



Atlantic States Marine Fisheries Commission

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MEMORANDUM

October 8, 2015

To: Atlantic Striped Bass Management Board
From: Atlantic Striped Bass Technical Committee
RE: 2015 Atlantic Striped Bass Stock Assessment Update

The 2015 Atlantic Striped Bass Stock Assessment Update utilizes catch and index data from 1982-2014.

In 2014, the Atlantic striped bass stock was not overfished or experiencing overfishing based on the point estimates of fully-recruited fishing mortality (F) and female spawning stock biomass (SSB) relative to the reference points defined in this assessment. SSB was estimated at 63,918 metric tons (140 million pounds) which is above the SSB threshold of 57,626 metric tons, but below the SSB target of 72,032 metric tons. Total F was estimated at 0.205 which is below the F threshold of 0.219 but above the F target of 0.180.

Commercial removals, i.e., landings plus dead discards, in 2013 and 2014 were estimated at 1,290,682 and 1,697,689 fish, respectively. Recreational removals, i.e., angler harvest plus dead releases, in 2013 and 2014 were estimated at 2,921,317 and 2,444,551, respectively.

Total abundance increased to 195 million fish by 2012 due primarily to the abundant 2011 year-class from the Chesapeake Bay. Total abundance dropped in 2013 as the small 2012 year-class recruited to the population. In 2014, total abundance was estimated at 134 million fish. Abundance of age 8+ fish has declined since 2012 and is expected to drop slightly in 2015.

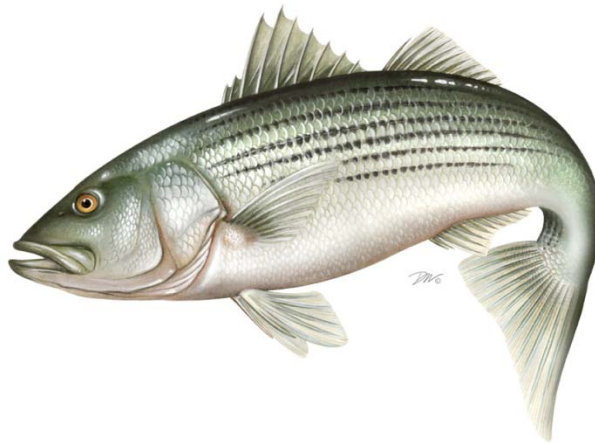
According to the projections model, if a constant catch of 3,402,641 fish, i.e., 2015 harvest estimate plus the average commercial discards during 2010-2014, was maintained during 2015-2017, the probability of SSB falling below the threshold is 0.49 by 2015 and declines slightly thereafter. The fully-recruited F is expected to decrease to an average of 0.18 during 2015-2017 and there is little chance (less than 12%) that F would exceed the F threshold.

Enclosed: 2015 Atlantic Striped Bass Stock Assessment Update

CC: Atlantic Striped Bass Technical Committee
Atlantic Striped Bass Stock Assessment Subcommittee
Atlantic Striped Bass Advisory Panel

M15-081

**Atlantic States Marine Fisheries Commission
Atlantic Striped Bass Stock Assessment Update
2015**



**Prepared by:
Atlantic Striped Bass Technical Committee**



Sustainably Managing Atlantic Coastal Fisheries

Update of the Striped Bass Stock Assessment using Data through 2014

This document summarizes the striped bass assessment that uses catch and index data from 1982-2014.

Commercial Data Sources

Strict quota monitoring is conducted by states through various state and federal dealer and fishermen reporting systems. Landings are compiled annually from those sources by state biologists. Commercial harvest in some states is recorded in pounds and is converted to number of fish using conversion methods. Biological data (e.g., length, weight, etc.) and age structures (scales) from commercial harvest are collected from a variety of gear types through state-specific port sampling programs. Harvest numbers are apportioned to age classes using length frequencies and age-length keys derived from biological sampling.

Commercial Landings (Weight)

Historically, annual commercial harvest of striped bass peaked at almost 6,804 mt (15 million pounds) in 1973, but through management actions, it declined by 99 percent to 63 mt (140,000 pounds) in 1986. Commercial landings have increased from 313 mt (800,000 pounds) in 1990 to 3,332 mt (7.3 million pounds) in 2004 following liberalization of fishery regulations. Since 2005, landings have fluctuated about an average of 3,162 mt (6.97 million pounds); however, landings have declined slightly in recent years (2011-2014) (Figure 1).

Commercial Landings (Numbers)

Commercial harvest of striped bass was over one million fish from 1997 through 2000 and near one million fish through 2006 (Table 1). Since 2007, numbers of fish landed have declined (Table 1). In 2014, only 766,298 fish were harvested and the Chesapeake Bay jurisdictions (Maryland, Virginia, and the Potomac River Fisheries Commission) accounted for 81% of the numbers of striped bass harvested (Table 1).

Commercial Landings Age Composition

The age structure of commercial harvest varies by state due to size regulations and season of the fisheries. The coast-wide time series of commercial-harvest age composition is provided in Table 2. In 2013 and 2014, the commercial harvest was comprised primarily of ages 4-10 striped bass (Table 3). Harvest in Chesapeake Bay fisheries (Maryland, Virginia, and the PRFC) was comprised mostly of ages 3-7 (Table 3).

Commercial Discards

Discard estimates for fisheries in Chesapeake Bay, the Ocean and Delaware Bay are based on the ratio of tags reported from discarded fish in the commercial fishery to tags reported from discarded fish in the recreational fishery, scaled by total recreational discards. Total discards in 2013 and 2014 were estimated to be 3.1 million and 4.6 million fish, respectively.

Total discards are allocated to fishing gears based on the relative number of tags recovered by each gear. Discards by fishing gear were multiplied by gear specific release mortalities and summed

to estimate total number of dead discards in a given year. The estimates of dead discards are 525,581 and 931,391 fish for 2013 and 2014, respectively (Table 4).

Age Composition of Commercial Dead Discards

Commercial discard proportions at age were obtained by applying age distributions from fishery dependent sampling or independent surveys that used comparable gear types. Gear specific proportions at age were applied to discard estimates by gear and expanded estimates summed across all gears. Most commercial discards since 2004 were fish of ages 3-7 (Table 4).

Total Removals by Commercial Fisheries

Total commercial striped bass removals (harvest plus dead discards) were 1.29 million and 1.69 million fish in 2013 and 2014, respectively. Except for 2014, harvest has generally exceeded dead discards since the mid 1990s (Figure 2). Commercial losses in 2013 and 2014 were dominated by the 2008 and 2009 year classes (ages 4 and 5 in 2013, and ages 5 and 6 in 2014).

Recreational Data Sources

Information on harvest and release numbers, harvest weights, and sizes of harvested bass from 1982-2003 come from the National Marine Fisheries Service's Marine Recreational Fisheries Statistics Survey (MRFSS/MRIP). The MRFSS/MRIP data collection consisted of a stratified intercept survey of anglers at fishing access sites that obtains numbers of fish harvested and released per angler trip, and a telephone survey that derives numbers of angler trips. Estimates of harvest and release numbers are derived on a bi-monthly basis.

In response to a peer review of the MRFSS program (National Resource Council 2006), NMFS established the Marine Recreational Information Program (MRIP) to improve recreational data collection and estimation methodologies. The timeline of MRIP changes can be found at <http://www.st.nmfs.noaa.gov/recreational-fisheries/in-depth/making-improvements-mrip-initiative/history-timeline/index>. MRIP estimates are now calculated assuming intercepts at a site represent a cluster of samples, and sample sites are weighted by their probability of selection, which is a function of fishing pressure recommended by state advisors. The MRFSS estimation procedure assumed that each intercept was an independent observation and that all sites were equally likely to have been sampled. Re-estimation of catch and harvest from 2004-2010 using the new methodology occurred in 2011 and is the standard used presently. However, the additional site metadata needed to replicate the MRIP estimation method are not currently available prior to 2004; therefore, estimates of catch for 1982–2003 are based on the MRFSS methodology.

Anecdotal evidence had suggested that North Carolina, Virginia, and possibly other states had sizeable wave-1 fisheries beginning in 1996 (wave-1 sampling that began in 2004 in North Carolina waters and large wave-1 tag return data for North Carolina and Virginia supported this contention). However, MRFSS/MRIP did not sample in January and February (wave-1) prior to 2004; therefore, there was little information for the winter fishery (Jan, Feb) that had developed off of North Carolina and Virginia. Harvest in wave 1 for these fisheries was estimated back to 1996 using observed relationships between landings and tag returns. For North Carolina, the ratio of estimated landings to tag returns in wave-1 of 2004 and annual tag returns in wave-1 were used to estimate annual landings

from tag returns in January and February of 1996-2003. For Virginia waters, the 1996-2004 mean ratio of landings and tag returns in wave-6 and annual tag returns in wave-1 were used to estimate landings from tag returns in January and February of 1996-2004. For 2005-2012, MRFSS/MRIP wave-1 estimates of harvest for the winter fishery in Virginia waters were still unavailable; therefore, they were estimated. The approach used to estimate wave-1 harvest in prior years was abandoned because correlation between wave 6 harvest and tag returns off Virginia weakened significantly. In 2012, the regression method of Nelson was updated to include the new MRIP NC wave 1 estimates of harvest and 2012 MRIP and tag data, and the wave 1 estimates from 2005-2012 were re-estimated. For 2013 and 2014, the 2005-2012 regression was used to estimate Virginia wave-1 harvest. Dead releases for the winter recreational fishery in North Carolina or Virginia were not estimated.

Most states use the length frequency distributions of harvested striped bass measured by the MRFSS. The MRFSS measurements are converted from fork length (inches) to total length (inches) using conversion equations. Proportions-at-length are calculated and multiplied by the MRFSS harvest numbers to obtain total number harvested-at-length. Data on sizes of released striped bass come mostly from state-specific sampling or volunteer angling programs. Proportions-at-length are calculated and multiplied by the number of MRFSS/MRIP dead releases to obtain total number dead releases-at-length. For those programs that do not collect data on released fishes, the lengths of tagged fish released by anglers participating in the American Littoral Society's striped bass tagging program or from state-sponsored tagging programs are used. Details on calculations are given in the 2013 SARC document (NEFSC, 2013).

Many states collect scale samples during state sampling programs designed to collect information on harvest and released striped bass from the recreational fishery. Age-length keys are usually constructed and applied to harvest and dead release numbers-at-length. When sampling of the recreational fishery does not occur, age-length keys are constructed by using data on age-length from commercial sampling, fisheries-independent sampling or striped bass tagging programs. For those states that do not collect scale samples, age-length keys are usually borrowed from neighboring states.

Age composition of the January/February recreational fishery in North Carolina and Virginia was estimated from length-frequency data collected by MRFSS/MRIP and appropriate state age-length keys. Length-frequencies for the North Carolina winter harvest of 2004 came from data in wave-6 of 2003 and wave-1 of 2004. Length-frequencies for the winter harvests of 1996-2003 came from wave-6 of year t-1. Lengths were converted to age for North Carolina with a combined age-length key from New York and North Carolina. Length-frequencies for the Virginia winter harvest in 1996-2012 came from MRFSS/MRIP data in wave-6 of year t-1. We converted the Virginia lengths to age with a Virginia age-length key in 2013, and used the MD coast age distribution to apportion wave-1 harvest to age classes in 2014 (there were no coastal age data provided by VA).

Recreational Total Landings

Figure 1 traces the impressive growth of the Atlantic coast-wide recreational fisheries from 1982 through 2014. Harvest increased from 1,010 mt (2.2 million pounds) in 1990 to 14,082 mt (31 million pounds) in 2006 (Figure 1). Following the peak in 2006, harvest declined through 2012 to 8,740 mt (19 million pounds) and increased in 2013 and 2014 (Figure 1).

Recreational Landings in Numbers

Recreational harvest of striped bass was greater than 1.4 million fish from 1997 through 2006, and more than 2.4 million striped bass during 2003-2006 (Table 5). Harvest was generally highest in Virginia, Maryland, New Jersey, and Massachusetts (Table 5). Coast-wide harvest of striped bass

declined to 1.5 million fish in 2012 and increased to an average of 1.97 million fish in 2013-2014 (Table 5).

Age Composition of Recreational Landings

Time series of harvest numbers-at-age are given in Table 6. Coast-wide recreational harvest was dominated by the 2003 (age 10) and 2007 (age 6) year-classes in 2013, and by the 2004 (age 10) and 2009 (age 5) year-classes in 2014 (Table 7). Ages 5-10 comprised about 62% in 2013 and 72% in 2014 of the coast-wide harvest, and ages 8+ comprised >49% in both years (Table 6). Recreational harvest from the ocean states (includes Delaware Bay) was comprised mostly of ages 6-10, while harvest in Chesapeake Bay (MD and VA) was dominated by ages 4-8 (Table 7).

Recreational Dead Releases

The number of striped bass that are caught and released (B2) is estimated by MRFSS/MRIP (Table 8). The releases have accounted for 85 to 90% of the annual catch in most years (Figure 2). The number of releases that die due to the capture and release process is estimated by multiplying the total release numbers (B2) by an estimate of hooking mortality. The overall 9% hooking mortality rate estimated by Diodati and Richards (1996) was used. Estimates of the number of dead releases are presented in Table 9. The numbers of fish released dead increased from 132 thousand fish in 1990 to 1.4 million fish in 1997. Releases remained around 1.2 million through 2003, but increased to the series maximum of 2.1 million fish in 2006. Releases declined substantially from 2006 through 2012 (Table 9). The number of dead releases increased to 768,599 fish in 2013 and declined slightly to 655,429 fish in 2014. The numbers of fish released dead are generally highest in Maryland, Massachusetts, New Jersey and New York (Table 9).

Age Composition of Dead Releases

Ages of coast-wide recreational dead releases ranged from 0 to 15+, but most dead releases were ages 2-6 (Table 10). The dead releases were dominated by ages 2-5 in MD and VA and 3-6 in ocean states (Table 10).

Total Removals by Recreational Fisheries

Total recreational striped bass removals (harvest and dead discards) in 2013 and 2014 were 2.92 million and 2.44 million fish, respectively (Figure 2). In 2013 and 2014, the harvest and dead releases combined were dominated by ages 2-6 in Maryland and Virginia and ages 6-10 in ocean states.

Incidental Removals

Some states collect information on the number of striped bass killed for other purposes such as scientific research. These are tabulated by region, age and year in Table 11.

Total Removals

Combined losses (commercial, recreational and incidental removals) indicated that the recreational fishery removed the largest number of striped bass in 2013 and 2014 (Figure 3). Historically, the recreational fishery has been the dominant source of fishing removals since 1991 (Figure 2). The above components were totaled by year to produce the overall catch at age matrices by region (Table 12). Estimated total removals in Chesapeake Bay and the Ocean regions declined from 2006 through 2012 (Table 12; Figure 4). The total removals of striped bass in Chesapeake Bay in 2013 increased by 14% compared to 2012 and in 2014 increased by 9% compared to 2013 (Table

12; Figure 4). The total removals of striped bass in the Ocean region in 2013 increased by 40% compared to 2012 and in 2014 declined by 26% compared to 2013 (Table 12; Figure 4). Ages 3-6 in 2013 and 2014 sustained the highest losses in Chesapeake Bay and ages 6-10 in 2013 and 2014 sustained the highest losses in the Ocean region.

Catch Weight at Age

Catch mean weight at age data, which is used to calculate total biomass and spawning stock biomass, was calculated for the period 1998-2002 using all available weight data from MA, NY, MD, VA, NH, and CT (1998-2001) and adding data from RI and DE in 2002 (NOAA 46th SAW Striped Bass Assessment Report - Appendix A5). Mean weights at age for the 2003-2014 striped bass catches were determined as a result of the expansion of catch and weight at age. Data came from Maine and New Hampshire recreational harvest and discards; Massachusetts recreational and commercial catch; Rhode Island recreational and commercial catch; Connecticut recreational catch; New York recreational catch and commercial landings; New Jersey recreational catch; and Delaware, Maryland, Virginia, and North Carolina recreational and commercial catch. Weighted mean weights at age were calculated as the sum of weight at age multiplied by the catch at age in numbers, divided by the sum of catch at age in numbers. Details of developing weights at age for 1982 to 1996 can be found in NEFSC Lab Ref. 98-03. Weights at age for 1982-2014 are presented in Table 13.

Indices of Relative Abundance

States provide age-specific and aggregate indices from fisheries-dependent and fisheries-independent sources that are assumed to reflect trends in striped bass relative abundance. Descriptions of the current survey indices are given below. A summary of index information is provided in Table 14.

Fishery-Independent Surveys

Connecticut Trawl Survey (CTTRL)

Connecticut provides an aggregate (ages 4-6) index of relative abundance from a bottom trawl survey. The Connecticut DEEP Marine Fisheries Division has conducted a fisheries-independent Trawl Survey in Long Island Sound since 1984. The Long Island Sound Trawl Survey (LISTS) provides fishery independent monitoring of important recreational species, as well as annual total counts and biomass for all finfish taken in the Survey. All finfish species are measured on all tows. The Long Island Sound Trawl Survey encompasses an area from New London, Connecticut (longitude 72° 03') to Greenwich, Connecticut (longitude 73° 39'). The sampling area includes Connecticut and New York state waters from 5 to 46 meters in depth and is conducted over mud, sand and transitional (mud/sand) sediment types. Long Island Sound is surveyed in the spring (April-June) and fall (September-October) periods with 40 sites sampled monthly for a total of 200 sites annually.

The sampling gear employed is a 14 m otter trawl with a 51 mm codend. To reduce the bias associated with day-night changes in catchability of some species, sampling is conducted during daylight hours only). LISTS employs a stratified-random sampling design. The sampling area is divided into 1.85 x 3.7 km (1 x 2 nautical miles) sites, with each site assigned to one of 12 strata defined by depth interval (0 - 9.0 m, 9.1 - 18.2 m, 18.3 - 27.3 m or, 27.4+ m) and bottom type (i.e., mud, sand, or transitional). For each monthly sampling cruise, sites are selected randomly from

within each stratum. The number of sites sampled in each stratum was determined by dividing the total stratum area by 68 km² (20 square nautical miles), with a minimum of two sites sampled per stratum. Discrete stratum areas smaller than a sample site are not sampled. The CTTTL index is computed as the stratified geometric mean number per tow.

New York Ocean Haul Seine Survey

New York provided age-specific geometric mean indices of relative abundance for striped bass generated from an ocean haul seine survey from 1987 - 2006. Since 1987, NY DEC sampled the mixed coastal stocks of striped bass by ocean haul seine. Sampling was conducted annually during the Fall migration on the Atlantic Ocean facing beaches off the east end of Long Island. A crew of commercial haul seine fishermen was contracted to set and retrieve the gear, and assist department biologists in handling the catch. The survey seine measured approximately 1,800 feet long and was composed of two wings attached to a centrally located bunt and cod end. The area swept was approximately ten acres. The seine was fifteen feet deep in the wings and twenty feet deep in the bunt.

Under the original design, sampling dates were selected at random to create a schedule of thirty dates. For each date selected, two of ten fixed stations were chosen at random, without replacement, as the sampling locations for that day. Since this design was difficult to implement due to weather-related delays, the sampling design was altered in 1990. Instead of randomly selecting thirty days, sixty consecutive working days were identified during the fall. One station was randomly selected, without replacement, for each working day until six "rounds" of ten hauls had been scheduled. Hauls that were missed due to bad weather or equipment failure were added to the next scheduled sampling day. No more than three hauls were attempted for any given day so that sampling was evenly distributed over time. Sixty hauls were scheduled for each year.

Since 1995, the survey team was prohibited from gaining access to several of the fixed stations. Instead of the original ten stations, two of the original stations plus three alternate sites were used to complete the annual survey. These alternate stations occur within the geographic range of the original standard stations. Also since 1995, funding delays resulted in a one-month delay in the commencement of field sampling activities. Between 1987 and 1994 field sampling began in early September. Since 1995, sampling began in late September to early October. In addition, decreases in funding have led to reductions in annual sampling effort from sixty seine hauls to forty-five seine hauls per season since 1997. The time series of catch and catch-at-age has been standardized by date for the entire time series.

This survey (see below) ended in 2007 due to state changes in contract relationships with private fishermen. The index remains in the assessment because it provides abundance trends for 1987-2006.

NEFSC Trawl Survey

The original vessel for this survey was replaced in 2009 with a larger vessel that cannot sample the inshore strata where most striped bass were caught. The index is still used in the assessment because it provides abundance trends for 1991-2008. The Northeast Fisheries Science Center provided an aggregate (2-9) index of relative abundance from the spring stratified-random bottom trawl survey. The survey covers waters from the Gulf of Maine to Cape Hatteras, NC. Only data from inshore strata from 1991-2008 are used.

New Jersey Bottom Trawl Survey (NJTRL)

New Jersey provides age-specific (2-9+) geometric mean indices of relative abundance for striped bass from a stratified-random bottom trawl initiated in 1989. The survey area consists of NJ coastal

waters from Ambrose Channel, or the entrance to New York harbor, south to Cape Henlopen Channel, or the entrance to Delaware Bay, and from about the 3 fathom isobath inshore to approximately the 15 fathom isobath offshore. This area is divided into 15 sampling strata. Latitudinal boundaries are identical to those which define the sampling strata of the National Marine Fisheries Service (NMFS) Northwest Atlantic groundfish survey. Exceptions are those strata at the extreme northern and southern ends of NJ. Where NMFS strata are extended into NY or DE waters, truncated boundaries were drawn which included only waters adjacent to NJ, except for the ocean waters off the mouth of Delaware Bay, which are also included. Samples are collected with a three-in-one trawl, so named because all the tapers are three to one. The net is a two seam trawl with forward netting of 12 cm (4.7 inches) stretch mesh and rear netting of 8 cm (3.1 inches) stretch mesh. The codend is 7.6 cm stretch mesh (3.0 inches) and is lined with a 6.4 mm (0.25 inch) bar mesh liner. The headrope is 25 m (82 feet) long and the footrope is 30.5 m (100 feet) long. Trawl samples are collected by towing the net for 20 minutes. The total weight of each species is measured with hanging metric scales and the length of all individuals comprising each species caught, or a representative sample by weight for large catches, is measured to the nearest cm total length and only data from April are used for striped bass.

Maryland Spawning Stock Survey (MDSSN)

Maryland provides spawning stock age-specific (2-13+) mean indices of relative abundance for striped bass in Chesapeake Bay from a gillnet survey initiated in 1985. Multi-panel experimental drift gill nets are deployed in spawning areas in the Potomac River and in the Upper Chesapeake Bay during the spring spawning season in April and May. There are generally 20-25 sampling days in a season. Ten mesh panels 150 feet long that range from 8 to 11.5 feet deep are used. The panels are constructed of multifilament nylon webbing in 3.00- to 10.00-inch stretch-mesh. In the Upper Bay, the entire suite of 10 meshes is fished simultaneously. In the Potomac River, two suites of 5 panels are fished simultaneously. Overall, soak times for each mesh panel range from 15 to 65 minutes. In both systems, all 10 meshes are fished twice daily (20 sets) unless weather or other circumstances prohibit a second soak. Sampling locations are assigned using a stratified random survey design. Each sampled spawning area is considered a stratum. One randomly chosen site per day is fished in each spawning area. The Potomac River sampling area consists of 40 0.5-square-mile quadrants and the Upper Bay sampling area consists of 31 1-square-mile quadrants. The Choptank River was also sampled between 1985-1996. A sub-sample of striped bass captured in the nets is aged. Scales are removed from two-three randomly chosen male striped bass per one cm length group, per week, for a maximum of ten scales per length group over the entire season. Scales are taken from all males over 700 mm TL and all females regardless of total length.

CPUEs for individual mesh sizes and length groups are calculated for each spawning area. Mesh-specific CPUEs ($CPUE_{i,j}$) are calculated by summing the catch in each length group across days and sets, and dividing the result by the total effort for each mesh. Sex-specific mesh selectivity coefficients are then used to correct the mesh-specific length group CPUE estimates. Sex-specific models are used to develop selectivity coefficients for fish sampled from the Potomac River and Upper Bay. Model building and hypothesis testing has determined that male and female striped bass possess unique selectivity characteristics, but no differences are evident between the Upper Bay and the Potomac River. Therefore, sex-specific selectivity coefficients for each mesh and length group are estimated by fitting a skew-normal model to spring data from 1990 to 2000 following the procedure presented in Helser and others. (1998). Model residuals are re-sampled 1,000 times to generate a population of 1,000 mesh- and size-class specific selectivity coefficients for each year, sample area,

and sex. The CPUE for each size class and mesh is then divided by the appropriate selectivity coefficient to generate 1,000 replicate matrices of mesh- and length-specific corrected catch frequencies. A vector of selectivity-corrected length-group CPUEs for each spawning area and sex is then developed. The selectivity-corrected CPUEs are averaged across meshes, using a mean that is weighted by the capture efficiency of the mesh. Finally, area- and sex-specific estimates of relative abundance are pooled to develop Bay-wide estimates of relative abundance.

Delaware Spawning Stock Electrofishing Survey (DESSN)

Delaware provides spawning stock age-specific (2-13+) mean indices of relative abundance for striped bass in the Delaware River from an electroshock survey initiated in 1996. Striped bass are sampled in the Delaware River from the vicinity of Big Timber Creek and League Island near river kilometer 152 located between Central Philadelphia downstream to the Delaware Memorial Bridge below Wilmington, DE at river kilometer 110. A stratified-random sampling design is used and a Smith-Root model 18-E boat electrofisher is used to collect striped bass. Typically, sampling is conducted with the boat moving in the direction of the tidal flow and in a zigzag pattern. Only striped bass approximately >200 mm total length are collected. Sampling is conducted weekly during mid-April to May (two days per week) and seven 12-minute timed samples are made per day. Length, weight, and sex are recorded and scales are collected from each fish. Due to staffing problems, the DE SSN was not completed in 2014.

New York Young-of-the-Year and Yearling Survey (NYYOY and NY Age 1)

In 2014, New York proposed a change in the young-of-year striped bass sampling program for the Hudson River. Objectives were to 1) adopt a more efficient sampling design for the juvenile striped bass survey without compromising the integrity of the index, and 2) determine the time-period for the index that best measures the abundance of juvenile striped bass. In the original program, from 1979-2013, approximately 25 stations were sampled every other week beginning in August and continued through the remaining summer/fall months. Sites were selected from a suite of 36 fixed stations located in the brackish water portion of the Hudson River: Tappan Zee to Haverstraw Bay (rkm 35 – 63). Sampling occurred over two to three days. A minimum of a four person sampling crew was needed to perform the survey each sampling day due to gear constraints and the large amount of data recorded at each site.

The gear is a 71 m x 3 m beach seine with 0.64 mm mesh. Sampling occurs during the day. Fish captured by seine are sorted by species and life stage, counted, and returned to the river. Lengths of striped bass and selected other species are obtained from a subset of the catch. The gear and fish processing procedure has not changed.

The “old” index was based on a six week time-period dating back to the beginning of the survey in 1979, where sampling was conducted from late August through November. However, an in-river, July through November off-shore trawl survey conducted in the same reach, indicated that young-of-year striped bass were present in this nursery area well before the late August start date of the seine program. Subsequently in 1985, three additional weeks of sampling were added to the seine program, moving back the start of sampling to mid-July to create the “nine-week index”. For all years, both the “6-week” (beginning in 1979) and “9-week” (beginning in 1985) relative abundance indices were calculated as geometric means of catch per haul. Only those hauls that resulted in a representative sample, i.e. no major loss due to obstructions or gear problems (tears, hangs, etc.) were included in the calculation. Both series were reported to ASMFC; however, the “6-week” was used as the primary Hudson index.

In the revised sampling program, in 2014, NY sought a more efficient sample design given staffing constraints and the desire to remove redundancies in effort. We examined the existing 35 year time series, 1979 to 2013, to eliminate sites that compromised the safety of the crew or equipment, sampled redundant adjacent habitats, or presented other recurring sampling issues. This analysis whittled sampling sites down from 25 to 13. The “revised” index incorporates the “9-week” index (mid July through November) seasonal component, retains the broad geographical reach of the nursery area, and does not compromise the integrity of the abundance index as it correlates well with the original indices:

- 6-week 13 site subset (6-week13ss) vs original 6-week: $R = 0.979$, $R^2 = 0.956$, $p < 0.0001$
- 9-week 13 site subset (9-week13ss) vs original 9-week: $R = 0.984$, $R^2 = 0.968$, $p < 0.0001$

In addition to running this correlation to the original index, New York also revisited the validation procedure for the revised index. We compared the nine week, 13 site subset survey with the Western Long Island Age 1 survey and to the Hudson Age 6-8 gill net (former shad fishery bycatch) index. The correlations met the significance level required by ASMFC for both surveys. The ASFMC Management Board accepted the revision of the index as recommended by the Technical Committee in May 2014.

During the 2014 field season, the sampling design had to be slightly altered due to the presence of a large, immovable hang in one of the 13 selected sites. An adjacent alternate site with similar habitat characteristics was selected as a replacement; recalculation of the index using the substituted site resulted in a slight change to the annual index values. This final revised index still met the validation significance level required by ASMFC. The geometric mean is used as the relative index.

New York also provides an index of relative abundance for yearling striped bass in western Long Island. The beach seine (61-m) survey samples fixed stations during May-October. The geometric mean is used as the relative index.

New Jersey Young-of-the-Year Survey (NJYOY)

New Jersey provides an index of relative abundance for young-of-the year striped bass in the Delaware River for years 1980 to present. A bagged beach seine is used at fixed and random stations, which are sampled biweekly from August-October. About 256 hauls are made each year. Relative abundance index for striped bass is calculated as the mean geometric number of young-of-the-year captured per seine haul.

Virginia Young-of-the-Year Survey (VAYOY)

Virginia provides an index of relative abundance for young-of-the-year bass in the Virginia portion of Chesapeake Bay. Begun in 1980, the fixed station survey is conducted in the James, York, and Rappahannock river systems. Eighteen index stations are sampled five times a year on a biweekly basis from mid-July through September. Twenty auxiliary stations provide geographically expanded coverage during years of unusual precipitation or drought when the normal index stations do not yield samples. A bagged beach seine (30.5 m long) is set by hand with one end fixed on the beach and the other fully extended perpendicular to the beach. The seine is swept with the current. Two hauls are made at each site. Abundance indices are computed as the geometric mean number of young-of-the-year or yearling bass per haul.

Maryland Young-of-the-Year and Yearlings Surveys (MDYOY and MD Age1)

Maryland provides an index of relative abundance for young-of-the-year and yearling striped bass in the Maryland portion of Chesapeake Bay. Begun in 1954, the fixed station survey is conducted in the Upper Bay, Choptank, Nanticoke, and Potomac Rivers. Each station is sampled once during each monthly round performed during July, August, and September. A bagless beach seine (30.5 m long) is set by hand with one end fixed on the beach and the other fully extended perpendicular to the beach. The seine is swept with the current. Two hauls are made at each site. Abundance indices are computed as the geometric mean number of young-of-the-year or yearling bass per haul.

Fisheries-Dependent Indices

Total Catch Rate Index

An aggregate index of relative abundance for 1988 to present is generated from MRFSS/MRIP intercept data. Generalized linear modeling (GLM; McCullagh and Nelder, 1989) is used to derive annual mean catch-per-hour estimates by adjusting the number of caught fish per trip for the classification variables of state, year, two-month sampling wave, number of days fished in the past 12 months (as a measure of avidity), and number of hours fished. In the analyses, only data from anglers who reported that they targeted striped bass is used to insure methods used among anglers are as consistent as possible and to identify those targeting anglers that did not catch striped bass (zero catches). Also, only data from private boats fishing in the Ocean during waves 3-5 are used.

A delta-lognormal model (Lo *et al.* 1992) was selected as the best approach to estimate year effects after examination of model dispersion (Terceiro, 2003) and standardized residual deviance versus linear predictor plots (McCullagh and Nelder, 1989). In the delta-lognormal model, catch data is decomposed into catch success/failure and positive catch per trip ($y > 0$) components. Each component is analyzed separately using appropriate statistical techniques and then the statistical models are recombined to obtain estimates of the variable of interest. The catch success/failure was modeled as a binary response to the categorical variables using multiple logistic regression. The *glm* function in R is used to estimate parameters, and goodness-of-fit was assessed using concordance measures and the Hosmer-Lemeshow test. Positive catches, transformed using the natural logarithm, is modeled assuming a normal error distribution using function *glm* in R. Any variable not significant at $\alpha=0.05$ with type-III (partial) sum of squares is dropped from the initial GLM model and the analysis is repeated. First-order interactions were considered in the initial analyses but it was not always possible to generate annual means by the least-square methods with some interactions included (Searle and others 1980); therefore, only main effects are considered. The annual index of striped bass total catch rate is estimated by multiplying together the prediction of the probability of obtaining a positive catch and the least-squares mean estimate of the positive catch from the models.

Virginia Pound Net (VAPNET)

Since 1991, the Virginia Institute of Marine Science has conducted the Virginia pound net survey. The pound net survey takes place on the striped bass spawning grounds in the Rappahannock River between river miles 44-47. VIMS has the option of sampling up to four commercial nets. The upper and lower nets are used for this survey and the middle nets are used for tagging. VIMS alternates sampling between the upper and lower nets. The sampling occurs from March 30 to May 3, when the females are on the spawning ground. The pound nets are checked twice a week, but are fishing

constantly. When the samples are collected, the fish are sexed and measured, scales are taken from every fish, and a subsample of fish have otoliths removed.

Comparison of Fisheries-Independent and Fisheries-Dependent Indices

Time series of each index used in the current assessment are shown in Table 15 and 16. The fishery-independent indices for combined ages generally indicate an increase in population abundance from the early 1990s through the mid 1990s, and relatively stable levels through 2007 (Figure 5). The New Jersey and Connecticut trawl indices showed declines through 2011 and increases in 2012 and 2013, respectively (Figure 5). The Maryland gillnet survey showed a relatively stable spawning stock biomass population since the mid 1980s. The Delaware electrofishing index exhibited a slight decline in spawning stock through 2009, an increase through 2011 and a decline in 2012 (Figure 5).

The coast-wide MRFSS/MRIP index indicated that abundance declined from 1998 to 2003, rose steadily through 2006, declined through 2011, increased through 2013 and declined slightly in 2014 (Figure 5). The VA pound net index showed variable but level trends prior to 1999, an increase in 1999 and 2000, a decline through 2002, an increase through 2004, and then a variable but level trend through 2010. A decline occurred in 2011 and has remained at about the same level during 2012-2014.

Young-of-the-year and age-1 indices in Chesapeake Bay were variable but declines were observed during 2004-2010 and in some years close to low values not observed since 1990 (Figure 6). In Delaware Bay, recruitment of YOY increased from 2007 through 2009, declined slightly during 2010-2011, and increased in 2013 and 2014. Recruitment in the Hudson River declined from 2007-2013 (Figure 6). Strong year-classes were evident in 1993, 1996, 2001, 2003 and 2011 in Chesapeake Bay (Maryland and Virginia), and in 1993, 1995, 1999, 2003, 2009 and 2014 in Delaware Bay, in 1997, 1999, 2001, 2003, 2010 and 2014 in Hudson River (Figure 6). The lowest YOY index value in the Chesapeake Bay time series was observed in 2012.

Age composition data for the age-specific indices are given in Table 17.

Model Description

See the 2013 SARC document for complete description of the striped bass statistical catch-at-age model. A summary of the model structure used in this assessment is listed in Table 18.

Data Inputs

Plus Group

As in the 2013 benchmark, an age 13+ plus-group was used for catch and indices data as an attempt to address the increase in scale-ageing bias after ages 12 or so.

Removals Data

Total removals (recreational and commercial harvest numbers plus number of discards that die due to handling and release and incidental removals) and the proportions of catch-at-age of striped bass fisheries are the primary data used in the model. The removals data were partitioned into three “fleets” in an attempt to account for more realistic patterns in fishing selectivity known to have

occurred as management measures changed over time. All selectivity time blocks corresponded to Amendment changes. Removals data were split into *Chesapeake Bay*, *Ocean* and the *Commercial Dead Discards*. The latter was a separate fleet because commercial discards were from a multitude of gears that do not necessarily target striped bass and the mixed gear types may have a unique selectivity over time. In addition, the data prior to 1996 could not be separated into regions. The Chesapeake Bay fleet includes commercial and recreational harvest and recreational dead discards taken in the Bay by MD, VA, and the PRFC. The Ocean fleet includes commercial and recreational harvest and recreational dead discards taken in the ocean by ME, NH, MA, NY, NJ, DE (Delaware Bay and ocean), MD, VA and NC.

Young-of-the-Year and Age 1 Indices

All indices used in the benchmark assessment were used in the update. Each index was linked to a particular age (Table 19). Young-of-the-year indices were lagged one year ahead and linked to age 1.

Starting Values

Initial starting values for all parameters are given in Table 20. Based on the coast-wide age samples, the starting effective sample sizes for the age proportions in each fleet were set at 50. Used as starting values, the average effective sample size for each survey with age composition data was calculated in the 2007 benchmark (<http://www.nefsc.noaa.gov/publications/crd/crd0803/>) by using methods in Pennington and Volstad (1994) and Pennington and others (2002). In essence, effective sample size was estimated by first calculating the length sample variance using the simple random sampling equation and dividing into it the cluster sampling variance of mean length derived through bootstrapping, assuming each seine/trawl haul, gillnet set, or electrofishing run was the sampling unit. The average of the annual effective sample sizes was used as starting values in each survey multinomial error distribution (NJ Trawl = 23; NYOHS = 56; DESSN = 68; MDSSN=68; VAPNET = 68).

Sex Proportions-at-age

Female sex proportions-at-age are used to apportion the numbers-at-age to female numbers-at-age for calculation of female spawning stock biomass. The sex proportions were derived from available state catch datasets. The proportions used were:

Age	1	2	3	4	5	6	7	8	9	10	11	12	13+
Prop	0.53	0.56	0.56	0.52	0.57	0.65	0.73	0.81	0.88	0.92	0.95	0.97	1.00

Female Maturity

The proportions mature-at-age for females were derived from literature values and field samples.

Age	1	2	3	4	5	6	7	8	9	10	11	12	13+
Prop	0.0	0.0	0.0	0.04	0.13	0.45	0.89	0.94	1.00	1.00	1.00	1.00	1.00

Natural Mortality

The age-specific M estimates used in the updated base model are:

Age	1	2	3	4	5	6	≥ 7
M	1.13	0.68	0.45	0.33	0.25	0.19	0.15

Model Specification

Phases

Model parameters were solved in phases. The parameters solved in each phase were:

- 1 Yr 1, Age 1 N or Avg N (log)
- 2 recruitment deviations and fishing mortality
- 3 stock-recruitment parameters
- 4 catch selectivity parameters
- 5 survey selectivity parameters
- 6 catchability coefficients of survey indices

Catch Selectivity Functions

The same four time blocks for catch selectivity estimations used in the 2013 benchmark were used in this update. The periods are listed in Table 18.

Stock-Recruitment Curve

Based on literature reviews and committee opinion, the Beverton-Holt equation was selected as the appropriate stock recruitment relationship for striped bass.

Data Weighting

Data weighting was accomplished by first running the model with all initial starting values, lambda weights = 1, and index CV weights = 1. The lambda weights for the total removal data were increased to 2 for the Bay, Ocean, and Commercial Discards to force the model to better fit the data in these early years (1982-1984). Based on recommendations by the SARC panel, the initial effective sample sizes were first adjusted once by using the Francis multipliers and the model was re-run. After the model was re-run, the index CV weights were adjusted to obtain index RMSE values close to 1.0. The estimated RMSE values were used as the CV weights and this allowed the resulting RMSE values to be near 1.0. The model was re-run to make small adjustments in the RMSE values. Since the MRFSS and MDSSN indices have considerable influence on the model results, the CV weights for these indices were then adjusted until the RMSE values were nearly identical to balance the influence of each index.

Results

Resulting RMSE for fleet catch and survey indices and effective sample sizes for age compositions are given in Table 21. Resulting contributions to total likelihood are listed in Table 22. The converged total likelihood was 10,383.3. Estimates of fully-recruited fishing mortality for each fleet, total fishing mortality, recruitment, parameters of the selectivity functions for the selectivity periods, catchability coefficients for all surveys, and parameters of the survey selectivity functions are given in Table 23 and are shown graphically in Figures 7-9. Graphs depicting the observed and predicted values and residuals for the catch age composition, survey indices, and survey compositions are given in Appendix A. The model fit the observed total catches (Figure 7) and catch age compositions of all fleets well, except for ages 1 and 13+ for the Ocean and Commercial Discard fleets (Appendix A), and the YOY, age 1, CTTRL, and NEFSC indices reasonably well (Appendix A). The predicted trends matched the observed trends in age composition survey indices (except MDSSN and NYOHS), and predicted the survey age composition reasonably well (MDSSN) to poorly (NJ Trawl) (Appendix A).

Estimates of the catch selectivity patterns for each fleet showed that, although the patterns varied over time with changes in regulation, selectivity was dome-shaped for Chesapeake Bay and Commercial Discard fleets and primarily flat-topped for the Ocean over time (Figure 8).

Fishing Mortality

Partial fully-recruited fishing mortality in 2014 for the Bay, Ocean and Commercial Discard fleets was 0.065, 0.145, and 0.042, respectively (total fully-recruited $F_{2014}=0.205$) (Table 23; Figure 9). The maximum total F-at-age in 2014 was 0.205 for age 11 (Table 24). Fishing mortality-at-age in 2013 and 2014 for the three fleets is shown in Figure 10. Fishing mortality-at-age peaked at age 5 in the Chesapeake Bay and Commercial Discards fleets and age 13+ in the Ocean fleet. The highest fishing mortality was attributed to the Ocean fleet at ages ≥ 6 (Table 24).

Population Abundance (January 1)

Striped bass abundance (1+) increased steadily from 1982 through 1997 when it peaked around 249 million fish (Table 25; Figure 11). Total abundance fluctuated without trend through 2004. From 2005-2009, age 1+ abundance declined to about 133 million fish. Total abundance increased to 195 million fish by 2012 (Figure 11). The increase in 2012 was due primarily to the abundant 2011 year class from Chesapeake Bay (Table 25). Total abundance dropped in 2013 as the very small 2012 year-class from Chesapeake Bay recruited to the population (Figure 11). Abundance increased slightly in 2014 to 134 million fish. Abundance of striped bass age 8+ increased steadily through 2004 to 11.4 million fish, but declined to 7.6 million fish through 2010 (Table 25; Figure 11). A small increase in 8+ abundance occurred in 2011 as the 2003 year class became age 8 (Figure 11). Abundance of age 8+ fish has declined since 2012 (Figure 11) and is expected to drop slightly in 2015.

Spawning Stock Biomass and Total Biomass

Weights-at-age used to calculate female spawning stock biomass (SSB) were generated from catch weights-at-age and the Rivard algorithm described in the NEFSC's VPA/ADAPT program. Female SSB grew steadily from 1982 through 2003 when it peaked at about 78 thousand metric tons (Table 26, Figure 12A). Female SSB has declined since then and was estimated at 63,918 metric tons (95% CI: 51,183-76,653) in 2014 (Table 26; Figure 12A). The SSB point estimate in 2014 remained above the threshold level of 57,626 thousand metric tons and indicates that the striped bass are not overfished. However, given the error associated with the 2014 values, there is a probability of 0.16 that the female spawning stock biomass in 2014 is below the threshold. The spawning stock numbers (Figure 12B) declined more rapidly than the spawning stock biomass.

Exploitable biomass (January 1) increased from 9,901 metric tons in 1982 to its peak at 109 thousand metric tons in 1997 (Figure 12C). It declined through 1999 but increased slightly in 2000. Exploitable biomass was relatively stable at an average of 103 thousand metric tons through 2005, but it has since declined to about 89 thousand metric tons in 2014 (Figure 12C).

Retrospective Analysis

Retrospective analysis plots and percent difference plots between the 2014 and peels of the retrospective analysis are shown in Figure 13. Moderate retrospective bias was evident in the more recent estimates of fully-recruited total F, SSB, and age 8+ abundance of SCA (Figure 13). The retrospective pattern suggests that fishing mortality is likely slightly over-estimated (between 2 and 13% since 2007) and could decrease with the addition of future years of data, while female spawning biomass appears under-estimated and could increase with the addition of future years of data. Similar retrospective trends have been observed in the previous assessments of striped bass using the ADAPT VPA (ASMFC 2005), the 2007 benchmark, 2013 benchmark and supporting ASAP model presented in the 2013 benchmark assessment document.

Comparison of Results from the 2015 Updated Assessment with 2013 Benchmark Assessment

Fully-recruited fishing mortality and female spawning stock biomass estimates from the update and benchmarks assessments are shown in Figure 14. The updated assessment produced slightly lower fully-recruited fishing mortality and higher female spawning stock biomass estimates from 2005-2012 than the 2013 benchmark assessment (Figure 14).

Status of the Stock

In 2014, the Atlantic striped bass stock was not overfished or experiencing overfishing based on the point estimates of fully-recruited fishing mortality and female spawning stock biomass relative to the reference points defined in this assessment. Female spawning stock biomass was estimated at 63,918 metric tons (140 million pounds) which is above the SSB threshold of 57,626 metric tons, but below the SSB target of 72,032 metric tons. Total fishing mortality was estimated at 0.205 which is below the F threshold of 0.219 but above the F target of 0.180 (Figure 14). However, because of error associated with these estimates, there is a probability of 0.16 that the 2014 female SSB estimates is below or equal to the SSB threshold, or conversely, a probability of 0.84 that the 2014 female SSB is above the threshold. There is a probability of 0.29 that the 2014 fully-recruited fishing mortality is

above or equal the fishing mortality threshold, or conversely, a 0.71 chance that the 2014 fully-recruited is below the fishing mortality threshold. If the estimates of SSB and fully-recruited F are adjusted for the average retrospective bias in the last five years (since there was not a consistent pattern in the retrospective bias and the number of years chosen for the correction will affect the level of bias, the committee chose the last five years for recent trends), the probability of the 2014 female SSB estimates being below or equal to the SSB threshold declines to 0.03, while the probability of the 2014 fully-recruited fishing mortality being above or equal the fishing mortality threshold declines to 0.19.

