Atlantic States Marine Fisheries Commission
Striped Bass Technical Committee

2001 Stock Assessment Report

for

Atlantic Striped Bass

October 2001

The ASMFC Striped Bass stock assessment sub-committee and Technical Committee met in August 2001 to evaluate the status of the striped bass resource. The assessment includes the Hudson, Delaware, Chesapeake and mixed coastal stocks. 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 2000 catch and survey data.

Commercial Fishery

Commercial landings in 2000 totaled 1,057,712 fish and 6,620,429 pounds (3,003 mt) (Table 1, Table 2). The landings represent a decline of 46,101 fish and increase of 137,189 pounds compared to 1999 (Table 8). The Chesapeake Region (Maryland, PRFC, and Virginia) accounts for most of the commercial harvest, 73% by weight and 87% by number (Table 3). Overall, commercial harvest represented 36% by number and 28% by weight of total harvest removals in 2000, and 23 % by number of the total catch (harvest + discard) (Figure 1, Table 2). Commercial harvest was primarily fish of ages 4 to 6 (67% of commercial harvest).

Commercial discards were estimated using the same method as in previous years. The estimation was based on the ratio of commercial to recreational released fish tag recovery data scaled by total recreational discards. However, a number of procedural changes resulted in some substantial differences in the discard estimates for 1998 to 2000, affecting both the estimate of total discards, the estimate of discard mortalities, and the distributions at age (Table 9). The total estimated discards changed due to 1) calculating the tag ratio value by area (Chesapeake and Coast) to account for area specific differences in the recovery ratio and 2) incorporating system-specific discard estimates for the Hudson and Delaware Rivers. Overall discard mortality changed due to incorporation of region-specific (Chesapeake and Coast) discard gear proportions for 1998 – 2000. Previously (1982-1997), total discards were allocated to gears based on the overall distribution of tag recoveries by gear. The distribution of discards by age also changed, due to separation of available gill net discard age distributions into drift and anchor gill net categories rather than combining all gill nets. Total commercial discards losses for 2000 were estimated as 386,884 fish, representing 8% of total removals in number (Figure 1, Table 2, Table 4, Table 9). Discards were dominated by fish of ages 2 to 4.

Recreational Fishery

Recreational statistics were collected as part of the MRFSS (Marine Recreational Fishery Statistics Survey) program. Landings (A+B1) in 2000 were 1,924,001 fish totaling 17,098,549 pounds (7756 mt) (Table 1, Table 2). The landings represent an increase of 604,207 fish and an increase of 3,203,979 pounds compared to 1999 (Table 7). The states landing the largest proportion of the recreational landings were Maryland, New Jersey, Virginia, New York, and Massachusetts (Table 6). Overall, recreational landings represented 72% by number and 65% by weight of the reported total landings, and 41% by number of total catch (landings + discard) (Figure 1). Age composition of landings were primarily ages 4 to 7 (74% of landings).

Recreational discards (B2's) increased in 2000 to 16,311,806 fish (Table 2, Table 7). Applying a hooking mortality rate of 8% resulted in estimated losses from hooking mortality of 1,304,944 fish (Table 2). The states with the largest proportion of the overall discards were Massachusetts, Maryland, and New York (Table 7). Recreational discards represented 28% by number of the total catch (Figure 1, Table 2). Discards were greatest on the 1996 year class (age 4) which comprised 28% of the total.

Total recreational striped bass catch in 2000 was 3,228,945 fish. The catch was dominated by ages 4 to 7 (72% of total). Total recreational discard and landings losses increased sharply between 1994 and 1997, fluctuated without a strong trend through 1999, then increased by over one million fish in 2000 (Table 10).

Total Catch at Age

The above components are totaled by year to produce the overall catch at age matrix for VPA input (Table 11). The total catch of striped bass in 2000 was 4.68 million fish. The 2000 catch represented the highest catch since 1982, exceeding the previous high in 1997, by over 20,000 fish.

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 2000 value was about one-half the series average

(Figure 2). 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 and the 2000 value was about average and considerably higher than the 1999 (Figure 3). Survey values for ages 2 and 3 (lagged ahead to ages 3 and 4) were included this year in an attempt better estimate abundance of younger ages. The NEFSC spring inshore survey was incorporated as an age-aggregated index in the 1999 assessment, and was used in the 2000 assessment as age-specific indices. This survey increased during the early to mid-1990s before declining in 1998 and 1999. The 2000 value was one of the highest in the series (Figure 4). The Rappahannock River, Virginia pound net CPUE was used for the first time this year, in an attempt to provide more information on the overall spawning stock. This survey, begun in 1991, showed an increase with the 2000 value the series high (Figure 5). Three trawl indices, aggregated across ages, were also added for the first time in the 2000 VPA (Figure 6). The Connecticut trawl index increased steadily from 1984 to 1999, then dropped slightly in 2000. Both the Delaware and New Jersey trawl indices exhibited a sharp increase in the mid-1990s, with peaks in 1994 and 1996 for the Delaware and the New Jersey surveys, respectfully. Thereafter, both have decreased sharply.

Juvenile indices from the Chesapeake Bay (Maryland and Virginia) show improved recruitment in 2000 (Figure 7), and appeared to be fluctuating without any strong trend since the mid-1990s. Both suggested recent strong cohorts in 1993 and 1996. Juvenile indices of the Hudson and Delaware stocks showed above average recruitment in 1999 and, with the exception of the Hudson, again in 2000 (Figure 8). The NY and NJ surveys showed overall increasing trends since 1991.

The Maryland age-1 index was slightly above average in 1999 and about average in 2000, and reflected only a slight upward trend over the last few years (Figure 9). The Long Island age-1 index dropped slightly in 2000 but remained above average, while exhibiting a strong increasing trend over most of the series (Figure 9)

Fishery Dependent Indices

The Massachusetts commercial catch per trip dropped slightly in 1999, but recovered to near-peak values in 2000 (Figure 10). The Connecticut volunteer angler catch per trip decreased in 1999 to about the 1995 and 1997 levels, and appeared to be fluctuating randomly over the last 5 years (Figure 11). No value was available for this survey for 2000. The values for age 1 (lagged ahead as age 2) were dropped due to high PV's and low catches.

The Hudson River shad fishery bycatch 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 dropped again in 2000 after recovering slightly in 1999 (Figure 12).

Weight at Age

Weight at age information has not been updated since the 1996 fishery year. Therefore, weight at age from 1996 fishery data was used in the 2000 assessment for 1997 through 2000. Details of developing weights at age for 1982 to 1996 can be found in NEFSC Lab Ref. 98-03.

Virtual Population Analysis Results

Catch at Age

A catch at age matrix was developed using the same methods described for the 1996 assessment (NEFSC Lab Ref 98-03). Commercial landings at age were based on reported landings by state and associated age/length information. Commercial discard age data was from fishery dependent data and independent surveys using comparable gear. Recreational landings at age were based on a combination of MRFSS length samples, volunteer angler logbooks and American Littoral Society (ALS) lengths of released fish. Age composition of the recreational discards were estimated using lengths available from angler logbooks and ALS data.

The predominant age in the catch matrix was age 5, the 1995 year class, followed closely by ages 4, 6, and 7 (Table 11, Figure 13). The VPA update for the year 2000 was the first year the 1995 cohort dominated the catch, as the strong 1993 cohort dominated the catch from 1997 to 1999.

Indicators of model fit

The ADAPT program with iterative re-weighting was used for the striped bass VPA. The model resulted in an overall mean square residual of 0.00677, sum of squares = 7.02 and coefficients of variation for terminal population estimates ranging from 0.17 (age 9) to 0.36 (age 1) (Table 12). 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) (Table 13). 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 PVs while retaining the information of each survey concerning the abundance of particular stock components. Most surveys of ages 2-10 abundance had initial partial variances below 1.5, while several indices of older ages had significantly higher partial variances (Table 13). Iterative re-weighting reduces the influence of surveys with high variance by changing the weight applied to each survey, and results in all surveys providing equivalent contributions to the overall variance.

