Atlantic States Marine Fisheries Commission
Atlantic Croaker Technical Committee

Annual Review of Assessment Triggers 2011

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 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 2010, approximately 14.3 million pounds were landed by commercial fisheries (Table 1). This value represents 82.3% of the average of the previous two years' commercial landings (Average, 2008–2009 = 17.3 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 2010 (Figure 2). The recreational harvest

totaled 4.3 million pounds in 2010 (Table 1). This value represents 80.1% of the average of the previous two years' recreational harvest (Average, 2008–2009 = 5.4 pounds). As such, the trigger is not 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 2011 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 9.93 inches (Table 2). The average of the 2008–2009 recreational harvest average lengths was 10.0 inches. The average total length in 2010 decreased by a little more than 0.50% relative to the 2008–2009 average. The average lengths for the Mid-Atlantic and South Atlantic states differed, with an average 2010 length in the Mid-Atlantic of 10.3 inches versus 9.3 inches average length for the South Atlantic states (Table 2). These average lengths reflect a slight increase in the Mid-Atlantic compared to 2008-09 (0.56%) but a larger decrease in the South Atlantic (-4.78%). These differences are primarily 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 2010 was compared to the average of the 2008 and 2009 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 2010 relative to the 2008–2009 average for all state-gear combinations evaluated except for the North Carolina ocean gill net fishery, in which samples exhibited an increase of less than half an inch (Table 2), though the overall trend of the two-year averages is a declining one. The observed decreases in average length ranged from 0.1 to 1.3 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 Virginia's pound-net fishery increased in 2010 relative to the 2008–2009 average by 0.05 pounds, as did North Carolina's ocean gill net fishery (0.03 pounds) (

Table **3**). Average weight decreased in New Jersey's gill-net (0.22 pounds), Maryland pound-net (0.27 pounds), Virginia's haul seine (0.12 pounds), Virginia's sink/anchor gill-net (0.13 pounds), and North Carolina's fly net (0.3 pounds) commercial 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 was calculated for 2007–2010 using data provided by New Jersey, Maryland, Virginia, and North Carolina. The number of age samples collected is summarized by state and year in 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.

The average length and average weight at age of Atlantic croaker sampled from the commercial fisheries was variable during 2007–2010 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 2007-2010. In comparisons of average weight at age within states among 2007-2010, 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 again increased (Figure 15). Effort decreased in

the anchor gill-net, drift gill net, and haul seine fisheries from 2009 to 2010. Effort levels have varied for the four fisheries over the years, although the haul seine fishery has shown an overall declining trend in effort for the past five years. All fisheries had increased in landings-per-unit-effort though.

Commercial landings and effort increased in North Carolina's ocean gill-net fishery from 2009 to 2010, showing an uptick in what has been an overall declining trend during the past several years

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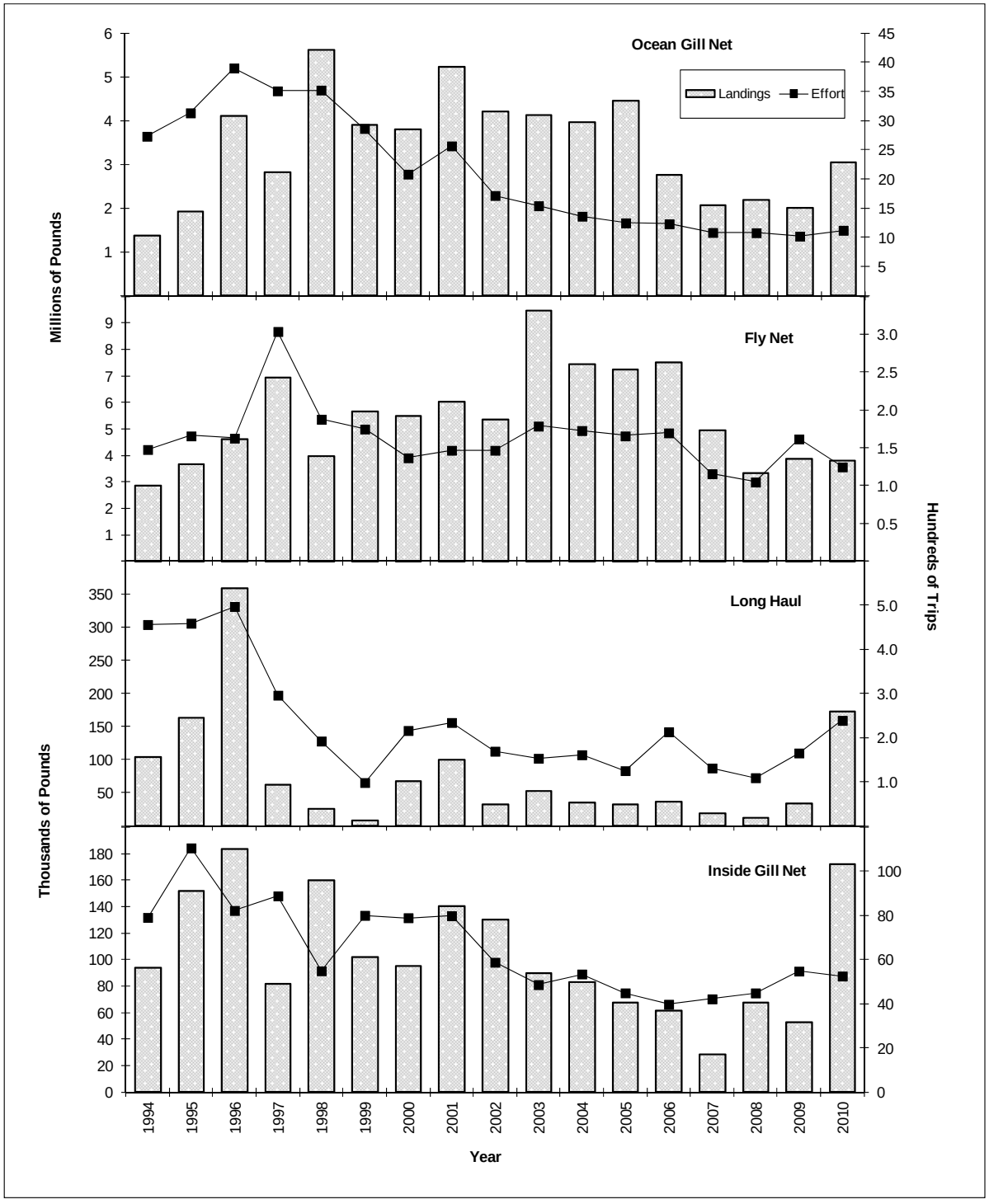

Figure 16). North Carolina's fly-net fishery exhibited a slight decrease in landings and effort from 2009 to 2010 with no real overall trend in the last decade.

Effort in Florida's commercial cast-net fishery has shown an overall increase over the available time series, although showed a decrease from 2009 to 2010 with a corresponding decrease in landings (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.

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 2010 trigger exercise, recreational fishery catch rates were calculated using both the directed trips approach and a modification of the Stephens and MacCall method (K. Drew, ASMFC, pers. comm.). The TC evaluated both 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 2010 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 and 2010 index 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. During the last nine years of the time series (2002–2010), the NMFS index exceeded the time-series average, except for 2009. The SEAMAP index has been variable and without trend over the survey time series (Figure 19). This index has been near the time-series average in the past four years with an uptick in 2010.

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, peaking severely in 2009 (the peak in 2009 is due to an unusually high tow; if that tow is excluded, the value for 2009 is just below the long-term average; both values are plotted in Figure 20). In 2010 the VIMS index sharply decreased but remained above the time-series average.

The young-of-year index derived from the NC P195 survey was variable and 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, although the index has been below the time-series average in four of the six most recent years.

Summary

Based on an evaluation of landings, effort, and biological sampling data from the commercial and recreational fisheries as well as indices derived from fisheries-independent surveys, the TC concluded that an assessment update for Atlantic croaker is not warranted at this time. Moving forward, the TC would like to investigate ways to provide additional historical

context behind the triggers for the Board. Multiple methods have been used in other species, including a stoplight approach for North Carolina blue crab and management triggers for spot, and the TC felt that exploring these methods could provide more informative management information to the Board, especially considering the overall decline in commercial and recreational landings of croaker during the past decade.

References

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Table 1. Comparison of Atlantic croaker commercial landings and recreational harvest estimates from the most recent year, 2010, to the average of the estimates from the previous two years, 2008 and 2009.

Fisheries Data	Pounds		2010 as % of 2008–2009 Avg.
	Avg., 2008–2009	2010	
Commercial Landings	17,323,161	14,252,412	82.3
Recreational Harvest	5,374,936	4,303,465	80.1

Table 2. Comparison of the average total length (inches) of Atlantic croaker observed in the most recent year, 2010, to the average of the average lengths of the previous two years, 2008 and 2009, by fishery, region or state, and gear.

Fishery	State	Gear	Average Length (in)		Percent Change (%)
			Avg., 2008–2009	2010	
Recreational	NJ–East FL	All	10.0	9.9	-0.56
Recreational	M. Atlantic (NJ-VA)	All	10.3	10.4	0.56
Recreational	S. Atlantic (NC-E. FL)	All	9.3	9.1	-4.78
Commercial	New Jersey	Gill Net	12.9	11.4	-10.94
Commercial	New Jersey	Trawl	11.2	11.2	-0.15
Commercial	Maryland	Pound Net	11.8	11.4	-3.32
Commercial	Virginia	Haul Seine	10.6	10.1	-5.02
Commercial	Virginia	Pound Net	12.8	12.6	-1.08
Commercial	Virginia	Sink/Anchor Gill Net	12.8	12.5	-2.37
Commercial	North Carolina	Long Haul	10.0	10.8	7.30
Commercial	North Carolina	Inside Gill Net	10.1	11.2	10.97
Commercial	North Carolina	Ocean Gill Net	12.1	12.3	1.53
Commercial	North Carolina	Fly Net	11.4	11.1	-2.46

Table 3. Comparison of the average weight (pounds) of Atlantic croaker observed in the most recent year, 2010, to the average of the average weights of the previous two years, 2008 and 2009, by fishery, state, and gear.