Projections

Three-year projections of female spawning stock biomass were made by using a population simulation model written in R. The model begins in year 2014 with known January-1 values of abundance-at-age from the SCA and projects SSB and fishing mortality in 2015-2017 assuming a constant catch of 3,402,641 fish (estimated 2015 harvest plus average commercial discards during 2010-2014). For 2014, the January-1 abundance-at-age data with associated standard errors from the SCA model, the fully-recruited fishing mortality estimate in 2014 ($F=0.205$), selectivity-at-age in 2014, Rivard weights in 2014, natural mortality, female sex proportions-at-age, and female maturity-at-age are used to calculate female spawning biomass as modeled in the SCA model. For 2015, the January-1 abundance-at-age is calculated from the known values of 2014 abundance-at-age, selectivity and fully-recruited fishing mortality. For the remaining years, the Jan-1 abundance-at-age is projected and is calculated by using the previous year's abundance-at-age, selectivity, fishing mortality and natural mortality following the standard exponential decay model. The fully-recruited fishing mortality in 2015-2017 is estimated by using an iterative approach in which catch-at-age is calculated by using the catch equation given a January-1 abundance-at-age, starting fishing mortality and average selectivity-at-age from 2010-2014. The sum of age-specific catches are then compared to the assumed constant catch for 2015-2017. This procedure is repeated by changing fully-recruited F until the square of the log difference between predicted catch and total catch is minimized. Given the value of fully-recruited F, spawning stock biomass for the current year is then calculated.

For each iteration of the simulation, the abundance-at-age in 2014 is randomly drawn from a normal distribution parameterized with the 2014 estimates of January-1 abundance-at-age and associated standard errors from the stock assessment model. For the remaining years, abundance of age-1 recruits is randomly selected from the 1990-2014 recruitment estimates. An age 13 plus-group is assumed. For years 2015-2017, selectivity-at-age was derived from the geometric mean of the 2010-2014 F-at-ages and dividing the resulting vector by the maximum F-at-age. Female spawning stock biomass was calculated by using average Rivard weight estimates from 2010-2014, sex proportions-at-age, and female maturity-at-age.

For each year of the projection, the probability of SSB being equal to or lower than the SSB reference point was calculated from the 10,000 simulations by using function *p_{gen}* in R package *fishmethods*. The SSB reference point was the 1995 SSB estimate (57,626 metric tons) and the error of the estimates of current SSB and SSB reference point were incorporated in the calculation of probability. Similarly, the probability of current F being greater than or equal to the F reference point ($F=0.22$) was calculated from 10,000 simulations as well. The CV of the F reference point was assumed equal to the value for the 2014 fully-recruited F estimate.

If the constant catch of 3,402,641 fish was maintained during 2015-2017, the probability of being below the SSB threshold increases to 0.49 by 2015 (Figure 15). After 2015, the probability is expected to decline slightly (2017: Pr=0.40). The fully-recruited F is expected to decrease to an average of 0.18 during 2015-2017 and there is little chance that the fully-recruited F would exceed the F threshold in any year (Pr \leq 0.12).

If the numbers-at-age and fully-recruited F in 2014 were adjusted for average (2009-2013) retrospective bias, the probabilities of being below the SSB threshold are sharply reduced (Figure 16). The probability increases from 0.03 in 2014 to 0.12 by 2015 (Figure 16). After 2015, the probability is expected to decline (2017: Pr=0.06). The fully-recruited F is expected to decrease to an average of 0.17 during 2015-2017 and there is little chance that the fully-recruited F would exceed the F threshold in any year (Pr \leq 0.06). However, these results should be treated with caution because the magnitude of the retrospective bias in numbers-at-age and fully-recruited F appears relatively unpredictable (i.e., it is expected that numbers-at-age are underestimated and fully-recruited F is overestimated in the terminal year, but the magnitude cannot be predicted).

In addition, projections were run to estimate the probability of SSB being less than or equal to the SSB target (=72,032 mt), and F being equal to or greater than the F target (=0.18) reference point. If the constant catch of 3,402,641 fish was maintained during 2015-2017, the probability of being below the SSB target reference point increases to 0.98 by 2015 (Figure 17). After 2015, the probability is expected to decline slightly (2017: Pr=0.978). The fully-recruited F is expected to decrease to an average of 0.18 during 2015-2017 and the probability of being above the F target is expected to increase slightly from 0.46 in 2015 to 0.60 in 2017.

If the numbers-at-age and fully-recruited F in 2014 were adjusted for average (2009-2013) retrospective bias, the probabilities of being below the SSB target are reduced (Figure 18). The probability increases from 0.62 in 2014 to 0.88 in 2015 (Figure 18). After 2015, the probability is expected to decline (2017: Pr=0.81). The fully-recruited F is expected to decrease to an average of 0.17 during 2015-2017. The probability of F being below the F target drops to 0.25 in 2015 but increases to 0.42 by 2017. The same caution made in the reference point comparisons above for the retrospective adjustment applies here as well.

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Table 1. Commercial harvest (numbers) by state and year.

Year	ME	NH	MA*	RI	CT	NY	NJ	DE	MD	PRFC	VA	NC	Total
1982			26,183	52,896	207	74,935		12,794	189,089	54,421	14,905	3,200	428,630
1983			9,528	48,173	83	66,334		5,806	147,079	63,171	15,962	1,405	357,541
1984			5,838	8,878	192	70,472		12,832	392,696	372,924	6,507	532	870,871
1985	90		7,601	7,173	350	52,048		1,359		82,550	23,450		174,621
1986			3,797	2,668						10,965	251		17,681
1987			3,284	23						9,884	361		13,552
1988			3,388							19,334	10,588		33,310
1989			7,402										7,402
1990			5,927	784		11,784		698	534	38,884	56,222	803	115,636
1991			9,901	3,596		15,426		3,091	31,880	44,521	44,970	413	153,798
1992			11,532	9,095		20,150		2,703	119,286	23,291	42,912	1,745	230,714
1993			13,099	6,294		11,181		4,273	211,089	24,451	39,059	3,414	312,860
1994			11,066	4,512		15,212		4,886	208,914	25,196	32,382	5,275	307,443
1995			44,965	19,722		43,704		5,565	280,051	29,308	88,274	23,325	534,914
1996			38,354	18,570		39,707		20,660	415,272	46,309	184,495	3,151	766,518
1997			44,841	7,061		37,852		33,223	706,847	87,643	165,583	25,562	1,108,612
1998			43,315	8,835		45,149		31,386	790,154	93,299	204,911	16,040	1,233,089
1999			40,838	11,559		49,795		34,841	650,022	90,575	205,143	21,040	1,103,812
2000			40,256	9,418		54,894		25,188	627,777	91,471	202,227	6,480	1,057,712
2001			40,248	10,917		58,296		34,373	549,896	87,809	148,346	22,936	952,820
2002			48,926	11,653		47,142		30,440	296,635	80,300	127,211	15,784	658,091
2003			61,262	15,497		68,354		31,531	439,482	83,091	161,777	13,823	874,817
2004			66,556	15,867		70,367		28,406	461,064	91,888	147,998	31,014	913,160
2005			65,332	14,949		70,560		26,336	569,964	80,615	119,244	26,573	973,572
2006			75,062	15,429		73,528		30,212	655,951	92,288	109,396	2,799	1,054,664
2007			57,634	13,934		78,287		31,090	598,495	86,695	140,602	16,621	1,023,358
2008			65,330	16,616		73,263		31,866	594,655	81,720	134,603	12,903	1,010,955
2009			63,875	20,725		82,574		21,590	618,076	89,693	138,303	8,675	1,043,512
2010			65,277	17,256		81,896		19,830	584,554	90,258	159,197	12,670	1,030,938
2011			63,309	14,344		87,349		20,517	490,969	96,126	148,063	10,814	931,490
2012			66,394	14,953		66,897		15,738	472,517	90,616	111,891	323	839,329
2013			62,570	13,825		76,206		17,679	399,118	78,006	117,697	0	765,101
2014			60,619	10,468		52,903		14,894	370,661	81,429	175,324	0	766,298

* Includes fish taken for personal consumption

Table 2. Total commercial harvest (numbers) by age and year.

Year	Age													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13+	
1982	0	45,129	200,221	117,158	22,927	5,035	3,328	2,861	1,871	4,407	5,837	7,639	12,217	428,630
1983	0	54,348	120,639	120,999	38,278	7,416	1,954	677	607	1,690	1,314	2,375	7,245	357,541
1984	0	478,268	270,140	55,598	30,580	21,688	6,441	1,744	1,020	771	146	279	4,196	870,871
1985	0	53,699	45,492	7,545	9,448	19,248	21,569	6,581	3,692	1,514	466	607	4,760	174,621
1986	0	639	6,020	3,207	180	703	1,425	1,199	546	182	105	220	3,255	17,681
1987	0	0	3,087	4,265	1,618	252	1,104	1,075	448	233	95	273	1,102	13,552
1988	0	0	2,086	3,961	15,491	6,469	2,803	539	541	218	266	108	828	33,310
1989	0	0	0	0	0	139	1,111	959	1,007	631	475	164	2,916	7,402
1990	0	650	12,551	48,024	29,596	15,122	3,111	2,357	1,147	519	272	130	2,157	115,636
1991	0	2,082	22,430	44,723	41,048	21,614	8,546	4,412	4,816	1,163	269	125	2,570	153,798
1992	0	640	32,277	58,009	46,661	41,581	22,186	11,514	8,746	6,314	1,062	464	1,260	230,714
1993	0	1,848	21,073	93,868	87,447	42,112	32,485	13,829	8,396	6,420	3,955	763	664	312,860
1994	0	1,179	22,873	71,614	101,512	48,269	28,530	14,886	8,902	5,323	2,513	1,250	592	307,443
1995	0	6,726	35,190	114,519	134,709	98,471	38,918	34,191	37,324	21,827	8,364	3,166	1,509	534,914
1996	0	557	50,102	127,825	179,031	161,361	120,693	51,995	29,907	18,864	11,663	9,674	4,847	766,518
1997	0	1,843	37,754	342,867	213,454	206,836	102,034	76,149	54,989	30,373	17,813	13,813	10,686	1,108,612
1998	0	6,124	54,375	267,791	411,067	184,209	94,726	75,915	63,592	31,809	19,948	12,110	11,423	1,233,089
1999	0	7,591	94,342	211,645	264,460	221,773	92,992	66,837	63,357	35,916	20,939	14,180	9,780	1,103,812
2000	0	244	51,876	203,457	284,772	194,336	121,949	72,841	51,768	37,496	19,263	11,391	8,320	1,057,712
2001	0	165	86,190	189,602	241,867	140,555	89,963	95,580	34,026	31,547	22,172	12,853	8,300	952,820
2002	0	184	39,914	133,965	130,689	107,219	68,875	45,032	56,146	28,715	20,386	12,252	14,713	658,091
2003	0	3,932	59,027	156,836	171,626	132,005	96,662	76,612	70,049	59,722	20,916	15,944	11,484	874,817
2004	1,221	18,069	83,780	173,546	123,717	102,815	94,480	97,849	73,246	57,207	43,534	22,876	20,818	913,160
2005	0	145	43,488	239,748	252,020	102,076	57,072	56,939	75,306	50,440	41,629	25,937	28,771	973,572
2006	0	81	90,820	192,639	335,889	150,133	48,304	43,705	46,313	61,550	39,664	23,017	22,550	1,054,664
2007	0	0	4,711	305,597	207,826	190,053	78,099	51,494	64,579	51,397	32,964	20,498	16,141	1,023,358
2008	0	0	12,506	233,419	311,903	125,702	92,605	60,928	42,177	41,351	35,246	29,726	25,394	1,010,955
2009	0	69	19,745	190,560	356,448	191,280	68,995	69,342	41,636	31,813	27,531	18,630	27,461	1,043,512
2010	0	7,178	46,448	219,450	247,340	177,935	133,809	58,962	45,183	30,091	21,540	17,394	25,606	1,030,938
2011	0	788	49,592	127,860	199,887	198,523	118,074	93,069	45,488	42,628	15,586	12,507	27,489	931,490
2012	0	7,574	52,373	100,268	247,767	138,058	93,514	54,667	60,289	25,132	25,512	14,275	19,900	839,329
2013	0	465	56,877	130,722	149,660	148,739	70,319	57,246	50,022	53,178	14,798	12,540	20,534	765,101
2014	0	469	58,072	108,014	194,079	133,322	87,856	49,620	41,178	38,606	26,715	9,220	19,147	766,298

Table 3. Age composition of commercial harvest in 2013 and 2014 by state.

2013														
State	1	2	3	4	5	6	7	8	9	10	11	12	13+	Total
MA	0	0	3	10	167	685	1,676	8,951	18,711	14,960	5,864	3,056	8,486	62,569
RI	0	0	0	0	304	1,148	2,064	2,906	3,889	1,859	345	529	780	13,825
NY	0	0	276	2,209	4,970	16,843	10,492	14,082	10,216	14,358	1,104	1,381	276	76,206
DE	0	0	0	170	1,576	5,048	5,028	3,860	1,352	126	422	73	24	17,679
MD Bay	0	0	52,339	105,400	102,753	85,465	24,523	11,055	5,105	4,122	615	134	0	391,510
MD Cst	0	0	0	0	34	432	412	565	1,072	2,753	628	908	803	7,608
PRFC	0	0	431	6,177	18,819	24,278	18,532	8,188	862	287	0	287	144	78,006
VA Bay	0	465	3,828	16,756	21,036	14,816	7,567	7,487	8,317	12,922	5,059	4,860	6,607	109,719
VA Cst	0	0	0	0	0	25	25	151	497	1,791	761	1,313	3,415	7,978
NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
														765,100

2014														
State	1	2	3	4	5	6	7	8	9	10	11	12	13+	Total
MA	0	0	0	0	142	440	1,670	2,909	9,631	16,262	13,407	5,281	10,877	60,619
RI	0	0	7	15	56	110	349	851	2,349	2,644	1,963	822	1,304	10,468
NY	0	0	126	5,935	9,413	10,571	11,492	7,322	4,348	2,539	896	260	0	52,903
DE	0	0	0	162	1,131	2,601	2,345	3,154	1,365	921	1,305	748	1,162	14,894
MD Bay	0	0	35,270	69,988	114,454	64,571	35,685	20,383	13,796	6,290	1,500	81	163	362,180
MD Cst	0	0	0	0	345	1,073	1,547	1,931	995	651	1,316	116	508	8,481
PRFC	0	0	0	7,834	28,861	27,418	12,369	3,711	825	0	412	0	0	81,430
VA Bay	0	469	22,669	24,080	39,680	26,442	22,046	9,189	6,655	7,024	4,288	870	2,965	166,377
VA Cst	0	0	0	0	0	95	352	171	1,215	2,275	1,629	1,041	2,169	8,946
NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
														766,299

Table 4. Commercial discards (numbers) by age and year. * = updated.

Year	Age													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13+	
1982	0	31,645	3,644	11,456	5,623	1,291	2,397	1,014	369	92	85	0	7	57,624
1983	0	24,067	1,453	2,878	7,761	2,311	610	610	262	174	0	0	0	40,127
1984	0	33,575	1,611	5,812	9,734	11,272	2,815	117	586	66	0	52	0	65,639
1985	0	7,728	30,472	5,939	10,891	3,395	2,742	1,045	261	131	131	0	0	62,734
1986	0	5,841	20,758	100,067	27,989	13,315	4,295	1,415	346	0	0	0	0	174,024
1987	0	4,206	14,382	28,597	51,389	16,940	6,520	1,319	1,011	395	111	86	111	125,066
1988	0	6,142	22,593	36,616	70,959	71,694	23,232	9,116	3,110	1,653	218	195	24	245,552
1989	0	13,854	50,240	49,029	83,396	82,757	33,479	15,502	6,342	705	1,409	1,409	705	338,827
1990	0	14,526	68,713	80,935	111,888	115,702	71,600	36,256	5,948	1,539	1,401	1,503	0	510,011
1991	79	12,632	37,009	64,210	77,335	56,894	36,912	24,857	6,610	4,071	6,542	16	0	327,167
1992	117	3,698	34,218	36,746	44,412	34,688	14,798	11,179	3,398	2,356	991	0	0	186,601
1993	0	7,449	50,160	79,011	95,116	63,487	20,941	15,351	9,270	4,606	1,651	536	260	347,839
1994	0	31,770	47,169	45,081	88,122	84,570	39,229	12,524	6,223	3,674	712	415	30	359,518
1995	0	72,822	75,520	53,551	94,158	121,592	61,447	19,083	7,569	4,269	2,290	2,346	807	515,454
1996	0	27,133	114,085	76,336	61,884	58,787	30,835	14,916	6,148	3,989	159	502	50	394,824
1997	476	7,108	64,352	61,871	30,602	20,951	14,002	6,592	1,963	4,309	2,658	801	1,060	216,745
1998	0	13,233	53,899	98,510	83,288	29,197	12,970	12,591	7,860	4,372	3,891	2,419	3,802	326,032
1999	984	58,076	49,894	43,744	55,740	14,477	5,213	3,704	1,980	1,304	648	612	243	236,619
2000	196	178,457	189,933	157,291	62,699	33,918	26,938	7,831	4,111	3,876	801	863	83	666,997
2001	0	2,638	58,079	77,958	88,808	29,410	18,877	11,613	9,664	6,371	4,778	1,957	747	310,900
2002	1,700	20,888	42,641	21,409	28,791	23,720	12,381	6,854	5,645	2,255	1,522	149	248	168,201
2003	1,512	6,227	28,061	54,464	56,728	19,866	30,850	18,633	16,410	13,572	8,164	3,207	4,281	261,974
2004	2,943	52,811	80,744	76,790	62,580	48,683	52,231	41,378	23,549	9,829	10,381	2,365	1,359	465,642
2005	432	11,513	103,930	245,644	169,860	68,808	54,397	43,911	43,609	23,102	16,147	8,477	8,713	798,544
2006	0	555	25,769	28,836	36,995	27,669	15,055	16,698	12,693	13,187	7,392	4,430	5,245	194,524
2007	284	6,302	18,190	89,608	97,557	139,873	78,655	48,521	42,665	30,644	22,419	19,979	11,902	606,599*
2008	0	109	2,928	45,076	71,474	58,005	44,675	21,699	13,857	13,043	12,619	14,253	10,978	308,715
2009	0	1,661	80,748	166,818	123,878	91,220	30,653	38,426	20,517	16,384	15,706	7,675	18,258	611,944
2010	0	1,379	16,212	76,208	64,148	46,221	19,637	9,510	6,534	4,079	3,116	1,792	6,007	254,841
2011	0	3,880	61,564	109,748	131,320	80,575	54,479	49,187	37,502	30,917	15,468	11,281	31,535	617,457*
2012	0	9,118	50,673	116,560	205,853	136,385	109,776	38,433	41,328	17,081	22,239	17,148	28,267	792,861*
2013	0	4,502	70,746	116,465	100,230	73,842	44,949	32,774	22,008	20,188	7,357	10,847	21,673	525,581
2014	0	21	37,916	108,024	233,435	180,063	148,881	62,830	47,609	50,812	33,159	6,274	22,367	931,391

Table 5. Recreational harvest (numbers) by state and year (includes wave 1 estimated harvest for Virginia).

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total
1982	929		83,933	1,757	50,081	21,278	58,294	0	984	0	0	217,256
1983	7,212	4,576	39,316	1,990	42,826	43,731	127,912	135	31,746	0	0	299,444
1984	0	0	3,481	1,230	5,678	57,089	13,625	16,571	16,789	0	0	114,463
1985	11,862	0	66,019	670	15,350	23,107	13,145	0	2,965	404	0	133,522
1986	0	0	29,434	3,291	1,760	27,477	36,999	0	14,077	1,585	0	114,623
1987	0	90	10,807	2,399	522	14,191	9,279	0	4,025	2,442	0	43,755
1988	0	647	21,050	5,226	2,672	20,230	12,141	0	133	24,259	367	86,725
1989	738	0	13,044	4,303	5,777	12,388	1,312	0	0	0	0	37,562
1990	2,912	617	20,515	4,677	6,082	24,799	44,878	2,009	736	56,017	0	163,242
1991	3,265	274	20,799	17,193	4,907	54,502	38,300	2,741	77,873	42,224	391	262,469
1992	6,357	2,213	57,084	14,945	9,154	45,162	41,426	2,400	99,354	21,118	967	300,180
1993	612	1,540	58,511	17,826	19,253	78,560	64,935	4,055	104,682	78,481	264	428,719
1994	3,771	3,023	74,538	5,915	16,929	87,225	34,877	4,140	199,378	127,945	7,426	565,167
1995	2,189	3,902	73,806	29,997	38,261	155,821	254,055	15,361	355,237	149,103	11,450	1,089,182
1996	1,893	6,461	68,300	60,074	62,840	225,428	127,952	22,867	337,415	244,746	17,136	1,175,112
1997	35,259	13,546	199,373	62,162	64,639	236,902	67,800	19,706	334,068	518,483	96,189	1,648,127
1998	38,094	5,929	207,952	44,890	64,215	166,868	88,973	18,758	391,824	383,786	45,773	1,457,062
1999	21,102	4,641	126,755	56,320	55,805	195,261	237,010	8,772	263,191	411,873	65,658	1,446,388
2000	62,186	4,262	181,295	95,496	53,191	270,798	402,302	39,543	506,462	389,126	20,452	2,025,113
2001	59,947	15,291	288,032	80,125	54,165	189,714	560,208	41,195	382,557	355,020	58,873	2,085,127
2002	71,907	12,857	308,749	78,190	51,060	202,075	416,455	29,149	282,429	411,248	109,052	1,973,171
2003	57,765	24,878	407,100	115,471	95,983	313,761	391,842	29,522	525,191	455,812	127,727	2,545,052
2004	48,816	8,386	445,745	83,990	102,844	263,096	424,208	25,429	368,682	548,768	230,783	2,550,747
2005	83,617	24,940	340,743	110,490	141,290	376,894	411,532	20,438	533,929	293,161	104,904	2,441,938
2006	75,347	13,521	314,987	75,811	115,214	367,835	509,606	20,159	669,140	547,482	79,023	2,788,125
2007	53,694	6,348	315,409	101,400	118,549	474,062	289,656	8,465	765,169	353,372	37,376	2,523,500
2008	59,152	5,308	377,959	51,191	108,166	685,589	309,411	26,934	415,403	401,155	25,750	2,466,018
2009	62,153	8,587	344,401	71,427	60,876	356,311	283,024	19,539	501,845	326,867	5,650	2,040,680
2010	17,396	5,948	341,045	70,108	92,806	538,374	320,413	16,244	457,898	102,405	23,778	1,986,415
2011	18,105	32,704	255,507	88,635	63,288	674,844	393,194	18,023	445,171	146,603	94,182	2,230,256
2012	11,624	14,498	377,931	61,537	64,573	424,522	168,629	25,399	262,143	134,758	0	1,545,614
2013	23,143	17,657	298,945	218,236	143,373	490,855	345,008	19,520	477,295	118,686	0	2,152,718
2014	20,750	6,415	277,138	103,516	86,763	409,342	225,910	8,774	583,028	67,486	0	1,789,122

Table 6. Recreational harvest (numbers) by age and year (includes wave 1 for Virginia).

Year	Age													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13+	
1982	0	5,721	36,125	81,725	24,916	10,963	16,943	11,960	8,970	5,980	4,983	5,980	2,990	217,257
1983	4,617	25,001	50,976	62,840	95,870	27,371	15,035	3,338	1,799	1,799	2,699	2,699	5,398	299,443
1984	2,021	22,316	24,474	15,610	16,528	15,288	8,034	2,548	0	849	849	0	5,945	114,463
1985	225	3,305	13,315	22,732	36,208	19,572	18,593	9,786	1,957	1,957	0	0	5,872	133,522
1986	11,002	5,426	9,354	12,136	12,339	13,473	12,285	18,427	7,020	4,387	2,632	877	5,265	114,623
1987	1,083	1,370	3,822	2,596	4,838	3,756	3,756	2,817	3,756	1,878	939	1,878	11,267	43,756
1988	1,023	8,195	5,116	5,120	6,135	11,214	10,191	12,225	9,169	3,056	3,056	3,056	9,169	86,725
1989	0	0	3,130	2,087	4,174	6,260	7,304	4,174	2,087	2,087	1,043	0	5,217	37,562
1990	627	7,933	17,317	39,534	22,708	22,980	16,657	15,810	7,680	3,009	1,797	899	6,290	163,242
1991	1,368	21,382	38,339	61,798	27,957	13,322	24,432	26,848	23,268	9,293	4,159	937	9,367	262,470
1992	1,881	15,923	61,295	52,925	54,507	20,325	13,805	23,488	23,613	18,849	3,854	1,943	7,771	300,179
1993	2,209	18,044	53,461	93,539	68,083	49,704	18,614	20,458	36,054	35,685	19,855	4,461	8,552	428,719
1994	2,112	43,976	138,180	95,461	91,957	47,419	29,827	23,833	34,809	29,999	13,650	8,815	5,128	565,167
1995	562	134,922	222,570	183,276	105,211	164,461	64,387	81,839	59,042	34,224	24,276	6,888	7,523	1,089,181
1996	531	129,149	257,038	214,669	109,367	116,156	137,033	80,275	58,041	27,210	18,534	19,437	7,673	1,175,113
1997	1,837	2,837	74,549	240,321	185,350	213,594	217,940	290,961	183,150	120,586	58,005	32,037	26,958	1,648,125
1998	0	20,368	133,541	229,441	168,884	164,613	134,977	153,529	163,905	96,099	87,690	41,837	62,180	1,457,063
1999	0	2,307	39,471	141,735	166,527	282,809	200,750	168,942	155,988	108,584	87,820	42,054	49,400	1,446,388
2000	0	503	37,950	255,084	402,268	367,123	423,409	201,142	120,257	97,670	53,095	28,375	38,237	2,025,112
2001	1,036	559	60,048	169,642	340,240	403,155	379,607	314,763	150,791	92,207	80,417	44,978	47,683	2,085,127
2002	0	1,530	33,823	141,000	266,095	405,275	334,964	249,670	237,566	107,817	86,338	46,611	62,481	1,973,171
2003	0	36,600	76,642	198,625	295,548	362,028	463,663	336,910	275,724	218,321	123,058	72,670	85,263	2,545,052
2004	427	214	94,601	207,895	211,670	268,011	301,427	435,274	331,997	265,634	210,003	103,959	119,632	2,550,745
2005	0	322	40,333	245,135	337,585	282,138	285,659	240,402	308,962	233,801	232,352	100,482	134,766	2,441,938
2006	0	8,326	112,441	209,402	372,824	335,684	245,484	289,948	249,576	341,499	248,790	158,204	215,948	2,788,125
2007	0	73	25,068	333,424	269,399	403,913	267,964	239,743	269,469	267,806	182,806	133,849	129,988	2,523,500
2008	0	246	7,036	74,691	340,359	211,584	473,211	359,388	200,562	243,217	197,085	156,271	202,367	2,466,018
2009	0	970	15,868	103,386	228,968	429,381	221,964	309,080	169,576	122,503	132,590	111,295	195,097	2,040,680
2010	0	8,973	25,576	141,402	156,928	288,769	487,688	201,524	215,001	155,490	81,649	79,440	143,974	1,986,415
2011	0	8,101	33,913	89,551	176,608	330,321	360,990	542,248	186,305	174,692	84,284	63,411	179,831	2,230,256
2012	880	5,750	37,455	51,034	138,448	166,043	230,082	267,495	275,475	91,442	91,694	60,174	129,641	1,545,614
2013	0	24,441	91,051	168,967	140,260	348,574	240,079	233,810	264,731	340,962	81,245	69,275	149,323	2,152,718
2014	0	425	113,852	179,894	226,704	179,158	203,847	129,816	180,710	203,607	147,676	76,302	147,129	1,789,122

Table 7. Age composition of recreational harvest in 2013 and 2104 by state.

2013		Age												Total
State	1	2	3	4	5	6	7	8	9	10	11	12	13+	
ME	0	1,489	5,213	3,704	2,368	3,311	1,818	1,647	1,733	1,123	349	163	226	23,143
NH	0	0	83	158	1,963	5,145	2,858	2,800	2,446	1,525	290	190	199	17,657
MA	0	0	642	6,053	28,774	57,188	38,366	42,629	48,936	37,782	12,445	8,143	17,987	298,945
RI	0	0	0	0	5,699	41,989	79,481	46,533	26,334	9,588	2,859	2,999	2,755	218,236
CT	0	0	17	567	2,802	32,938	10,156	17,329	25,961	41,477	5,568	1,525	5,034	143,373
NY	0	2,442	3,358	2,061	17,382	71,288	20,040	32,098	88,446	109,726	32,095	29,910	82,008	490,855
NJ	0	0	0	0	325	41,819	47,915	59,316	39,678	94,696	18,593	12,862	29,805	345,008
DE	0	0	0	3	229	2,598	3,639	3,007	2,520	2,328	1,598	1,564	2,034	19,520
MD Bay	0	10,924	71,035	133,802	70,036	79,800	25,592	17,160	16,767	26,688	4,180	8,211	4,448	468,642
MD Cst	0	0	0	0	51	699	1,273	1,335	1,765	2,304	196	291	739	8,654
VA Bay	0	9,586	10,703	22,621	10,441	9,189	4,192	4,974	3,557	5,126	2,339	2,334	1,330	86,391
VA Cst	0	0	0	0	190	2,610	4,749	4,982	6,588	8,599	733	1,085	2,759	32,295
NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	24,441	91,051	168,967	140,260	348,575	240,079	233,810	264,731	340,962	81,245	69,275	149,324	2,152,719

2014		Age												Total
State	1	2	3	4	5	6	7	8	9	10	11	12	13+	
ME	0	295	8,306	6,422	2,393	916	1,001	353	388	355	220	49	53	20,750
NH	0	0	0	0	709	1,558	1,915	509	562	541	370	94	158	6,415
MA	0	0	0	1,476	10,319	29,805	57,596	29,644	41,356	44,669	29,955	10,113	22,204	277,138
RI	0	0	40	0	4,379	8,372	13,321	7,731	14,182	18,140	15,006	6,652	15,693	103,516
CT	0	0	692	2,413	6,221	11,718	12,885	11,940	15,667	12,148	7,045	2,835	3,199	86,763
NY	0	0	384	298	16,297	51,836	44,715	41,316	62,254	67,718	52,686	20,248	51,590	409,342
NJ	0	0	0	2,850	6,436	16,468	28,927	22,913	26,725	41,518	11,410	32,638	36,024	225,910
DE	0	0	30	45	155	752	872	1,428	1,423	1,010	633	463	1,963	8,774
MD Bay	0	0	86,682	156,785	170,625	49,576	35,536	10,571	15,585	15,610	27,939	2,575	9,725	581,208
MD Cst	0	0	0	0	0	72	166	178	288	270	499	61	285	1,819
VA Bay	0	130	17,718	9,605	9,169	7,842	6,356	2,634	1,311	720	236	369	5,275	61,366
VA Cst	0	0	0	0	0	244	558	599	968	908	1,678	205	960	6,120
NC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	425	113,852	179,894	226,704	179,159	203,847	129,816	180,710	203,607	147,676	76,302	147,129	1,789,121

Table 8. Recreational releases by state and year.

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total
1982	687	0	6,441	2,551	643,187	12,297	87,648	0	30,376	0	0	783,187
1983	0	0	34,018	5,444	0	1,469	117,807	0	213,487	11,997	0	384,222
1984	1,887	0	98,405	85,135	31,176	40,469	52,930	0	104,095	8,775	0	422,872
1985	81,153	93	12,360	40,567	26,946	57,540	5,524	702	147,103	2,598	0	374,586
1986	4,379	0	442,298	2,014	10,494	123,842	0	0	390,063	7,528	0	980,618
1987	18,106	435	93,660	63,849	78,434	253,986	56,697	16,988	118,395	7,611	0	708,161
1988	4,528	6,699	209,632	23,347	25,532	92,611	486,306	2,455	132,250	5,631	0	988,991
1989	16,028	4,822	193,067	38,007	125,370	365,712	265,958	4,807	114,269	72,766	0	1,200,806
1990	12,542	15,518	339,511	67,509	89,490	265,099	254,384	14,411	420,084	175,046	0	1,653,594
1991	67,490	6,559	448,735	30,975	301,476	756,663	166,198	38,334	1,036,011	208,350	256	3,061,047
1992	31,177	27,613	779,814	120,410	292,259	799,149	413,506	36,932	749,959	115,899	679	3,367,397
1993	373,064	14,979	833,566	100,993	271,318	694,107	308,253	89,543	1,556,848	100,374	1,524	4,344,569
1994	363,703	43,501	2,102,514	138,989	489,967	1,132,707	568,047	103,992	2,785,392	197,022	5,005	7,930,839
1995	505,758	285,486	3,280,882	356,324	507,124	1,209,585	694,889	115,363	2,401,277	370,949	16,225	9,743,862
1996	1,626,705	292,820	3,269,746	314,336	1,051,612	1,436,091	776,165	99,372	2,545,238	759,916	116,667	12,288,668
1997	1,417,976	279,298	5,417,751	606,746	722,708	1,018,892	736,734	130,073	4,019,987	1,232,323	135,853	15,718,341
1998	691,378	243,301	7,184,358	613,421	1,026,192	884,626	488,319	185,016	2,641,680	796,372	173,704	14,928,367
1999	649,816	145,730	4,576,208	360,121	704,025	1,228,628	1,152,682	105,696	2,387,615	940,755	263,445	12,514,721
2000	942,593	209,606	7,382,031	541,516	926,367	1,373,069	885,289	151,838	3,244,731	1,022,040	129,729	16,808,809
2001	870,522	164,336	5,410,899	377,474	1,107,707	824,278	965,650	162,677	2,890,054	620,947	49,953	13,444,497
2002	1,392,200	238,003	5,718,984	530,402	696,976	588,155	715,099	114,650	2,928,589	706,729	63,269	13,693,056
2003	846,708	260,167	4,361,710	448,707	843,037	1,083,808	925,885	169,012	4,652,800	970,554	48,945	14,611,333
2004	693,400	225,777	4,979,075	525,936	826,724	2,709,246	1,502,694	155,655	3,479,634	1,732,890	222,302	17,053,333
2005	2,985,203	572,633	3,988,679	633,871	1,761,628	1,412,191	1,218,893	251,049	3,855,552	1,295,768	103,432	18,078,899
2006	4,000,309	460,615	7,809,777	834,953	986,700	1,722,386	1,890,294	247,653	3,711,343	1,655,007	24,262	23,343,299
2007	1,115,068	257,372	5,331,470	677,851	984,638	1,677,717	1,789,294	248,689	3,064,928	949,158	13,838	16,110,023
2008	465,003	77,237	3,649,415	416,373	3,104,779	1,346,385	1,309,453	260,677	1,338,728	532,161	10,776	12,510,987
2009	263,512	57,443	2,282,601	398,686	1,161,278	1,073,467	800,510	145,586	1,423,332	358,991	5,407	7,970,813
2010	193,743	51,833	1,671,437	183,112	670,534	1,068,672	690,340	65,048	1,508,647	134,350	20,365	6,258,081
2011	142,505	98,693	973,192	214,302	612,367	1,506,080	884,013	110,085	1,127,511	153,582	110,150	5,932,480
2012	214,185	64,226	989,509	247,075	264,927	586,044	406,096	109,960	2,206,518	101,736	1,615	5,191,891
2013	422,598	84,015	1,691,026	826,280	778,250	989,783	1,107,218	83,494	2,387,276	168,989	1,057	8,539,986
2014	277,209	78,612	1,826,412	163,239	303,836	726,137	1,051,323	185,166	2,415,192	254,795	626	7,282,547

Table 9. Recreational dead releases (numbers) by state and year (using 0.09 release mortality).

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	Total
1982	62	0	580	230	57,887	1,107	7,888	0	2,734	0	0	70,487
1983	0	0	3,062	490	0	132	10,603	0	19,214	1,080	0	34,580
1984	170	0	8,856	7,662	2,806	3,642	4,764	0	9,369	790	0	38,058
1985	7,304	8	1,112	3,651	2,425	5,179	497	63	13,239	234	0	33,713
1986	394	0	39,807	181	944	11,146	0	0	35,106	678	0	88,256
1987	1,630	39	8,429	5,746	7,059	22,859	5,103	1,529	10,656	685	0	63,734
1988	408	603	18,867	2,101	2,298	8,335	43,768	221	11,903	507	0	89,009
1989	1,443	434	17,376	3,421	11,283	32,914	23,936	433	10,284	6,549	0	108,073
1990	1,129	1,397	30,556	6,076	8,054	23,859	22,895	1,297	37,808	15,754	0	148,823
1991	6,074	590	40,386	2,788	27,133	68,100	14,958	3,450	93,241	18,752	23	275,494
1992	2,806	2,485	70,183	10,837	26,303	71,923	37,216	3,324	67,496	10,431	61	303,066
1993	33,576	1,348	75,021	9,089	24,419	62,470	27,743	8,059	140,116	9,034	137	391,011
1994	32,733	3,915	189,226	12,509	44,097	101,944	51,124	9,359	250,685	17,732	450	713,776
1995	45,518	25,694	295,279	32,069	45,641	108,863	62,540	10,383	216,115	33,385	1,460	876,948
1996	146,403	26,354	294,277	28,290	94,645	129,248	69,855	8,943	229,071	68,392	10,500	1,105,980
1997	127,618	25,137	487,598	54,607	65,044	91,700	66,306	11,707	361,799	110,909	12,227	1,414,651
1998	62,224	21,897	646,592	55,208	92,357	79,616	43,949	16,651	237,751	71,673	15,633	1,343,553
1999	58,483	13,116	411,859	32,411	63,362	110,577	103,741	9,513	214,885	84,668	23,710	1,126,325
2000	84,833	18,865	664,383	48,736	83,373	123,576	79,676	13,665	292,026	91,984	11,676	1,512,793
2001	78,347	14,790	486,981	33,973	99,694	74,185	86,909	14,641	260,105	55,885	4,496	1,210,005
2002	125,298	21,420	514,709	47,736	62,728	52,934	64,359	10,319	263,573	63,606	5,694	1,232,375
2003	76,204	23,415	392,554	40,384	75,873	97,543	83,330	15,211	418,752	87,350	4,405	1,315,020
2004	62,406	20,320	448,117	47,334	74,405	243,832	135,242	14,009	313,167	155,960	20,007	1,534,800
2005	268,668	51,537	358,981	57,048	158,547	127,097	109,700	22,594	347,000	116,619	9,309	1,627,101
2006	360,028	41,455	702,880	75,146	88,803	155,015	170,126	22,289	334,021	148,951	2,184	2,100,897
2007	100,356	23,163	479,832	61,007	88,617	150,995	161,036	22,382	275,844	85,424	1,245	1,449,902
2008	41,850	6,951	328,447	37,474	279,430	121,175	117,851	23,461	120,486	47,894	970	1,125,989
2009	23,716	5,170	205,434	35,882	104,515	96,612	72,046	13,103	128,100	32,309	487	717,373
2010	17,437	4,665	150,429	16,480	60,348	96,180	62,131	5,854	135,778	12,092	1,833	563,227
2011	12,825	8,882	87,587	19,287	55,113	135,547	79,561	9,908	101,476	13,822	9,913	533,923
2012	19,277	5,780	89,056	22,237	23,843	52,744	36,549	9,896	198,587	9,156	145	467,270
2013	38,034	7,561	152,192	74,365	70,043	89,080	99,650	7,514	214,855	15,209	95	768,599
2014	24,949	7,075	164,377	14,692	27,345	65,352	94,619	16,665	217,367	22,932	56	655,429

Table 10. Recreational dead releases (numbers) by age and year.

2013		Age													
State	0	1	2	3	4	5	6	7	8	9	10	11	12	13+	Total
ME	0	0	2,779	8,998	4,407	3,194	5,653	3,261	3,074	3,196	2,095	651	304	422	38,034
NH	0	0	1,160	2,261	1,321	670	865	430	319	294	167	32	21	22	7,561
MA	0	0	37,188	39,760	19,343	9,912	11,147	6,963	7,574	9,754	6,397	1,785	749	1,620	152,192
RI	0	0	20,460	21,504	19,035	5,618	3,621	1,623	792	858	437	139	89	186	74,365
CT	0	326	11,533	27,733	14,979	5,227	6,962	605	603	997	824	167	23	64	70,043
NY	0	907	16,199	38,694	13,559	4,475	5,823	980	1,466	2,745	3,483	344	61	344	89,080
NJ	0	0	6,103	38,483	30,899	8,752	7,353	2,065	1,426	921	2,385	275	305	684	99,650
DE	0	0	2,219	2,716	686	125	560	789	344	32	13	8	10	11	7,514
MD Bay	0	723	68,367	57,664	45,124	13,753	11,104	5,039	3,684	2,687	3,633	574	981	1,034	214,367
MD Cst	0	0	50	91	99	50	87	32	32	16	22	3	1	5	488
VA Bay	0	536	2,851	4,104	4,557	1,153	776	324	203	107	163	26	28	70	14,898
VA Cst	0	0	32	58	63	32	56	20	20	10	14	2	1	3	311
NC	0	0	4	10	13	10	14	8	8	8	10	2	2	4	95
Total	0	2,491	168,947	242,077	154,085	52,972	54,019	22,140	19,545	21,627	19,643	4,009	2,575	4,469	768,599

2014		Age													
State	0	1	2	3	4	5	6	7	8	9	10	11	12	13+	Total
ME	0	0	428	11,248	6,411	2,168	1,257	1,444	508	551	495	302	64	72	24,949
NH	0	0	195	3,858	1,774	684	210	164	47	47	45	31	8	13	7,075
MA	0	0	4,040	78,151	37,692	17,257	7,237	7,256	2,771	3,038	3,159	2,124	685	968	164,377
RI	0	0	374	7,614	4,787	832	150	139	82	145	186	154	68	161	14,692
CT	0	148	995	10,740	7,017	3,217	651	440	634	561	730	647	467	1,099	27,345
NY	0	320	3,482	33,544	17,410	5,204	1,062	758	773	600	496	375	409	919	65,352
NJ	0	0	756	17,402	17,156	42,293	9,316	2,394	1,472	1,074	1,021	218	781	736	94,619
DE	0	0	1,943	4,377	2,479	1,695	2,756	2,058	675	328	208	76	24	45	16,665
MD Bay	0	4,809	10,595	153,153	23,820	15,985	2,948	2,015	611	907	693	1,299	118	320	217,275
MD Cst	0	0	0	26	22	23	11	5	5	1	0	0	0	0	93
VA Bay	0	40	7,502	9,267	2,711	1,426	724	304	319	120	139	162	14	36	22,765
VA Cst	0	0	0	46	39	42	20	8	8	1	0	0	0	0	167
NC	0	0	0	7	7	10	7	6	3	4	4	3	1	3	56

Table 11. Age composition of incidental removals.

Year	Bay													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	63	194	1250	730	289	86	65	42	25	26	19	24	12	2825
2000	39	96	2125	3439	1255	355	195	101	61	40	33	9	8	7756
2001	0	15	337	956	660	120	63	56	50	51	21	10	4	2343
2002	0	9	62	408	508	156	84	36	27	17	7	1	1	1317
2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11 cont.

Year	Age													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13+	
1982	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	1	4	271	203	107	136	26	3	0	0	0	0	0	752
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	1	29	6	6	15	21	25	10	6	2	0	0	121
2005	0	20	5	5	11	13	15	23	19	8	4	1	1	125
2006	0	0	0	1	0	0	0	0	0	0	0	0	0	1
2007	0	3	8	11	8	5	0	0	0	0	0	0	0	35
2008	0	0	0	1	0	0	0	0	0	0	0	0	0	1
2009	0	0	17	15	0	0	0	0	0	0	0	0	0	32
2010	0	0	17	14	1	0	0	0	0	0	0	0	0	32
2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 12. Total removals and associated coefficients of variation and age proportions of total removals of striped bass split into Chesapeake Bay, Ocean, and Commercial Discard fleets, 1982-2014. Age-0 fish are not included.

