	x	x	x
1994	13.15	14.64	631.30	0.52	0.26	27.60	164.59	3.52	4.25	x	x	x
1995	9.15	5.08	97.49	2.06	1.25	42.58	157.35	3.01	0.74	x	x	x
1996	5.32	5.14	192.34	0.03	0.01	14.80	65.37	1.46	2.15	0.73	x	x
Continued												

Year	SEAMAP all Weight	SEAMAP Fall Weight	NMFS Fall Number	VIMS Spring DLN	VIMS Spring DLN-Rivers only	NCDMF 120 Numbers	NCDMF 195-Spring Numbers	MDDNR CBT GM	MDDNR BCT GM	FLFWCC 21.3m seine Numbers	FLFWCC 183m seine Numbers	FLFWCC 6.1m trawl Numbers
1997	4.18	2.30	72.06	65.51	8.67	59.25	386.78	3.20	5.32	0.11	x	x
1998	11.51	4.65	158.67	12.68	8.42	97.49	699.99	4.88	30.05	0.40	x	x
1999	11.10	17.48	669.35	4.98	2.46	22.29	744.69	2.24	4.18	1.47	x	x
2000	10.10	4.19	403.93	1.17	0.70	61.53	169.42	0.97	2.76	0.76	x	x
2001	11.28	2.66	51.62	1.55	0.21	28.98	112.28	0.40	0.86	19.59	0.49	x
2002	10.56	9.24	170.81	7.65	4.61	23.22	77.39	2.28	3.50	4.81	1.12	20.13
2003	14.85	14.12	336.07	0.90	0.07	28.82	171.08	0.85	0.81	4.27	1.24	26.18
2004	21.54	15.39	558.17	4.36	2.90	44.80	445.92	0.68	3.51	5.22	0.84	21.72
2005	18.64	23.83	376.15	2.72	1.59	49.38	225.36	0.41	0.44	34.02	0.86	82.50
2006	18.68	12.08	479.58	9.46	5.79	9.41	129.25	1.93	2.10	6.64	1.13	26.69
2007	11.93	9.20	1525.93	6.36	4.18	47.88	111.71	0.53	0.54	2.01	1.25	16.26
2008	15.82	12.02	160.63	28.06	22.21	14.89	300.20	0.96	4.51	8.28	1.64	46.73
2009	16.33	8.67	968.85	114.71	7.32	13.05	79.52	1.46	0.67	5.02	1.32	16.03
2010	16.33	20.39	354.53	29.07	6.63	59.28	1185.43	0.97	0.59	8.05	1.33	107.71
2011	40.30	6.20	730.11	4.43	1.36	4.65	89.87	1.05	1.15	2.88	3.18	15.89

Table 6. (continued)

Year	NJ DR seine Numbers	NJ DB trawl Numbers	NJ OT Aug Numbers	NJ OT Oct Numbers	DE Juvenile GM	DE Adult Numbers
1972	x	x	x	x	x	x
1973	x	x	x	x	x	x
1974	x	x	x	x	x	x
1975	x	x	x	x	x	x
1976	x	x	x	x	x	x
1977	x	x	x	x	x	x
1978	x	x	x	x	x	x
1979	x	x	x	x	x	0.70
1980	0.00	x	x	x	0.20	0.40
1981	0.00	x	x	x	0.19	0.70
1982	0.00	x	x	x	0.00	0.00
1983	0.00	x	x	x	0.00	0.30
1984	0.00	x	x	x	2.17	0.00
1985	0.16	x	x	x	7.15	x
1986	0.29	x	x	x	2.18	x
1987	0.00	x	x	x	1.24	x
1988	0.00	x	1.59	0.00	0.00	x
1989	0.27	x	0.00	0.00	4.94	x
1990	0.00	x	0.00	0.00	0.06	0.10
1991	0.14	0.19	4.87	0.38	2.00	2.90
1992	0.09	4.27	0.15	6.18	15.01	0.90
1993	1.12	1.96	0.18	0.77	13.22	1.30
1994	0.37	2.10	9.87	0.87	6.04	4.00
1995	3.67	30.67	40.46	12.95	22.52	6.70
1996	5.21	52.33	6.38	5.36	42.92	24.37
Continued						

Year	NJ DR seine Numbers	NJ DB trawl Numbers	NJ OT Aug Numbers	NJ OT Oct Numbers	DE Juvenile GM	DE Adult Numbers
1997	0.89	23.70	3.97	3.21	24.05	57.72
1998	3.14	79.09	0.56	2.64	27.66	69.64
1999	0.88	77.04	140.13	20.92	45.30	81.54
2000	3.59	35.05	47.69	45.38	15.84	34.55
2001	1.04	179.27	15.72	22.51	60.72	11.24
2002	5.26	175.51	392.90	133.40	88.82	226.68
2003	0.06	1.57	21.72	40.70	4.64	131.63
2004	0.91	6.31	365.59	159.77	17.19	30.35
2005	1.22	17.95	28.62	172.79	5.54	17.23
2006	1.82	262.66	7.56	25.97	11.77	193.10
2007	2.27	10.32	46.28	205.03	4.47	7.14
2008	2.74	157.23	0.85	75.00	7.50	42.00
2009	0.40	8.58	247.03	0.15	16.50	107.00
2010	0.15	11.66	10.74	10.31	17.60	9.00
2011	0.00	2.43	345.44*	63.95	4.50	13.00

*August OT was not completed until 9/14/11, due to Hurricane Irene

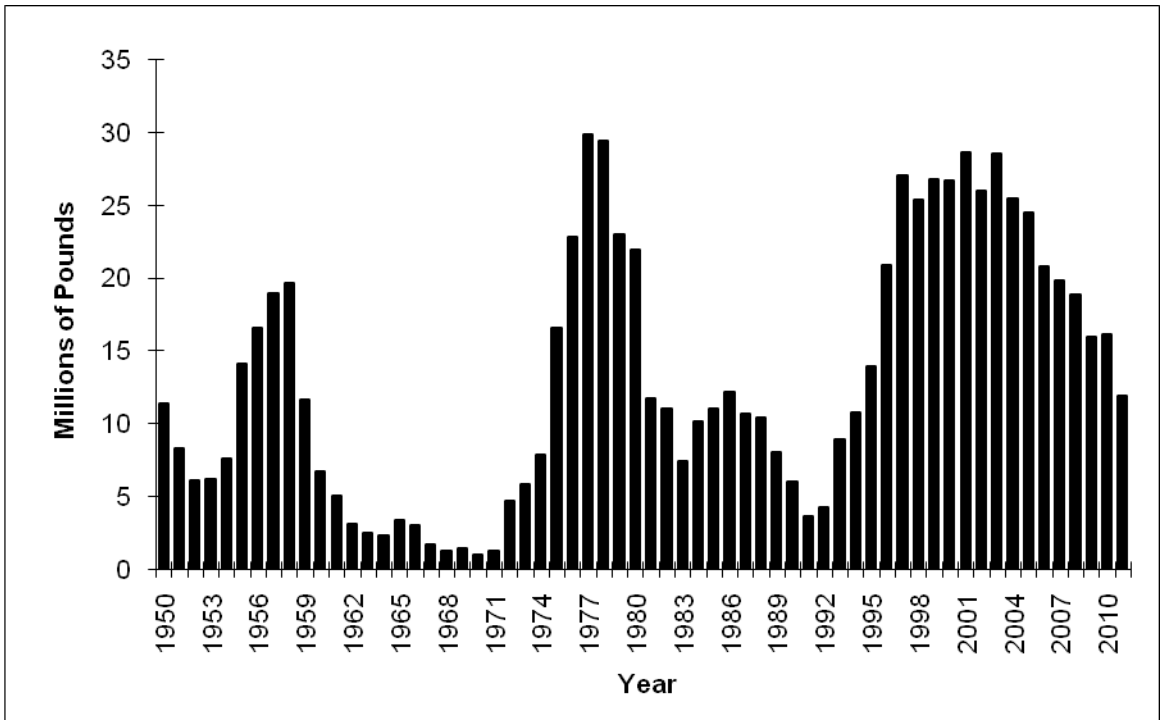

Figure 1. Annual commercial landings (pounds) of Atlantic croaker along the U.S. east coast, 1950–2011.