Fishery	State	Gear	Average Weight (lb)		Percent Change (%)
			Avg., 2008–2009	2010	
Commercial	New Jersey	Gill Net	1.00	0.78	-22.50
Commercial	New Jersey	Trawl	0.64	0.69	7.30
Commercial	Maryland	Pound Net	0.95	0.68	-28.66
Commercial	Virginia	Haul Seine	0.58	0.46	-19.55
Commercial	Virginia	Pound Net	0.94	0.95	0.99
Commercial	Virginia	Sink/Anchor Gill Net	0.97	0.84	-13.57
Commercial	North Carolina	Long Haul	0.49	0.57	15.98
Commercial	North Carolina	Inside Gill Net	0.49	0.69	39.46
Commercial	North Carolina	Ocean Gill Net	0.74	0.77	5.03
Commercial	North Carolina	Fly Net	0.63	0.60	-4.49

Table 4. Number of Atlantic croaker age samples collected from commercial landings, by state, 2007–2010.

State	Age Samples (n)			
	2007	2008	2009	2010
New Jersey	96	994	558	750
Maryland	277	306	222	345
Virginia	344	546	512	451
North Carolina	336	739	709	703

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	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
1973	x	x	0.18	x	78.04	x	x	x	x	x	x
1974	x	x	11.18	x	38.92	x	x	x	x	x	x
1975	x	x	18.85	x	30.05	x	x	x	x	x	x
1976	x	x	57.25	x	34.27	x	x	x	x	x	x
1977	x	x	109.55	x	3.62	x	x	x	x	x	x
1978	x	x	65.12	x	24.38	x	x	x	x	x	x
1979	x	x	45.77	x	48.24	x	x	x	x	x	x
1980	x	x	5.42	x	64.28	x	x	x	x	x	x
1981	x	x	5.70	x	16.52	x	x	x	x	x	x
1982	x	x	45.48	x	48.33	x	x	x	x	x	x
1983	x	x	12.43	x	92.65	x	x	x	x	x	x
1984	x	x	24.73	x	60.32	x	x	x	x	x	x
1985	x	x	146.80	x	27.74	x	x	x	x	x	x
1986	x	x	70.83	x	21.95	x	x	x	x	x	x
1987	x	x	75.79	x	52.15	105.77	x	x	x	x	x
1988	x	x	94.12	0.95	25.28	75.88	x	x	x	x	x
1989	x	x	7.69	14.14	24.15	125.80	1.02	0.83	x	x	x
1990	12.18	7.72	115.52	6.40	19.01	355.53	0.11	0.18	x	x	x
1991	29.71	24.53	64.17	28.39	8.60	266.03	3.09	4.06	x	x	x
1992	25.69	4.32	2.24	2.80	20.04	65.90	0.83	1.28	x	x	x
1993	13.36	18.68	19.42	7.22	55.23	437.62	1.84	3.67	x	x	x
1994	13.15	14.64	3.72	0.52	27.60	164.59	3.65	4.25	x	x	x
1995	9.15	5.08	631.30	2.06	42.58	157.35	2.94	0.74	x	x	x
1996	5.32	5.14	97.49	0.03	14.80	65.37	1.46	2.15	0.034	x	x
Continued											

Year	SEAMAP all Weight	SEAMAP Fall Weight	NMFS Fall Number	VIMS Spring DLN	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	192.34	65.51	59.25	386.78	3.22	5.32	0.092	x	x
1998	11.51	4.65	72.06	12.68	97.49	699.99	4.79	30.05	0.468	x	x
1999	11.10	17.48	158.67	4.98	22.29	744.69	2.30	4.18	0.383	x	x
2000	10.10	4.19	669.35	1.17	61.53	169.42	0.94	2.76	0.774	x	x
2001	11.28	2.66	403.93	1.55	28.98	112.28	0.40	0.86	0.640	0.143	x
2002	10.56	9.24	51.62	7.65	23.22	77.39	2.25	3.50	0.234	0.195	1.95
2003	14.85	14.12	170.81	0.90	28.82	171.08	0.89	0.81	0.159	0.343	1.93
2004	21.54	15.39	336.07	4.36	44.80	445.92	0.68	3.51	0.237	0.283	1.89
2005	18.64	23.83	558.17	2.72	49.38	225.36	0.38	0.44	1.074	0.368	6.97
2006	18.68	12.08	376.15	9.46	9.41	129.25	1.98	2.10	0.354	0.311	2.89
2007	11.93	9.20	479.58	6.36	47.88	111.71	0.53	0.54	0.000	0.354	1.58
2008	15.82	12.02	1525.93	28.06	14.89	300.20	0.96	4.51	0.646	0.357	3.05
2009	16.33	8.67	141.65	114.71	13.05	79.52	1.46	0.67	0.272	0.391	2.46
2010	16.33	20.39	753.41	29.07	59.28	1185.43	1.04	0.59	0.712	0.506	5.51

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	3.00	x	x	x	7.15	x
1986	4.00	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	8.00	x	0.00	0.00	4.94	x
1990	0.00	x	0.00	0.00	0.06	0.10
1991	1.93	0.19	4.87	0.38	2.00	2.90
1992	2.13	4.27	0.15	6.18	15.01	0.90
1993	8.19	1.96	0.18	0.77	13.22	1.30
1994	6.22	2.10	9.87	0.87	6.04	4.00
1995	15.19	30.67	40.46	12.95	22.52	6.70
1996	31.88	52.33	6.38	5.36	42.92	24.37

Year	NJ DR seine Numbers	NJ DB trawl Numbers	NJ OT Aug Numbers	NJ OT Oct Numbers	DE Juvenile GM	DE Adult Numbers
1997	7.61	23.70	3.97	3.21	24.05	57.72
1998	10.70	79.09	0.56	2.64	27.66	69.64
1999	6.30	77.04	140.13	20.92	45.30	81.54
2000	22.48	35.05	47.69	45.38	15.84	34.55
2001	7.89	179.27	15.72	22.51	60.72	11.24
2002	11.84	175.51	392.90	133.40	88.82	226.68
2003	9.00	1.57	21.72	40.70	4.64	131.63
2004	10.92	6.31	365.59	159.77	17.19	30.35
2005	13.31	17.95	28.62	172.79	5.54	17.23
2006	5.35	262.66	7.56	25.97	11.77	193.10
2007	12.58	10.32	46.28	205.03	4.47	7.14
2008	12.65	157.23	0.85	75.00	7.50	42.00
2009	6.33	8.58	247.03	0.15	16.50	107.00
2010	3.50	11.66	10.74	10.31	17.60	9.00

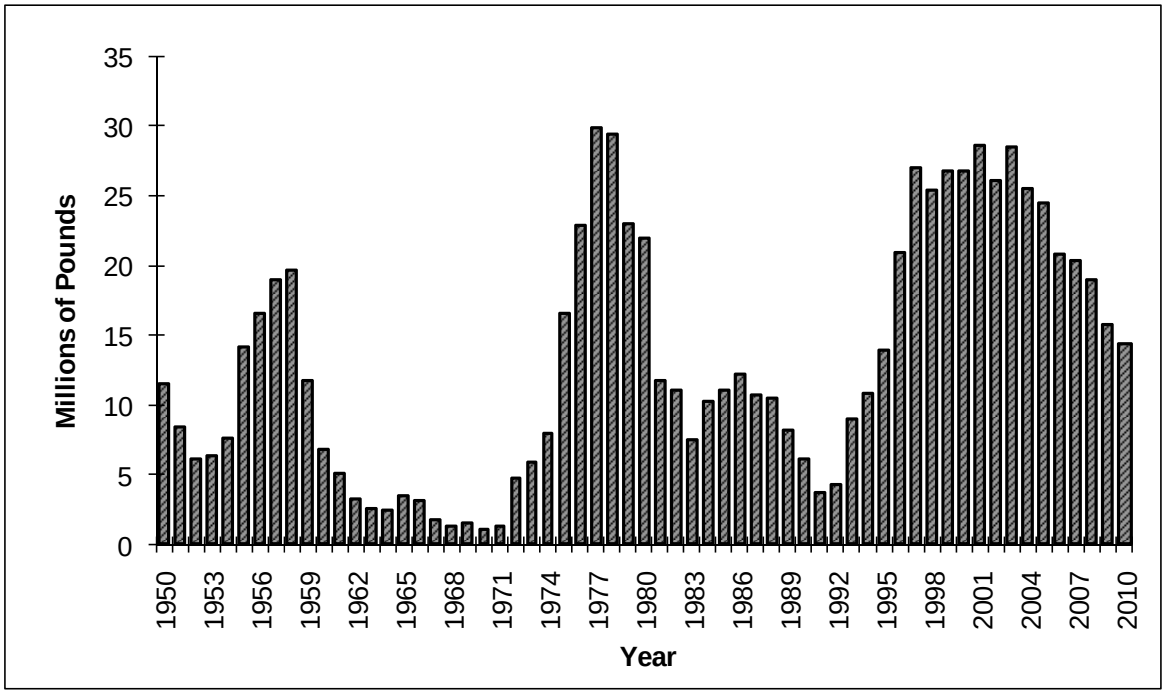

Figure 1. Annual commercial landings (pounds) of Atlantic croaker along the U.S. east coast, 1950–2010.