Year	Chesapeake Bay		Age Proportions												
	Total	CV	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	262,133	0.857	0.00507	0.12678	0.59014	0.23839	0.03160	0.00498	0.00099	0.00089	0.00012	0.00000	0.00029	0.00047	0.00029
1983	277,824	0.224	0.01104	0.28325	0.36483	0.28873	0.03398	0.00918	0.00351	0.00307	0.00086	0.00028	0.00016	0.00032	0.00078
1984	798,853	0.444	0.00557	0.61276	0.33834	0.03751	0.00495	0.00013	0.00068	0.00005	0.00001	0.00000	0.00000	0.00000	0.00000
1985	122,842	0.447	0.01132	0.52144	0.40241	0.04234	0.01142	0.00471	0.00483	0.00153	0.00000	0.00000	0.00000	0.00000	0.00000
1986	56,504	0.516	0.09360	0.28059	0.46742	0.10997	0.01729	0.00595	0.01951	0.00567	0.00000	0.00000	0.00000	0.00000	0.00000
1987	23,170	0.489	0.05059	0.17128	0.40184	0.24355	0.07494	0.00375	0.02876	0.02530	0.00000	0.00000	0.00000	0.00000	0.00000
1988	42,211	0.887	0.02643	0.20139	0.10296	0.10244	0.36728	0.14152	0.05660	0.00138	0.00000	0.00000	0.00000	0.00000	0.00000
1989	16,791	0.285	0.06463	0.56728	0.15406	0.10122	0.07011	0.02801	0.01070	0.00400	0.00000	0.00000	0.00000	0.00000	0.00000
1990	205,740	0.333	0.01873	0.14393	0.18579	0.32698	0.17722	0.10363	0.02839	0.00924	0.00457	0.00152	0.00000	0.00000	0.00000
1991	352,428	0.171	0.00255	0.15667	0.24267	0.25941	0.15361	0.07895	0.05201	0.02952	0.01372	0.00641	0.00448	0.00000	0.00000
1992	383,546	0.156	0.00530	0.09234	0.22350	0.24898	0.18261	0.12646	0.06779	0.03110	0.01392	0.00612	0.00188	0.00000	0.00000
1993	597,071	0.152	0.00278	0.11137	0.16410	0.27782	0.20806	0.11027	0.06903	0.02844	0.01566	0.00797	0.00363	0.00087	0.00000
1994	859,681	0.158	0.00841	0.08882	0.17138	0.19982	0.23514	0.13061	0.08229	0.04048	0.02364	0.01201	0.00506	0.00235	0.00000
1995	1,133,791	0.132	0.00447	0.14701	0.20492	0.22479	0.16855	0.14799	0.04925	0.03082	0.01229	0.00383	0.00414	0.00097	0.00099
1996	1,465,451	0.137	0.00036	0.09842	0.26089	0.18188	0.16817	0.14229	0.08644	0.03241	0.01535	0.00720	0.00462	0.00121	0.00076
1997	1,998,211	0.117	0.02075	0.04500	0.07404	0.32221	0.18116	0.15894	0.08528	0.05664	0.02819	0.01457	0.00648	0.00427	0.00247
1998	1,934,786	0.099	0.00169	0.03597	0.14993	0.25242	0.27003	0.12710	0.06030	0.03604	0.02901	0.01880	0.00978	0.00517	0.00377
1999	1,726,756	0.107	0.00123	0.01763	0.15538	0.22930	0.22668	0.19522	0.07263	0.03593	0.02879	0.01361	0.01137	0.00630	0.00593
2000	2,019,358	0.092	0.01360	0.05297	0.06707	0.24036	0.27401	0.16615	0.09269	0.04241	0.01809	0.01515	0.00751	0.00515	0.00486
2001	1,695,685	0.089	0.02650	0.05998	0.11749	0.19551	0.23594	0.13129	0.08764	0.06882	0.02137	0.01887	0.01455	0.01317	0.00888
2002	1,311,055	0.096	0.01116	0.10412	0.10416	0.19271	0.18460	0.15229	0.10087	0.04483	0.05433	0.01364	0.01389	0.00794	0.01547
2003	2,052,319	0.075	0.00000	0.10428	0.13637	0.17148	0.14837	0.12365	0.09679	0.06315	0.05577	0.05495	0.01998	0.01202	0.01319
2004	1,825,612	0.076	0.03768	0.04394	0.20312	0.20733	0.11058	0.09403	0.08510	0.06536	0.04986	0.03511	0.03521	0.01488	0.01780
2005	1,963,065	0.088	0.00404	0.12303	0.06758	0.24029	0.21357	0.08748	0.05656	0.03891	0.05310	0.03768	0.03703	0.02214	0.01857
2006	2,329,278	0.072	0.01351	0.05082	0.17163	0.17673	0.24904	0.11652	0.04082	0.03479	0.03336	0.04266	0.02650	0.01715	0.02646
2007	2,134,342	0.100	0.00347	0.03161	0.03894	0.34255	0.18042	0.15994	0.05946	0.03628	0.03861	0.03262	0.03410	0.01809	0.02391
2008	1,548,345	0.081	0.01419	0.01321	0.04745	0.17432	0.34241	0.09064	0.09039	0.05106	0.02367	0.03694	0.03197	0.04284	0.04091
2009	1,702,422	0.082	0.00349	0.03330	0.04027	0.22943	0.25108	0.19254	0.03551	0.05209	0.04212	0.02027	0.02750	0.02219	0.05020
2010	1,482,203	0.111	0.00349	0.00724	0.13179	0.16251	0.23568	0.19246	0.14358	0.03569	0.03282	0.01731	0.00698	0.00878	0.02166
2011	1,378,058	0.088	0.01078	0.02751	0.04607	0.28452	0.15229	0.17340	0.12382	0.08052	0.02371	0.02888	0.01392	0.00895	0.02563
2012	1,198,075	0.108	0.05011	0.05544	0.10794	0.11923	0.25603	0.14501	0.08838	0.03531	0.05086	0.01895	0.02779	0.00991	0.03504
2013	1,363,533	0.081	0.00092	0.06761	0.14675	0.24527	0.17454	0.16533	0.06290	0.03869	0.02743	0.03883	0.00938	0.01235	0.01000
2014	1,492,601	0.112	0.00325	0.01253	0.21758	0.19752	0.25472	0.12027	0.07659	0.03177	0.02626	0.02042	0.02401	0.00270	0.01238

Table 12 cont.

Year	Ocean		Age Proportions												
	Total	CV	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	454,241	0.366	0.00192	0.09698	0.22097	0.32694	0.09921	0.03720	0.04890	0.03454	0.02380	0.02287	0.02365	0.02971	0.03331
1983	413,741	0.699	0.00653	0.04616	0.19767	0.25603	0.30420	0.07791	0.03870	0.00765	0.00524	0.00825	0.00959	0.01205	0.03003
1984	224,539	0.450	0.00973	0.11611	0.15973	0.20421	0.19731	0.16935	0.06206	0.01893	0.00451	0.00722	0.00443	0.00124	0.04517
1985	219,014	0.679	0.00017	0.01728	0.11977	0.13099	0.20756	0.17460	0.18067	0.07387	0.02579	0.01585	0.00213	0.00277	0.04854
1986	164,055	0.324	0.04844	0.02205	0.15063	0.18503	0.12483	0.10479	0.08366	0.13130	0.04612	0.02785	0.01669	0.00669	0.05193
1987	97,873	0.265	0.01071	0.03159	0.17315	0.19850	0.15288	0.08658	0.06610	0.04540	0.05458	0.02157	0.01056	0.02198	0.12638
1988	166,833	0.326	0.00637	0.10903	0.12105	0.13938	0.13371	0.12561	0.09128	0.09001	0.06513	0.01963	0.01991	0.01897	0.05992
1989	136,245	0.276	0.00021	0.11817	0.22478	0.13368	0.16919	0.10076	0.08498	0.04536	0.03088	0.01995	0.01114	0.00120	0.05969
1990	221,962	0.126	0.00071	0.08812	0.14014	0.20822	0.11709	0.12640	0.10339	0.09868	0.04569	0.01956	0.00932	0.00463	0.03806
1991	339,335	0.144	0.00138	0.07349	0.13753	0.21154	0.10729	0.05437	0.10331	0.11826	0.10193	0.03752	0.01508	0.00313	0.03518
1992	450,413	0.106	0.00216	0.03819	0.25005	0.17186	0.16916	0.06228	0.04469	0.08125	0.08000	0.06316	0.01181	0.00534	0.02005
1993	535,519	0.119	0.00479	0.03264	0.12837	0.21235	0.16552	0.12198	0.04575	0.04911	0.08234	0.08233	0.04671	0.01088	0.01721
1994	726,704	0.074	0.00071	0.08875	0.30239	0.15930	0.15848	0.06702	0.03408	0.03328	0.05852	0.05144	0.02245	0.01571	0.00787
1995	1,367,251	0.099	0.00003	0.18718	0.15586	0.13456	0.08978	0.13697	0.05718	0.08427	0.07277	0.04281	0.02543	0.00738	0.00578
1996	1,582,160	0.067	0.00033	0.03773	0.20362	0.19814	0.14332	0.11791	0.12558	0.06498	0.04515	0.02287	0.01586	0.01732	0.00721
1997	2,173,177	0.055	0.00106	0.07183	0.09794	0.14617	0.10018	0.09920	0.10283	0.14866	0.09919	0.06575	0.03218	0.01912	0.01587
1998	2,098,919	0.064	0.00589	0.05958	0.10075	0.14372	0.15136	0.11133	0.08738	0.09777	0.09259	0.04866	0.04597	0.02207	0.03292
1999	1,953,346	0.062	0.00039	0.00743	0.07537	0.10786	0.11237	0.19360	0.12586	0.10795	0.09818	0.06923	0.05035	0.02498	0.02644
2000	2,584,015	0.064	0.00356	0.02137	0.04529	0.15533	0.15168	0.16933	0.19966	0.09557	0.05935	0.04518	0.02493	0.01290	0.01586
2001	2,554,609	0.045	0.00170	0.01553	0.04076	0.07805	0.16409	0.18713	0.17640	0.15741	0.07048	0.03981	0.03448	0.01607	0.01810
2002	2,553,899	0.052	0.00317	0.03562	0.05083	0.07920	0.11422	0.20629	0.14982	0.12079	0.10372	0.05129	0.03890	0.02117	0.02498
2003	2,682,570	0.047	0.00035	0.04553	0.07122	0.06428	0.11528	0.12142	0.17520	0.13276	0.10143	0.07438	0.04304	0.02630	0.02881
2004	3,173,119	0.063	0.00127	0.01806	0.12858	0.09754	0.08148	0.09566	0.09711	0.15098	0.10876	0.08659	0.06406	0.03374	0.03617
2005	3,079,601	0.055	0.00434	0.08402	0.06446	0.13414	0.12610	0.09345	0.09115	0.08397	0.10216	0.07424	0.06973	0.02901	0.04321
2006	3,614,394	0.051	0.00081	0.02834	0.20945	0.06263	0.12243	0.10721	0.06851	0.08024	0.06795	0.09247	0.06733	0.04167	0.05098
2007	2,862,392	0.052	0.00062	0.03268	0.09830	0.12323	0.09599	0.13814	0.09448	0.08547	0.09679	0.09560	0.05763	0.04446	0.03661
2008	3,054,618	0.059	0.00321	0.01403	0.05737	0.06605	0.15785	0.09098	0.16941	0.12409	0.07045	0.08173	0.06487	0.04276	0.05720
2009	2,099,071	0.055	0.00088	0.03088	0.02788	0.05193	0.07758	0.24108	0.10273	0.15564	0.08113	0.05836	0.05782	0.04468	0.06941
2010	2,098,391	0.058	0.00022	0.01035	0.04893	0.02783	0.05848	0.13228	0.26271	0.10345	0.11146	0.08251	0.04706	0.04250	0.07222
2011	2,317,689	0.054	0.00390	0.01838	0.03177	0.05015	0.03966	0.13735	0.15787	0.24812	0.08807	0.08143	0.03775	0.02870	0.07686
2012	1,654,349	0.074	0.00144	0.03236	0.03716	0.03177	0.07348	0.09537	0.14922	0.18255	0.17587	0.05969	0.05344	0.03946	0.06820
2013	2,322,884	0.083	0.00053	0.04376	0.08175	0.05137	0.04516	0.14030	0.10623	0.11100	0.12871	0.15534	0.03757	0.02908	0.06918
2014	1,718,249	0.072	0.00027	0.00728	0.10278	0.06659	0.07649	0.09272	0.11313	0.08143	0.11062	0.12741	0.08378	0.04897	0.08856

Table 12 cont.

Year	Commercial Discards		Age Proportions												
	Total	CV	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	57,624	0.350	0.00000	0.54917	0.06325	0.19881	0.09759	0.02240	0.04160	0.01760	0.00640	0.00160	0.00148	0.00000	0.00012
1983	40,127	0.350	0.00000	0.59977	0.03620	0.07172	0.19342	0.05759	0.01521	0.01521	0.00652	0.00435	0.00000	0.00000	0.00000
1984	65,639	0.350	0.00000	0.51151	0.02455	0.08854	0.14829	0.17173	0.04288	0.00179	0.00893	0.00100	0.00000	0.00079	0.00000
1985	62,734	0.350	0.00000	0.12319	0.48574	0.09467	0.17361	0.05411	0.04371	0.01665	0.00416	0.00208	0.00208	0.00000	0.00000
1986	174,024	0.350	0.00000	0.03356	0.11928	0.57502	0.16084	0.07651	0.02468	0.00813	0.00199	0.00000	0.00000	0.00000	0.00000
1987	125,066	0.350	0.00000	0.03363	0.11499	0.22866	0.41089	0.13545	0.05213	0.01055	0.00808	0.00315	0.00089	0.00069	0.00089
1988	245,552	0.350	0.00000	0.02501	0.09201	0.14912	0.28898	0.29197	0.09461	0.03713	0.01267	0.00673	0.00089	0.00079	0.00010
1989	338,827	0.350	0.00000	0.04089	0.14828	0.14470	0.24613	0.24425	0.09881	0.04575	0.01872	0.00208	0.00416	0.00416	0.00208
1990	510,011	0.350	0.00000	0.02848	0.13473	0.15869	0.21938	0.22686	0.14039	0.07109	0.01166	0.00302	0.00275	0.00295	0.00000
1991	327,167	0.350	0.00024	0.03861	0.11312	0.19626	0.23638	0.17390	0.11282	0.07598	0.02020	0.01244	0.02000	0.00005	0.00000
1992	186,601	0.350	0.00063	0.01982	0.18337	0.19692	0.23801	0.18589	0.07930	0.05991	0.01821	0.01263	0.00531	0.00000	0.00000
1993	347,839	0.350	0.00000	0.02142	0.14421	0.22715	0.27345	0.18252	0.06020	0.04413	0.02665	0.01324	0.00475	0.00154	0.00075
1994	359,518	0.350	0.00000	0.08837	0.13120	0.12539	0.24511	0.23523	0.10911	0.03484	0.01731	0.01022	0.00198	0.00115	0.00008
1995	515,454	0.350	0.00000	0.14128	0.14651	0.10389	0.18267	0.23589	0.11921	0.03702	0.01468	0.00828	0.00444	0.00455	0.00156
1996	394,824	0.350	0.00000	0.06872	0.28895	0.19334	0.15674	0.14889	0.07810	0.03778	0.01557	0.01010	0.00040	0.00127	0.00013
1997	216,745	0.350	0.00220	0.03279	0.29690	0.28546	0.14119	0.09666	0.06460	0.03041	0.00906	0.01988	0.01226	0.00370	0.00489
1998	326,032	0.350	0.00000	0.04059	0.16532	0.30215	0.25546	0.08955	0.03978	0.03862	0.02411	0.01341	0.01193	0.00742	0.01166
1999	236,619	0.350	0.00416	0.24544	0.21086	0.18487	0.23557	0.06118	0.02203	0.01565	0.00837	0.00551	0.00274	0.00259	0.00103
2000	666,997	0.350	0.00029	0.26755	0.28476	0.23582	0.09400	0.05085	0.04039	0.01174	0.00616	0.00581	0.00120	0.00129	0.00012
2001	310,900	0.350	0.00000	0.00849	0.18681	0.25075	0.28565	0.09460	0.06072	0.03735	0.03108	0.02049	0.01537	0.00629	0.00240
2002	168,201	0.350	0.01011	0.12418	0.25351	0.12728	0.17117	0.14102	0.07361	0.04075	0.03356	0.01340	0.00905	0.00089	0.00148
2003	261,974	0.350	0.00577	0.02377	0.10711	0.20790	0.21654	0.07583	0.11776	0.07112	0.06264	0.05181	0.03116	0.01224	0.01634
2004	465,642	0.350	0.00632	0.11341	0.17340	0.16491	0.13439	0.10455	0.11217	0.08886	0.05057	0.02111	0.02229	0.00508	0.00292
2005	798,544	0.350	0.00054	0.01442	0.13015	0.30761	0.21271	0.08617	0.06812	0.05499	0.05461	0.02893	0.02022	0.01062	0.01091
2006	194,524	0.350	0.00000	0.00285	0.13247	0.14824	0.19018	0.14224	0.07739	0.08584	0.06525	0.06779	0.03800	0.02277	0.02696
2007	606,599	0.350	0.00047	0.01039	0.02999	0.14772	0.16083	0.23059	0.12967	0.07999	0.07034	0.05052	0.03696	0.03294	0.01962
2008	308,715	0.350	0.00000	0.00035	0.00948	0.14601	0.23152	0.18789	0.14471	0.07029	0.04489	0.04225	0.04088	0.04617	0.03556
2009	611,944	0.350	0.00000	0.00271	0.13195	0.27260	0.20243	0.14907	0.05009	0.06279	0.03353	0.02677	0.02567	0.01254	0.02984
2010	254,841	0.350	0.00000	0.00541	0.06361	0.29904	0.25172	0.18137	0.07706	0.03732	0.02564	0.01601	0.01223	0.00703	0.02357
2011	617,457	0.350	0.00000	0.00628	0.09971	0.17774	0.21268	0.13049	0.08823	0.07966	0.06074	0.05007	0.02505	0.01827	0.05107
2012	792,861	0.350	0.00000	0.01150	0.06391	0.14701	0.25963	0.17202	0.13846	0.04847	0.05212	0.02154	0.02805	0.02163	0.03565
2013	525,581	0.350	0.00000	0.00857	0.13460	0.22159	0.19070	0.14050	0.08552	0.06236	0.04187	0.03841	0.01400	0.02064	0.04124
2014	931,391	0.350	0.00000	0.00002	0.04071	0.11598	0.25063	0.19333	0.15985	0.06746	0.05112	0.05456	0.03560	0.00674	0.02402

Table 13. Catch weights-at age (kilograms).

Year	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.13	0.64	1.09	1.54	2.42	3.75	4.83	5.79	6.20	8.68	10.80	11.20	14.05
1983	0.20	0.55	0.94	1.37	2.37	3.29	3.77	5.36	6.01	8.10	9.57	10.39	11.11
1984	0.24	0.60	1.69	1.62	2.67	3.39	5.07	5.65	6.76	7.76	8.41	12.65	12.38
1985	0.06	0.61	1.07	1.66	2.19	3.59	4.91	5.46	6.77	7.45	9.00	10.69	13.91
1986	0.14	0.57	1.27	2.40	2.44	3.12	3.95	5.05	5.44	6.09	7.75	9.16	12.78
1987	0.20	0.77	1.41	2.11	2.50	2.91	3.61	4.74	5.52	6.49	7.77	9.78	13.15
1988	0.31	0.91	1.10	1.98	3.12	4.02	4.38	4.70	5.24	5.62	8.58	10.40	13.27
1989	0.16	0.83	1.22	2.23	3.06	4.53	5.37	6.23	6.04	8.68	8.94	9.74	13.36
1990	0.08	0.89	1.14	2.05	2.35	3.83	4.91	5.96	5.70	5.97	7.44	9.08	12.60
1991	0.21	0.92	1.29	2.17	2.62	3.17	4.81	5.64	6.46	6.24	9.46	8.30	14.22
1992	0.10	0.69	1.31	1.93	2.81	3.67	4.90	5.79	6.96	8.15	9.77	12.44	13.97
1993	0.07	0.76	1.31	1.99	2.77	3.58	4.80	6.11	7.03	8.01	9.53	10.76	14.55
1994	0.24	1.05	1.69	2.21	2.85	3.50	4.94	6.20	6.80	7.53	9.73	10.69	12.73
1995	0.28	0.70	1.35	2.18	2.77	3.65	5.38	6.16	7.27	8.86	7.57	9.73	16.66
1996	0.14	1.05	1.47	2.32	3.23	4.52	6.39	7.11	7.81	9.20	9.31	10.10	13.70
1997	0.13	0.62	1.18	2.46	2.81	3.64	4.51	5.07	6.73	9.17	9.94	10.24	14.78
1998	0.39	0.77	1.20	1.62	2.25	2.95	4.69	5.66	6.82	7.03	7.76	9.87	11.87
1999	0.62	0.90	1.11	1.44	1.91	2.51	3.36	5.03	6.56	7.85	8.69	9.76	11.98
2000	0.37	0.55	1.10	1.45	1.96	2.79	3.89	5.09	7.11	7.37	9.70	10.70	13.55
2001	0.16	0.38	1.12	1.75	2.21	3.25	4.12	5.02	6.36	7.79	8.65	8.29	10.87
2002	0.12	0.31	1.06	1.51	2.18	3.17	4.19	5.48	6.03	7.56	9.09	9.75	11.52
2003	0.10	0.60	1.00	1.40	2.20	3.20	4.10	5.20	6.10	7.20	8.50	9.40	11.00
2004	0.23	0.33	0.84	1.40	2.43	3.11	4.14	5.17	6.07	7.12	8.18	9.03	10.71
2005	0.13	0.50	1.14	1.64	2.22	3.23	4.18	5.64	6.38	7.21	8.51	10.00	12.19
2006	0.18	0.38	0.81	1.35	1.96	2.80	3.84	5.35	6.70	7.41	8.58	9.40	12.05
2007	0.10	0.46	0.94	1.30	2.10	3.07	4.31	5.32	6.89	7.84	9.39	10.12	12.77
2008	0.21	0.45	1.04	1.43	2.14	3.47	5.05	5.51	6.69	8.26	9.19	9.82	12.00
2009	0.26	0.62	1.03	1.41	1.92	3.29	4.49	5.74	6.87	7.73	8.81	9.47	12.24
2010	0.16	0.70	1.11	1.41	1.99	3.34	4.27	5.21	6.27	7.65	8.97	9.15	11.59
2011	0.20	0.52	1.04	1.55	2.00	3.08	4.10	5.13	6.41	7.54	8.20	9.98	13.08
2012	0.08	0.48	1.01	1.67	2.30	3.25	4.44	5.88	6.57	8.31	9.05	10.41	13.84
2013	0.19	0.49	0.96	1.39	2.27	3.38	4.14	5.30	6.69	7.55	9.26	10.44	13.14
2014	0.49	0.55	0.89	1.27	2.15	3.07	4.28	5.30	6.99	8.43	9.17	11.91	14.29

Table 14. Description and characteristics of fishery-independent and –dependent indices.

State	Index	Design	Time of Year	What Stock?	Ages
Marine Recreational Fisheries Survey	Total Catch Rate Index	Stratified Random	May-Dec	Mixed	Aggregate (3-13+)
Connecticut Trawl Survey	Mean number per tow	Stratified Random	April-June	Mixed	Aggregate (4-6)
NEFSC Trawl Survey	Mean number per tow	Stratified Random	March-May	Mixed	Aggregate (2-9)
New Jersey Trawl Survey	Mean number per tow	Stratified Random	April	Mixed	2-13+
New York Ocean Haul Seine Survey	Mean number per haul	Random	Sept-Nov	Mixed	2-13+
Delaware Electrofishing Survey	Mean number per hour	Lattice	April-May	Delaware	2-13+
New York YOY Seine Survey	Mean number per haul	Fixed	July-Nov	Hudson	0
New York W. Long Island Seine Survey	Mean number per haul	Fixed	May-Oct	Hudson	1
New Jersey YOY Seine Survey	Mean number per haul	Fixed/Random	Aug-Oct	Delaware	0
Virginia YOY Seine Survey	Mean number per haul	Fixed	July-Sept	Chesapeake	0
Maryland YOY and Age 1 Seine Survey	Mean number per haul	Fixed	July-Sept	Chesapeake	0-1
Maryland Gillnet Survey	Mean number per set	Stratified Random	April-May	Chesapeake	2-13+
Virginia Pound Net Survey	Mean number per set	Fixed	March-May	Chesapeake	1-13+

Table 15. Index and coefficients of variation for fishery-independent and –dependent indices.

Year	Aggregate						Age-specific											
	MRIP		NEFSC		CTTRL		NYOHS		NJTRL		MD SSN		DE SSN		VAPNET			
	Index	CV	Index	CV	Index	CV	Index	CV	Index	CV	Index	CV	Index	CV	Index	CV		
1982																		
1983																		
1984					0.02	1.00												
1985					0.01	1.00					4.88	0.25						
1986					0.01	1.00					10.07	0.25						
1987					0.05	0.40	3.83	0.11			7.15	0.25						
1988	0.40	0.79			0.04	0.50	3.60	0.10			3.27	0.25						
1989	0.29	0.85			0.06	0.33	2.58	0.13	0.23	0.61	3.96	0.25						
1990	0.25	0.77			0.16	0.27	3.50	0.18	1.13	0.60	5.04	0.25						
1991	0.31	0.38	0.23	0.17	0.15	0.21	3.28	0.19	1.41	0.67	4.61	0.25			18.75	0.25		
1992	0.89	0.24	0.24	0.34	0.22	0.25	3.00	0.19	0.65	0.70	6.29	0.25			8.45	0.25		
1993	0.67	0.21	0.48	0.21	0.27	0.16	3.32	0.11	0.67	0.53	6.25	0.25			21.72	0.25		
1994	1.06	0.16	1.39	0.22	0.30	0.19	2.90	0.15	1.47	0.40	5.13	0.25			13.87	0.25		
1995	1.32	0.14	0.95	0.20	0.60	0.13	2.84	0.18	4.21	0.14	4.62	0.25			14.52	0.25		
1996	1.64	0.12	0.60	0.20	0.63	0.14	5.11	0.10	5.66	0.20	7.59	0.25	3.38	0.10	12.30	0.25		
1997	1.59	0.13	1.18	0.13	0.85	0.13	4.84	0.14	5.82	0.21	3.87	0.25	4.10	0.09	20.10	0.25		
1998	2.04	0.10	0.73	0.15	0.97	0.13	5.01	0.15	5.01	0.10	4.79	0.25	3.73	0.12	14.85	0.25		
1999	2.01	0.11	0.45	0.23	1.10	0.12	3.46	0.16	3.51	0.12	3.97	0.25	2.59	0.12	29.89	0.25		
2000	1.77	0.12	1.27	0.19	0.84	0.14	4.36	0.11	5.31	0.13	3.52	0.25	2.05	0.16	39.70	0.25		
2001	1.43	0.12	0.62	0.26	0.61	0.15	3.47	0.15	1.58	0.36	2.83	0.25	1.88	0.18	18.63	0.25		
2002	1.24	0.14	0.98	0.14	1.30	0.10	3.23	0.20	2.13	0.17	4.00	0.25	1.60	0.15	5.23	0.25		
2003	1.06	0.15	0.77	0.24	0.87	0.09	4.24	0.19	6.83	0.10	4.55	0.25	2.47	0.12	15.65	0.25		
2004	1.17	0.14	0.33	0.25	0.56	0.09	4.88	0.09	6.05	0.15	6.11	0.25	2.89	0.12	31.64	0.25		
2005	1.52	0.14	0.29	0.20	1.17	0.10	3.91	0.14	6.41	0.12	4.96	0.25	1.77	0.14	18.14	0.25		
2006	1.61	0.13	0.63	0.29	0.61	0.09	4.37	0.14	2.61	0.28	4.92	0.25	2.22	0.18	22.14	0.25		
2007	0.93	0.15	0.74	0.13	1.02	0.10			3.50	0.32	2.14	0.25	1.78	0.33	31.52	0.25		
2008	0.81	0.15	0.65	0.17	0.57	0.09			1.38	0.33	4.37	0.25	1.72	0.12	18.32	0.25		
2009	0.80	0.15			0.60	0.10			2.24	0.34	5.70	0.25	1.25	0.17	22.96	0.25		
2010	0.76	0.15			0.40	0.21			0.73	0.53	4.53	0.25	2.69	0.21	34.89	0.25		
2011	0.68	0.15			0.48	0.21			2.07	0.28	4.58	0.25	3.25	0.20	8.96	0.25		
2012	1.10	0.15			0.43	0.17			3.48	0.20	2.64	0.25	1.94	0.19	17.48	0.25		
2013	1.73	0.15			0.67	0.09			2.51	0.54	4.41	0.25	2.10	0.07	10.60	0.25		
2014	1.16	0.15			0.41	0.08			0.31	1.00	5.57	0.25			13.01	0.25		

Table 16. Young-of-the-year and age-1 fishery-independent indices of relative abundance.

Year	Unlagged											
	YOY								Age 1			
	NY		NJ		MD		VA		NY		MD	
Index	CV	Index	CV	Index	CV	Index	CV	Index	CV	Index	CV	
1969					2.81	0.34					0.25	0.50
1970					12.52	0.26					0.13	0.50
1971					4.02	0.28					1.36	0.38
1972					3.26	0.30					0.46	0.42
1973					2.32	0.34					0.46	0.34
1974					2.63	0.32					0.26	0.38
1975					2.81	0.28					0.22	0.46
1976					1.58	0.30					0.13	0.70
1977					1.60	0.30					0.06	0.76
1978					3.75	0.26					0.18	0.46
1979	3.54	0.30			1.78	0.28					0.29	0.46
1980	10.01	0.24			1.02	0.28					0.18	0.44
1981	14.57	0.22			0.59	0.32					0.02	1.02
1982	23.30	0.19	0.10	1.22	3.57	0.27	2.71	0.50			0.02	1.16
1983	26.72	0.23	0.07	1.48	0.61	0.33	3.40	0.40			0.32	0.40
1984	24.67	0.20	0.37	0.71	1.64	0.28	4.47	0.46			0.01	2.00
1985	2.20	0.54	0.03	2.05	0.91	0.36	2.41	0.41	0.61	1.20	0.16	0.50
1986	4.65	0.49	0.32	0.55	1.34	0.32	4.74	0.37	0.30	1.00	0.03	0.94
1987	28.36	0.57	0.53	0.47	1.46	0.33	15.74	0.34	0.21	1.11	0.06	0.92
1988	49.28	0.37	0.35	0.41	0.73	0.39	7.64	0.32	0.81	0.90	0.07	0.58
1989	35.37	0.44	1.07	0.36	4.87	0.34	11.23	0.29	1.78	0.70	0.19	0.48
1990	35.53	0.46	1.05	0.32	1.03	0.29	7.34	0.31	0.37	0.84	0.33	0.42
1991	6.00	0.52	0.47	0.26	1.52	0.32	3.76	0.33	1.26	0.67	0.20	0.44
1992	16.93	0.37	1.18	0.23	2.34	0.32	7.35	0.36	1.34	0.66	0.15	0.52
1993	21.99	0.48	1.78	0.24	13.97	0.25	18.11	0.23	0.75	0.70	0.19	0.50
1994	23.61	0.38	0.96	0.24	6.40	0.27	10.48	0.27	1.43	0.76	0.78	0.36
1995	19.03	0.35	1.98	0.25	4.41	0.24	5.45	0.32	1.29	0.68	0.12	0.56
1996	12.12	0.40	1.70	0.23	17.61	0.25	23.00	0.29	1.54	0.75	0.08	0.78
1997	27.11	0.49	1.01	0.24	3.91	0.25	9.35	0.30	1.00	0.84	0.26	0.46
1998	16.10	0.43	1.31	0.26	5.50	0.25	13.25	0.29	2.10	0.79	0.17	0.50
1999	30.67	0.39	1.90	0.23	5.34	0.30	2.80	0.34	2.05	0.59	0.37	0.36
2000	6.88	0.54	1.78	0.26	7.42	0.23	16.18	0.31	1.56	0.74	0.26	0.40
2001	28.90	0.54	1.20	0.23	12.57	0.28	14.17	0.32	2.16	0.60	0.32	0.36
2002	14.72	0.37	0.53	0.29	2.20	0.27	3.98	0.37	2.53	0.53	0.79	0.32
2003	29.78	0.50	2.47	0.24	10.83	0.26	22.89	0.28	1.19	0.53	0.07	0.66
2004	8.73	0.38	1.13	0.26	4.85	0.25	12.70	0.27	2.41	0.53	0.74	0.36
2005	11.28	0.54	1.22	0.22	6.91	0.25	9.09	0.28	0.64	0.89	0.28	0.44
2006	5.83	0.44	0.67	0.25	1.78	0.29	10.10	0.28	2.02	0.62	0.28	0.42
2007	42.65	0.42	1.41	0.21	5.12	0.27	11.96	0.30	0.58	0.80	0.07	0.60
2008	19.04	0.39	1.26	0.24	1.26	0.31	7.97	0.33	1.24	0.65	0.31	0.40
2009	13.92	0.47	1.92	0.24	3.92	0.23	8.42	0.30	0.33	0.79	0.12	0.54
2010	25.62	0.46	1.30	0.21	2.54	0.25	9.07	0.35	0.45	0.76	0.17	0.45
2011	12.16	0.53	1.41	0.26	9.57	0.24	27.09	0.26	2.00	0.66	0.02	1.02
2012	9.85	0.49	0.34	0.24	0.49	0.32	2.68	0.29	0.90	0.60	0.35	0.34
2013	5.07	0.41	0.90	0.13	3.42	0.21	10.94	0.29	0.56	0.68	0.05	0.74
2014	24.60	0.38	1.65	0.08	4.06	0.29	11.30	0.29	0.82	0.61	0.12	0.57

Table 17. Age composition of age-specific survey indices.

NYOHS

Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1987		0.0318	0.1949	0.3591	0.2787	0.0883	0.0349	0.0067	0.0017	0.0000	0.0006	0.0000	0.0028
1988		0.2255	0.2687	0.1945	0.1660	0.0851	0.0218	0.0144	0.0039	0.0021	0.0007	0.0000	0.0137
1989		0.1833	0.2690	0.1478	0.1596	0.1025	0.0936	0.0217	0.0030	0.0020	0.0030	0.0020	0.0108
1990		0.0608	0.2957	0.3063	0.1139	0.0985	0.0557	0.0444	0.0158	0.0058	0.0010	0.0000	0.0023
1991		0.2070	0.3666	0.2439	0.0519	0.0166	0.0253	0.0416	0.0230	0.0063	0.0020	0.0036	0.0115
1992		0.0792	0.4166	0.2577	0.1211	0.0329	0.0143	0.0170	0.0250	0.0175	0.0032	0.0058	0.0096
1993		0.1563	0.3868	0.2908	0.0701	0.0328	0.0094	0.0090	0.0115	0.0131	0.0070	0.0025	0.0082
1994		0.1410	0.2705	0.1562	0.1346	0.0832	0.0546	0.0375	0.0222	0.0406	0.0127	0.0241	0.0203
1995		0.2450	0.2695	0.2542	0.0720	0.0658	0.0352	0.0123	0.0054	0.0123	0.0115	0.0031	0.0084
1996		0.0832	0.7475	0.1142	0.0328	0.0094	0.0073	0.0027	0.0013	0.0007	0.0000	0.0005	0.0003
1997		0.2063	0.2425	0.4508	0.0669	0.0184	0.0037	0.0037	0.0039	0.0017	0.0007	0.0009	0.0006
1998		0.1876	0.2969	0.1714	0.2855	0.0366	0.0091	0.0058	0.0029	0.0002	0.0010	0.0015	0.0011
1999		0.0697	0.6277	0.1722	0.0594	0.0438	0.0050	0.0032	0.0046	0.0035	0.0039	0.0007	0.0046
2000		0.1273	0.1930	0.4338	0.1541	0.0364	0.0368	0.0041	0.0039	0.0016	0.0018	0.0010	0.0044
2001		0.0524	0.4553	0.1474	0.2129	0.0735	0.0274	0.0194	0.0032	0.0039	0.0011	0.0000	0.0025
2002		0.3225	0.2261	0.1843	0.0805	0.0735	0.0572	0.0198	0.0198	0.0013	0.0048	0.0018	0.0057
2003		0.2022	0.3647	0.1251	0.0922	0.0406	0.0646	0.0506	0.0227	0.0177	0.0126	0.0009	0.0049
2004		0.0501	0.5698	0.2734	0.0628	0.0222	0.0076	0.0061	0.0036	0.0011	0.0014	0.0017	0.0002
2005		0.2444	0.1280	0.4126	0.1370	0.0336	0.0138	0.0035	0.0090	0.0065	0.0035	0.0037	0.0045
2006		0.0639	0.6359	0.0728	0.1610	0.0424	0.0144	0.0057	0.0025	0.0003	0.0010	0.0000	0.0000

NJ Trawl

Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1989	0.0000	0.2780	0.4440	0.0060	0.1370	0.0520	0.0110	0.0160	0.0000	0.0560	0.0000	0.0000	0.0000
1990	0.0000	0.0610	0.1820	0.0200	0.4140	0.1320	0.0290	0.0970	0.0050	0.0610	0.0000	0.0000	0.0000
1991	0.0000	0.2770	0.2840	0.0210	0.0200	0.1480	0.1320	0.0170	0.0340	0.0460	0.0210	0.0000	0.0000
1992	0.0000	0.2580	0.4780	0.0610	0.0640	0.0550	0.0740	0.0100	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.2380	0.3530	0.1500	0.0870	0.1230	0.0240	0.0250	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.2870	0.3700	0.1550	0.0900	0.0480	0.0310	0.0100	0.0090	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.6580	0.1720	0.0670	0.0450	0.0320	0.0120	0.0070	0.0040	0.0030	0.0000	0.0000	0.0000
1996	0.0000	0.1620	0.5800	0.1600	0.0610	0.0210	0.0130	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.1870	0.4090	0.2360	0.1130	0.0350	0.0120	0.0050	0.0010	0.0030	0.0000	0.0000	0.0000
1998	0.0000	0.4420	0.1930	0.0430	0.1300	0.0860	0.0540	0.0250	0.0140	0.0110	0.0020	0.0010	0.0000
1999	0.0000	0.0770	0.3200	0.1810	0.2560	0.1150	0.0320	0.0110	0.0050	0.0030	0.0000	0.0010	0.0000
2000	0.0000	0.1520	0.1400	0.1570	0.2740	0.1670	0.0730	0.0270	0.0060	0.0020	0.0010	0.0000	0.0000
2001	0.0000	0.1480	0.1670	0.1990	0.2990	0.1030	0.0420	0.0230	0.0130	0.0060	0.0010	0.0000	0.0000
2002	0.0000	0.0050	0.0230	0.0710	0.2060	0.3590	0.2300	0.0760	0.0240	0.0040	0.0000	0.0000	0.0000
2003	0.0000	0.3040	0.2380	0.0410	0.1260	0.0970	0.1220	0.0490	0.0150	0.0060	0.0010	0.0010	0.0000
2004	0.0000	0.1820	0.5190	0.0900	0.0400	0.0580	0.0430	0.0360	0.0210	0.0080	0.0040	0.0010	0.0000
2005	0.0000	0.4928	0.2179	0.0610	0.1055	0.0473	0.0418	0.0193	0.0090	0.0025	0.0018	0.0004	0.0007
2006	0.0000	0.0605	0.1003	0.0549	0.2475	0.2560	0.1001	0.0690	0.0456	0.0447	0.0129	0.0073	0.0012
2007	0.0000	0.0287	0.0405	0.2849	0.1571	0.2686	0.0905	0.0325	0.0250	0.0232	0.0204	0.0193	0.0101
2008	0.0000	0.0126	0.0542	0.1013	0.4130	0.0979	0.1441	0.0902	0.0269	0.0158	0.0110	0.0196	0.0118
2009	0.0000	0.1092	0.0085	0.0339	0.1526	0.4425	0.0972	0.0936	0.0374	0.0169	0.0039	0.0034	0.0008
2010	0.0000	0.0272	0.0165	0.0035	0.0448	0.1776	0.4689	0.0912	0.0955	0.0532	0.0212	0.0004	0.0000
2011	0.0000	0.0998	0.0867	0.0706	0.0215	0.0954	0.1651	0.2748	0.0888	0.0472	0.0258	0.0059	0.0183
2012	0.0029	0.1942	0.0929	0.0413	0.0819	0.0460	0.1051	0.1715	0.2066	0.0473	0.0084	0.0018	0.0000
2013	0.0000	0.5249	0.1973	0.0071	0.0177	0.0622	0.0470	0.0417	0.0394	0.0529	0.0075	0.0024	0.0000
2014	0.0000	0.0661	0.5814	0.1700	0.0191	0.0435	0.0389	0.0231	0.0272	0.0116	0.0116	0.0075	0.0000

Table 17 cont.

MDSSN

Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1985	0.2879	0.6259	0.0653	0.0098	0.0027	0.0045	0.0001	0.0008	0.0001	0.0001	0.0008	0.0020	
1986	0.2286	0.2593	0.4942	0.0040	0.0053	0.0020	0.0029	0.0028	0.0000	0.0000	0.0000	0.0009	
1987	0.1989	0.3609	0.1610	0.2463	0.0250	0.0031	0.0036	0.0003	0.0000	0.0000	0.0000	0.0009	
1988	0.1246	0.2370	0.2178	0.1741	0.2279	0.0040	0.0000	0.0001	0.0133	0.0000	0.0000	0.0011	
1989	0.0837	0.3908	0.2034	0.1150	0.1233	0.0831	0.0004	0.0002	0.0001	0.0000	0.0000	0.0000	
1990	0.1550	0.3140	0.2391	0.0959	0.0681	0.0636	0.0592	0.0017	0.0002	0.0002	0.0010	0.0020	
1991	0.1593	0.4148	0.1351	0.1023	0.0580	0.0566	0.0418	0.0231	0.0009	0.0033	0.0000	0.0049	
1992	0.0435	0.3515	0.2440	0.0932	0.1111	0.0682	0.0463	0.0218	0.0111	0.0052	0.0000	0.0039	
1993	0.0655	0.2112	0.2994	0.1411	0.0816	0.0830	0.0593	0.0361	0.0118	0.0050	0.0014	0.0047	
1994	0.0523	0.2016	0.1908	0.2296	0.1159	0.0662	0.0835	0.0343	0.0167	0.0061	0.0024	0.0006	
1995	0.1082	0.2538	0.1457	0.1319	0.1122	0.0871	0.0543	0.0429	0.0252	0.0210	0.0076	0.0101	
1996	0.0052	0.4852	0.1346	0.0458	0.0916	0.0849	0.0557	0.0467	0.0221	0.0200	0.0062	0.0021	
1997	0.1050	0.1197	0.3477	0.1189	0.0560	0.0510	0.0668	0.0577	0.0319	0.0311	0.0097	0.0046	
1998	0.0753	0.2983	0.0684	0.3118	0.0675	0.0276	0.0387	0.0362	0.0314	0.0190	0.0207	0.0052	
1999	0.0177	0.4392	0.2019	0.1432	0.0890	0.0287	0.0166	0.0279	0.0132	0.0128	0.0067	0.0031	
2000	0.0290	0.1437	0.3053	0.1427	0.1652	0.0773	0.0399	0.0229	0.0225	0.0220	0.0138	0.0157	
2001	0.0167	0.1384	0.1852	0.1826	0.0822	0.1007	0.1345	0.0466	0.0421	0.0348	0.0196	0.0166	
2002	0.2407	0.1037	0.0961	0.2081	0.0849	0.0747	0.0790	0.0568	0.0185	0.0102	0.0135	0.0138	
2003	0.0390	0.2418	0.1051	0.0815	0.1352	0.1248	0.0676	0.0604	0.0756	0.0217	0.0232	0.0240	
2004	0.0512	0.2932	0.1992	0.0671	0.0539	0.0719	0.0761	0.0609	0.0432	0.0447	0.0133	0.0254	
2005	0.1353	0.2111	0.1477	0.1941	0.0486	0.0516	0.0434	0.0548	0.0408	0.0350	0.0226	0.0152	
2006	0.0174	0.5259	0.0817	0.0969	0.0599	0.0297	0.0253	0.0366	0.0425	0.0265	0.0212	0.0366	
2007	0.0376	0.1067	0.3553	0.0691	0.0710	0.0626	0.0343	0.0417	0.0464	0.0742	0.0371	0.0640	
2008	0.0074	0.1989	0.2486	0.2574	0.0385	0.0520	0.0445	0.0254	0.0272	0.0227	0.0317	0.0457	
2009	0.0704	0.0739	0.2684	0.0905	0.2425	0.0370	0.0398	0.0547	0.0158	0.0277	0.0212	0.0579	
2010	0.0166	0.3305	0.1113	0.1435	0.1115	0.1212	0.0148	0.0307	0.0225	0.0088	0.0113	0.0777	
2011	0.0500	0.1600	0.2700	0.0990	0.1250	0.0830	0.0980	0.0220	0.0200	0.0170	0.0170	0.0390	
2012	0.0574	0.1965	0.0876	0.0895	0.0674	0.0872	0.0854	0.0946	0.0281	0.0624	0.0512	0.0926	
2013	0.0166	0.3305	0.1113	0.1435	0.1115	0.1212	0.0148	0.0307	0.0225	0.0088	0.0113	0.0777	
2014	0.0500	0.1600	0.2700	0.0990	0.1250	0.0830	0.0980	0.0220	0.0200	0.0170	0.0170	0.0390	

DE SSN

Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1996	0.0060	0.4170	0.1920	0.0610	0.0850	0.0760	0.0640	0.0580	0.0150	0.0090	0.0090	0.0090	
1997	0.0930	0.0740	0.3910	0.1370	0.0510	0.0640	0.0730	0.0320	0.0300	0.0230	0.0090	0.0230	
1998	0.0400	0.0870	0.0980	0.3470	0.0900	0.0610	0.1050	0.0950	0.0340	0.0250	0.0080	0.0110	
1999	0.0000	0.1050	0.1440	0.1770	0.2350	0.0720	0.0540	0.0760	0.0580	0.0510	0.0140	0.0140	
2000	0.0360	0.0360	0.2100	0.1710	0.1380	0.2230	0.0660	0.0300	0.0390	0.0320	0.0100	0.0100	
2001	0.0060	0.1150	0.1000	0.1850	0.1100	0.1400	0.2000	0.0500	0.0150	0.0400	0.0200	0.0200	
2002	0.0340	0.0710	0.1910	0.1780	0.1570	0.1130	0.0890	0.0970	0.0260	0.0160	0.0100	0.0180	
2003	0.0200	0.0970	0.0970	0.1340	0.0890	0.1110	0.1250	0.1050	0.1210	0.0340	0.0280	0.0380	
2004	0.0070	0.1660	0.2310	0.0980	0.0680	0.0540	0.1120	0.0780	0.0810	0.0440	0.0140	0.0470	
2005	0.0960	0.1570	0.1680	0.1980	0.0810	0.0460	0.0300	0.0360	0.0610	0.0360	0.0460	0.0460	
2006	0.0595	0.2007	0.0967	0.1413	0.1413	0.0706	0.0520	0.0409	0.0483	0.0483	0.0372	0.0632	
2007	0.0061	0.0887	0.3700	0.1804	0.1009	0.0734	0.0306	0.0245	0.0306	0.0275	0.0398	0.0275	
2008	0.0299	0.0329	0.1257	0.3024	0.1467	0.1317	0.0449	0.0359	0.0359	0.0269	0.0449	0.0419	
2009	0.1296	0.1014	0.0930	0.1803	0.1352	0.0901	0.0789	0.0366	0.0338	0.0169	0.0282	0.0761	
2010	0.1469	0.2041	0.1204	0.1143	0.1224	0.0898	0.0469	0.0429	0.0245	0.0224	0.0204	0.0449	
2011	0.0220	0.0550	0.1890	0.1720	0.1300	0.0950	0.1140	0.0950	0.0450	0.0300	0.0120	0.0410	
2012	0.1538	0.2985	0.2062	0.0308	0.0338	0.0185	0.0677	0.0338	0.0185	0.0154	0.0554	0.0677	
2013	0.0382	0.0795	0.0572	0.0684	0.1701	0.1590	0.1335	0.1145	0.0636	0.0334	0.0270	0.0556	
2014	-	-	-	-	-	-	-	-	-	-	-	-	

Table 17 cont.