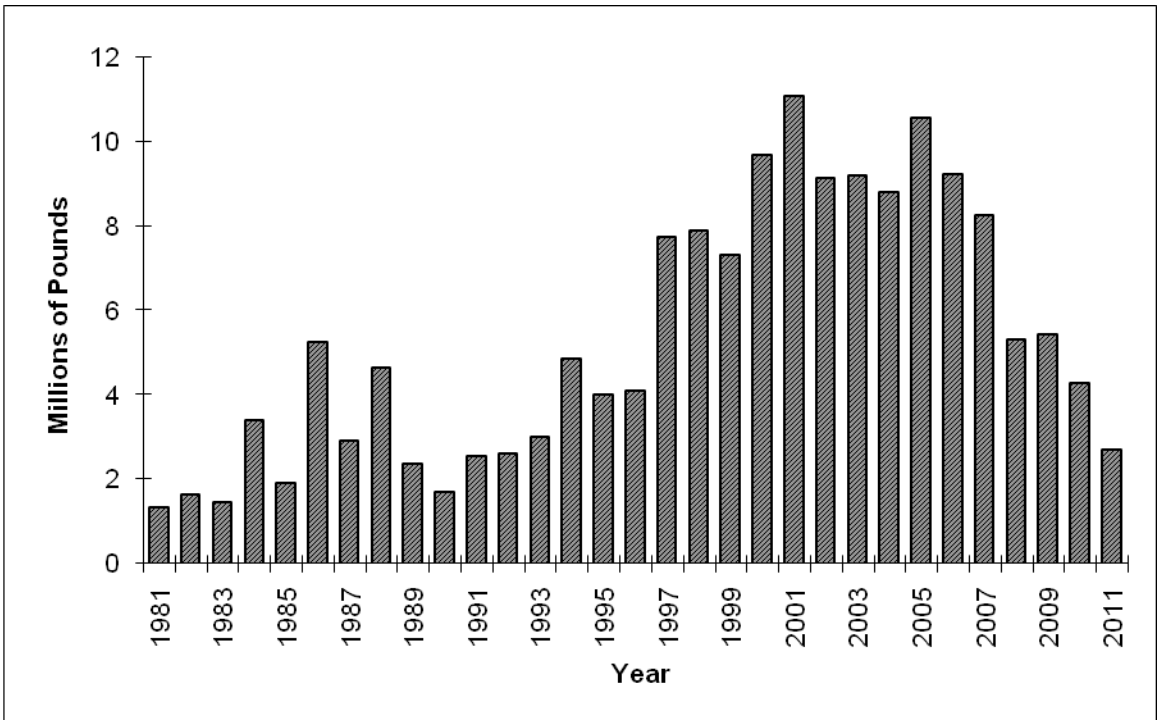

Figure 2. Annual recreational harvest (pounds; Type A + B1) of Atlantic croaker along the U.S. east coast, 1981–2011.

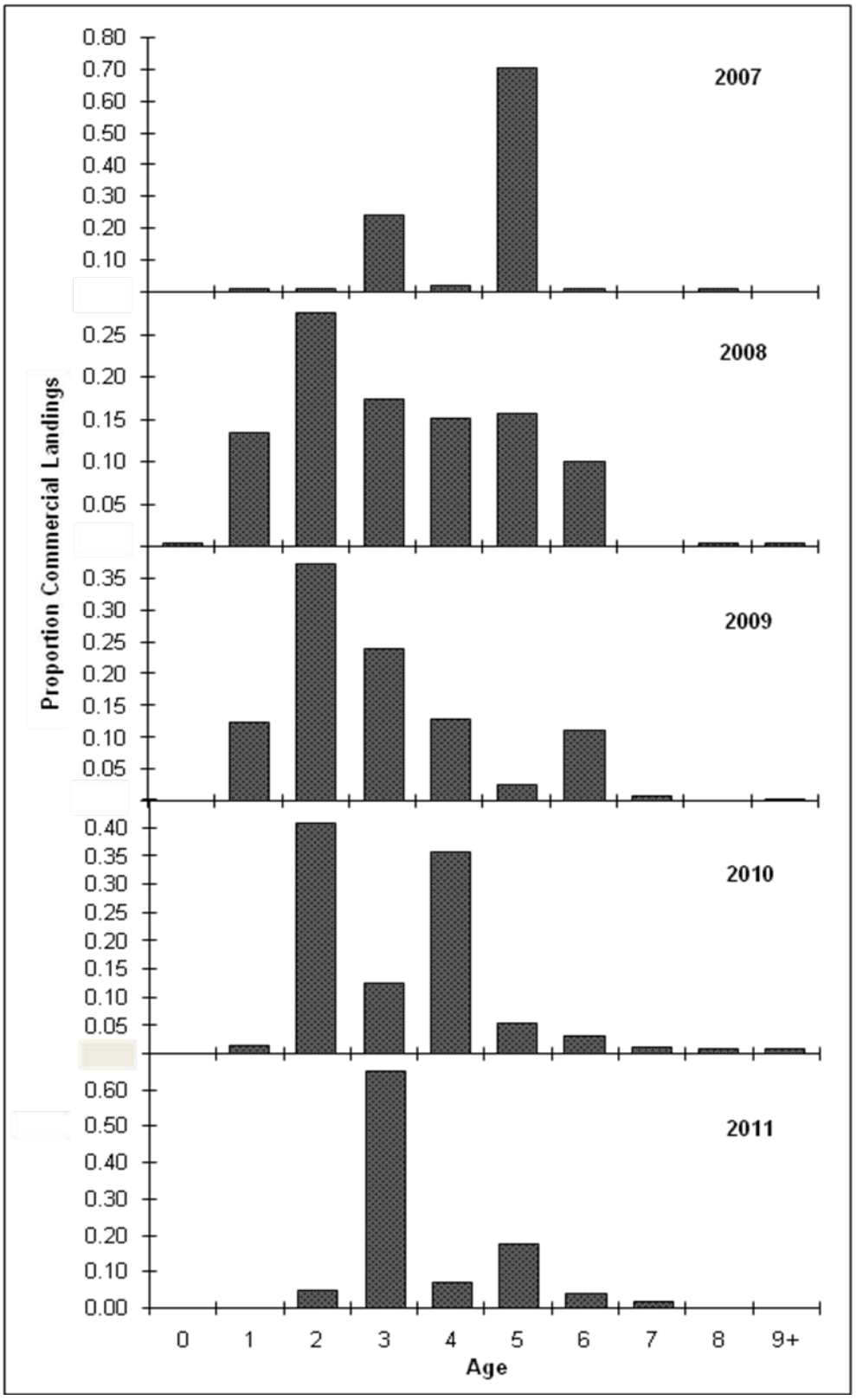

Figure 3. Proportion of Atlantic croaker commercial landings (pounds) at age for New Jersey pooled over all gears, 2007–2011.

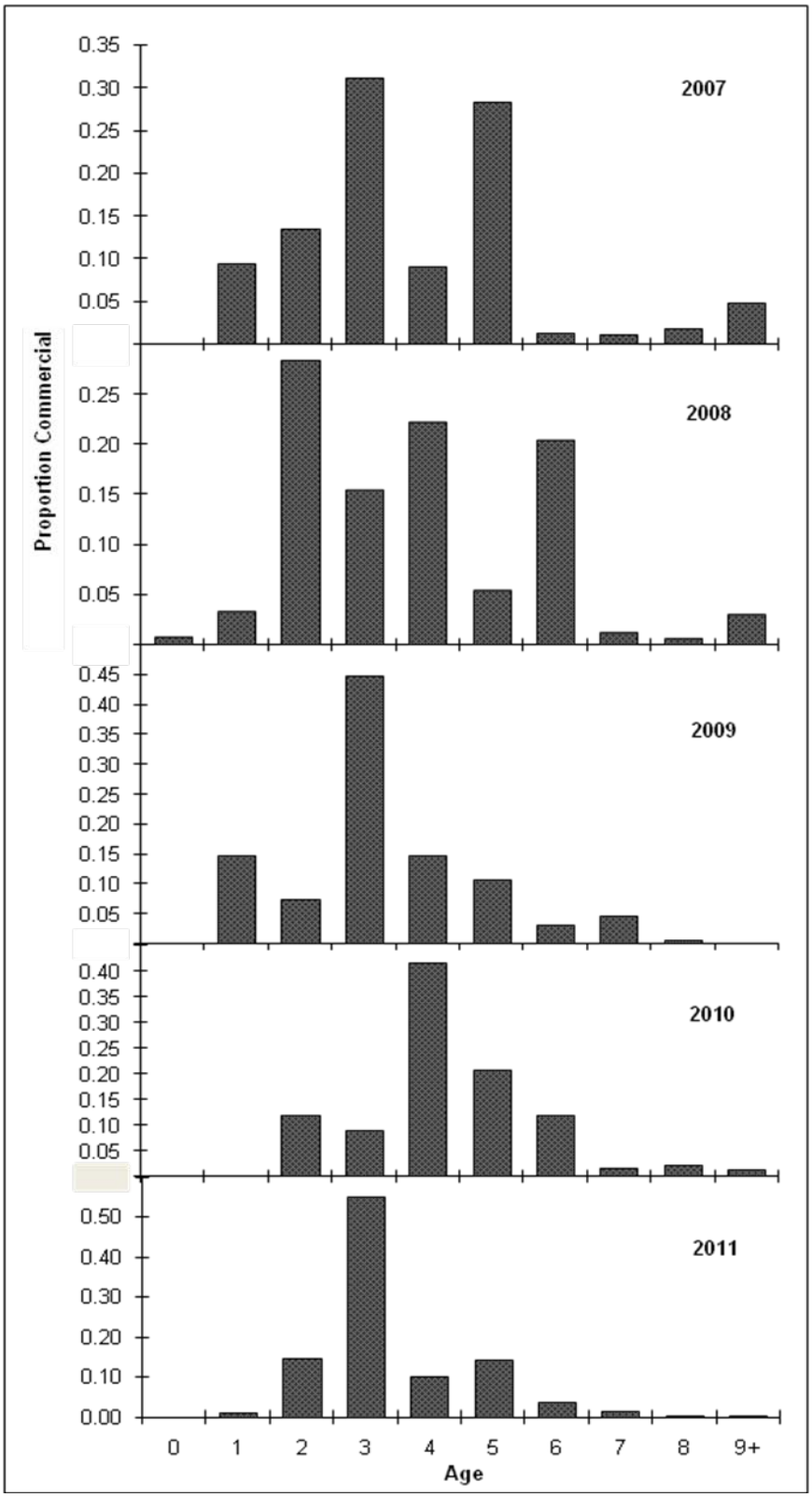

Figure 4. Proportion of Atlantic croaker commercial landings (pounds) at age for Maryland pooled over all gears, 2007–2011.