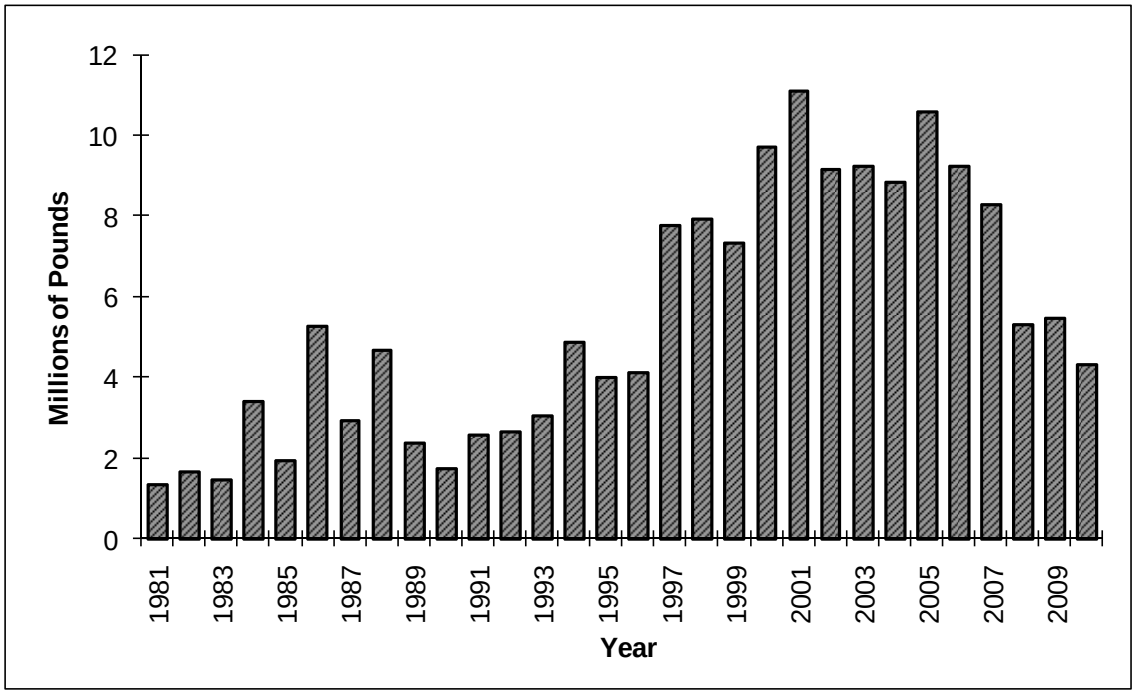

Figure 2. Annual recreational harvest (pounds; Type A + B1) of Atlantic croaker along the U.S. east coast, 1981–2010.

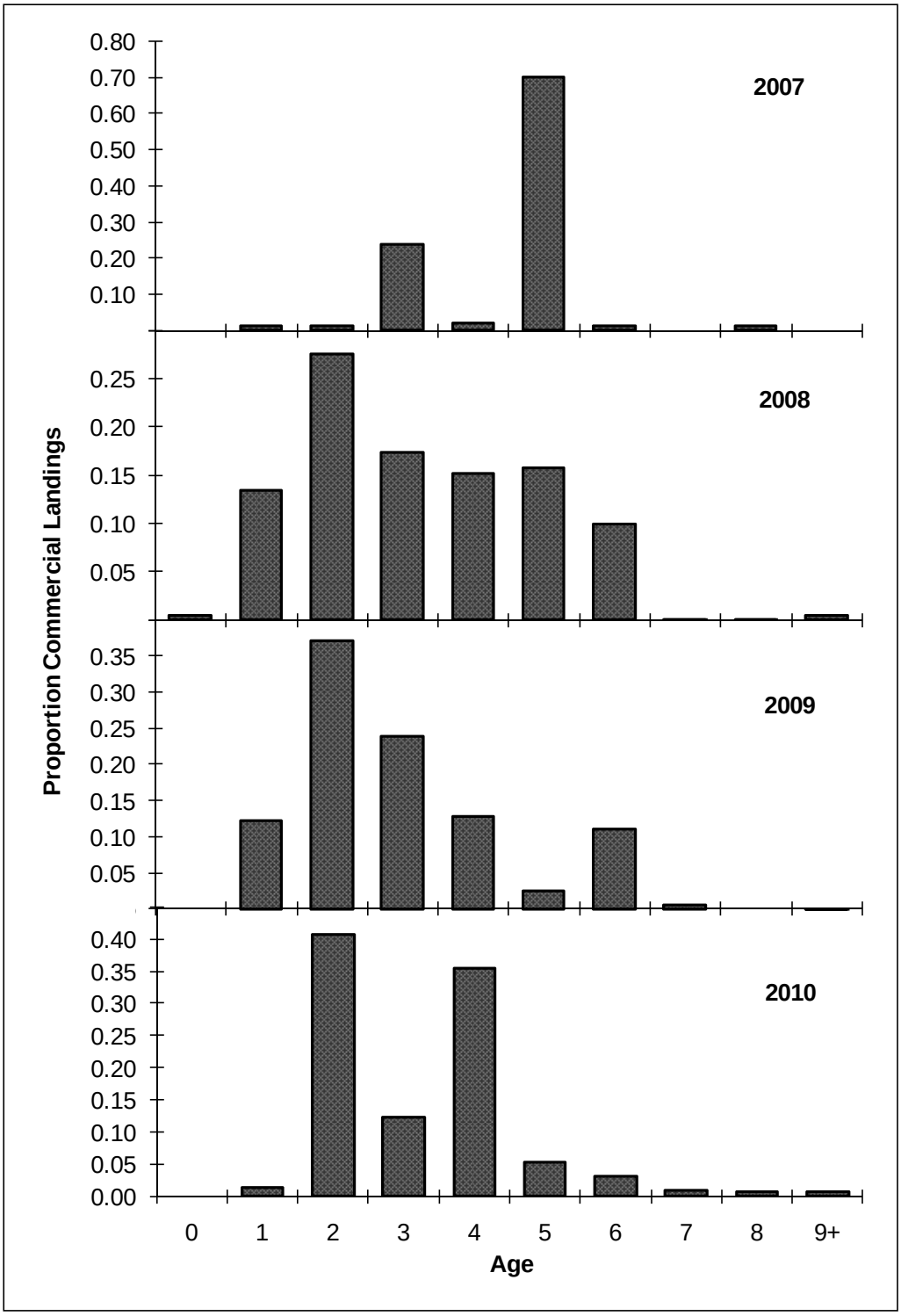

Figure 3. Proportion of Atlantic croaker commercial landings (pounds) at age for New Jersey pooled over all gears, 2007–2010.

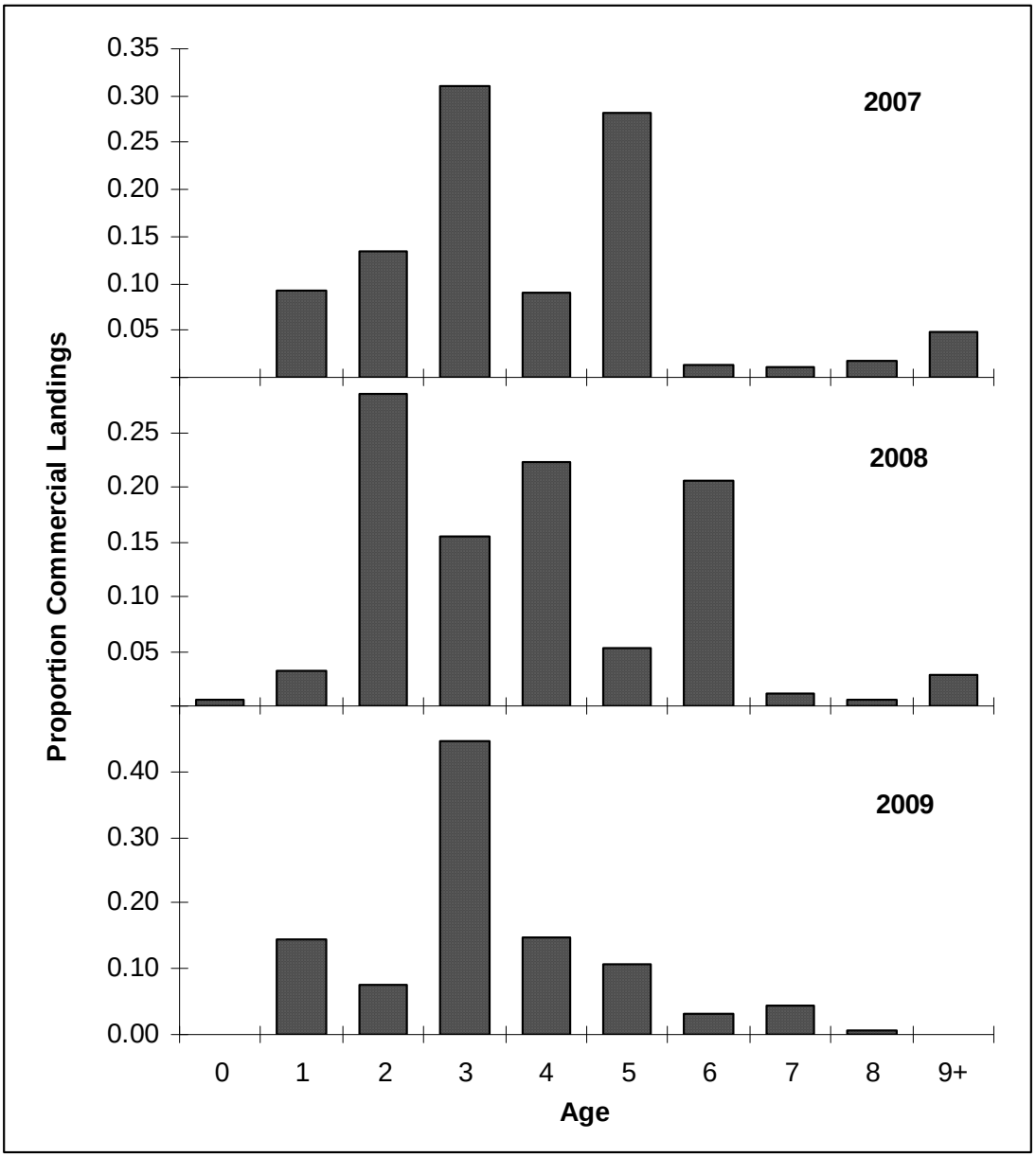

Figure 4. Proportion of Atlantic croaker commercial landings (pounds) at age for Maryland pooled over all gears, 2007–2009. Data from 2010 were not available for this report.