Fishing Mortality

Average fishing mortality rate (F) for ages 4 through 13 in 2000 was equal to 0.28 (exploitation rate (or harvest rate) of 23%). F was fairly stable between 1997 and 2000 for the younger ages (3-8 and 4-13), but more variable for the older ages (8-13) (Table 14, Figure 14). The revised 1998 assessment average F for ages 4 to 13 was 0.32, and the 1999 assessment average F for ages 4-13 was also 0.32. After considerable changes in the catch at age and tuning indices during this assessment, the 1998 and 1999 4 through 13 F were essentially unchanged at 0.31 (exploitation rate of 25%) (Table 14). The mortality on younger striped bass (ages 3-8) increased from around 0.20 in 1998 and 1999 to 0.25 in 2000. In the previous two striped bass stock assessments, mortality on older fish was estimated above the F=0.31 target for 1998 and 1999. The 2000 assessment continued to estimate Fs greater than 0.31 on older fish for 1998 and 1999 (0.37 and 0.39, respectively), but was reduced to 0.29 in 2000. For individual cohorts, F ranged from 0.03 on age 2 to a high of 0.39 on age 10. In 2000, the 1990 through 1993 cohorts were subjected to the highest fishing mortality. The 2000 F weighted by N for ages 6-13 was used in comparison to tag based estimates and was estimated at 0.33.

Partial Recruitment

Full recruitment estimated from the back-calculated partial recruitment occurred by age 7 (95%). The exploitation pattern changed in 2000 to greater selectivity at younger ages (4-10) and decreased selectivity at older ages compared to previous years (Table 15). For the purpose of estimating average F, full recruitment was considered as age 4, based on catch at age data.

Population Abundance

Population abundance (stock size as of January 1, 2001) increased slightly to 45.6 million fish, following a decline in abundance from 1997 to 2000 (Table 16, Figure 15). The 2000 year class dominated the population, representing about 25% of the total abundance, while the 1998-2000 cohorts (ages 1-3) represented 57% of the total population (Table 16). Abundance of the 1993 cohort, which had the highest observed abundance at age 1 in the time series, remained the highest abundance for age 8 striped bass since 1982. Recruitment of age 1 fish in 2001 (2000 cohort) was estimated as 11.5 million fish, above the 1990-2000 average of 9.7 million (Figure 16). Recruitment of the 1999 cohort appeared slightly below average, while the 1998 and 1997 were about average. The 1996 year class at age 1appeared as a dominant cohort, nearly equivalent to the 1993 year class in abundance.

Spawning Stock Biomass

Although all results are subject to uncertainty, a special caution is urged in interpreting estimates of population and spawning stock biomass. Additional uncertainty is due to the use of constant weight at age inputs since 1996 (see weight at age above) that likely bias estimates of biomass. Potential bias can be examined by comparing reported landing weights to calculated landing weights. For example, incorporating only recreational landings (A+B1 fish), the cross-product of the recreational catch at age and the estimated weight at age (10,014 MT) is 30% higher than the reported landings for 2000. The reported and calculated recreational landed weights were within 1% in 1996, but the calculated values exceeded the reported values consistently from 1997 through 2000, by 16 to 30%. Therefore, although the VPA results (Table 17) suggest that SSB continued to increase to 20,840 MT (15.9 million pounds)(Figure 17), it is quite possible that this was simply an artifact of the weights at age. Possibly, SSB peaked several years ago when total abundance peaked.

Precision of Estimates

Uncertainty in the results of the terminal year estimate of F, N and SSB in the VPA was evaluated using a bootstrap re-sampling algorithm. Five hundred iterations were made to obtain standard errors, coefficients of variation (CV) and bias estimates for stock size estimates of ages 1-15 at the beginning of 2001, fishing mortality of ages 1-15 in 2000, and spawning stock biomass of females on January 1, 2001 (Table 18). Results indicate an 80% probability that F on the fully recruited ages (ages 5-13 as listed in the input specifications) was between 0.26 and 0.35 (Figure 18). The estimate of bias was less than 5% for ages 2-15, but substantially higher for age 1. The bootstrap mean of the fully-recruited F in 1999 was 0.27 with a 2.7% bias and a CV of 0.10.

The 2000 estimate of total abundance was between 39,046 and 55,775with a probability of 80%. The bootstrap mean was 47,143 with a bias of 4.47% (Figure 19). SSB of females was between 17,695 mt and 22,806 mt at an 80% probability level. However, refer to previous section for cautions in interpreting SSB results.

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 no consistent trend through 1996, although there was a slight tendency to under-estimate Fs in the 1995 terminal year. There was little evidence of retrospective bias between the 1999 and 2000 terminal years (Figure 20).

Relative to the current assessment, age 2+ abundance was under-estimated for the 1995-1997 terminal years, and slightly over-estimated for the 1998 terminal year (Figure 21).

Time Series Changes in VPA results

Since the initial VPA based assessment in 1998, changes have occurred in compiling the catch at age, choice of indices used for tuning, calculation of index values and the VPA model selection. Nevertheless, the resulting estimate of fishing mortality for ages 4 to 13 has remained relatively stable. Annual estimates of F from consecutive assessments are presented in Figure 22.

Discussion

The results of the VPA for striped bass from 1982 to 2000 indicates a steady increase in total abundance until 1997 followed by a steady level through 2000. Concurrently, the catch and fishing mortality of striped bass ages 4 through 13 has increased (Figure 23). In recent years, the total removals have been dominated by the recreational sector. The increase in recreational catch in 2000 was due in part to an increase in recreational fishing effort. During 2000, the exploitation pattern also shifted to higher selectivity on younger ages although the age 4 through 13 F did not exceed target F of 0.31.

The estimated strength of the 1996 year class increased since the last assessment. The reason for this change appears to be the additional information provided by the recruitment of this year class to the fishery and coastal surveys. Increased catch requires that the model account for the change with increased initial abundance in the VPA population estimate. Similarly, the 1993 year class appeared to remain a dominant year class compared to previous evaluations.

The issues to be investigated in future assessments include reexamining the use of F weighted by N for comparison to tagging F estimates, the potential of a dome shaped exploitation pattern due to changes in striped bass catchability with age, implications of iterative reweighting compared to apriori weighting and the appropriateness of each of the tuning indices. In adddition, the catch weights at age will be calculated for recent years.

Tagging Results

Description of Tagging Programs:

The results provided here originate from nine different striped bass tagging programs conducted from Maine to North Carolina. All of these tagging programs have been in progress for eight years or longer. Producer area tagging programs operate mainly during spring, on spawning stock aggregations, utilizing a variety of capture types including pound nets, gill nets, seines and electro-shocking. Coastal tagging programs operate mainly during fall, on mixed stocks, and utilize various capture gears including hook & line, seine, gill net, and otter trawl. For most producer area and coastal programs (as defined in the Striped Bass FMP), tagging was conducted in association with routine monitoring programs performed by the states. The Western Long Island survey uses seine gear and operates from April through November in various bays situated around the western end of Long Island, New York.

