D. Atlantic Striped Bass Advisory Report

Introduction

The 36th SARC was asked to provide review and comment on a number of methodological aspects of the current striped bass assessment approach. The terms of reference included neither requests for stock status nor management advice. This part of the Advisory Report therefore differs from the previous sections and attempts to directly answer the Terms of Reference provided by the Atlantic States Marine Fisheries Commission.

1. Characterize the commercial and recreational catch including landings and discards.

Total catch in numbers including landings and discards dropped about 14%, from 5.04 million in 2000 to 4.3 million in 2001. While the 2000 total catch represented a series high, the 2001 catch is slightly above the 1996-2000 average of 3.9 million. Ages 4 to 7 represented 62% of the total catch, and ages 8+ represented 24%. The modal age is 5, consistent with that in 2000. The 1993-1997 year classes dominate, accounting for 12-18% of total catch. Although the proportion of 8 and older fish in the catch dropped to 15% in 2000 from 21% in 1999, it rose to a series high 24% in 2001.

Recreational fisheries accounted for 71% of the total 2001 catch, 46% of which was landings and 25% discards. New Jersey recreational fisheries accounted for 28% of total recreational landings, followed by MD (19%), VA (15%), MA (14%), and NY (9%). The remaining States each accounted for 4% or less of the total recreational landings. Commercial fisheries accounted for 29% of the total 2001 catch, 22% of which was landings and 7% was discards. Maryland commercial fisheries accounted for 57% of the total commercial landings, followed by VA (16%), PRFC (9%), and NY (6%). The remaining States each accounted for 4% or less of the total commercial landings.

Although total catch dropped considerably in 2001, total landings in numbers dropped less than 1% from 2.98 million fish in 2000 to 2.95 million in 2001. Landings by weight increased 8% to 25.8 million pounds, surpassing the previous high of 23.7 million pounds set in 2000.

Catch and Stock Status Summary (landings, discard, and SSB in metric tons, recruitment in millions of fish).

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Max[1]	Min[1]	Mean[1]
Commercial														
Landings	460	638	777	805	1,555	2,178	2,679	2,936	2,941	3,003	2,826	4,312	63	1,425
Discard	1,030	560	1,041	1,113	1,567	1,233	675	1,102	583	1,499	1,098	53	1,598	806
Recreational														
Catch	1,921	2,089	3,125	4,407	6,049	8,657	11,830	11,116	10,850	14,728	14,663	391	14,728	4,749
Total	3,411	3,287	4,943	6,325	9,171	12,069	15,184	15,155	14,375	19,231	18,588	773	19,231	6,369
SSB	20,976	23,365	27704	30,871	33,365	40,342	43,587	47,760	48,589	47,335	51,916	2,154	51,916	23,999
Recruitment	20.98	23.37	27.7	30.87	33.37	40.34	43.59	47.76	48.59	47.34	51.92	2.15	51.92	24
F age 4-10	0.1	0.08	0.11	0.12	0.18	0.18	0.23	0.21	0.22	0.24	0.23	0.05	0.41	0.17

[1] Based on 1982-2001 period.

2. **Review the VPA-based stock assessment and provide guidance on determining the best, most appropriate model configuration. Provide specific guidance on plus grouping, as well as an evaluation of the fishery independent surveys and the ages on which to base the last true age F.**

Age structure

Future assessments should review the selection of fully recruited ages for F estimation. Using age 5 striped bass as the first fully recruited age may not be appropriate. Proper assignment of the plus group should also be investigated. Creating a 12+ age group is an acceptable compromise, given that the 12+ group constitutes about 2% of the total harvest on average. Potential age misspecification is problematic, especially for older striped bass. The assessment should be re-run after the ageing issues are resolved. A calibration matrix that creates a conversion between scales and otoliths can be used to correct age misspecification from scale samples.

PR model

A flat-topped PR model specification is probably not appropriate. The data presented indicate that the dome-shaped PR is more suitable to Atlantic striped bass analysis. Specifically, catch on ages 4, 5 and 6, tagging information, and movement of large fish offshore, where there is little fishing activity, are evidence for a dome-shaped curve.

Tuning indices

An objective discrimination of which tuning indices to include or withhold from the model should be integrated in the next assessment. Candidate indices may be selected for inclusion by randomizing the series to see how each index performs. If parameter estimates and VPA diagnostics are significantly improved, then the index is a candidate for tuning the VPA. Indices should also be scrutinized for spatial and temporal compatibility with stock migration patterns. Statistical weights may be assigned *a priori* to candidate indices. Survey indices from the northern range of the stock may be characterizing the entire stock complex and should receive greater weighting in the VPA.

3. **Estimate fishing mortality rates for specific components of the coastal stock complex using tagging data.**

The tagging data are used to calculate maximum likelihood estimates of the multinomial parameters of survival and recovery based on an observed matrix of recaptures (using Program MARK). These methods are used to estimate fishing mortality rates for four mixed coastal stocks (Massachusetts, New York, Delaware Bay, and North Carolina). There should be some *a priori* deletion of models that do not have significant weight in the analysis. Deletion of some models may reduce the degree of uncertainty in the estimate. For example, the constant survival tagging model ought to be removed because it is biologically not reasonable, given documented changes in fishing effort.

4. Discuss the validity of averaging stock specific estimates from several separate tagging programs as a means of estimating total stock exploitation.

Tagging programs for specific coastal stocks operate during different time frames; the Massachusetts hook and line program and the New York ocean haul survey tag fish during fall, the New Jersey program tags fish during March and April, and the North Carolina winter trawl survey tags fish during January. Estimates from the Massachusetts program are generally low, and may reflect movement of tagged fish into the EEZ. Although it is desirable to get an overall estimate of fishing mortality of the coastal population, differences among tagging programs make averaging problematic.

5. Review the discard-estimation methodology and the validity of using tag returns as an adjustment to the reporting rate.

The discard estimation methodology is appropriate. However, error bars should be included around the estimators if it is ratio-based, or bootstrapping should be done if ratios are not used. Discard estimates use percentage mortality by gear; additional studies on discard mortalities by gear should be conducted to improve the quality of discard estimates.

6. Provide a comparison of tag- and VPA-derived F estimates. If possible, provide guidance on the most comparable aspects of the VPA output and the tag-derived F. Also provide guidance on which of the tagging programs (or average of programs) would be most comparable to the VPA-derived F.

VPA Fs weighted by N for ages 5-10 and average tag Fs from coastal tagging programs (only positive F values were included in the average) are compared in one of the documents presented and reviewed. Both estimates of fishing mortality show the same increasing trend over time. The VPA Fs tend to be slightly higher than the average coastal tag Fs, although the VPA estimate is not statistically different, based on 95% confidence intervals. The NC offshore winter tag program provided the closest comparison with the VPA results. Tagging estimates and VPA estimates should be incorporated into one assessment so that there is one result. Tagging estimates could be another parameter of the overall assessment.

D. ATLANTIC STRIPED BASS CONSENSUS SUMMARY

The Atlantic Coast striped bass stock is assessed with two separate methods: 1) catch-age based virtual population analysis, and 2) tag release-recovery based survival estimation. Each program is presented in this report as separate segments. The VPA analysis, prepared by the Stock Assessment Subcommittee, is used to evaluate fishing mortality for the mixed coastal stock and provide estimates of abundance and biomass. The tagging analysis, prepared by the Tagging Workgroup, is used to evaluate fishing mortality for specific stocks and averaged results are used to develop a mixed stock mortality estimate. Fishing mortality rates from both programs are compared. A summary of the Chesapeake Bay tag-based direct enumeration study, used to evaluate compliance of the Chesapeake Bay management program with FMP mortality targets, is also presented. The ASMFC Striped Bass stock assessment sub-committee and Technical Committee met in September 2002 to evaluate the status of the striped bass resource.

I. CATCH-AGE BASED VPA ANALYSIS

The first analytical assessment using virtual population analysis (VPA) was conducted in 1997 (for years 1982-1996) and reviewed by the 26th Stock Assessment Review Committee at the Northeast Fisheries Science Center. The results of the review were reported in the proceedings of the 26th Northeast Regional Stock Assessment Workshop (26th SAW): SARC Consensus Summary of Assessments (NEFSC Ref. Document 98-03). This report represents the latest in the series of annual assessments with the inclusion of the 2001 catch and survey data.

Commercial Fishery

Commercial landings in 2001 totaled 941.7 thousand fish and 6.2 million pounds (2,826 mt) (Table D1, Table D2). The landings represent a decline of 109.5 thousand fish (10.4%) and of 395.7 thousand pounds (6%) compared to 2000 (Table D8). The Chesapeake Region (Maryland, PRFC, and Virginia) accounts for most of the commercial harvest, 65% by weight and 82% by number (Table D3). Overall, commercial harvest represented 22% by number and 24% by weight of total harvest in 2001, and 29 % of total catch in number (harvest + discard) (Figure D1, Table D2). Commercial harvest was comprised primarily of fish ages 4 to 6 (60% of commercial harvest). Ages 3 through 8 comprised 88.5% of the harvest.

Direct measurements of commercial discards of striped bass were not available. For past assessments that incorporated 1982-97, the estimates were based on the ratio of commercial to recreational released fish tag recovery data, scaled by total recreational discards:

$$CD = RD*(CT/RT)$$

where:

CD is an estimate of the number of fish discarded by commercial fishery,
RD - number of fish discarded by recreational fishery,
CT- number of tags returned from discarded fish by commercial fishermen,
RT- number of tags returned from discarded fish by recreational fishermen.

Total discards were allocated to gears based on the overall distribution of recovered tags by gear. Discards by fishing gear were multiplied by gear specific release mortalities and summed to estimate total number of fish killed. The technical committee attempted to improve the estimate of commercial discards for the 1998-2001 period by accounting for spatial distribution of different fishing gear and effort. The ratio of tags recovered in commercial and recreational fisheries and corresponding discards were calculated separately for Chesapeake Bay and the coast. Commercial discards for the Hudson and Delaware Rivers were estimated separately. Total commercial discards losses for 2001 were estimated as 310,900 fish, representing 7.2% of total removals in number (Figure D1, Table 2, Table 4, Table 9).

Commercial discard proportions at age were obtained using age distributions from fishery dependent and independent surveys done using comparable gear. These proportions at age were applied to discard estimates by gear and expanded estimates summed across all gears. Total commercial discards were dominated by fish of ages 3 to 6.

Recreational Fishery

Recreational statistics were collected as part of the MRFSS (Marine Recreational Fishery Statistics Survey) program. Landings (A+B1) in 2001 were 2.0 million fish totaling 19.58 million pounds (8,889 mt) (Table D1, Table D2). The landings represent an increase of 88.3 thousand fish (4.6%) and 2.48 million pounds (14.5%) compared to 2000 (Table D1). The states landing the largest proportion of the recreational landings were New Jersey, Maryland, Virginia, New York, and Massachusetts (Table D6, Figure D2). Overall, recreational landings represented 71% by number and 76% by weight of the reported total landings (Figure D1). Striped bass of age 4 to 8 comprised 75% of landings.

Recreational discards (B2's) declined in 2001 to 13.5 million fish (Table D2) compared to 2000 estimates. Application of an 8% hooking mortality rate resulted in estimated losses of 1.1 million fish (Table D2). The states with the largest proportion of the overall discards were Massachusetts and Maryland (Table D7). Recreational discards represented 25% by number of the total catch (Figure D1, Table D2). Discards of the 1996 year class were greatest among all cohorts both in 2000 and 20001. Total recreational striped bass catch in 2001 was 3.1 million fish. The catch was dominated by ages 4 to 8 (76.5% of total). Total recreational discard and landings losses have been growing steadily between 1982 and 2001, with some intermittent decline in 1998-1999 (Table D10, Figure D3).

Total Catch at Age

The above components are totaled by year to produce the overall catch at age matrix for VPA input (Table D11). The total catch of striped bass in 2001 was 4.3 million fish, a decline from 5.04 million fish in 2000. The decline in harvest occurred primarily in ages 2-7 and especially ages 4 and 5 (Figure D4). At the same time there was in increase in the number of harvested fish of age 8 and older with the exception of age 10.

Indices of Abundance

Fishery Independent Indices

The Maryland gillnet survey of spawning biomass has generally declined since 1993, although there was a strong peak in 1996. The 2002 value was very similar to 2001 about one-half the series average (Figure D5). Values for age-2 were dropped as tuning indices due to frequency of zero catches over time. The New York ocean haul seine index increased considerably for 1996-1998, while the 2001 value decreased from 2000 and was near the 1999 value (Figure D6). The NEFSC spring inshore survey was incorporated as an age-aggregated index in the 1999 assessment, and was used in the 2000 and current assessment as age-specific indices. The aggregated index increased during the early to mid-1990s before declining in 1998 and 1999. The 2002 value increased to one of the highest in the series (Figure D7). The Rappahannock River, Virginia pound net CPUE was included for the first time in 2001, in an attempt to provide more information on the overall spawning stock. This survey, begun in 1991, showed high abundance in 1999 and 2000, while the 2001 value was just below average (Figure D8). Three age-aggregated trawl indices from Connecticut, New Jersey and Delaware were added in the 2000 VPA (Figure D9). All surveys showed a decline from 1999 to 2001 to near or below average although Connecticut and New Jersey indices increased in 2002.

Juvenile indices from the Chesapeake Bay (Maryland and Virginia) show another very strong recruitment in 2001 (Figure D10). Previous strong cohorts in 1993 and 1996 have been clearly detectable in coast-wide landings during recent years. The juvenile index for the Hudson River was very high in 2001, while the Delaware index was below average (Figure D11). The NY and NJ young-of-year surveys showed overall increasing trends since 1991.

The Maryland age-1 index was slightly above average in 2001, and reflected only a slight upward trend over the last few years (Figure D12). The Long Island age 1 index in 2001 was the highest for the time series (Figure D12).

Fishery Dependent Indices

The Massachusetts commercial catch per trip reached the highest level in 2001 (Figure D13). The Connecticut volunteer angler catch per trip was well above average in 2000 and reached the highest level in 2001 (Figure D14). The index for age 1 (lagged ahead as age 2) was not included in the VPA analysis.

The Hudson River shad fishery by-catch of spawning striped bass (age 8+) was reconfigured by the NYDEC for use as an age-aggregate index in the VPA. This survey increased steadily through 1996, then dropped to the average for 1997-1998. The survey index was well below average in 2000 and 2001 (Figure D15).

Weight at Age

Weight at age information was updated for the period 1997-2001. Mean weights at age for the 2001 striped bass catch were determined from available state data. The available data were from Maine and New Hampshire recreational harvest and discards; Massachusetts recreational and commercial catch; New York recreational catch and commercial landings; New Jersey recreational catch; Delaware commercial catch and Virginia 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 in numbers. In the VPA model, the estimated weights at age for 2001 were applied to 1997 to 2000 where weight data were unavailable. Details of developing weights at age for 1982 to 1996 can be found in NEFSC Lab Ref. 98-03. Weight at age for the 1982-2001 period is presented in Table D12.

Virtual Population Analysis

Catch at Age

A catch at age matrix was developed using standard methods described in the previous assessment documents (Anon 2001). Commercial landings at age were estimated by applying corresponding length frequency distributions and age length keys to the reported number of fish landed by the commercial fishery in each state. Length frequencies of recreational landings were based on a combination of MRFSS length samples and volunteer angler logbooks. State specific age-length keys were applied to length frequencies to estimate number of fish at age landed by recreational fishery. Age composition of the recreational discards was estimated using lengths available from volunteer angler logbooks and American Littoral Society data.

All states agencies used striped bass scales to estimate age. However, the Technical Committee was concerned about a problem ageing striped bass. Several recent studies (Secor et al. 1995, Bobko 2002, King 2002) have indicated that scales may not provide a reliable age estimate for older fish, beginning with ages 10 to 12. In previous assessments of striped bass, fish of age 15 and older were combined into a 15+ group. The committee adopted the 12+ configuration as the preferred option because 1) estimation of fewer ages reduced the uncertainty associated with ageing error in older fish 2) the change resulted in a more stable exploitation pattern and 3) the estimates of fishing mortality were more closely aligned with estimates from tag models which do not rely on age data. The ADAPT program, a part of the NEFSC stock assessment software FACT, was used to analyze striped bass populations.

ADAPT model inputs

Fishing mortality estimation for age 11, the oldest true age, was based on ages 5 through 10. Abundance of age classes 1 through 11 in the terminal year was estimated using a Marquardt algorithm. Fishing mortality on the plus group was set equal to the fishing mortality for the last true age and was estimated using a backward method. Natural mortality was assumed constant and equal to 0.15 year^{-1}. The model was run using the iterative re-weighting option in FACT.

Model fit.

All estimates of abundance at age (N) and catchability coefficients (q) were significant at the 0.05 level (T statistic > 1.96, Table D13). CVs of the N and q estimates were relatively low (most in the range of 20-30%), indicating a good fit. Estimate of ages 1and 2 abundance had greater CVs (50 and 38%), which were expected due to generally higher variation of indices of abundances of younger ages. Among the catchability coefficient estimates, poor performers were the following indices: NEFSC trawl survey indices for ages 1 and 2 with CVs of 0.5 and 0.38 respectively and Virginia pound net survey indices for ages 1 and 12+ with CVs of 0.49 and 0.33. High variances for these indices were likely caused by the scarcity of either very young (ages 1 and 2) or old fish (ages 10-12+) in the sampling gear. Mean square residuals were 0.95 prior to re-weighting and 0.008 following iterative re-weighting, indicating a good fit of the model. The correlation between parameters was small, which indicated parameters independence, a desired property.

Each survey used to tune the VPA contributes to the overall variance in the model, and the amount of the total variance attributable to an index is indicated by its partial variance (PV). Surveys or particular ages of surveys with high PV's are often deleted from assessment runs because they contribute relatively little additional information, and such an approach has been used in the past to trim down the number of surveys. This assessment was a compilation of several stocks and the relative importance of each component's contribution to the total harvest and population abundance was unknown. Iterative re-weighting was used to reduce the influence of surveys with high partial variance while retaining the information of each survey concerning the abundance of particular stock components. Iterative re-weighting resulted in very small changes in estimates of abundance and fishing mortality, indicating that none of the indices had performed very poorly.

Fishing Mortality

The 2001 average fishing mortality rate (F) for fully recruited ages, 7 through 10 (plus group age minus two), equaled 0.29 and was below current target (0.31) and overfishing values (0.38) (Table D14, Figure D16). Average fishing mortality for ages 4 through 10, which has been reported as average F in previous assessments, was 0.23 (Table D14, Figure D16). Fishing mortality on ages 3-8, which are generally targeted in producer areas, was 0.19. An F weighted by N was calculated for comparison to tagging results since the tag releases and recaptures also weighted by abundance as part of the experimental design. The VPA F weighted by N for ages 5-10 (age 5 to compare with tagged fish > 28") was 0.21.

A bootstrap procedure was used to estimate variation in fully-recruited fishing mortality (ages 7-10). Results of 500 bootstrap iterations show Fs ranging from 0.21 to 0.36 with an 80% probability that F was between 0.26 and 0.32 in 2001 (Figure D22).
The VPA indicates that fishing mortality has been steadily increasing since 1989 (Table D14). The modification of the VPA model to limit the ages to 12 plus changed the estimate of F in the early years of the time series. New estimate in 1982 for fully recruited F was 0.54 (Figure D15) with maximum Fs at age of 0.78.

Partial Recruitment

Full recruitment estimated as the back-calculated partial recruitment was at age 7 in 2001, up from age 6 in 2000. Prior to 2000, age at full F varied between ages 7 and 10 (Table D16). Changes in regulations in 2000 and 2001 to shift exploitation patterns may account for the changes from the 1990s.

Population Abundance

Population abundance (stock size as of January 1, 2002) was at the highest level in time series (Table D17, Figure D19) and was estimated at 59.6 million fish. Bootstrap estimates of population abundance are shown in Figure D23. VPA results suggested that the increase was due to very strong 2000 and 2001 year classes. Recruitment of age 1 fish in 2002 (2001 cohort) was estimated as 17.9 million fish, which makes it the biggest cohort ever, exceeding both 1993 and 1996 year classes (Figure D20). This follows the 2000 cohort estimated as 15.5 million fish which also exceeded 1993 and 1996. Abundance estimates for striped bass age 3 and older have declined slightly since 1999 as the previously strong cohorts move through the fishery. However, both the 1993 and 1996 year classes remain the most abundant at age in the time series.

Spawning Stock Biomass

All VPA runs indicated that spawning stock biomass (SSB) has been growing steadily since 1982 and reached the highest level in 2001 (Figure D21). However, SSB growth was slowed after 1998. Female SSB estimates are of 25.8 mt in 2001.

Retrospective Patterns

A retrospective analysis was conducted on the VPA results with successive terminal years extending back to 1995, in order to determine trends in estimation of F or total abundance in the terminal year. The analysis revealed that there was little evidence of retrospective bias in the assessment. However, there was a tendency of overestimation of age 1 abundance by the model.

Sensitivity Analysis

Due to the uncertainty in age determination, sensitivity runs were made for the VPA using a 13+ group. Changing the plus group ages had a significant change in the estimates. The average F for ages 4 to 11 was 0.32, ages 8 to 10 equaled 0.4 and average F for ages 3 to 8 was 0.22.

Stock size estimates were also influenced, as 1+ abundance with 13+ decreased to 52.6 million fish compared to 59.6 million with 12+. Recruitment estimates at age 1 also declined by 1.8 million fish to 16.1 million.

The overall trend appears to be a decrease in fishing mortality and increase in stock size estimates as the plus group is reduced in age.

II. TAGGING PROGRAM ANALYSIS

Introduction

This report summarizes results from analyses of tagging data from the U.S.F.W.S. Cooperative Striped Bass Tagging Program. The results include estimates of instantaneous fishing mortality (F) and survival (S) rates. Estimates of F and S are provided with and without correction for live release bias. Also, included are QAICc estimates and weights used for model selection and model averaging, length frequency of tag releases, age frequency of recaptures, geographic distributions of recaptures by month, and estimates of catch and exploitation rates by program.

Description of Tagging Programs:

Eight tagging programs provided information for this report, and have been in progress for at least nine years. Producer area tagging programs operate mainly during spring spawning, and use many capture gears, such as pound nets, gill nets, seines and electroshocking. Coastal programs tag striped bass from mixed stocks during fall and use several gears including hook & line, seine, gill net, and otter trawl. Most producer area and coastal programs tag striped bass during routine state monitoring programs. The Western Long Island Survey seines striped bass from May through October in bays along the western end of Long Island, New York; data from May through August are most consistent and were used for tag analysis.

Tag release and recapture data are exchanged between the U.S. Fish and Wildlife Service (USFWS) office in Annapolis, MD, and the cooperating tagging agencies. The USFWS maintains the tag release/recovery database and provides rewards to fishermen who report the recapture of tagged fish. Through July of 2002, a total of 385,891 striped bass have been tagged and released, with 70,118 recaptures reported and recorded in the USFWS database (Tina McCrobie, personal comm.).

Analysis Methods:

The Striped Bass Tagging Committee analysis protocol is based on assumptions described in Brownie et. al. (1985). The tag recovery data is analyzed in program MARK (White, 1999). Important assumptions of the tagging programs (as reported in Brownie 1985) are as follows:

1. The sample is representative of the target population.
2. There is no tag loss.
3. Survival rates are not affected by the tagging itself.
4. The year of tag recoveries is correctly tabulated.

Other assumptions related to the modeling component of the analyses include:

5. The fate of each tagged fish is independent of the fate of other tagged fish.
6. The fate of a given tagged fish is a multinomial random variable.
7. All tagged individuals of an identifiable class (age, sex) in the sample have the same annual survival and recovery rates.

The tagging committee calculates maximum likelihood estimates of the multinomial parameters of survival and recovery based on an observed matrix of recaptures (using Program MARK). The analysis protocol follows an information-theoretic approach based on Kullback-Leibler information theory and Akaike's information criterion (Burnham and Anderson 1988), and involves the following steps. First, a full set of biologically-reasonable candidate models are identified prior to analysis. Various patterns of survival and recovery are used to parameterize the candidate models. These include models, which allow parameters to be constant, time specific, or allow time to be modeled as a continuous variable. Other models allow time periods to coincide with changes in regulatory regimes established coastwide. Candidate models used in the analyses of striped bass tag recoveries are listed and described below.

S(.) r(.)	Constant survival and reporting
S(t) r(t)	Time specific survival and reporting
S(.) r(t)	Constant survival and time specific reporting
S(p) r(t)	*Regulatory period based survival and time specific reporting
S(p) r(p)	*Regulatory period based survival and reporting

S(.) r(p)	*Constant survival and regulatory period based reporting
S(t) r(p)	*Time specific survival and regulatory period reporting
S(d) r(p)	*Regulatory period based survival with unique terminal year and regulatory period based reporting
S(v) r(p)	*Regulatory period based survival with 2 terminal years unique and regulatory period based reporting
S(Tp) r(Tp)	*Linear trend within regulatory period for both survival and reporting
S(Tp) r(p)	*Linear trend within regulatory period survival and regulatory period based reporting (no trend)
S(Tp) r(t)	*Linear trend within regulatory period survival and time specific reporting (no trend)
* Periods	1 = { 87- 89}, 2 = { 90- 94}, 3 = { 95- 2001}

Candidate models are fit to the tag recovery data and arranged in order of fit by the second order adjustment to Akaike's information criterion (AICc) (Akaike, 1973; Burnham and Anderson, 1992). If overdispersion is detected, then an estimate of the variance inflation factor (i.e., c-hat) is used to adjust AICc (after adjustment, AICc is called QAICc; Anderson et al 1994). Annual survival is calculated as a weighted average across all models, where weight is a function of model fit (Burnham and Anderson 1998; Smith et al. 2001). Model averaging eliminates the need to select the single 'best' model, allowing the uncertainty of model selection to be incorporated into the variance of parameter estimates (Burnham and Anderson 1998; Smith et al. 2001). Also, the committee uses a goodness-of-fit bootstrap procedure (included in program MARK) to estimate the probability that the fully time saturated model fits the data. At the Striped Bass Technical/Stock Assessment meeting (10-12 September 2002), it was suggested that a probability under 0.2 represents lack of fit; this is an arbitrary cutoff point but we use it herein to indicate model fit.

Since survival cannot be uniquely estimated for the terminal year in the fully time saturated {S(t)r(t)} model, the time saturated model is excluded from the model averaged survival estimate for the terminal year only. The final steps involve adjusting the estimates of survival for reporting rate (Kahn, 2001) and bias due to live release (Smith et al. 2001). Instantaneous fishing mortality (F), not directly estimated by these analysis procedures, is determined by converting survival (S) to total mortality (Z) and subtracting a constant value for natural mortality (M) of 0.15. Using this technique, natural mortality is held fixed, and any change in total mortality (Z) results in an equal change in fishing mortality (F).