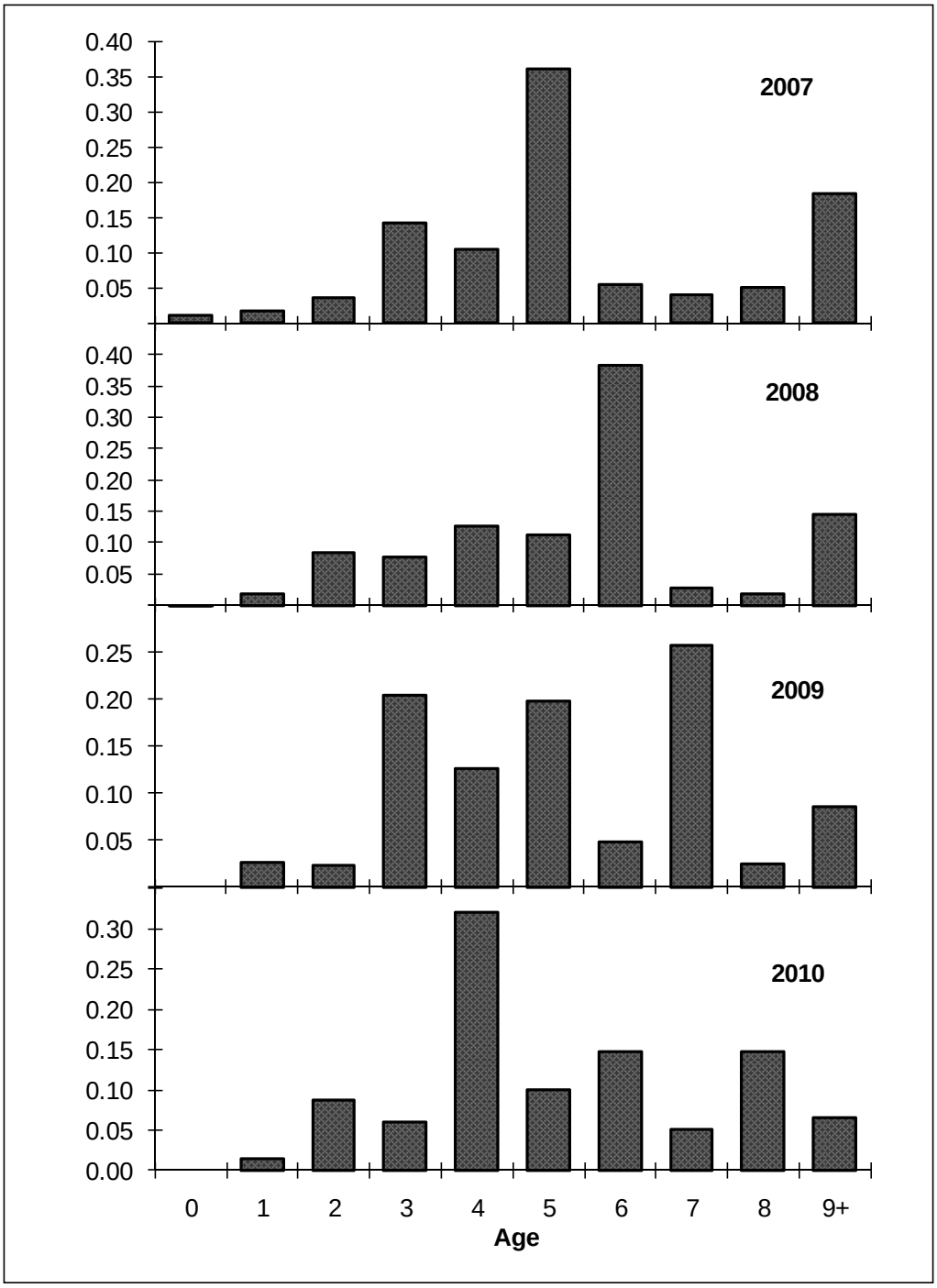

Figure 5. Proportion of Atlantic croaker commercial landings (pounds) at age for Virginia pooled over all gears, 2007–2010.

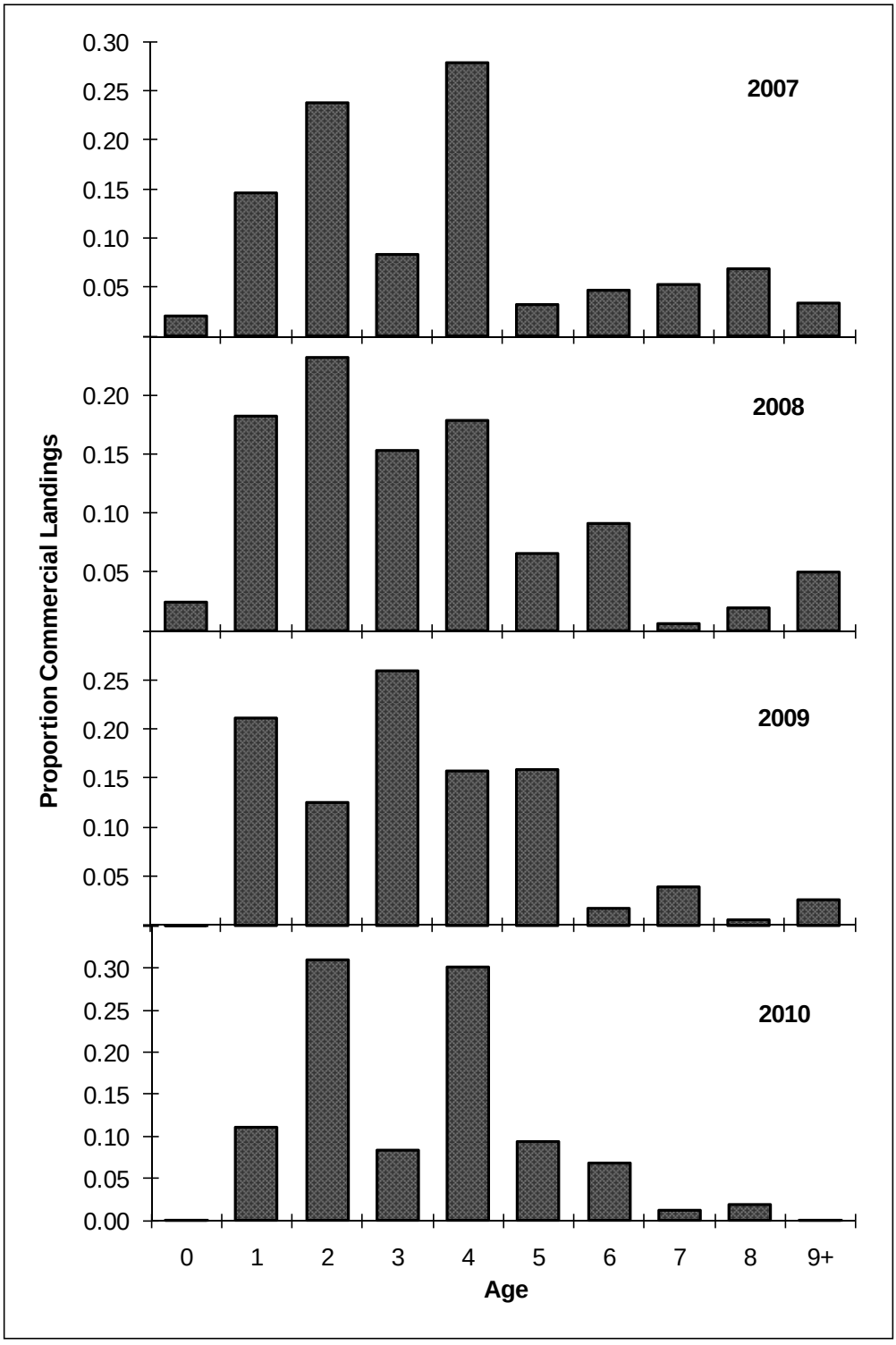

Figure 6. Proportion of Atlantic croaker commercial landings (pounds) at age for North Carolina pooled over all gears, 2007–2010.

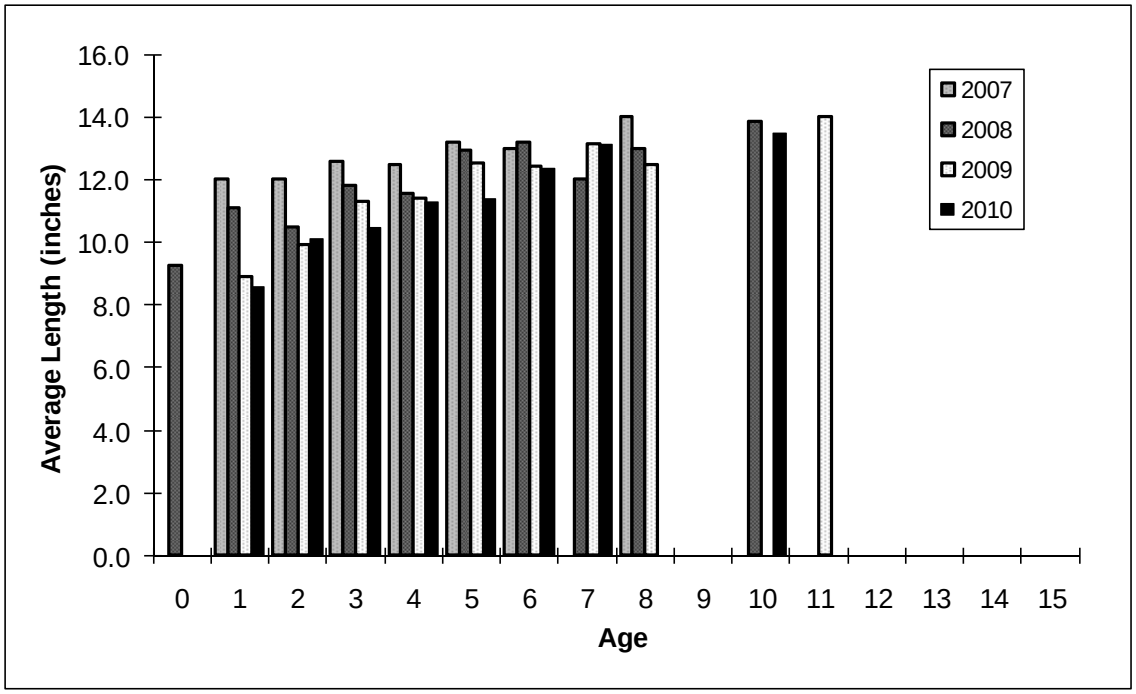

Figure 7. Average total length (inches) at age of Atlantic croaker sampled from New Jersey's commercial landings pooled over all gears, 2007–2010.