Tag release and recapture data were 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 April of 2001 there were 361,674 tag releases, and 65,590 recaptures reported 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). Several important assumptions of the tagging programs taken from Brownie (1985), worth repeating here are:

1. The tagged 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 analysis 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 program MARK calculates maximum likelihood estimates of the multinomial parameters of survival and recovery based on an observed matrix of recaptures. The analysis protocol involves the following series of 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 that 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. A list of the candidate models used in the analyses of striped bass tag recoveries and their descriptions are provided 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 = {≥1987-≥1989}, 2 = {≥1990-≥1994}, 3 = {≥1995- 2000}

These models are then fit to the tag recovery data and are arranged in order of fit by Akaike's Information Criteria (AIC) (Akaike, 1973; Burnham and Anderson, 1992). Annual survival is then calculated as a weighted average across all models, where the weight is a function of model fit (Burnham and Anderson 1998; Smith et al. 2000). The lower the AIC (ie., the better the fit), the higher the weight assigned to a specific model in the model averaging. 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. 2000).

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, 2000) and bias due to live release (Smith et al., 2000). 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. As a consequence, any change in total mortality (Z) results in an equal change in fishing mortality (F).

Results

Mean instantaneous fishing mortality (F) from the coastal mixed stock tagging programs for striped bass tagged at twenty-eight inches and greater in total length {believed to represent those fish fully recruited to the coastal fisheries} was 0.22 in 2000 (Table 19).

Stock specific instantaneous fishing mortality (F) from producer area tagging programs for striped bass twenty-eight inches and greater in total length were 0.48 for the Delaware River, 0.16 for the Maryland portion of the Chesapeake Bay, and 0.24 for the Rappahannock River, Virginia. No estimate for the Hudson River could be provided due to the low estimate of survival which, when adjusted for natural mortality, resulted in a fishing mortality estimate of zero. Therefore, the committee(s) decided to omit the Hudson tag estimate of fishing mortality from this year's assessment, as unreliable.

In the current analysis, average fishing mortality (F) exhibited an increasing trend over the last several years to the series high of 0.22 in 2000 for the coastal tagging programs. Producer area tagging programs exhibited similar trends in average F, rising to a series high of 0.28 in 1999. No average F for producer areas was available in 2000 due to the problems identified with the Hudson River tagging analysis results.

Table 20 provides the raw estimates of survival from MARK, and components of the live release bias adjustment. The magnitude of the live release bias has decreased since the late 1980's and early 1990's, from relaxed management and the resulting effects on the proportion of tag recaptures subsequently released alive.

Table 21 provides the Akaike weights used to calculate the model averaged survival estimates for each program. Those highlighted were the highest weighted model for that program. These are provided so that the reader may evaluate the model, or models, which contributed significantly to the overall results. In nearly each case, the best fit was for those which inferred time or regulatory period specific survival or reporting. The only cases where a model of constant survival and reporting were indicated were for the New Jersey/Delaware Bay coastal program and the Virginia/Rappahannock producer area program.

Tables 22 and 23 provide the total length frequencies of tag releases by program for 2000 and the age frequency of all 2000 (year) recaptures. The length frequency data shows the relative differences within and between fish tagged on the coast and in producer area programs. The producer area programs exhibit two modes, probably related to differences in length frequency by sex. The coast programs exhibit single modes, likely related to the differences in the design of the program and the gear used in capturing fish for tagging. In general, the Massachusetts tagging by hook and line gear tends to release proportionally more large fish than the other coast programs, whereas the North Carolina trawl survey released proportionally more small fish than other coastal tagging programs.

Age distribution of the 2000 recaptures is problematic since a few programs do not assign ages to all of the fish that are tagged. Hence, the age of individual fish cannot be inferred when those fish are recaptured at a later date. The greatest proportions of recaptures were among ages four through seven. In general, these cohorts accounted for 67% of the recaptures of fish tagged on the coast. Similarly, the greatest proportions of recaptures from producer area tag programs were from among ages four, five, and seven. These cohorts accounted for 57% of the recaptures of fish tagged in producer areas.

Table 24 provides the geographic distribution of recaptures by state and month for each of the tagging programs during 2000. The pattern of tag recoveries common to all the programs, northward movement in spring and a southward return in the fall, is reflective of the migration of fish and the pattern of fishing effort directed at striped bass.

Tables 25 through 27 provide results from the Western Long Island Survey of juvenile striped bass released from May through August. These results are reported separately because they provide survival estimates of fish tagged at very young ages (1, 2+). The time series suggests that total mortality may be higher for age 1 fish than the older (age 2+) group.

<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 11 agencies (1987 - 2000) of the Cooperative Striped Bass Tagging Program (Tables 28 to 31). The time series of annual catch rates reflects trends in fishing effort, and the time series of annual exploitation rates depicts trends in exploitation. Overall increases in annual catch rates and annual exploitation rates from 1987 to 1998 suggest an increase in fishing pressure over that part of the time series, but recent estimates of annual catch rates and annual exploitation rates have decreased for most of the 11 tagging agencies.

Estimates of annual exploitation rates of 18-28 inch fish for the recent recapture year were lower for VIMS (spring and fall releases), MDDNR (spring and fall releases), CTDEP, NCCOOP, NYDECCST, and MADFWELE, but higher than those of the previous recapture year for tagged cohorts released by DEDNREC, NJDEP, and NYDECHUD. Annual exploitation rates for 18-28 inch fish released by coastal agencies, such as MADFWELE, NYDECCST, and NYDECHUD, have remained low across the time series, in part, because of the 28 inch length limit and a high proportion of fish released alive.

Estimates of annual exploitation rates of >= 28 inch fish for the final recapture year were lower than those of the previous recapture year for tagged cohorts released by NCCOOP, CTDEP, MADFWELE, MDDNR (spring and fall releases), NYDECHUD, NYDECCST, and VIMS (fall releases) (exceptions included an increase in estimates for DEDNREC, and relatively no change for NJDEP). Additionally, the weighted average of exploitation rates of producer areas decreased in 2000. A weighted average of estimates from producer areas may be appropriate if recoveries occur during coastal mixing after spawning; however, many recoveries during the first year after release occur in close proximity to the producer area of release. Although the above discussion focused on changes within recent years, a better approach would be to consider trends across the entire time series. The increase in annual tag-encounter rates and annual exploitation rates from 1987 - 1998 may have resulted from an increase in fishing pressure, or an increase in tag reporting rates. It is unlikely that reporting rates of tagged striped bass have increased over time, although annual reporting rates have not been studied over the time series of the tagging program. The decrease in encounter and exploitation rates during recent recapture years may have resulted from a decrease in fishing effort and/or a decrease in CPUE, and indicates that fishing mortality was lower during recent years than during previous recapture years.

Direct Enumeration Study

The jurisdictions of the Chesapeake Bay region (MD, PRFC, and VA) conduct a tagging program to estimate fishing mortality on striped bass targeted in the fall and winter fisheries within the Bay. The 2000 fishing mortality study was similar to the multiple release studies completed from 1995 through 1999. Striped bass were tagged and released in pre-set periods utilizing a multiple-release design throughout the Chesapeake Bay prior to and during the recreational fishing seasons for Maryland and Virginia. There were seven release rounds in Maryland, and three in Virginia. USFWS internal anchor tags were applied to 9,453 striped bass and the numbers of tagged fish were then adjusted for tag-induced mortality of 1.3% prior to analysis. Recoveries for the fishing mortality rate estimate were used from tagged fish harvested by recreational/charter anglers from both jurisdictions combined in 2000.

Tag recovery and release data were analyzed with logistic regression analysis to produce a Chesapeake Bay-wide estimate of F for the recreational, charter and commercial components of the 2000 striped bass fishery. Estimates of the rate of exploitation (U) were directly derived from modeling of tag recovery data from fish harvested by recreational anglers and were determined for the recreational/charter season component of the fishery, bay-wide. Estimates of exploitation for the recreational/charter season were converted to instantaneous rates (F_R). These estimates were adjusted to include the resident portion of the commercial and recreational fisheries that occurred during summer 2000, winter 2000-2001 and during spring/summer of 2001, respectively. The expanded estimates of F_T were calculated based on weighting of recreational/charter estimates of F_R by proportional additions of spring recreational or commercial harvest in numbers. Estimated non-harvest mortality (0.10) was added to the point estimate of $F_T = 0.18$ to obtain the final estimate of bay-wide fishing mortality of $F_{Bay} = 0.28$ for the 2000 fishing season. The variance of 0.0012is equivalent to a CV of 19.5%.