Results

The 2001 weighted-mean instantaneous fishing mortality (F) was **0.53** for >= 18 inch fish from producer area (Delaware and Maryland) tagging programs (Table D20). This weighted mean excluded Hudson River (data were unavailable for 2001) and Virginia (because of lack of fit for the full parameterized model). For the subset of >= 28 inch striped bass, the weighted mean fishing mortality (F) in 2001 was **0.16** (Table D21). The weights used in the calculations were as follows: Delaware (0.10) and Maryland (0.90). These were modified from the previous weight scheme [Hudson (0.13); Delaware (0.09); and Chesapeake Bay (0.78), with MD (0.67) and VA (0.33)] as provided from G. Shepherd (pers. comm.). The weight scheme was modified because of the lack of Hudson River data and the lack of fit of the full parameterized model with Virginia data.

A 2001 unweighted-mean instantaneous fishing mortality (F) was not calculated for >= 18 inch fish from the coastal mixed stock tagging programs (Table D20). Survival estimates from three of the four coastal tagging programs were not representative; MADFW primarily tags fish larger than 28 inches, and GOF bootstrap analyses indicated a lack of model fit of data from NYOHS and NCCOOP. For striped bass tagged at twenty-eight inches and greater in total length (believed to represent those fish fully recruited to the coastal fisheries) the 2001 unweighted-mean fishing mortality was **0.09** (Table D21). This unweighted mean was calculated with data from MADFW, NYOHS, and NJDEL, but excluded NCCOOP because of lack of model fit.

In general, fishing mortality estimated by tag-based survival analyses has increased in recent years for the >= 18 inch group, and decreased for the >= 28 inch group. This relationship is consistent with recent changes to regulations that have shifted harvest to smaller fish.

Tables D22 and D23 provide the raw estimates of survival from MARK, and components of the live release bias adjustment. For most tagging programs, the proportion of >= 28 inch fish released alive was lowest within the years of 1996 to 1999; these estimates in recent years have increased slightly (Table D23). If the entire time series is considered, then live release bias has decreased since the late 1980's and early 1990's and may result from lowered size limits. The overall decreasing trend in the number of fish released alive (based on tag data) differs from recent MRFSS reports.

For bias adjustment calculations, the committee applies an 8% mortality to live releases, because most live releases are captured with hook and line. Also, a reporting rate of 0.433 is used to adjust survival and fishing mortality rates (based on a high reward tag study of striped bass released in Delaware; D.Kahn, pers. comm.).

A GOF bootstrap test indicated that most time saturated models fit the data (exceptions included the >= 18 inch group of NYOHS, and both size groups of VARAP and NCCOOP; Tables D22 and D23).

Tables D24 and D25 provide the Akaike weights used to calculate the model averaged survival estimates for each program. Those highlighted were the highest weighted models for that program. These are provided so that the reader may evaluate the model (or models) that influence the overall results. In nearly each case, the best fitting models inferred time or regulatory period specific survival or reporting. For several programs, a model of trend within regulatory period received highest weight. The only case where a model of constant survival and reporting received highest weight was for fish greater than twenty-eight inches total length in the Virginia/Rappahannock producer area program.

Tables D26 and D27 provide the total length frequencies of fish tagged and released by program for 2001 and the age frequencies of 2001 (year) recaptures. The length frequency data show the relative differences within and between fish tagged on the coast and in producer area programs. The bimodal length frequencies of producer area programs are probably related to differences between sexes. The coast programs exhibit single modes, likely related to differences in program design and gear type. In general, the Massachusetts program (which captures fish with hook and line) releases proportionally more large fish than other coastal programs, whereas the North Carolina trawl survey releases proportionally more small fish than other tag programs.

Age distributions of 2001 recaptures are problematic since few programs assign ages to all tagged fish. Hence, fish not aged at release cannot be assigned an age at recapture. The greatest proportions of recaptures were among ages four through eight, which included 13.3, 25.4, 16.5, 12.4, and 10.1% of the total. In general, these cohorts accounted for 84% of recaptures from fish tagged on the coast, and 64% of those from producer areas.

Table D28 provides geographic distributions of recaptures by state and month during 2001. Northward spring movements followed by southward returns during fall are consistent across programs and reflect migration patterns and fishing effort.

Tables D29 through 12 provide results from the Western Long Island Survey of juvenile striped bass (ages 1, 2, and 3+). These results indicate a decrease in total mortality as age increases from 1 to 3+.

<u>Trends in encounter and exploitation rates</u>:
Annual catch rates and annual exploitation rates were estimated with tag recoveries of striped bass released by seven agencies (1987 - 2001) of the Cooperative Striped Bass Tagging Program (Tables D32 to D35). Previous estimates of VA-York (1991 - 1999) and NYHUD (1988 - 2000) are included for comparison. Each time series of annual catch rates and annual exploitation rates reflects trends in fishing effort and exploitation, respectively.

Catch and exploitation rates are estimated from recaptures of two size groups (>= 18 inch and >= 28 inch) during the first year after release. Adjusted R/M ratios were used as described below (Reporting rate = 0.43, hooking mortality rate = 0.08, R_k = killed recaptures, R_L = recaptures released alive):

(1) Annual catch rate = (R / 0.43) / M
(2) Annual exploitation rate = $((R_k + R_L * 0.08) / 0.43) / M$

Herein, we report trends across the entire time series by program. Overall increases in annual catch rates and annual exploitation rates from 1987 - 1997 or 1987 - 1998 suggest an increase in fishing pressure over that part of the time series, but recent estimates (i.e., the previous two years) of annual catch rates and annual exploitation rates have decreased for most tagging programs.

In general, estimates of exploitation rates are consistent with estimates of F (from survival analyses) as reported above for >= 28 inch fish, but not with those reported for >= 18 inch fish.

III. STATUS OF INDIVIDUAL STOCKS

A coast-wide stock of striped bass is comprised of several populations, primarily Hudson River, Delaware Bay and Chesapeake Bay. It is equally important to maintain individual stock at healthy level so that over-fishing does not occur at the local level. For that purpose we report estimates of fishing mortality and population characteristics for each individual stock.

Chesapeake Bay

Fishing mortality

Tag-based estimates of fishing mortality in 2001 for the Chesapeake Bay stock were available only from the Maryland spring tagging program and the direct enumeration study conducted through the calendar year of June 2001-June 2002. For fish $\geq$28 inches, the spring estimate of F = 0.13 was lower than the N-weighted VPA F estimates of 0.27 and 0.37 on ages 8-10 (12+) and 8-11 (13+), respectively. It should be noted that the tag-based F and N-weighted VPA F are not directly comparable to the reference point because of the methods used to calculate that measure.

A direct enumeration study to estimate the bay-wide fishing mortality based on the tag release and recovery data is conducted by Maryland and Virginia since 1993. The multiple release design and analysis used in this study was reported in Hebert et. al. 1997; Goshorn et al. 1998; Goshorn et al. 1999; Goshorn et al. 2000; Hornick et al. 2000; Hornick et al. 2001. Striped bass were tagged and released throughout the Chesapeake Bay prior to and during the recreational fishing seasons for each respective jurisdiction during four release rounds in Maryland, and three in Virginia. Jurisdictional regions within the Chesapeake Bay were open for recreational striped bass fisheries for a combined total of approximately 31 weeks (6/1/01 - 12/31/01) during the 2001 fall season. All tagging was done cooperatively with commercial watermen. Tag recoveries were handled and recorded by each management jurisdiction and by the U. S. Fish and Wildlife Service (USFWS). USFWS internal anchor tags were applied to 6,663 striped bass. A logistic model was applied to tag recovery and release data. The proportion of the number of recovered tags to the number of tags released was the response variable and the explanatory variables consisted of one categorical variable (interval number, which accounted for unequal interval lengths) and two binary variables, disposition and angler type Estimates of exploitation for the recreational/charter season were converted to instantaneous rates for each round and summed across intervals to determine F for the recreational/charter fishery (F_R). This estimate was then adjusted to include the Chesapeake Bay resident portion of the commercial and recreational fisheries that occurred during summer 2001, winter 2001-2002 and during spring of 2002, respectively. The expanded estimates of total F were calculated based on weighting of recreational/charter estimates of F_R by proportional additions of spring recreational or commercial harvest in numbers. The estimate of the Chesapeake Bay-wide F (F_{Bay}) for 2001 is F_{Bay}= 0.23. Non-harvest mortality (0.10) was added to the point estimate of F = 0.13 to obtain the final estimate of bay-wide fishing mortality of F_{Bay} = 0.23 for 2001. The final estimate of bay-wide F (F_{Bay} = 0.23) is below the Atlantic States Marine Fisheries Commission's (ASMFC) determined 2001 target fishing rate of F = 0.28 for the Chesapeake Bay. A time series of fishing mortality estimates derived by this method is presented in Table D38.

Spawning stock
Spawning stock relative abundance (ages 8+) has been increasing since 1999. The index increased to 79.81 in 2001, but dropped slightly in 2002 to 72.7. Although the spawning stock index dropped in 2002, this value is well above the 1985-2001 average of 46.6 and is equivalent to the 1993-1998 levels.

Recruitment
Both Maryland and Virginia index of YOY striped bass abundance (geometric mean) in 2001 was well above the 1957-2000 average. These observations indicated that 2001 was an excellent recruitment year. At the same time the 2002 index was well below the 1957-2001 average.

<u>Hudson River</u>

Fishing mortality
Data from 2001 have not been processed due to lack of staff at NYDEC; therefore; no tag-based estimates were available for the Hudson River.

Spawning stock
Spawning stock relative abundance (gillnet CPUE; ages 8+) increased slightly in 2001 to 633.2; however, the index is still below the 1985-2000 average of 746.9.

Recruitment
The Hudson River index of YOY striped bass abundance (geometric mean) increased to 22.98 in 2001. The 2001 value is well above the 1979-2000 average of 13.32, indicating that 2001 was a relatively good year of recruitment for striped bass.

<u>Delaware Bay</u>

Fishing mortality
Tag-recapture data is employed in two analyses, a Petersen exploitation estimate and an estimate of F based on survival modeling with MARK program software. The two sets of estimates have been the highest on the coast for the last several years. Both estimates, when translated into F, are F weighted by N. The exploitation estimate for 2001 was 28%, which translates into F_{2001} = 0.36. The 2001 F estimate from the MARK program with trend models included was F_{2001} = 0.42. If trend models are eliminated, the MARK estimate was F_{2001} = 0.35. The Delaware River stock suffers high levels of entrainment mortality from the Salem Nuclear Generating Station. This mortality on YOY larvae and juveniles has been estimated as averaging 32% per year, in the worst case of no compensatory increase in survival of those YOY fish escaping entrainment and impingement.

Spawning stock
The spawning stock survey occurs in April and May on the spawning grounds in the tidal freshwater Delaware River from Wilmington through Philadelphia. Two agencies co-operate in this survey, which tags fish and develops Catch Per Unit Effort estimates of abundance in standardized surveys. The Delaware Division of Fish and Wildlife (DDFW) employs electrofishing gear in a formal systematic sampling design (this type of design is randomized), while the Pennsylvania Fish and Boat Commission (PFBC) also employs electrofishing gear, but in a fixed design. Trends in overall abundance are flat from 1995-2001 for the PFBC and

indicate a slow decline in the DDFW estimates for the period 1996-2001. Further analysis will be conducted. The more extensive DDFW data shows an increase in larger, older fish in recent years, but a decline in recruitment of younger age groups into the spawning stock.

Recruitment
A YOY survey is conducted annually by the New Jersey Division of Fish, Game and Wildlife employing a beach seine. The index was extremely low at the beginning of the time series in 1980, then gradually climbed to a value of 1.03 in 1989. Since then, it has fluctuated without trend between about 1.00 and 2.00. The 2001 index was 1.07.

IV. DISCUSSION

VPA Analysis
The results of the VPA analysis indicate that the coastal stocks of striped bass remain at or below the target F and are not in an overfished condition. Recruitment continues to increase to record levels while spawning stock biomass estimates are at the highest level in the time series. Catches in the recreational fishery also continue to increase.

The sensitivity of the VPA model to changes in the plus grouping was of concern to the Technical Committee. The primary purpose of reducing the plus group was to reduce problems associated with age error. This change also illustrated the problems associated with defining plus groups and oldest age F estimates in an age-structured model. A change in the plus group influenced the calculated exploitation pattern and consequently the average F at fully recruited ages. With more ages in the model, the average F tended to be higher. However, due to the direction of the potential age bias in the inputs, it is expected that the model would be over-estimating F by incorporating older and possibly incorrect ages. Consequently there is more uncertainty in the VPA estimates than are indicated by the bootstrap results.

Tag Analysis
There are several sources of uncertainty associated with the estimation of survival and recovery parameters in the tagging analysis for striped bass. The primary source involves the violation of assumptions basic to all tag recovery modeling, as mentioned earlier in this text. Others involve ad-hoc methods employed to correct for live release bias, as well as the use of a contemporary reporting rate to adjust retrospective recaptures. In addition, the best fitting model for several programs in the >= 18 inch total length group was the time saturated model, which is omitted from the suite of models during model averaging due to constraints on the terminal year survival estimate. The application of a constant value for natural mortality across all groups and time does not allow for potential changes in natural mortality, and dictates that changes in survival result only in changes in fishing mortality.

Also, GOF bootstrap analyses indicated a lack of fit for time saturated models from some tagging programs. The c-hat adjustment corrects for lack of fit associated with overdispersion, but will not correct lack of fit when data do not support the full parameterized model. In the latter case, additional thought toward selection of candidate models may be necessary. In general, lack of fit occurred in program results with highest weight on the full parameterized (time saturated) model and large year to year variation in survival estimates. The tagging committee plans to examine the use of covariate models in future analyses; preliminary covariate analyses with the NCCOOP data reduced problems with the full parameterized model and extreme year to year variation in survival estimates.

Additionally, the tagging committee will examine the use of trend models, which have been used to fit increasing or decreasing trends in survival estimates. In all cases for the 2001 analysis, when trend models were given highest weight (such as DE and MD for the >= 18 inch group, and DE and NJ for the >= 28 inch group), F estimates of the terminal year were high. This effect also occurred for the terminal year estimates of NYOHS, NJ, and VA for the >= 18 inch group, because the trend models received highest weight after omission of the time saturated model. Resolution of many of these issues will take time, and may require a change in the analysis protocol adopted by the tagging committee. It is likely that additional research is required to investigate the differences in release mortality associated with different capture gears, or that the committee may need to investigate other methods to directly determine instantaneous fishing mortality (F). Some solutions may take longer, as the state of the theoretical science is generally in advance of any practical application. Perhaps, as in the model averaging approach, we should not focus on individual tagging program results, but instead consider the aggregate, and examine trends applicable to the whole stock over time.

<u>TAG-VPA F Comparison</u>

Results from the VPA average F and the tagging estimates of F are not directly comparable. Since the tag releases are made proportional to abundance, the appropriate comparison between tag and VPA F's are the tag F with the VPA F weighted by N. Tag results are for striped bass 28 inches and greater. Therefore, comparison was between VPA F's weighted by N for ages 5 to 10 and average tag F's from coastal programs (only positive F values were included in the average).

The results from the two independent estimates of fishing mortality show the same increasing trend over time. The VPA Fs tend to be slightly higher than the average coastal tag Fs (Figure D24, D26), although the VPA estimate is not statistically different based on 95% confidence intervals. The NC offshore winter tag program provided the closest comparison with the VPA results as shown in Figure D25. Part of the variation between the two is the result of the different models used for the estimation.

V. CONCERNS

The uncertainty associated with ageing striped bass with scales remains a problem. A thorough analysis of the scale and otolith database is required to develop a reliable procedure for correction of ages estimated with scales. In response to this problem, the ASMFC will convene an ageing workshop during the winter of 2003 to evaluate the problem and develop some possible solutions.

The Technical Committee remained concerned about the high levels of fishing mortality on the Delaware River stock as determined by tagging estimates of survival.

Some members of the Technical Committee were concerned that the distribution of larger striped bass has shifted to offshore waters as the population has increased in abundance. Since the EEZ is closed to harvest and there is limited fishery independent survey data for older striped bass beyond state waters, these fish may not be represented in the assessment. Low tag recovery of fish tagged in MA may be an indication of shifting distribution.

Some members of the Technical Committee were concerned that the VPA is not adequately robust when dealing with a mixed stock such as coastal striped bass. Other methods that are capable of directly accounting for mixed stock management units should be explored in the future. Some members were also concerned that the tag based estimates of survival among coastal programs were so variable. It is possible that the assumption of mixing and dispersal is not being adequately met to provide a comprehensive estimate of mortality.

Developing consensus management recommendations remains difficult when faced with two separate assessment techniques. Methods that combine catch, survey, and tag data into a single analytical framework should be explored.

VI. SARC COMMENTS

VPA Analysis

Selection of ages 5-10 to estimate the F on age 11 will produce strong dome shaped PR. A flat top PR is not appropriate. When fishing offshore is prohibited, it provides a refuge for large fish and may result in a dome shape PR. Availability may be declining not because of the decline of fish numbers but because they are moving out of the area. Partial recruitment calculation is shifting around with age class dominance.

Including ages 5 and 6 may be helpful early on in the time series when there were not many age 7 and older fish, but that is not helpful now. Need to be careful how you calculate the F on the oldest true age. Use the previous age to estimate the F on the first age in the plus group (ie use age 10 to estimate the F on age 11). That allows for a greater potential for allowing a dome to occur. There would be an even stronger dome if the age range were 4-10 rather than 5-10. Catch on age 4, 5 and 6, tagging information, fish moviement into an area where fishing is not occurring- all of these are evidence for a domed shaped curve.

Plots of residual time series are needed to judge the quality of fit.

Estimates of F are sensitive to the plus group. For example, in the 13+ run, the F in 2001 is 0.4 (Table D14).

There are 4 years were the plus group is greater than the sum of the previous plus group.age 11.

There is no description in the document that describes how the target and threshold Fs were derived in Amendment 5. Need some background on the derivation of the target and threshold Fs.

The document should include table of F by age and year in addition to average Fs.

It appears that there is a problem with age precision beyond age 8 in MA scale reading study. The mean weight at age in some cohorts is going down. This is because of the bias and imprecision in ageing.

The SARC recommends developing a calibration matrix that creates conversion between scales and otoliths. This is a very important outcome from the intended ageing workshop.

The issue of an appropriate VPA configuration should also address allowing for a dome shaped selectivity pattern and an objective discrimination of which tuning indices were included or withheld from the model.

Indices should be tested through the randomization tests, PCA.

Range of the stock distribution by season and fraction of the stock that would be present in a certain area should be considered in parallel with the indices selection. All of the indices that are north of the spawning areas may be capturing the stock as a whole and maybe those indices should be provided with greater weight in the VPA.

Error bars should be included around the estimators if it is based on ratios or bootstrap should be done if ratios are not used.

Use the MRFSS estimate for recapture rate (1 in 13 fish is actually retained?) as an independent estimate of recaptures.

<u>Tag Analysis</u>
Tagging in Delaware is done in the Delaware River, this may be a reason for the increase in DE estimates.

Assume the tagging reporting is constant because there aren't better estimates. Reporting rates may vary.

Including the constant survival models is inappropriate if one wants to be able to compare the tagging estimates and the VPA results.

28" or greater (at tag and release) are assumed to be about age 7. Have not run age based models. Analysis uses 28" or greater as a group and that is compared to the 5-10 ages. Probably should be examined a bit further.

Diminishing the quality of the parameter estimates when including models that are not given much weight, although it may not significantly influence the output, it is going to influence the uncertainty. This may be a reason to throw out these models.

Tag analysis implies a very high dome because the F is greater on the 18" and greater (tag analysis) compared to the F estimate from the tag analysis for 28" or greater.
Fish captured more than once are only included the first time around in the analysis.

Research recommendations.

Conduct a workshop to evaluate an appropriateness of scales in ageing old fish.

Explore applicability of Bayesian framework to striped bass assessment.

Develop the model that will combine VPA and tagging data.

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VI. Tables and Figures

VPA Tables and Figures

Table D1. Total Atlantic Coast harvest of striped bass in metric tons and numbers from 1982 to 2001.

Year	Commercial		Recreational		Total	
	MT	N	MT	N	MT	N
1982	992	428,630	1,144	217,256	2,136	645,886
1983	639	357,541	1,217	299,444	1,856	656,985
1984	1,104	870,871	579	114,463	1,683	985,334
1985	4,312	174,621	372	133,522	4,684	308,143
1986	68	17,681	501	114,623	569	132,304
1987	63	13,552	388	43,755	451	57,307
1988	117	33,310	570	86,725	687	120,035
1989	91	7,402	332	37,562	423	44,964
1990	313	115,636	1,010	163,242	1,323	278,878
1991	460	153,798	1,653	262,469	2,113	416,267
1992	638	230,714	1,830	300,180	2,468	530,894
1993	777	312,860	2,564	428,719	3,341	741,579
1994	805	307,443	3,084	565,167	3,889	872,610
1995	1,555	534,914	5,675	1,089,183	7,230	1,624,097
1996	2,178	766,518	6,003	1,175,112	8,181	1,941,630
1997	2,679	1,058,181	7,267	1,515,296	9,946	2,573,477
1998	2,936	1,223,828	5,771	1,366,353	8,707	2,590,181
1999	2,941	1,103,812	6,245	1,319,794	9,186	2,423,606
2000	3,003	1,051,275	7,756	1,924,001	10,759	2,975,276
2001	2,826	941,733	8,889	2,012,314	11,715	2,954,047

Table D2. Total 2001 striped bass discard and harvest in numbers and % of total by fishery component.

Fishery Component	Discard	Discard Losses	Harvest	Total Catch
Recreational	13,456,350	1,076,508	2,012,314	3,088,822
Commercial	2,023,439	310,900	941,733	1,252,633
Sampling			2,343	2,343
Total	15,479,789	1,387,408	2,956,390	4,343,798

Percent of Total

Fishery Component	Discard Losses	Harvest	Total Catch
Recreational	24.78%	46.33%	71.11%
Commercial	7.16%	21.68%	28.84%
Sampling		0.05%	0.05%
Total	31.94%	68.06%	100.00%

Table D3. Atlantic Coast striped bass commercial harvest in numbers at age by state, 2001.

State	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Maine																0
New Hampshire																0
Massachusetts	0	0	0	0	0	0	1,877	7,090	6,673	8,342	9,176	3,962	2,294	626	208	40,248
Rhode Island	0	0	16	122	779	1,543	1,841	1,841	744	934	1,139	589	614	458	297	10,917
Connecticut																0
New York	0	0	0	209	6,842	10,682	10,263	23,668	3,700	1,745	768	349	70			58,296
New Jersey																0
Delaware	0	0	34	1,247	10,932	9,448	5,926	5,349	946	89	402					34,373
Maryland	0	0	81,433	141,666	169,554	83,660	32,555	14,582	5,389	4,245	2,749	1,983	795	199		538,808
PRFC	0	0	1,492	40,281	32,396	6,394	3,410	2,558	853	213	0	0	0	213		87,809
Virginal	0	165	3,215	6,077	20,234	26,951	30,885	33,327	9,352	7,183	4,050	4,998	750	1,000	159	148,346
North Carolina	0	0	0	0	0	0	69	3,680	5,710	8,415	3,676	878	439	69		22,936
Total	0	165	86,190	189,602	240,736	138,678	86,825	92,095	33,367	31,165	21,960	12,759	4,962	2,564	665	941,733

Table D4. Estimated Atlantic Coast commercial discard losses at age for 2001.

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
2001	1	2,638	58,079	77,958	88,808	29,410	18,877	11,613	9,664	6,371	4,778	1,957	737	10	0	310,900

Table D5. Reported scientific removals at age for 2001.

	Age															
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
2001	0	15	337	956	660	120	63	56	50	51	21	10	3	1		2,343

Table D6. Total Atlantic Coast striped bass recreational landings in numbers at age by state, 2001.

State	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Maine	0	0	12,070	19,382	17,763	5,406	1,862	3,206	7	35	115	42	29	27	6	59,947
New Hampshire	0	0	0	397	1,165	2,289	3,124	2,394	1,804	1,192	1,604	895	429	0	0	15,291
Massachusetts	0	0	0	5,058	6,488	38,087	85,493	71,709	41,694	14,091	13,709	6,312	3,948	1,442	0	288,032
Rhode Island	0	0	0	262	12,953	24,631	19,322	14,236	3,082	1,787	1,746	1,112	661	197	138	80,127
Connecticut	0	0	0	1,027	12,187	11,205	7,608	6,632	3,575	167	312	1,001	1,460	2,731	5,507	53,412
New York	0	0	0	4,173	23,885	55,309	48,074	36,796	7,233	5,135	4,351	1,270	2,026	541	917	189,710
New Jersey	0	0	0	18,505	105,286	159,608	116,225	70,521	39,494	21,947	17,285	6,330	2,989	1,495	523	560,208
Delaware	0	0	736	432	2,026	3,481	10,012	13,089	3,312	1,655	2,926	2,548	671	307	0	41,195
Maryland	0	47,386	81,500	87,717	31,086	33,625	21,125	18,583	19,320	14,548	15,510	5,525	4,434	1,241	956	382,557
Virgina	0	559	17,487	31,868	75,877	62,904	45,005	40,275	8,216	7,581	4,483	5,528	893	1,041	102	301,819
North Carolina	0	0	0	4,214	3,766	181	2,590	9,008	8,358	5,888	6,011	0	0	0	0	40,016
Total	0	47,945	111,793	173,036	292,482	396,725	360,440	286,449	136,095	74,025	68,051	30,562	17,541	9,022	8,149	2,012,314

Table D7. Total Atlantic Coast striped bass recreational discard losses in numbers at age by state, 2001.

State	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Maine	110	3,858	20,848	17,224	13,401	5,883	3,955	3,443	554	134	134	51	32	11	4	69,639
New Hampshire	0	654	2,054	2,800	2,843	1,587	1,268	1,303	279	104	124	67	50	12	0	13,147
Massachusetts	0	6,233	27,455	75,063	89,902	74,347	69,146	60,716	16,978	4,439	4,725	1,979	1,320	258	310	432,872
Rhode Island	0	870	2,103	1,090	5,960	7,839	5,788	4,159	844	489	478	304	181	54	38	30,197
Connecticut	3,367	14,178	10,722	8,064	26,053	8,950	4,608	5,051	3,633	620	1,063	1,152	443	177	532	88,617
New York	276	5,567	11,569	6,884	14,025	10,683	7,969	4,999	1,128	703	590	184	283	85	134	65,073
New Jersey	99	3,824	5,415	14,468	28,558	13,500	6,373	2,820	1,195	522	343	88	42	14	0	77,262
Delaware	0	13	437	568	2,444	2,457	3,500	3,516	725	262	438	342	74	40	0	14,816
Maryland	25,426	62,527	77,792	30,745	19,194	4,643	6,072	2,974	883	466	165	146	94	34	43	231,204
Virgina	5,463	13,434	16,714	6,606	4,124	998	1,305	639	190	100	35	31	20	7	9	49,676
North Carolina	0	0	6	290	1,366	828	555	553	246	94	58	0	0	0	9	4,006
Total	34,741	111,159	175,115	163,803	207,871	131,714	110,540	90,174	26,655	7,933	8,154	4,346	2,541	693	1,079	1,076,508

Table D8. Atlantic Coast striped bass commercial landings in numbers at age, 1982-2001.