VA PNET

Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1991	0.0231	0.0182	0.1970	0.4403	0.1469	0.0919	0.0275	0.0138	0.0275	0.0000	0.0000	0.0138	0.0000
1992	0.0245	0.0613	0.0736	0.1963	0.3374	0.1411	0.0368	0.0491	0.0245	0.0552	0.0000	0.0000	0.0000
1993	0.0056	0.0267	0.0487	0.1678	0.4470	0.1710	0.0305	0.0197	0.0272	0.0216	0.0342	0.0000	0.0000
1994	0.0000	0.1082	0.0361	0.0999	0.3449	0.1668	0.0864	0.0443	0.0391	0.0248	0.0248	0.0248	0.0000
1995	0.0029	0.2184	0.3448	0.0718	0.1609	0.0489	0.0431	0.0489	0.0287	0.0057	0.0201	0.0057	0.0000
1996	0.0000	0.0426	0.3314	0.2387	0.1361	0.1052	0.0743	0.0309	0.0309	0.0075	0.0000	0.0000	0.0025
1997	0.0000	0.0306	0.1990	0.4133	0.0638	0.0026	0.0357	0.0408	0.0765	0.0510	0.0510	0.0179	0.0179
1998	0.0000	0.0132	0.1492	0.4393	0.1027	0.0028	0.0361	0.0486	0.0541	0.0618	0.0618	0.0153	0.0153
1999	0.0000	0.0269	0.3932	0.3918	0.0951	0.0037	0.0170	0.0147	0.0109	0.0123	0.0133	0.0147	0.0065
2000	0.0000	0.0008	0.3964	0.4604	0.0848	0.0028	0.0127	0.0127	0.0102	0.0074	0.0094	0.0013	0.0013
2001	0.0000	0.0038	0.1471	0.4020	0.2303	0.0054	0.0311	0.0467	0.0467	0.0435	0.0242	0.0140	0.0054
2002	0.0000	0.0000	0.0975	0.2753	0.2639	0.0478	0.1300	0.0784	0.0535	0.0363	0.0115	0.0000	0.0057
2003	0.0000	0.0000	0.0486	0.1917	0.2128	0.0236	0.1169	0.0895	0.1086	0.0914	0.0722	0.0211	0.0236
2004	0.0000	0.0000	0.1111	0.1783	0.1889	0.1120	0.0714	0.1332	0.0746	0.0535	0.0320	0.0352	0.0099
2005	0.0000	0.0034	0.1037	0.3076	0.1569	0.0402	0.0436	0.0958	0.0958	0.0533	0.0391	0.0323	0.0283
2006	0.0000	0.0041	0.3606	0.2925	0.1449	0.0064	0.0233	0.0416	0.0393	0.0535	0.0105	0.0091	0.0142
2007	0.0000	0.0010	0.0799	0.2713	0.1957	0.0362	0.0355	0.0479	0.0600	0.0850	0.1206	0.0225	0.0444
2008	0.0000	0.0093	0.2402	0.3930	0.1779	0.0278	0.0328	0.0311	0.0158	0.0235	0.0235	0.0251	0.0000
2009	0.0000	0.0031	0.0826	0.2215	0.3028	0.0939	0.0533	0.0533	0.0520	0.0520	0.0293	0.0162	0.0402
2010	0.0000	0.0069	0.0787	0.1945	0.3121	0.1266	0.0458	0.0308	0.0380	0.0530	0.0329	0.0209	0.0598
2011	0.0000	0.0090	0.0516	0.1211	0.1547	0.1076	0.0886	0.0987	0.1076	0.1166	0.0706	0.0280	0.0460
2012	0.0000	0.0000	0.0824	0.1882	0.2235	0.1247	0.0612	0.0541	0.0753	0.0494	0.0565	0.0259	0.0588
2013	0.0000	0.0000	0.1557	0.1642	0.1802	0.0783	0.0283	0.0245	0.0283	0.1066	0.0368	0.0821	0.1151
2014	0.0000	0.0000	0.2575	0.2037	0.0315	0.0000	0.0046	0.0361	0.0500	0.1038	0.1176	0.0407	0.1545

Table 18. Model structure, equation, and data inputs used in this assessment.

General Definitions	Symbol	Description/Definition
Year Index	y	$y = \{1982, \dots, 2014\}$ for catch. $y = \{1970, \dots, 2014\}$ for indices.
Age Index: $a = \{1, \dots, 13+\}$	a	
Fleet Index: $f = \{1: \text{Chesapeake Bay}, 2: \text{Coast}, 3: \text{Commercial Dead Discards}\}$	f	
Indices Index: $t = \{1, \dots, 16\}$	t	
Input Data	Symbol	Description/Definition
Observed Fleet Catch	$C_{f,y}$	Reported number of striped bass killed each year (y) by fleet (f)
Coefficient of Variation for Fleets	$CV_{f,y}$	Calculated from MRIP harvest and releases estimates with associated proportional standard errors (commercial harvest from census – no error)
Observed Fleet Age Compositions	$P_{f,y,a}$	Proportion-at-age (a) for each year (y) and fleet (f)
Observed Total Indices of Relative Abundance	$I_{t,y}$	Reported by various states. YOY and Age 1 Indices: 6 Age-aggregated Indices: 3 (1 fishery-dependent; 2 fishery-independent) Indices with Age Composition: 5 (all fishery-independent)
Coefficient of Variation for Indices	$CV_{t,y}$	Calculated from indices and associated standard errors
Observed Age Compositions of Indices of Relative Abundance	$P_{t,y,a}$	Proportion-at-age (a) for each year (y) and index (t)
Effective Sample Size Starting Values	\hat{n}	Fleets: 50 Indices: NYOHS – 22, NJ Trawl – 23, MDSSN – 68, DESSN – 68, VAPNET – 68, VAGNET – 68 (calculated from method of Pennington and Volstad, 1995)

Table 18 cont.

Population Model	Symbol	Equation
Age-1 numbers	$\hat{N}_{y,1}$	$\hat{N}_{y,1} = \exp \left(\log_e(\hat{\alpha}) + \log_e(SSB_{y-1}) - \log_e \left(1 + \frac{SSB_{y-1}}{\hat{\beta}} \right) + \hat{e}_y - 0.5\hat{\sigma}_R^2 \right)$ $\hat{\sigma}_R = \sqrt{\frac{\sum (\hat{e}_y - \hat{\sigma})^2}{n-1}}$ <p>where e_y are independent and identically distributed normal random variables with zero mean and constant variance and are constrained to sum to zero over all years</p>
Abundance-at-Age	$\hat{N}_{y,a}$	<p>First year (ages 2-A in 1970): $\hat{N}_{y,a} = \hat{N}_{y,a-1} \exp^{-\hat{F}_{1982,a-1} - M_{1982,a-1}}$</p> <p>Rest of years (ages 2-12): $\hat{N}_{y,a} = \hat{N}_{y-1,a-1} \exp^{-\hat{F}_{y-1,a-1} - M_{y-1,a-1}}$</p>
Plus-group abundance-at-age	$\hat{N}_{y,A}$	$\hat{N}_{y,A} = \hat{N}_{y-1,A-1} \exp^{-\hat{F}_{y-1,A-1} - M_{y-1,A-1}} + \hat{N}_{y-1,A} \exp^{-\hat{F}_{y-1,A} - M_{y-1,A}}$
Fishing Mortality	$\hat{F}_{f,y,a}$	$\hat{F}_{f,y,a} = \hat{F}_{f,y} \cdot \hat{s}_{f,a}$ <p>where F_{fy} and s_{fa} are estimated parameters</p>
Total Mortality	$\hat{Z}_{y,a}$	$Z_{y,a} = F_{y,a} + M_{y,a}$
Fleet Selectivity	$\hat{s}_{f,a}$	<p>Fleet 1 (Chesapeake Bay): 1982-1984, 1985-1989, 1990-1995, 1996-2014 Fleet 2 (Coast): 1982-1984 Fleet 3 (Commercial Dead Discards): 1985-1989, 1990-1996, 1997-2002, 2003-2014</p> $\hat{s}_a = \frac{1}{1-\hat{\gamma}} \cdot \left(\frac{1-\hat{\gamma}}{\hat{\gamma}} \right)^{\hat{a}} \frac{\exp^{\hat{a}\hat{\gamma}(\hat{\beta}-a)}}{1 + \exp^{\hat{a}(\hat{\beta}-a)}}$ <p>Fleet 2 (Coast): 1985-1989, 1990-1996, 1997-2014</p> $\hat{s}_a = \exp^{-\exp^{-\hat{\beta}(a-\hat{a})}}$ <p>Fleet 3 (Commercial Dead Discards): 1982-1984</p> $\hat{s}_a = \alpha \exp^{\beta a}$
Predicted Catch-At-Age	$\hat{C}_{f,y,a}$	$\hat{C}_{f,y,a} = \frac{\hat{F}_{f,y,a}}{\hat{F}_{f,y,a} + M_{y,a}} \cdot (1 - \exp^{-\hat{F}_{y,a} - M_{y,a}}) \cdot \hat{N}_{y,a}$

Table 18 cont.

Population Model	Symbol	Equation
Predicted Total Catch	$\hat{C}_{y,a}$	$\hat{C}_{f,y} = \sum_a \hat{C}_{f,y,a}$
Predicted Proportions of Catch-At-Age	$\hat{P}_{f,y,a}$	$\hat{P}_{f,y,a} = \frac{\hat{C}_{f,y,a}}{\sum_a \hat{C}_{f,y,a}}$
Predicted Aggregated Indices of Relative Abundance	$\hat{I}_{t,y,\sum a}$	$\hat{I}_{t,y,\sum a} = \hat{q}_t \cdot \sum_a \hat{N}_{y,a} \cdot \exp^{-p_t \cdot Z_{y,a}}$
Predicted Age-Specific Indices of Relative Abundance	$\hat{I}_{t,y,a}$	$\hat{I}_{t,y,a} = \hat{q}_t \cdot \hat{s}_{t,a} \cdot \hat{N}_{y,a} \cdot \exp^{-p_t \cdot \hat{Z}_{y,a}}$
Predicted Total Indices of Relative Abundance with Age Composition Data	$\hat{I}_{t,y}$	$\hat{I}_{t,y} = \hat{q}_t \sum_a \hat{s}_{t,a} \cdot \hat{N}_{y,a} \cdot \exp^{-p_t \cdot \hat{Z}_{y,a}}$
Predicted Age Composition of Survey	$\hat{U}_{t,y,a}$	$\hat{U}_{t,y,a} = \frac{\hat{I}_{t,y,a}}{\sum_a \hat{I}_{t,y,a}}$
Female Spawning Stock Biomass (metric tons)	SSB_y	$SSB_y = \sum_{a=1}^A N_{y,a} \cdot sr_a \cdot m_a \cdot w_{y,a} / 1000$

Table 18 cont.

Likelihood	Symbol	Equation
Concentrated Lognormal Likelihood for Fleet Catch (F) and Indices of Relative Abundance (T)	$-L_F; -L_T$	$-L_F = 0.5 * \sum_f n_f * \ln \left(\frac{\sum_f RSS_f}{\sum_f n_f} \right); \quad -L_T = 0.5 * \sum_t n_t * \ln \left(\frac{\sum_t RSS_t}{\sum_t n_t} \right)$ <p>where</p> $RSS_f = \lambda_f \sum_y \left(\frac{\ln(C_{f,y} + 1e^{-5}) - \ln(\hat{C}_{f,y} + 1e^{-5})}{\delta_f \cdot CV_{f,y}} \right)^2$ $RSS_t = \lambda_t \sum_y \left(\frac{\ln(I_{t,y} + 1e^{-5}) - \ln(\hat{I}_{t,y} + 1e^{-5})}{\delta_t \cdot CV_{t,y}} \right)^2$ <p>$CV_{f,y}$ and $CV_{t,y}$ are the annual coefficient of variation for the observed total catch (f) and index (t) in year y, δ_f and δ_t is the CV weights for total catch f and index t, and λ_f and λ_t are relative weights.</p>
Multinomial fleet catch (FC) and index (TC) age compositions	$-L_{FC}; -L_{TC}$	$-L_{FC} = \lambda_f \sum_y -n_{f,y} \sum_a P_{f,y,a} \cdot \ln(\hat{p}_{f,y,a} + 1e^{-7})$ $-L_{TC} = \lambda_t \sum_y -n_{t,y} \sum_a U_{t,y,a} \cdot \ln(\hat{u}_{t,y,a} + 1e^{-7})$ <p>where λ_f and λ_t are a user-defined weighting factors and n_y are the effective sample sizes.</p>
Effective sample size	\hat{n}	The multiplier from equation 1.8 method of Francis (2011) was used to adjust the starting values.
Constraints Added To Total Likelihood	$P_{n1}, P_{rdev}, P_{fadd}$	$P_{n1} = \lambda_{n1} (\hat{N}_{y,1} - N_{y,1}^e)^2 \quad \text{- forces } N_{i,t} \text{ to follow S-R curve}$ $P_{rdev} = \lambda_R \sum_y \log_e(\hat{\sigma}_R) + \frac{\hat{\sigma}_y^2}{2\hat{\sigma}_R^2} \quad \text{- for bias correction to constrain deviations}$ $P_{fadd} = \begin{cases} \text{phase} < 3, & 10 \cdot \sum_y (F_{f,y} - 0.15)^2 \\ \text{phase} \geq 3, & 0.000001 \cdot \sum_y (F_{f,y} - 0.15)^2 \end{cases} \quad \text{- avoid small F values at start}$

Table 18 cont.

Diagnostics	Symbol	Equation
Standardized residuals (lognormal – catch and surveys)	$r_{f,y,a}$ or $r_{t,y,a}$	$r_{t,y} = \frac{\log I_{t,y} - \log \hat{I}_{t,y}}{\sqrt{\log_e((\delta_f CV_{t,y})^2 + 1)}}$ $r_{f,y} = \frac{\log C_{f,y} - \log \hat{C}_{f,y}}{\sqrt{\log_e(CV_{f,y}^2 + 1)}}$
Standardized residuals (age compositions – catch and surveys)	$ra_{f,y,a}$ or $ra_{t,y,a}$	$ra_{f,y,a} = \frac{P_{f,y,a} - \hat{P}_{f,y,a}}{\sqrt{\frac{\hat{P}_{f,y,a}(1 - \hat{P}_{f,y,a})}{\hat{n}_f}}}$ $ra_{t,y,a} = \frac{P_{t,y,a} - \hat{P}_{t,y,a}}{\sqrt{\frac{\hat{P}_{t,y,a}(1 - \hat{P}_{t,y,a})}{\hat{n}_t}}}$
Root mean square error	$RMSE$	<p>Total catch</p> $RMSE_f = \sqrt{\frac{\sum r_{f,y}^2}{n_f}}$ <p>Index</p> $RMSE_t = \sqrt{\frac{\sum r_{t,y}^2}{n_t}}$

Table 19. The fraction of total mortality (p) that occurs prior to the survey and ages to which survey indices are linked.

Survey	p	Linked Ages
Age-specific		
NY YOY	0	1 (January 1st)
NJ YOY	0	1 (January 1st)
MD YOY	0	1 (January 1st)
VA YOY	0	1 (January 1st)
MD Age 1	0	2 (January 1st)
NY Age 1	0	2 (January 1st)
Aggregate		
MRFSS	0.5	3-13+
NEFSC	0.333	2-9
CT Trawl	0.333	4-6
Indices with age composition		
NY OHS	0.75	2-13+
NJ Trawl	0.25	2-13+
MD SSN	0.25	2-13+
DE SSN	0.25	2-13+
VA Poundnet	0.25	1-13+

Table 20. Starting values used in the SCA model.

Parameter(s)	Equation	ADMB Name	Phase	Start Value	Lower Bound	Upper Bound
Yr 1, Age 1 N or Avg N (log)		log_R	1	10	0.27	25
R Deviation (log)		log_R_dev	2	0	-20	20
Fishing Mortality (log)		log_F	2	-1.6	-12	2.31
Aggregate qs (log)		agg_qs	6	-16	-50	0
AgeComp qs (log)		ac_qs	6	-16	-50	0
Catch Selectivity	Gompertz	flgom_a	4	3	-20	150
Catch Selectivity	Gompertz	flgom_b	4	1	-20	150
Catch Selectivity	Thompson	flthom_a	4	-3.81	-20	0
Catch Selectivity	Thompson	flthom_b	4	3	0	150
Catch Selectivity	Thompson	flthom_c	4	0.9	1.00E-28	0.999
Catch Selectivity	Exponential	flexp_a	4	0.1	-150	150
Catch Selectivity	Exponential	flexp_b	4	1	-150	150
AC Selectivity	Gompertz	acgom_a	5	3	-20	150
AC Selectivity	Gompertz	acgom_b	5	1	-20	150
AC Selectivity	Gamma	acgam_a	5	3	0	150
AC Selectivity	Gamma	acgam_b	5	1	0	150
AC Selectivity	Thompson	acthom_a	5	-3.81	-20	0
AC Selectivity	Thompson	acthom_b	5	3	0	150
AC Selectivity	Thompson	acthom_c	5	0.9	1.00E-28	0.999
AC Selectivity	User-Defined	userparms	5	0.6	0	1
S-R Equation	Beverton	BH_a	3	10000	0	100000
S-R Equation	Beverton	BH_b	3	11000	0	100000

Table 21. RMSE and effective sample size estimates for the fleet catch, relative abundance indices, and age compositions.

Index	n	Weight	RMSE	Percentile	
				0.025	0.975
NYYOY	35	2.65	1.000	0.768	1.239
NJYOY	32	1.45	0.998	0.757	1.248
MDYOY	45	1.85	1.002	0.797	1.213
VAYOY	32	1.40	0.986	0.757	1.248
NYAge1	29	1.40	0.990	0.743	1.259
MDAge1	45	1.30	0.987	0.797	1.213
MRFSS	27	1.83	0.994	0.733	1.268
CTTRL	31	3.30	1.007	0.752	1.252
NEFSC	18	1.30	0.997	0.669	1.318
NYOHS	20	2.85	1.019	0.687	1.304
NJTRAWL	26	2.60	1.017	0.728	1.272
MDSSN	30	2.82	0.995	0.748	1.256
DESSN	18	2.60	1.000	0.669	1.318
VAPNET	24	1.90	1.010	0.716	1.281

Age Composition	
Fleet/Index	n_{eff}
Bay Fleet	31.7
Ocean Fleet	46.8
Commercial Discards	23.0
NYOHS	18.7
NJTRAWL	5.0
MDSSN	17.5
DESSN	24.5
VAPNET	8.4

Table 22. Likelihood components with respective contributions from the base model run.

Likelihood Components		
Concentrated Log-Likelihood	Weight	RSS
Bay Total Catch	2	19.92
Ocean Total Catch	2	0.56
Commercial Discards Total Catch	2	0.11
Aggregate Abundance Indices		
NY YOY	1	24.39
NJ YOY	1	25.46
MD YOY	1	39.53
VA YOY	1	28.24
NY Age 1	1	24.31
MD Age 1	1	31.43
MRFSS/MRIP	1	25.18
CTTRL	1	21.42
NEFSC	1	15.78
Age Comp Abundance Indices		
NYOHS	1	19.52
NJ Trawl	1	18.61
MD SSN	1	24.12
DE SSN	1	16.93
VA PNET	1	22.08
Total RSS		357.60
No. of Obs		511.00
Conc. Likel.		-91.20
Age Composition Data		
	Likelihood	
Bay Age Comp	1	2014.65
Ocean Age Comp	1	3570.94
Commercial Discards Age Comp	1	1549.42
NYOHS	1	622.88
NJ Trawl	1	254.87
MD SSN	1	1060.51
DE SSN	1	1001.44
VA PNET	1	433.53
log_R constraint	1	0.28
Recr Devs	1	14.09
Total Likelihood		10383.30
AIC		21178.60

Table 23. Parameter estimates and associated standard deviations of base model configuration.

Year	Bay			Ocean			Commercial Discards			Total			Recruitment	SD	CV
	Full F	SD	CV	Full F	SD	CV	Full F	SD	CV	Full F	SD	CV			
1982	0.811	0.120	0.15	0.158	0.004	0.02	0.010	0.005	0.47	0.866	0.119	0.14	19,164,800	2,235,250	0.116633
1983	0.067	0.045	0.67	0.119	0.003	0.03	0.006	0.019	2.91	0.155	0.049	0.31	46,186,300	4,254,990	0.092127
1984	0.135	0.003	0.02	0.060	0.006	0.11	0.008	0.004	0.42	0.160	0.044	0.27	40,908,500	3,910,340	0.095587
1985	0.009	0.013	1.56	0.096	0.005	0.05	0.017	0.005	0.31	0.099	0.045	0.46	39,887,500	3,724,700	0.09338
1986	0.004	0.048	13.61	0.056	0.003	0.06	0.031	0.019	0.62	0.062	0.017	0.28	32,095,100	3,254,630	0.101406
1987	0.001	0.002	1.30	0.026	0.006	0.22	0.017	0.006	0.35	0.030	0.007	0.23	42,690,600	3,910,190	0.091594
1988	0.002	0.043	18.09	0.036	0.006	0.16	0.029	0.006	0.20	0.046	0.008	0.18	55,831,600	4,678,200	0.083791
1989	0.001	0.019	23.46	0.024	0.006	0.25	0.038	0.024	0.64	0.047	0.010	0.21	62,126,900	5,061,920	0.081477
1990	0.015	0.002	0.16	0.017	0.008	0.45	0.056	0.002	0.03	0.085	0.014	0.17	83,533,700	6,215,900	0.074412
1991	0.022	0.002	0.11	0.022	0.006	0.27	0.032	0.006	0.19	0.073	0.009	0.13	68,563,500	5,560,030	0.081093
1992	0.021	0.045	2.13	0.025	0.006	0.23	0.016	0.021	1.32	0.057	0.006	0.10	70,015,800	5,787,600	0.082661
1993	0.029	0.005	0.16	0.027	0.003	0.09	0.025	0.005	0.18	0.077	0.008	0.10	90,969,700	6,935,760	0.076243
1994	0.039	0.001	0.03	0.034	0.006	0.18	0.023	0.004	0.19	0.090	0.008	0.09	180,963,000	10,579,600	0.058463
1995	0.047	0.018	0.39	0.056	0.016	0.28	0.031	0.023	0.75	0.124	0.011	0.09	114,886,000	8,133,810	0.070799
1996	0.057	0.009	0.16	0.055	0.001	0.02	0.010	0.002	0.24	0.114	0.008	0.07	124,648,000	8,585,730	0.06888
1997	0.066	0.000	0.01	0.159	0.005	0.03	0.005	0.005	1.03	0.190	0.018	0.09	153,941,000	9,578,590	0.062222
1998	0.060	0.008	0.13	0.144	0.015	0.10	0.008	0.017	2.19	0.173	0.017	0.10	98,336,800	7,269,810	0.073928
1999	0.051	0.004	0.08	0.124	0.002	0.01	0.005	0.005	0.97	0.149	0.014	0.10	100,575,000	7,242,380	0.07201
2000	0.059	0.001	0.02	0.156	0.004	0.03	0.015	0.006	0.38	0.188	0.018	0.10	79,720,800	6,332,940	0.079439
2001	0.052	0.011	0.21	0.152	0.013	0.08	0.008	0.017	2.21	0.177	0.017	0.10	118,508,000	8,066,220	0.068065
2002	0.042	0.007	0.17	0.150	0.001	0.01	0.004	0.002	0.53	0.170	0.016	0.09	138,314,000	8,939,080	0.064629
2003	0.068	0.000	0.00	0.159	0.005	0.03	0.009	0.006	0.63	0.195	0.017	0.09	76,283,800	6,366,090	0.083453
2004	0.060	0.007	0.11	0.193	0.016	0.08	0.016	0.020	1.27	0.230	0.022	0.10	166,587,000	10,416,000	0.062526
2005	0.064	0.010	0.15	0.193	0.004	0.02	0.027	0.006	0.22	0.240	0.023	0.10	93,274,000	7,404,280	0.079382
2006	0.078	0.003	0.04	0.235	0.004	0.02	0.007	0.006	0.82	0.275	0.028	0.10	86,785,300	7,141,460	0.082289
2007	0.071	0.002	0.03	0.193	0.015	0.08	0.021	0.016	0.76	0.238	0.024	0.10	65,913,200	6,258,270	0.094947
2008	0.054	0.014	0.27	0.211	0.002	0.01	0.011	0.008	0.74	0.242	0.026	0.11	87,451,600	7,765,440	0.088797
2009	0.065	0.003	0.05	0.149	0.003	0.02	0.023	0.006	0.27	0.194	0.020	0.10	61,360,500	6,460,080	0.105281
2010	0.061	0.003	0.05	0.153	0.014	0.09	0.011	0.024	2.29	0.187	0.020	0.11	78,064,700	8,026,970	0.102825
2011	0.060	0.008	0.14	0.176	0.001	0.01	0.027	0.006	0.21	0.221	0.024	0.11	97,968,500	9,669,200	0.098697
2012	0.054	0.003	0.05	0.131	0.005	0.04	0.036	0.007	0.20	0.181	0.020	0.11	125,129,000	15,264,900	0.121993
2013	0.062	0.003	0.05	0.190	0.015	0.08	0.025	0.019	0.77	0.234	0.028	0.12	31,872,000	5,741,350	0.180138
2014	0.065	0.004	0.06	0.145	0.002	0.01	0.042	0.010	0.24	0.205	0.025	0.12	76,119,600	9,983,850	0.13116

Table 23 cont.

Catch Selectivity Parameters

Bay				Ocean			Commercial Discards				
	Estimate	SD	CV		Estimate	SD	CV		Estimate	SD	CV
1982-1984				1982-1984			1982-1984				
α	-5.628	0.429	0.08	α	-2.483	0.338	0.14	α	0.017	0.008	0.49
β	2.259	0.064	0.03	β	3.363	0.253	0.08	β	1.242	0.194	0.16
γ	0.923	0.021	0.02	γ	0.991	0.023	0.02				
1985-1989				1985-1989			1985-1989				
α	-3.821	0.480	0.13	α	5.133	0.614	0.12	α	-2.134	0.244	0.11
β	2.010	0.125	0.06	β	0.433	0.065	0.15	β	4.093	0.389	0.10
γ	0.951	0.023	0.02					γ	0.879	0.066	0.08
1990-1995				1990-1995			1990-1995				
α	-2.290	0.229	0.10	α	3.100	0.175	0.06	α	-1.908	0.157	0.08
β	3.467	0.247	0.07	β	0.918	0.111	0.12	β	4.674	0.366	0.08
γ	0.889	0.038	0.04					γ	0.815	0.063	0.08
1996-2014				1997-2014			1996-2002				
α	-1.918	0.118	0.06	α	5.427	0.263	0.05	α	-2.745	0.506	0.18
β	3.772	0.144	0.04	β	0.421	0.029	0.07	β	2.815	0.280	0.10
γ	0.941	0.017	0.02					γ	0.957	0.028	0.03
								2003-2014			
								α	-2.371	0.287	0.12
								β	3.748	0.193	0.05
								γ	0.976	0.017	0.02

Survey Selectivity Parameters			
	Estimate	SD	CV
NYOHS			
α	-5.691	0.088	0.02
β	2.288	0.034	0.02
γ	0.962	0.006	0.01
NJ Trawl			
α	3.107	0.611	0.20
β	0.525	0.133	0.25
DE SSN			
α	3.355	0.194	0.06
β	0.776	0.110	0.14
MDSSN			
s_2	0.138	0.022	0.16
VAPNET			
α	-3.221	0.438	0.14
β	3.108	0.106	0.03
γ	0.999	0.000	0.00

Catchability Coefficients			
Survey	Estimate	SD	CV
NY YOY	2.96E-07	4.17E-08	0.14
NJ YOY	1.23E-08	8.28E-10	0.07
MD YOY	4.35E-08	3.36E-09	0.08
VA YOY	1.08E-07	7.88E-09	0.07
NY Age 1	4.49E-08	3.99E-09	0.09
MD Age 1	9.54E-09	8.54E-10	0.09
MRFSS	3.14E-08	1.89E-09	0.06
NEFSC	3.48E-08	2.62E-09	0.08
CTTRL	1.00E-08	1.02E-09	0.10
NYOHS	1.59E-07	1.42E-08	0.09
NJTRL	9.65E-08	1.19E-08	0.12
MDSSN	1.24E-07	1.44E-08	0.12
DESSN	8.26E-08	9.64E-09	0.12
VAPNET	5.07E-07	5.16E-08	0.10

Table 24. Total fishing mortality-at-age and fishing mortality-at-age by fleet.

Total Fishing Mortality													
Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.003	0.248	0.866	0.680	0.514	0.391	0.309	0.254	0.218	0.193	0.176	0.164	0.157
1983	0.001	0.025	0.108	0.154	0.155	0.144	0.135	0.128	0.122	0.118	0.115	0.111	0.109
1984	0.001	0.044	0.160	0.149	0.126	0.105	0.091	0.081	0.074	0.069	0.066	0.063	0.061
1985	0.001	0.008	0.019	0.038	0.057	0.069	0.079	0.086	0.092	0.095	0.097	0.099	0.099
1986	0.000	0.004	0.013	0.035	0.054	0.058	0.060	0.061	0.062	0.062	0.062	0.062	0.061
1987	0.000	0.002	0.006	0.018	0.027	0.029	0.029	0.029	0.030	0.029	0.029	0.029	0.029
1988	0.000	0.003	0.010	0.029	0.044	0.046	0.045	0.044	0.044	0.043	0.042	0.041	0.041
1989	0.000	0.002	0.009	0.031	0.047	0.046	0.042	0.039	0.037	0.035	0.033	0.031	0.030
1990	0.000	0.004	0.019	0.053	0.085	0.084	0.068	0.054	0.043	0.036	0.031	0.027	0.024
1991	0.000	0.004	0.021	0.052	0.073	0.070	0.059	0.050	0.042	0.037	0.033	0.030	0.028
1992	0.000	0.004	0.019	0.045	0.057	0.056	0.049	0.043	0.039	0.035	0.033	0.031	0.030
1993	0.000	0.005	0.025	0.059	0.077	0.073	0.063	0.054	0.047	0.042	0.038	0.035	0.033
1994	0.001	0.006	0.031	0.072	0.090	0.085	0.074	0.064	0.057	0.051	0.047	0.044	0.041
1995	0.001	0.008	0.043	0.098	0.124	0.120	0.107	0.094	0.085	0.078	0.072	0.068	0.065
1996	0.001	0.008	0.040	0.088	0.112	0.114	0.111	0.105	0.100	0.096	0.091	0.088	0.084
1997	0.001	0.006	0.031	0.081	0.121	0.143	0.160	0.173	0.182	0.187	0.190	0.190	0.190
1998	0.001	0.006	0.030	0.076	0.112	0.132	0.147	0.158	0.166	0.170	0.173	0.173	0.173
1999	0.001	0.005	0.025	0.064	0.095	0.112	0.126	0.135	0.142	0.146	0.148	0.149	0.149
2000	0.001	0.007	0.036	0.086	0.122	0.144	0.160	0.172	0.180	0.185	0.188	0.188	0.188
2001	0.001	0.006	0.029	0.072	0.106	0.128	0.145	0.158	0.167	0.173	0.176	0.177	0.177
2002	0.001	0.005	0.024	0.061	0.093	0.115	0.133	0.147	0.157	0.163	0.167	0.169	0.170
2003	0.001	0.006	0.029	0.084	0.127	0.150	0.166	0.179	0.187	0.192	0.195	0.195	0.195
2004	0.001	0.006	0.030	0.088	0.136	0.165	0.187	0.204	0.216	0.223	0.227	0.229	0.230
2005	0.001	0.007	0.033	0.100	0.152	0.180	0.201	0.217	0.228	0.235	0.239	0.240	0.239
2006	0.001	0.008	0.036	0.103	0.159	0.194	0.221	0.242	0.256	0.266	0.271	0.274	0.275
2007	0.001	0.007	0.034	0.100	0.152	0.180	0.201	0.217	0.227	0.234	0.237	0.238	0.238
2008	0.001	0.006	0.029	0.084	0.131	0.163	0.189	0.208	0.223	0.232	0.238	0.241	0.242
2009	0.001	0.006	0.030	0.090	0.135	0.156	0.171	0.181	0.189	0.193	0.194	0.194	0.193
2010	0.001	0.006	0.027	0.078	0.119	0.141	0.158	0.170	0.179	0.184	0.186	0.187	0.187
2011	0.001	0.006	0.031	0.093	0.142	0.167	0.187	0.201	0.211	0.217	0.220	0.221	0.220
2012	0.001	0.005	0.028	0.088	0.131	0.150	0.162	0.171	0.177	0.180	0.181	0.180	0.179
2013	0.001	0.006	0.032	0.096	0.146	0.174	0.195	0.211	0.222	0.229	0.233	0.234	0.234
2014	0.001	0.006	0.033	0.103	0.153	0.173	0.186	0.196	0.201	0.204	0.205	0.204	0.202

Chesapeake Bay													
Year	Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.0016	0.2399	0.8105	0.5333	0.3456	0.2240	0.1451	0.0941	0.0610	0.0395	0.0256	0.0166	0.0129
1983	0.0001	0.0199	0.0672	0.0442	0.0287	0.0186	0.0120	0.0078	0.0051	0.0033	0.0021	0.0014	0.0011
1984	0.0003	0.0401	0.1353	0.0890	0.0577	0.0374	0.0242	0.0157	0.0102	0.0066	0.0043	0.0028	0.0022
1985	0.0003	0.0052	0.0085	0.0072	0.0060	0.0050	0.0041	0.0034	0.0028	0.0024	0.0020	0.0016	0.0013
1986	0.0001	0.0021	0.0035	0.0030	0.0025	0.0021	0.0017	0.0014	0.0012	0.0010	0.0008	0.0007	0.0006
1987	0.0000	0.0009	0.0014	0.0012	0.0010	0.0008	0.0007	0.0006	0.0005	0.0004	0.0003	0.0003	0.0002
1988	0.0001	0.0014	0.0024	0.0020	0.0017	0.0014	0.0012	0.0010	0.0008	0.0007	0.0006	0.0005	0.0004
1989	0.0000	0.0005	0.0008	0.0007	0.0006	0.0005	0.0004	0.0003	0.0003	0.0002	0.0002	0.0002	0.0001
1990	0.0002	0.0011	0.0065	0.0153	0.0149	0.0119	0.0093	0.0072	0.0056	0.0043	0.0034	0.0026	0.0020
1991	0.0002	0.0016	0.0096	0.0225	0.0219	0.0175	0.0136	0.0106	0.0082	0.0064	0.0050	0.0038	0.0030
1992	0.0002	0.0015	0.0089	0.0210	0.0205	0.0163	0.0127	0.0099	0.0077	0.0060	0.0046	0.0036	0.0028
1993	0.0003	0.0021	0.0125	0.0293	0.0286	0.0228	0.0178	0.0138	0.0107	0.0083	0.0065	0.0050	0.0039
1994	0.0004	0.0028	0.0168	0.0394	0.0385	0.0307	0.0239	0.0186	0.0144	0.0112	0.0087	0.0067	0.0052
1995	0.0005	0.0034	0.0201	0.0472	0.0461	0.0368	0.0286	0.0222	0.0173	0.0134	0.0104	0.0081	0.0063
1996	0.0005	0.0028	0.0144	0.0421	0.0565	0.0545	0.0493	0.0441	0.0394	0.0352	0.0315	0.0281	0.0251
1997	0.0006	0.0033	0.0168	0.0491	0.0659	0.0635	0.0574	0.0514	0.0459	0.0410	0.0367	0.0327	0.0293
1998	0.0005	0.0030	0.0152	0.0446	0.0599	0.0578	0.0522	0.0467	0.0417	0.0373	0.0333	0.0298	0.0266
1999	0.0004	0.0025	0.0130	0.0381	0.0511	0.0493	0.0446	0.0399	0.0356	0.0318	0.0284	0.0254	0.0227
2000	0.0005	0.0029	0.0149	0.0437	0.0587	0.0567	0.0512	0.0458	0.0409	0.0366	0.0327	0.0292	0.0261
2001	0.0004	0.0026	0.0131	0.0384	0.0515	0.0497	0.0449	0.0402	0.0359	0.0321	0.0287	0.0256	0.0229
2002	0.0004	0.0021	0.0106	0.0311	0.0417	0.0402	0.0364	0.0325	0.0291	0.0260	0.0232	0.0207	0.0185
2003	0.0006	0.0034	0.0173	0.0507	0.0680	0.0656	0.0593	0.0531	0.0474	0.0424	0.0379	0.0338	0.0302
2004	0.0005	0.0030	0.0152	0.0446	0.0599	0.0577	0.0522	0.0467	0.0417	0.0373	0.0333	0.0298	0.0266
2005	0.0005	0.0032	0.0163	0.0478	0.0641	0.0619	0.0559	0.0501	0.0447	0.0400	0.0357	0.0319	0.0285
2006	0.0007	0.0039	0.0198	0.0581	0.0779	0.0752	0.0680	0.0608	0.0543	0.0485	0.0434	0.0387	0.0346
2007	0.0006	0.0035	0.0180	0.0528	0.0709	0.0684	0.0618	0.0553	0.0494	0.0442	0.0395	0.0353	0.0315
2008	0.0005	0.0027	0.0137	0.0402	0.0539	0.0520	0.0470	0.0421	0.0376	0.0336	0.0300	0.0268	0.0240
2009	0.0005	0.0032	0.0164	0.0481	0.0645	0.0623	0.0563	0.0504	0.0450	0.0402	0.0359	0.0321	0.0287
2010	0.0005	0.0030	0.0154	0.0451	0.0605	0.0584	0.0528	0.0472	0.0422	0.0377	0.0337	0.0301	0.0269
2011	0.0005	0.0030	0.0152	0.0444	0.0596	0.0575	0.0520	0.0465	0.0416	0.0371	0.0332	0.0296	0.0265
2012	0.0005	0.0027	0.0137	0.0401	0.0538	0.0519	0.0469	0.0420	0.0375	0.0335	0.0300	0.0268	0.0239
2013	0.0005	0.0031	0.0157	0.0460	0.0617	0.0596	0.0538	0.0482	0.0430	0.0385	0.0344	0.0307	0.0274
2014	0.0006	0.0032	0.0165	0.0483	0.0649	0.0626	0.0566	0.0506	0.0453	0.0404	0.0361	0.0323	0.0288

Table 24 cont.

Year	Ocean Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.0005	0.0057	0.0486	0.1365	0.1582	0.1570	0.1537	0.1502	0.1468	0.1435	0.1403	0.1371	0.1340
1983	0.0004	0.0043	0.0367	0.1031	0.1194	0.1186	0.1161	0.1134	0.1109	0.1084	0.1059	0.1035	0.1012
1984	0.0002	0.0022	0.0185	0.0520	0.0602	0.0598	0.0585	0.0572	0.0559	0.0546	0.0534	0.0522	0.0510
1985	0.0003	0.0020	0.0080	0.0193	0.0342	0.0497	0.0633	0.0740	0.0819	0.0875	0.0913	0.0938	0.0955
1986	0.0001	0.0012	0.0047	0.0113	0.0201	0.0292	0.0371	0.0434	0.0481	0.0514	0.0536	0.0551	0.0561
1987	0.0001	0.0006	0.0022	0.0052	0.0093	0.0135	0.0172	0.0201	0.0222	0.0238	0.0248	0.0255	0.0259
1988	0.0001	0.0008	0.0030	0.0073	0.0130	0.0188	0.0240	0.0280	0.0310	0.0331	0.0346	0.0355	0.0362
1989	0.0001	0.0005	0.0020	0.0049	0.0087	0.0127	0.0162	0.0189	0.0209	0.0223	0.0233	0.0240	0.0244
1990	0.0000	0.0011	0.0056	0.0109	0.0141	0.0157	0.0164	0.0166	0.0167	0.0168	0.0168	0.0168	0.0168
1991	0.0000	0.0014	0.0074	0.0143	0.0186	0.0207	0.0216	0.0220	0.0221	0.0222	0.0222	0.0222	0.0222
1992	0.0000	0.0016	0.0085	0.0164	0.0213	0.0236	0.0246	0.0251	0.0252	0.0253	0.0253	0.0253	0.0253
1993	0.0000	0.0017	0.0091	0.0175	0.0228	0.0253	0.0264	0.0268	0.0270	0.0271	0.0271	0.0271	0.0271
1994	0.0000	0.0022	0.0113	0.0218	0.0284	0.0316	0.0329	0.0335	0.0337	0.0338	0.0338	0.0338	0.0338
1995	0.0001	0.0036	0.0188	0.0363	0.0472	0.0525	0.0547	0.0556	0.0560	0.0561	0.0562	0.0562	0.0562
1996	0.0001	0.0036	0.0185	0.0358	0.0465	0.0517	0.0539	0.0548	0.0552	0.0553	0.0554	0.0554	0.0554
1997	0.0003	0.0024	0.0103	0.0268	0.0501	0.0755	0.0989	0.1181	0.1327	0.1432	0.1506	0.1556	0.1590
1998	0.0002	0.0022	0.0093	0.0242	0.0452	0.0682	0.0893	0.1066	0.1198	0.1293	0.1360	0.1405	0.1436
1999	0.0002	0.0019	0.0081	0.0209	0.0391	0.0589	0.0772	0.0921	0.1035	0.1117	0.1174	0.1214	0.1240
2000	0.0003	0.0024	0.0102	0.0263	0.0492	0.0742	0.0972	0.1161	0.1304	0.1408	0.1480	0.1530	0.1563
2001	0.0003	0.0023	0.0099	0.0256	0.0478	0.0721	0.0944	0.1127	0.1266	0.1366	0.1436	0.1484	0.1517
2002	0.0003	0.0023	0.0097	0.0253	0.0472	0.0712	0.0933	0.1114	0.1251	0.1350	0.1420	0.1467	0.1499
2003	0.0003	0.0024	0.0103	0.0267	0.0500	0.0754	0.0987	0.1178	0.1324	0.1429	0.1502	0.1552	0.1586
2004	0.0003	0.0029	0.0125	0.0324	0.0607	0.0915	0.1198	0.1430	0.1607	0.1734	0.1824	0.1885	0.1926
2005	0.0003	0.0029	0.0126	0.0325	0.0609	0.0918	0.1202	0.1435	0.1612	0.1740	0.1829	0.1891	0.1932
2006	0.0004	0.0036	0.0153	0.0397	0.0741	0.1118	0.1465	0.1748	0.1964	0.2120	0.2229	0.2304	0.2354
2007	0.0003	0.0029	0.0125	0.0325	0.0607	0.0915	0.1199	0.1431	0.1608	0.1735	0.1824	0.1885	0.1927
2008	0.0004	0.0032	0.0137	0.0355	0.0664	0.1002	0.1312	0.1567	0.1760	0.1900	0.1997	0.2064	0.2109
2009	0.0003	0.0023	0.0097	0.0251	0.0469	0.0708	0.0927	0.1106	0.1243	0.1342	0.1411	0.1458	0.1490
2010	0.0003	0.0023	0.0099	0.0258	0.0482	0.0727	0.0952	0.1136	0.1276	0.1378	0.1448	0.1497	0.1530
2011	0.0003	0.0027	0.0115	0.0297	0.0555	0.0838	0.1097	0.1310	0.1471	0.1588	0.1670	0.1726	0.1763
2012	0.0002	0.0020	0.0085	0.0221	0.0412	0.0622	0.0814	0.0972	0.1092	0.1179	0.1239	0.1281	0.1309
2013	0.0003	0.0029	0.0123	0.0320	0.0598	0.0902	0.1182	0.1411	0.1585	0.1711	0.1799	0.1859	0.1900
2014	0.0002	0.0022	0.0094	0.0244	0.0457	0.0689	0.0902	0.1077	0.1210	0.1306	0.1373	0.1419	0.1450

Year	Commercial Discards Age												
	1	2	3	4	5	6	7	8	9	10	11	12	13+
1982	0.0006	0.0020	0.0070	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
1983	0.0004	0.0013	0.0045	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065
1984	0.0005	0.0017	0.0058	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083	0.0083
1985	0.0001	0.0005	0.0028	0.0111	0.0167	0.0145	0.0114	0.0088	0.0068	0.0053	0.0041	0.0032	0.0024
1986	0.0001	0.0009	0.0052	0.0206	0.0309	0.0269	0.0211	0.0164	0.0127	0.0098	0.0076	0.0059	0.0045
1987	0.0001	0.0005	0.0028	0.0111	0.0167	0.0145	0.0114	0.0088	0.0068	0.0053	0.0041	0.0032	0.0024
1988	0.0001	0.0008	0.0050	0.0195	0.0292	0.0254	0.0199	0.0154	0.0119	0.0092	0.0071	0.0055	0.0043
1989	0.0002	0.0011	0.0064	0.0252	0.0378	0.0329	0.0258	0.0200	0.0155	0.0120	0.0093	0.0072	0.0055
1990	0.0003	0.0015	0.0069	0.0267	0.0563	0.0563	0.0422	0.0300	0.0211	0.0148	0.0104	0.0073	0.0051
1991	0.0002	0.0009	0.0039	0.0152	0.0321	0.0321	0.0240	0.0171	0.0120	0.0084	0.0059	0.0042	0.0029
1992	0.0001	0.0004	0.0019	0.0074	0.0156	0.0156	0.0117	0.0083	0.0058	0.0041	0.0029	0.0020	0.0014
1993	0.0001	0.0007	0.0031	0.0119	0.0252	0.0252	0.0189	0.0134	0.0094	0.0066	0.0047	0.0033	0.0023
1994	0.0001	0.0006	0.0028	0.0109	0.0230	0.0230	0.0172	0.0122	0.0086	0.0061	0.0043	0.0030	0.0021
1995	0.0002	0.0008	0.0038	0.0147	0.0309	0.0309	0.0232	0.0165	0.0116	0.0081	0.0057	0.0040	0.0028
1996	0.0001	0.0013	0.0073	0.0100	0.0092	0.0082	0.0073	0.0065	0.0058	0.0052	0.0046	0.0041	0.0036
1997	0.0001	0.0007	0.0038	0.0052	0.0048	0.0043	0.0038	0.0034	0.0030	0.0027	0.0024	0.0021	0.0019
1998	0.0001	0.0010	0.0055	0.0076	0.0070	0.0062	0.0055	0.0049	0.0044	0.0039	0.0035	0.0031	0.0027
1999	0.0001	0.0007	0.0038	0.0052	0.0048	0.0043	0.0038	0.0034	0.0030	0.0027	0.0024	0.0021	0.0019
2000	0.0002	0.0020	0.0113	0.0155	0.0143	0.0127	0.0113	0.0101	0.0090	0.0080	0.0071	0.0063	0.0056
2001	0.0001	0.0010	0.0057	0.0078	0.0072	0.0064	0.0057	0.0051	0.0045	0.0040	0.0036	0.0032	0.0028
2002	0.0000	0.0006	0.0032	0.0044	0.0041	0.0036	0.0032	0.0029	0.0026	0.0023	0.0020	0.0018	0.0016
2003	0.0000	0.0002	0.0015	0.0064	0.0089	0.0088	0.0084	0.0079	0.0075	0.0071	0.0067	0.0063	0.0060
2004	0.0000	0.0003	0.0027	0.0114	0.0158	0.0156	0.0148	0.0140	0.0132	0.0125	0.0118	0.0112	0.0105
2005	0.0001	0.0005	0.0046	0.0192	0.0268	0.0264	0.0251	0.0237	0.0224	0.0212	0.0200	0.0189	0.0178
2006	0.0000	0.0001	0.0012	0.0049	0.0068	0.0068	0.0064	0.0061	0.0057	0.0054	0.0051	0.0048	0.0046
2007	0.0000	0.0004	0.0035	0.0148	0.0207	0.0204	0.0194	0.0183	0.0173	0.0163	0.0154	0.0146	0.0138
2008	0.0000	0.0002	0.0019	0.0079	0.0109	0.0108	0.0103	0.0097	0.0092	0.0087	0.0082	0.0077	0.0073
2009	0.0001	0.0005	0.0040	0.0166	0.0231	0.0228	0.0217	0.0205	0.0193	0.0183	0.0173	0.0163	0.0154
2010	0.0000	0.0002	0.0018	0.0076	0.0105	0.0104	0.0099	0.0093	0.0088	0.0083	0.0079	0.0074	0.0070
2011	0.0001	0.0005	0.0045	0.0191	0.0265	0.0262	0.0249	0.0235	0.0222	0.0210	0.0198	0.0187	0.0177
2012	0.0001	0.0007	0.0061	0.0257	0.0358	0.0354	0.0336	0.0317	0.0300	0.0283	0.0267	0.0253	0.0239
2013	0.0001	0.0005	0.0042	0.0177	0.0246	0.0243	0.0231	0.0218	0.0206	0.0194	0.0184	0.0173	0.0164
2014	0.0001	0.0008	0.0072	0.0302	0.0421	0.0416	0.0395	0.0373	0.0352	0.0333	0.0314	0.0297	0.0280

Table 25. Estimates of population abundance by age.