Discussion

As with any modeling exercise, there are several sources of uncertainty associated with these methods for estimation of survival and recovery parameters in the tagging analysis for striped bass. The primary source involves the violation of general assumptions, as mentioned earlier in this text. Measures of uncertainty specific to the striped bass tagging study 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. Finally, the application of a constant value for natural mortality across all groups and time does not allow for differences in natural mortality with size of fish or time.

In addition, caution is urged when comparing the tag based fishing mortality estimates over time due to the many changes that occurred in the tagging program analysis. For example, the committee switched to computer program MARK from PC Surviv, and began incorporating the live release bias adjustment. Further changes have occurred to the bias adjustment calculations from last year. The committee is applying 8% mortality to the live releases, appropriate since most of the recaptures released alive are reported from hook and line gear, which was not incorporated into last years estimates. Also, the reporting rate was re-calculated using strictly recreational recaptures, which resulted in a lower reporting rate of 0.433 from the rate used previously (0.55) (D.Kahn, personal comm.).

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 formulae to directly determine instantaneous fishing mortality (F) , for example. Some solutions may take longer, as the state of the theoretical science is generally in advance of any practical application.

Conclusion

The results of the striped bass stock assessment for 1982-2000 indicate that the overall abundance of the stock is very high and the fishing mortality remains below the target fishing mortality. The abundance increased steadily between 1982 and 1997 but has remained stable since.

The VPA results indicate fishing mortality increased steadily until 1999 but decreased slightly in 2000. There was a noticeable shift in the exploitation pattern in the 2000 fishery. In previous years, striped bass in older age classes experienced the highest proportion of mortality while the recent assessment showed a proportional shift to younger age groups. This was likely the result of changes in management policies that were enacted during 2000 intended to reduce mortality of older fish to levels approaching target F.

Fishing mortality calculated using the catch at age model and the tagging model produced comparable trends but different absolute values. The average F based on tags was 0.22 whereas the comparable VPA F (average weighted by N for ages 6-13) was 0.33. Among fish greater than 28 inches from individual stocks, the Delaware stock experienced the highest mortality based followed by the mixed stock estimate from coastal New York. In contrast, the Maryland mortality estimate was 0.16 and the coastal Massachusetts estimate of 0.08.

Overall, the Atlantic stocks of striped bass appear to be abundant in number, capable of producing strong incoming year classes and are being fished at levels within the bounds of the current Fishery Management Plan.

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Table 1. Total Atlantic Coast harvest of striped bass in metric tons and numbers from 1982 to 2000.

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	1,057,712	7,756	1,924,001	10,759	2,981,713

Table 2. Total 2000 striped bass discard and harvest in numbers and % of total by fishery component.

Fishery Component	Discard	Discard Losses	Harvest	Total Catch
Recreational	16,311,806	1,304,944	1,924,001	3,228,945
Commercial	3,620,400	386,884	1,057,712	1,444,596
Sampling			7,757	7,757
Total	19,932,206	1,691,828	2,989,470	4,681,298

Percent of Total

Fishery Component	Discard	Discard Losses	Harvest	Total Catch
Recreational		27.88%	41.10%	59.06%
Commercial		8.26%	22.59%	40.85%
Sampling			0.17%	0.09%
Total		36.14%	63.86%	100.00%

Table 3. Atlantic Coast striped bass commercial harvest in numbers at age by state, 2000.

	AGE															
STATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Maine																
New Hampshire																
Massachusetts						23	1,230	4,501	12,048	11,643	6,193	2,796	1,064	489	268	40,256
Rhode Island				9	51	421	1,763	1,830	2,335	1,850	753	286	76	29	15	9,418
Connecticut																0
New York				1,212	6,129	8,824	29,232	6,601	1,684	606	539			67		54,894
Hudson																0
New Jersey																
Delaware			237	6,370	8,472	5,727	3,864	398	73		47					25,188
Maryland			42,471	165,210	218,116	125,929	40,507	20,150	5,661	6,892	1,587	784	307	113	51	627,777
PRFC			6,188	24,072	31,781	18,349	5,902	2,936	825	1,004	231	114	45	17	7	91,471
Virginia			1,495	20,351	44,117	24,194	47,116	21,606	16,630	19,396	4,879	984	717	698	44	202,227
North Carolina							48	699	1,566	2,072	1,758	265	72		0	6,480
Total			50,392	217,223	308,665	183,467	129,662	58,722	40,821	43,463	15,987	5,230	2,281	1,413	386	1,057,712

Table 4. Estimated Atlantic Coast commercial discard losses at age for 2000.

	AGE															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
2000	109	101,718	107,764	91,931	37,496	20,662	16,479	4,878	2,506	2,269	489	519	34	12	17	386,884

Table 5. Reported scientific removals at age for 2000.

	AGE															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
2000	39	96	2,125	3,439	1,255	355	195	101	61	40	33	9	5	1	2	7,757

Table 6. Total Atlantic Coast striped bass recreational landings in numbers at age by state, 2000.

	AGE														
STATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Maine	0	0	818	28,472	18,714	9,366	1,483	241	0	0	0	0	0	0	0	59,094
New Hampshire	0	0	0	0	0	30	292	535	1,232	1,065	572	238	85	63	16	4,128
Massachusetts	0	0	0	0	836	9,227	42,006	37,441	31,387	26,828	13,626	7,721	2,203	2,157	2,101	175,533
Rhode Island	0	351	5,609	4,231	3,076	12,029	21,763	11,581	9,959	9,445	5,779	2,944	1,189	398	484	88,838
Connecticut	0	0	101	4,778	7,619	8,081	17,968	3,995	2,195	2,219	1,654	1,060	536	291	124	50,620
New York	0	0	0	457	27,260	79,190	106,795	23,087	8,727	7,215	2,125	930	1,139	1,297	864	259,085
Hudson River																
New Jersey	0	0	2,603	21,789	85,877	93,898	88,165	56,432	23,494	10,483	3,536	2,510	1,561	64	39	390,450
Delaware	0	0	0	0	0	2,769	15,402	7,735	3,405	3,558	2,049	1,148	340	186	1,152	37,743
Pennsylvania																
Maryland	0	0	19,640	134,793	144,199	93,336	41,966	25,486	11,252	9,926	5,354	2,748	1,567	198	222	490,688
Dist. Columbia																
PRFC	0	0	1,260	8,650	9,254	5,988	2,645	1,600	686	604	313	155	97	0	22	31,275
Virginia	0	0	4,083	45,064	117,316	44,608	63,425	16,104	9,513	12,554	4,582	2,007	2,725	1,101	1,272	324,354
North Carolina	0	0	0	0	754	948	1,613	2,181	1,891	3,628	761	416	0	0	0	12,193
Total	0	351	34,115	248,234	414,904	359,469	403,524	186,418	103,742	87,525	40,351	21,877	11,441	5,754	6,297	1,924,001

Table 7. Total Atlantic Coast striped bass recreational discard losses in numbers at age by state, 2000.