	Age															
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
1982	0	45,129	200,221	117,158	22,927	5,035	3,328	2,861	1,871	4,407	5,837	7,639	2,509	2,810	6,898	428,630
1983	0	54,348	120,639	120,999	38,278	7,416	1,954	677	607	1,690	1,314	2,375	2,656	1,856	2,733	357,541
1984	0	478,268	270,140	55,598	30,580	21,688	6,441	1,744	1,020	771	146	279	1,096	1,042	2,058	870,871
1985	0	53,699	45,492	7,545	9,448	19,248	21,569	6,581	3,692	1,514	466	607	493	894	3,373	174,621
1986	0	639	6,020	3,207	180	703	1,425	1,199	546	182	105	220	288	963	2,004	17,681
1987	0	0	3,087	4,265	1,618	252	1,104	1,075	448	233	95	273	302	235	565	13,552
1988	0	0	2,086	3,961	15,491	6,469	2,803	539	541	218	266	108	250	41	537	33,310
1989	0	0	0	0	0	139	1,111	959	1,007	631	475	164	343	444	2,129	7,402
1990	0	650	12,551	48,024	29,596	15,122	3,111	2,357	1,147	519	272	130	428	322	1,407	115,636
1991	0	2,082	22,430	44,723	41,048	21,614	8,546	4,412	4,816	1,163	269	125	80	553	1,937	153,798
1992	0	640	32,277	58,009	46,661	41,581	22,186	11,514	8,746	6,314	1,062	464	169	346	745	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	184	76	404	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	198	68	326	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	997	363	149	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	2,264	1,134	1,449	766,518
1997	0	335	96,860	293,511	225,218	201,397	103,129	60,000	33,262	18,888	11,811	7,861	2,753	2,178	978	1,058,181
1998	0	3,122	65,861	209,898	526,183	192,473	70,124	59,604	44,017	25,365	14,592	5,878	3,837	1,387	1,487	1,223,828
1999	0	7,344	93,998	233,720	275,305	235,925	76,755	47,252	54,777	35,387	24,006	9,883	6,832	1,836	795	1,103,812
2000	0	0	50,392	217,214	308,615	183,048	127,913	56,940	38,767	42,264	15,849	5,434	2,614	1,593	633	1,051,275
2001	0	165	86,190	189,602	240,736	138,678	86,825	92,095	33,367	31,165	21,960	12,759	4,962	2,564	665	941,733

Table D9. Atlantic Coast striped bass commercial discard losses in numbers at age, 1982-2001.

	age															
year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**total**
1982	0	31,645	3,644	11,456	5,623	1,291	2,397	1,014	369	92	85	0	0	7	0	57,624
1983	0	24,067	1,453	2,878	7,761	2,311	610	610	262	174	0	0	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	0	0	65,639
1985	0	7,728	30,472	5,939	10,891	3,395	2,742	1,045	261	131	131	0	0	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	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	0	0	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	0	0	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	663	41	0	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	0	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	0	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	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	0	0	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	0	0	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	0	0	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	0	0	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	0	0	216,743
1998	0	13,233	53,899	98,510	83,288	29,197	12,970	12,591	7,860	4,372	3,891	2,419	3,311	124	367	326,031
1999	984	58,076	49,894	43,744	55,740	14,477	5,213	3,704	1,980	1,304	648	612	240	3	0	236,620
2000	196	178,457	189,933	157,291	62,699	33,918	26,938	7,831	4,111	3,876	801	863	41	17	25	666,996
2001	0	2,638	58,079	77,958	88,808	29,410	18,877	11,613	9,664	6,371	4,778	1,957	737	10	0	310,900

Table D10. Atlantic Coast striped bass recreational harvest and discard losses in numbers at age, 1982-2001.

	age															
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15+**	**Total**
1982	1,810	28,781	52,833	92,221	29,879	12,854	18,488	12,927	9,453	6,094	5,095	6,029	938	1,276	1,233	279,911
1983	3,625	31,912	56,144	69,265	103,980	29,559	16,149	2,837	2,026	1,845	3,267	3,269	2,220	2,203	1,880	330,182
1984	5,563	30,909	30,946	21,015	20,060	18,720	9,025	2,807	510	1,242	547	5	1,087	3,199	2,657	148,293
1985	1,311	11,102	25,995	26,999	38,364	20,464	19,211	9,658	2,397	1,760	447	220	29	23	5,509	163,489
1986	11,332	14,529	37,064	29,602	21,730	17,954	14,647	21,383	8,299	5,078	3,250	1,344	587	1,561	4,713	193,072
1987	1,368	6,709	20,160	18,560	14,254	7,849	5,580	4,096	4,925	2,355	1,242	1,608	2,889	1,851	6,963	100,408
1988	2,566	24,740	17,076	22,645	20,650	19,753	14,563	14,756	10,344	3,902	3,192	2,949	2,152	2,991	3,565	165,844
1989	729	22,140	29,416	19,216	21,499	12,542	11,055	4,565	3,074	2,422	1,350	392	909	1,122	3,196	133,626
1990	2,123	31,055	43,205	58,871	31,731	34,344	29,368	29,259	13,600	5,198	3,388	1,874	3,521	3,075	4,918	295,530
1991	1,713	58,121	85,813	99,784	43,567	22,929	45,853	53,651	47,331	18,855	7,362	2,613	2,544	2,751	14,465	507,353
1992	2,797	41,431	133,156	94,464	86,059	33,254	25,436	45,087	46,239	36,112	7,248	3,606	1,554	4,579	8,549	569,572
1993	287	60,335	114,073	154,451	105,949	79,780	33,126	38,157	64,920	65,119	35,527	8,028	4,109	1,097	11,327	776,285
1994	5,655	112,473	278,783	173,947	178,115	99,550	67,673	59,288	84,757	71,964	32,788	20,638	3,131	1,455	9,417	1,199,634
1995	3,838	347,272	348,369	279,759	162,474	250,606	104,445	137,595	106,747	62,459	41,591	10,943	7,720	1,562	3,310	1,868,692
1996	465	64,983	475,768	430,833	292,853	237,424	285,000	141,528	104,054	44,865	30,222	34,487	11,419	3,253	1,052	2,158,205
1997	2,057	278,024	325,236	494,939	360,153	371,499	288,376	305,724	165,092	97,283	45,173	21,325	8,470	5,596	3,816	2,772,763
1998	26,421	167,050	365,650	398,264	515,548	289,268	197,340	192,807	163,616	84,105	76,586	36,875	25,688	13,375	15,918	2,568,510
1999	8,162	50,834	287,988	377,852	320,364	463,488	254,502	175,799	136,715	101,802	72,950	34,535	18,610	11,174	6,196	2,320,972
2000	37,743	145,384	177,411	611,244	648,639	563,116	583,058	246,999	117,697	95,309	42,948	22,994	12,530	6,580	6,710	3,318,362
2001	34,741	159,104	286,908	336,838	500,352	528,438	470,980	376,624	162,750	81,958	76,205	34,909	20,081	9,715	9,219	3,088,822

Table D11. Total Atlantic Coast striped bass catch in numbers at age, including scientific sampling, estimated commercial and recreational discard losses, 1982-2001.

Year	Age															
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**Total**
1982	1,810	105,555	256,699	220,835	58,429	19,180	24,213	16,802	11,692	10,593	11,017	13,668	3,447	4,093	8,131	766,165
1983	3,625	110,327	178,236	193,141	150,019	39,286	18,713	4,125	2,895	3,709	4,581	5,644	4,876	4,059	4,613	727,849
1984	5,563	542,751	302,698	82,425	60,374	51,680	18,280	4,668	2,117	2,078	693	336	2,183	4,241	4,715	1,084,802
1985	1,311	72,529	101,959	40,483	58,703	43,106	43,522	17,283	6,351	3,404	1,043	827	522	917	8,882	400,844
1986	11,332	21,009	63,841	132,875	49,899	31,972	20,367	23,997	9,191	5,260	3,355	1,564	875	2,524	6,717	384,778
1987	1,368	10,915	37,629	51,422	67,260	25,041	13,204	6,490	6,384	2,982	1,448	1,968	3,302	2,086	7,528	239,026
1988	2,566	30,882	41,755	63,222	107,100	97,917	40,598	24,411	13,995	5,773	3,676	3,251	2,426	3,032	4,102	444,706
1989	729	35,994	79,655	68,244	104,896	95,437	45,645	21,026	10,423	3,758	3,234	1,965	1,915	1,608	5,325	479,855
1990	2,123	46,231	124,469	187,830	173,215	165,168	104,079	67,871	20,695	7,256	5,061	3,507	3,949	3,397	6,325	921,176
1991	1,792	72,836	145,252	208,716	161,950	101,438	91,311	82,920	58,757	24,090	14,173	2,755	2,624	3,304	16,402	988,318
1992	2,914	45,769	199,651	189,219	177,132	109,523	62,419	67,781	58,384	44,782	9,301	4,070	1,723	4,925	9,294	986,887
1993	287	69,633	185,306	327,330	288,512	185,379	86,551	67,337	82,587	76,145	41,133	9,327	4,553	1,173	11,731	1,436,983
1994	5,655	145,422	348,825	290,641	367,749	232,389	135,432	86,698	99,882	80,962	36,013	22,302	3,359	1,523	9,743	1,866,595
1995	3,838	426,821	459,079	447,829	391,341	470,669	204,809	190,869	151,640	88,555	52,246	16,455	9,524	1,925	3,459	2,919,060
1996	465	92,673	639,954	634,993	533,768	457,572	436,529	208,439	140,109	67,719	42,043	44,663	13,733	4,387	2,501	3,319,547
1997	2,533	285,466	486,449	850,321	615,973	593,847	405,508	372,316	200,317	120,479	59,642	29,987	12,282	7,774	4,794	4,047,687
1998	26,421	183,404	485,409	706,672	1,125,019	510,938	280,434	265,002	215,493	113,842	95,070	45,172	32,836	14,886	17,771	4,118,368
1999	9,210	116,452	433,400	656,249	651,804	714,112	336,562	226,801	193,497	138,519	97,623	45,054	25,687	13,018	6,991	3,664,980
2000	37,977	323,937	419,860	989,188	1,021,208	780,437	738,105	311,870	160,636	141,488	59,631	29,301	15,191	8,190	7,370	5,044,390
2001	34,741	159,284	373,435	527,397	741,748	667,237	557,868	468,775	196,167	113,175	98,186	47,677	25,046	12,280	9,883	4,343,798

Table D12. Mean weight at age (kg) 1982-2001.

Year	Age														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
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	12.97	13.26	15.91
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	11.10	11.12
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	10.65	11.75	14.75
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	11.42	14.34	15.98
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	10.97	11.55	15.83
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	11.38	11.62	16.46
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	11.50	11.31	17.00
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	13.04	9.93	17.11
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	9.36	10.80	17.65
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	9.62	15.96	17.09
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	13.10	11.15	17.65
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	14.45	13.85	15.36
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	11.38	9.06	17.75
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	13.97	15.65	20.37
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	11.36	12.45	17.30
1997	0.14	1.05	1.47	2.32	3.23	4.52	6.39	7.11	7.81	9.20	9.31	10.10	11.36	12.45	17.30
1998	0.14	1.05	1.47	2.32	3.23	4.52	6.39	7.11	7.81	9.20	9.31	10.10	11.36	12.45	17.30
1999	0.14	1.05	1.47	2.32	3.23	4.52	6.39	7.11	7.81	9.20	9.31	10.10	11.36	12.45	17.30
2000	0.14	1.05	1.47	2.32	3.23	4.52	6.39	7.11	7.81	9.20	9.31	10.10	11.36	12.45	17.30
2001	0.14	1.05	1.47	2.32	3.23	4.52	6.39	7.11	7.81	9.20	9.31	10.10	11.36	12.45	17.30

Table D13. Estimated parameter values and associated SE, T statistic and CV from ADAPT 12+ run prior to re-weighting.

	PAR.	EST.	STD.ERR	T-STATISTIC	C.V.		PAR.	EST.	STD.ERR	T-STATISTIC	C.V.
N	1	1.73E+04	8.72E+03	1.99E+00	0.5	q	NYOHS6	2.60E-04	6.65E-05	3.90E+00	0.26
N	2	1.29E+04	4.95E+03	2.62E+00	0.38	q	NYOHS7	5.47E-04	1.40E-04	3.90E+00	0.26
N	3	6.61E+03	2.04E+03	3.23E+00	0.31	q	NYOHS8	7.92E-04	2.04E-04	3.89E+00	0.26
N	4	4.77E+03	1.32E+03	3.63E+00	0.28	q	NYOHS9	1.27E-03	3.27E-04	3.88E+00	0.26
N	5	3.80E+03	9.64E+02	3.95E+00	0.25	q	NYOHS10	2.13E-03	5.50E-04	3.88E+00	0.26
N	6	4.96E+03	1.20E+03	4.13E+00	0.24	q	NYOHS11	2.74E-03	7.32E-04	3.74E+00	0.27
N	7	2.93E+03	7.40E+02	3.95E+00	0.25	q	NYOHS12+	2.68E-03	6.89E-04	3.88E+00	0.26
N	8	1.52E+03	4.17E+02	3.65E+00	0.27	q	NEFSC2	5.10E-05	1.94E-05	2.63E+00	0.38
N	9	1.61E+03	4.30E+02	3.75E+00	0.27	q	NEFSC3	5.69E-05	1.64E-05	3.48E+00	0.29
N	10	4.57E+02	1.38E+02	3.32E+00	0.3	q	NEFSC4	9.24E-05	2.54E-05	3.63E+00	0.28
N	11	2.86E+02	8.60E+01	3.33E+00	0.3	q	NEFSC5	1.33E-04	3.30E-05	4.04E+00	0.25
q	MACOM7	5.73E-04	1.64E-04	3.49E+00	0.29	q	NEFSC6	2.52E-04	6.24E-05	4.04E+00	0.25
q	MACOM8	8.32E-04	2.39E-04	3.48E+00	0.29	q	NEFSC7	3.89E-04	9.66E-05	4.03E+00	0.25
q	MACOM9	1.46E-03	4.19E-04	3.48E+00	0.29	q	NEFSC8	6.62E-04	1.60E-04	4.14E+00	0.24
q	MACOM10	1.94E-03	5.57E-04	3.48E+00	0.29	q	NEFSC9	9.02E-04	2.25E-04	4.01E+00	0.25
q	MACOM11	2.57E-03	7.38E-04	3.48E+00	0.29	q	NEFSC10	1.51E-03	3.88E-04	3.89E+00	0.26
q	MACOM12+	2.72E-03	7.80E-04	3.48E+00	0.29	q	NEFSC11	1.88E-03	5.40E-04	3.48E+00	0.29
q	CTCPUE3	1.73E-04	3.84E-05	4.52E+00	0.22	q	NEFSC12+	2.69E-03	8.02E-04	3.36E+00	0.3
q	CTCPUE4	2.39E-04	5.17E-05	4.63E+00	0.22	q	HUDSHD8:12	2.76E-04	6.64E-05	4.16E+00	0.24
q	CTCPUE5	3.54E-04	7.64E-05	4.63E+00	0.22	q	YOYNY1	1.12E-04	2.45E-05	4.57E+00	0.22
q	CTCPUE6	4.86E-04	1.05E-04	4.63E+00	0.22	q	YOYNJ1	7.95E-05	1.79E-05	4.45E+00	0.22
q	CTCPUE7	7.33E-04	1.59E-04	4.62E+00	0.22	q	YOYMD1	8.57E-05	1.88E-05	4.57E+00	0.22
q	CTCPUE8	9.35E-04	2.03E-04	4.61E+00	0.22	q	YOYVA1	1.09E-04	2.38E-05	4.57E+00	0.22
q	CTCPUE9	1.52E-03	3.30E-04	4.61E+00	0.22	q	YRLLI2	1.18E-04	2.87E-05	4.13E+00	0.24
q	CTCPUE10	2.74E-03	5.95E-04	4.61E+00	0.22	q	YRLMD2	1.26E-04	2.81E-05	4.49E+00	0.22
q	CTCPUE11	3.30E-03	7.53E-04	4.38E+00	0.23	q	NJTRL2:12	2.12E-05	5.63E-06	3.77E+00	0.27
q	CTCPUE12+	1.06E-03	2.30E-04	4.61E+00	0.22	q	CTTRL4:06	6.49E-05	1.56E-05	4.16E+00	0.24
q	MDSSN3	1.60E-04	3.75E-05	4.27E+00	0.23	q	DETRWL2:07	2.42E-05	6.92E-06	3.50E+00	0.29
q	MDSSN4	2.12E-04	4.96E-05	4.28E+00	0.23	q	VAPN1	8.43E-05	4.14E-05	2.04E+00	0.49
q	MDSSN5	2.75E-04	6.41E-05	4.28E+00	0.23	q	VAPN2	6.41E-05	1.93E-05	3.33E+00	0.3
q	MDSSN6	3.82E-04	8.92E-05	4.28E+00	0.23	q	VAPN3	8.77E-05	2.63E-05	3.34E+00	0.3
q	MDSSN7	5.47E-04	1.28E-04	4.27E+00	0.23	q	VAPN4	1.28E-04	3.81E-05	3.35E+00	0.3
q	MDSSN8	6.35E-04	1.53E-04	4.14E+00	0.24	q	VAPN5	2.12E-04	6.34E-05	3.35E+00	0.3
q	MDSSN9	8.34E-04	1.96E-04	4.26E+00	0.23	q	VAPN6	1.50E-04	4.46E-05	3.35E+00	0.3
q	MDSSN10	1.24E-03	3.11E-04	4.01E+00	0.25	q	VAPN7	5.48E-04	1.64E-04	3.35E+00	0.3
q	MDSSN11	2.33E-03	6.22E-04	3.75E+00	0.27	q	VAPN8	7.96E-04	2.38E-04	3.34E+00	0.3
q	MDSSN12+	1.86E-03	4.36E-04	4.26E+00	0.23	q	VAPN9	1.06E-03	3.17E-04	3.34E+00	0.3
q	NYOHS3	1.10E-04	2.84E-05	3.89E+00	0.26	q	VAPN10	1.55E-03	4.65E-04	3.34E+00	0.3
q	NYOHS4	1.36E-04	3.48E-05	3.90E+00	0.26	q	VAPN11	2.38E-03	7.46E-04	3.19E+00	0.31
q	NYOHS5	1.98E-04	5.08E-05	3.91E+00	0.26	q	VAPN12+	1.81E-03	5.99E-04	3.02E+00	0.33

Table D14. Fishing mortality for several age intervals in 12+ and 13+ runs.

Average F for Ages	**4,11**	**4,10**	**3,8**		**8,11**	**7,10**
Year	**13+**	**12+**	**13+**	**12+**	**13+**	**12+**
1982	0.43	0.41	0.31	0.34	0.60	0.54
1983	0.40	0.30	0.29	0.25	0.44	0.27
1984	0.15	0.15	0.21	0.18	0.09	0.12
1985	0.17	0.15	0.19	0.15	0.12	0.17
1986	0.15	0.13	0.15	0.11	0.17	0.16
1987	0.07	0.05	0.06	0.04	0.08	0.06
1988	0.13	0.10	0.10	0.07	0.17	0.12
1989	0.08	0.06	0.07	0.06	0.10	0.06
1990	0.13	0.10	0.12	0.09	0.12	0.08
1991	0.14	0.10	0.10	0.08	0.19	0.11
1992	0.11	0.08	0.08	0.07	0.13	0.09
1993	0.15	0.11	0.10	0.08	0.20	0.12
1994	0.16	0.12	0.10	0.09	0.21	0.15
1995	0.20	0.18	0.15	0.13	0.25	0.21
1996	0.21	0.18	0.19	0.17	0.22	0.19
1997	0.27	0.23	0.23	0.21	0.30	0.25
1998	0.27	0.21	0.20	0.17	0.32	0.23
1999	0.28	0.21	0.18	0.16	0.38	0.27
2000	0.29	0.24	0.24	0.21	0.33	0.27
2001	0.32	0.24	0.22	0.19	0.40	0.29
1999-2001 Average	**0.30**	**0.23**	**0.21**	**0.19**	**0.37**	**0.28**

Table D15. Fishing mortality at age in 2001 for 12+ and 13+ group runs.

Age	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Plus Group													
13+	0	0.03	0.06	0.16	0.16	0.25	0.34	0.35	0.41	0.44	0.41	0.34	0.34
12+	0	0.02	0.06	0.14	0.15	0.21	0.29	0.28	0.3	0.3	0.29	0.29	

Table D16. Back-calculated partial recruitment and 1996-2001 average PR from 12+ run.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	97-01 av
1	0	0	0.01	0	0.02	0.01	0	0	0	0	0	0	0	0	0	0	0.01	0	0.02	0.01	0
2	0.11	0.15	0.54	0.1	0.03	0.06	0.06	0.1	0.07	0.08	0.07	0.07	0.1	0.13	0.04	0.08	0.05	0.05	0.12	0.08	0.11
3	0.44	0.33	1	0.16	0.13	0.2	0.11	0.39	0.26	0.2	0.39	0.2	0.33	0.27	0.26	0.19	0.17	0.13	0.26	0.19	0.44
4	0.44	0.78	0.37	0.23	0.31	0.35	0.16	0.48	0.74	0.43	0.5	0.45	0.32	0.4	0.53	0.32	0.36	0.28	0.45	0.45	0.44
5	0.28	0.69	0.7	0.42	0.44	0.54	0.37	0.74	1	0.65	0.71	0.55	0.54	0.39	0.69	0.52	0.6	0.41	0.72	0.48	0.28
6	0.2	0.38	0.66	0.89	0.36	0.77	0.41	0.94	0.96	0.61	0.9	0.54	0.47	0.68	0.67	0.84	0.65	0.51	0.88	0.66	0.2
7	0.37	0.37	0.43	1	0.73	0.51	0.66	0.53	0.84	0.55	0.76	0.52	0.42	0.39	1	0.62	0.62	0.58	0.96	0.93	0.37
8	0.89	0.12	0.22	0.67	1	0.85	0.48	1	0.63	0.69	0.82	0.6	0.56	0.57	0.56	1	0.61	0.69	1	0.9	0.89
9	1	0.39	0.13	0.46	0.59	1	1	0.58	0.81	0.55	1	0.74	1	1	0.61	0.55	1	0.61	0.92	0.97	1
10	0.53	1	0.72	0.32	0.62	0.68	0.48	0.8	0.32	1	0.84	1	0.82	0.95	0.72	0.54	0.46	1	0.81	1	0.53
11	0.33	0.52	0.56	0.62	0.5	0.6	0.43	0.75	0.88	0.62	0.8	0.57	0.53	0.52	0.71	0.67	0.64	0.51	0.85	0.82	0.33
12	0.33	0.52	0.56	0.62	0.5	0.6	0.43	0.75	0.88	0.62	0.8	0.57	0.53	0.52	0.71	0.67	0.64	0.51	0.85	0.82	0.33

Table D17. Estimated population abundance, thousands at age, 1982-2002.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	1,733	4,264	3,431	3,643	3,038	3,703	5,627	6,863	7,690	7,776	7,674	9,035	14,803	11,212	12,509	14,225	8,536	11,442	8,381	15,558	17,967
2	1,402	1,490	3,666	2,948	3,135	2,604	3,186	4,841	5,906	6,617	6,691	6,603	7,776	12,736	9,646	10,766	12,241	7,322	9,840	7,179	13,359
3	953	1,109	1,180	2,652	2,470	2,679	2,232	2,713	4,133	5,040	5,628	5,716	5,618	6,558	10,566	8,217	9,002	10,366	6,194	8,169	6,029
4	817	582	789	735	2,188	2,067	2,271	1,882	2,261	3,442	4,204	4,659	4,748	4,512	5,219	8,500	6,621	7,297	8,520	4,942	6,631
5	319	498	322	603	595	1,760	1,731	1,896	1,557	1,772	2,769	3,443	3,706	3,817	3,468	3,903	6,527	5,043	5,672	6,416	3,692
6	144	220	290	221	464	466	1,453	1,391	1,534	1,179	1,375	2,219	2,695	2,849	2,922	2,490	2,788	4,574	3,736	3,935	4,751
7	104	107	153	201	150	370	377	1,159	1,108	1,167	921	1,082	1,738	2,104	2,015	2,091	1,592	1,925	3,275	2,491	2,740
8	36	67	74	115	133	110	306	287	956	857	920	735	851	1,370	1,621	1,330	1,423	1,110	1,345	2,134	1,609
9	23	16	54	60	83	92	89	241	228	759	661	729	570	652	1,002	1,202	799	979	745	868	1,391
10	34	9	11	45	45	63	73	64	198	177	599	515	551	398	420	733	849	488	663	492	556
11	53	19	4	7	35	34	51	58	51	163	130	474	372	399	260	299	519	625	291	440	313
12+	140	80	74	79	122	351	178	193	173	289	279	308	381	239	403	274	602	579	292	415	550
10+	227	108	89	131	202	448	302	315	422	629	1,008	1,297	1,304	1,036	1,083	1,306	1,970	1,692	1,246	1,347	1,419
8+	286	191	217	306	418	650	697	843	1,606	2,245	2,589	2,761	2,725	3,058	3,706	3,838	4,192	3,781	3,336	4,349	4,419
1+	5,758	8,461	10,048	11,309	12,458	14,299	17,574	21,588	25,795	29,238	31,851	35,518	43,809	46,846	50,051	54,030	51,499	51,750	48,954	53,039	59,588

Table D18. Spawning stock biomass of female striped bass in metric tons at age and annual total in MT and millions of pounds (Mlb), 1982-2001.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	19	13	19	23	66	64	73	56	68	102	126	142	157	162	171	293	227	256	296	171
5	40	57	37	70	73	265	273	288	218	252	419	486	540	595	553	640	1,071	828	945	1,069
6	114	130	172	143	258	264	977	1,108	1,116	684	905	1,489	1,772	1,927	2,246	1,952	2,194	3,627	2,924	3,176
7	197	166	261	339	236	524	564	2,267	2,185	2,115	1,529	1,904	3,060	3,806	4,003	4,834	3,490	4,206	7,139	5,380
8	86	152	153	265	290	212	560	666	2,396	1,993	2,165	1,784	2,051	3,316	4,394	3,855	4,408	3,199	3,843	6,133
9	56	43	154	174	212	230	207	608	639	2,221	1,948	2,198	1,715	2,022	3,243	4,152	2,727	3,607	2,508	2,893
10	128	30	35	149	137	176	193	203	563	494	2,049	1,794	1,888	1,433	1,604	2,887	3,343	1,886	2,818	1,862
11	270	81	18	29	126	112	180	194	194	580	479	1,966	1,544	1,424	1,108	1,284	2,224	2,675	1,240	2,079
12	959	409	476	542	811	2,426	1,260	1,375	1,226	2,062	2,084	2,113	2,737	2,026	2,887	1,945	4,263	4,098	2,056	3,244
Total, MT	1,867	1,080	1,322	1,733	2,208	4,273	4,284	6,763	8,603	10,500	11,701	13,873	15,462	16,709	20,208	21,840	23,946	24,379	23,766	26,004
Total, Mlb	4.11	2.38	2.91	3.81	4.86	9.40	9.42	14.88	18.93	23.10	25.74	30.52	34.02	36.76	44.46	48.05	52.68	53.63	52.29	57.21

Table D19. Estimates of bay-wide fishing mortality and ASMFC Target Fishing mortality estimates. (Estimates include a non-harvest mortality of 0.10.)