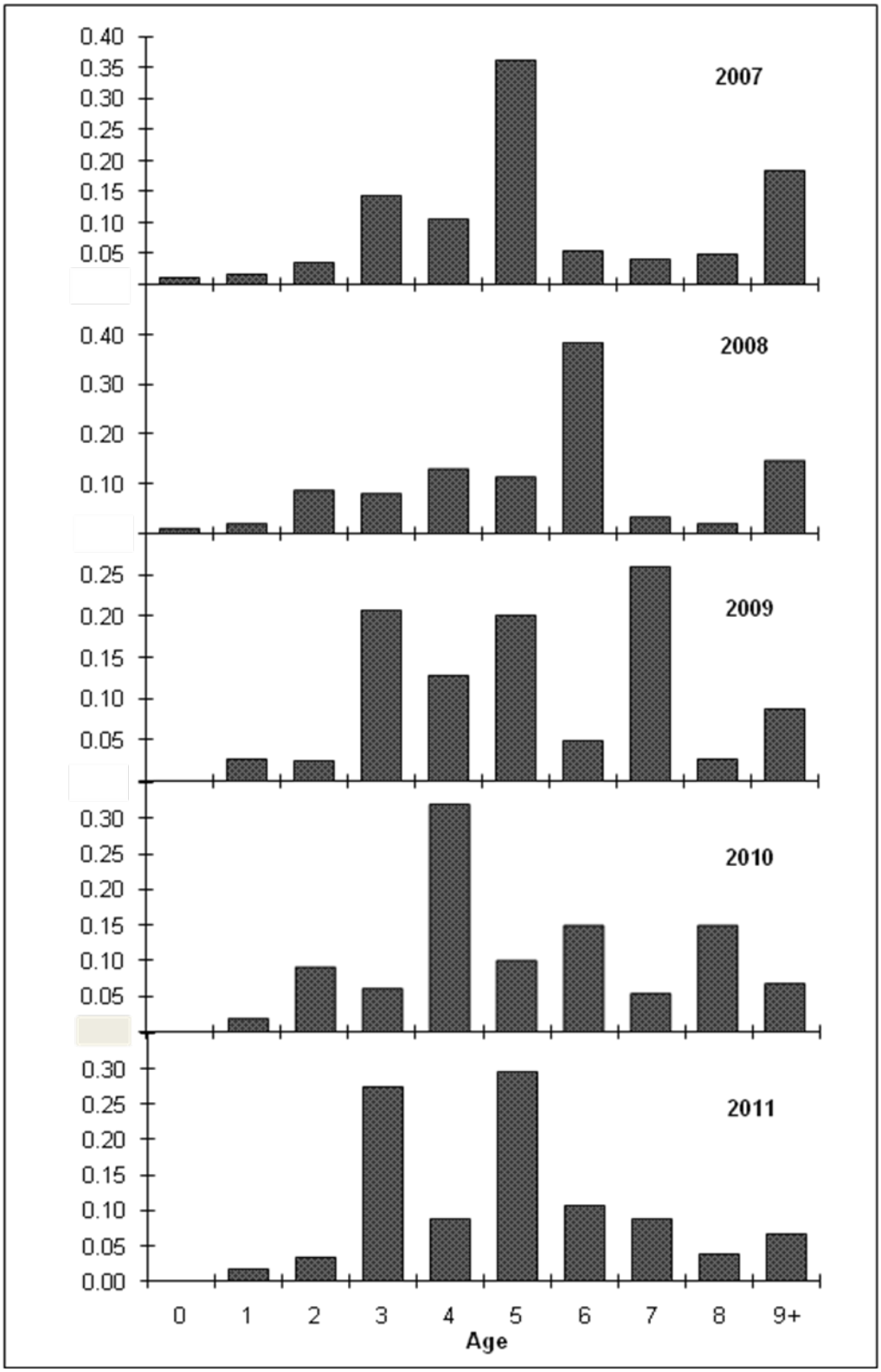

Figure 5. Proportion of Atlantic croaker commercial landings (pounds) at age for Virginia pooled over all gears, 2007–2011.

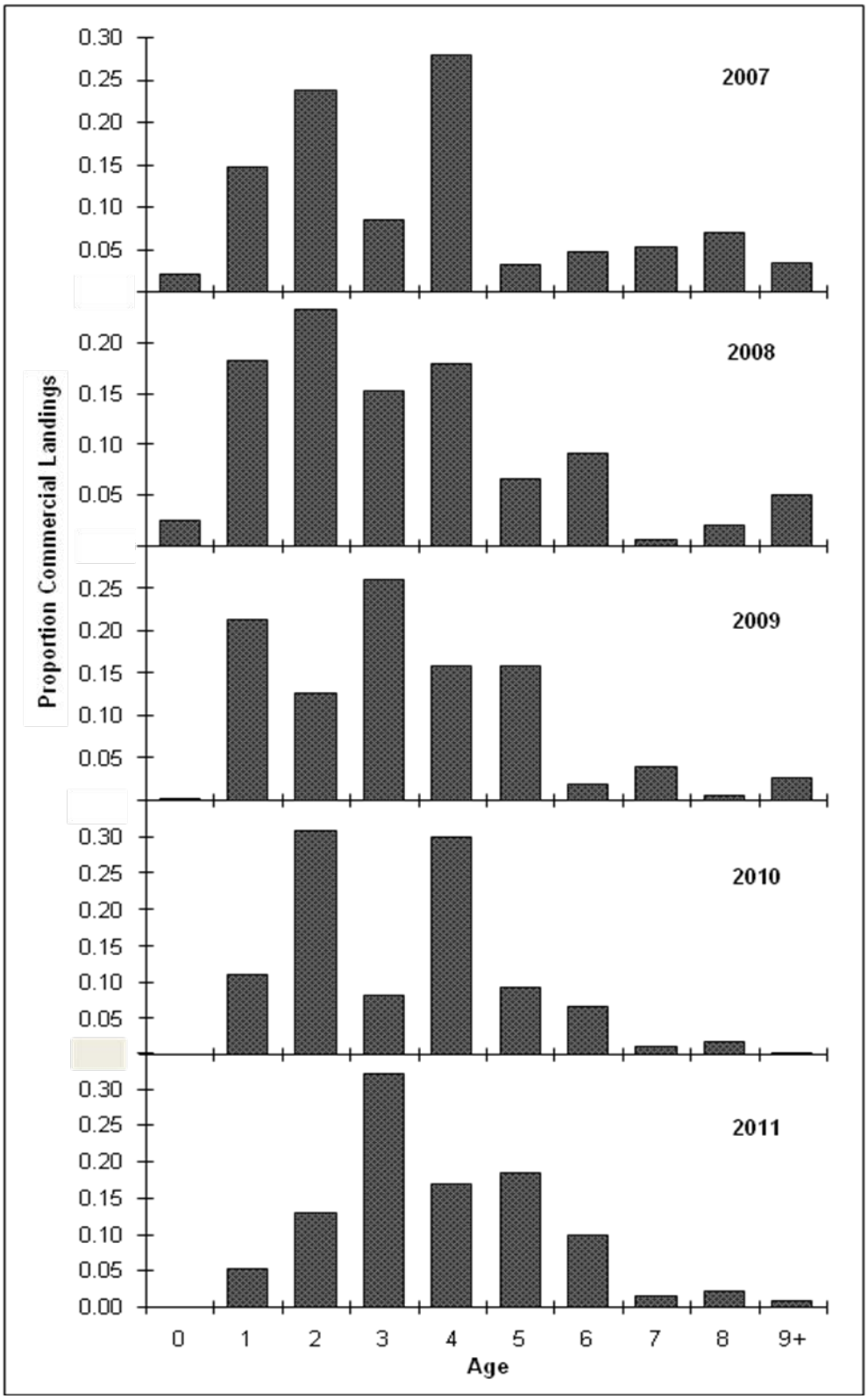

Figure 6. Proportion of Atlantic croaker commercial landings (pounds) at age for North Carolina pooled over all gears, 2007–2011.