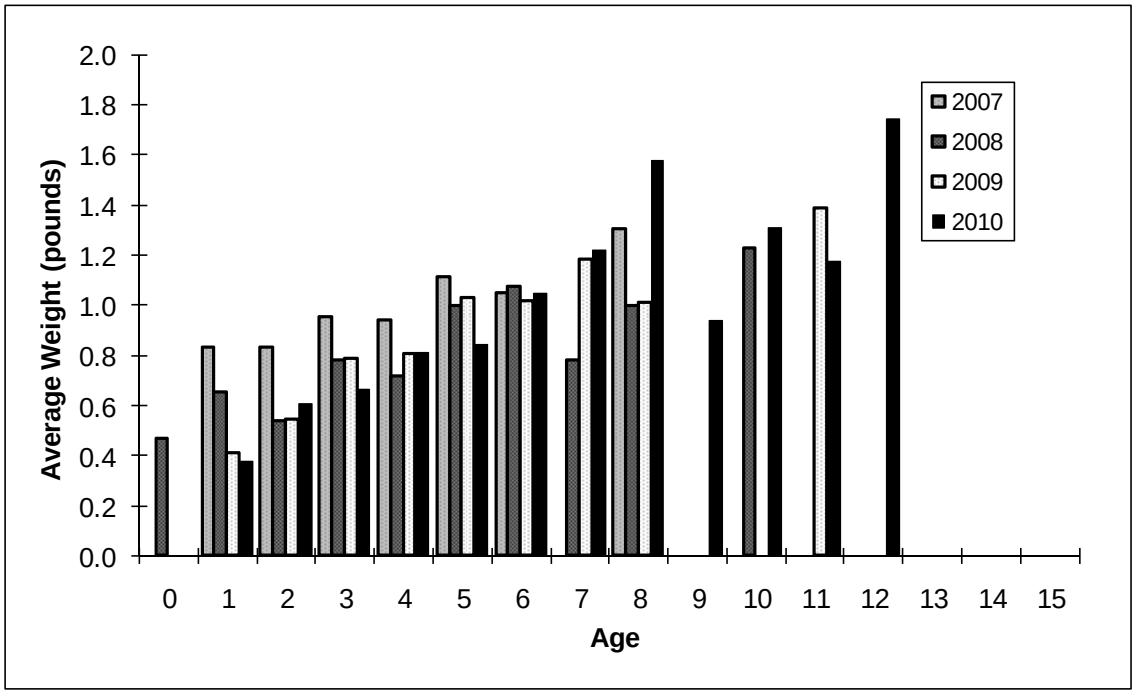

Figure 8. Average weight (pounds) at age of Atlantic croaker sampled from New Jersey's commercial landings pooled over all gears, 2007–2010.

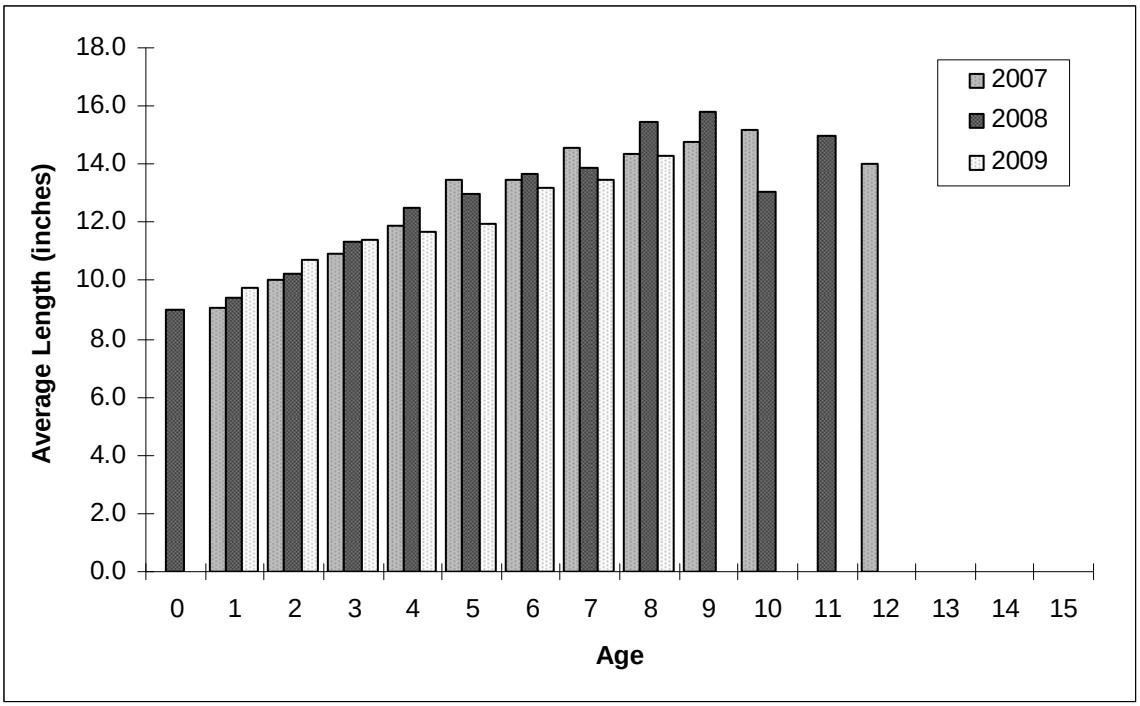

Figure 9. Average total length (inches) at age of Atlantic croaker sampled from Maryland's commercial pound-net landings, 2007–2009. Data for 2010 were not available for this report.

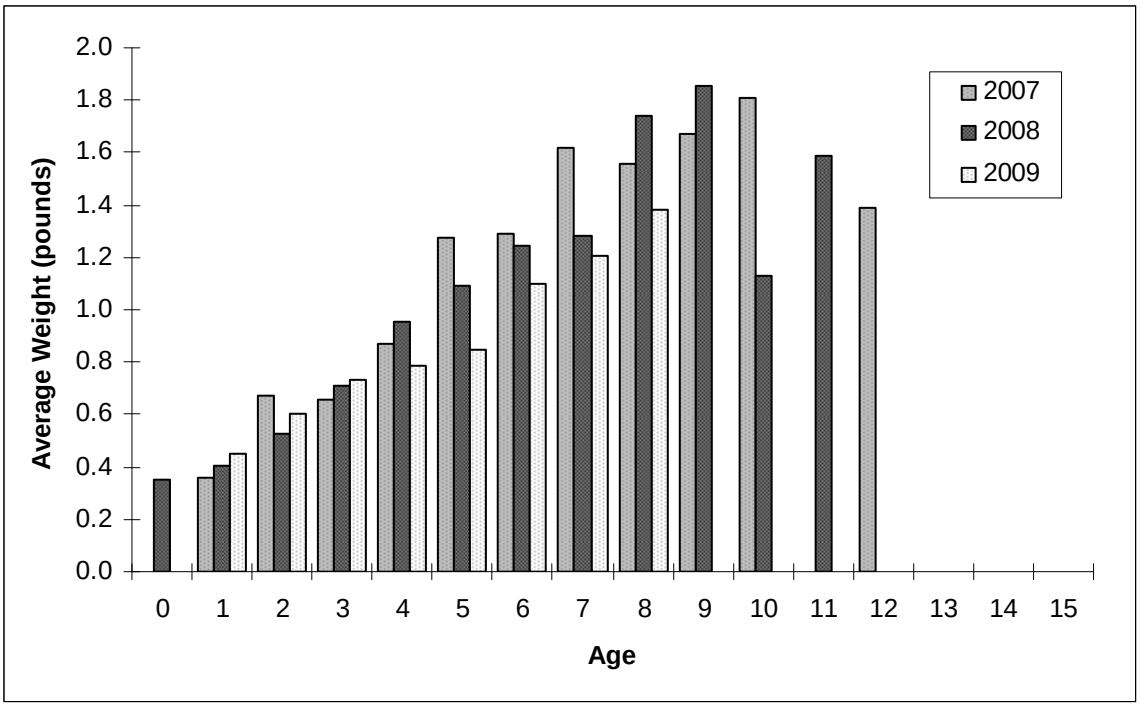

Figure 10. Average weight (pounds) at age of Atlantic croaker sampled from Maryland's commercial pound-net landings, 2007–2009. Data for 2010 were not available for this report.

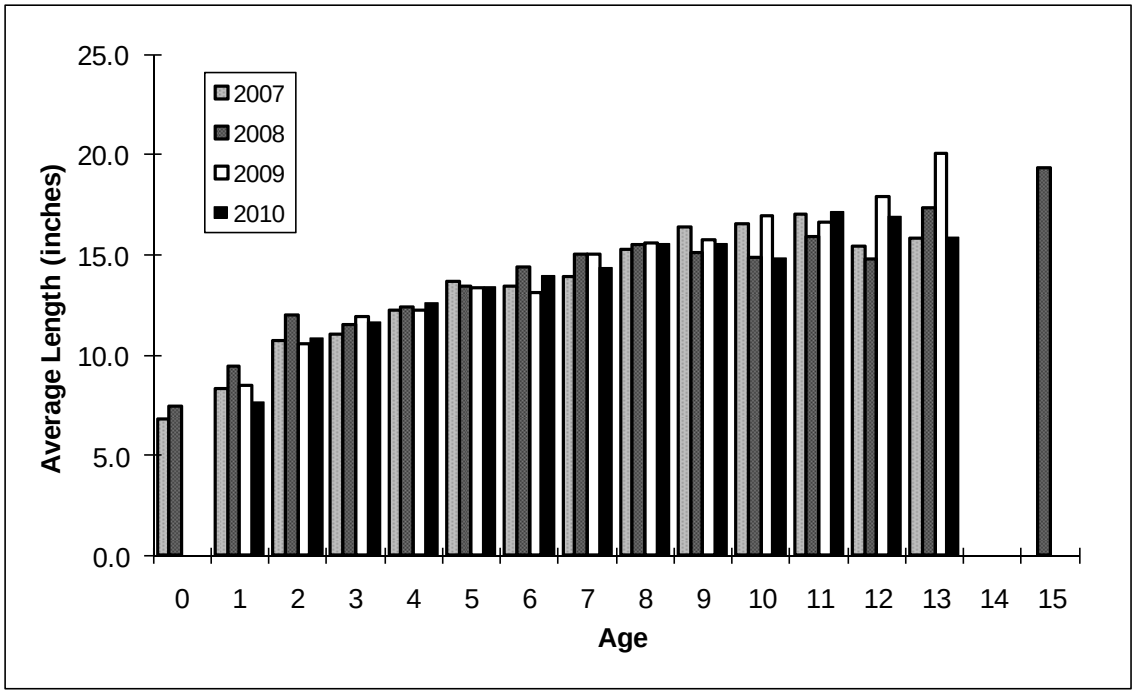

Figure 11. Average total length (inches) at age of Atlantic croaker sampled from Virginia's commercial landings pooled over all gears, 2007–2010.