Year	**Bay-wide F**	**ASMFC target**
1993	**0.19**	0.25
1994	**0.20**	0.25
1995	**0.25**	0.30
1996	**0.33**	0.30
1997	**0.25**	0.28
1998	**0.21**	0.28
1999	**0.31**	0.28
2000	**0.28**	0.28
2001	**0.23**	0.28

Figure D1.Proportions of recreational and commercial fishery landings in numbers for 2001.

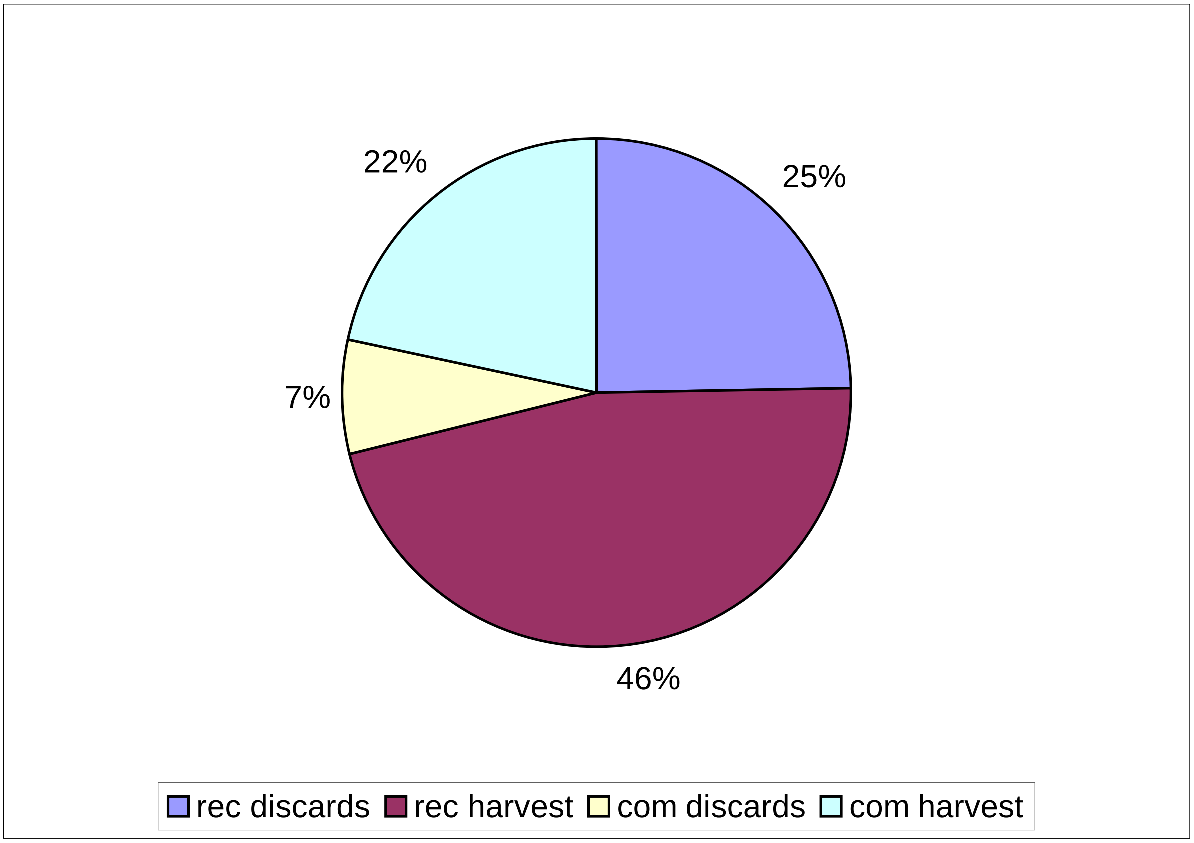
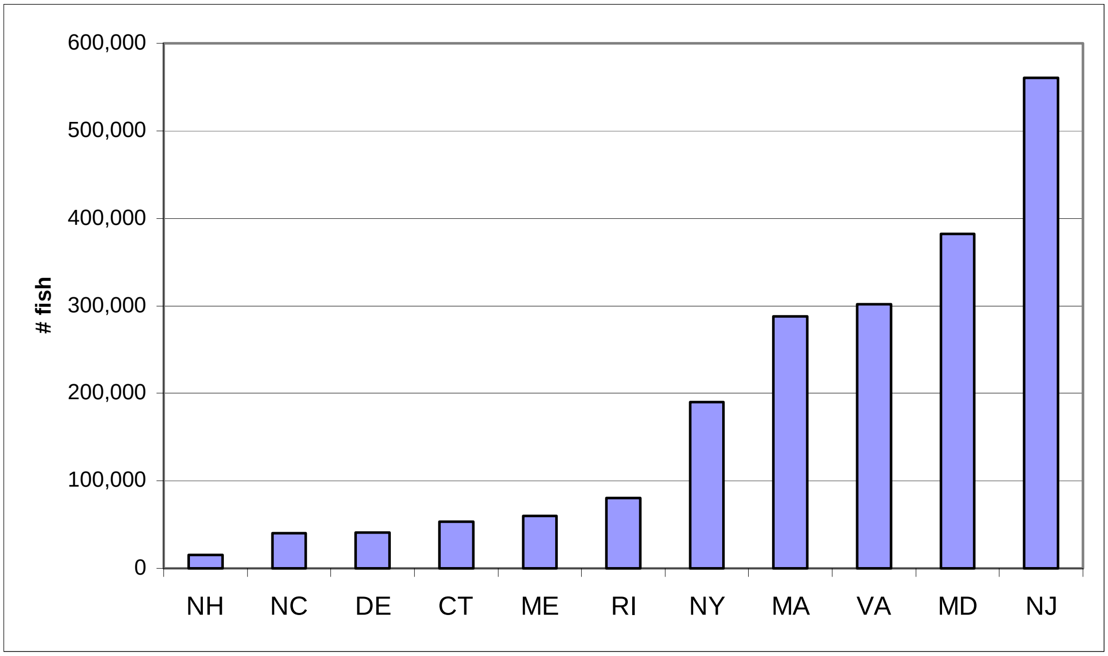


Figure D2. Recreational harvest in numbers of fish and weight (million lb) by state for 2001.



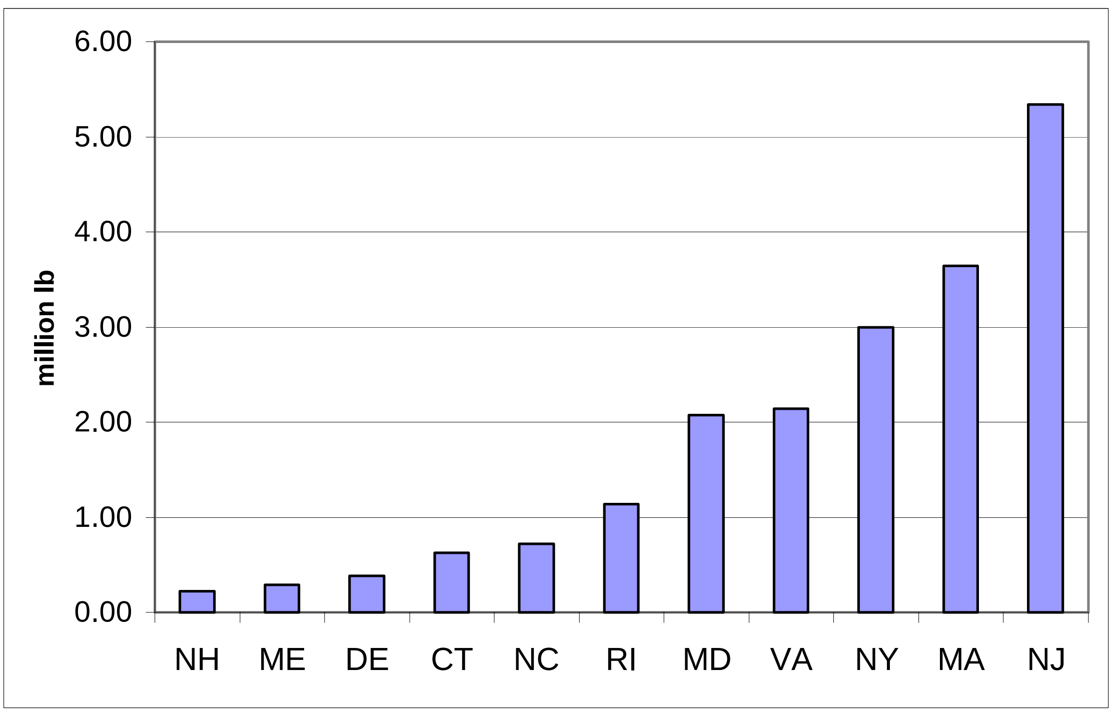


Figure D3. Total losses (harvest and dead discards) for recreational fishery in 1982-2001.

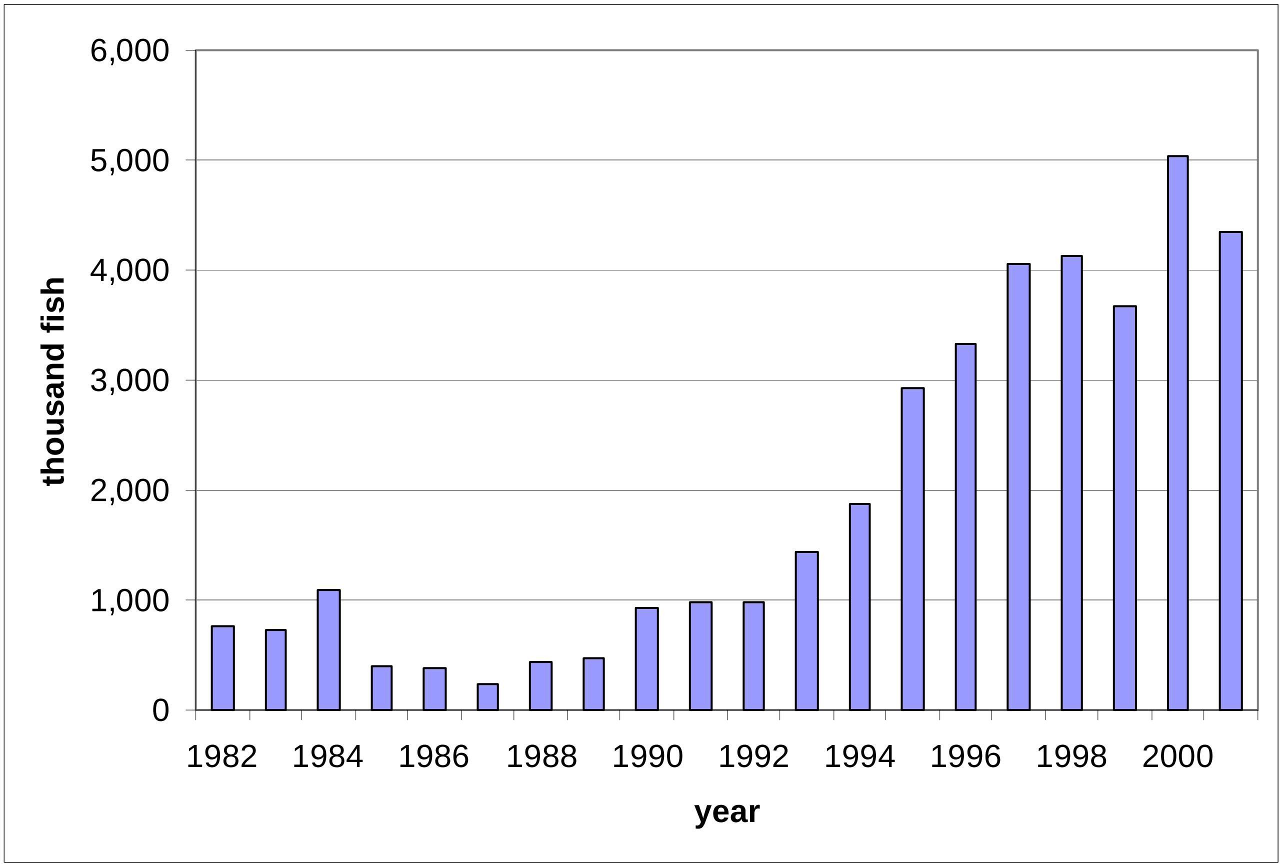


Figure D4. Recreational and commercial catch (harvest and discard) in number in 2000 and 2001.

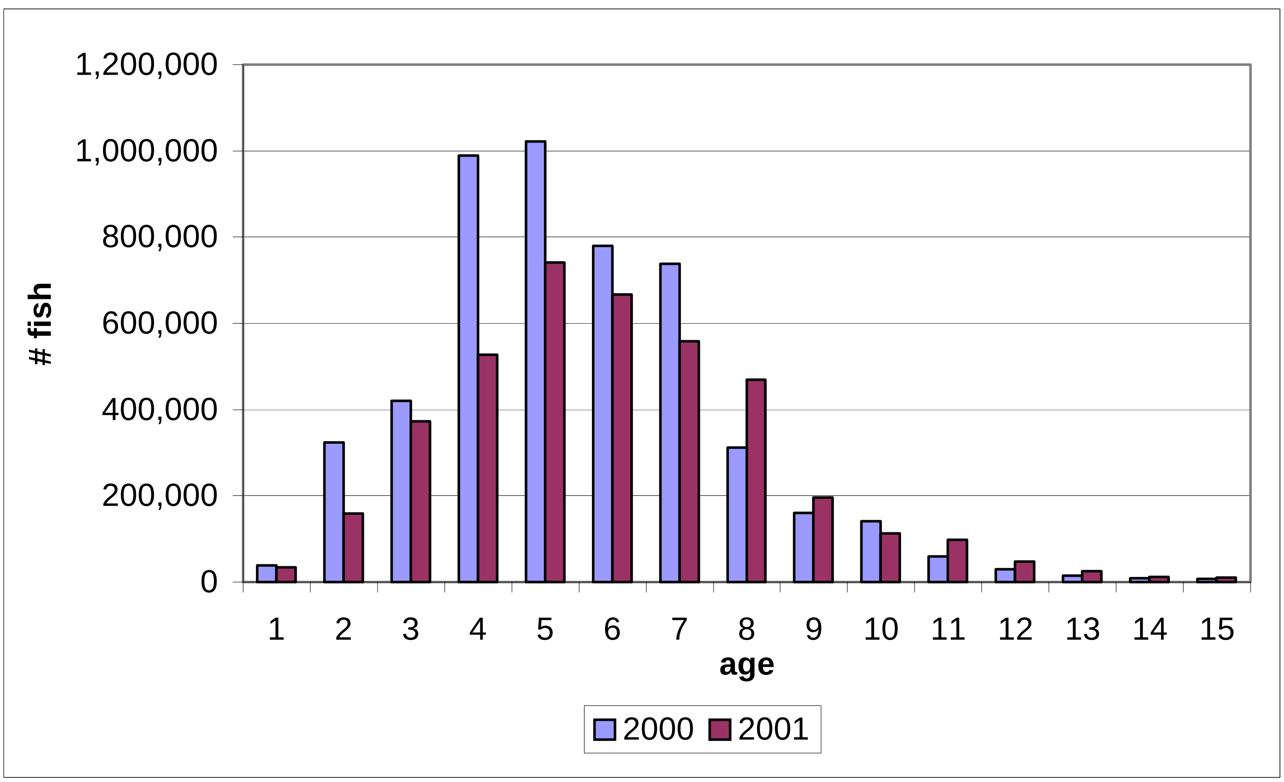


Figure D5. Maryland Spawning Stock Index, ages 2-12+, 1985-2001.

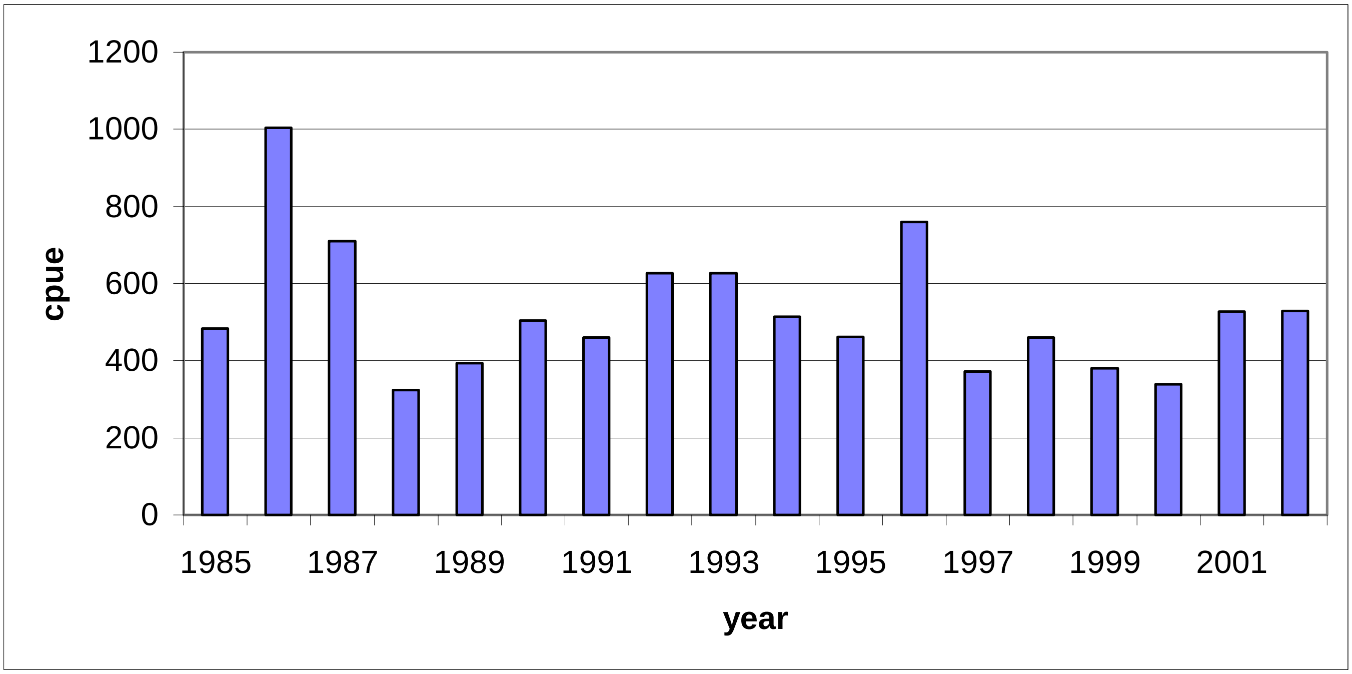


Figure D6. New York Ocean Haul Seine, Total CPUE ages 5-12+, 1987-2001.

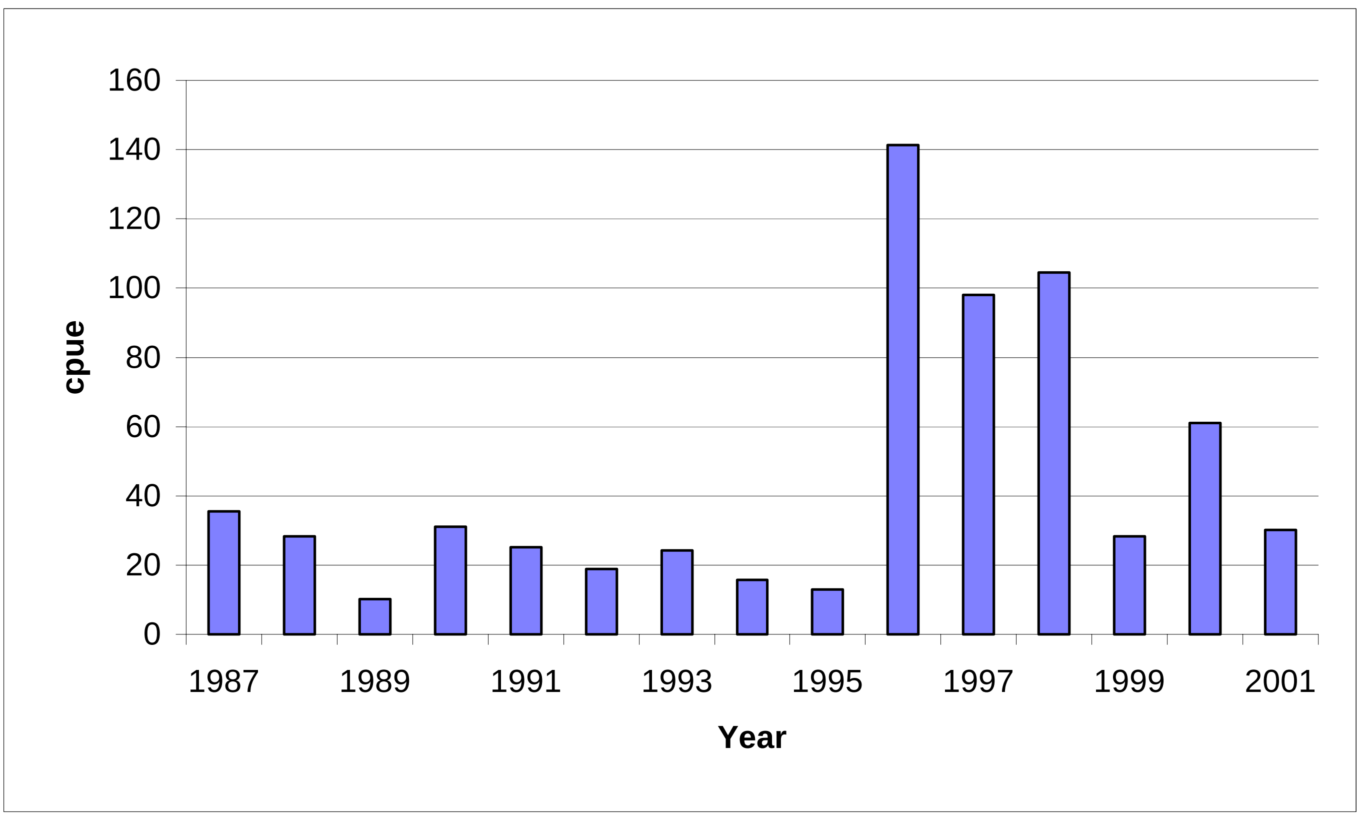


Figure D7. NMFS/NEFSC trawl survey CPUE Ages 2-12+, 1983-2002.

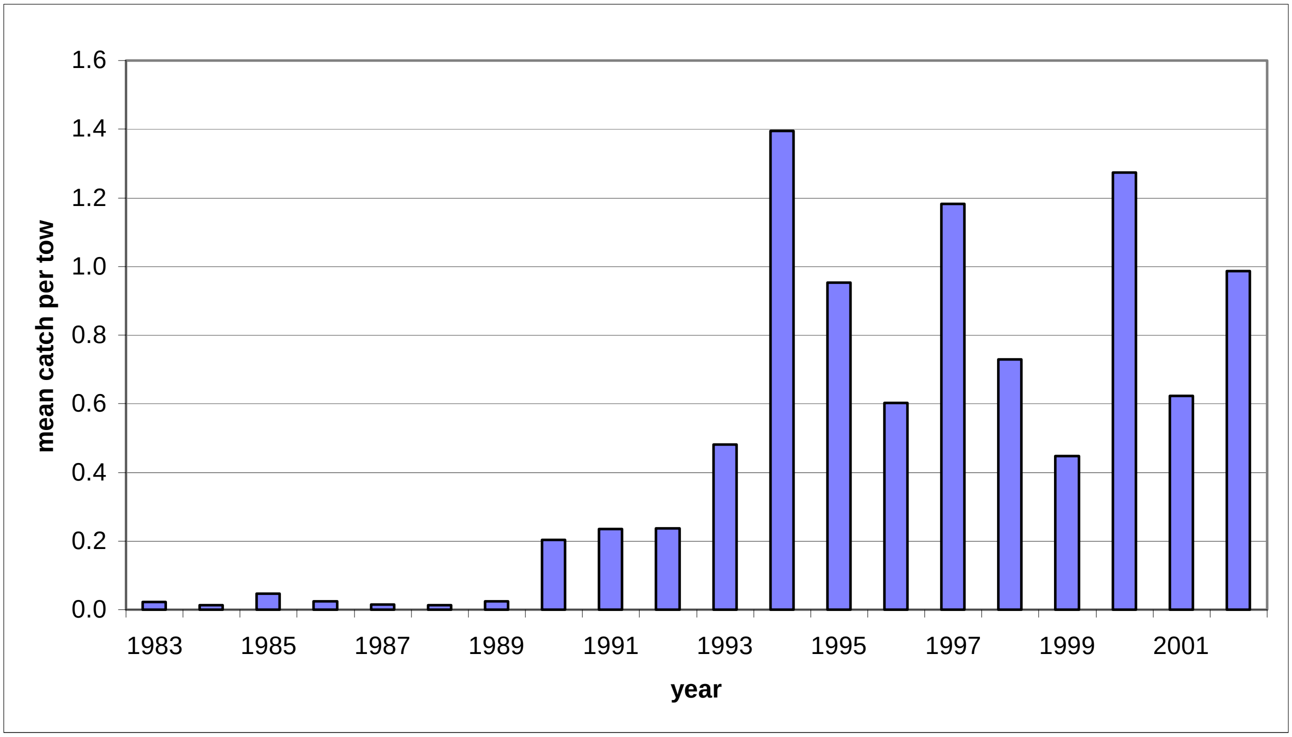


Figure D8. Virginia Rappahannock River Pound Net CPUE, 1991-2002.