Year	Age													Total	8+
	1	2	3	4	5	6	7	8	9	10	11	12	13+		
1982	19,164,800	5,877,320	4,201,390	2,456,710	598,881	198,913	170,662	115,002	87,552	97,978	77,167	152,037	78,761	33,277,173	608,497
1983	46,186,300	6,174,050	2,324,490	1,126,690	894,979	279,032	111,266	107,869	76,763	60,612	69,531	55,710	169,053	57,636,345	539,538
1984	40,908,500	14,906,400	3,049,230	1,329,850	694,562	597,196	199,880	83,711	81,713	58,459	46,357	53,370	173,409	62,182,638	497,020
1985	39,887,500	13,202,300	7,227,720	1,657,500	823,521	476,819	444,450	157,078	66,436	65,294	46,939	37,355	183,486	64,276,397	556,587
1986	32,095,100	12,877,500	6,637,540	4,520,550	1,147,620	605,881	367,958	353,566	124,029	52,180	51,101	36,655	172,129	59,041,809	789,660
1987	42,690,600	10,363,800	6,496,720	4,175,870	3,138,390	847,204	472,742	298,273	286,249	100,346	42,207	41,341	169,027	69,122,769	937,443
1988	55,831,600	13,788,400	5,240,620	4,116,060	2,949,860	2,379,100	680,684	395,158	249,266	239,206	83,864	35,283	175,948	86,164,649	1,178,725
1989	62,126,900	18,030,200	6,964,100	3,307,220	2,875,160	2,198,820	1,879,720	560,071	325,344	205,365	197,222	69,198	174,519	98,913,839	1,531,719
1990	83,533,700	20,064,000	9,115,580	4,399,700	2,305,460	2,136,080	1,736,470	1,550,770	463,521	269,952	170,764	164,284	203,491	126,113,772	2,822,782
1991	68,563,500	26,971,100	10,127,300	5,702,720	3,000,320	1,648,580	1,624,280	1,396,570	1,264,880	382,011	224,150	142,552	308,667	121,356,630	3,718,830
1992	70,015,800	22,138,900	13,610,700	6,323,750	3,892,150	2,172,940	1,270,810	1,317,620	1,143,900	1,043,600	316,870	186,656	377,359	123,811,055	4,386,005
1993	90,969,700	22,610,200	11,176,100	8,512,510	4,347,430	2,862,240	1,699,820	1,041,450	1,086,110	947,163	867,040	263,927	471,104	146,854,794	4,676,794
1994	180,963,000	29,372,900	11,403,000	6,952,870	5,770,920	3,136,330	2,199,770	1,373,750	849,285	891,814	781,718	718,313	611,482	245,025,152	5,226,362
1995	114,886,000	58,425,100	14,797,100	7,049,390	4,650,520	4,107,880	2,381,650	1,758,220	1,108,810	690,687	729,414	642,099	1,096,980	212,323,850	6,026,210
1996	124,648,000	37,086,200	29,367,700	9,040,640	4,594,080	3,198,610	3,012,480	1,842,820	1,377,140	876,750	550,056	584,016	1,400,650	217,579,142	6,631,432
1997	153,941,000	40,239,800	18,645,400	17,987,700	5,952,620	3,197,810	2,359,060	2,321,580	1,427,410	1,072,100	685,762	432,073	1,568,770	249,831,085	7,507,695
1998	98,336,800	49,684,900	20,257,200	11,527,600	11,925,300	4,108,660	2,291,330	1,729,980	1,680,970	1,024,550	765,456	488,301	1,423,840	205,244,887	7,113,097
1999	100,575,000	31,740,100	25,017,700	12,534,000	7,678,380	8,302,880	2,977,050	1,702,470	1,271,050	1,225,650	743,623	554,324	1,384,330	195,706,557	6,881,447
2000	79,720,800	32,466,700	15,998,500	15,560,400	8,450,930	5,438,160	6,135,650	2,260,110	1,279,810	949,071	911,443	551,856	1,438,090	171,161,520	7,390,380
2001	118,508,000	25,729,000	16,329,300	9,836,740	10,269,600	5,824,460	3,895,570	4,501,300	1,637,960	919,813	678,710	650,200	1,419,080	200,199,733	9,807,063
2002	138,314,000	38,252,800	12,958,700	10,118,100	6,582,530	7,190,240	4,237,290	2,900,430	3,308,340	1,193,000	666,122	489,965	1,491,640	227,703,157	10,049,497
2003	76,283,800	44,651,200	19,284,500	8,070,300	6,845,430	4,671,170	5,299,620	3,193,260	2,155,620	2,434,420	872,133	485,057	1,439,140	175,685,650	10,579,630
2004	166,587,000	24,621,200	22,486,500	11,943,300	5,335,520	4,695,710	3,325,440	3,862,260	2,298,430	1,538,520	1,728,790	617,832	1,362,860	250,403,362	11,408,692
2005	93,274,000	53,767,100	12,396,300	13,908,300	7,860,150	3,625,770	3,293,040	2,374,480	2,711,520	1,594,540	1,059,300	1,185,250	1,355,080	198,404,830	10,280,170
2006	86,785,300	30,103,100	27,058,900	7,644,320	9,051,770	5,259,620	2,504,230	2,317,770	1,644,670	1,857,460	1,084,920	718,214	1,720,570	177,750,844	9,343,604
2007	65,913,200	28,004,800	15,135,500	16,638,800	4,959,790	6,013,790	3,583,410	1,728,370	1,566,600	1,095,360	1,225,410	711,873	1,595,420	148,172,323	7,923,033
2008	87,451,600	21,271,800	14,090,800	9,327,480	10,822,700	3,317,190	4,152,550	2,522,520	1,197,760	1,074,050	746,086	831,910	1,565,230	158,371,676	7,937,556
2009	61,360,500	28,226,400	10,711,100	8,725,370	6,168,220	7,391,540	2,330,500	2,960,060	1,762,650	825,065	732,890	506,201	1,620,180	133,320,676	8,407,046
2010	78,064,700	19,804,900	14,215,500	6,627,580	5,734,390	4,198,970	5,230,340	1,691,250	2,124,930	1,256,330	585,721	519,455	1,508,540	141,562,606	7,686,226
2011	97,968,500	25,197,700	9,978,090	8,821,670	4,405,470	3,964,030	3,014,410	3,844,650	1,227,910	1,529,770	899,816	418,418	1,447,910	162,718,344	9,368,474
2012	125,129,000	31,620,300	12,687,200	6,167,190	5,778,040	2,977,750	2,772,590	2,152,980	2,706,630	855,936	1,059,960	621,575	1,288,420	195,817,571	8,685,501
2013	31,872,000	40,390,900	15,933,700	7,863,880	4,060,850	3,947,940	2,120,540	2,029,600	1,561,910	1,952,290	615,532	761,554	1,374,360	114,485,056	8,295,246
2014	76,119,600	10,286,600	20,331,500	9,837,430	5,137,910	2,732,540	2,743,120	1,501,690	1,414,500	1,076,570	1,336,450	419,845	1,455,080	134,392,835	7,204,135

Table 26. Estimate of female spawning stock biomass-at-age by year.

Year	Age													Total	SD
	1	2	3	4	5	6	7	8	9	10	11	12	13+		
1982	0	0	0	59	87	197	481	466	416	713	748	1,532	1,037	5,736	1327.34
1983	0	0	0	27	128	230	256	403	378	397	580	534	1,768	4,701	1122.1
1984	0	0	0	35	106	503	557	307	433	370	347	578	2,031	5,267	1195.72
1985	0	0	0	51	113	434	1,220	605	357	412	364	344	2,405	6,305	1308.56
1986	0	0	0	165	173	473	872	1,277	562	284	352	307	2,081	6,545	1225.7
1987	0	0	0	145	528	646	1,014	976	1,290	544	278	351	2,109	7,883	1302.09
1988	0	0	0	139	567	2,323	1,657	1,254	1,062	1,167	604	314	2,213	11,300	1484.3
1989	0	0	0	115	536	2,481	5,781	2,306	1,540	1,371	1,415	601	2,212	18,359	1984.4
1990	0	0	0	147	362	2,107	5,132	6,490	2,253	1,410	1,190	1,368	2,434	22,893	2216.61
1991	0	0	0	196	501	1,323	4,536	5,486	6,679	2,033	1,703	1,060	4,166	27,681	2570.37
1992	0	0	0	205	696	2,003	3,436	5,255	6,302	7,002	2,494	1,996	5,002	34,390	3022.65
1993	0	0	0	283	745	2,630	4,688	4,340	6,063	6,387	7,157	2,550	6,502	41,345	3408.36
1994	0	0	0	250	1,017	2,820	6,154	5,752	4,682	5,750	6,520	6,858	7,378	47,181	3634.86
1995	0	0	0	266	820	3,826	7,040	7,357	6,433	4,976	4,950	5,728	17,280	58,677	4395.3
1996	0	0	0	339	907	3,474	10,234	8,762	8,404	6,595	4,531	5,022	18,109	66,379	4693.68
1997	0	0	0	720	1,075	3,060	6,478	8,882	8,010	8,116	5,931	3,913	21,651	67,836	4866.78
1998	0	0	0	319	1,851	3,246	6,146	6,598	8,769	6,133	5,503	4,380	15,809	58,755	4267.34
1999	0	0	0	320	951	5,509	5,912	6,016	6,635	8,015	5,459	4,646	15,551	59,014	4371.87
2000	0	0	0	390	1,034	3,737	13,017	7,386	6,864	5,839	7,440	5,078	18,200	68,987	5034.94
2001	0	0	0	284	1,379	4,524	8,873	15,122	8,115	6,027	5,011	5,084	14,422	68,842	4850.9
2002	0	0	0	263	918	5,656	10,166	10,569	15,711	7,440	5,180	4,208	16,078	76,190	5374.99
2003	0	0	0	195	924	3,675	12,390	11,198	10,523	14,402	6,383	4,093	14,775	78,558	5513.22
2004	0	0	0	284	760	3,619	7,834	13,379	11,001	9,024	12,106	4,958	13,576	76,541	5569.8
2005	0	0	0	356	1,045	2,943	7,747	8,789	13,436	9,418	7,611	10,159	15,349	76,854	6037.35
2006	0	0	0	183	1,140	3,744	5,570	8,246	8,616	11,304	7,842	5,915	19,197	71,757	6074.51
2007	0	0	0	355	627	4,453	8,403	6,010	8,295	7,062	9,575	6,231	18,934	69,945	6336.47
2008	0	0	0	222	1,377	2,744	11,236	9,276	6,198	7,253	5,818	7,280	17,448	68,852	6317.69
2009	0	0	0	211	741	5,907	5,964	11,710	9,418	5,283	5,634	4,308	18,513	67,687	6438.82
2010	0	0	0	160	706	3,308	12,735	6,048	10,721	8,043	4,492	4,266	16,332	66,811	6392.72
2011	0	0	0	232	543	2,957	7,126	13,380	6,128	9,437	6,414	3,671	17,631	67,520	6842.52
2012	0	0	0	169	811	2,320	6,835	8,241	13,755	5,732	8,138	5,527	16,670	68,197	7362.52
2013	0	0	0	186	574	3,272	5,011	7,301	8,287	12,183	4,900	6,918	16,790	65,423	7418.14
2014	0	0	0	215	666	2,100	6,717	5,317	7,573	7,348	10,341	4,247	19,394	63,918	7959.33

Figure 1. Time series of coast-wide commercial and recreational harvest in metric tons.

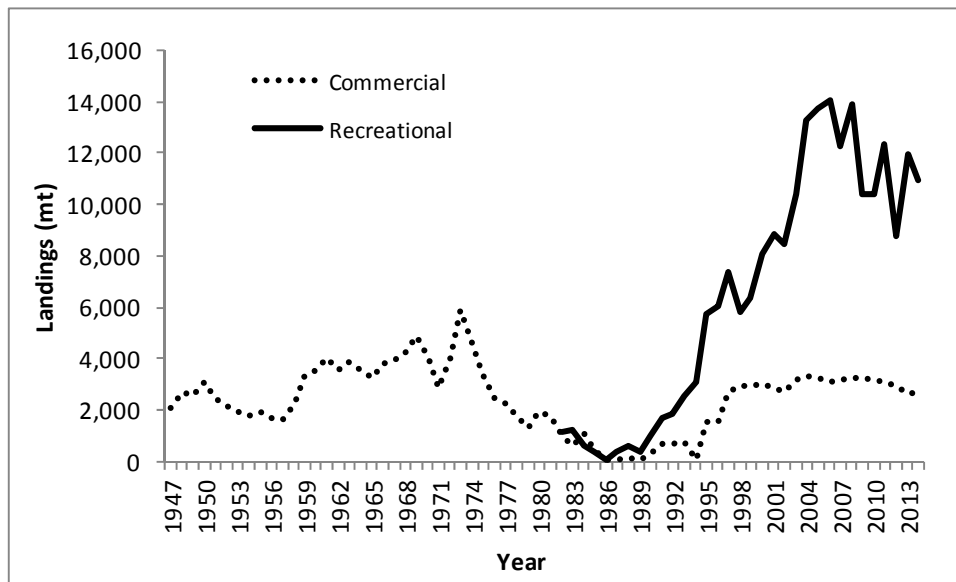


Figure 2. Time series of harvest and dead release/discard numbers from the coast-wide commercial and recreational fisheries during 1982-2014.

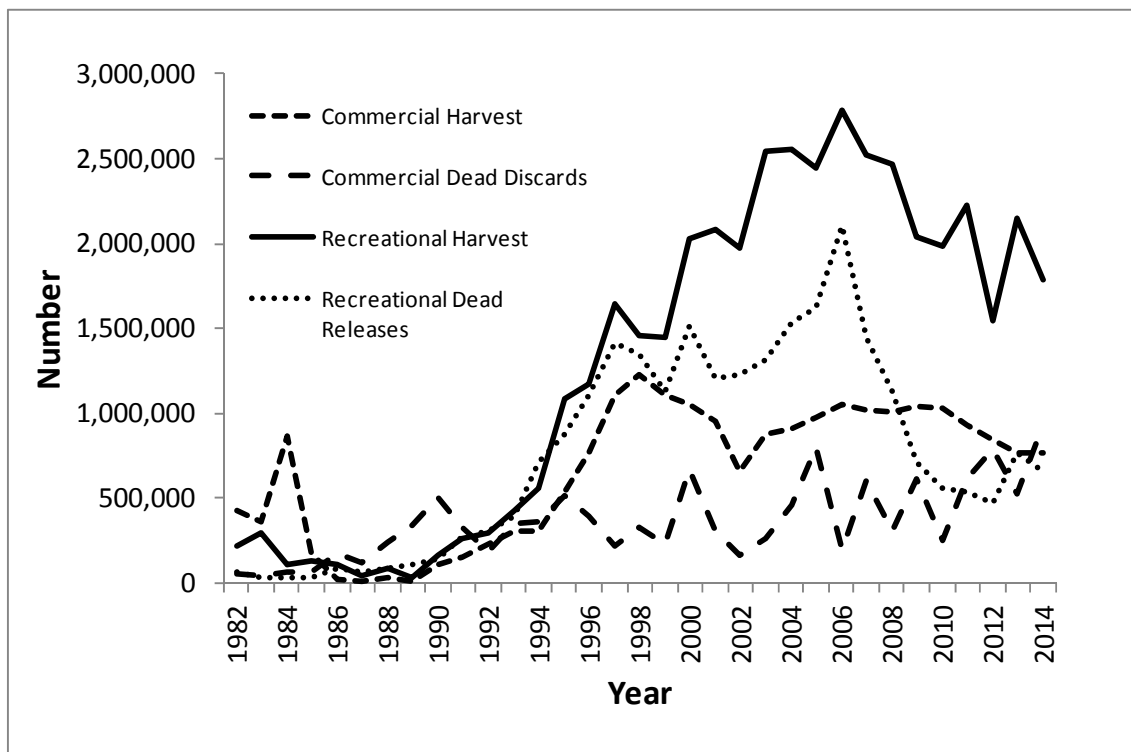


Figure 3. Percentage of total removals by fishery component in 2013 and 2014.

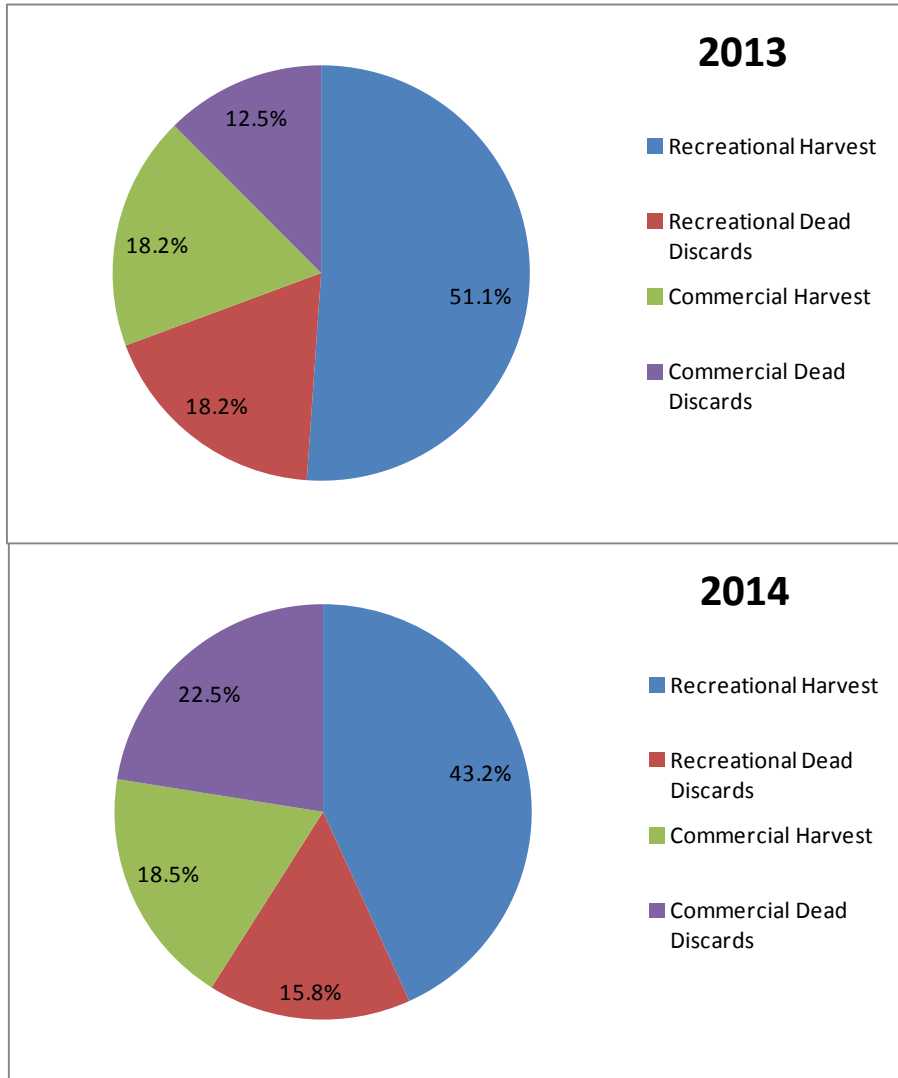


Figure 4. Total removals (numbers) of striped bass by regional fleets.

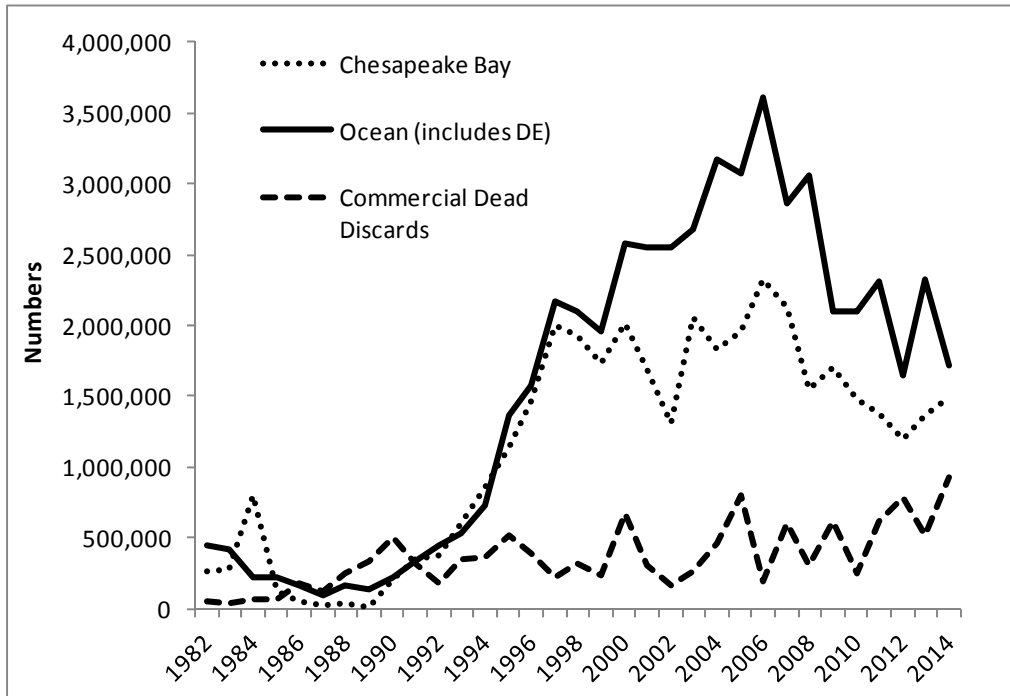


Figure 5. Fishery-independent and –dependent indices of relative abundance.

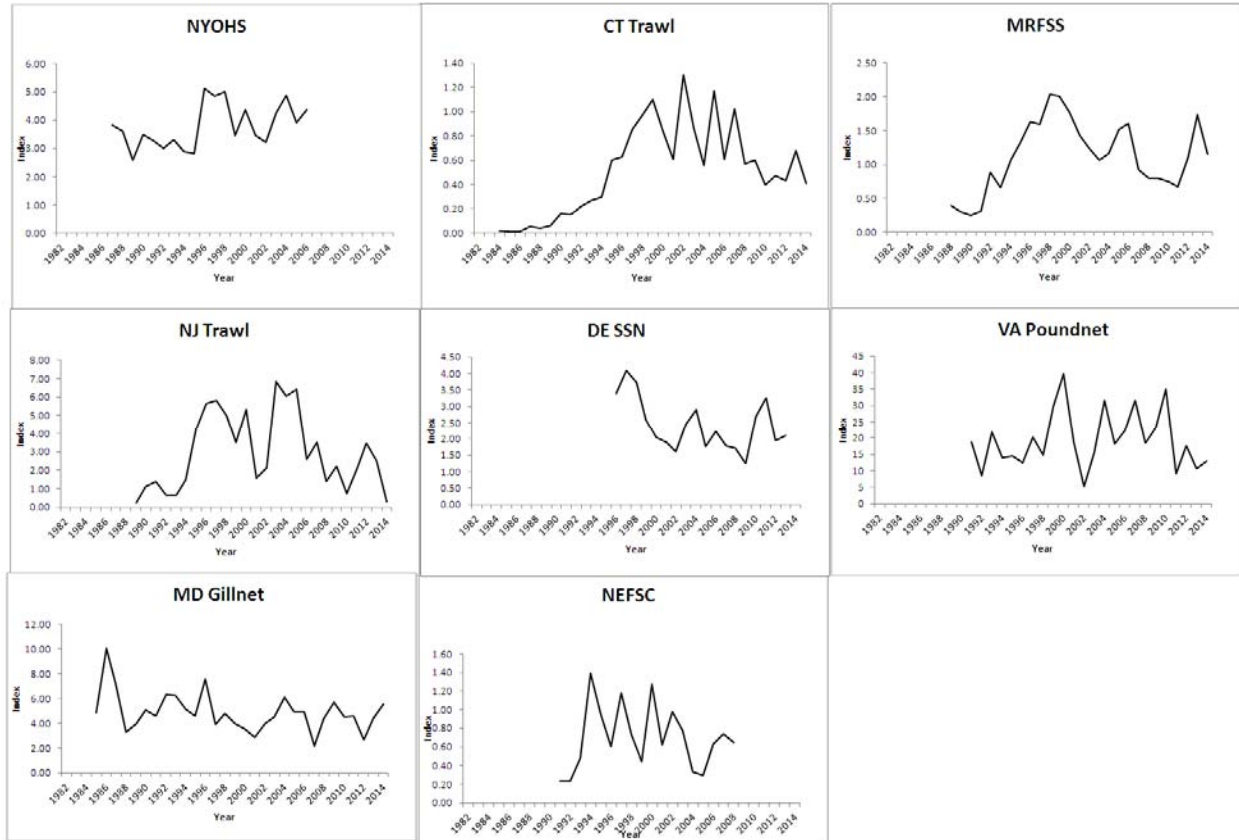


Figure 6. Young-of-the-year and age-1 indices of relative abundance.

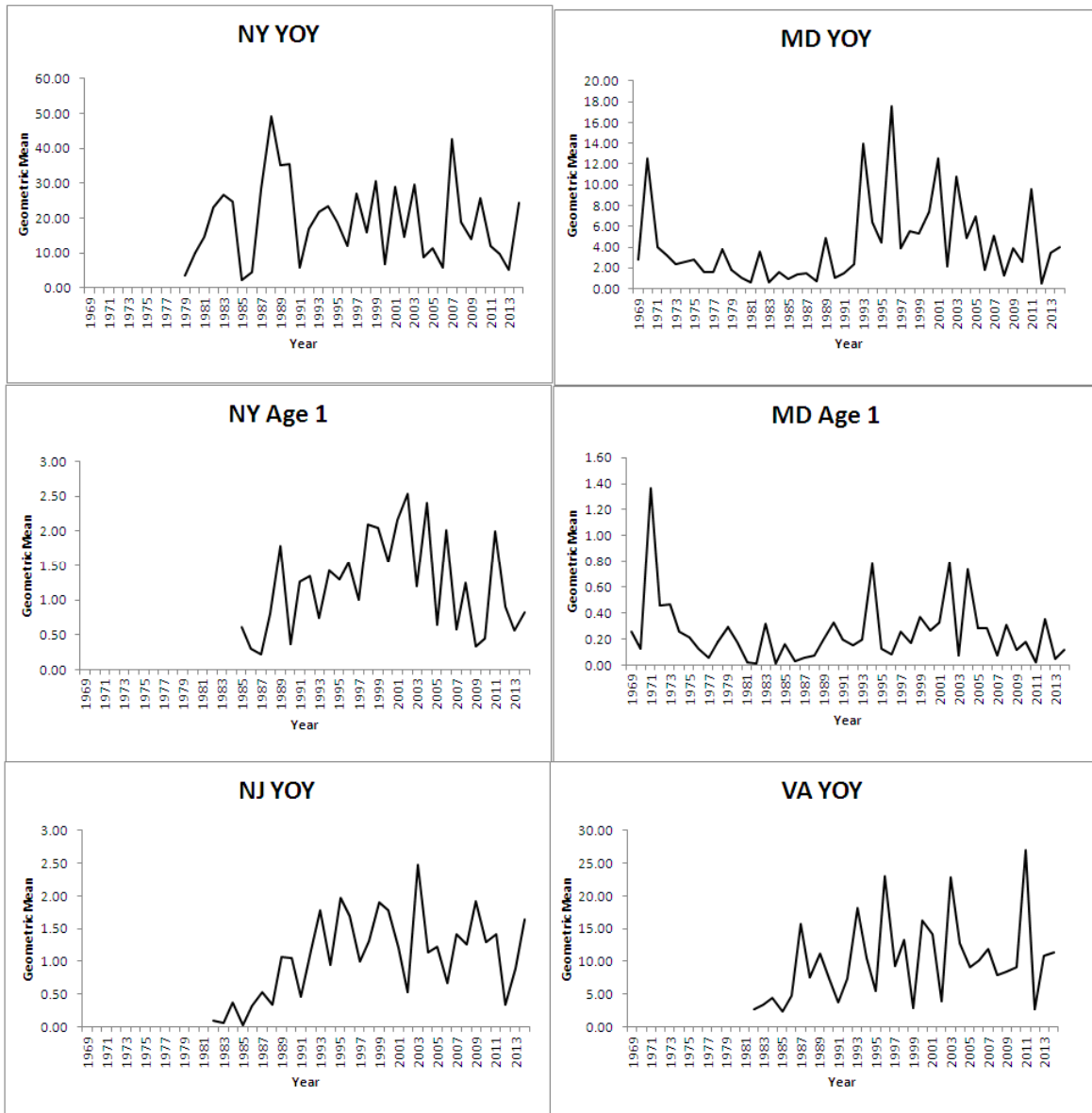


Figure 7. Observed and predicted total catch and standardized residuals by fleet (Fleet 1 = Bay, Fleet 2 = Ocean, Fleet 3 = Commercial Discards).

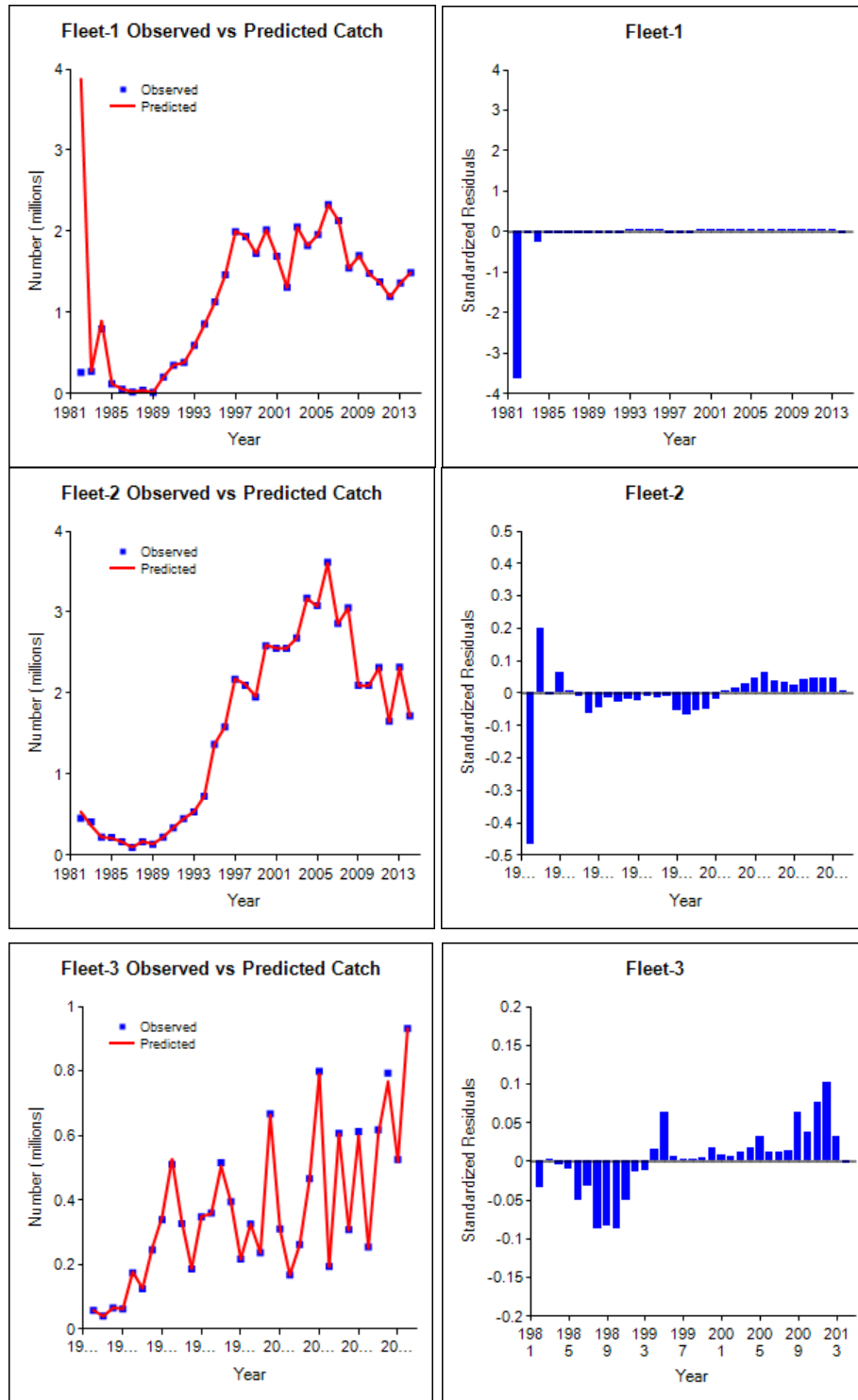


Figure 8. Catch selectivity patterns by fleet (Fleet 1 = Bay, Fleet 2 = Ocean, Fleet 3 = Commercial Discards).

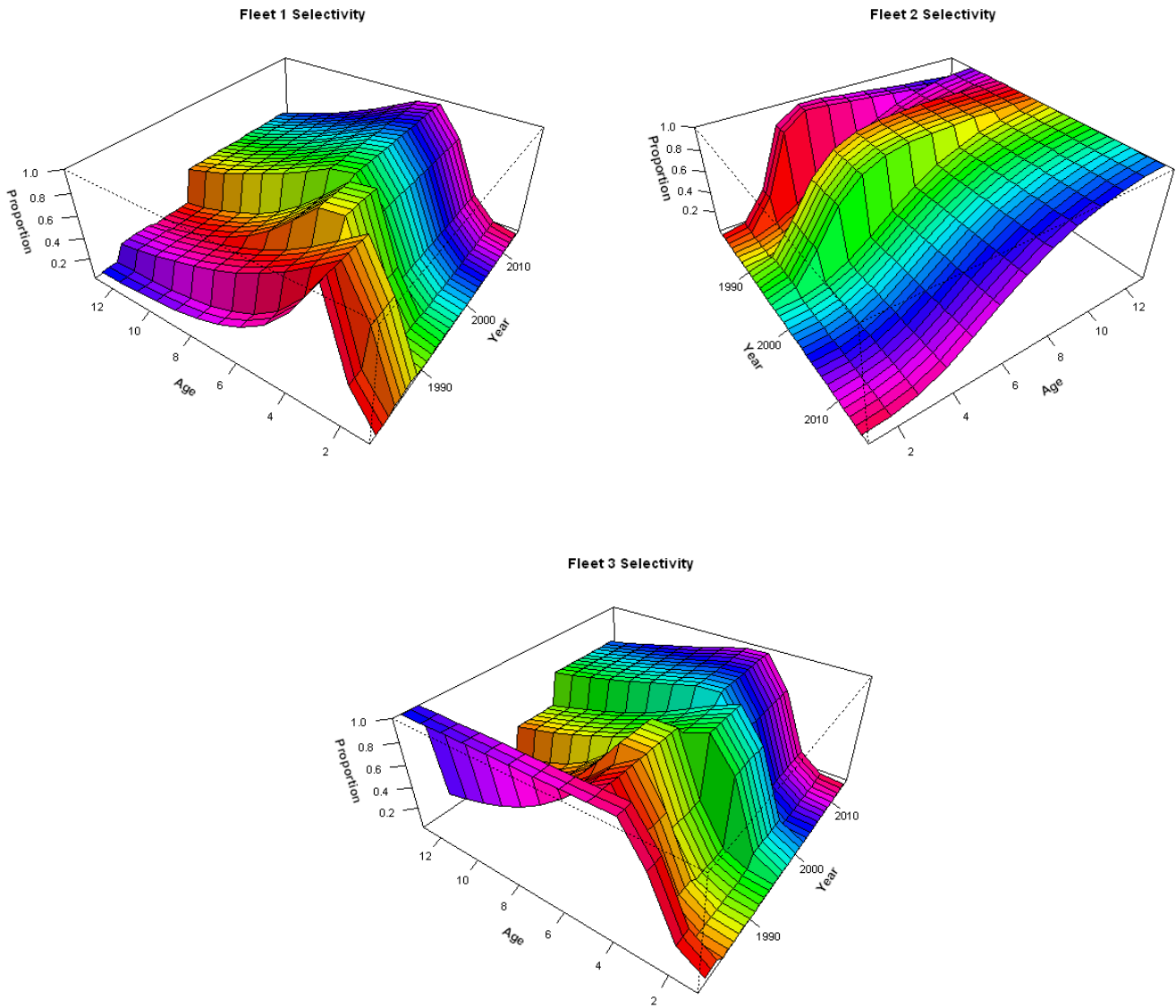


Figure 9. Estimates of total and fleet-specific fully-recruited fishing mortality (± 1 SD) and recruitment (± 1 SD) from the SCA base model run.

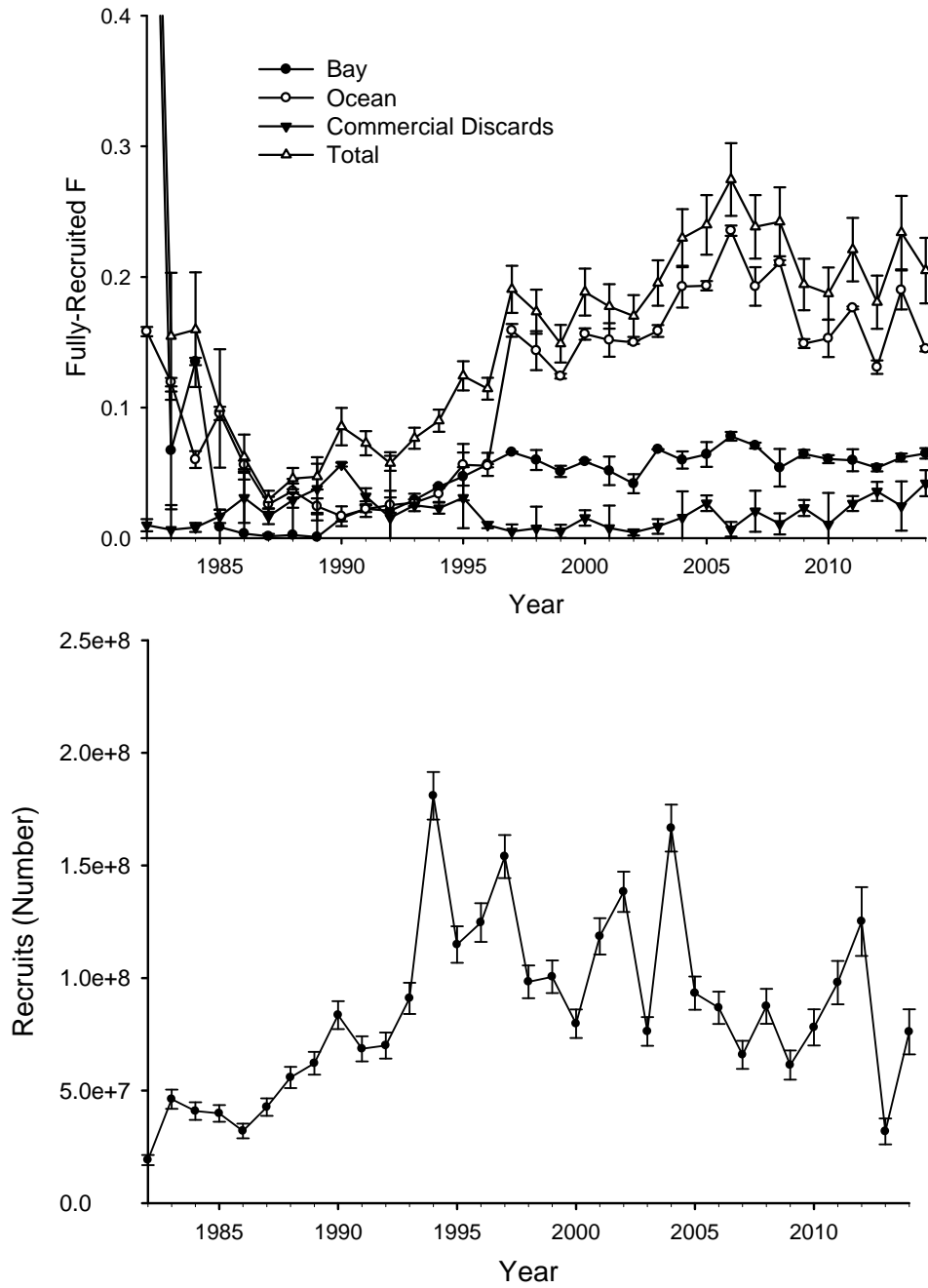


Figure 10. Comparison of fishing mortality-at-age in 2013 and 2014 from the SCA model partitioned into fleets.

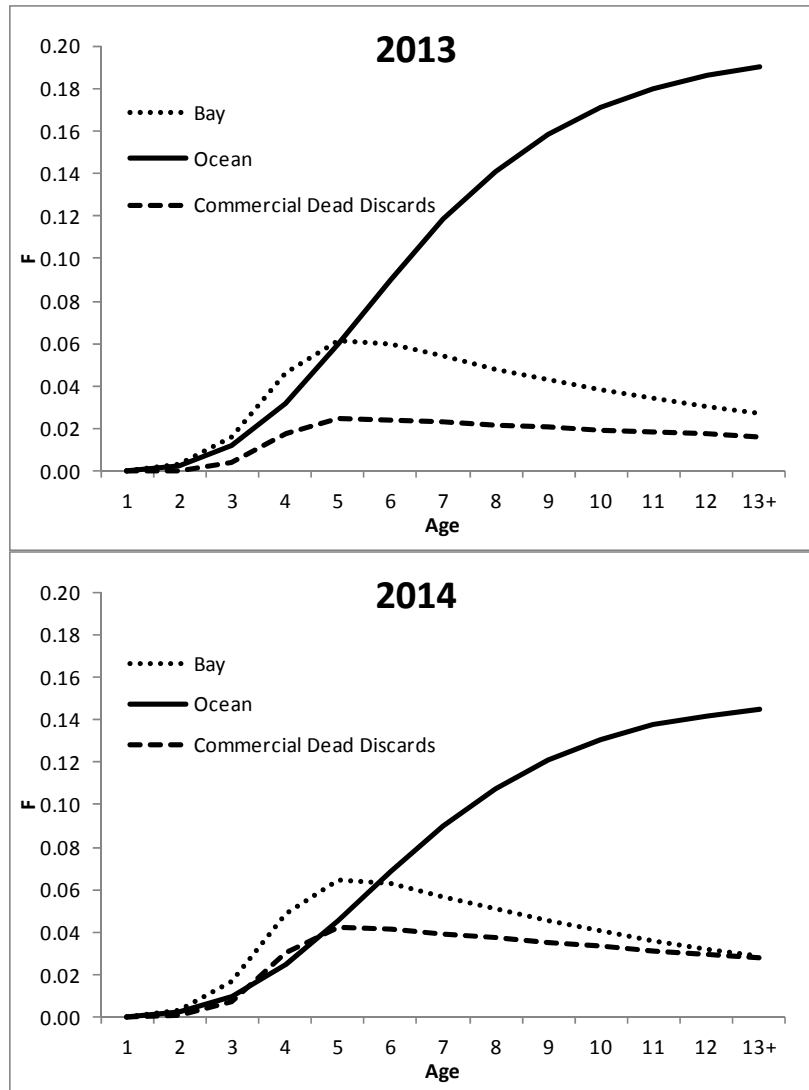


Figure 11. Estimates of January-1 total (age 1+) and 8+ abundance for 1982-2015. January-1 abundance for age 1 in 2015 was estimated from the 2014 observed values of the YOY indices and SCA model catchability coefficients, while older ages were projected from January-1 abundances and fishing and natural mortalities-at-age for 2014.