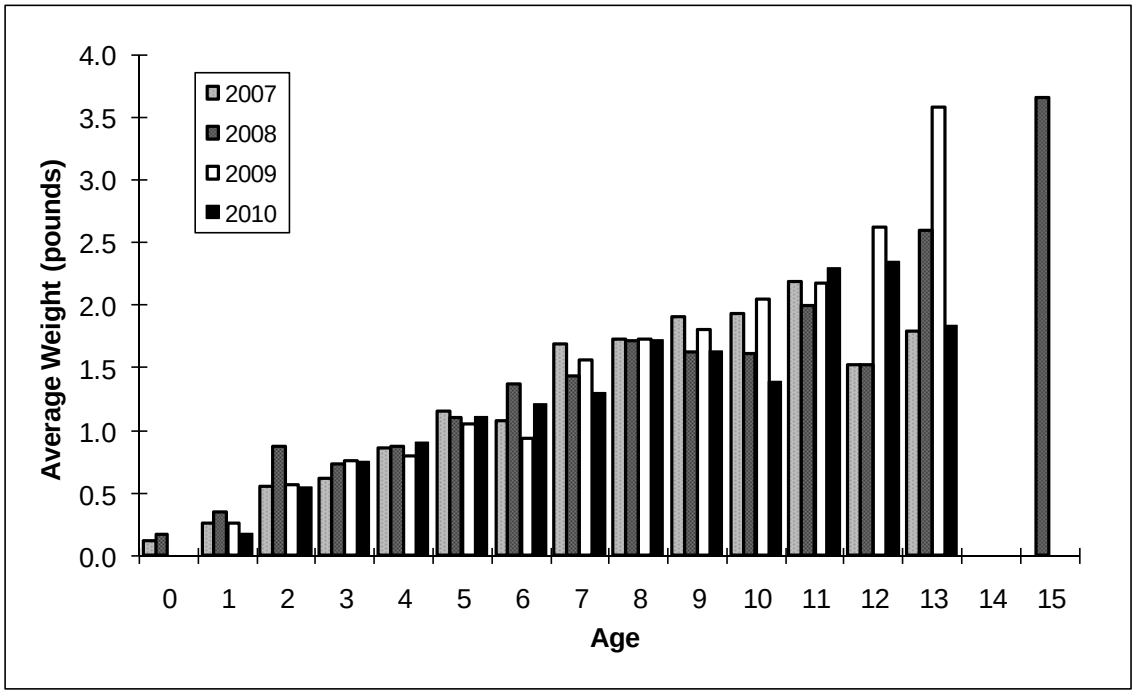

Figure 12. Average weight (pounds) at age of Atlantic croaker sampled from Virginia's commercial landings pooled over all gears, 2007–2010.

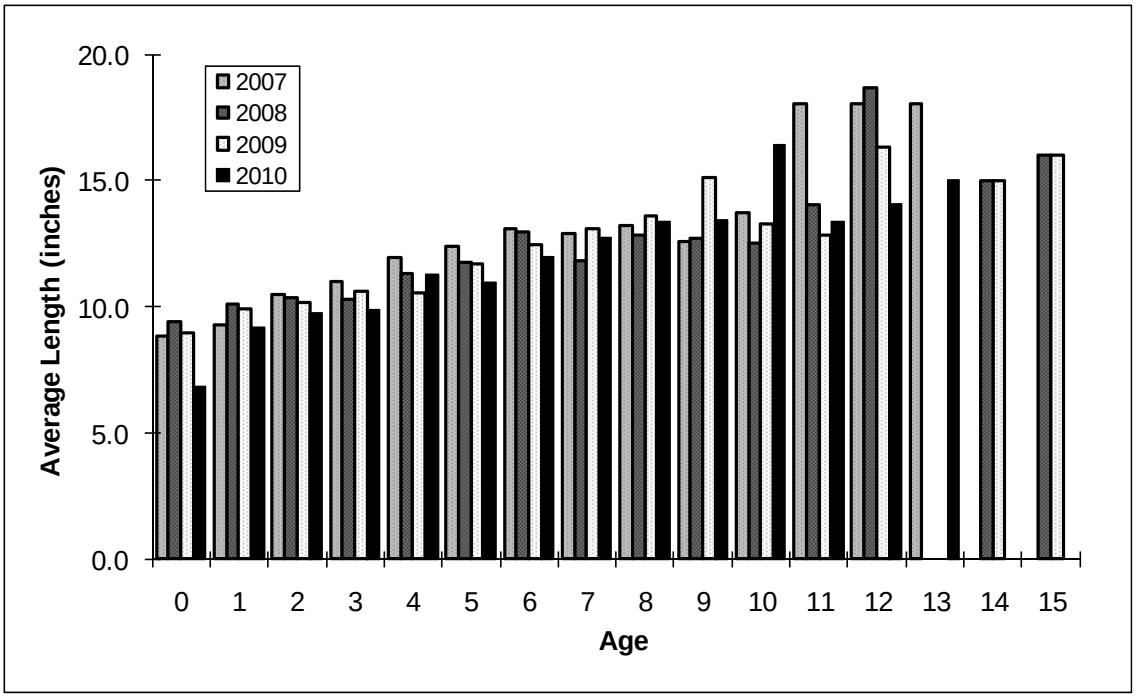

Figure 13. Average total length (inches) at age of Atlantic croaker sampled from North Carolina's commercial landings pooled over all gears, 2007–2010.

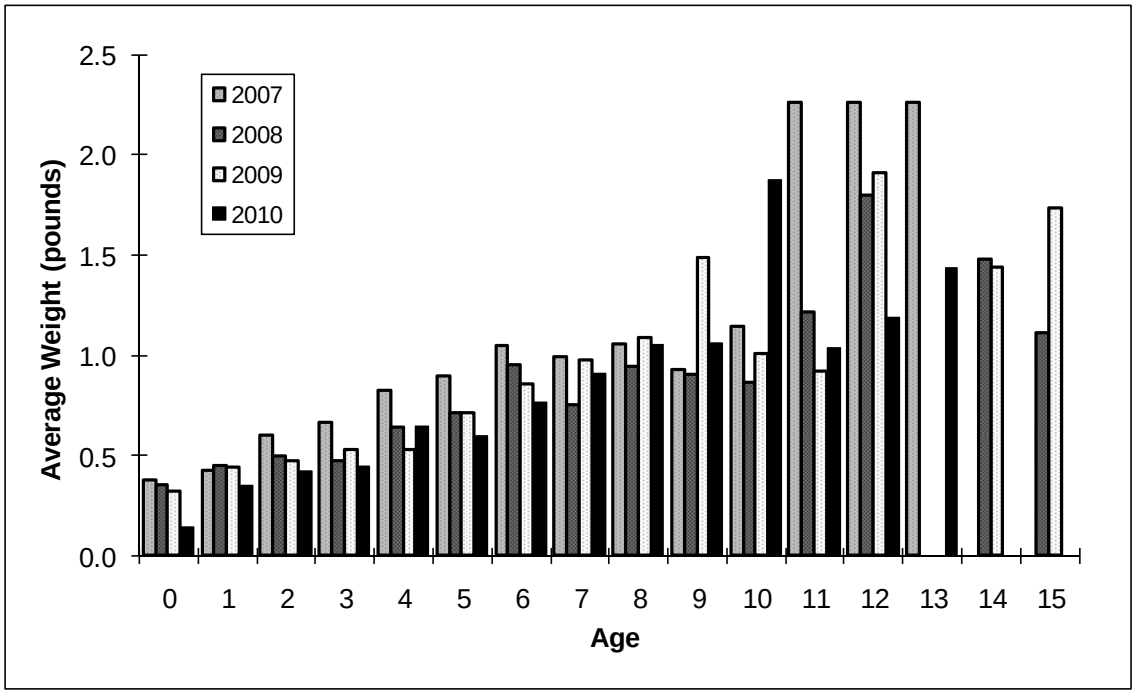

Figure 14. Average weight (pounds) at age of Atlantic croaker sampled from North Carolina's commercial landings pooled over all gears, 2007–2010.