	AGE														
STATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Maine	48	6,938	15,758	27,671	10,851	5,604	2,550	970	474	376	206	105	47	26	19	71,645
New Hampshire	16	1,574	2,799	4,046	2,562	2,331	1,389	521	325	295	188	107	59	26	11	16,250
Massachusetts	0	4,396	31,198	166,948	121,803	113,986	86,505	32,171	6,726	3,880	2,014	712	711	198	238	571,487
Rhode Island	0	311	2,206	11,803	8,612	8,059	6,116	2,274	476	274	142	50	50	14	17	40,404
Connecticut	6,743	17,511	6,756	15,057	6,193	4,054	8,973	1,840	1,147	789	492	457	68	122	0	70,201
New York	806	14,544	11,303	30,191	16,327	14,551	11,642	2,720	1,096	1,012	286	162	127	148	147	105,061
Hudson River																
New Jersey	55	835	19,506	17,654	16,070	8,346	3,939	1,751	511	165	66	38	24	0	0	68,960
Delaware	96	342	899	2,959	2,335	2,051	1,071	497	338	347	257	168	100	52	14	11,527
Pennsylvania																
Maryland	21,709	69,629	40,412	62,932	19,842	16,420	9,069	5,216	2,118	1,763	1,107	524	211	114	62	251,129
Dist. Columbia																
PRFC	882	2,825	1,588	2,381	691	530	222	146	43	44	23	8	3	1	1	9,387
Virginia	6,837	21,929	12,727	19,820	6,249	5,171	2,856	1,643	667	555	349	165	66	36	20	79,090
North Carolina	0	0	319	1,544	3,039	931	1,029	1,397	760	588	147	49	0	0	0	9,803
Total	37,191	140,833	145,470	363,007	214,573	182,035	135,362	51,145	14,681	10,090	5,278	2,547	1,467	737	529	1,304,944

Table 8. Atlantic Coast striped bass commercial landings in numbers at age, 1982-2000.

	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	217,223	308,665	183,467	129,662	58,722	40,821	43,463	15,987	5,230	2,281	1,413	386	1,057,712

Table 9. Atlantic Coast striped bass commercial discard losses in numbers at age, 1982-2000.

	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	7,816	31,762	57,300	48,618	17,678	8,097	7,640	4,734	2,602	2,301	1,397	1,915	71	207	192,138
1999	574	35,388	30,029	26,306	34,943	10,631	3,593	2,458	1,308	839	422	388	149	3	0	147,031
2000	109	101,718	107,764	91,931	37,496	20,662	16,479	4,878	2,506	2,269	489	519	34	12	17	386,884

Table 10 Atlantic Coast striped bass recreational harvest and discard losses in numbers at age, 1982-2000.

	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	37,191	141,183	179,584	611,242	629,478	541,505	538,886	237,563	118,422	97,614	45,629	24,424	12,908	6,491	6,826	3,228,947

Table 11 Total Atlantic Coast striped bass catch in numbers at age, including estimated commercial and recreational discard losses, 1982-2000.

	AGE														
Year	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	177,987	463,272	665,461	1,090,350	499,419	275,561	260,051	212,367	112,072	93,479	44,150	31,440	14,833	17,612	3,984,475
1999	8,800	93,764	413,536	638,811	631,008	710,266	334,941	225,554	192,825	138,054	97,396	44,830	25,597	13,018	6,991	3,575,392
2000	37,339	242,998	339,865	923,835	976,895	745,989	685,222	301,264	161,810	143,387	62,138	30,182	15,230	7,916	7,112	4,681,181

Table 12. Estimated parameter values and associated SE, T-Statistic, and CV's from ADAPT.

Parameter	Estimate	SE	T-statistic	CV	Parameter	Estimate	SE	T-statistic	CV
N 1	1.15E+04	4.20E+03	2.75E+00	0.36	q NYOHS5	2.30E-04	5.57E-05	4.27E+00	0.23
N 2	7.39E+03	2.05E+03	3.61E+00	0.28	q NYOHS6	3.22E-04	9.21E-05	3.61E+00	0.28
N 3	7.25E+03	1.84E+03	3.93E+00	0.25	q NYOHS7	7.30E-04	2.09E-04	3.59E+00	0.28
N 4	5.77E+03	1.33E+03	4.33E+00	0.23	q NYOHS8	1.12E-03	3.77E-04	3.09E+00	0.32
N 5	5.45E+03	1.19E+03	4.58E+00	0.22	q NYOHS9	2.04E-03	6.73E-04	3.12E+00	0.32
N 6	3.18E+03	7.04E+02	4.51E+00	0.22	q NYOHS10	3.26E-03	9.04E-04	3.73E+00	0.27
N 7	1.93E+03	4.64E+02	4.15E+00	0.24	q NYOHS11	4.68E-03	1.64E-03	2.96E+00	0.34
N 8	1.44E+03	3.17E+02	4.54E+00	0.22	q NYOHS12	1.05E-02	2.19E-03	5.00E+00	0.20
N 9	6.51E+02	1.14E+02	5.73E+00	0.17	q NYOHS13	1.43E-02	6.03E-03	2.52E+00	0.40
N 10	3.65E+02	6.60E+01	5.53E+00	0.18	q NYOHS14	2.82E-02	8.13E-03	3.62E+00	0.28
N 11	2.83E+02	6.14E+01	4.60E+00	0.22	q NYOHS15	1.62E-02	3.67E-03	4.59E+00	0.22
N 12	2.01E+02	4.32E+01	4.65E+00	0.21	q NEFSC3	3.47E-05	2.31E-05	1.52E+00	0.66
N 13	1.06E+02	2.80E+01	3.79E+00	0.26	q NEFSC4	9.49E-05	4.71E-05	2.12E+00	0.47
N 14	6.62E+01	1.93E+01	3.43E+00	0.29	q NEFSC5	1.57E-04	5.41E-05	3.01E+00	0.33
q MACOM8	8.89E-04	1.55E-04	6.05E+00	0.17	q NEFSC6	2.40E-04	7.37E-05	3.36E+00	0.30
q MACOM9	1.46E-03	2.19E-04	6.90E+00	0.14	q NEFSC7	4.48E-04	1.25E-04	3.67E+00	0.27
q MACOM10	2.60E-03	3.00E-04	9.02E+00	0.11	q NEFSC8	8.24E-04	1.51E-04	5.69E+00	0.18
q MACOM11	4.20E-03	6.88E-04	6.35E+00	0.16	q NEFSC9	1.60E-03	3.45E-04	4.78E+00	0.21
q MACOM12	7.16E-03	1.34E-03	5.60E+00	0.18	q NEFSC10	2.43E-03	6.49E-04	3.87E+00	0.26
q MACOM13	1.19E-02	3.49E-03	3.62E+00	0.28	q NEFSC11	3.84E-03	1.55E-03	2.54E+00	0.39
q MACOM14	1.73E-02	5.17E-03	3.51E+00	0.28	q NEFSC12	6.92E-03	2.77E-03	2.56E+00	0.39
q MACOM15	1.69E-02	2.79E-03	6.31E+00	0.16	q NEFSC13	1.96E-02	8.33E-03	2.45E+00	0.41
q CTCPUE3	2.19E-04	5.72E-05	3.94E+00	0.25	q NEFSC14	1.99E-02	8.40E-03	2.48E+00	0.40
q CTCPUE4	3.37E-04	4.71E-05	7.33E+00	0.14	q NEFSC15	7.63E-03	5.09E-03	1.54E+00	0.65
q CTCPUE5	4.55E-04	5.00E-05	9.28E+00	0.11	q HUDSHD8:14	4.00E-04	1.06E-04	3.85E+00	0.26
q CTCPUE6	7.41E-04	1.28E-04	5.91E+00	0.17	q YOYNY1	1.33E-04	2.79E-05	4.80E+00	0.21
q CTCPUE7	1.06E-03	1.78E-04	6.08E+00	0.16	q YOYNJ1	9.22E-05	1.92E-05	4.83E+00	0.21
q CTCPUE8	1.73E-03	2.41E-04	7.31E+00	0.14	q YOYMD1	1.04E-04	1.59E-05	6.58E+00	0.15
q CTCPUE9	2.02E-03	4.13E-04	4.99E+00	0.20	q YOYVA1	1.30E-04	1.69E-05	7.74E+00	0.13
q CTCPUE10	3.28E-03	7.15E-04	4.67E+00	0.21	q YRLLI2	1.33E-04	1.86E-05	7.30E+00	0.14
q CTCPUE11	5.16E-03	1.35E-03	3.91E+00	0.26	q YRLMD2	1.47E-04	2.30E-05	6.50E+00	0.15
q CTCPUE12	4.67E-03	1.79E-03	2.69E+00	0.37	q NJTRL2:14	2.37E-05	5.50E-06	4.46E+00	0.22
q CTCPUE13	8.15E-03	3.58E-03	2.35E+00	0.43	q CTTRL4:6	8.08E-05	1.31E-05	6.35E+00	0.16
q CTCPUE14	1.17E-02	5.04E-03	2.38E+00	0.42	q DETRWL2:7	2.61E-05	6.98E-06	3.88E+00	0.26
q CTCPUE15	6.69E-03	3.52E-03	1.96E+00	0.51	q NYOHS3	1.21E-04	2.80E-05	4.37E+00	0.23
q MDSSN3	1.87E-04	4.88E-05	3.86E+00	0.26	q NYOHS4	1.43E-04	2.99E-05	4.97E+00	0.20
q MDSSN4	2.49E-04	6.48E-05	3.98E+00	0.25	q VAPN2	1.05E-04	6.05E-05	1.75E+00	0.57
q MDSSN5	3.36E-04	7.29E-05	4.74E+00	0.21	q VAPN3	8.72E-05	3.24E-05	2.70E+00	0.37
q MDSSN6	5.14E-04	1.02E-04	5.16E+00	0.19	q VAPN4	1.09E-04	3.79E-05	3.01E+00	0.33
q MDSSN7	7.29E-04	1.49E-04	5.00E+00	0.20	q VAPN5	1.76E-04	4.97E-05	3.70E+00	0.27
q MDSSN8	8.11E-04	3.28E-04	2.57E+00	0.39	q VAPN6	3.39E-04	8.58E-05	4.11E+00	0.24
q MDSSN9	1.12E-03	3.93E-04	2.92E+00	0.34	q VAPN7	2.63E-04	1.63E-04	1.67E+00	0.60
q MDSSN10	1.74E-03	6.69E-04	2.69E+00	0.37	q VAPN8	9.06E-04	1.32E-04	7.27E+00	0.14
q MDSSN11	3.39E-03	1.24E-03	2.83E+00	0.35	q VAPN9	1.52E-03	1.35E-04	1.17E+01	0.09
q MDSSN12	5.75E-03	1.57E-03	3.84E+00	0.26	q VAPN10	2.21E-03	3.50E-04	6.60E+00	0.15
q MDSSN13	9.97E-03	4.09E-03	2.54E+00	0.39	q VAPN11	3.89E-03	1.37E-03	2.96E+00	0.34
q MDSSN14	9.20E-03	5.28E-03	1.81E+00	0.55	q VAPN12	8.10E-03	1.60E-03	5.35E+00	0.19
q MDSSN15	7.15E-03	2.89E-03	2.56E+00	0.39	q VAPN13	1.26E-02	6.00E-03	2.26E+00	0.44
					q VAPN14	1.97E-02	8.97E-03	2.35E+00	0.42
					q VAPN15	1.58E-02	7.36E-03	2.25E+00	0.44