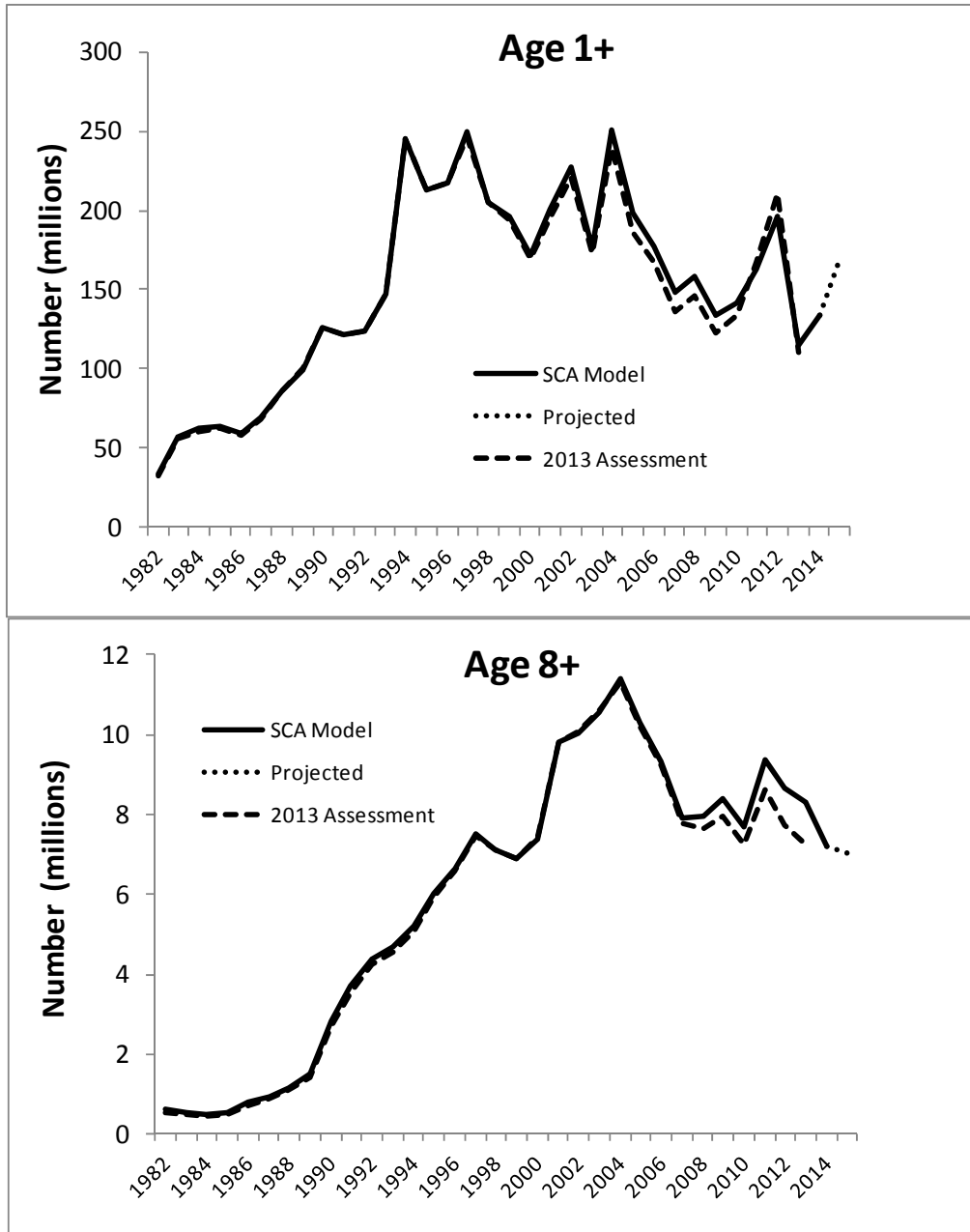


Figure 12. Estimates of A) female spawning stock biomass by year (solid line), B) female spawning stock numbers, and C) 1+ and 2+ January-1 biomass . Dotted lines equal 95% confidence intervals. Dashed line is the female spawning stock reference point (1995 value).

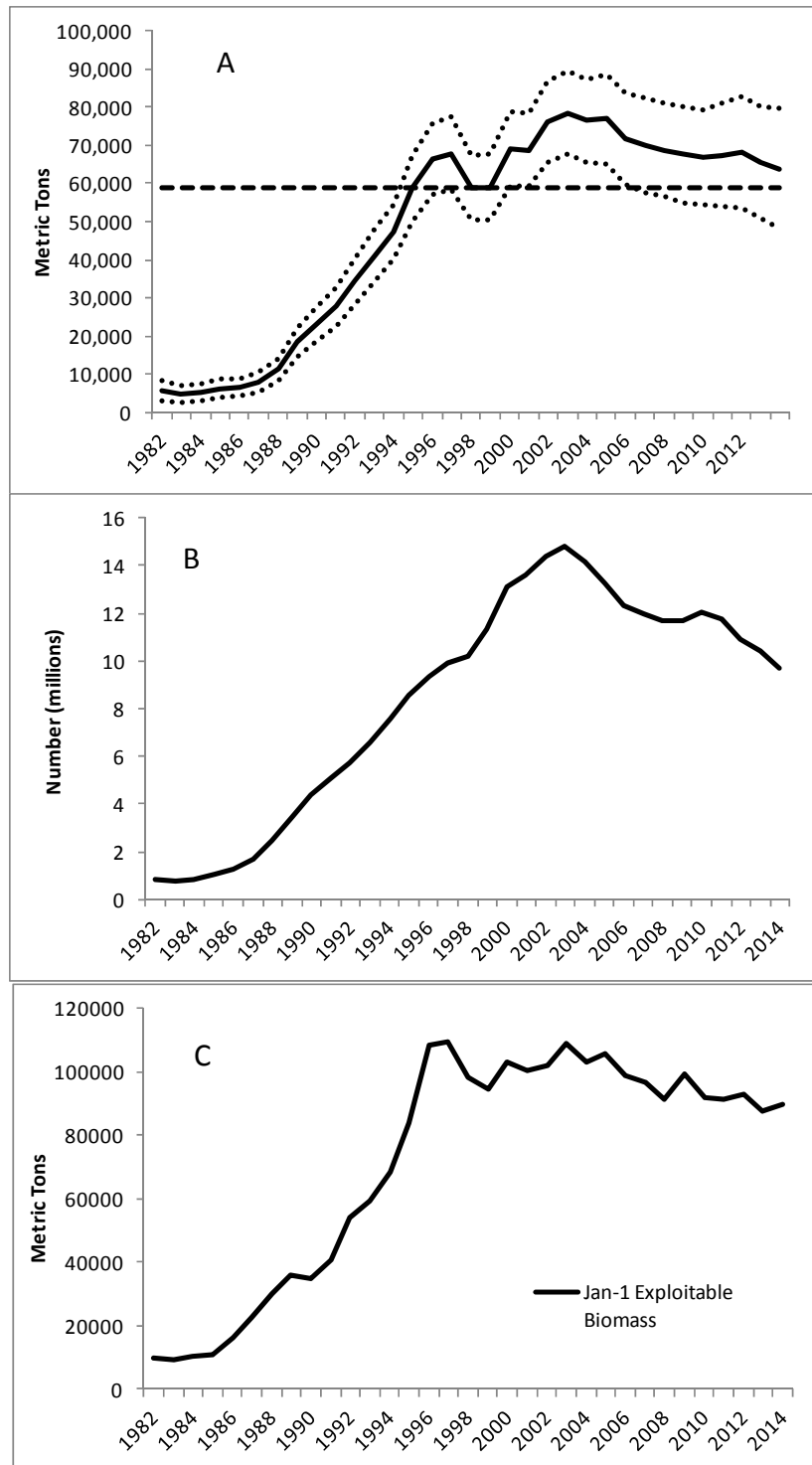


Figure 13. Retrospective analysis of fully-recruited F, female spawning stock biomass, 8+ abundance and Age 1 recruits.

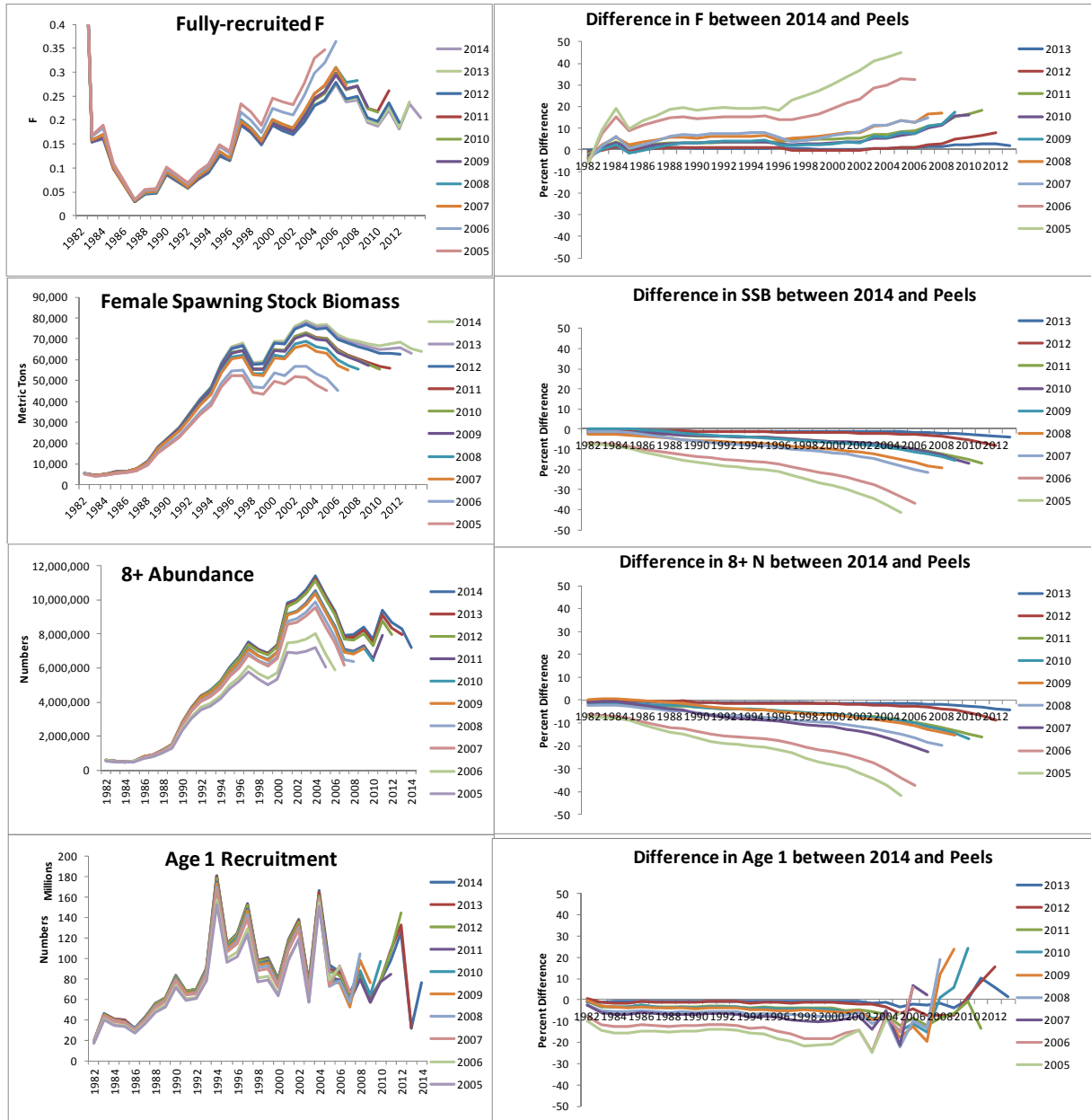


Table 14. Comparison of coast-wide fully-recruited (age-11) fishing mortality and female spawning stock biomass estimates between the 2015 and 2013 assessments.

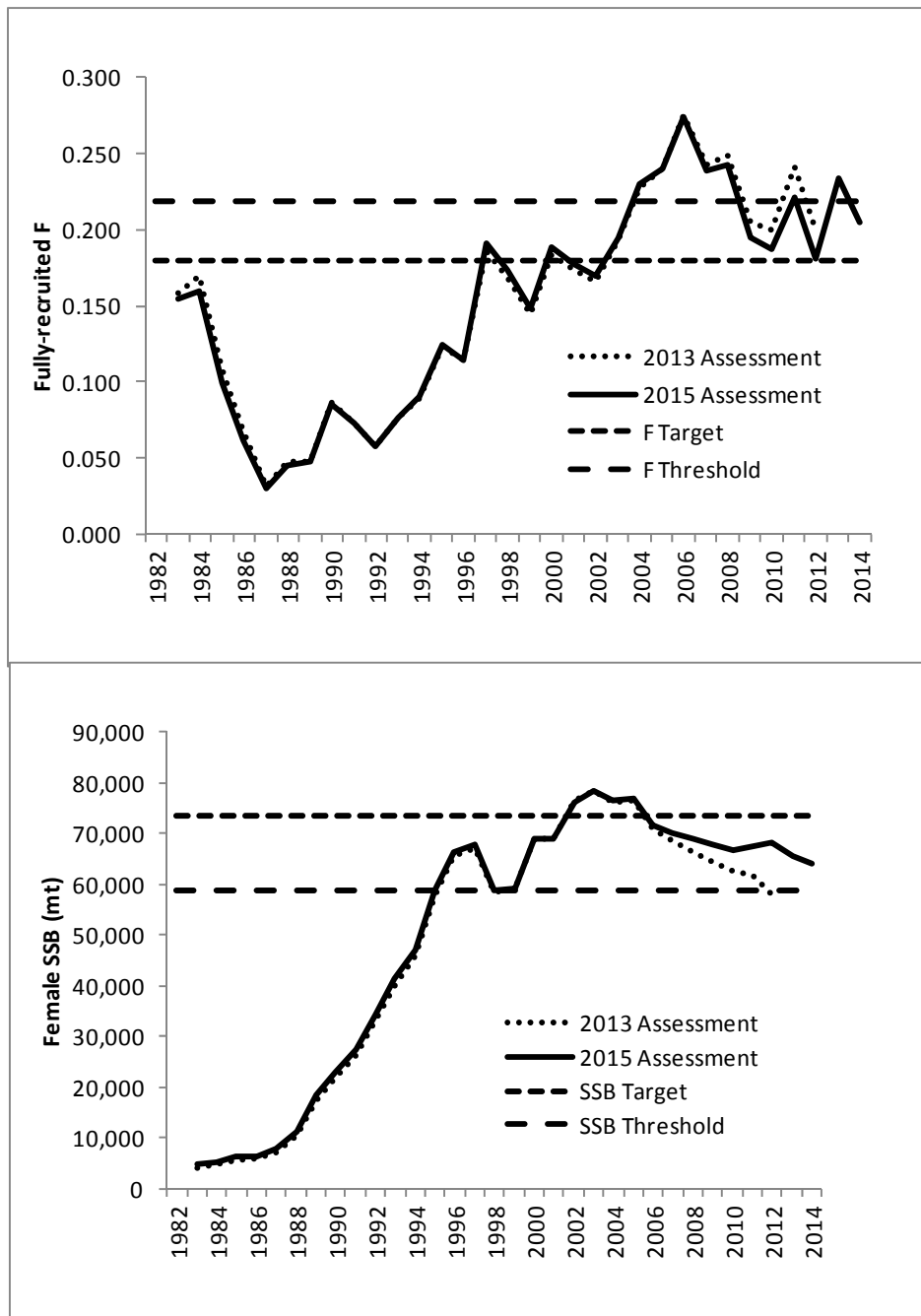


Figure 15. Projections of female spawning stock biomass and estimated fishing mortality assuming constant catch during 2015-2017. The graph on the left contains the projected estimates (median is the solid line with circle; 95% confidence intervals are dashed lines) compared to the reference point (dotted lines), and the graph on the right is the probability of the estimate comparison.

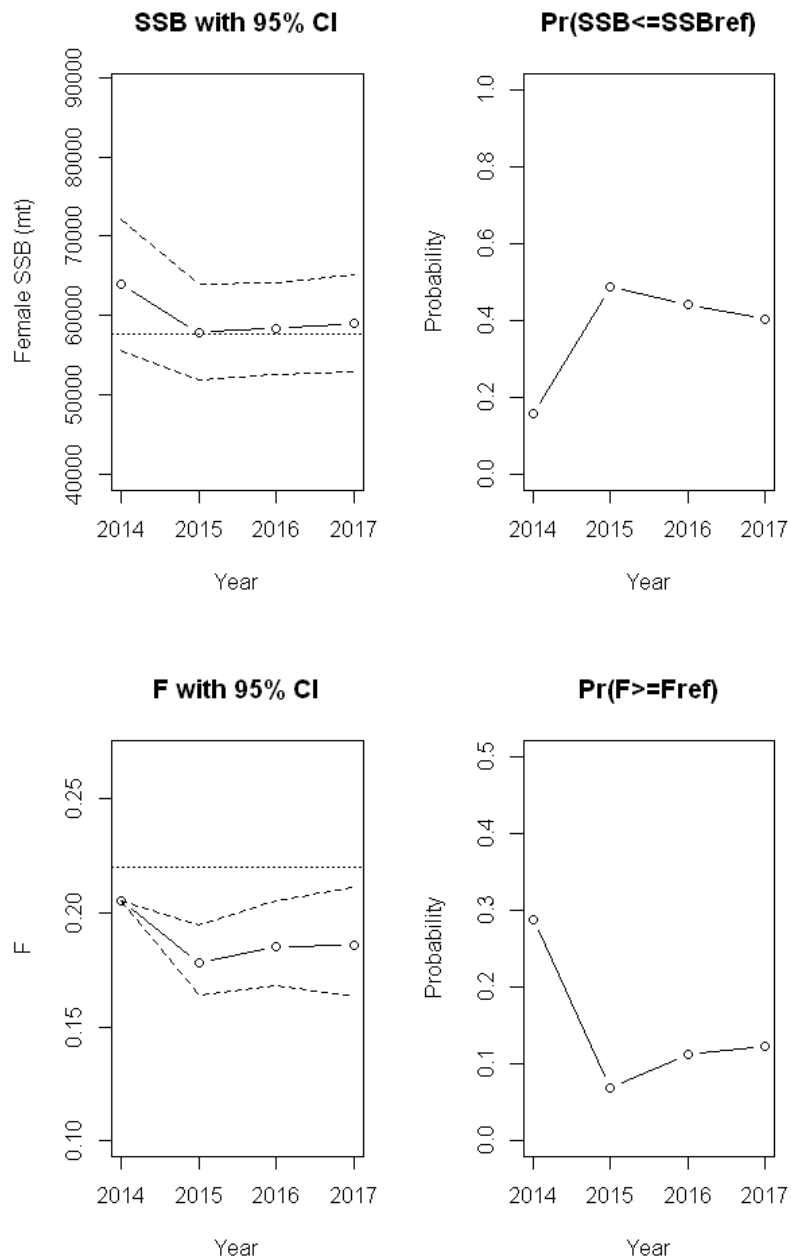


Figure 16. Projections of female spawning stock biomass and estimated fishing mortality assuming constant catch during 2015-2017 and adjusting the numbers-at-age in 2014 for the average age-specific retrospective bias in 2009-2013. The graph on the left contains the projected estimates (median is the solid line with circle; 95% confidence intervals are dashed lines) compared to the reference point (dotted lines), and the graph on the right is the probability of the estimate comparison.

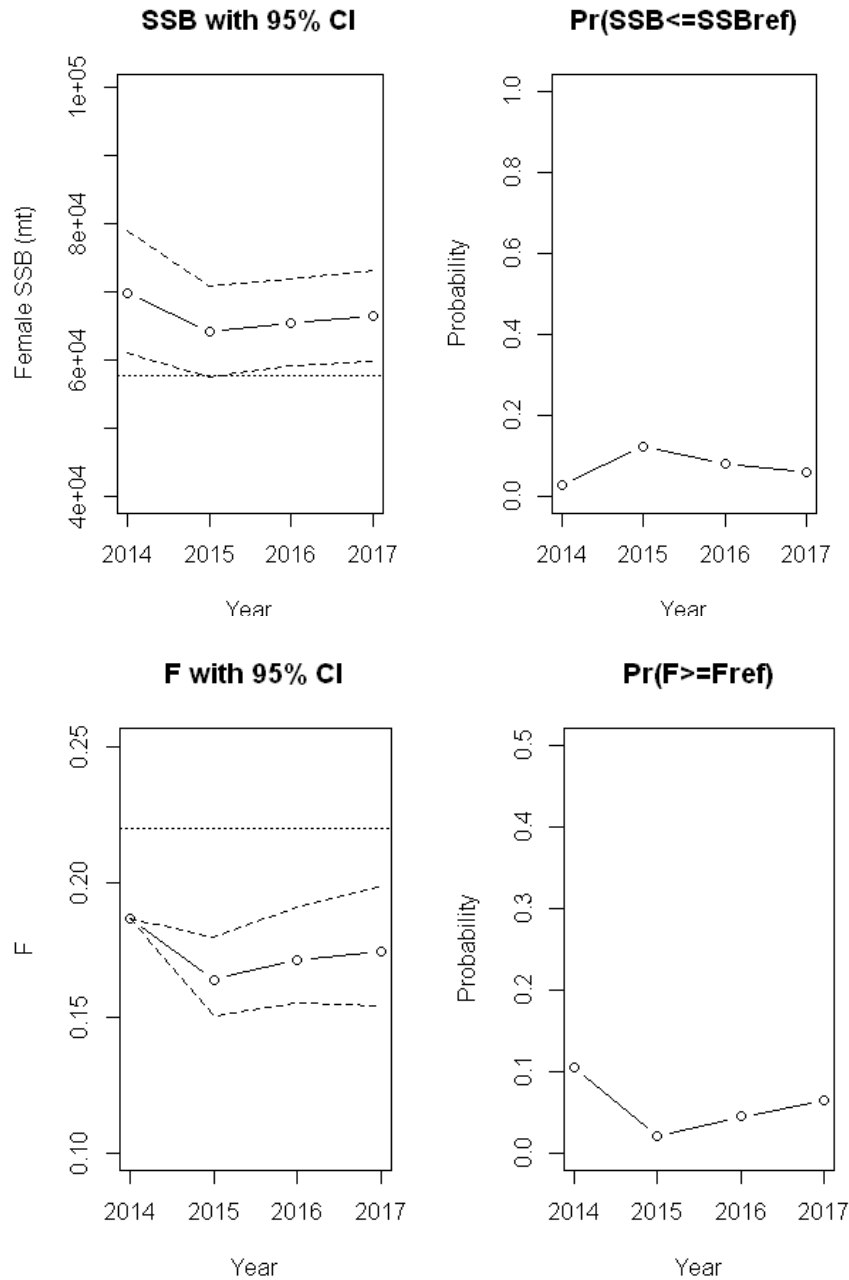


Figure 17. Projections of female spawning stock biomass and estimated fishing mortality assuming constant catch during 2015-2017. The graph on the left contains the projected estimates (median is the solid line with circle; 95% confidence intervals are dashed lines) compared to the targets (dotted lines), and the graph on the right is the probability of the estimate comparison.

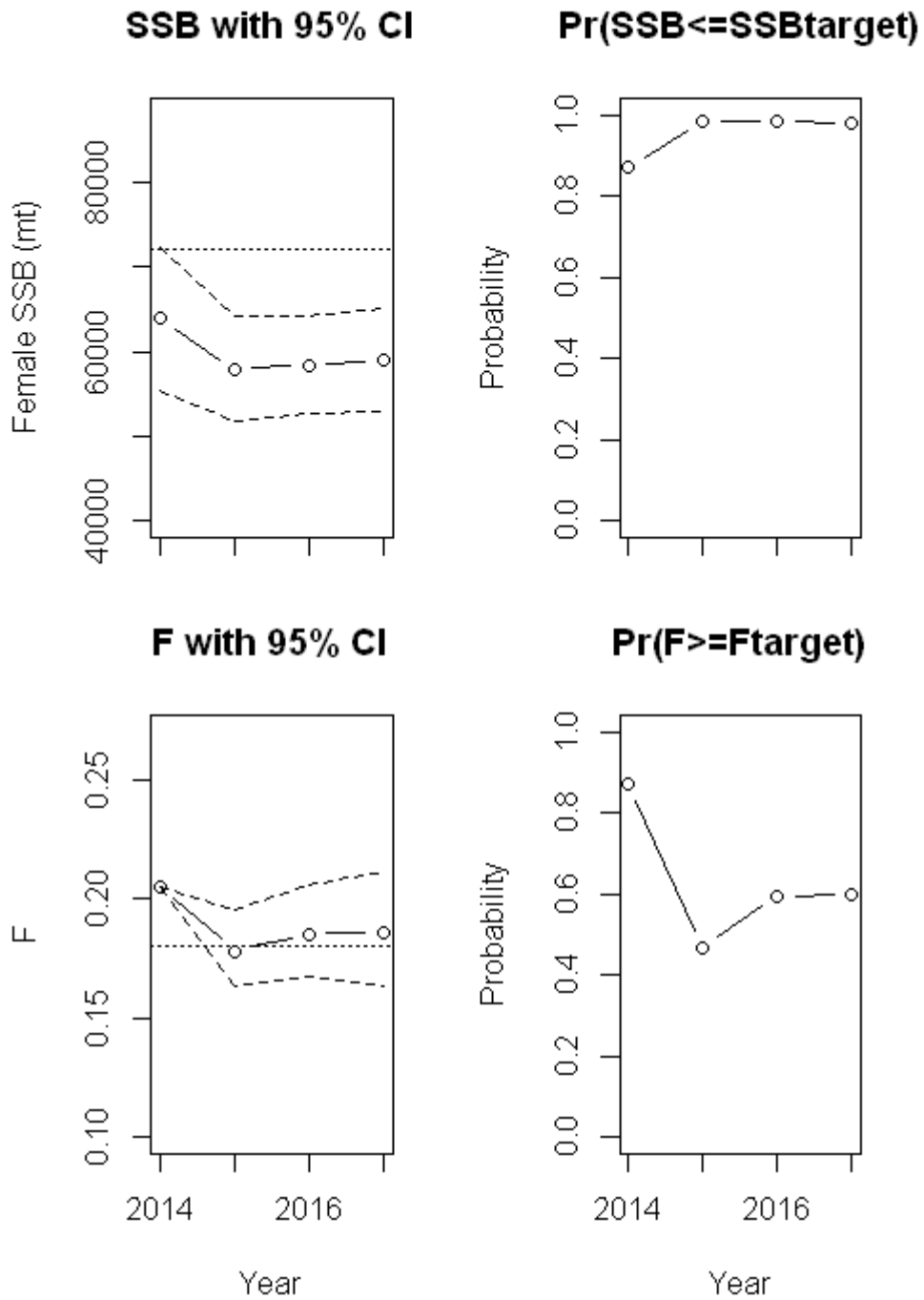
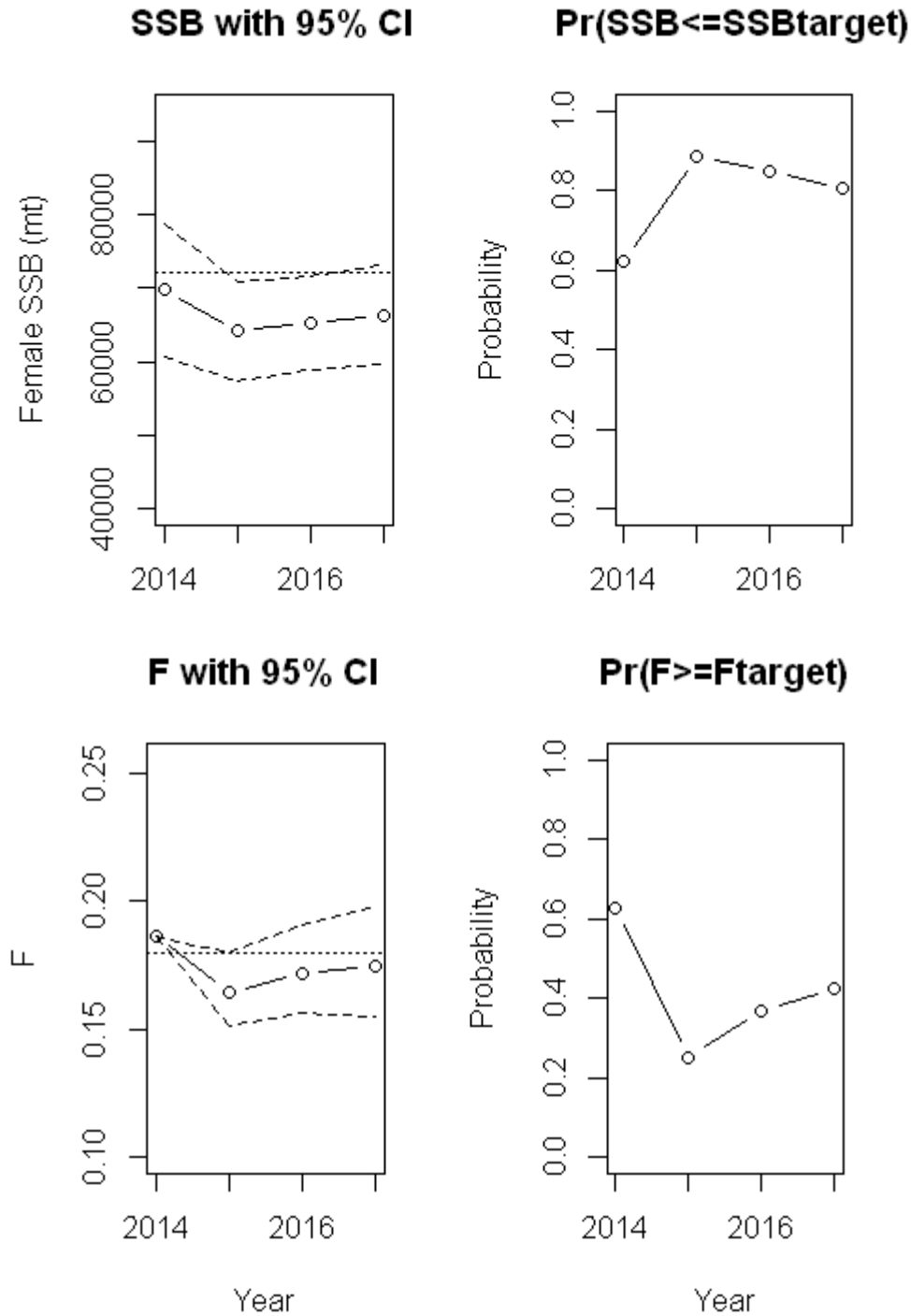


Figure 18. Projections of female spawning stock biomass and estimated fishing mortality assuming constant catch during 2015-2017 and adjusting the numbers-at-age in 2014 for the average age-specific retrospective bias in 2009-2013. The graph on the left contains the projected estimates (median is the solid line with circle; 95% confidence intervals are dashed lines) compared to the targets (dotted lines), and the graph on the right is the probability of the estimate comparison.



Appendix A. Plots of SCA model output.

Figure 1. Plots of observed and predicted catch proportions-at-age by year for each fleet.

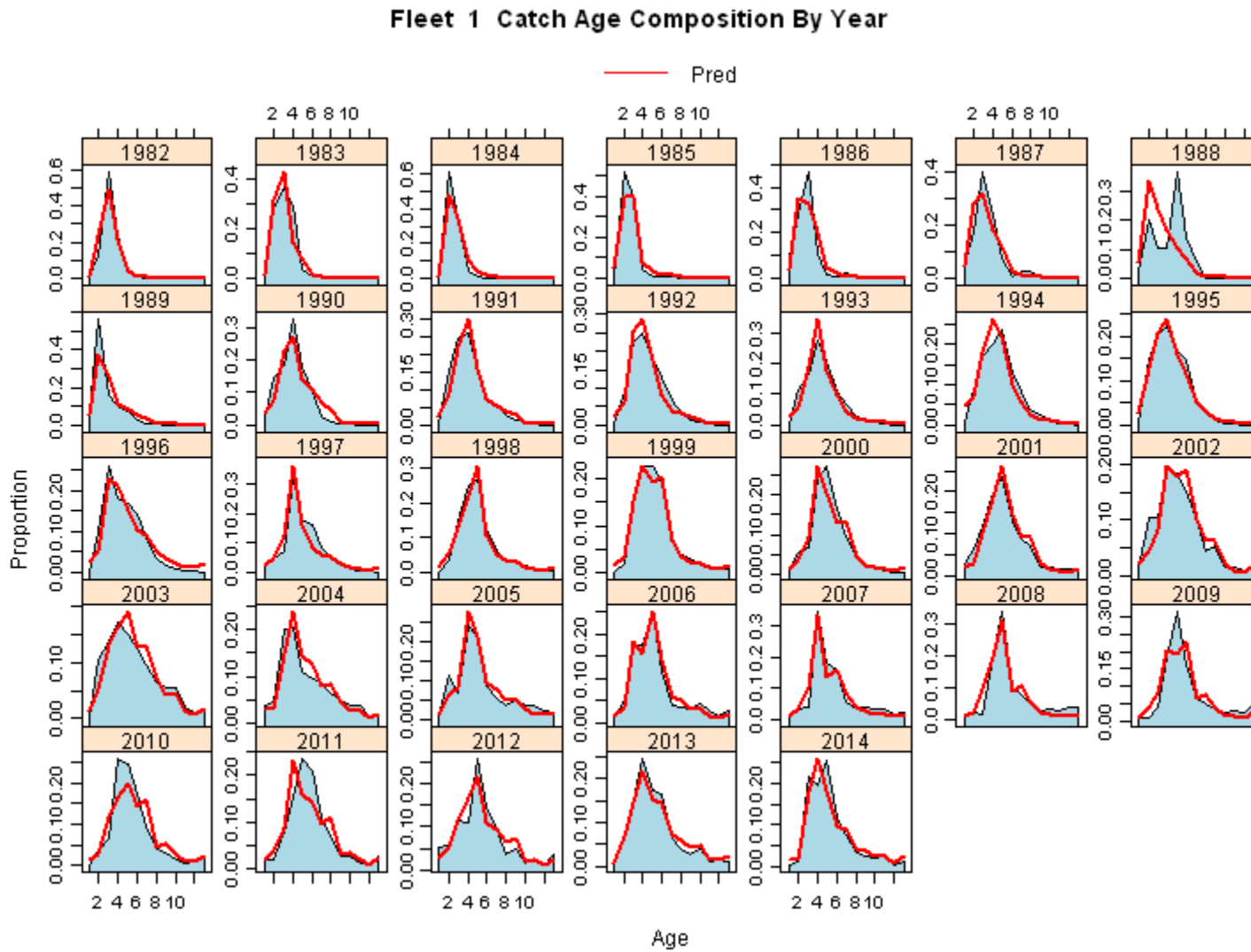


Figure 1 cont.

Fleet 2 Catch Age Composition By Year

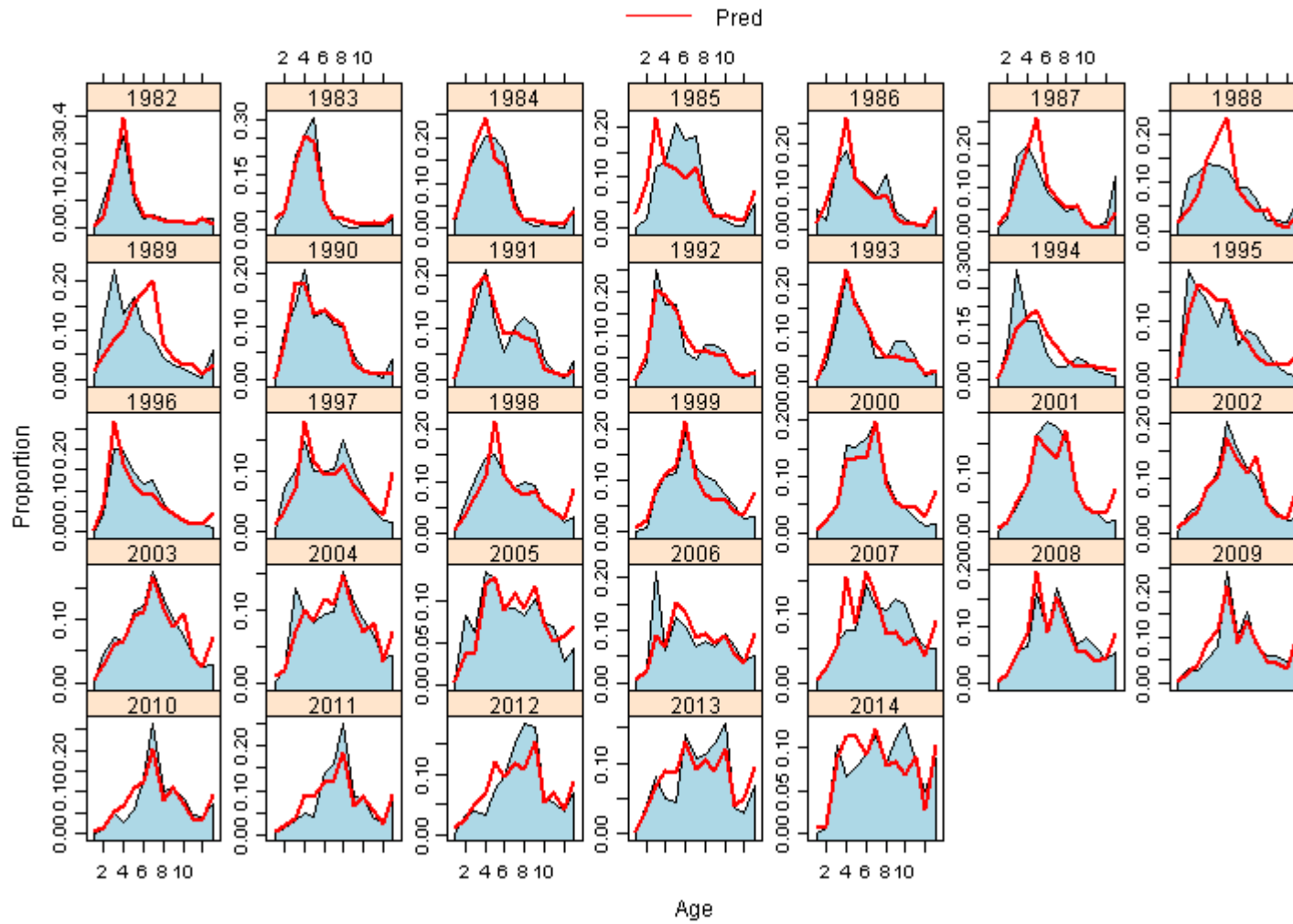


Figure 1 cont.

Fleet 3 Catch Age Composition By Year

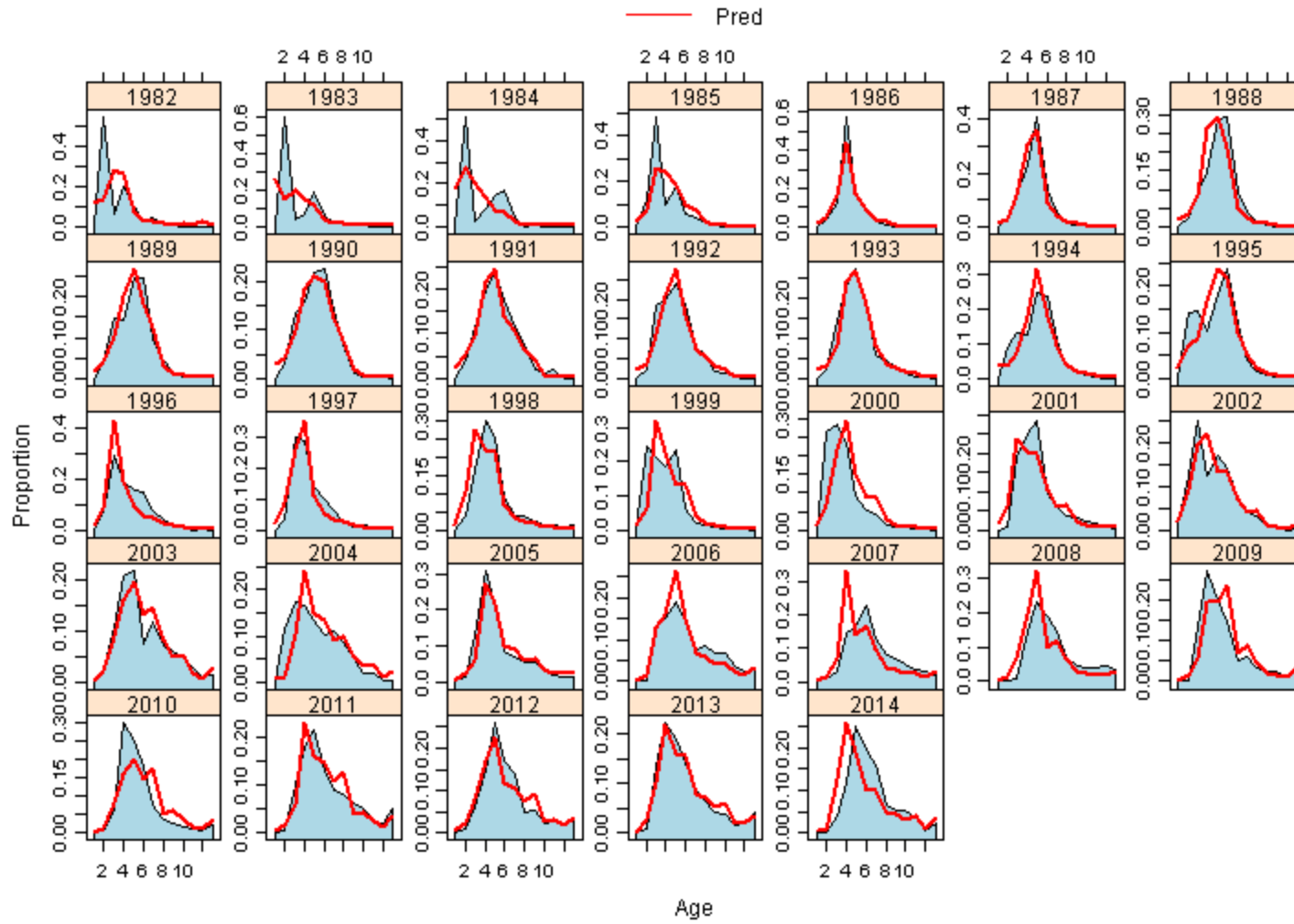


Figure 2. Standardized residuals of catch proportions-at-age by year for each fleet.

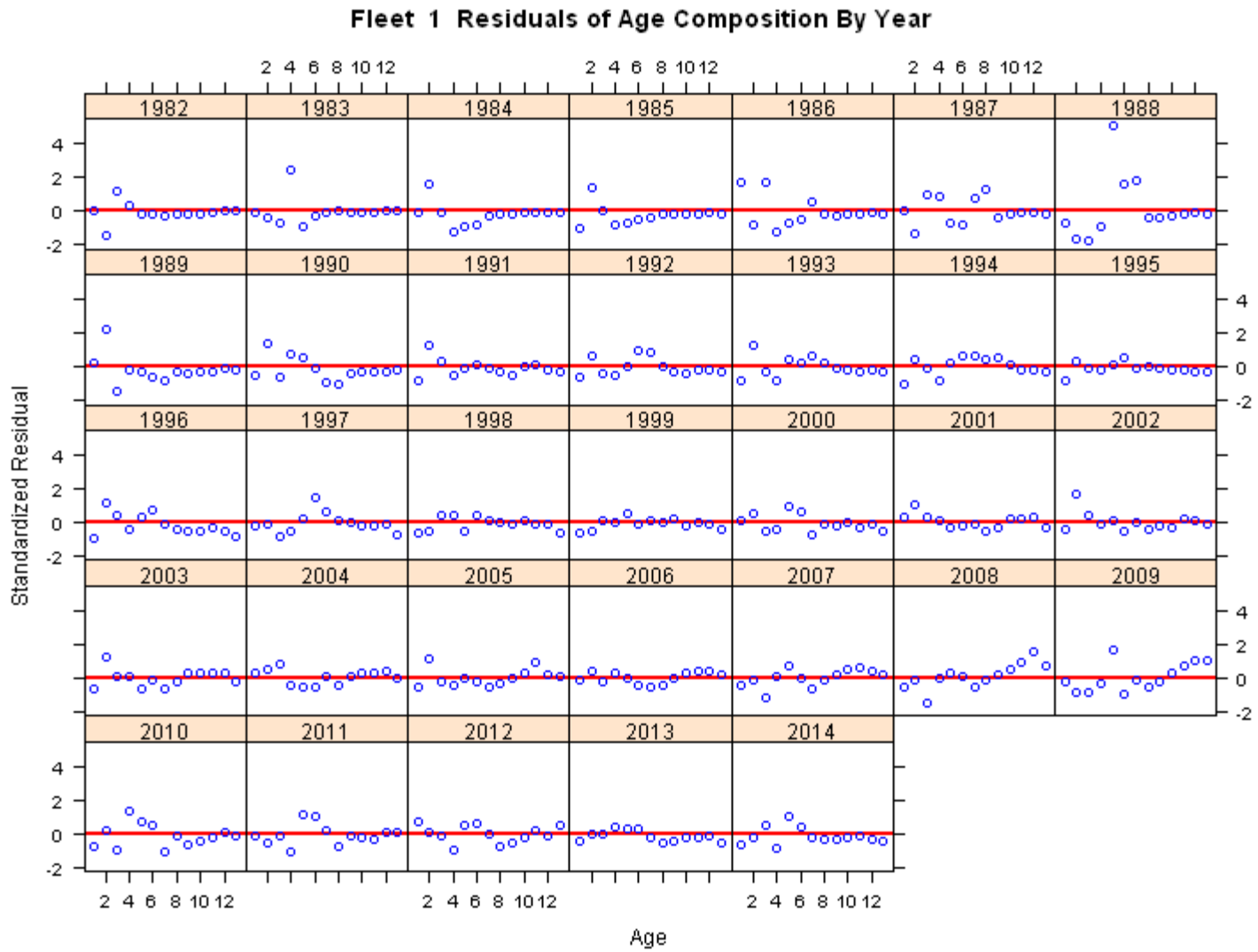


Figure 2 cont.