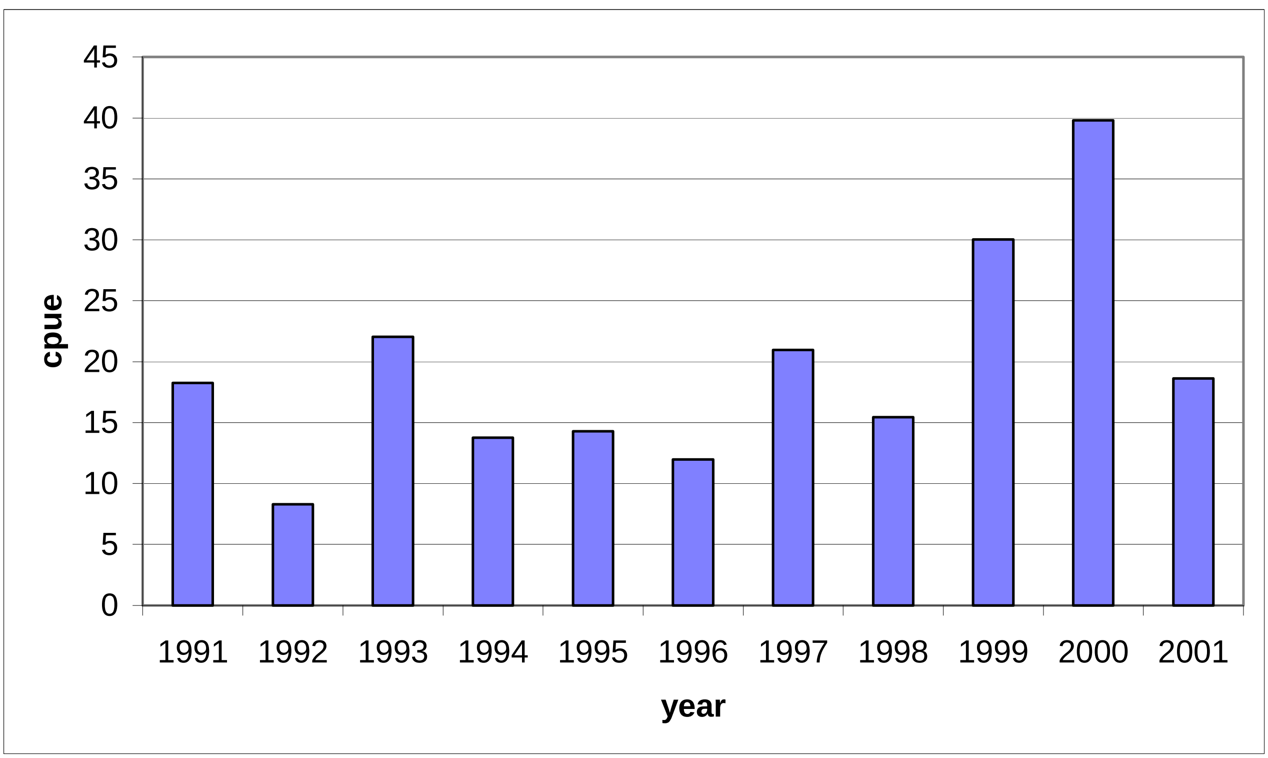


Figure D9. Age aggregated trawl CPUE, Delaware, New Jersey, and Connecticut, 1984-2002.

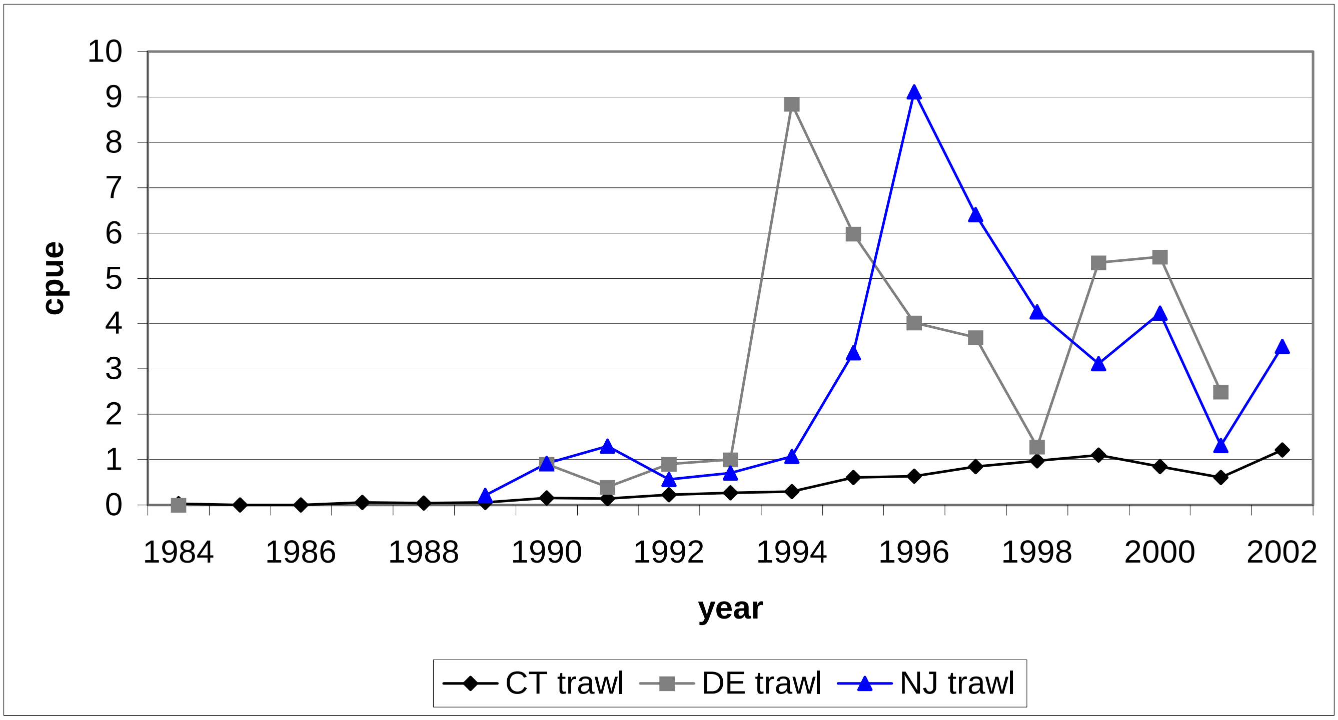


Figure D10. Indices of young of the year abundance for the Chesapeake Stock, Maryland and Virginia surveys, 1981-2001.

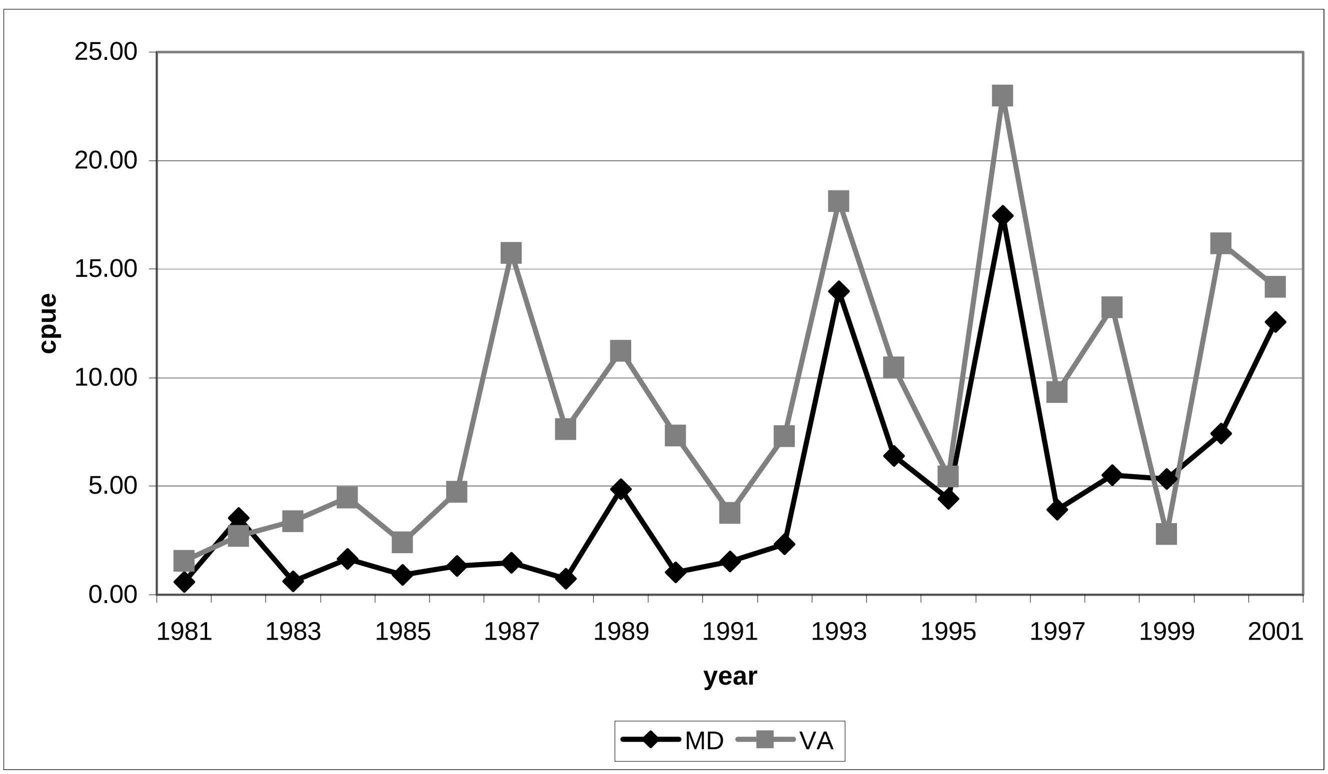


Figure D11. Young of the year survey values for the Hudson (NY) and Delaware Bay (DE, NJ) stocks, 1981-2001.

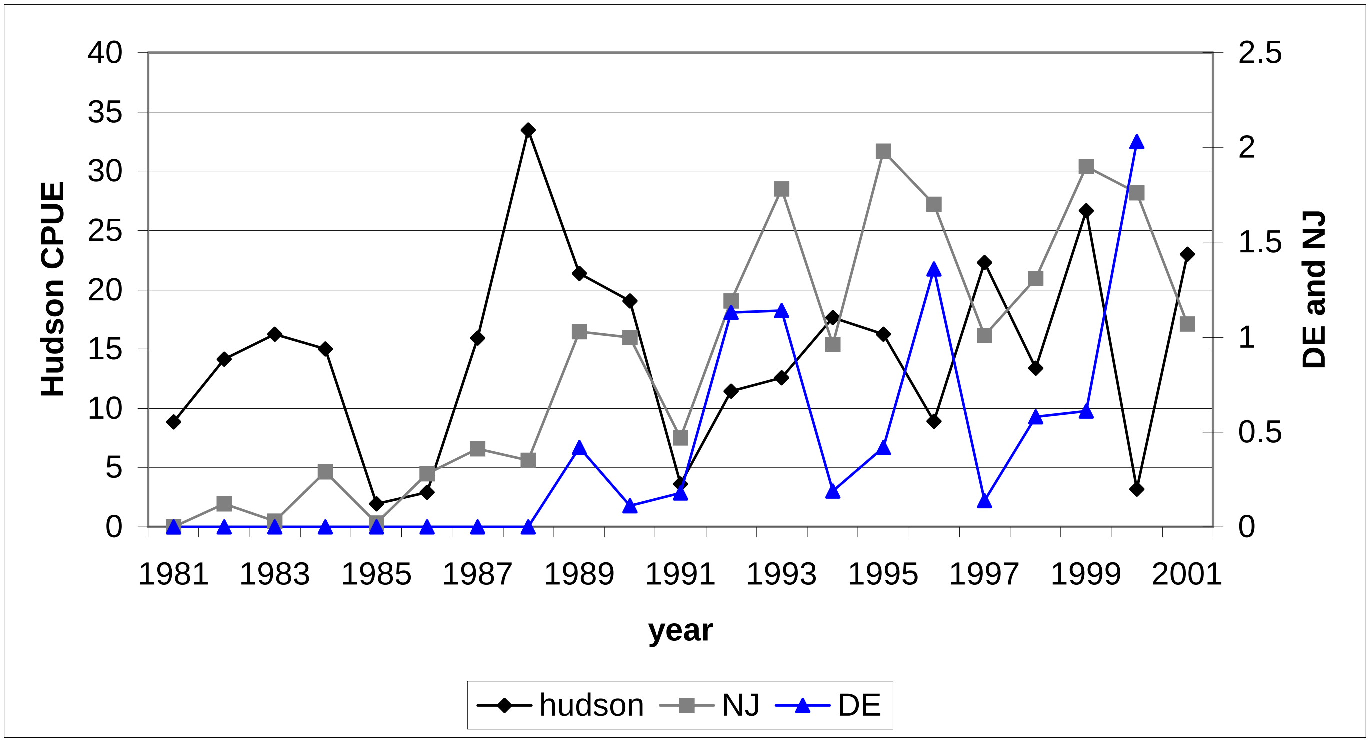


Figure D12. Indices of age-1 striped bass abundance for Long Island and Maryland.

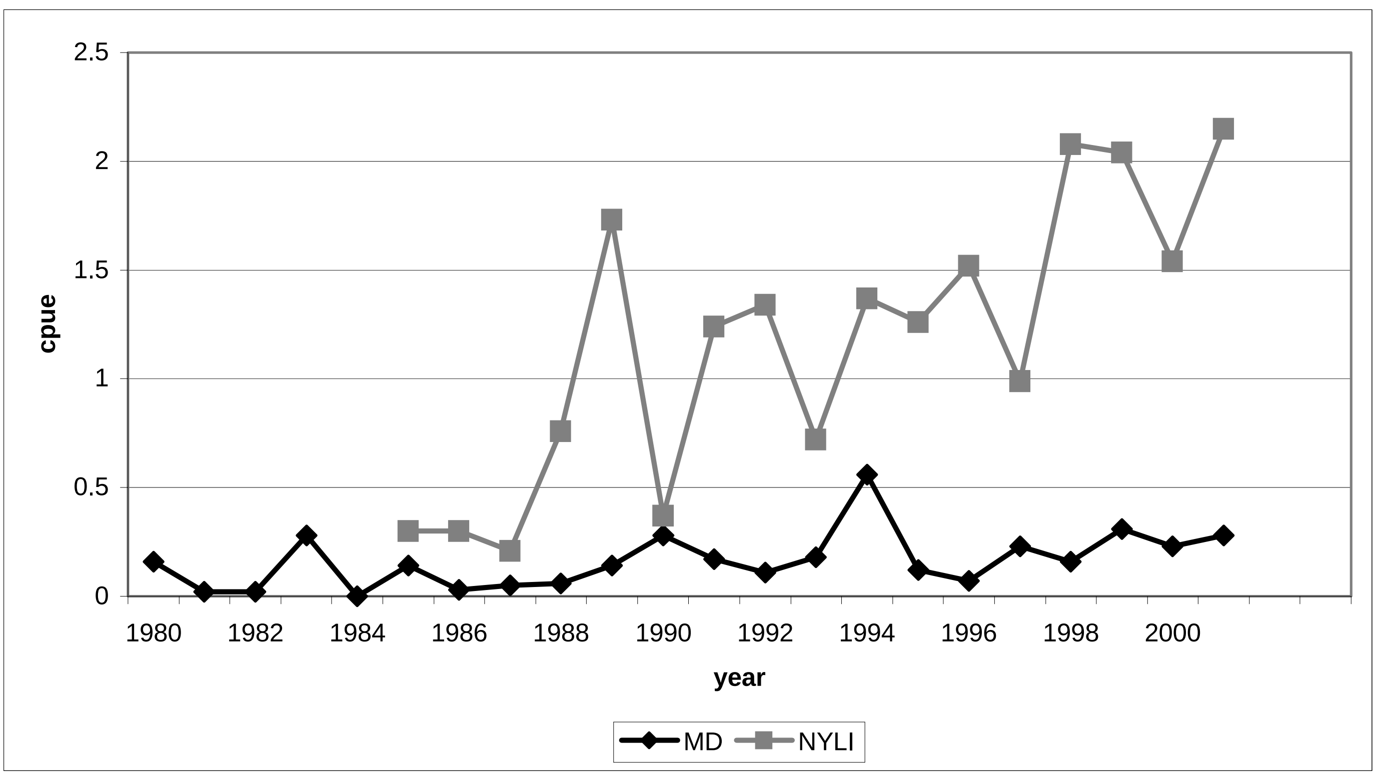


Figure D13. Massachusetts total age 8-12+ CPUE, 1990-2001.

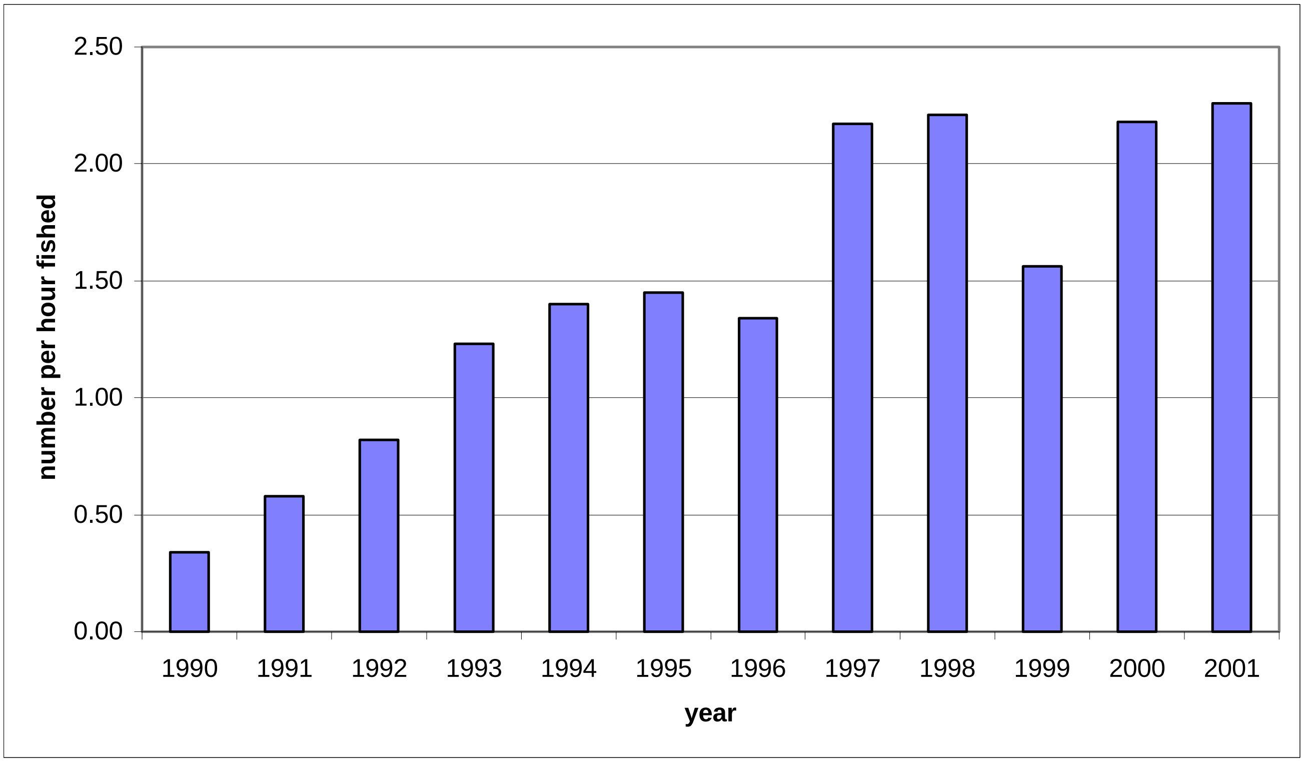


Figure D14. Connecticut total ages 2-12+ CPUE, 1981-2001.

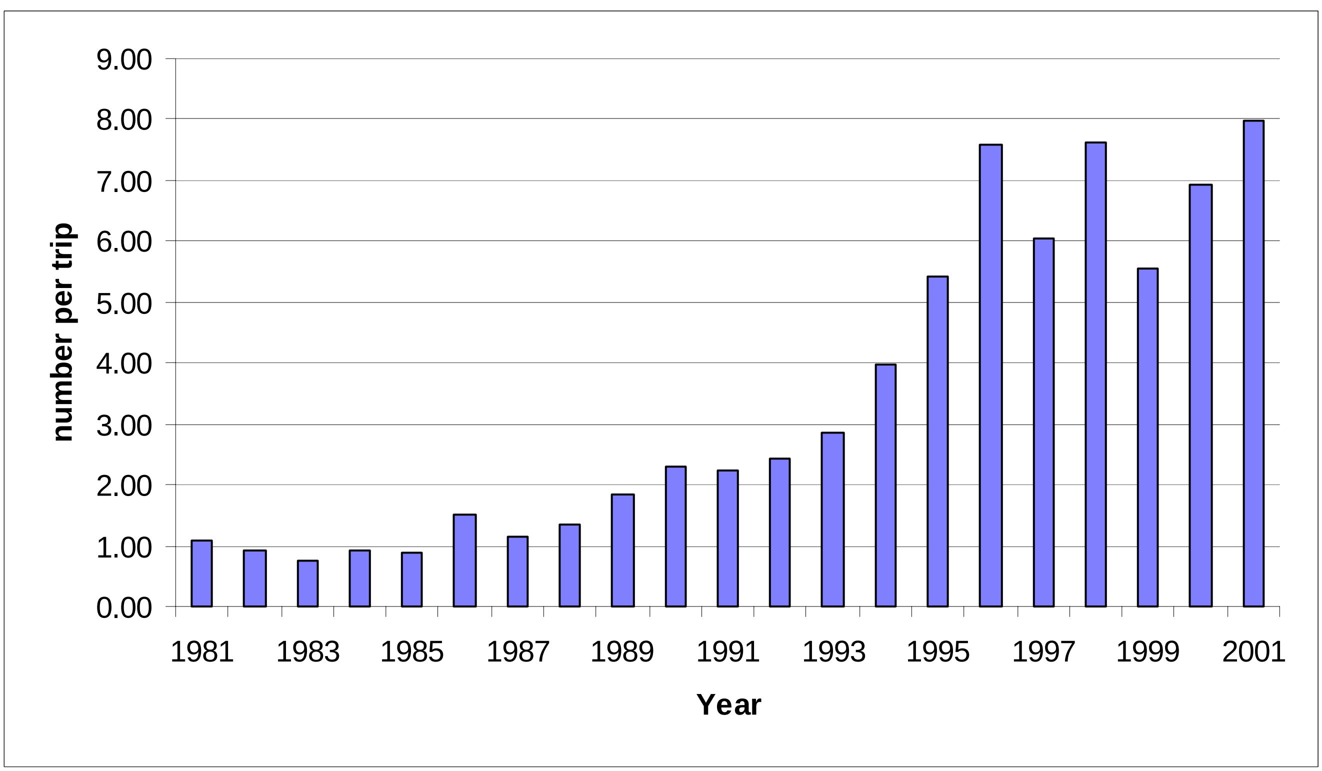


Figure D15. Hudson River shad bycatch indices of striped bass abundance, 1985-2001.

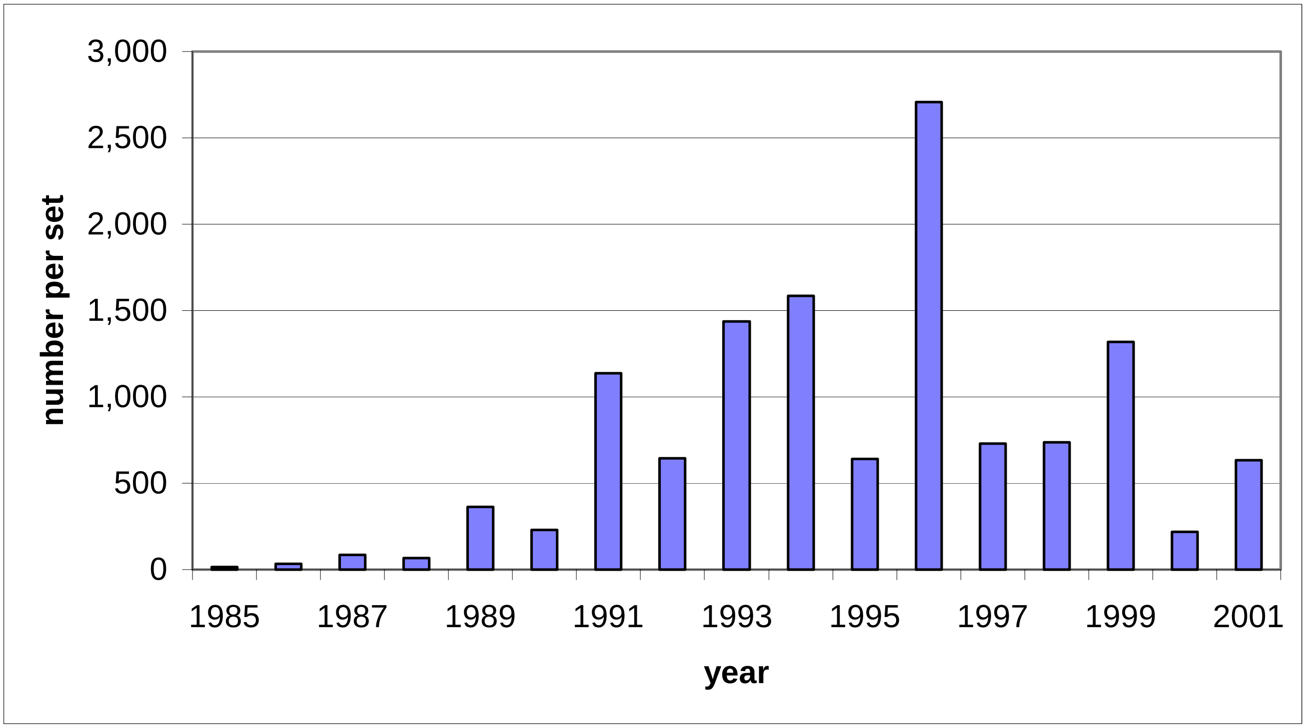


Figure D16. Striped bass fishing mortality from the 2001 ADAPT for age 4 through 10 for 12+ run and 4 through 11 for 13+ run.