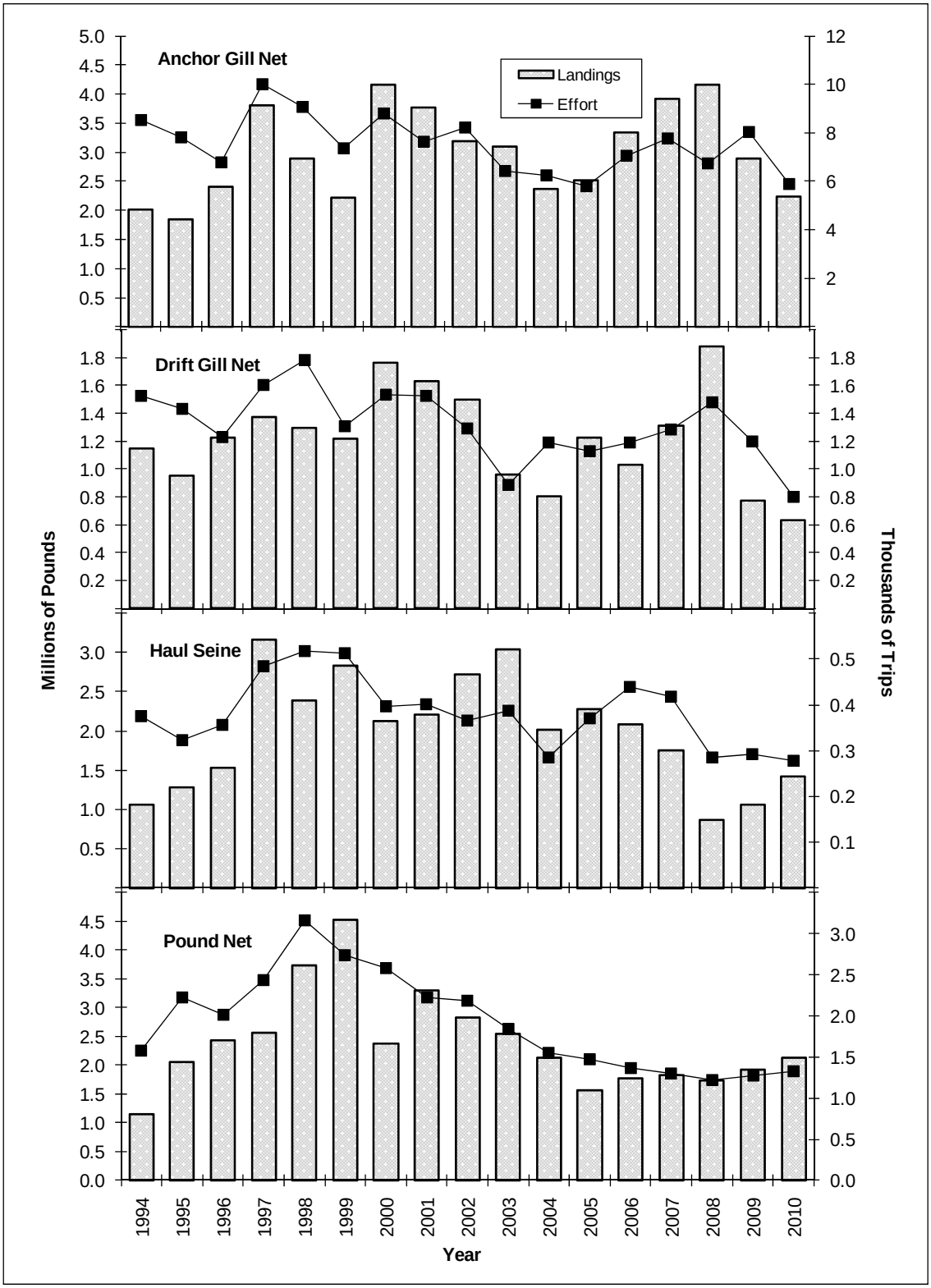

Figure 15. Annual landings (pounds) and effort (trips) in Virginia's Atlantic croaker commercial fisheries, by gear, 1994–2010.

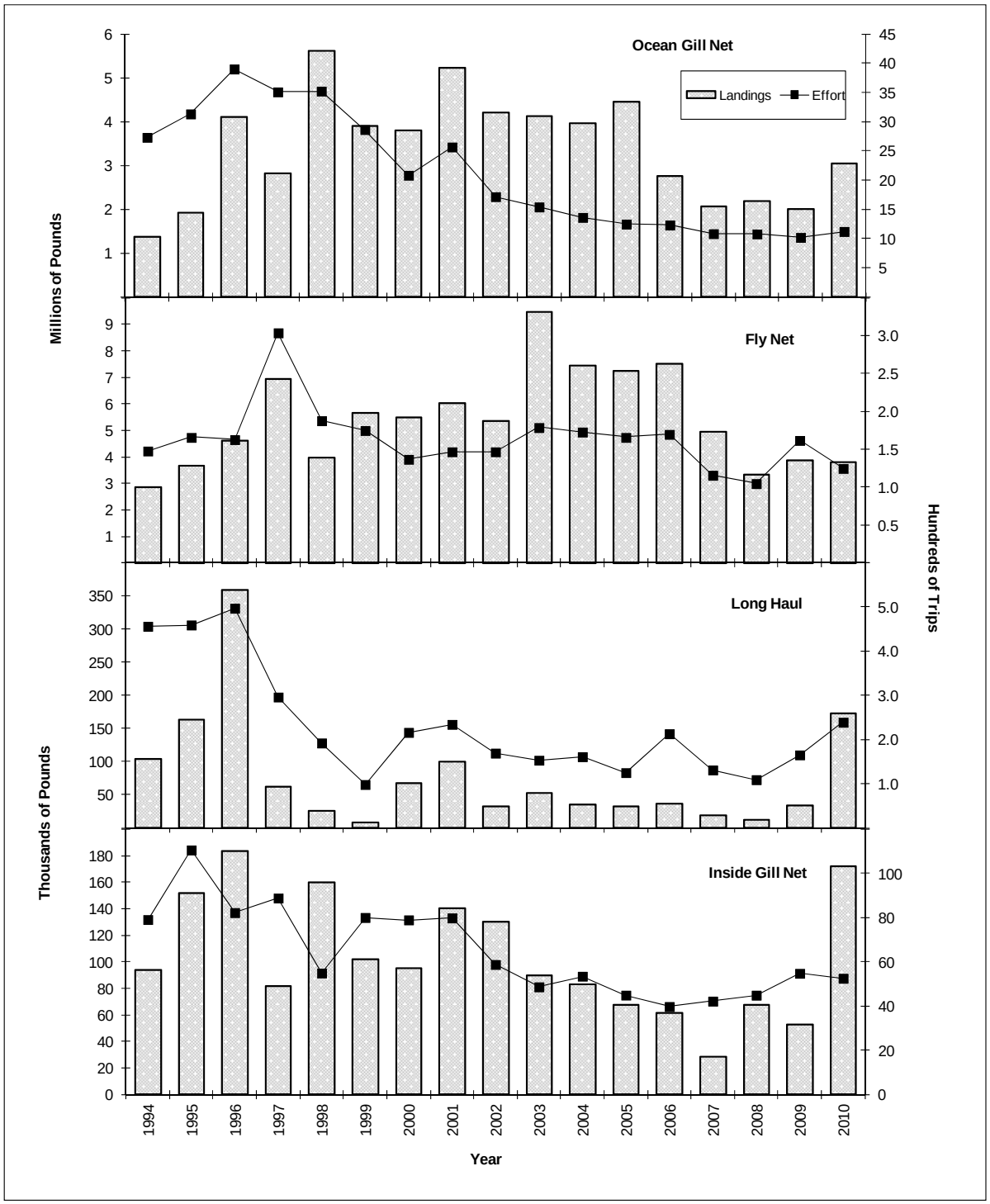

Figure 16. Annual landings (pounds) and effort (trips) in North Carolina's Atlantic croaker commercial fisheries, by gear, 1994–2010.

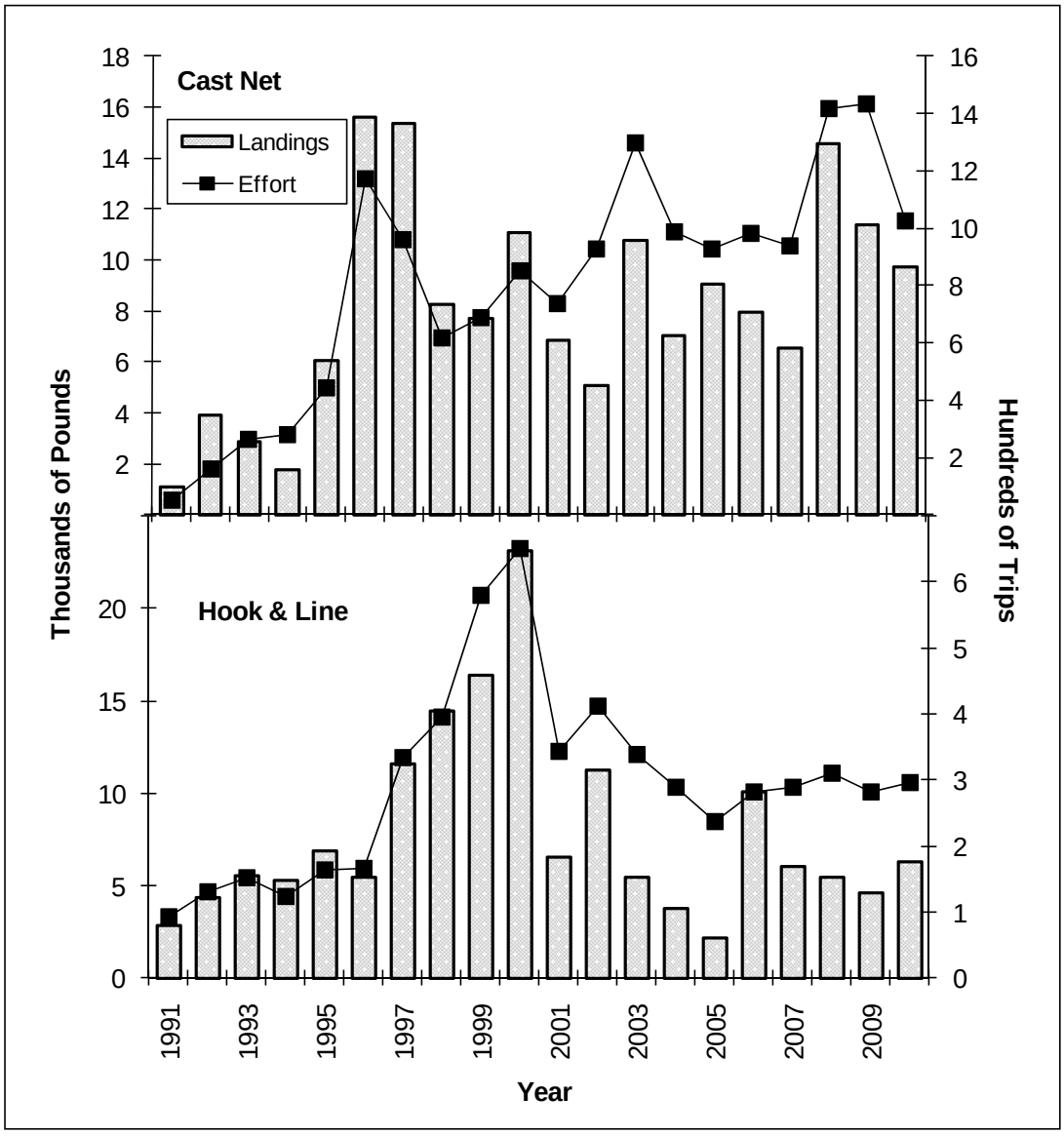

Figure 17. Annual landings (pounds) and effort (trips) in Florida's Atlantic croaker commercial fisheries, by gear, 1991–2010.