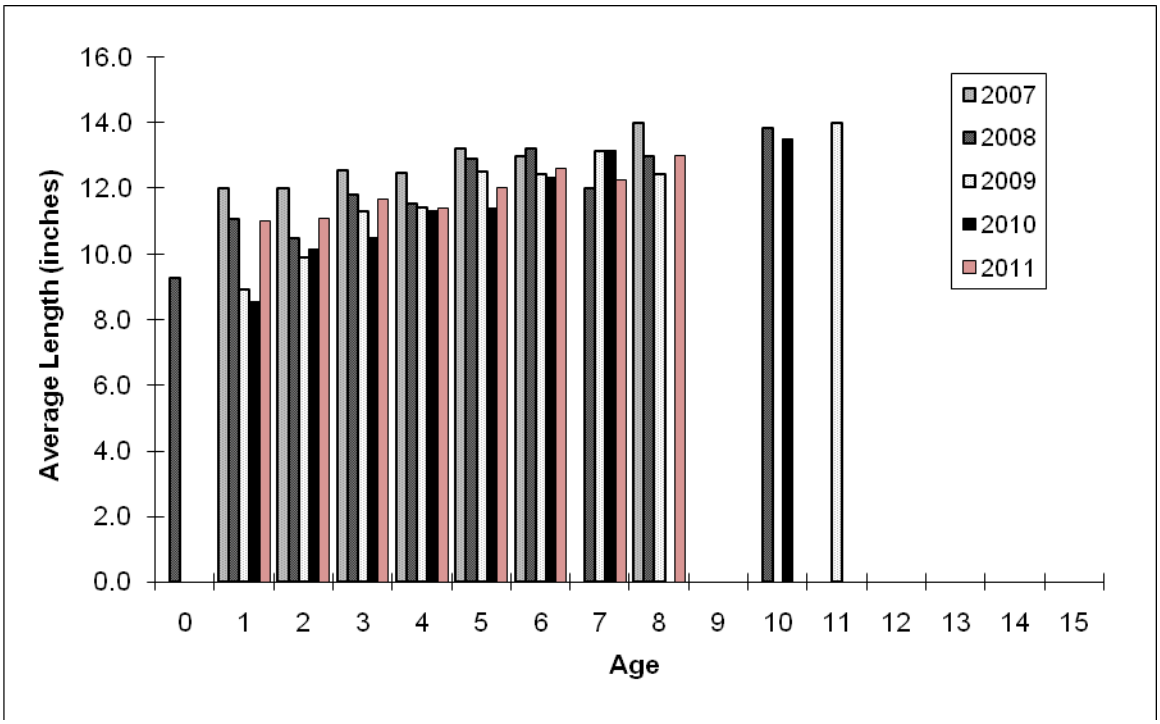

Figure 7. Average total length (inches) at age of Atlantic croaker sampled from New Jersey's commercial landings pooled over all gears, 2007–2011.

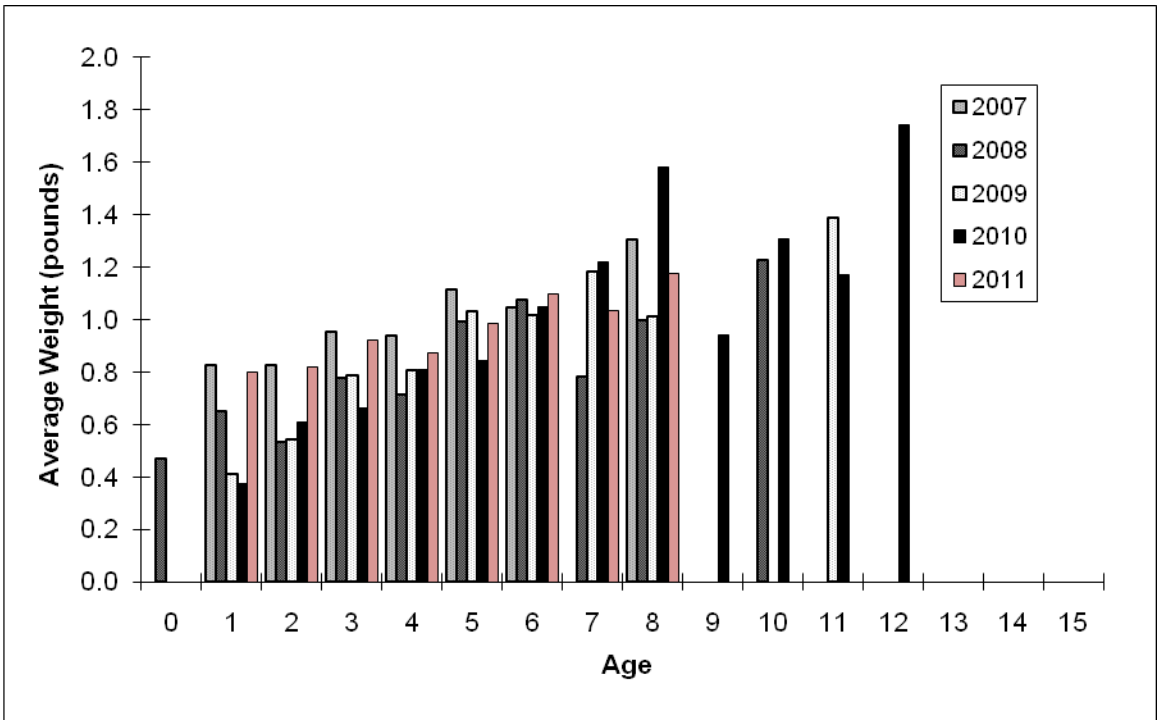

Figure 8. Average weight (pounds) at age of Atlantic croaker sampled from New Jersey's commercial landings pooled over all gears, 2007–2011.

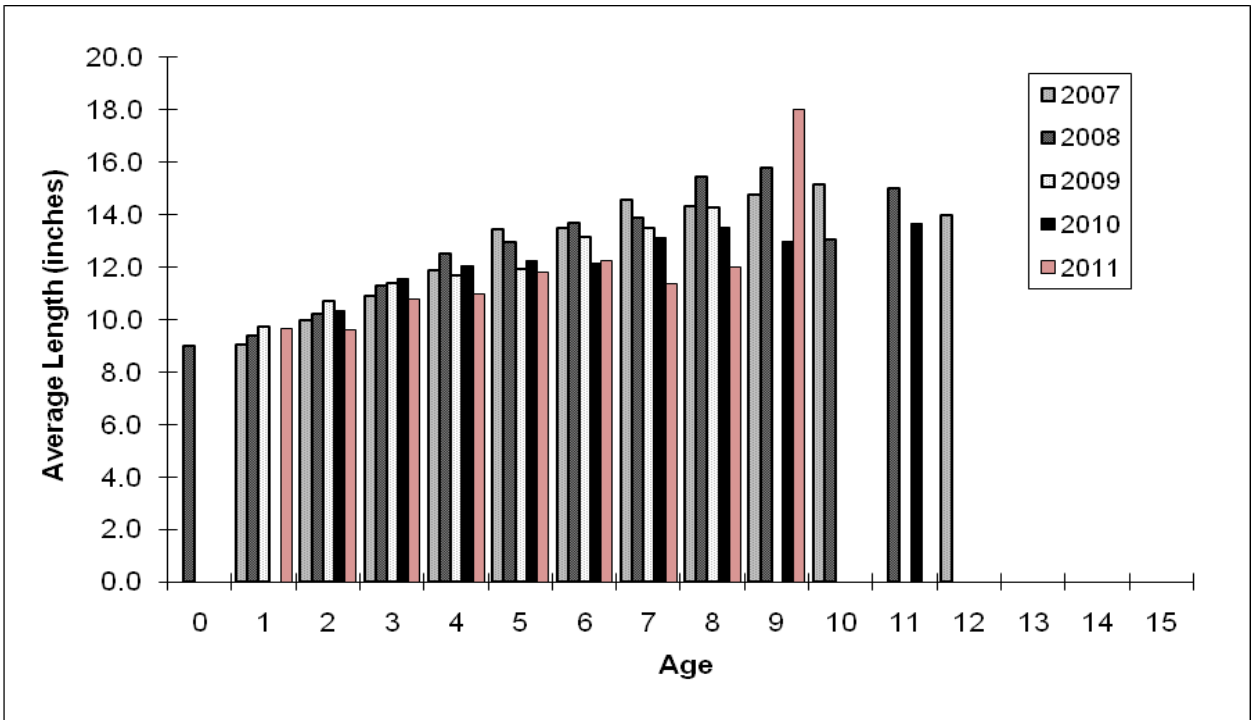

Figure 9. Average total length (inches) at age of Atlantic croaker sampled from Maryland's commercial pound-net landings, 2007–2011.