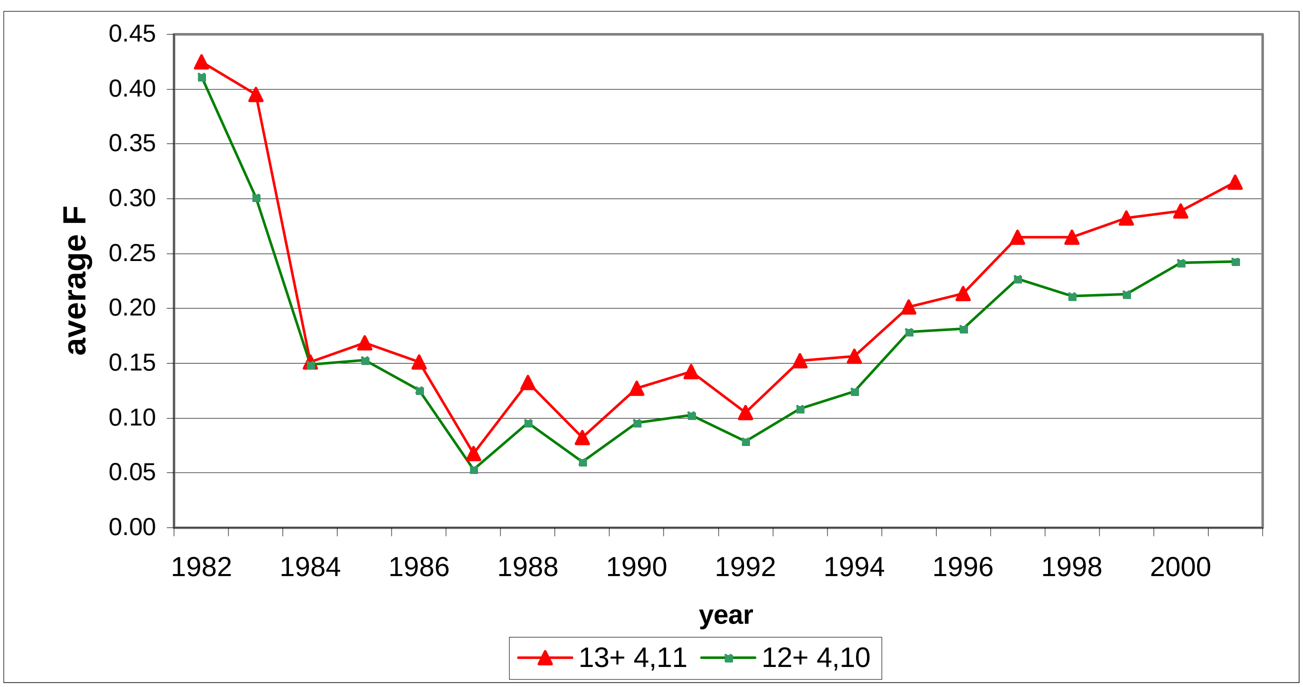


Figure D17. Striped bass fishing mortality from the 2001 ADAPT for ages 7-10 (12+ run) and 8-11 (13+ run).

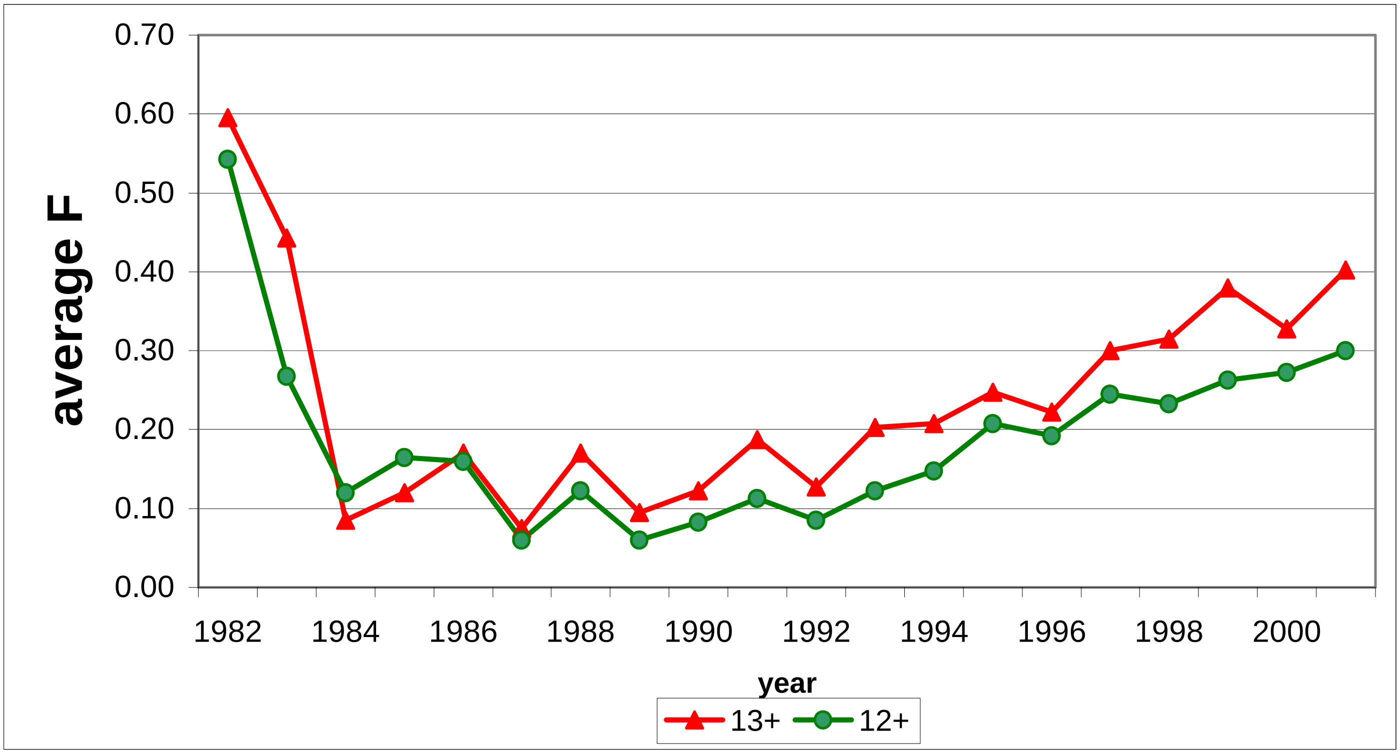


Figure D18. Striped bass fishing mortality from the 2001 ADAPT for ages 3 through 8 for 12+ and 13+ runs.

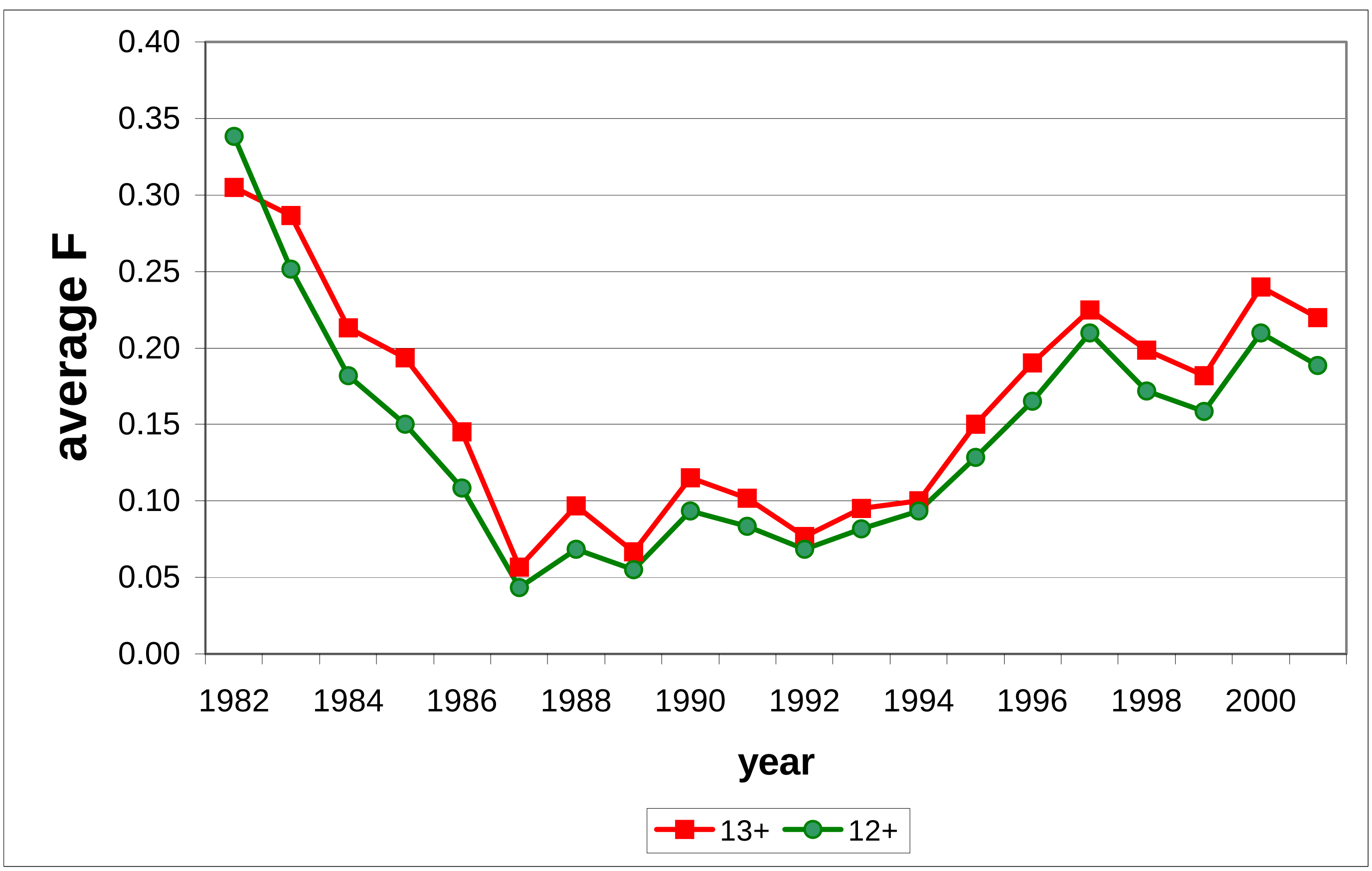


Figure D19. Population size (ages 1-12+) estimates for 12+ and 13+ runs.

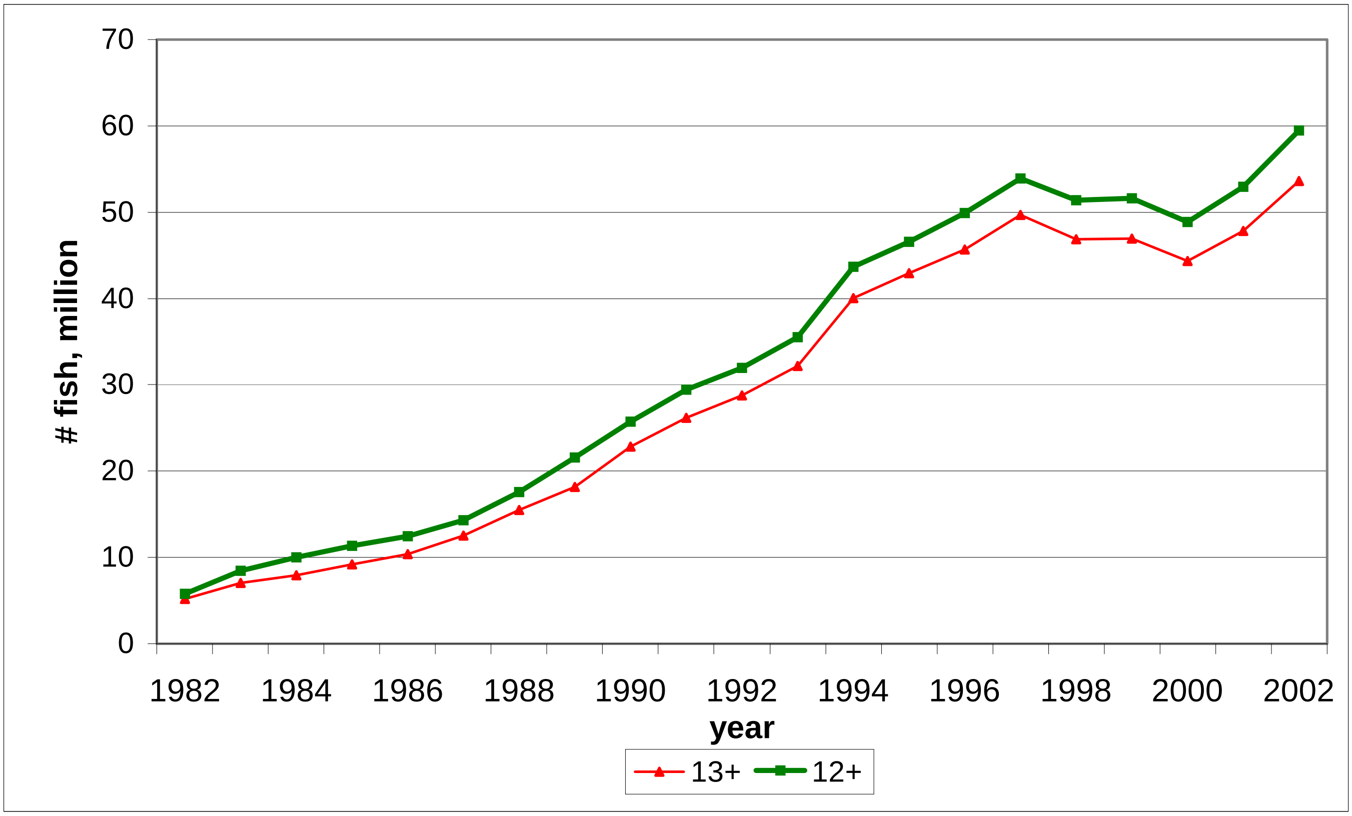


Figure D20. Recruitment (Age 1) for 12+ and 13+ runs.

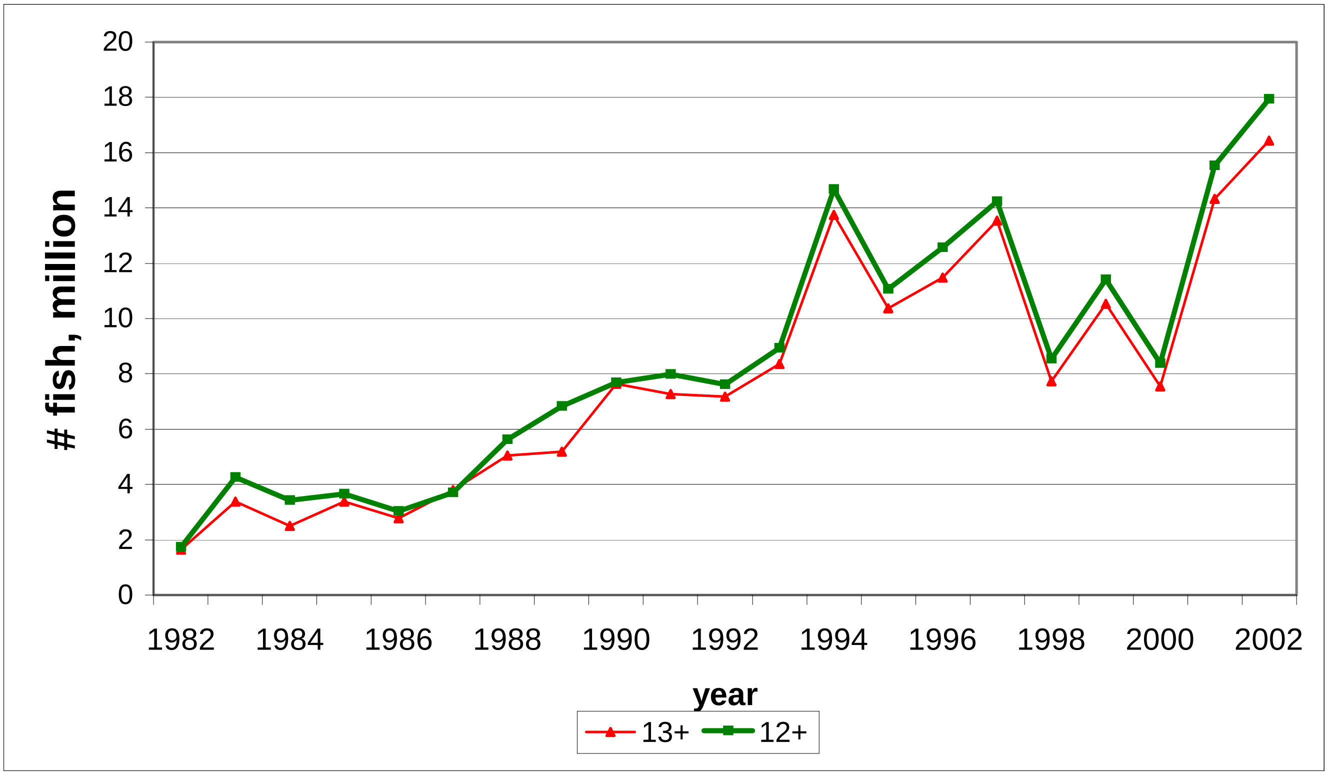


Figure D21. Female spawning stock biomass for 12+ and 13+ runs.

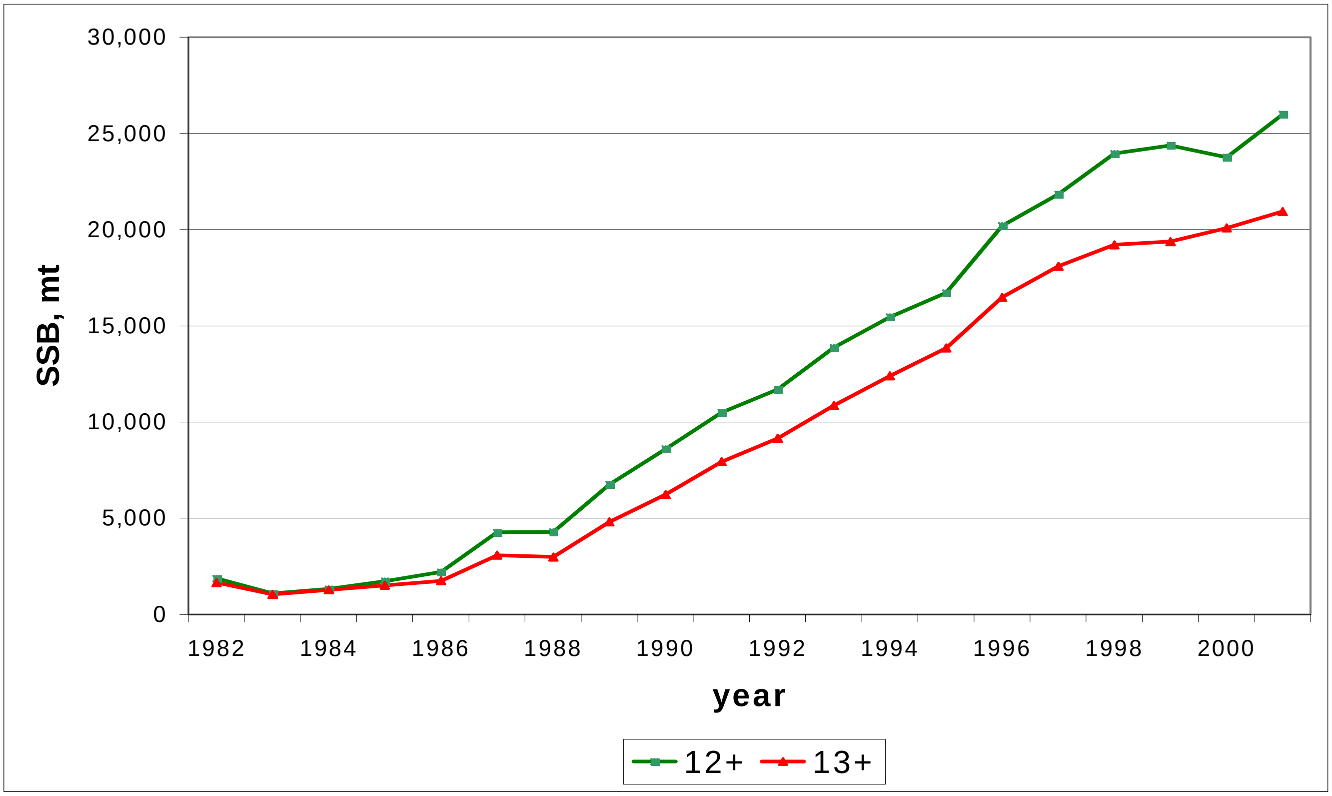


Figure D22. Terminal full F distribution (ages 7-10) based on 500 bootstrap iterations> 80 % confidence intervals are shown by dashed lines.

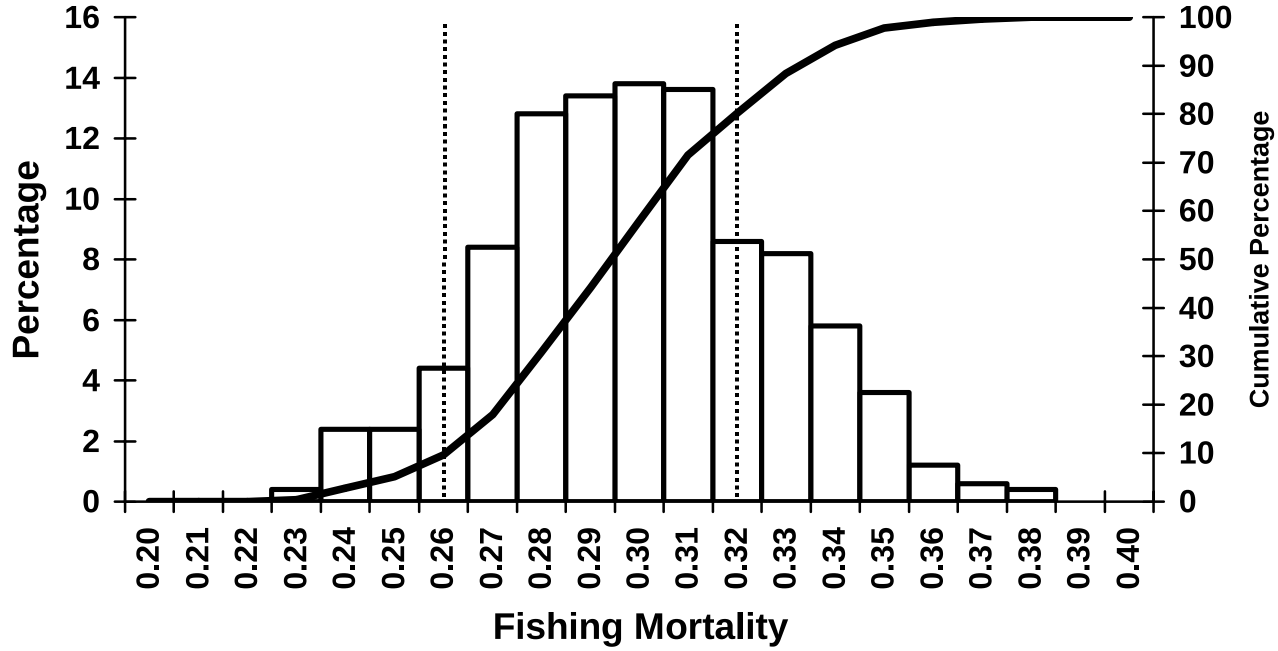
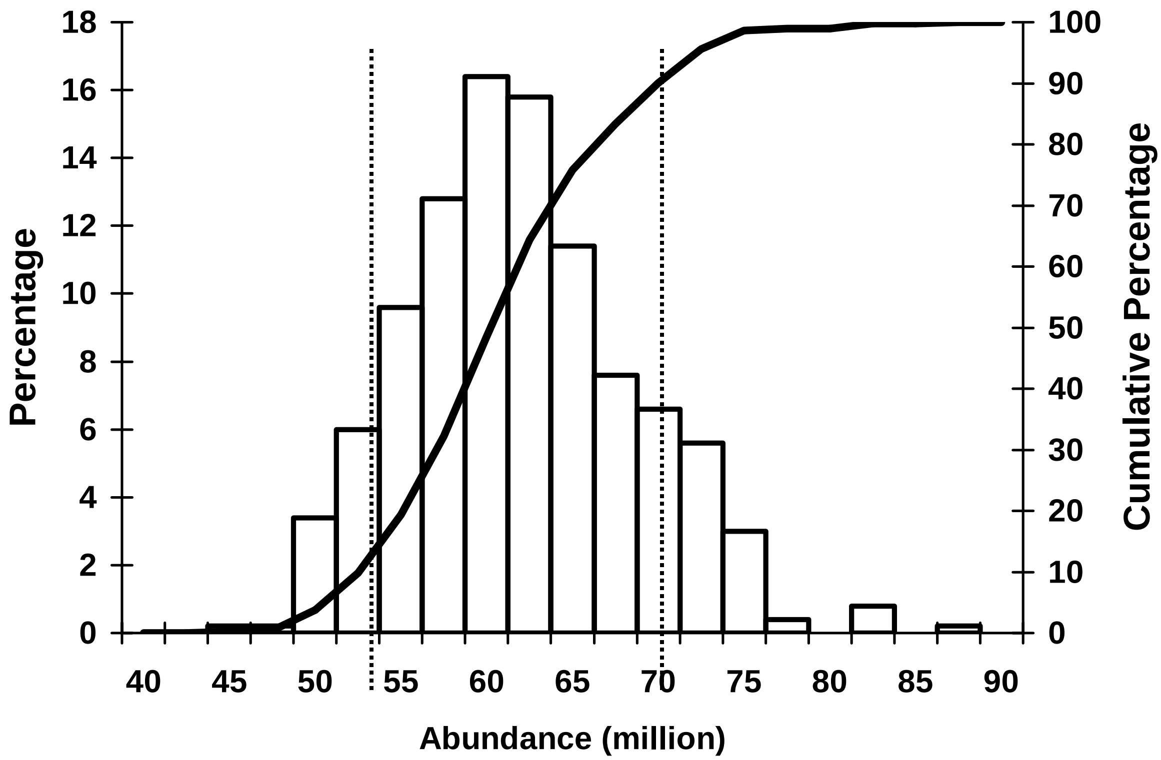


Figure D23. Population size (1+) estimates distribution in 2001 based on 500 bootstrap iterations> 80 % confidence intervals are shown by dashed lines.



Tagging Segment Tables

Table D20. Time series of instantaneous fishing mortality estimates (F) adjusted for live release bias. Results are for Striped bass >= 18 inches. Reporting Rate (DE) = 0.433.

Coast Programs*

Year	MADFW	NYOHS	NJDEL	NCCOOP
1988		0.28		-0.08
1989		-0.26	-0.23	0.34
1990		0.28	-0.17	0.35
1991		0.00	0.25	0.20
1992	-0.02	-0.18	0.19	-0.08
1993	0.00	0.50	0.30	0.01
1994	-0.01	0.12	0.20	0.39
1995	0.07	-0.16	-0.13	-0.16
1996	0.03	0.13	-0.03	0.46
1997	0.08	0.19	0.35	0.46
1998	0.05	0.54	0.02	0.45
1999	0.07	0.20	0.15	-0.06
2000	0.04	0.39	0.14	0.80
2001	-0.02	0.57	0.14	0.50

Producer Area Programs

Year	DE/PA	MDCB	VARAP	Weighted** Average
1987		0.09		
1988		0.06		
1989		-0.08		
1990		0.22	-0.09	
1991		0.21	1.01	
1992		0.18	-0.08	
1993	0.16	0.23	0.26	0.22
1994	0.11	0.21	0.29	0.20
1995	0.12	0.21	0.17	0.20
1996	0.18	0.25	0.32	0.25
1997	0.22	0.32	0.41	0.31
1998	0.24	0.38	0.70	0.37
1999	0.3	0.45	0.89	0.43
2000	0.33	0.47	0.75	0.46
2001	0.33	0.55	1.20	0.53

* A coastal unweighted average of F for striped bass >= 18 inches was not provided because MADFW primarily represents fish larger than 28 inches and GOF bootstrap indicated a lack of fit for the full parameterized models of NYOHS and NCCOOP.