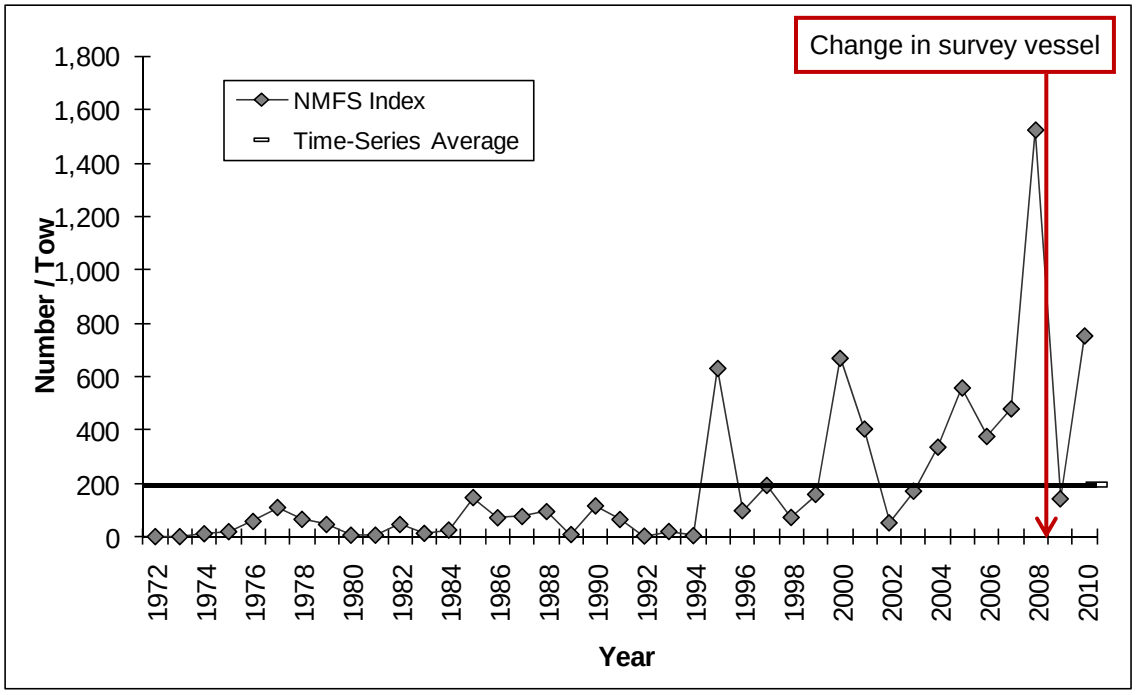

Figure 18. Annual index of relative abundance for Atlantic croaker derived from the NMFS Bottom Trawl Survey, 1972–2010.

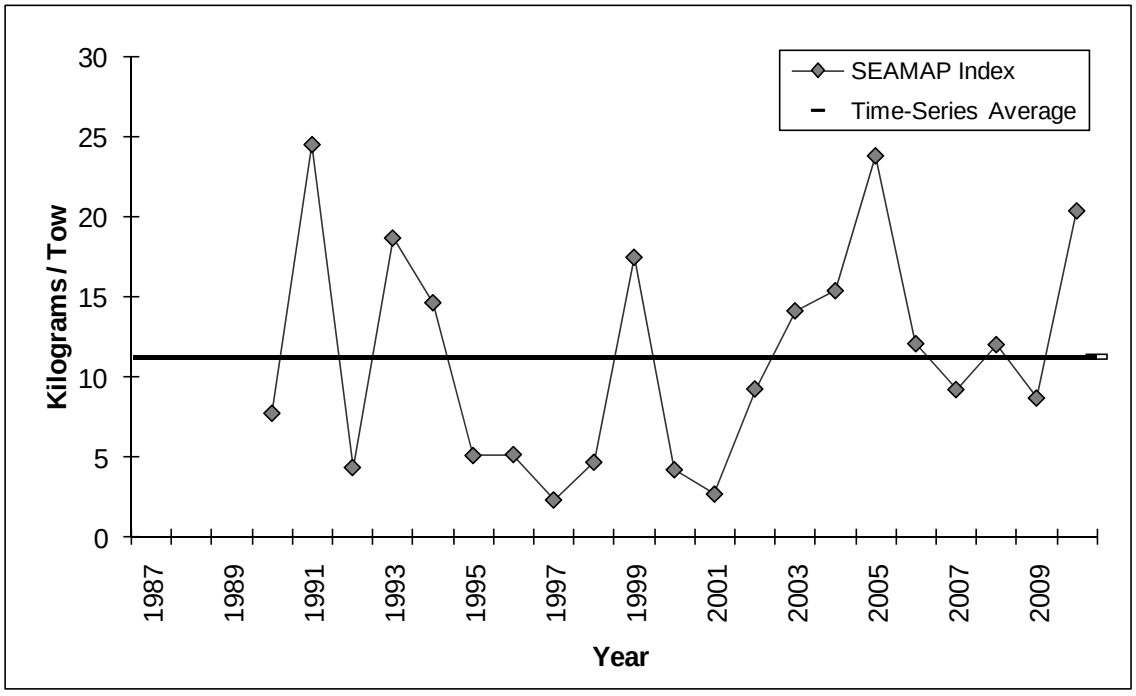

Figure 19. Annual index of relative abundance for Atlantic croaker derived from the SEAMAP-South Atlantic Coastal Survey, 1990–2010.

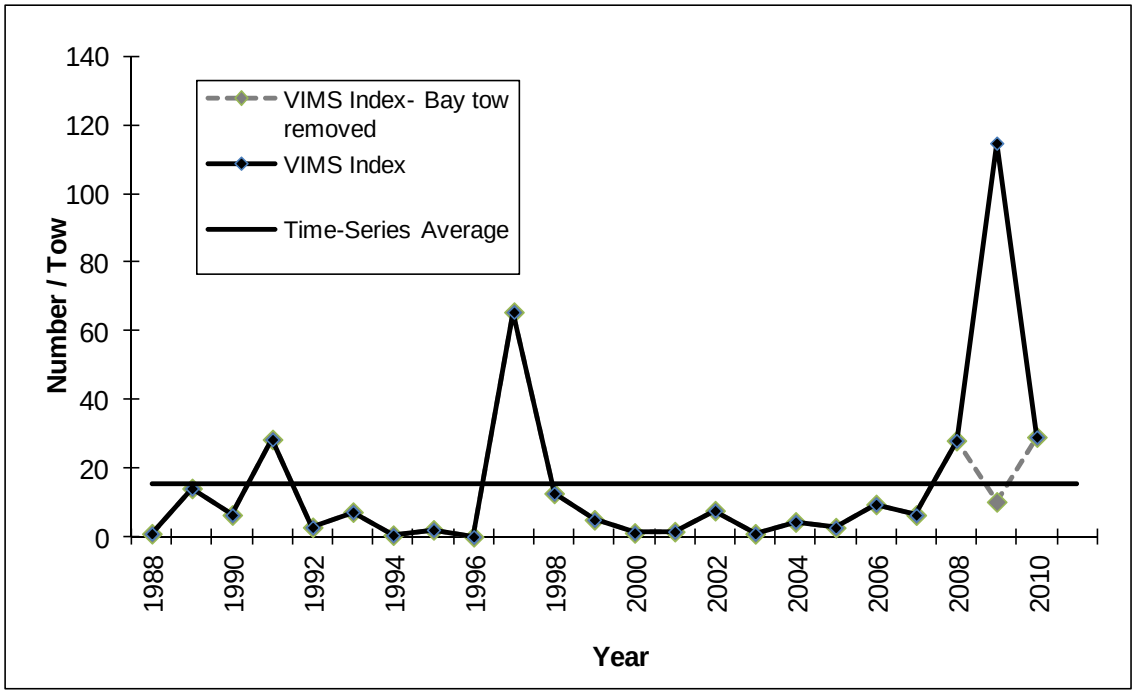

Figure 20. Annual young-of-year index for Atlantic croaker derived from the VIMS Juvenile Fish and Blue Crab Trawl Survey, 1988–2010.

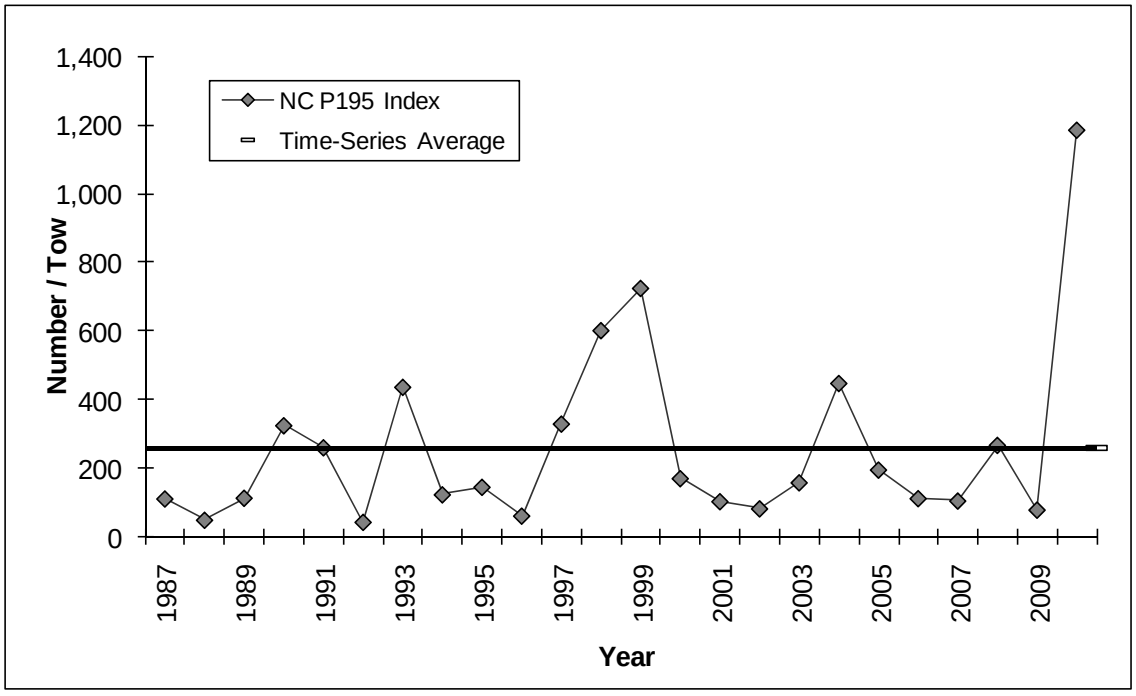

Figure 21. Annual young-of-year index for Atlantic croaker derived from the North Carolina Pamlico Sound Survey (Program 195), 1987–2010.