MACOM = Massachusetts Commercial CPUE
CTCPUE = Connecticut Recreational CPUE
MDSSN = Maryland Spawning Stock Survey CPUE
NYOHS = New York Ocean Haul Seine Survey CPUE
NEFSC = NMFS NEFSC Cruise CPUE
YOY*state* = State specific young of the year surveys
YRL*state* = State specific age-1 surveys
NJTRL = New Jersey Trawl Survey
VAPN = Rappahannock pound net CPUE

Table 13. Partial variance and % of total variance by survey before and after reweighting, and survey weight values.

Survey	Age	Par. Var.	% of Total	Par. Var.	% of Total	Weight
MACOM	8	0.286	0.003	0.007	0.012	0.024
MACOM	9	0.217	0.002	0.007	0.011	0.032
MACOM	10	0.120	0.001	0.007	0.013	0.058
MACOM	11	0.253	0.003	0.007	0.012	0.028
MACOM	12	0.328	0.003	0.007	0.012	0.021
MACOM	13	0.809	0.008	0.007	0.012	0.009
MACOM	14	0.866	0.009	0.007	0.012	0.008
MACOM	15+	0.262	0.003	0.007	0.013	0.027
CTCPUE	3	1.209	0.013	0.007	0.012	0.006
CTCPUE	4	0.345	0.004	0.006	0.011	0.017
CTCPUE	5	0.214	0.002	0.007	0.011	0.033
CTCPUE	6	0.536	0.006	0.007	0.012	0.013
CTCPUE	7	0.506	0.005	0.007	0.012	0.014
CTCPUE	8	0.349	0.004	0.007	0.012	0.020
CTCPUE	9	0.756	0.008	0.007	0.012	0.009
CTCPUE	10	0.861	0.009	0.007	0.012	0.008
CTCPUE	11	1.101	0.012	0.007	0.012	0.006
CTCPUE	12	2.473	0.026	0.007	0.012	0.003
CTCPUE	13	2.700	0.028	0.007	0.012	0.003
CTCPUE	14	2.642	0.028	0.007	0.012	0.003
CTCPUE	15+	3.642	0.038	0.007	0.012	0.002
MDSSN	3	1.119	0.012	0.007	0.013	0.006
MDSSN	4	1.060	0.011	0.007	0.012	0.007
MDSSN	5	0.743	0.008	0.007	0.012	0.009
MDSSN	6	0.625	0.007	0.007	0.011	0.011
MDSSN	7	0.666	0.007	0.007	0.012	0.011
MDSSN	8	2.398	0.025	0.007	0.012	0.003
MDSSN	9	1.973	0.021	0.007	0.012	0.004
MDSSN	10	2.052	0.021	0.007	0.012	0.003
MDSSN	11	1.597	0.017	0.007	0.012	0.004
MDSSN	12	0.724	0.008	0.007	0.012	0.010
MDSSN	13	2.446	0.026	0.007	0.012	0.003
MDSSN	14	3.630	0.038	0.007	0.012	0.002
MDSSN	15+	1.811	0.019	0.007	0.012	0.004
NYOHS	5	0.751	0.008	0.007	0.012	0.009
NYOHS	6	1.058	0.011	0.007	0.012	0.007
NYOHS	7	1.068	0.011	0.007	0.012	0.007
NYOHS	8	1.446	0.015	0.007	0.012	0.005
NYOHS	9	1.423	0.015	0.007	0.012	0.005
NYOHS	10	0.989	0.01	0.007	0.012	0.007
NYOHS	11	1.462	0.015	0.006	0.011	0.004
NYOHS	12	0.499	0.005	0.007	0.011	0.014
NYOHS	13	1.702	0.018	0.006	0.011	0.004
NYOHS	14	0.820	0.009	0.007	0.012	0.009
NYOHS	15+	0.651	0.007	0.007	0.012	0.011