**- Weighting Scheme: Delaware (0.10); Maryland (0.90)
VARAP was excluded from the producer area weighted average because a GOF bootstrap analysis indicated a lack of fit for the full parameterized model.

Table D21. Time series of instantaneous fishing mortality estimates (F) adjusted for live release bias. Results are for Striped bass >= 28 inches. Reporting Rate (DE) = 0.43.

Coast Programs

Year	MADFW	NYOHS	NJDEL	NCCOOP	Unweighted* Average	
1988		-0.20		-0.02	-0.20	**
1989		-0.16	-0.10	0.10	-0.13	**
1990		0.16	-0.25	0.08	-0.05	**
1991		0.15	-0.09	0.03	0.03	
1992	-0.02	0.10	0.20	0.03	0.09	
1993	-0.01	0.17	0.18	0.03	0.11	
1994	-0.01	0.17	0.10	0.07	0.09	
1995	0.10	0.11	0.07	0.12	0.09	
1996	0.09	0.15	0.10	0.27	0.11	
1997	0.11	0.17	0.19	0.24	0.16	
1998	0.08	0.22	0.16	0.22	0.15	
1999	0.10	0.20	0.12	0.24	0.14	
2000	0.08	0.08	0.22	0.22	0.13	
2001	-0.02	0.10	0.18	0.22	0.09	

Producer Area Programs

Year	DE/PA	MDCB	VARAP	Weighted*** Average
1988		-0.13		
1989		-0.16		
1990		0.23	0.19	
1991		0.10	0.18	
1992		0.11	0.13	
1993	-0.10	0.13	0.22	
1994	-0.07	0.11	0.25	
1995	0.26	0.21	0.29	0.21
1996	0.26	0.22	0.35	0.22
1997	0.30	0.23	0.33	0.23
1998	0.34	0.25	0.27	0.26
1999	0.40	0.24	0.31	0.26
2000	0.37	0.12	0.24	0.15
2001	0.43	0.13	0.24	0.16

* NCCOOP was excluded from the coastal weighted average because a GOF bootstrap analysis indicated a lack of fit for the full parameterized model.

** - Total mortality estimates (Z) at or below Natural mortality estimate of 0.15.

*** - Weighting Scheme: Delaware (0.10); Maryland (0.90)
* VARAP was excluded from the producer area weighted average because a GOF bootstrap analysis indicated a lack of fit for the full parameterized model.

Table D22. Survival (S) and fishing mortality (F) rates of striped bass >= 18 inches including estimates adjusted (adj.) for reporting rate (0.433), bias from live releases, and hooking mortality (0.08).

Coast Programs

Massachusetts
C-hat adjustment = 1.727; bootstrap GOF probability = 0.44 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1992	0.798	0.076	0.052	0.750	-0.094	0.880	-0.023	-0.119	0.084
1993	0.799	0.074	0.050	0.583	-0.071	0.860	0.000	-0.086	0.095
1994	0.798	0.076	0.058	0.558	-0.080	0.867	-0.008	-0.102	0.096
1995	0.751	0.136	0.052	0.527	-0.068	0.805	0.066	-0.006	0.144
1996	0.755	0.131	0.090	0.420	-0.100	0.839	0.026	-0.043	0.100
1997	0.762	0.122	0.061	0.278	-0.044	0.797	0.077	0.010	0.148
1998	0.766	0.117	0.074	0.323	-0.063	0.817	0.052	-0.014	0.122
1999	0.770	0.111	0.051	0.310	-0.040	0.802	0.070	0.005	0.141
2000	0.806	0.066	0.046	0.241	-0.028	0.829	0.037	-0.029	0.108
2001	0.846	0.017	0.038	0.358	-0.034	0.875	-0.017	-0.084	0.055

New York - Ocean Haul Seine
bootstrap GOF probability < 0.002 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1988	0.550	0.448	0.075	0.930	-0.150	0.650	0.280	0.117	0.504
1989	0.904	-0.049	0.093	0.940	-0.190	1.121	-0.260	-0.287	-0.234
1990	0.564	0.423	0.072	0.830	-0.130	0.650	0.280	0.104	0.509
1991	0.755	0.131	0.077	0.710	-0.130	0.863	0.000	-0.164	0.321
1992	0.919	-0.066	0.070	0.690	-0.110	1.033	-0.180	-0.263	0.831
1993	0.484	0.576	0.056	0.610	-0.080	0.524	0.500	0.283	0.761
1994	0.683	0.231	0.065	0.720	-0.110	0.763	0.120	-0.026	0.334
1995	0.935	-0.083	0.062	0.550	-0.080	1.015	-0.160	-0.182	-0.141
1996	0.695	0.214	0.059	0.580	-0.080	0.755	0.130	-0.036	0.403
1997	0.652	0.278	0.061	0.600	-0.080	0.711	0.190	-0.017	0.534
1998	0.467	0.611	0.053	0.570	-0.070	0.502	0.540	0.274	0.885
1999	0.655	0.273	0.061	0.510	-0.070	0.706	0.200	-0.052	0.679
2000	0.546	0.455	0.049	0.570	-0.060	0.583	0.390	0.061	0.939
2001	0.454	0.640	0.056	0.510	-0.070	0.485	0.570	0.382	0.799

New Jersey - Delaware Bay
bootstrap GOF probability = 0.35 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1989	0.885	-0.028	0.106	0.743	-0.180	1.081	-0.230	-0.341	0.727
1990	0.797	0.077	0.120	0.794	-0.220	1.020	-0.170	-0.356	0.548
1991	0.573	0.407	0.088	0.722	-0.140	0.670	0.250	0.023	0.579
1992	0.622	0.325	0.078	0.711	-0.130	0.711	0.190	0.043	0.386
1993	0.558	0.433	0.081	0.652	-0.120	0.635	0.300	0.184	0.446
1994	0.626	0.318	0.083	0.579	-0.110	0.705	0.200	0.101	0.315
1995	0.847	0.016	0.096	0.582	-0.130	0.977	-0.130	-0.212	0.035
1996	0.759	0.126	0.113	0.527	-0.150	0.890	-0.030	-0.176	0.228
1997	0.530	0.485	0.089	0.616	-0.130	0.607	0.350	0.146	0.612
1998	0.715	0.185	0.124	0.488	-0.150	0.844	0.020	-0.118	0.229
1999	0.655	0.273	0.083	0.577	-0.110	0.738	0.150	0.024	0.328
2000	0.660	0.266	0.085	0.579	-0.120	0.746	0.140	-0.007	0.356
2001	0.648	0.284	0.093	0.617	-0.130	0.748	0.140	0.014	0.303

North Carolina - Cooperative Trawl Cruise
probability < 0.001 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1988	0.909	-0.054	0.015	0.750	-0.027	0.933	-0.081	-0.105	-0.057
1989	0.604	0.354	0.010	0.720	-0.017	0.615	0.337	0.166	0.542
1990	0.556	0.437	0.057	0.583	-0.082	0.606	0.352	0.193	0.541
1991	0.615	0.336	0.077	0.693	-0.131	0.708	0.196	0.030	0.395
1992	0.814	0.056	0.090	0.531	-0.123	0.928	-0.075	-0.307	0.227
1993	0.757	0.129	0.072	0.647	-0.115	0.855	0.007	-0.211	0.286
1994	0.522	0.499	0.068	0.628	-0.105	0.584	0.389	0.220	0.592
1995	0.906	-0.052	0.080	0.523	-0.107	1.014	-0.164	-0.194	-0.134
1996	0.530	0.486	0.042	0.270	-0.028	0.545	0.457	0.240	0.735
1997	0.523	0.499	0.069	0.228	-0.042	0.546	0.456	0.180	0.838
1998	0.522	0.500	0.073	0.250	-0.048	0.548	0.451	0.167	0.849
1999	0.893	-0.037	0.065	0.150	-0.026	0.917	-0.063	-0.063	-0.063
2000	0.362	0.865	0.047	0.556	-0.064	0.387	0.798	0.540	1.149
2001	0.501	0.541	0.050	0.298	-0.038	0.521	0.503	0.271	0.805

Producer Area Programs

Delaware / Pennsylvania - Delaware River

C-hat adjustment = 1.057; bootstrap GOF probability = 0.44 for the full parameterized model.

With trend models included:

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1993	0.660	0.270	0.100	0.390	-0.098	0.730	0.160	0.010	0.350
1994	0.660	0.270	0.110	0.550	-0.148	0.770	0.110	-0.060	0.300
1995	0.650	0.280	0.120	0.500	-0.151	0.770	0.120	-0.020	0.270
1996	0.630	0.310	0.110	0.440	-0.122	0.720	0.180	0.080	0.300
1997	0.620	0.330	0.080	0.420	-0.099	0.690	0.220	0.120	0.350
1998	0.590	0.380	0.110	0.470	-0.129	0.680	0.240	0.130	0.370
1999	0.570	0.410	0.090	0.470	-0.103	0.635	0.300	0.170	0.460
2000	0.550	0.450	0.100	0.460	-0.114	0.620	0.330	0.140	0.560
2001	0.540	0.470	0.095	0.560	-0.128	0.620	0.330	0.080	0.660

With trend models excluded:

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1993	0.670	0.250	0.100	0.390	-0.098	0.740	0.150	-0.020	0.350
1994	0.657	0.270	0.110	0.550	-0.148	0.770	0.110	-0.050	0.300
1995	0.610	0.340	0.120	0.500	-0.151	0.720	0.180	0.100	0.270
1996	0.600	0.360	0.110	0.440	-0.122	0.680	0.230	0.130	0.340
1997	0.620	0.330	0.080	0.420	-0.099	0.690	0.220	0.120	0.350
1998	0.590	0.380	0.110	0.470	-0.129	0.680	0.290	0.130	0.370
1999	0.610	0.340	0.090	0.470	-0.103	0.680	0.240	0.150	0.330
2000	0.610	0.340	0.100	0.460	-0.114	0.690	0.220	0.140	0.320
2001	0.615	0.340	0.095	0.560	-0.128	0.700	0.200	0.120	0.290

Maryland - Chesapeake Bay Spring Spawning Stock

C-hat adjustment = 1.335; bootstrap GOF probability = 0.76 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1987	0.809	0.062	0.070	0.950	-0.145	0.946	-0.095	-0.188	0.060
1988	0.842	0.023	0.042	0.840	-0.077	0.911	-0.057	-0.104	0.006
1989	0.872	-0.014	0.034	0.930	-0.068	0.936	-0.084	-0.152	0.042
1990	0.638	0.299	0.055	0.580	-0.073	0.689	0.223	0.159	0.294
1991	0.635	0.303	0.082	0.450	-0.089	0.698	0.210	0.166	0.257
1992	0.630	0.312	0.111	0.430	-0.120	0.717	0.183	0.150	0.218
1993	0.626	0.319	0.089	0.380	-0.084	0.683	0.231	0.186	0.280
1994	0.622	0.325	0.100	0.430	-0.106	0.696	0.212	0.144	0.289
1995	0.626	0.318	0.117	0.320	-0.100	0.696	0.213	0.117	0.328
1996	0.601	0.359	0.110	0.350	-0.100	0.668	0.254	0.189	0.325
1997	0.575	0.403	0.114	0.270	-0.082	0.627	0.317	0.267	0.371
1998	0.544	0.458	0.111	0.250	-0.074	0.588	0.381	0.299	0.472
1999	0.519	0.506	0.109	0.200	-0.059	0.551	0.446	0.313	0.600
2000	0.490	0.563	0.095	0.360	-0.086	0.537	0.473	0.281	0.707
2001	0.463	0.620	0.082	0.330	-0.066	0.496	0.551	0.298	0.876

Virginia - Rappahannock River
C-hat adjustment = 1.377; bootstrap GOF probability = 0.18 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1990	0.810	0.060	0.111	0.481	-0.143	0.945	-0.094	-0.282	0.138
1991	0.287	1.098	0.063	0.524	-0.082	0.313	1.012	0.711	1.443
1992	0.801	0.072	0.125	0.408	-0.143	0.934	-0.082	-0.408	0.404
1993	0.594	0.370	0.089	0.456	-0.106	0.665	0.258	-0.090	0.798
1994	0.587	0.383	0.087	0.402	-0.092	0.647	0.286	-0.062	0.823
1995	0.688	0.223	0.076	0.255	-0.052	0.726	0.170	-0.160	0.667
1996	0.601	0.359	0.055	0.278	-0.039	0.626	0.319	-0.035	0.872
1997	0.537	0.471	0.068	0.330	-0.058	0.571	0.411	0.099	0.867
1998	0.400	0.766	0.066	0.371	-0.063	0.427	0.701	0.390	1.155
1999	0.329	0.961	0.081	0.294	-0.064	0.352	0.895	0.555	1.414
2000	0.376	0.827	0.069	0.436	-0.077	0.408	0.747	0.401	1.280
2001	0.240	1.278	0.075	0.368	-0.072	0.259	1.203	0.879	1.684

Table D23. Survival (S) and fishing mortality (F) rates of striped bass >= 28 inches including estimates adjusted (adj.) for reporting rate (0.433), bias from live releases, and hooking mortality (0.08).

Coast Programs

Massachusetts
C-hat adjustment = 1.494; bootstrap GOF probability = 0.32 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1992	0.804	0.068	0.048	0.750	-0.087	0.880	-0.023	-0.118	0.083
1993	0.806	0.066	0.054	0.571	-0.076	0.872	-0.013	-0.104	0.086
1994	0.807	0.064	0.059	0.486	-0.072	0.869	-0.010	-0.103	0.093
1995	0.736	0.157	0.056	0.405	-0.057	0.781	0.098	0.026	0.175
1996	0.739	0.152	0.089	0.255	-0.062	0.788	0.088	0.018	0.164
1997	0.742	0.148	0.076	0.205	-0.042	0.775	0.105	0.036	0.179
1998	0.744	0.146	0.086	0.274	-0.064	0.795	0.079	0.010	0.154
1999	0.746	0.143	0.066	0.271	-0.047	0.783	0.095	0.026	0.169
2000	0.766	0.117	0.059	0.222	-0.034	0.793	0.082	0.011	0.158
2001	0.850	0.013	0.046	0.316	-0.036	0.882	-0.025	-0.101	0.059

New York - Ocean Haul Seine
bootstrap GOF probability = 0.29 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1988	0.806	0.066	0.116	0.890	-0.230	1.050	-0.200	-0.310	0.006
1989	0.806	0.066	0.104	0.870	-0.200	1.011	-0.160	-0.272	0.044
1990	0.635	0.304	0.088	0.660	-0.130	0.734	0.160	0.092	0.235
1991	0.634	0.306	0.109	0.540	-0.140	0.742	0.150	0.087	0.217
1992	0.633	0.307	0.142	0.510	-0.190	0.780	0.100	0.039	0.163
1993	0.632	0.309	0.111	0.450	-0.130	0.724	0.170	0.111	0.242
1994	0.632	0.309	0.108	0.480	-0.130	0.725	0.170	0.104	0.249
1995	0.665	0.258	0.144	0.340	-0.140	0.769	0.110	0.028	0.214
1996	0.663	0.261	0.135	0.290	-0.110	0.743	0.150	0.069	0.240
1997	0.660	0.266	0.141	0.220	-0.090	0.725	0.170	0.095	0.261
1998	0.657	0.270	0.095	0.190	-0.050	0.690	0.220	0.139	0.319
1999	0.654	0.275	0.154	0.140	-0.070	0.701	0.200	0.113	0.317
2000	0.731	0.163	0.134	0.210	-0.080	0.795	0.080	-0.089	0.391
2001	0.740	0.151	0.092	0.210	-0.050	0.779	0.100	-0.064	0.410

New Jersey - Delaware Bay
bootstrap GOF probability = 0.48 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1989	0.819	0.050	0.104	0.565	-0.140	0.953	-0.100	-0.257	0.416
1990	0.817	0.052	0.135	0.833	-0.260	1.101	-0.250	-0.401	0.269
1991	0.578	0.398	0.249	0.500	-0.380	0.939	-0.090	-0.370	0.381
1992	0.616	0.335	0.080	0.710	-0.130	0.707	0.200	0.007	0.470
1993	0.646	0.287	0.100	0.417	-0.100	0.720	0.180	0.066	0.320
1994	0.686	0.227	0.103	0.466	-0.120	0.778	0.100	0.032	0.182
1995	0.715	0.185	0.102	0.448	-0.110	0.806	0.070	-0.038	0.204
1996	0.688	0.224	0.118	0.397	-0.120	0.782	0.100	0.004	0.210
1997	0.672	0.247	0.082	0.261	-0.050	0.709	0.190	0.123	0.276
1998	0.665	0.258	0.157	0.200	-0.090	0.734	0.160	0.085	0.244
1999	0.664	0.259	0.119	0.421	-0.130	0.761	0.120	0.015	0.261
2000	0.654	0.275	0.080	0.279	-0.050	0.692	0.220	0.061	0.441
2001	0.647	0.285	0.105	0.359	-0.100	0.716	0.180	-0.008	0.481

North Carolina - Cooperative Trawl Cruise
C-hat adjustment = 1.545; bootstrap GOF probability = 0.092 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1988	0.709	0.194	0.105	0.750	-0.194	0.880	-0.022	-0.188	0.177
1989	0.701	0.205	0.059	0.720	-0.102	0.781	0.097	-0.062	0.286
1990	0.703	0.202	0.075	0.583	-0.110	0.791	0.085	0.008	0.168
1991	0.704	0.201	0.089	0.693	-0.153	0.831	0.035	-0.034	0.109
1992	0.714	0.187	0.106	0.531	-0.147	0.837	0.028	-0.044	0.105
1993	0.709	0.195	0.092	0.647	-0.150	0.834	0.032	-0.036	0.104
1994	0.703	0.203	0.077	0.628	-0.121	0.800	0.074	-0.008	0.162
1995	0.651	0.278	0.104	0.523	-0.143	0.760	0.125	0.019	0.243
1996	0.637	0.301	0.050	0.270	-0.035	0.660	0.265	0.180	0.358
1997	0.634	0.305	0.098	0.228	-0.063	0.677	0.240	0.149	0.341
1998	0.637	0.301	0.113	0.250	-0.082	0.694	0.216	0.118	0.324
1999	0.643	0.291	0.103	0.150	-0.045	0.674	0.245	0.118	0.390
2000	0.639	0.297	0.053	0.556	-0.072	0.689	0.223	0.078	0.392
2001	0.640	0.296	0.091	0.298	-0.074	0.692	0.218	0.069	0.394

Producer Area Programs

Delaware / Pennsylvania - Delaware River

C-hat adjustment = 1.25; bootstrap GOF probability = 0.36 for the full parameterized model.

With trend models included:

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1993	0.870	-0.010	0.105	0.330	-0.090	0.960	-0.110	-0.270	0.090
1994	0.870	-0.010	0.085	0.290	-0.061	0.930	-0.070	-0.240	0.120
1995	0.590	0.380	0.120	0.350	-0.111	0.660	0.260	0.130	0.410
1996	0.580	0.390	0.152	0.280	-0.124	0.660	0.260	0.160	0.380
1997	0.570	0.410	0.080	0.520	-0.099	0.630	0.310	0.210	0.420
1998	0.560	0.430	0.150	0.170	-0.079	0.610	0.350	0.230	0.480
1999	0.550	0.450	0.093	0.210	-0.051	0.580	0.400	0.250	0.570
2000	0.545	0.460	0.160	0.170	-0.083	0.590	0.370	0.170	0.620
2001	0.540	0.470	0.120	0.120	-0.041	0.560	0.420	0.180	0.750

With trend models excluded:

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1993	0.860	0.000	0.105	0.330	-0.090	0.945	-0.090	-0.310	0.180
1994	0.860	0.000	0.085	0.290	-0.061	0.920	-0.060	-0.270	0.210
1995	0.575	0.400	0.120	0.350	-0.111	0.650	0.290	0.190	0.400
1996	0.575	0.400	0.152	0.280	-0.124	0.660	0.270	0.170	0.380
1997	0.575	0.400	0.080	0.520	-0.099	0.640	0.300	0.200	0.410
1998	0.570	0.410	0.150	0.170	-0.079	0.620	0.330	0.230	0.440
1999	0.570	0.410	0.093	0.210	-0.051	0.600	0.360	0.260	0.470
2000	0.580	0.390	0.160	0.170	-0.083	0.630	0.310	0.190	0.440
2001	0.580	0.390	0.120	0.120	-0.041	0.600	0.350	0.210	0.520

Maryland - Chesapeake Bay Spring Spawning Stock

C-hat adjustment = 1.281; bootstrap GOF probability = 0.98 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1987	0.925	-0.072	0.034	0.000	0.000	0.925	-0.072	-0.136	0.225
1988	0.922	-0.069	0.041	0.670	-0.062	0.983	-0.133	-0.196	0.124
1989	0.919	-0.065	0.052	0.790	-0.091	1.011	-0.161	-0.224	0.068
1990	0.624	0.322	0.070	0.570	-0.092	0.687	0.226	0.062	0.451
1991	0.641	0.295	0.123	0.590	-0.178	0.779	0.100	-0.004	0.226
1992	0.658	0.268	0.113	0.510	-0.143	0.768	0.114	0.059	0.175
1993	0.675	0.244	0.099	0.460	-0.112	0.760	0.125	0.058	0.203
1994	0.689	0.222	0.093	0.460	-0.105	0.770	0.111	0.007	0.247
1995	0.644	0.289	0.115	0.260	-0.080	0.701	0.206	0.129	0.294
1996	0.643	0.292	0.097	0.280	-0.070	0.691	0.220	0.157	0.290
1997	0.640	0.296	0.112	0.220	-0.067	0.686	0.227	0.171	0.290
1998	0.637	0.300	0.099	0.190	-0.050	0.671	0.250	0.183	0.324
1999	0.635	0.304	0.120	0.180	-0.060	0.676	0.242	0.160	0.337
2000	0.731	0.163	0.083	0.190	-0.040	0.762	0.122	-0.042	0.419
2001	0.729	0.166	0.066	0.250	-0.040	0.760	0.125	-0.048	0.450

Virginia - Rappahannock River
C-hat adjustment = 1.860; bootstrap GOF probability = 0.12 for the full parameterized model.

Year	S(unadj.)	F(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	F(adj.)	95%LCL F(adj)	95%UCL F(adj)
1990	0.622	0.325	0.086	0.577	-0.127	0.712	0.189	0.094	0.294
1991	0.622	0.325	0.091	0.560	-0.131	0.716	0.184	0.090	0.287
1992	0.622	0.325	0.123	0.535	-0.176	0.755	0.131	0.038	0.233
1993	0.624	0.321	0.099	0.349	-0.094	0.689	0.222	0.126	0.329
1994	0.624	0.321	0.084	0.318	-0.072	0.672	0.247	0.148	0.356
1995	0.597	0.367	0.123	0.189	-0.070	0.642	0.294	0.179	0.423
1996	0.597	0.366	0.046	0.130	-0.015	0.606	0.351	0.237	0.479
1997	0.597	0.366	0.080	0.167	-0.037	0.620	0.329	0.216	0.456
1998	0.597	0.366	0.137	0.217	-0.093	0.658	0.269	0.155	0.397
1999	0.597	0.366	0.102	0.200	-0.059	0.634	0.305	0.190	0.436
2000	0.628	0.315	0.079	0.349	-0.073	0.677	0.239	0.081	0.428
2001	0.636	0.303	0.071	0.304	-0.056	0.674	0.245	0.075	0.448

Table D24. QAICc weights used to derive model averaged parameter estimates given by Program MARK. Results are for Striped bass >= 18 inches.

Coast Programs

Model	MADFW	NYOHS	NJDEL	NCCOOP
{S(t)r(t)}	0.0002	**0.9808**	**0.9340**	**0.9999**
{S(Tp)r(t)}	0.0089	0.0004	0.0649	0.0000
{S(p)r(t)}	0.0630	0.0000	0.0000	0.0000
{S(t)r(p)}	0.0385	0.0000	0.0000	0.0000
{S(.)r(t)}	**0.1331**	0.0000	0.0000	0.0000
{S(Tp)r(Tp)}	0.0663	0.0188	0.0011	0.0000
{S(Tp)r(p)}	0.0070	0.0000	0.0000	0.0000
{S(d)r(p)}	**0.3254**	0.0000	0.0000	0.0000
{S(v)r(p)}	**0.3501**	0.0000	0.0000	0.0000
{S(p)r(p)}	0.0047	0.0000	0.0000	0.0000
{S(.)r(p)}	0.0006	0.0000	0.0000	0.0000
{S(.)r(.)}	0.0024	0.0000	0.0000	0.0000

Producer Area Programs*

Model	DE/PA *	DE/PA **	MDCB	VARAP
{S(t)r(t)}	0.0200	0.0540	0.0033	**0.9930**
{S(Tp)r(t)}	**0.4590**		**0.8023**	0.0070
{S(p)r(t)}	0.1240	**0.3299**	0.1943	0.0000
{S(t)r(p)}	0.1240	0.0924	0.0001	0.0000
{S(.)r(t)}	0.1480	**0.3947**	0.0000	0.0000
{S(Tp)r(Tp)}	**0.1600**		0.0000	0.0000
{S(Tp)r(p)}	0.0090		0.0000	0.0000
{S(d)r(p)}	0.0100	0.0260	0.0000	0.0000
{S(v)r(p)}	0.0070	0.0300	0.0000	0.0000
{S(p)r(p)}	0.0150	0.0400	0.0000	0.0000
{S(.)r(p)}	0.0009	0.0280	0.0000	0.0000
{S(.)r(.)}	0.0100	0.0030	0.0000	0.0000

* DE/PA with trend models, ** DE/PA without trend models

Model Descriptions

S(.) r(.)	Constant survival and reporting
S(t) r(t)	Time specific survival and reporting
S(.) r(t)	Constant survival and time specific reporting
S(p) r(t)	Regulatory period based survival and time specific reporting
S(p) r(p)	Regulatory period based survival and reporting
S(.) r(p)	Constant survival and regulatory period based reporting
S(t) r(p)	Time specific survival and regulatory period based reporting
S(d) r(p)	Regulatory period survival with terminal year unique and regulatory period reporting
S(v) r(p)	Regulatory period survival with 2 terminal years unique and regulatory period reporting
S(Tp) r(Tp)	Linear trend within regulatory period on both survival and reporting
S(Tp) r(p)	Linear trend within regulatory period survival and regulatory period reporting (no trend)
S(Tp) r(t)	Linear trend within regulatory period survival and time specific reporting (no trend)

Table D25. QAICc weights used to derive model averaged parameter estimates given by Program MARK. Results are for striped bass tagged at >= 28 inches. Models are described in Table 5.