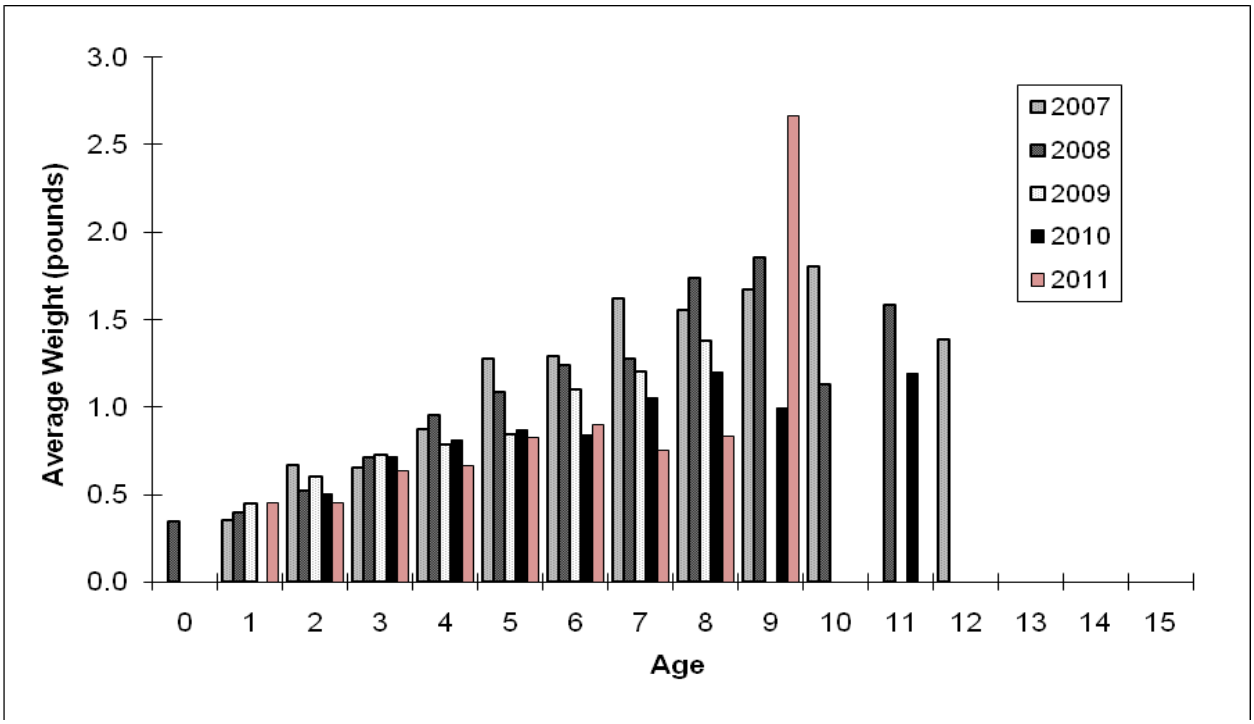

Figure 10. Average weight (pounds) at age of Atlantic croaker sampled from Maryland's commercial pound-net landings, 2007–2011.

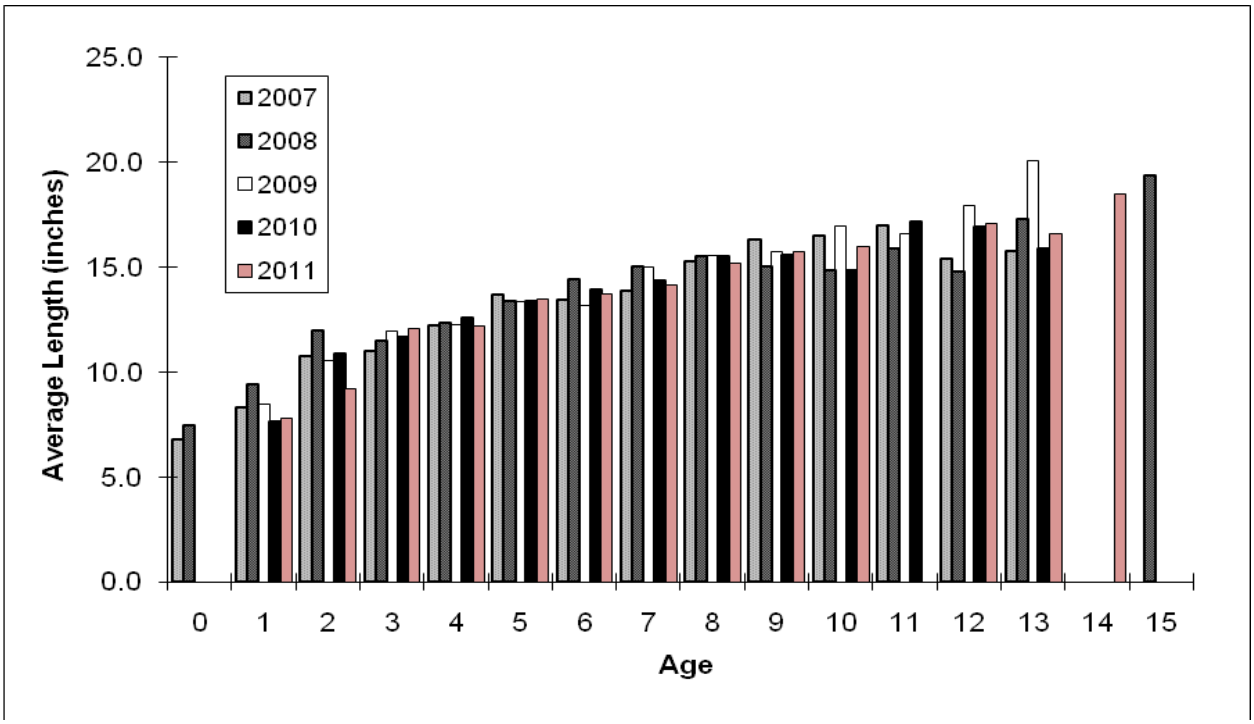

Figure 11. Average total length (inches) at age of Atlantic croaker sampled from Virginia's commercial landings pooled over all gears, 2007–2011.

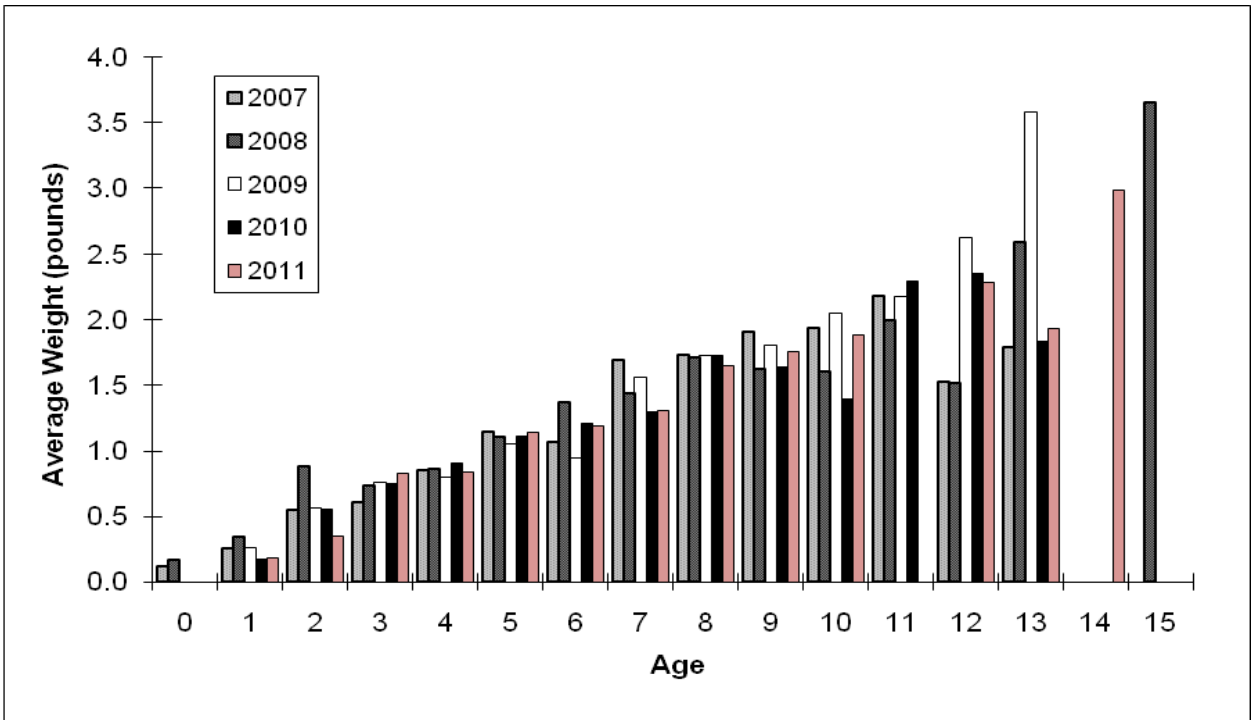

Figure 12. Average weight (pounds) at age of Atlantic croaker sampled from Virginia's commercial landings pooled over all gears, 2007–2011.