Survey	Age	Par. Var.	% of Total	Par. Var.	% of Total	Weight
NEFSC	3	3.438	0.036	0.007	0.013	0.002
NEFSC	4	2.201	0.023	0.007	0.012	0.003
NEFSC	5	1.308	0.014	0.007	0.012	0.005
NEFSC	6	1.134	0.012	0.007	0.012	0.006
NEFSC	7	1.024	0.011	0.007	0.012	0.007
NEFSC	8	0.450	0.005	0.008	0.013	0.018
NEFSC	9	0.645	0.007	0.007	0.012	0.011
NEFSC	10	1.056	0.011	0.007	0.012	0.007
NEFSC	11	2.005	0.021	0.007	0.012	0.003
NEFSC	12	1.361	0.014	0.007	0.012	0.005
NEFSC	13	1.822	0.019	0.007	0.012	0.004
NEFSC	14	1.113	0.012	0.007	0.012	0.006
NEFSC	15	2.944	0.031	0.007	0.012	0.002
HUDSHD	8-14	1.071	0.011	0.007	0.012	0.007
YOYNY	1	0.837	0.009	0.007	0.012	0.008
YOYNJ	1	0.785	0.008	0.007	0.012	0.009
YOYMD	1	0.433	0.005	0.007	0.012	0.016
YOYVA	1	0.306	0.003	0.006	0.01	0.020
YRLLI	2	0.277	0.003	0.006	0.011	0.022
YRLMD	2	0.430	0.004	0.006	0.011	0.014
NJTRL	2-14	0.637	0.007	0.007	0.012	0.011
CTTRL	4-6	0.363	0.004	0.007	0.013	0.019
DETRWL	2-7	0.715	0.007	0.007	0.012	0.010
NYOHS	3	0.711	0.007	0.006	0.011	0.008
NYOHS	4	0.550	0.006	0.007	0.012	0.013
VAPN	2	1.292	0.014	0.007	0.012	0.005
VAPN	3	1.341	0.014	0.008	0.014	0.006
VAPN	4	1.079	0.011	0.007	0.013	0.006
VAPN	5	0.711	0.007	0.007	0.013	0.010
VAPN	6	0.576	0.006	0.006	0.011	0.010
VAPN	7	3.558	0.037	0.007	0.012	0.002
VAPN	8	0.174	0.002	0.005	0.009	0.029
VAPN	9	0.059	0.001	0.006	0.011	0.102
VAPN	10	0.213	0.002	0.007	0.012	0.033
VAPN	11	1.116	0.012	0.007	0.012	0.006
VAPN	12	0.290	0.003	0.006	0.011	0.021
VAPN	13	1.333	0.014	0.006	0.011	0.005
VAPN	14	1.233	0.013	0.006	0.011	0.005
VAPN	15	1.751	0.018	0.007	0.012	0.004

Table 14. Fishing mortality at age and average across ages, 1982-2000.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0.13	0.11	0.29	0.04	0.01	0	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.01	0.03	0.02	0.01	0.03
3	0.38	0.31	0.45	0.08	0.04	0.02	0.02	0.04	0.04	0.04	0.04	0.04	0.07	0.09	0.08	0.08	0.07	0.05	0.05
4	0.30	0.52	0.22	0.09	0.13	0.04	0.04	0.04	0.11	0.08	0.07	0.08	0.08	0.12	0.16	0.14	0.14	0.12	0.15
5	0.21	0.33	0.29	0.22	0.15	0.08	0.11	0.08	0.13	0.12	0.09	0.13	0.11	0.13	0.20	0.21	0.25	0.18	0.25
6	0.13	0.21	0.17	0.32	0.17	0.10	0.16	0.12	0.16	0.10	0.11	0.12	0.14	0.20	0.21	0.33	0.25	0.24	0.31
7	0.27	0.17	0.13	0.20	0.23	0.09	0.22	0.10	0.18	0.12	0.08	0.11	0.12	0.16	0.26	0.28	0.24	0.25	0.37
8	0.20	0.06	0.05	0.17	0.15	0.10	0.24	0.16	0.20	0.21	0.12	0.11	0.14	0.23	0.23	0.36	0.27	0.30	0.36
9	0.17	0.05	0.04	0.09	0.12	0.05	0.31	0.14	0.22	0.25	0.21	0.19	0.23	0.37	0.25	0.34	0.33	0.32	0.34
10	0.24	0.07	0.04	0.08	0.10	0.05	0.06	0.12	0.14	0.40	0.29	0.43	0.28	0.30	0.26	0.33	0.31	0.36	0.39
11	0.49	0.15	0.02	0.02	0.10	0.03	0.08	0.04	0.23	0.40	0.25	0.45	0.35	0.27	0.22	0.37	0.44	0.46	0.25
12	0.26	0.46	0.01	0.02	0.04	0.07	0.09	0.05	0.05	0.18	0.18	0.40	0.44	0.25	0.37	0.23	0.48	0.37	0.23
13	0.14	0.13	0.31	0.02	0.03	0.12	0.11	0.07	0.12	0.05	0.15	0.30	0.23	0.32	0.32	0.15	0.37	0.54	0.19
14	0.21	0.23	0.15	0.19	0.15	0.08	0.14	0.10	0.16	0.14	0.11	0.14	0.14	0.19	0.23	0.29	0.27	0.24	0.30
15	0.21	0.23	0.15	0.19	0.15	0.08	0.14	0.10	0.16	0.14	0.11	0.14	0.14	0.19	0.23	0.29	0.27	0.24	0.30

Average Fishing Mortality. Reference ages (4-13) indicated in bold.

Ages	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
3,8	0.25	0.27	0.22	0.18	0.15	0.07	0.13	0.09	0.14	0.11	0.08	0.10	0.11	0.15	0.19	0.23	0.20	0.20	0.24
4,13	**0.24**	**0.21**	**0.13**	**0.12**	**0.12**	**0.07**	**0.14**	**0.09**	**0.15**	**0.19**	**0.15**	**0.23**	**0.21**	**0.24**	**0.25**	**0.27**	**0.31**	**0.31**	**0.28**
8,13	0.25	0.15	0.08	0.07	0.09	0.07	0.15	0.10	0.16	0.25	0.20	0.31	0.28	0.29	0.28	0.30	0.37	0.39	0.29

Table 15. Back-calculated partial recruitment and 1996-2000 average PR.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	96-00 avg
1	0	0	0.01	0	0.02	0	0	0	0	0	0	0	0	0	0	0	0.01	0.0	0.01	0.00
2	0.26	0.21	0.65	0.12	0.04	0.04	0.04	0.06	0.05	0.03	0.03	0.03	0.05	0.12	0.03	0.09	0.04	0.02	0.08	0.06
3	0.79	0.59	**1**	0.24	0.18	0.16	0.07	0.23	0.18	0.1	0.13	0.09	0.17	0.23	0.22	0.21	0.14	0.09	0.14	0.19
4	0.62	**1**	0.48	0.29	0.55	0.35	0.12	0.26	0.46	0.21	0.22	0.17	0.17	0.33	0.42	0.38	0.28	0.22	0.38	0.42
5	0.44	0.63	0.63	0.7	0.64	0.73	0.34	0.50	0.58	0.3	0.31	0.28	0.26	0.36	0.54	0.58	0.52	0.32	0.65	0.65
6	0.26	0.39	0.37	**1**	0.74	0.85	0.51	0.79	0.70	0.26	0.36	0.28	0.31	0.53	0.57	0.91	0.52	0.45	0.80	0.80
7	0.55	0.32	0.29	0.62	**1**	0.81	0.69	0.63	0.80	0.3	0.28	0.24	0.27	0.44	0.71	0.76	0.50	0.47	0.95	0.84
8	0.42	0.12	0.12	0.52	0.65	0.88	0.77	**1**	0.87	0.51	0.40	0.25	0.32	0.62	0.62	0.97	0.56	0.55	0.93	0.90
9	0.35	0.09	0.09	0.29	0.51	0.44	**1**	0.92	0.95	0.63	0.71	0.43	0.51	**1**	0.67	0.93	0.69	0.58	0.89	0.95
10	0.5	0.13	0.09	0.24	0.42	0.42	0.18	0.78	0.59	**1**	**1**	0.95	0.62	0.82	0.71	0.90	0.64	0.65	**1**	0.98
11	**1**	0.28	0.04	0.07	0.43	0.28	0.24	0.25	**1**	**1**	0.85	**1**	0.79	0.73	0.59	**1**	0.91	0.84	0.66	**1**
12	0.54	0.89	0.03	0.07	0.19	0.64	0.3	0.32	0.22	0.45	0.61	0.89	**1**	0.68	**1**	0.61	**1**	0.68	0.61	0.97
13	0.28	0.26	0.69	0.07	0.12	**1**	0.36	0.43	0.54	0.12	0.51	0.66	0.53	0.87	0.86	0.42	0.76	**1**	0.50	0.86
14	0.44	0.45	0.34	0.6	0.65	0.71	0.45	0.62	0.69	0.35	0.38	0.32	0.32	0.50	0.61	0.78	0.55	0.44	0.77	0.79
15	0.44	0.45	0.34	0.6	0.65	0.71	0.45	0.62	0.69	0.35	0.38	0.32	0.32	0.50	0.61	0.78	0.55	0.44	0.77	0.79