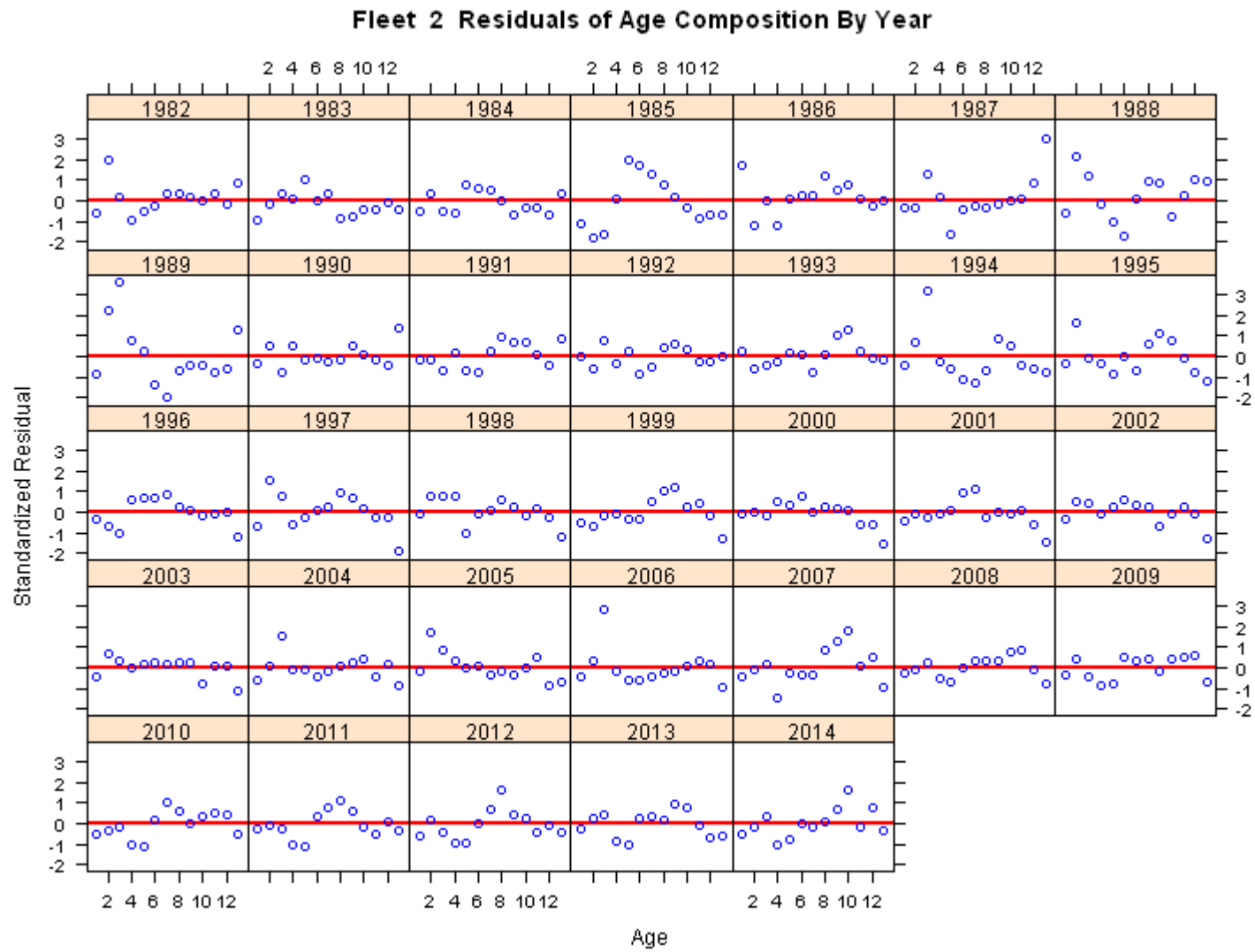


Figure 2 cont.

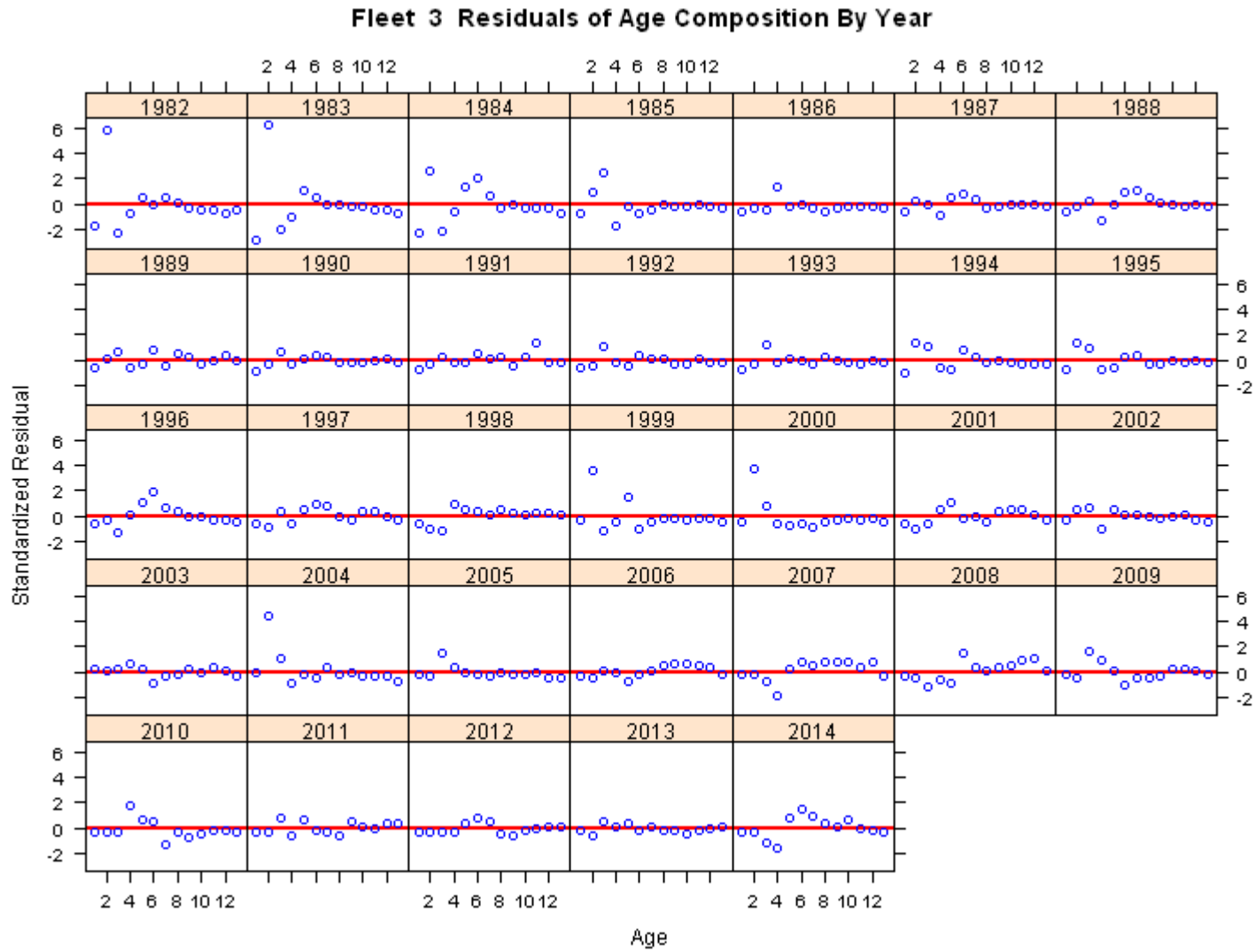


Figure 3 .Observed and predicted catch proportions-at-age by age for each fleet

Fleet 1 Catch Age Composition By Age

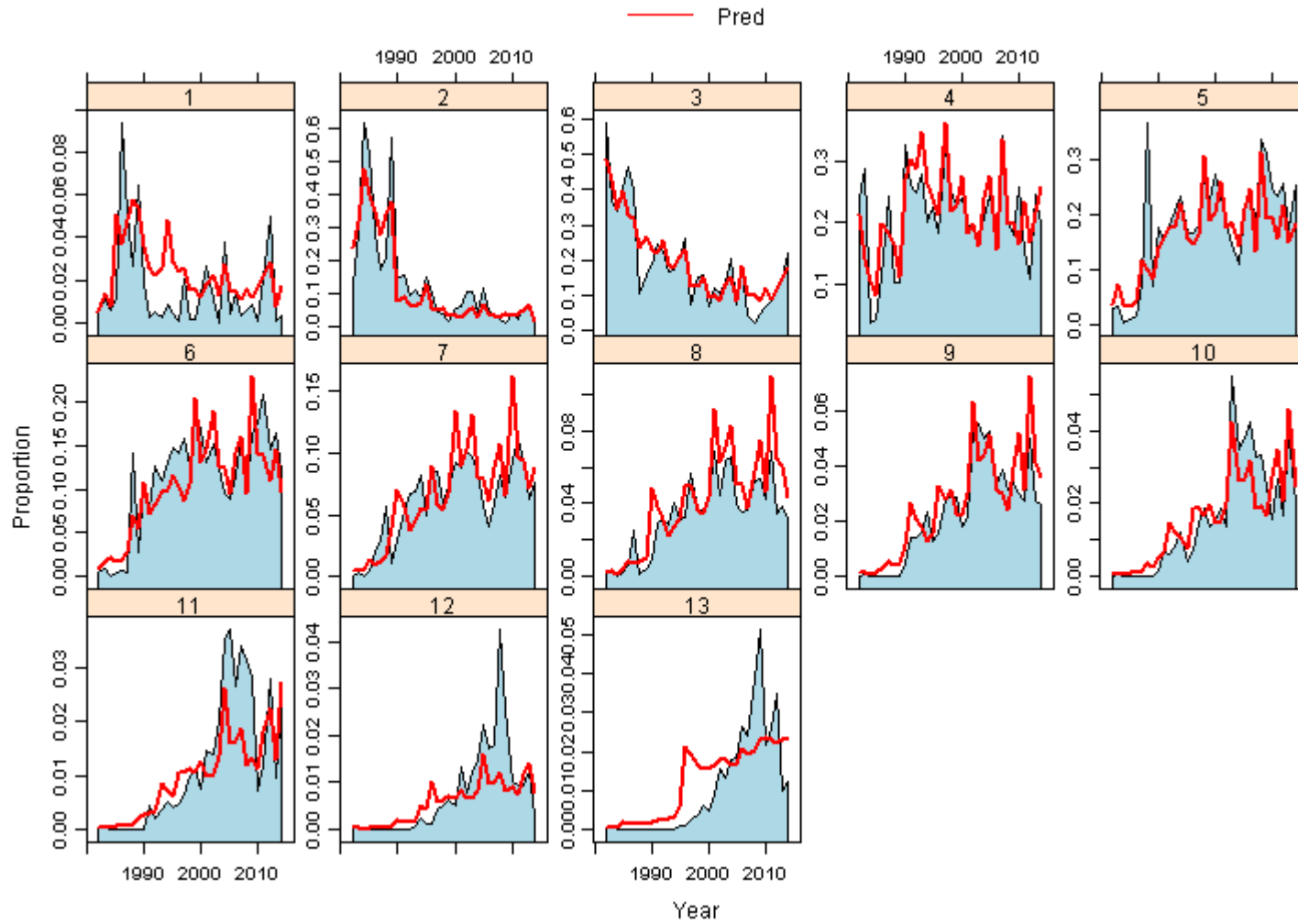


Figure 3 cont.

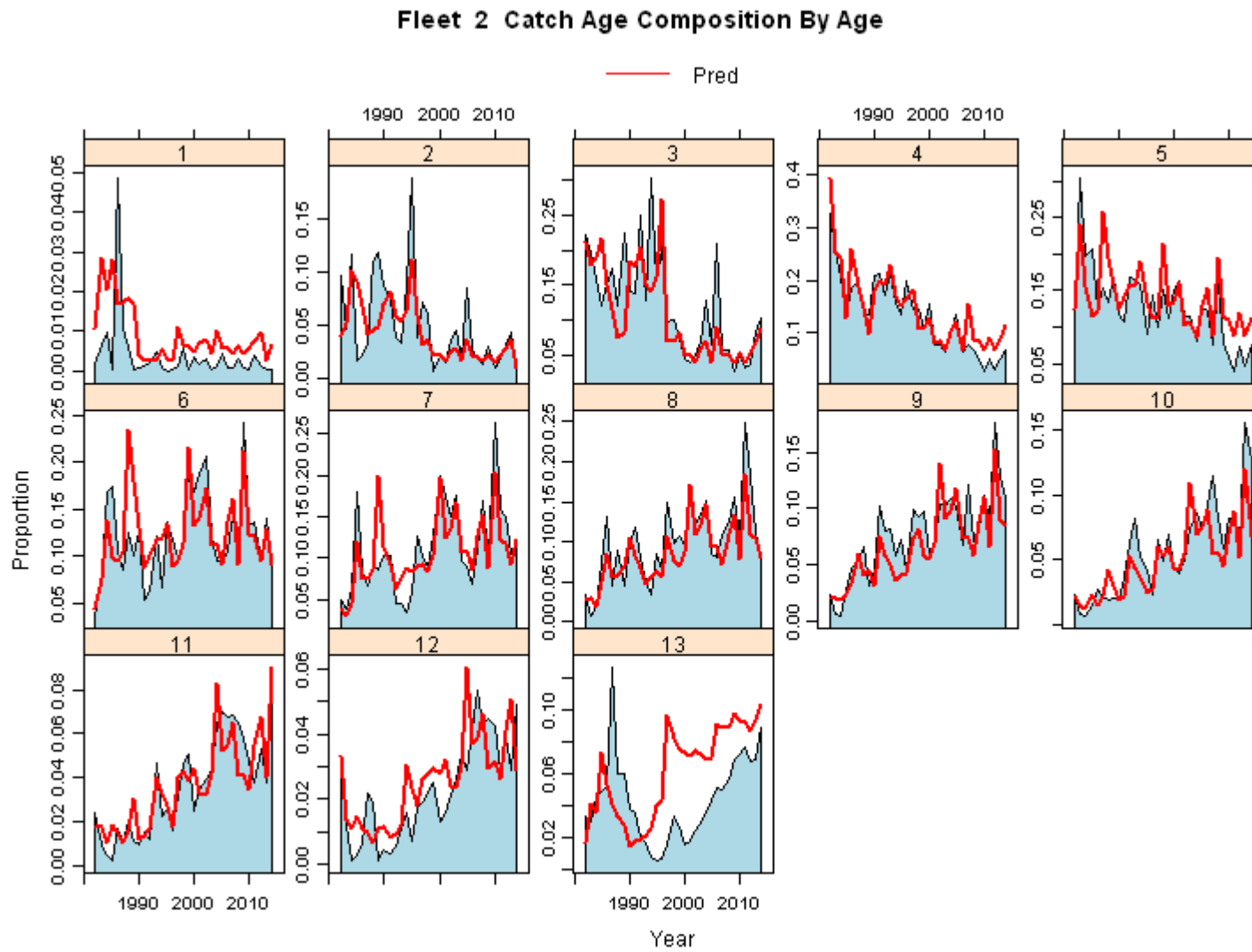


Figure 3 cont.

Fleet 3 Catch Age Composition By Age

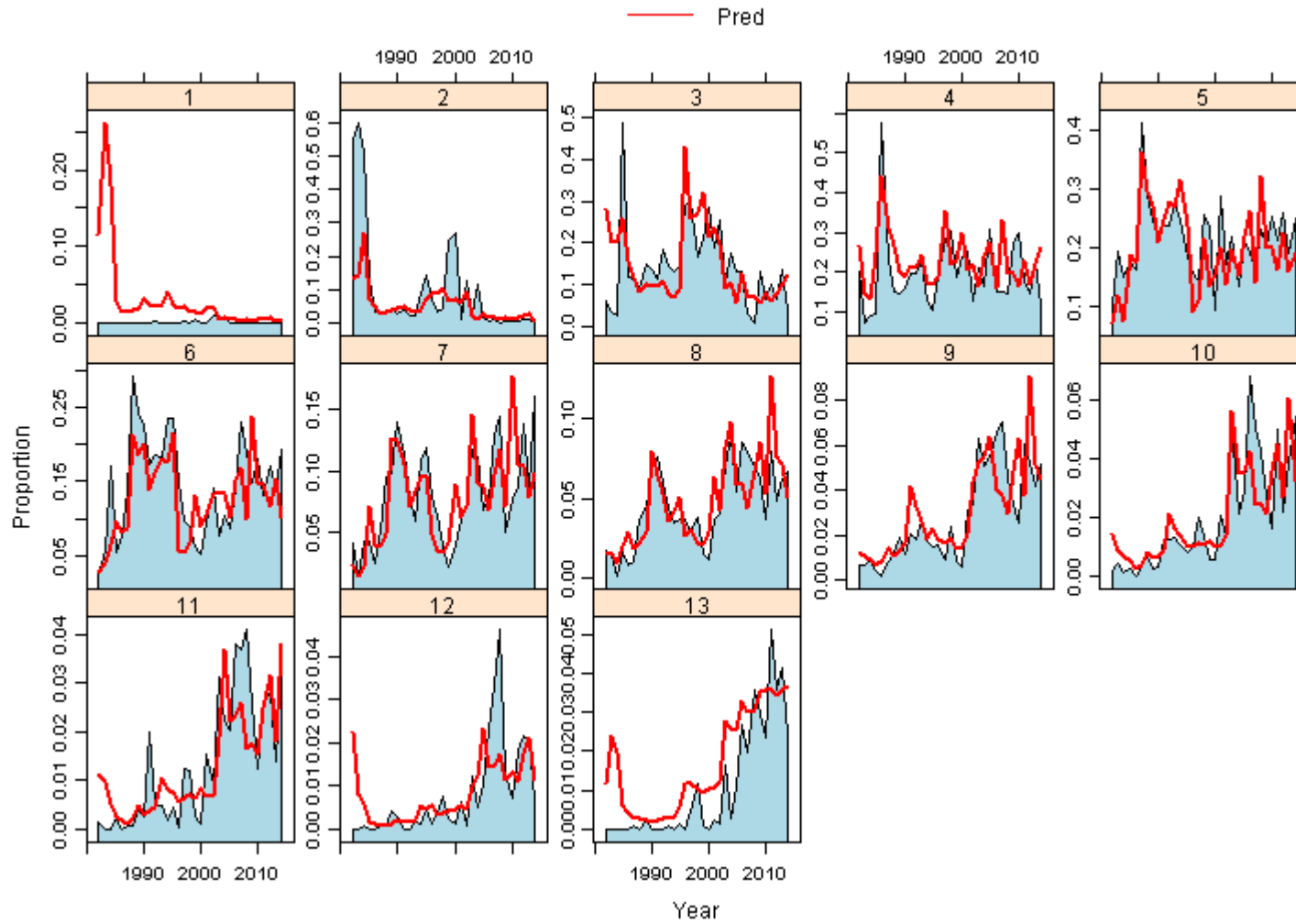


Figure 4. Standardized residuals of catch proportions-at-age by age.

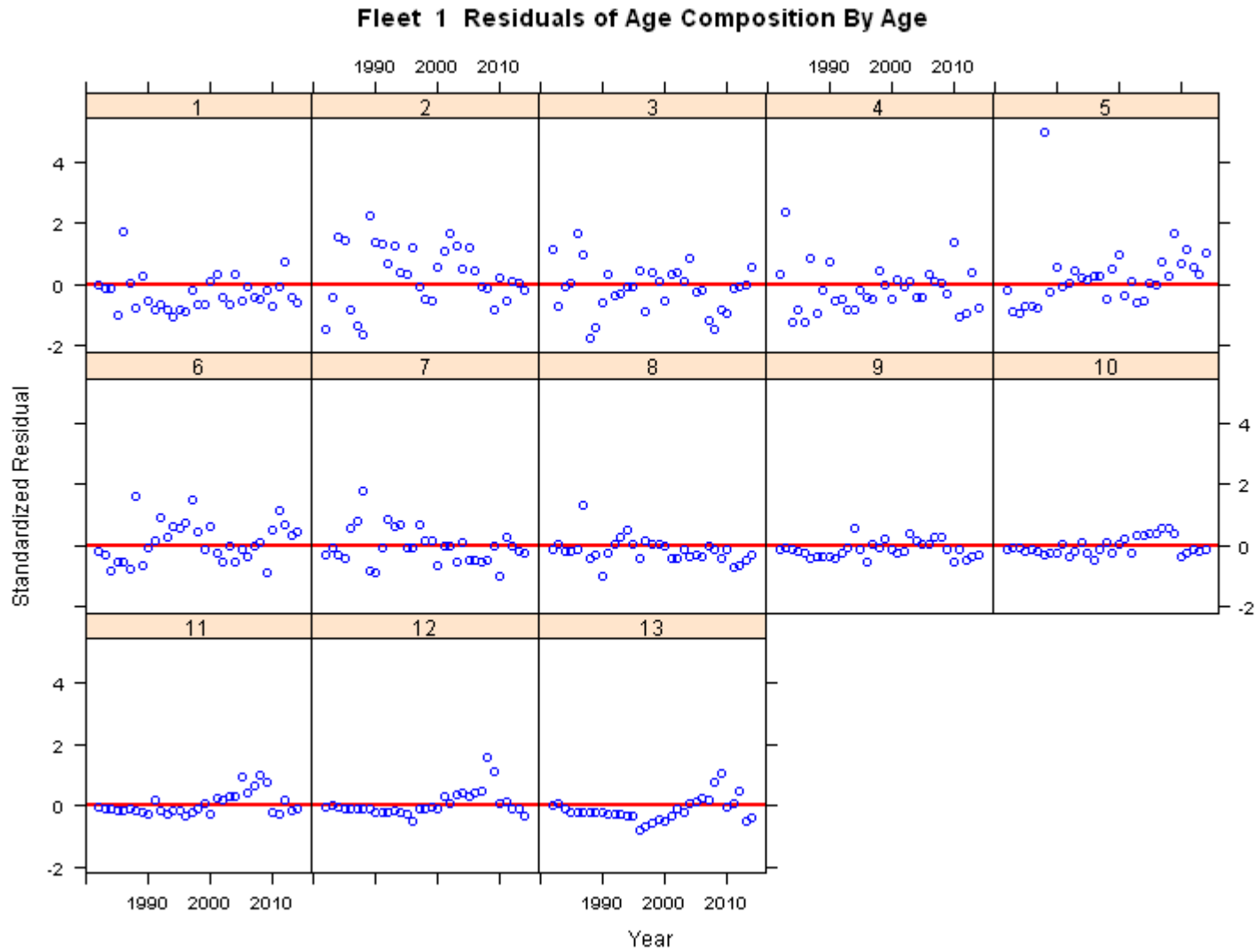


Figure 4 cont.

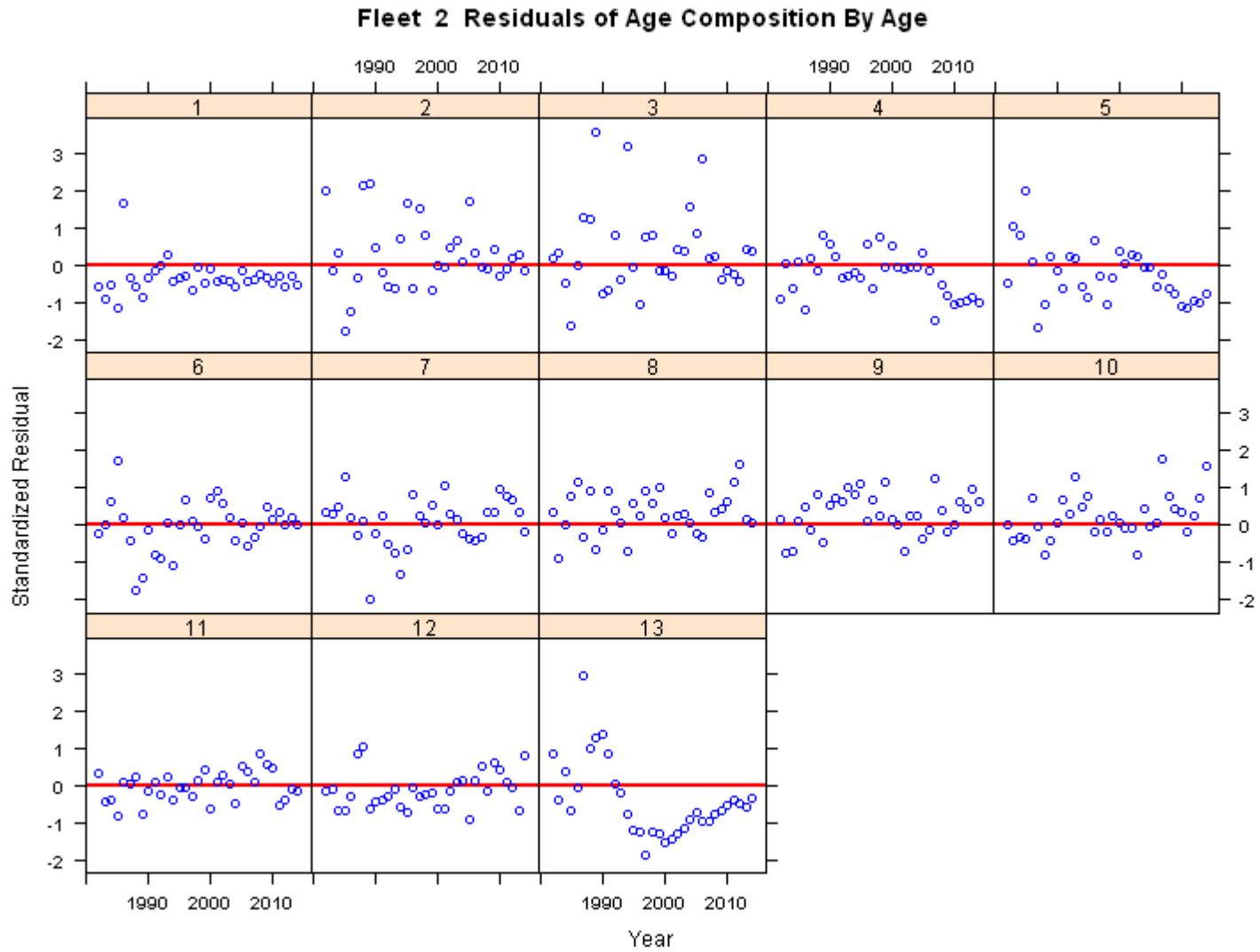


Figure 4 cont.

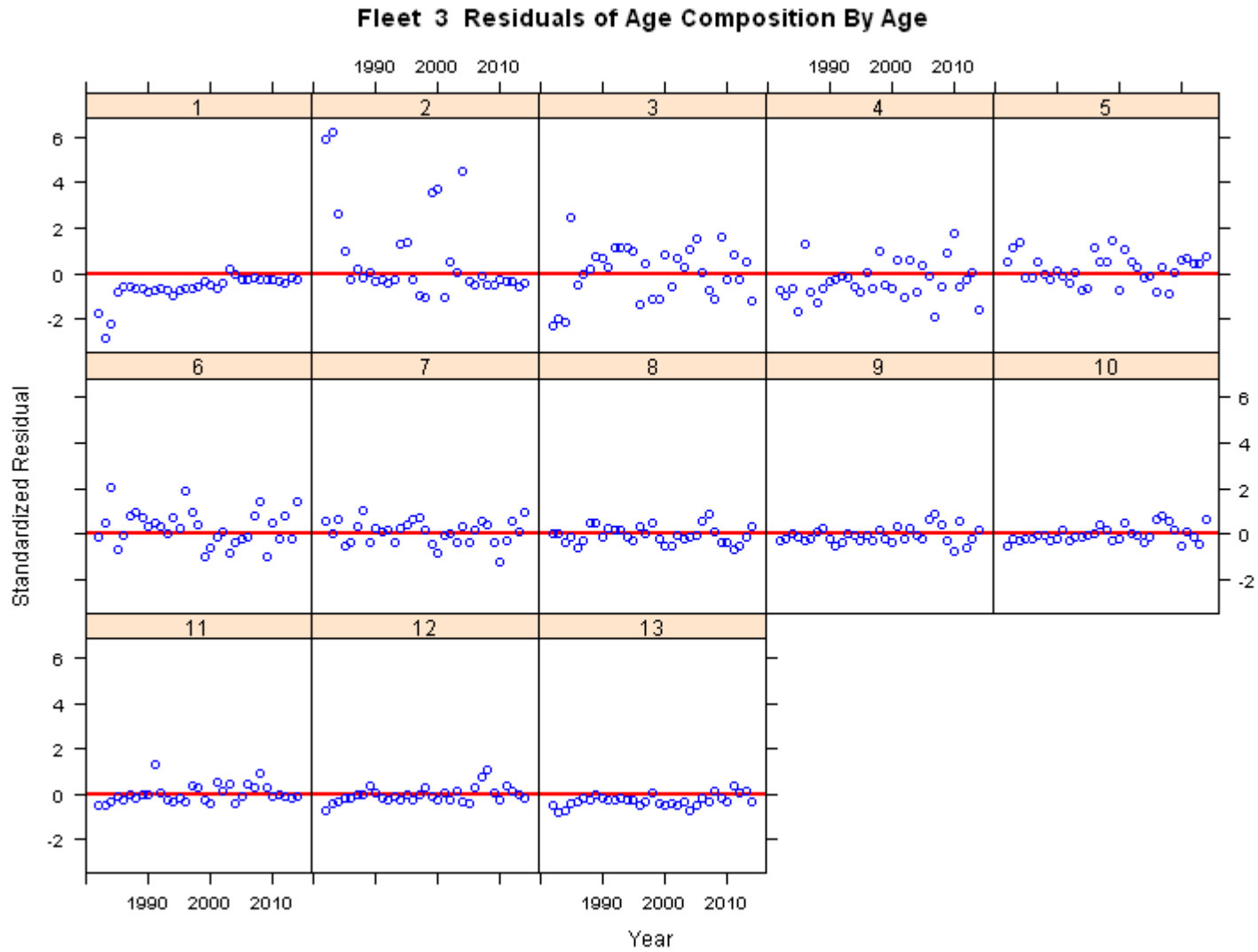


Figure 5. Observed and predicted values and standardized residuals for young-of-the-year and yearling surveys tuned to Age 1 and 2, respectively.

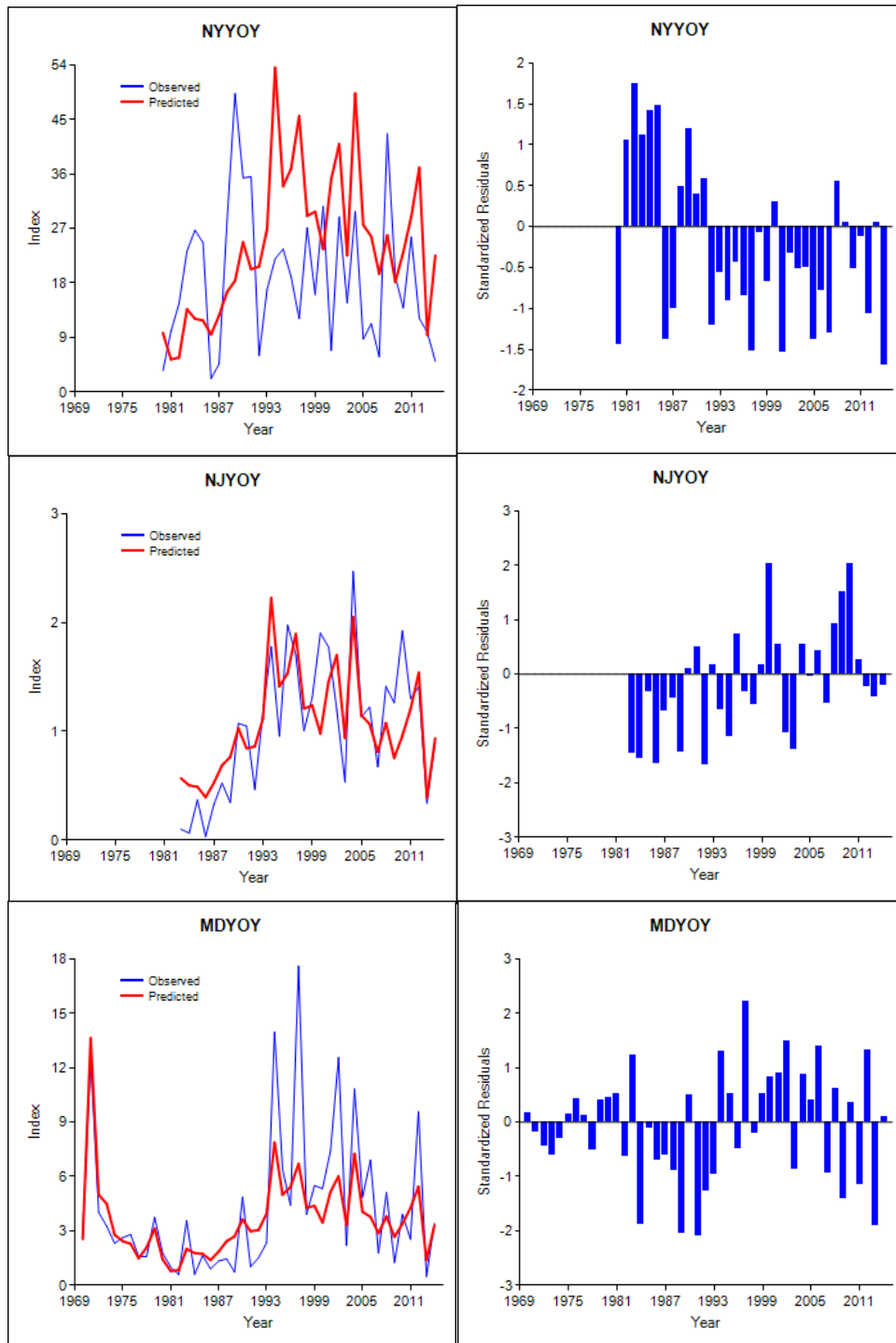


Figure 5 cont.

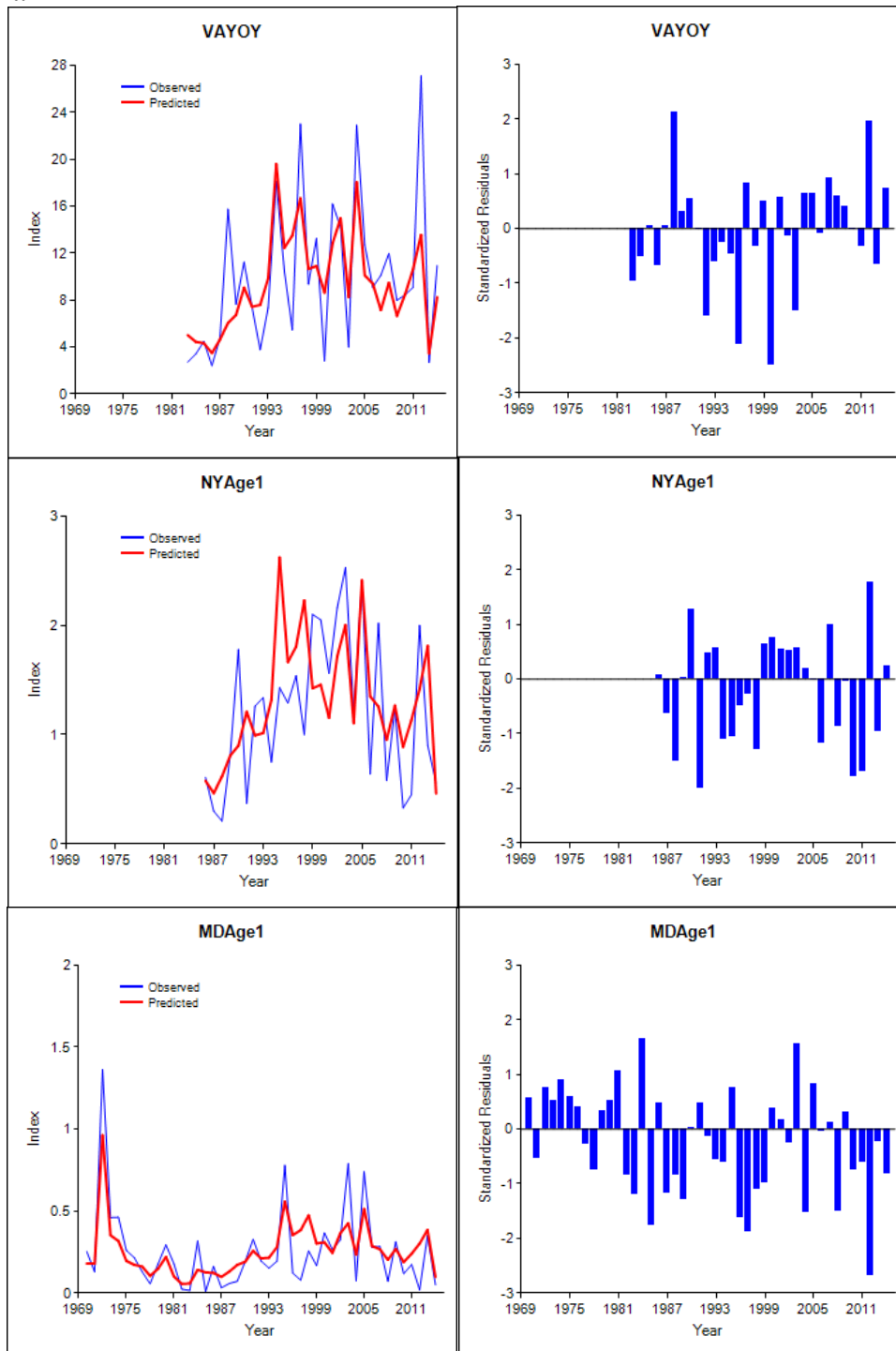


Figure 6. Observed and predicted values and standardized residuals for age-aggregated surveys.

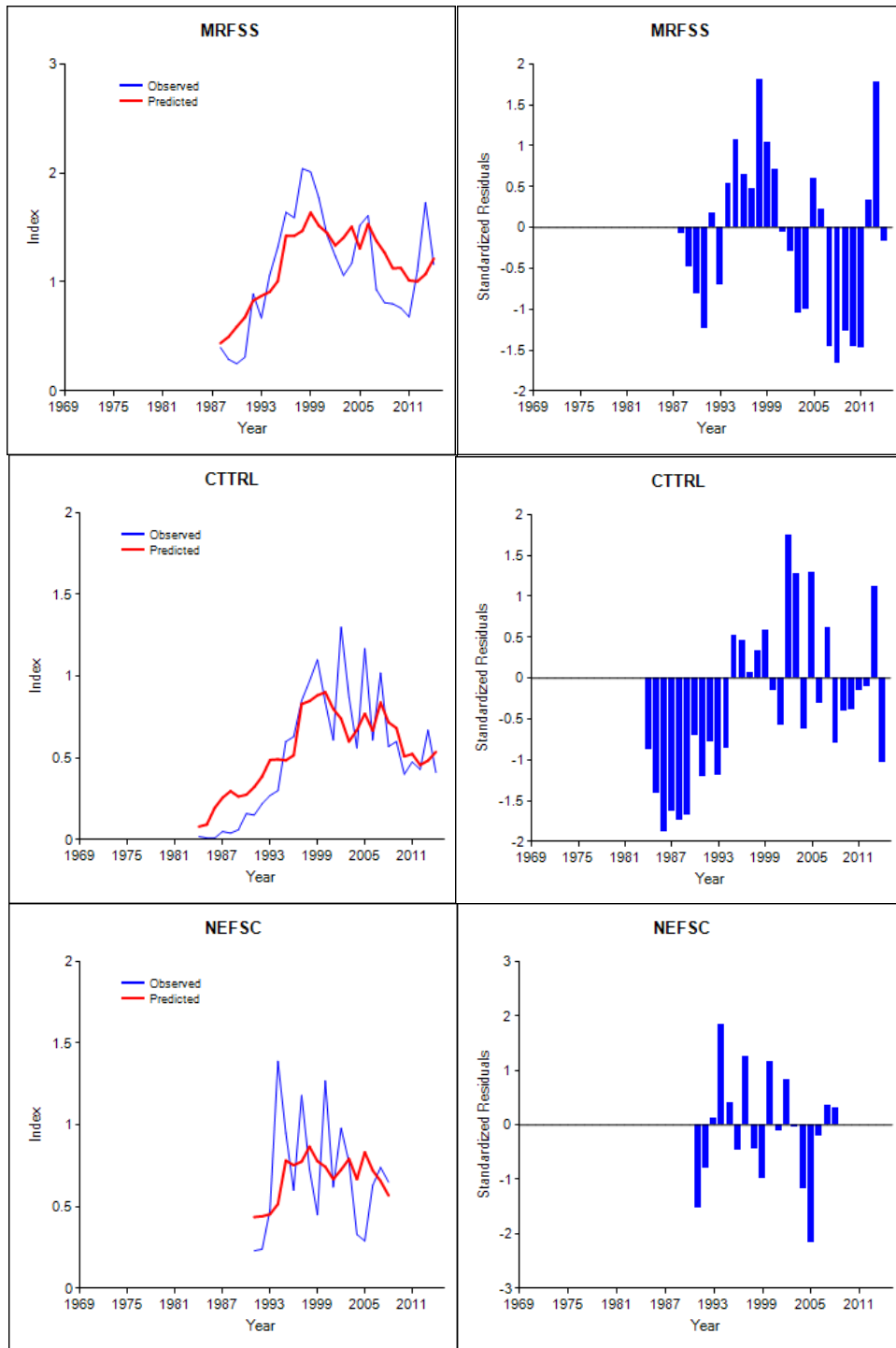


Figure 7. Observed and predicted values of the total index and standardized residuals for surveys with age composition data.

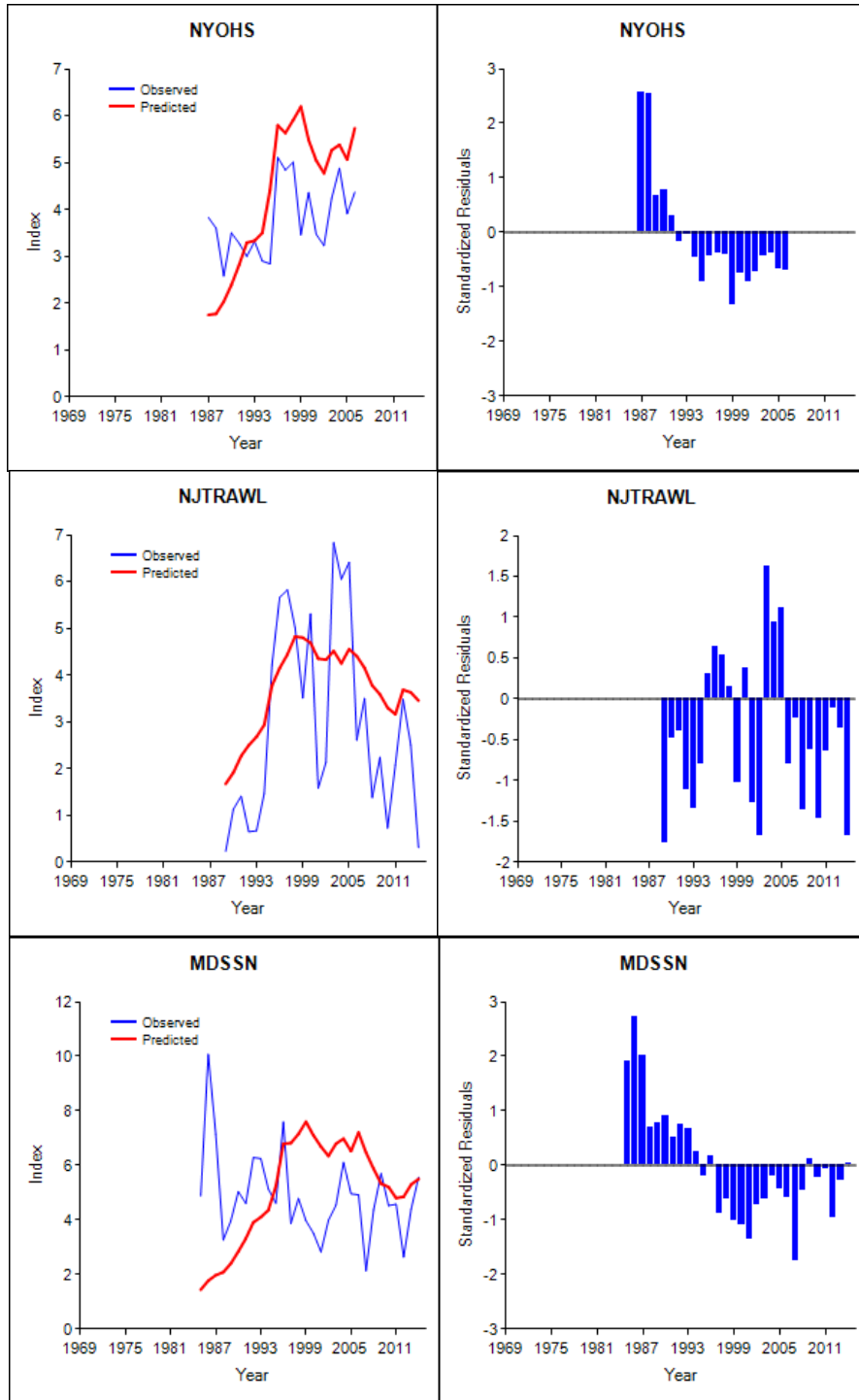


Figure 7 cont.