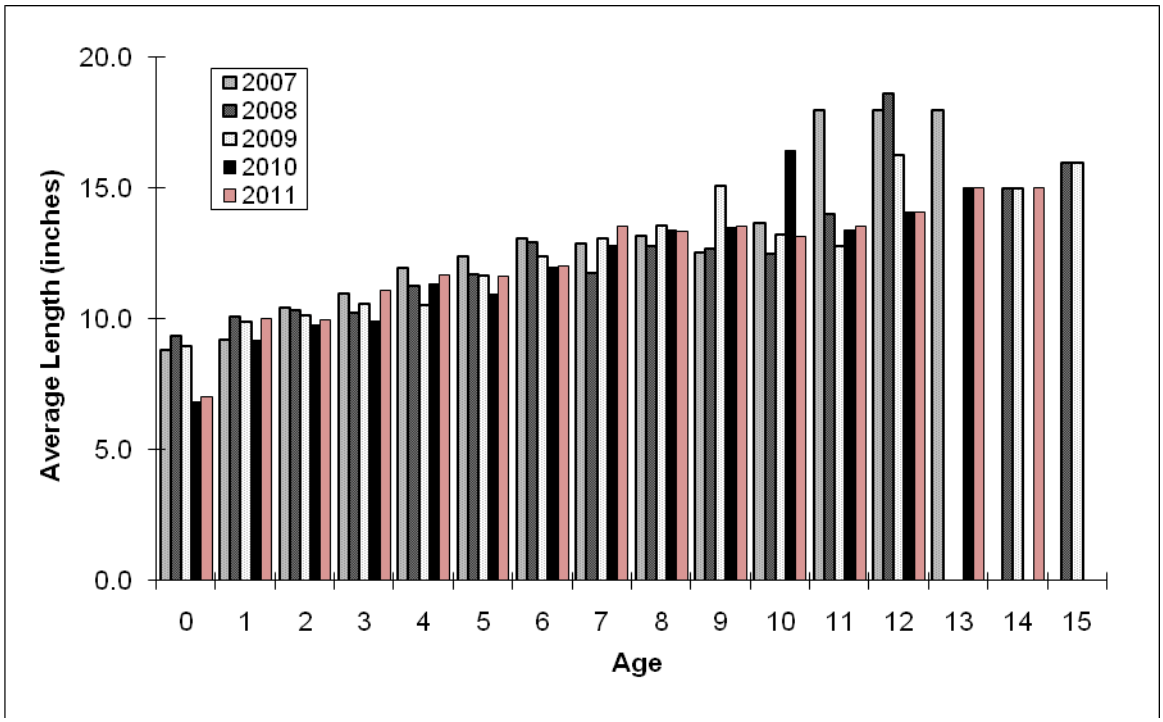

Figure 13. Average total length (inches) at age of Atlantic croaker sampled from North Carolina's commercial landings pooled over all gears, 2007–2011.

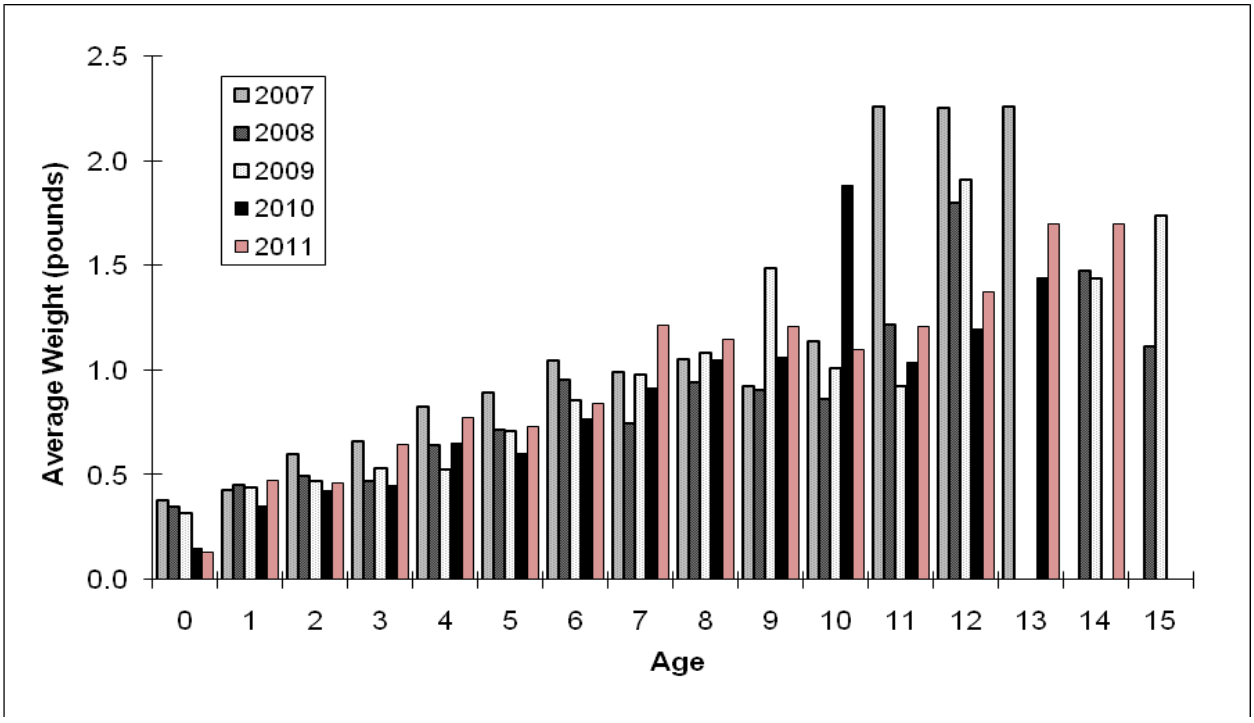

Figure 14. Average weight (pounds) at age of Atlantic croaker sampled from North Carolina's commercial landings pooled over all gears, 2007–2011.

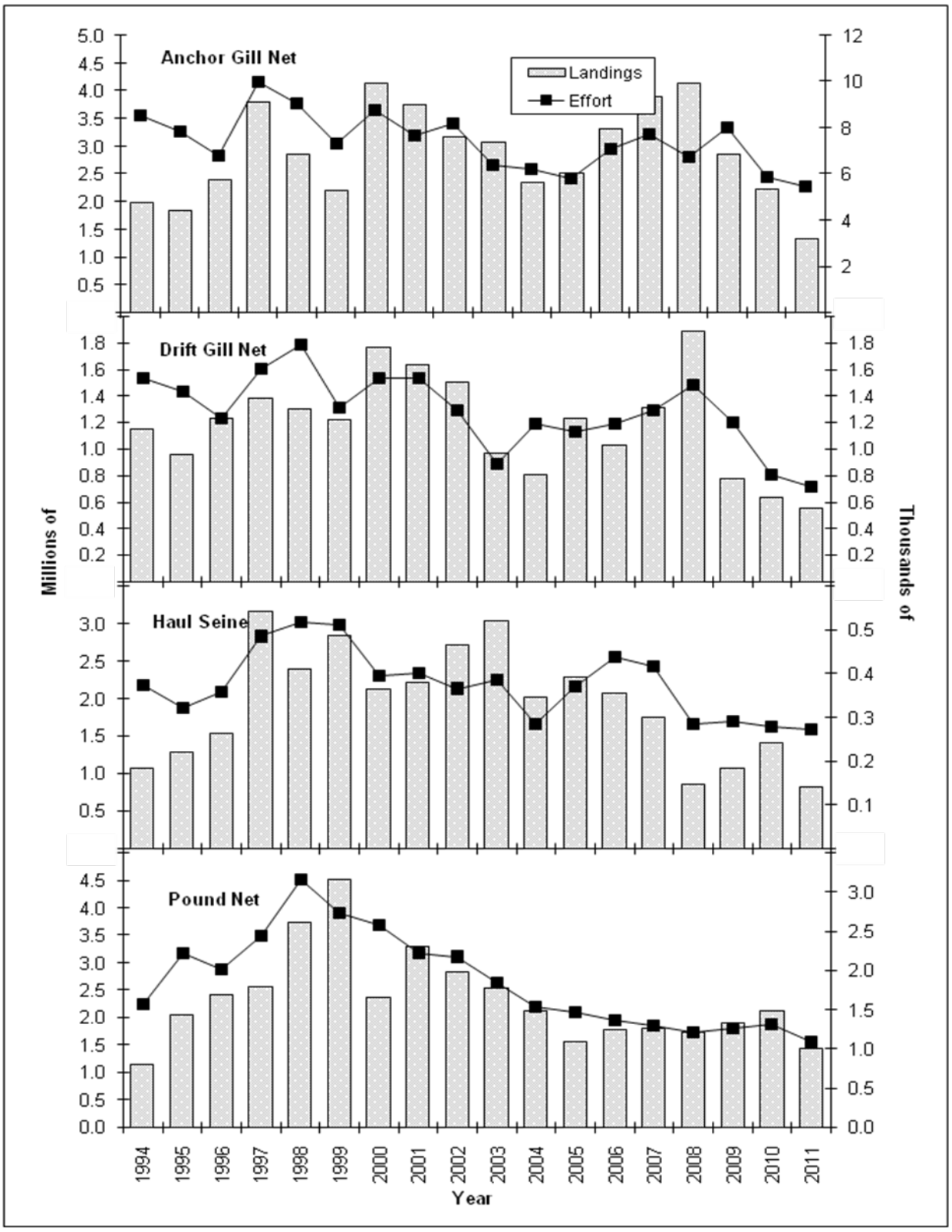

Figure 15. Annual landings (pounds) and effort (trips) in Virginia's Atlantic croaker commercial fisheries, by gear, 1994–2011.