Coast Programs

Model	MADFW	NYOHS	NJDEL	NCCOOP
{S(t)r(t)}	0.00002	0.00009	0.02076	0.03473
{S(Tp)r(t)}	0.00149	0.00022	**0.24351**	0.02508
{S(p)r(t)}	0.01026	0.00089	0.05423	0.05999
{S(t)r(p)}	0.00712	0.00090	0.01566	0.00193
{S(.)r(t)}	0.00997	0.00005	**0.26631**	0.05709
{S(Tp)r(Tp)}	0.03188	0.09525	**0.25370**	0.02335
{S(Tp)r(p)}	0.00443	0.02121	0.06528	0.07649
{S(d)r(p)}	**0.70171**	**0.11307**	0.00353	**0.12263**
{S(v)r(p)}	**0.21241**	**0.64935**	0.07345	**0.22490**
{S(p)r(p)}	0.01581	0.08943	0.00202	**0.31851**
{S(.)r(p)}	0.00197	0.01322	0.00054	0.04838
{S(.)r(.)}	0.00294	0.01632	0.00102	0.00690

Producer Area Programs

Model	DE/PA*	DE/PA**	MDCB	VARAP
{S(t)r(t)}	0.00040	0.00080	0.00012	0.00000
{S(Tp)r(t)}	0.14500		**0.23914**	0.00008
{S(p)r(t)}	0.00390	0.00800	0.00213	0.00037
{S(t)r(p)}	0.00290	0.00600	0.00767	0.00019
{S(.)r(t)}	0.00030	0.00050	0.00000	0.00089
{S(Tp)r(Tp)}	0.00400		0.07671	0.00806
{S(Tp)r(p)}	**0.36100**		0.00020	0.02050
{S(d)r(p)}	0.09700	**0.19800**	0.00079	0.08558
{S(v)r(p)}	0.09900	**0.20200**	**0.67319**	**0.24505**
{S(p)r(p)}	**0.26500**	**0.54100**	0.00004	0.11910
{S(.)r(p)}	0.00600	0.01300	0.00000	**0.17794**
{S(.)r(.)}	0.01500	0.03100	0.00000	**0.31845**

* DE/PA with trend models, ** DE/PA without trend models

Table D26. Total length frequencies of fish tagged in 2001 by program.

	Coast Programs				Producer Area Programs		
TL	MADFW	NYOHS	NJDEL	NCCOOP	DE/PA	MDCB	VARAP
249							
299						1	
349				1		9	
399		3		9	1	33	
449		36	15	114	69	126	
499		157	52	399	128	252	118
549	2	260	153	455	160	200	212
599	4	171	518	389	179	115	143
649	19	133	669	357	130	58	39
699	57	85	363	237	80	42	14
749	99	38	219	189	65	65	15
799	93	47	202	133	42	87	41
849	81	38	128	66	47	102	59
899	44	17	48	43	34	80	70
949	20	25	14	25	17	61	38
999	18	8	2	9	11	44	22
1049	10	5	2	2	13	27	14
1099	9				6	8	7
>1099		4		2	2	4	5
Total	456	1027	2385	2430	984	1314	797

Table D27. Age frequencies of tagged fish recaptured in 2001 by program.

	Coast Programs				Producer Area Programs		
AGE	MADFW	NYOHS	NJDEL		DE/PA	MDCB	VARAP
1							
2						1	
3		15	11		5	3	
4	1	16	118		4	1	21
5	4	48	186		22	7	41
6	4	33	126		19	2	16
7	22	19	59		34	10	6
8	16	27	15		36	21	7
9	15	8	5		14	6	11
10	9	6	1		8	8	4
11	10	9			4	8	3
12	6	3			14	11	4
13	1	3			3	4	2
14	8	3				7	4
15	1	5			1	1	1
16	1	4			1	3	2
17	2	4					1
18		1			1		1
19	1	2				2	
Total	101	206	521		166	95	124

Table D28. Distribution of tag recaptures by state (program) and

Coast Programs

Massachusetts (recaptures in 2001 from fish tagged and released during 1992-

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME							1						1
MA						5	11	11	5	2			34
RI							2	1	1	1			5
CT					1					1		1	3
NY				1	3	1				1	5	3	14
NJ				3	2		1			7	9	4	26
DE						1					1		2
MD				5	6						2		13
VA		3	1							1	4	2	11
NC		1									3	1	5
Total	0	4	1	9	12	7	15	12	6	13	24	11	114

New York - Ocean Haul Seine (recaptures in 2001 from fish tagged/release during 1988-

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME						3	6	5					14
NH						2			1				3
MA					7	14	6	5	5	3			40
RI					3	3	2	1	1	1	1		12
CT			2	1	1	2	4	2			1		13
NY	1		2		7	9	7	3	10	7	7	4	57
NJ	2	1		6	6	6	2		1	1	8	6	39
PA													0
DE			2							1			3
MD		1	1		1			1			1		5
VA	4			1	1		1				1	6	14
NC													0
Total	7	2	7	8	26	39	28	17	18	13	19	16	200

New Jersey - Delaware Bay (recaptures in 2001 from fish tagged/release during 1989-2001)

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME					1	2	9	3	1				16
NH						3			1				4
MA					12	23	30	19	16	6			106
RI				1	4	10	7	7	2	1			32
CT				1	4	4	4	3	1	1			18
NY				2	17	25	16	9	12	16	9		106
NJ			4	3	27	16	7	2	5	17	34		115
PA				1		1			2				4
DE			1	1	3						3	1	9
MD				2	3	1		1	2	1	3	2	15
VA			1									7	8
NC											1		1
Total	0	0	6	11	71	85	73	44	42	42	50	10	434

North Carolina - Cooperative Trawl Cruise
(recaptures in 2001 from fish tagged/release during 1988-2001)

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME					1	1							2
NH													0
MA					4	14	14	12	2	1			47
RI					1	5	1						7
CT							1	1		1			3
NY					4	4	3	3	6	3			23
NJ				1	2	2			1	3	9		18
PA													0
DE		1	1	1	1	1		1					6
MD	1	4	7	11	13	40	12	14	9	21	9	5	146
VA	2	9	6	1	8	2	2	1	1	16	35	21	104
NC	3	12	1	3				1			1	3	24
Total	6	26	15	17	34	69	33	33	19	45	54	29	380

Producer Area Programs

Delaware / Pennsylvania - Delaware River (1993 - 2001)
(recaptures during 1993-2001 from fish tagged/release during 1993-2001)

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME						1	1						2
NH						1							1
MA					4	11	26	20	7	5			73
RI					1	7	4	5	4	1			22
CT					1	2		1	2	2			8
NY					4	6	9	5	3	6	2	1	36
NJ			3	10	62	63	27	29	23	55	50	8	330
PA			4	25	14	4		2	2				51
DE	1		9	13	16	37	33	17	7	10	10	6	159
MD	9	9	4	11	14	50	31	26	27	42	27	15	265
VA	5	3	5		1	4	1		1	3	28	22	73
NC	1	1									2	2	6
Total	16	13	25	59	117	186	132	105	76	124	119	54	1026

Maryland - Chesapeake Bay Spring Spawning Stock
(recaptures in 2001 from fish tagged/release during 1987-2001)

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME			1										1
NH							1						1
MA					1	1	6	3	1				12
RI						2	2	1	1	1			7
CT						1		2					3
NY					2	1	2	4	1	2			12
NJ						4				2	3		9
PA					1								1
DE											1		1
MD	3	3	3	5	13	39	20	7	3	8	8	5	117
VA		1	1		4	5				4	10	6	31
NC	1										1	1	3
Total	4	4	5	5	21	53	31	17	6	17	23	12	198

Virginia - Rappahannock River (recaptures in 2001 from fish tagged/release during 1990-2001)

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
MA					1	1	4	4	4				14
RI						2		1	2				5
CT							1	1					2
NY					1	1			3				5
NJ					2					4	1		7
MD		1			3	6	4	5	3	6	4	1	33
VA	1		6	23	7	3		2	1	7	15	8	73
NC		1										1	2
													0
Total	1	2	6	23	14	13	9	13	13	17	20	10	141

Table D29.Time series of survival (S) and total mortality (Z) estimates adjusted for live release bias.
Results are for age 1, 2, and older striped bass tagged during Western Long Island survey.
Reporting Rate (DE) = 0.433
Bootstrap GOF S(a*t) r(a*t) prob = 0.51; c-hat was estimated as model dev/mean simulation dev = 180.288/182.654 = 0.98, no c-hat adjustment was used.

Models and AICc weights used to derive model averaged parameter estimates given by Program MARK. All other models tested had delta AIC > 7, and AICc weight < 0.01.

Model	AICc Weights
S(a) r(a*v)	0.45
S(a) r(a*p)	0.40
S(a) r(a*d)	0.12
S(a) r(a*t)	0.02

Age 1 Survival

Year	S(unadj.)	Z(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	Z(adj.)	LCLM (Z) Z(adj.)	UCLM (Z) Z(adj.)
1988	0.277	1.29	0.02	1.00	-0.053	0.292	1.23	1.01	1.47
1989	0.277	1.29	0.01	1.00	-0.024	0.283	1.26	1.04	1.50
1990	0.277	1.29	0.06	0.87	-0.116	0.313	1.16	0.94	1.40
1991	0.277	1.29	0.03	0.91	-0.056	0.293	1.23	1.01	1.47
1992	0.277	1.29	0.01	0.80	-0.017	0.281	1.27	1.05	1.51
1993	0.277	1.29	0.03	0.88	-0.066	0.296	1.22	1.00	1.46
1994	0.277	1.29	0.02	0.86	-0.034	0.286	1.25	1.03	1.49
1995	0.277	1.29	0.01	0.75	-0.019	0.282	1.27	1.05	1.50
1996	0.277	1.29	0.01	0.77	-0.022	0.283	1.26	1.04	1.50
1997	0.277	1.29	0.07	1.00	-0.155	0.327	1.12	0.90	1.36
1998	0.277	1.29	0.02	1.00	-0.040	0.288	1.24	1.03	1.48
1999	0.277	1.29	0.01	1.00	-0.027	0.284	1.26	1.04	1.50
2000	0.277	1.29	0.02	0.94	-0.041	0.288	1.24	1.02	1.48
2001	0.277	1.29	0.00	0.81	-0.007	0.279	1.28	1.06	1.52

Age 2 Survival

Year	S(unadj.)	Z(unadj.)	Recovery Rate	% Live Release	Bias Live Release	S(adj.)	Z(adj.)	LCLM (Z) Z(adj.)	UCLM (Z) Z(adj.)
1988	0.408	0.90	0.04	1.00	-0.097	0.452	0.79	0.62	1.00
1989	0.408	0.90	0.06	0.96	-0.128	0.468	0.76	0.58	0.96
1990	0.408	0.90	0.08	0.93	-0.155	0.483	0.73	0.55	0.93
1991	0.408	0.90	0.08	1.00	-0.170	0.492	0.71	0.53	0.91
1992	0.408	0.90	0.06	0.93	-0.124	0.466	0.76	0.59	0.97
1993	0.408	0.90	0.08	1.00	-0.163	0.487	0.72	0.54	0.92
1994	0.408	0.90	0.03	0.90	-0.056	0.432	0.84	0.66	1.04
1995	0.408	0.90	0.09	0.91	-0.172	0.493	0.71	0.53	0.91
1996	0.408	0.90	0.04	0.89	-0.076	0.442	0.82	0.64	1.02
1997	0.408	0.90	0.07	0.80	-0.120	0.464	0.77	0.59	0.97
1998	0.408	0.90	0.03	0.65	-0.048	0.429	0.85	0.67	1.05
1999	0.408	0.90	0.03	0.82	-0.045	0.427	0.85	0.67	1.05
2000	0.408	0.90	0.06	0.92	-0.119	0.463	0.77	0.59	0.97
2001	0.408	0.90	0.06	0.84	-0.109	0.458	0.78	0.60	0.98

Table D29. Continued.

Age 3+ Survival

Year	S(unadj.)	Z(unadj.)	Recovery	% Released	bias	S(adj.)	Z(adj.)	LCLM (Z)	UCLM (Z)
1988	0.604	0.50	0.07	1.00	-0.161	0.719	0.33	0.26	0.40
1989	0.604	0.50	0.14	0.92	-0.289	0.849	0.16	0.10	0.24
1990	0.604	0.50	0.13	0.87	-0.265	0.822	0.20	0.13	0.27
1991	0.604	0.50	0.09	0.94	-0.177	0.734	0.31	0.24	0.38
1992	0.604	0.50	0.11	0.87	-0.222	0.776	0.25	0.19	0.33
1993	0.604	0.50	0.07	1.00	-0.153	0.713	0.34	0.27	0.41
1994	0.604	0.50	0.03	1.00	-0.070	0.649	0.43	0.37	0.51
1995	0.604	0.50	0.07	0.73	-0.121	0.687	0.38	0.31	0.45
1996	0.604	0.50	0.07	0.73	-0.116	0.683	0.38	0.32	0.46
1997	0.604	0.50	0.05	0.58	-0.066	0.647	0.44	0.37	0.51
1998	0.604	0.50	0.11	0.56	-0.147	0.707	0.35	0.28	0.42
1999	0.604	0.50	0.05	0.56	-0.057	0.641	0.45	0.38	0.52
2000	0.604	0.50	0.06	0.75	-0.101	0.671	0.40	0.33	0.47
2001	0.604	0.50	0.11	1.00	-0.230	0.784	0.24	0.18	0.32

Table D30. Total length frequencies of WLI 2001 tag releases, and ages of WLI 2001 tag recaptures.

TL	WLI
199	86
249	126
299	72
349	29
399	30
449	22
499	21
549	12
599	8
649	3
699	
749	
799	1
849	
899	
949	
999	
1049	
1099	
>1099	
Total	410

AGE	WLI
1	1
2	19
3	10
4	6
5	5
6	2
7	
8	
9	2
10	
Total	45

Table D31. Distribution of tag recaptures by state and month for all recaptures 1988 - 2001

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
NB								1	1				2
ME					1	3	2	5	1				12
NH													0
MA					5	14	10	2	3	3		1	38
RI				3	5	2		1	3	3	1		18
CT			1		6	3	2	2	2	4	1	1	22
NY	5	3	8	34	54	67	63	63	85	119	73	16	590
NJ		1	1	1	3		1	3	1	3	11	3	28
PA													0
DE												1	1
MD	1		1	1	2					2	1		8
VA	1		1							1		1	4
NC												1	1
Total	7	4	12	39	76	89	78	77	96	135	87	24	724

Table D32. R/M estimates of exploitation rates of >= 28 inch striped bass from tagging programs (with reporting rate adjustment of 0.43, and hooking mortality rate adjustment of 0.08).

Year	NJDB	NYOHS	NCCOOP	MA	VA York	VA Rap	MDCB	DE/PA	NYHUD
1987	*	0.052	*	*	*	0.031	0.006	*	*
1988	*	0.038	0.076	*	*	0.132	0.041	*	0.110
1989	0.019	0.060	0.048	*	*	0.007	0.037	*	0.083
1990	0.041	0.063	0.080	*	*	0.090	0.084	*	0.135
1991	0.333	0.131	0.076	0.051	0.107	0.125	0.135	*	0.102
1992	0.078	0.140	0.140	0.070	0.034	0.121	0.131	0.178	0.152
1993	0.089	0.135	0.112	0.041	0.090	0.163	0.123	0.213	0.172
1994	0.086	0.197	0.088	0.052	0.138	0.103	0.115	0.121	0.118
1995	0.122	0.144	0.142	0.089	0.229	0.298	0.208	0.142	0.153
1996	0.217	0.475	0.116	0.140	0.233	0.040	0.172	0.337	0.232
1997	0.255	0.133	0.202	0.098	0.643	0.192	0.239	0.323	0.335
1998	0.371	0.341	0.224	0.084	0.160	0.324	0.196	0.300	0.218
1999	0.173	0.258	0.236	0.137	0.005	0.232	0.198	0.177	0.225
2000	0.139	0.059	0.062	0.071	*	0.128	0.173	0.322	0.139
2001	0.154	**	0.154	**	*	0.101	0.128	0.280	*

* Years when few or no striped bass were tagged and
** NYOHS and MA have fall tagging programs, and recapture interval of terminal year (2000) is fall 2000 to fall 2001; NCCOOP is a winter tagging program (Jan./Feb.) with recapture interval of terminal year (2001) from January 2001 to January 2002; others are spring tagging programs recapture interval of terminal year (2001) from spring 2001 to spring 2002.

Table D33. R/M estimates of catch rates of >= 28 inch striped bass from tagging programs. (with reporting rate adjustment of 0.43)

Year	NJDB	NYOHS	NCCOOP	MA	VA York	VA Rap	MDCB	DE/PA	NYHUD
1987	*	0.284	*	*	*	0.388	0.080	*	*
1988	*	0.224	0.256	*	*	0.312	0.091	*	0.220
1989	0.233	0.215	0.141	*	*	0.090	0.095	*	0.285
1990	0.517	0.215	0.173	*	*	0.203	0.175	*	0.362
1991	0.620	0.345	0.206	0.156	0.155	0.212	0.277	*	0.250
1992	0.275	0.268	0.269	0.133	0.089	0.216	0.248	0.179	0.302
1993	0.230	0.273	0.278	0.106	0.211	0.266	0.266	0.326	0.348
1994	0.302	0.358	0.208	0.161	0.278	0.191	0.225	0.201	0.256
1995	0.240	0.267	0.275	0.187	0.310	0.336	0.274	0.252	0.250
1996	0.355	0.589	0.154	0.241	0.287	0.074	0.262	0.409	0.330
1997	0.445	0.133	0.254	0.203	0.930	0.228	0.298	0.345	0.437
1998	0.406	0.392	0.285	0.155	0.197	0.423	0.229	0.353	0.304
1999	0.322	0.258	0.273	0.151	0.068	0.273	0.237	0.197	0.315
2000	0.250	0.152	0.128	0.107	*	0.182	0.200	0.396	0.217
2001	0.230	**	0.212	**	*	0.171	0.169	0.312	*

* Years when few or no striped bass were tagged and
** See footnote in Table D32.

Table D34. R/M estimates of exploitation rates of >= 18 inch striped bass from tagging programs (with reporting rate adjustment of 0.43, and hooking mortality rate adjustment of 0.08).

Year	NJDB	NYOHS	NCCOOP	MA	VA York	VA Rap	MDCB	DE/PA	NYHUD
1987	*	0.024	*	*	*	0.051	0.021	*	*
1988	*	0.031	0.047	*	*	0.132	0.017	*	0.060
1989	0.037	0.035	0.032	*	*	0.046	0.013	*	0.059
1990	0.112	0.044	0.070	*	*	0.120	0.068	*	0.094
1991	0.055	0.053	0.085	0.051	0.114	0.075	0.102	0.031	0.077
1992	0.060	0.047	0.164	0.057	0.096	0.063	0.140	0.133	0.105
1993	0.030	0.046	0.106	0.038	0.101	0.114	0.111	0.116	0.123
1994	0.041	0.064	0.089	0.040	0.094	0.102	0.121	0.119	0.085
1995	0.061	0.035	0.139	0.064	0.169	0.196	0.196	0.129	0.132
1996	0.102	0.060	0.109	0.109	0.155	0.132	0.172	0.170	0.170
1997	0.111	0.032	0.166	0.103	0.223	0.200	0.210	0.156	0.250
1998	0.136	0.055	0.150	0.056	0.167	0.149	0.207	0.146	0.177
1999	0.057	0.044	0.219	0.090	0.118	0.153	0.163	0.117	0.152
2000	0.072	0.039	0.088	0.050	*	0.096	0.133	0.147	0.101
2001	0.093	**	0.118	**	*	0.066	0.124	0.145	*

* Years when few or no striped bass were tagged and
** NYOHS and MA have fall tagging programs, and recapture interval of terminal year (2000) is fall 2000 to fall 2001; NCCOOP is a winter tagging program (Jan./Feb.) with recapture interval of terminal year (2001) from January 2001 to January 2002; others are spring tagging programs recapture interval of terminal year (2001) from spring 2001 to spring 2002.

Table D35. R/M estimates of catch rates of >= 18 inch striped bass from tagging programs. (with reporting rate adjustment of 0.43)

Year	NJDB	NYOHS	NCCOOP	MA	VA York	VA Rap	MDCB	DE/PA	NYHUD
1987	*	0.177	*	*	*	0.080	0.157	*	*
1988	*	0.242	0.216	*	*	0.274	0.100	*	0.192
1989	0.297	0.193	0.119	*	*	0.205	0.082	*	0.232
1990	0.675	0.174	0.180	*	*	0.279	0.131	*	0.293
1991	0.234	0.202	0.200	0.156	0.252	0.157	0.187	0.100	0.272
1992	0.264	0.142	0.293	0.120	0.341	0.125	0.245	0.211	0.238
1993	0.189	0.187	0.207	0.124	0.235	0.214	0.187	0.253	0.285
1994	0.200	0.155	0.199	0.143	0.253	0.179	0.218	0.226	0.214
1995	0.211	0.139	0.232	0.183	0.294	0.255	0.290	0.263	0.223
1996	0.265	0.190	0.151	0.237	0.221	0.190	0.281	0.263	0.288
1997	0.332	0.141	0.227	0.199	0.305	0.239	0.306	0.261	0.356
1998	0.323	0.150	0.247	0.105	0.230	0.219	0.297	0.265	0.260
1999	0.190	0.152	0.274	0.107	0.160	0.216	0.232	0.192	0.233
2000	0.215	0.141	0.158	0.093	*	0.144	0.233	0.269	0.205
2001	0.217	**	0.180	**	*	0.148	0.175	0.242	*

* Years when few or no striped bass were tagged and
** See footnote in Table D34.

Figure D24. Comparison of VPA and Tag program fishing mortality estimates.

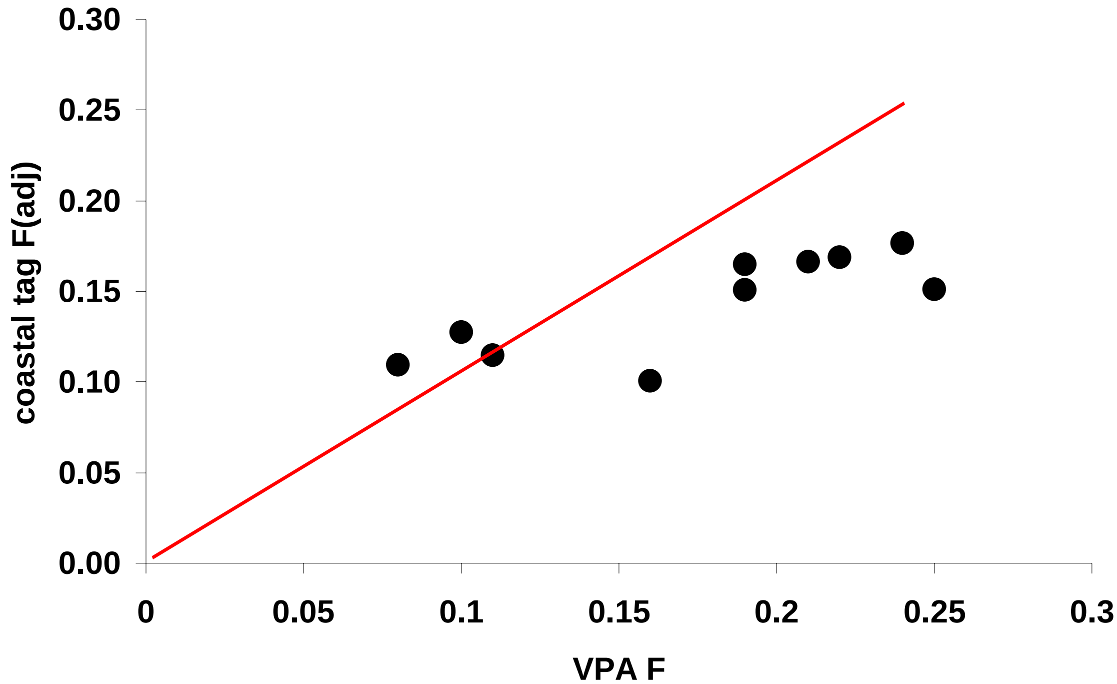


Figure D25. Comparison of VPA and Cooperative Cruise Tag program fishing mortality estimates.

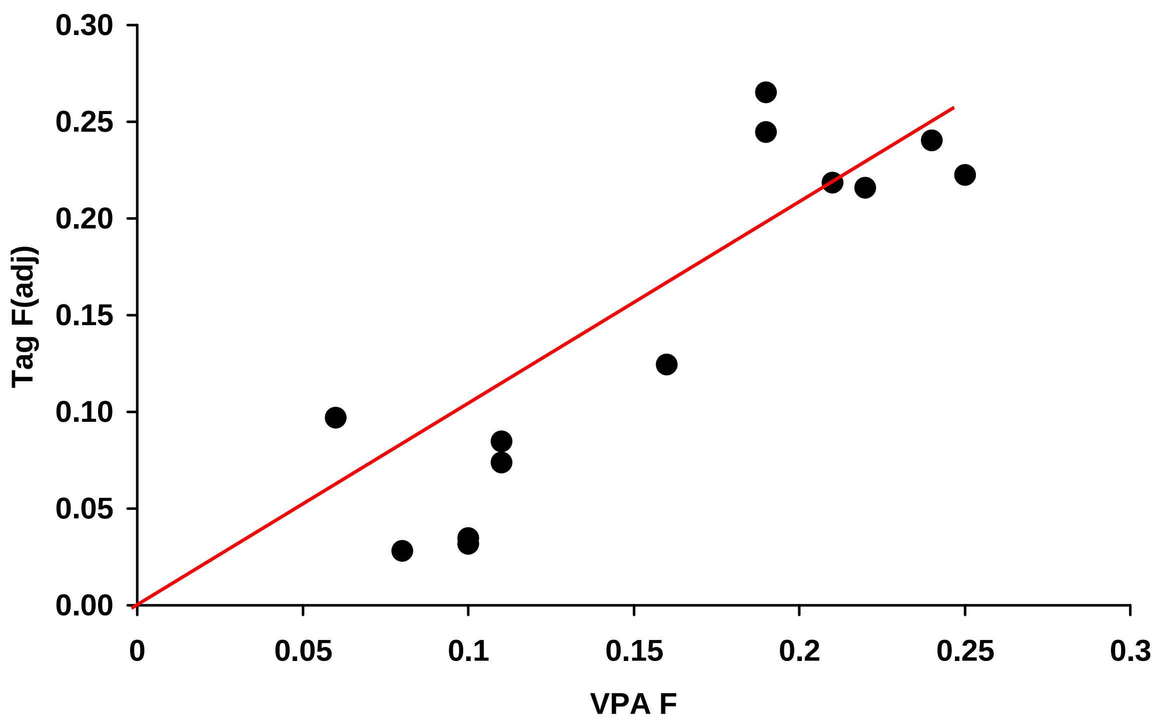


Figure D26. Time series of VPA and Tag estimated fishing mortality.