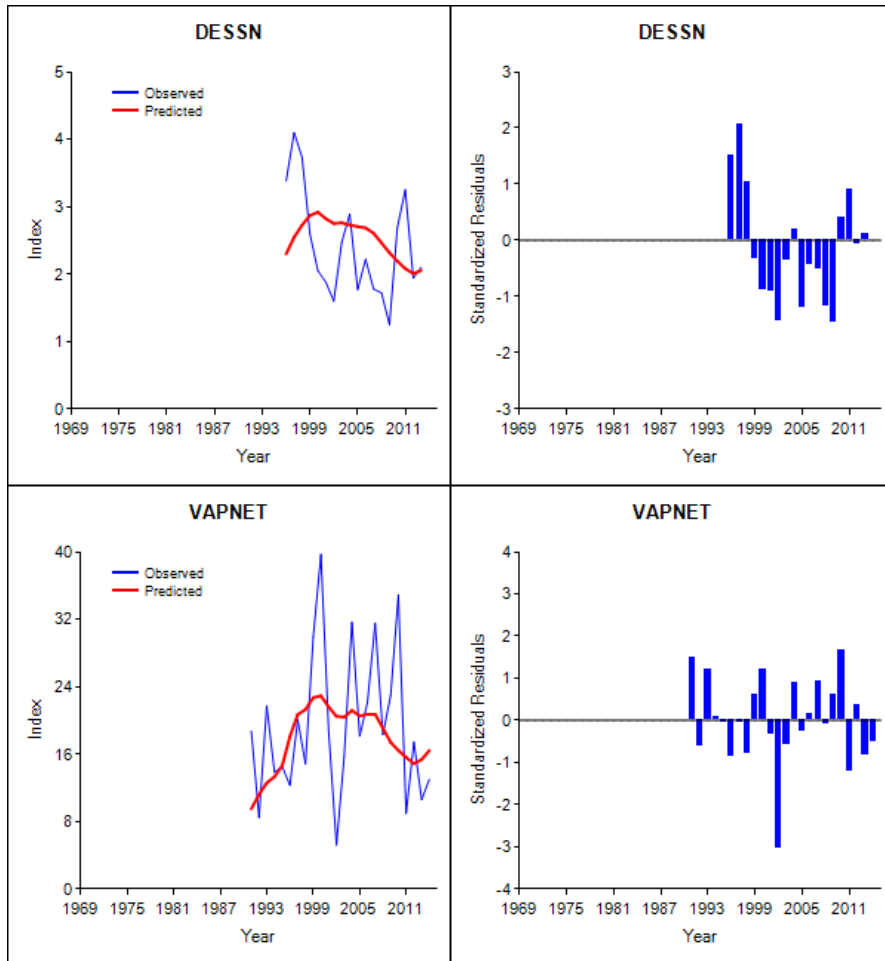


Figure 8. Selectivity patterns estimated for the NYOHS, NJ Trawl, MD SSN, DE SSN surveys and VAPNET.

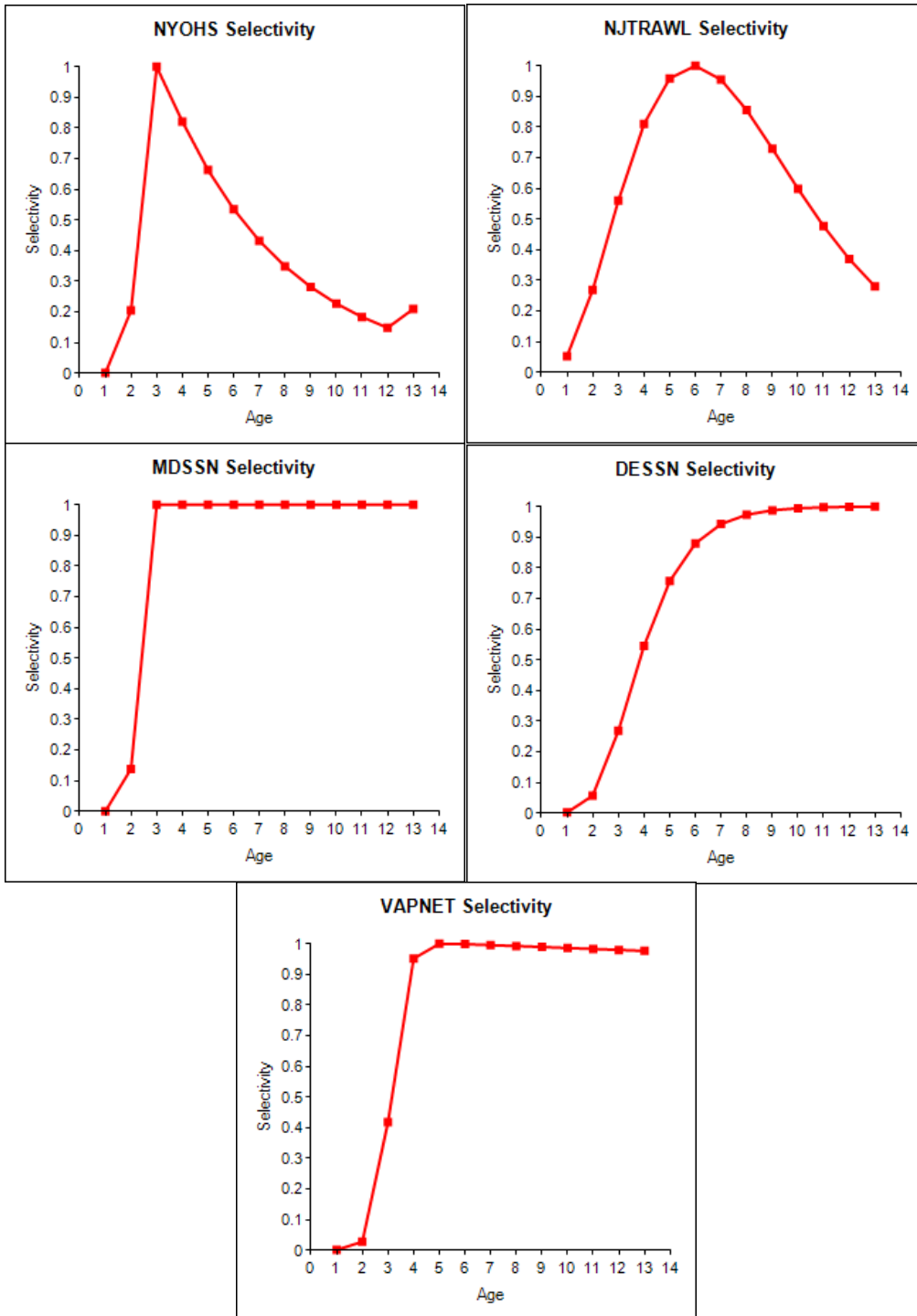


Figure 9. Observed and predicted proportions-at-age and standardized residual for each age by year for the NYOHS survey.

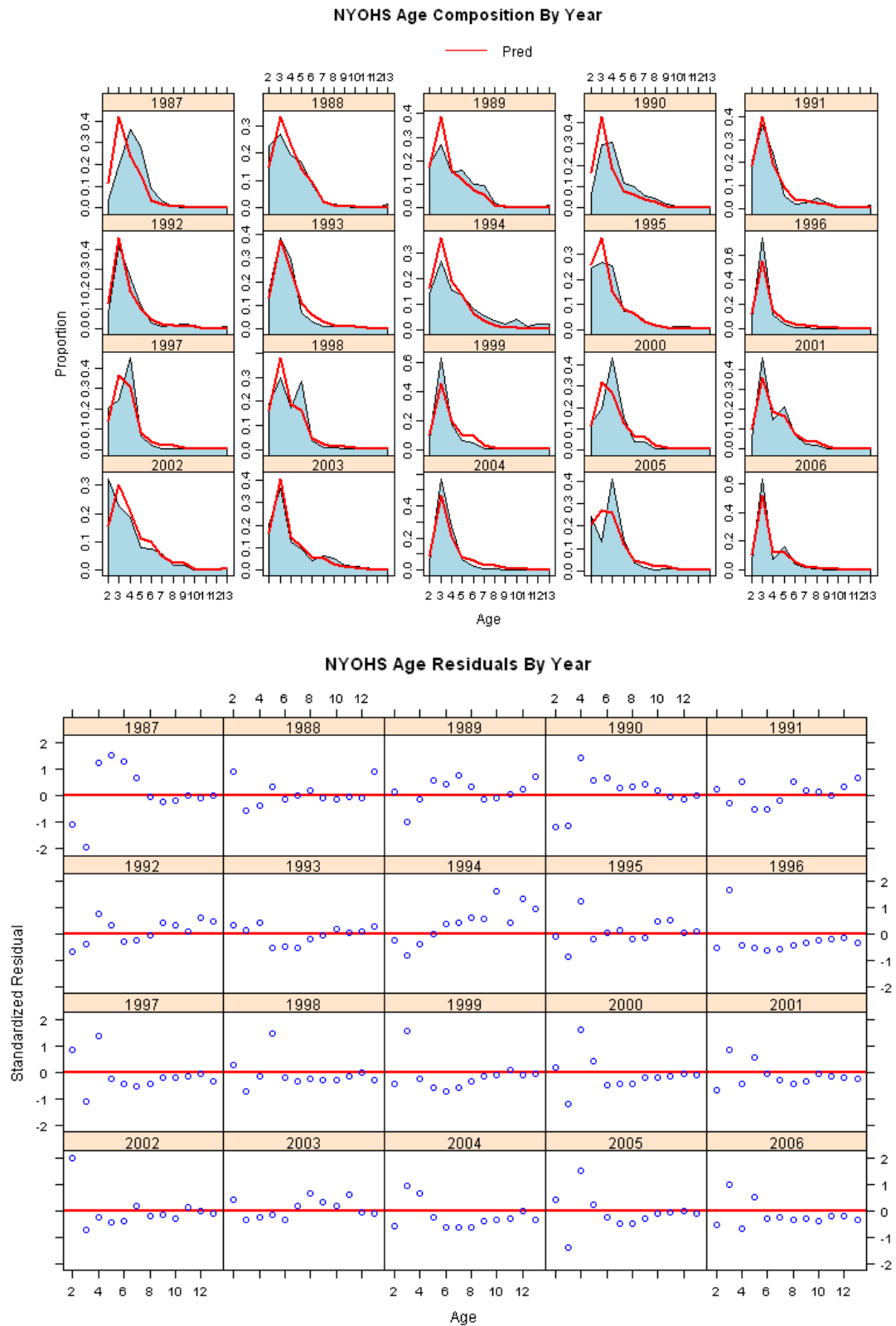


Figure 10. Observed and predicted proportions-at-age and standardized residual for each year by age for the NYOHS survey.

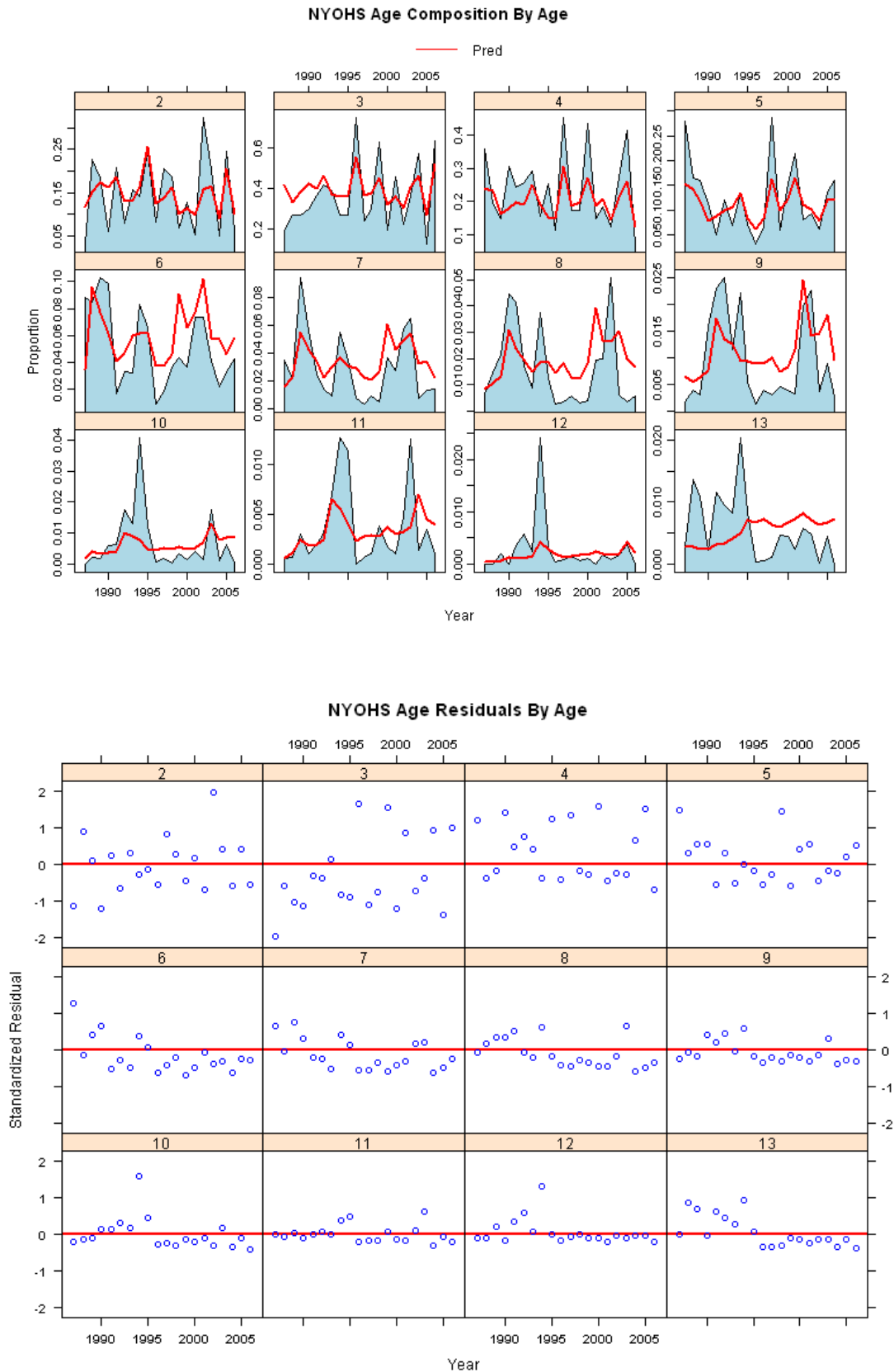


Figure 11. Observed and predicted proportions-at-age and standardized residuals for each age by year for the NJ Trawl survey.

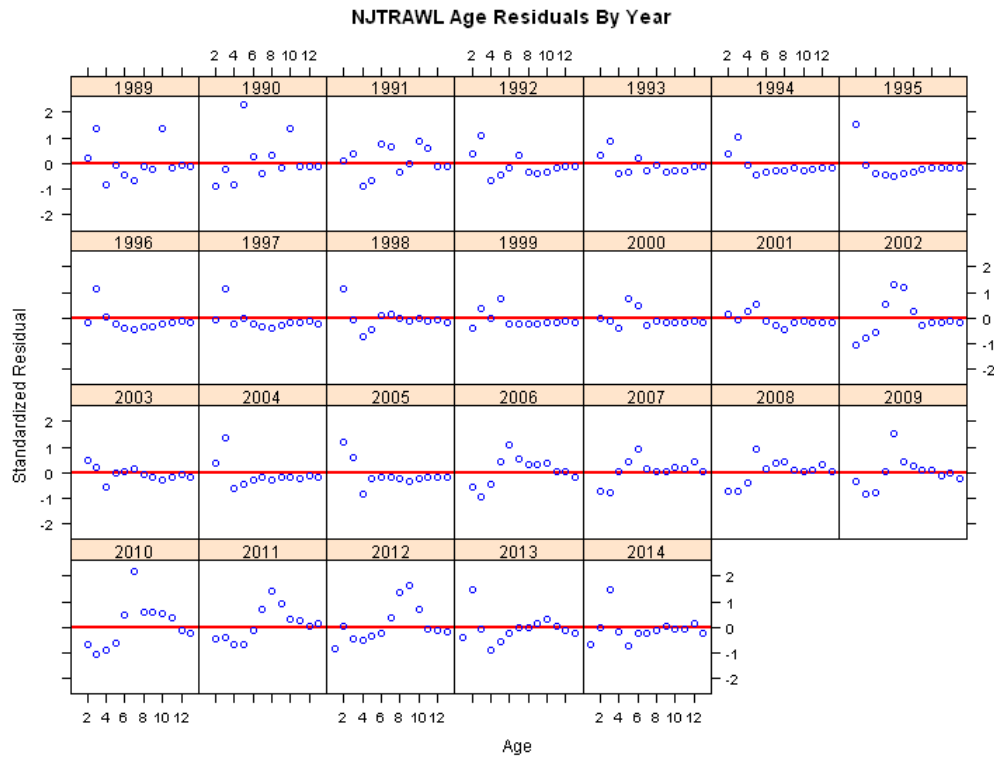
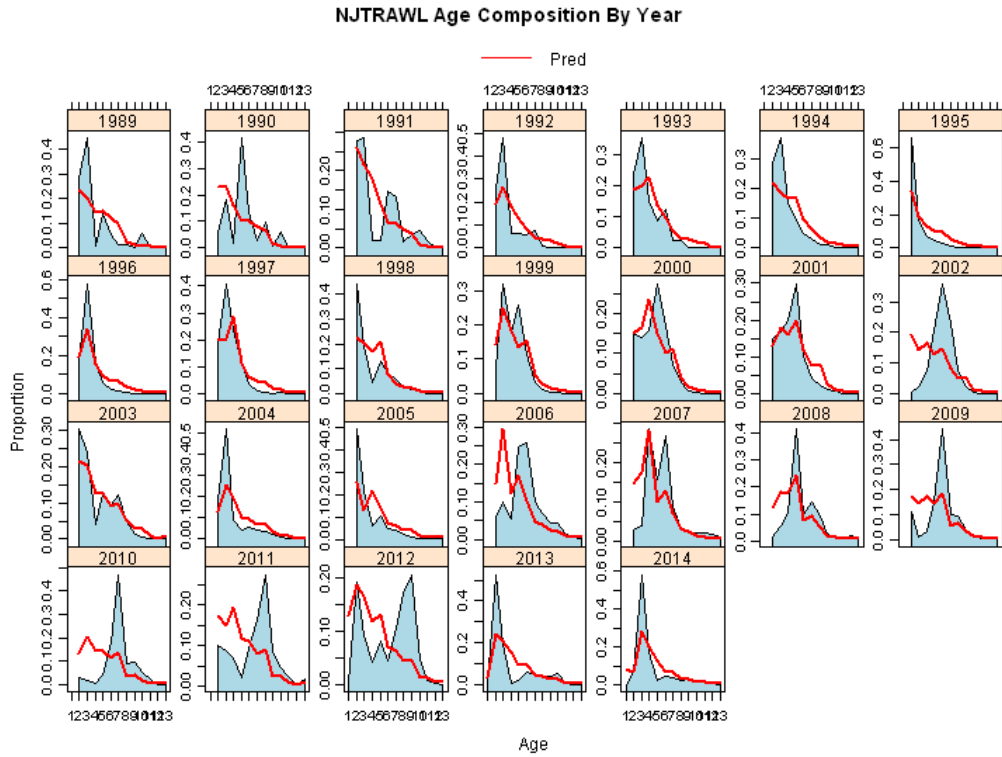


Figure 12. Observed and predicted proportions-at-age and residuals for each year by age for the NJ Trawl survey.

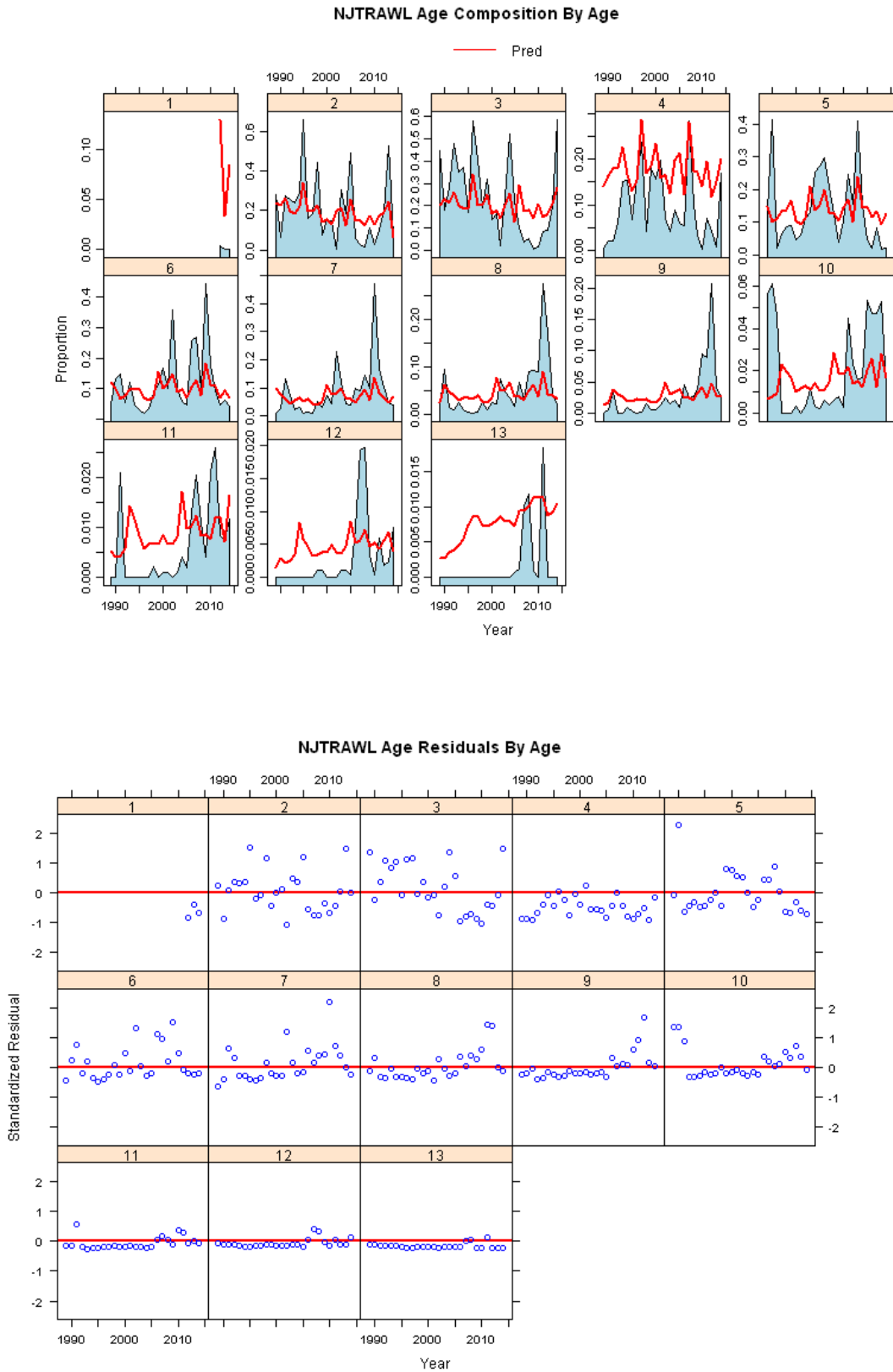


Figure 13. Observed and predicted proportions-at-age for each age by year for the MD SSN gillnet survey.

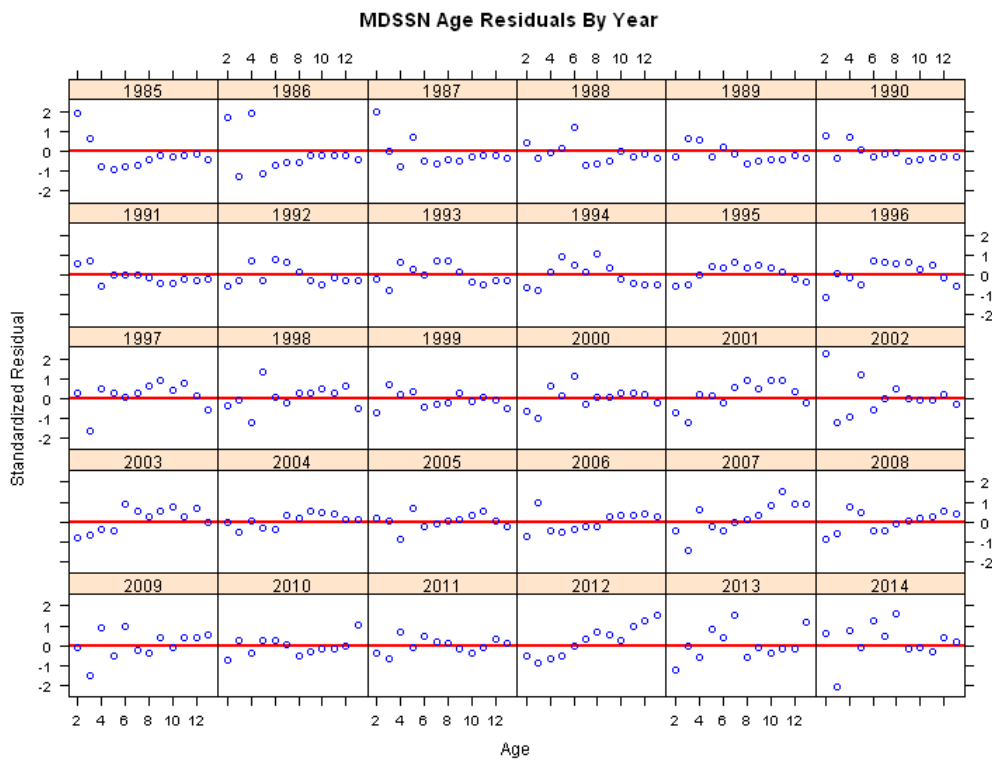
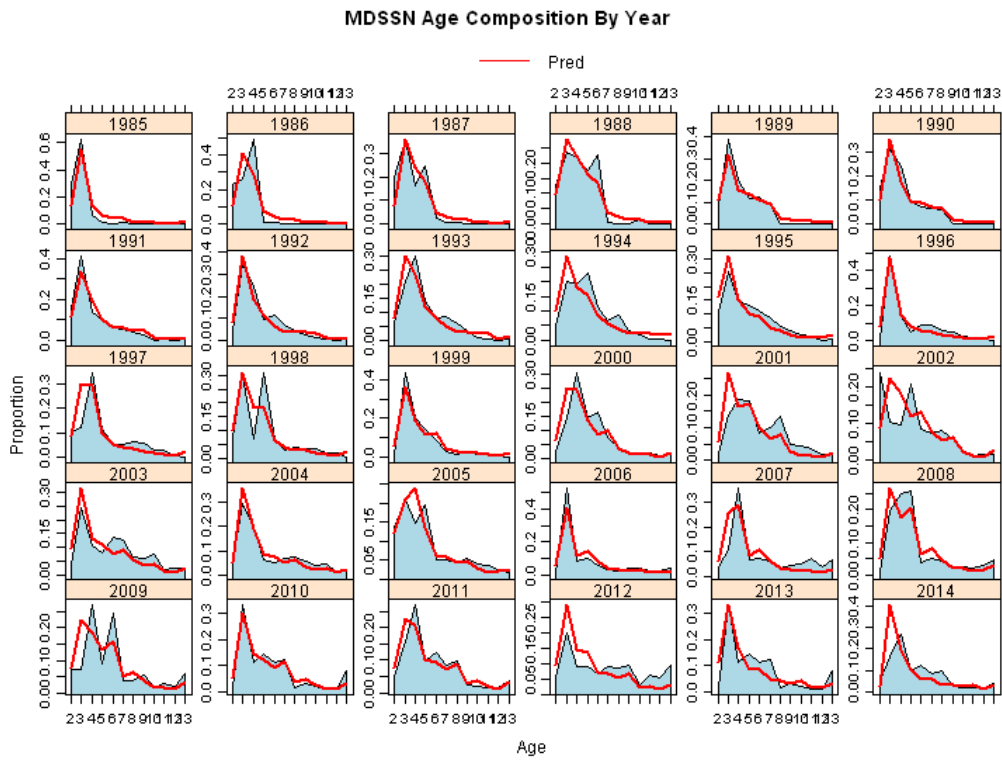


Figure 14. Observed and predicted proportions-at-age and standardized residuals for each year by age for the MD SSN gillnet survey.

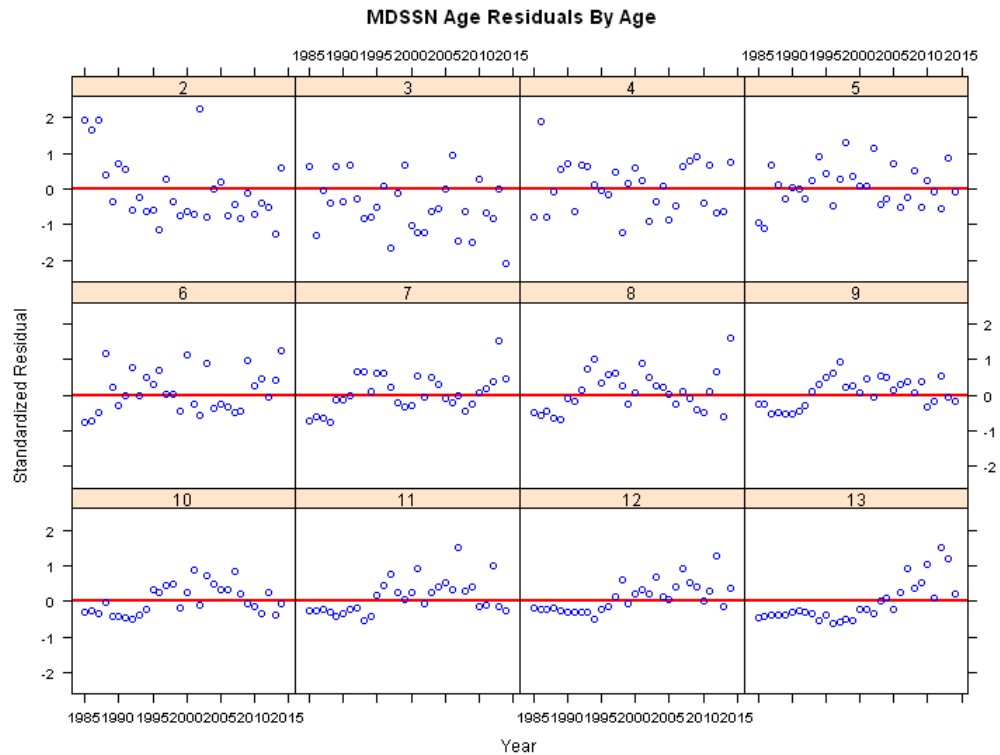
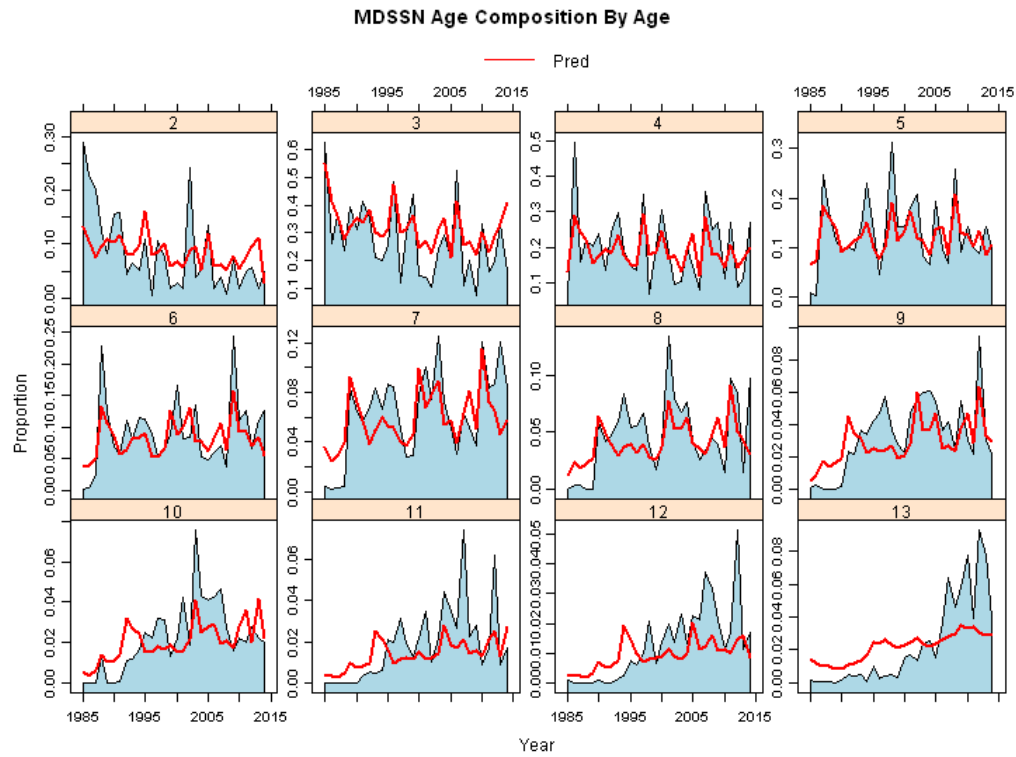


Figure 15. Observed and predicted proportions-at-age and standardized residuals for each age by year for the DE SSN electrofishing survey.

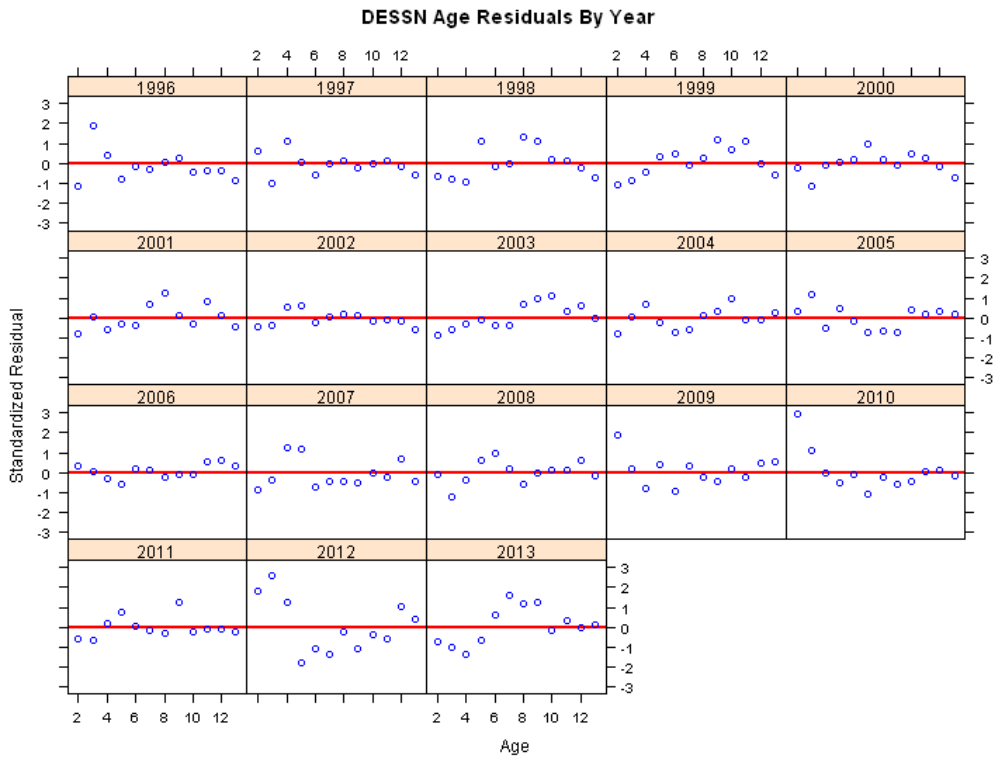
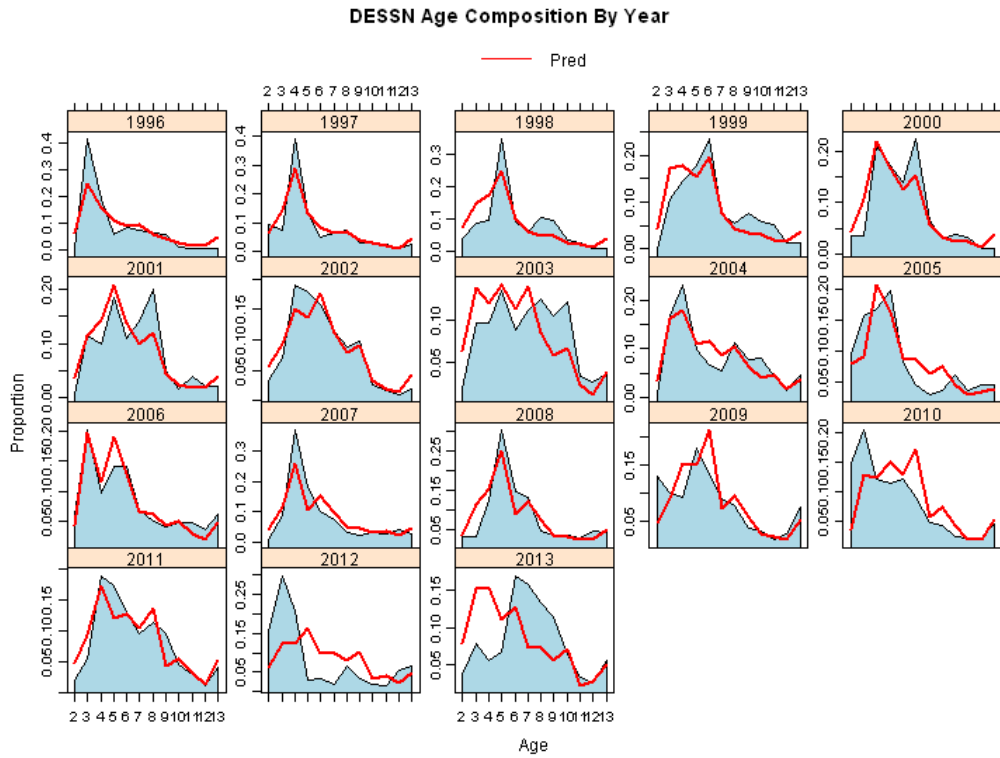


Figure 16. Observed and predicted proportions-at-age and standardized residuals for each year by age for the DE SSN electrofishing survey.

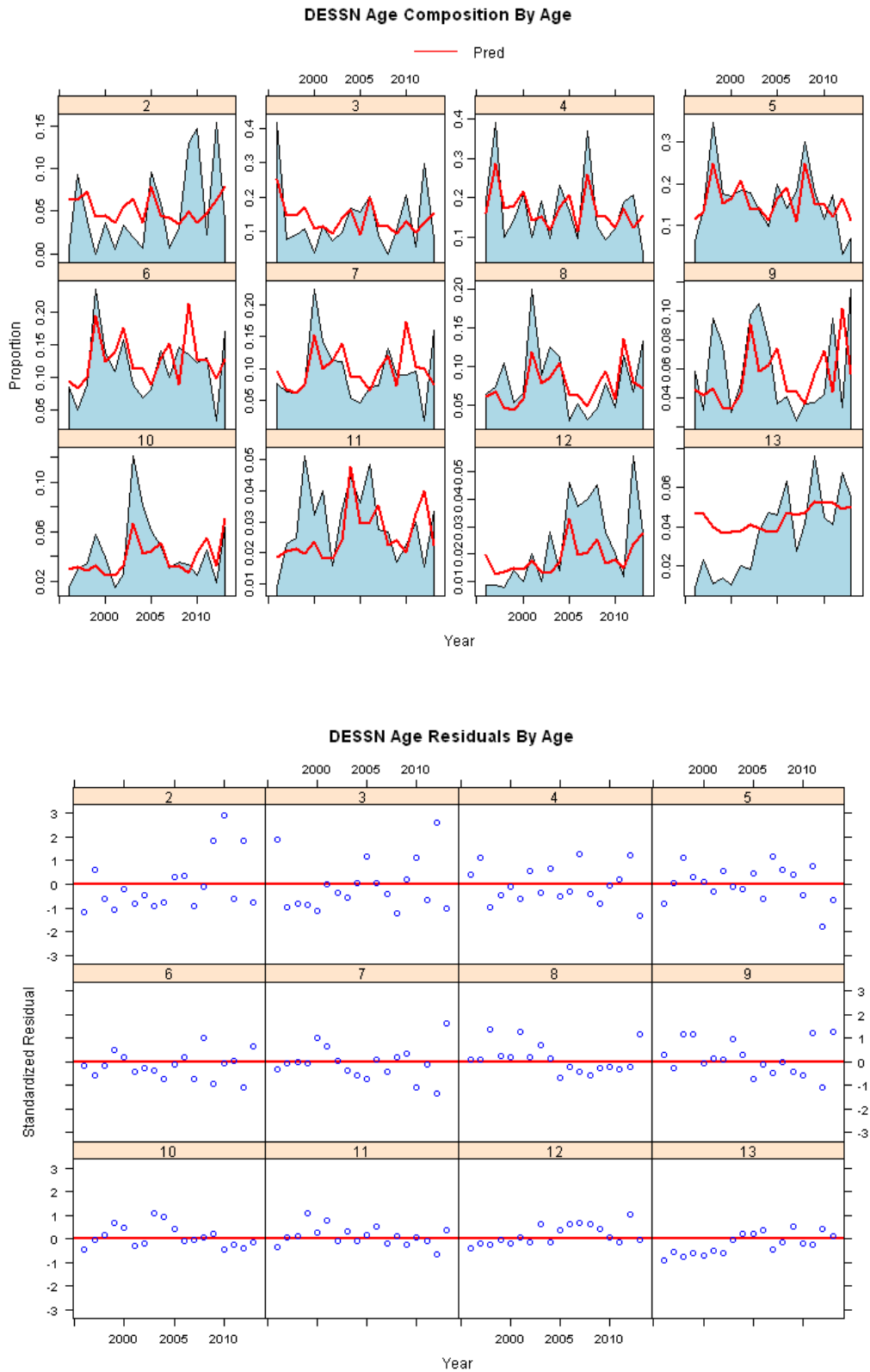


Figure 17. Observed and predicted proportions-at-age and standardized residuals for each age by year for the VAPNET survey.

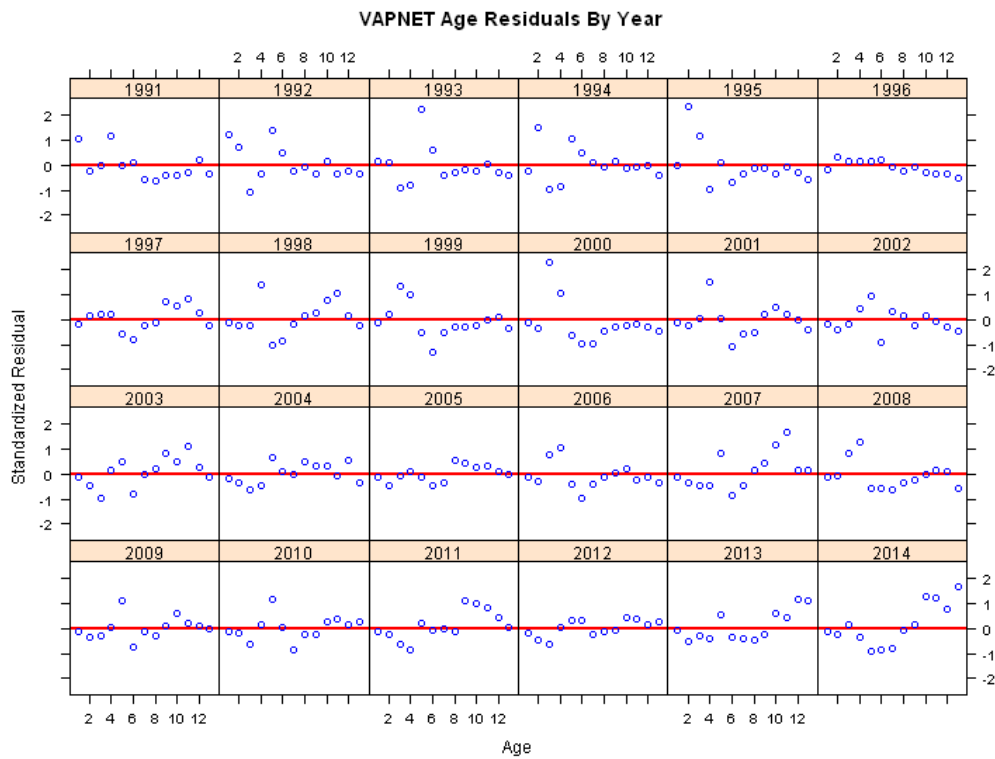
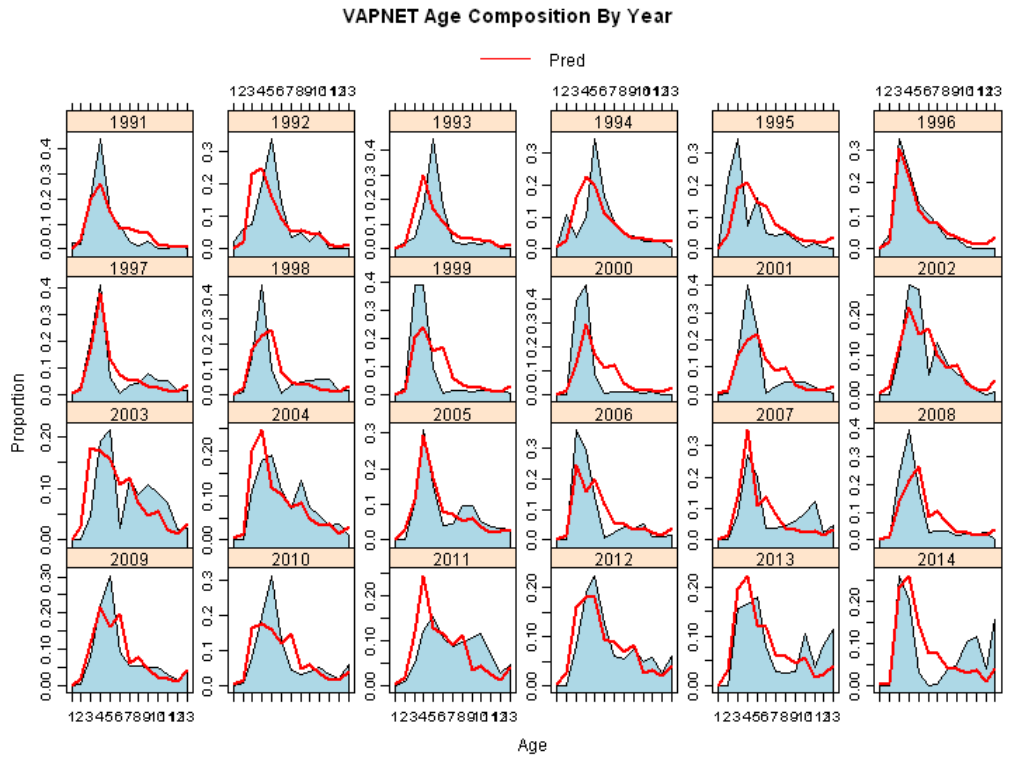


Figure 18. Observed and predicted proportions-at-age and standardized residuals for each year by age for the VAPNET survey.