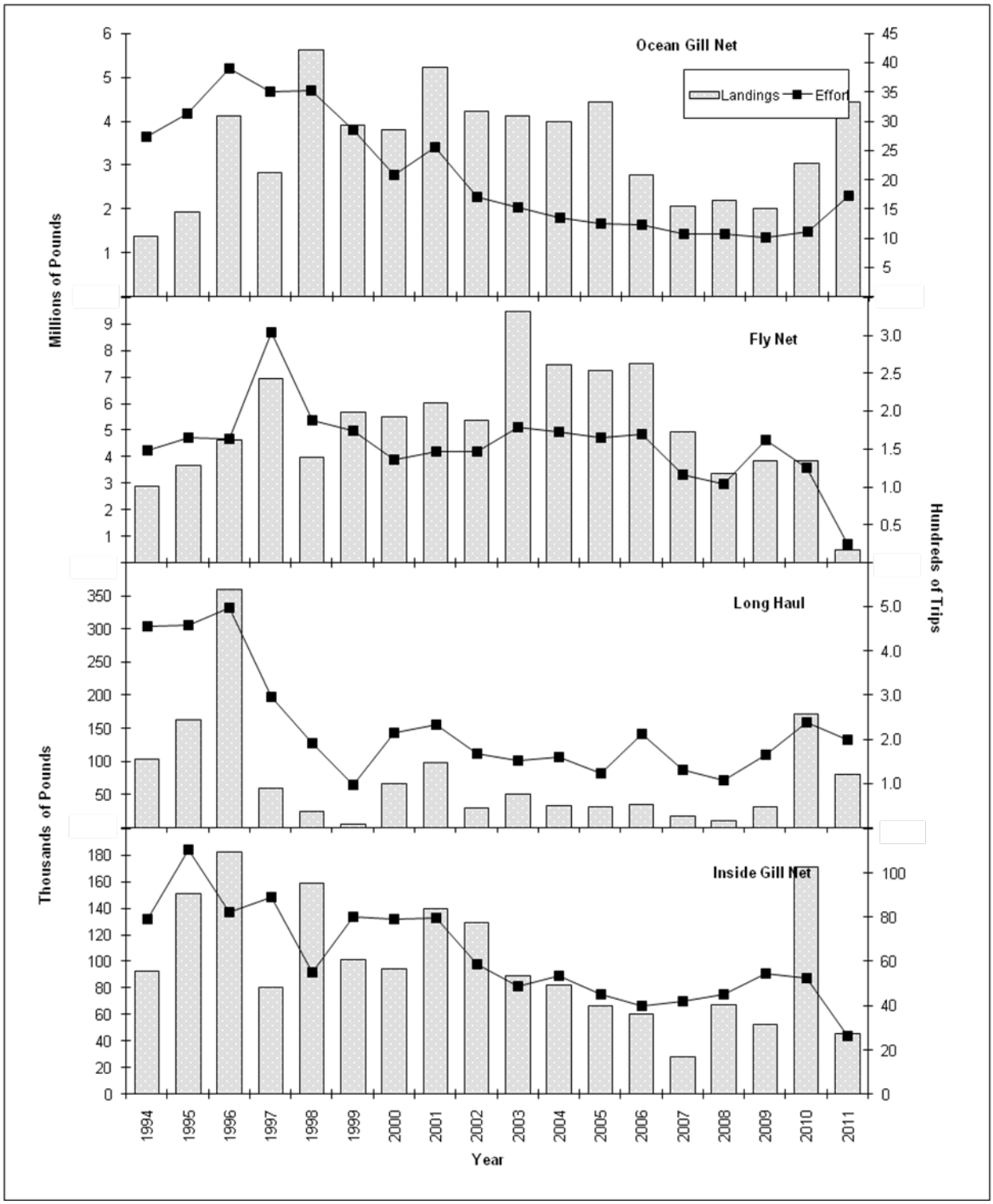

Figure 16. Annual landings (pounds) and effort (trips) in North Carolina's Atlantic croaker commercial fisheries, by gear, 1994–2011.

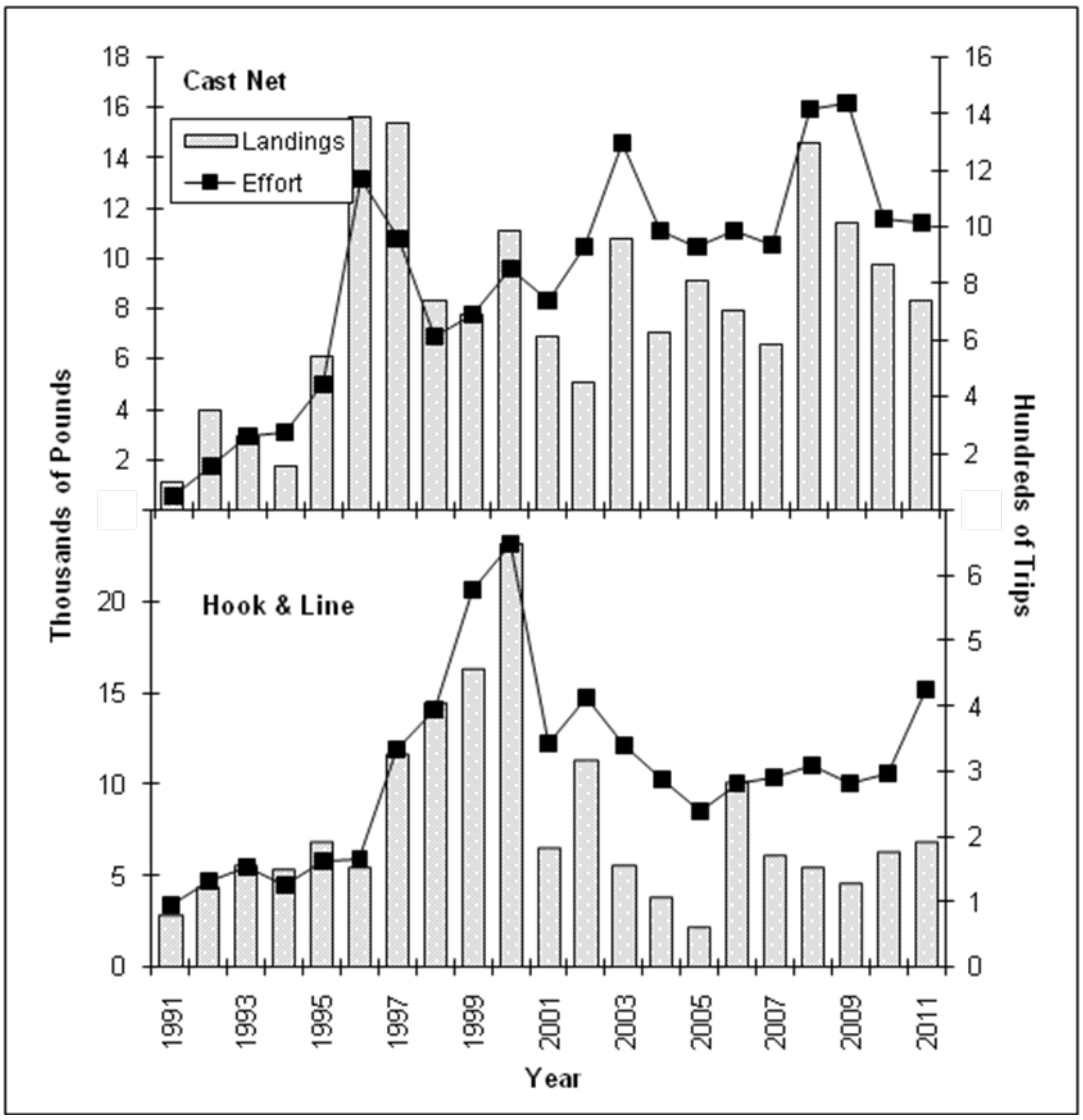

Figure 17. Annual landings (pounds) and effort (trips) in Florida's Atlantic croaker commercial fisheries, by gear, 1991–2011.

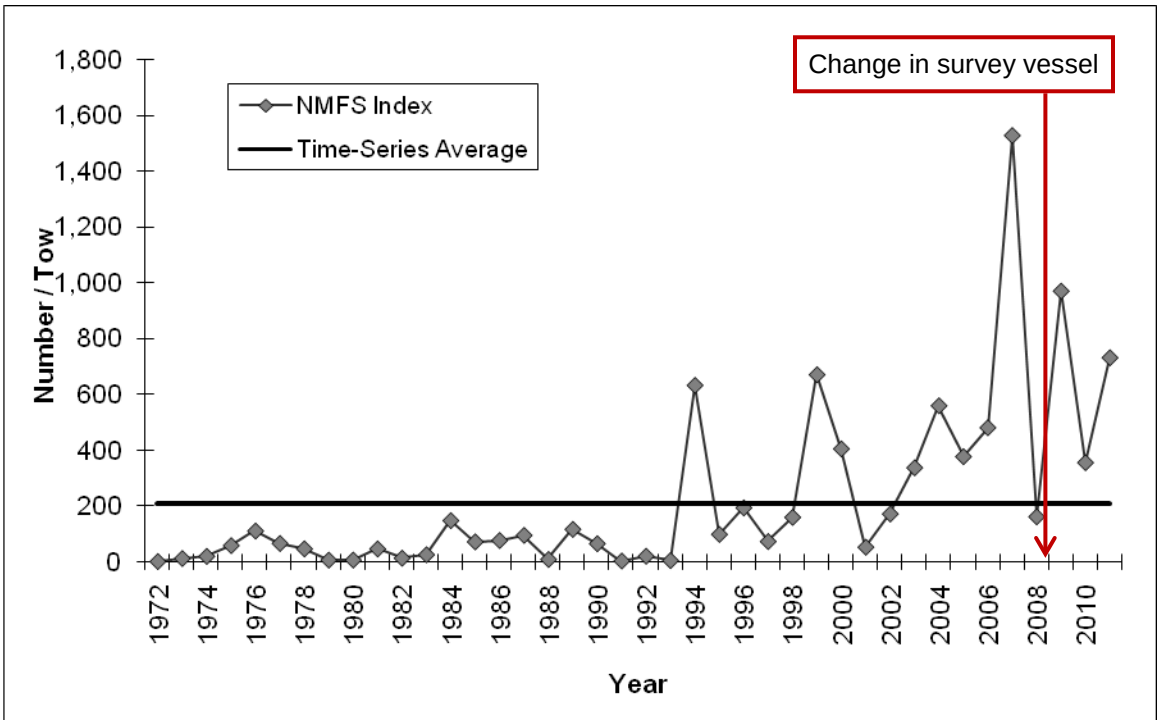

Figure 18. Annual index of relative abundance for Atlantic croaker derived from the NMFS Bottom Trawl Survey, Fall data,1972–2011.

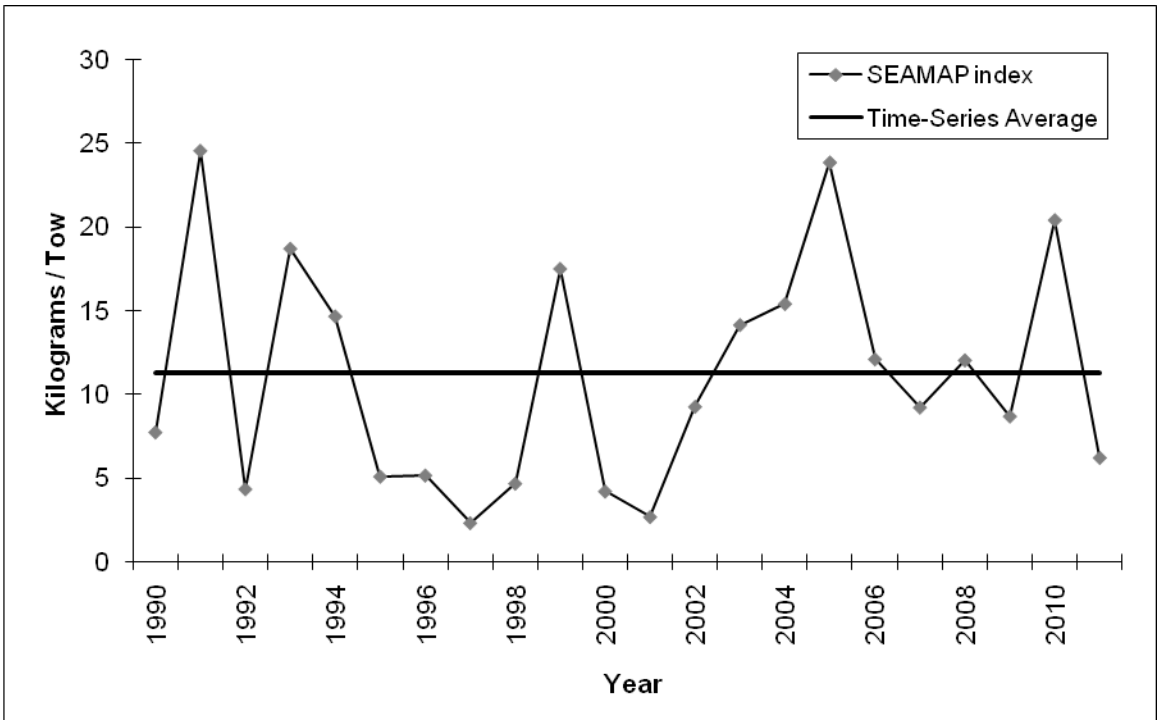

Figure 19. Annual index of relative abundance for Atlantic croaker derived from the SEAMAP-South Atlantic Coastal Survey, Fall data, 1990–2011.

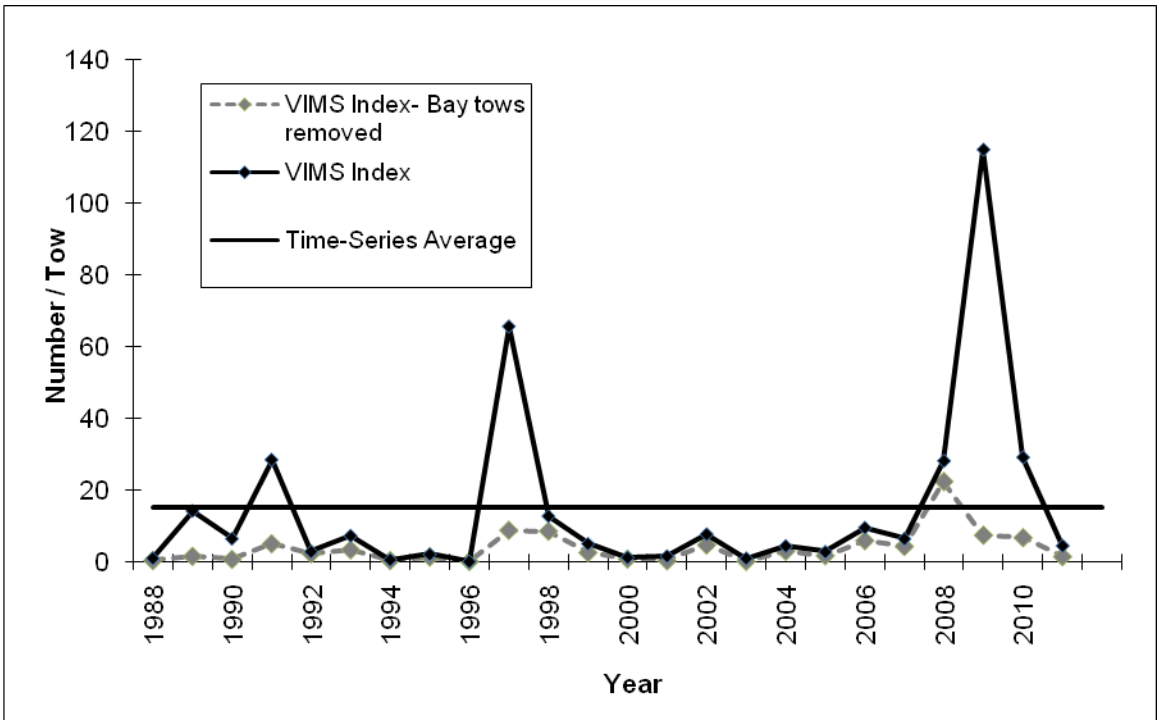

Figure 20. Annual young-of-year index for Atlantic croaker derived from the VIMS Juvenile Fish and Blue Crab Trawl Survey, 1988–2011.

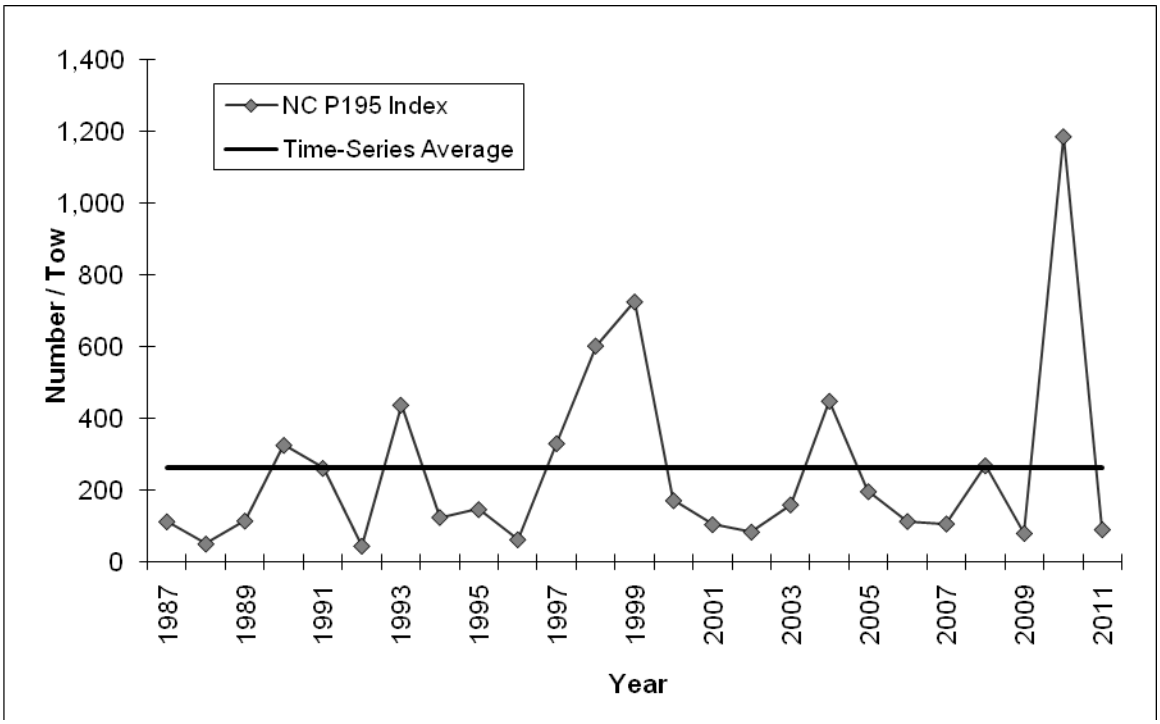

Figure 21. Annual young-of-year index for Atlantic croaker derived from the North Carolina Pamlico Sound Survey (Program 195), 1987–2011.