Table16. Estimated population abundance, thousands at age 1-15, 1982-2001.

AGE	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	1355	2689	2355	2918	2910	3297	4570	5337	7719	7061	7170	8251	12605	9631	10760	12322	9688	10099	8622	11537
2	952	1164	2311	2021	2510	2494	2836	3931	4593	6642	6076	6169	7102	10844	8286	9261	10603	8314	8684	7387
3	872	721	900	1485	1673	2141	2137	2413	3350	3910	5649	5187	5245	5978	8937	7046	7706	8961	7069	7249
4	911	512	455	494	1184	1380	1808	1800	2003	2768	3231	4677	4293	4191	4719	7099	5613	6203	7329	5769
5	328	579	262	316	387	896	1140	1497	1486	1549	2189	2605	3722	3425	3192	3473	5321	4214	4726	5451
6	173	228	359	169	217	287	708	882	1192	1118	1183	1719	1975	2862	2585	2252	2417	3568	3042	3179
7	110	131	160	261	106	157	224	519	671	872	869	917	1308	1484	2027	1801	1387	1617	2412	1926
8	98	73	95	121	185	72	123	155	404	481	666	690	709	1000	1087	1340	1174	938	1081	1446
9	82	69	59	78	88	137	56	83	114	285	337	510	531	530	684	743	808	769	598	651
10	53	59	57	48	61	67	112	35	62	79	191	236	363	365	315	458	453	498	483	365
11	31	36	48	47	39	48	55	91	27	47	46	123	132	237	232	209	283	286	301	283
12	64	16	27	40	39	30	40	44	75	18	27	31	67	81	156	160	124	157	156	201
13	28	42	9	23	34	32	24	31	36	61	13	19	18	37	54	92	110	66	93	106
14	23	21	32	6	19	28	25	18	25	27	50	10	12	12	23	34	68	64	33	66
15	46	24	36	55	51	101	34	61	46	135	96	95	80	22	13	21	81	35	29	40
Total	5,126	6,365	7,163	8,082	9,502	11,168	13,891	16,898	21,802	25,055	27,792	31,239	38,161	40,698	43,070	46,309	45,837	45,792	44,680	45,650

Table 17. Spawning stock biomass of female striped bass in metric tons at age and annual total in MT and millions of pounds (Mlb), 1982-2000.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	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
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	26	13	14	16	54	55	68	76	78	114	118	176	180	172	205	309	244	271	319
5	48	82	42	42	58	137	218	281	213	249	377	441	650	580	624	678	1,036	826	924
6	137	158	257	126	143	177	600	845	962	752	920	1,303	1,461	2,194	2,450	2,108	2,282	3,371	2,855
7	220	206	339	533	173	238	407	1,168	1,369	1,756	1,788	1,843	2,704	3,328	5,339	4,736	3,663	4,265	6,290
8	249	173	240	290	411	151	252	426	1,057	1,189	1,704	1,865	1,939	2,693	3,381	4,114	3,634	2,898	3,321
9	237	196	188	248	225	357	136	236	303	855	1,093	1,676	1,679	1,765	2,480	2,668	2,905	2,770	2,150
10	216	228	208	171	175	206	297	144	174	225	719	861	1,265	1,492	1,344	1,942	1,924	2,105	2,034
11	151	162	191	200	141	176	223	385	93	202	207	532	593	831	1,004	890	1,199	1,211	1,299
12	332	77	162	205	171	139	195	202	323	71	157	151	328	364	720	753	569	726	732
13	173	221	44	124	177	173	130	192	158	280	81	130	94	241	283	492	574	337	495
14	143	110	175	37	104	156	132	86	127	204	265	64	53	88	135	195	393	380	190
15	338	123	246	409	381	788	270	492	382	1,083	794	685	667	211	107	166	647	283	236
Total MT	2,268	1,746	2,103	2,400	2,210	2,753	2,924	4,530	5,237	6,977	8,221	9,722	11,609	13,956	18,071	19,049	19,067	19,441	20,840
Total Mlb	5.00	3.85	4.64	5.29	4.87	6.07	6.45	9.99	11.54	15.38	18.12	21.43	25.59	30.77	39.84	42.00	42.03	42.86	45.94

Table 18. Precision estimates for abundance and fishing mortality at age, age 5-13 fishing mortality, and female spawning stock biomass from 500 bootstrap iterations. Number is estimate prior to reweighting.

Parameter		Point Estimate	Bootstrap Mean	Percent Bias	80% Confidence Interval Lower Bound	Upper Bound
Number	Age 1	9586	10643	11.03	5303	15743
Number	Age 2	8715	8974	2.96	5501	13167
Number	Age 3	4971	5158	3.77	3255	6925
Number	Age 4	6644	6834	2.87	4795	8849
Number	Age 5	6193	6288	1.54	4710	8311
Number	Age 6	3536	3639	2.91	2530	4571
Number	Age 7	1794	1844	2.79	1225	2353
Number	Age 8	1922	1969	2.44	1354	2544
Number	Age 9	699	717	2.59	489	884
Number	Age 10	413	417	0.98	314	571
Number	Age 11	309	316	2.32	229	427
Number	Age 12	211	215	1.98	138	269
Number	Age 13	134	136	1.63	92	178
Number	Age 14	80	81	2.03	58	111
Number	Age 15	45	44	-1.89	41	53
All ages		45127	47143	4.47	39046	55775
F	Age 1	0	0	9.79	0.003	0.006
F	Age 2	0.03	0.03	4.62	0.013	0.050
F	Age 3	0.05	0.05	2.63	0.035	0.068
F	Age 4	0.15	0.15	2.88	0.106	0.203
F	Age 5	0.25	0.25	1.50	0.165	0.342
F	Age 6	0.31	0.32	2.32	0.180	0.454
F	Age 7	0.37	0.38	2.17	0.269	0.487
F	Age 8	0.36	0.37	1.81	0.239	0.494
F	Age 9	0.34	0.35	3.31	0.233	0.470
F	Age 10	0.39	0.40	2.25	0.262	0.535
F	Age 11	0.25	0.26	3.14	0.154	0.362
F	Age 12	0.23	0.24	3.77	0.154	0.323
F	Age 13	0.19	0.20	3.34	0.124	0.268
F	Age 14	0.3	0.31	2.53	0.262	0.353
F	Age 15	0.3	0.31	2.53	0.262	0.353
F full	Age 5-13	0.30	0.31	2.53	0.26	0.35
SSB mt	Female mean	20238	20616	1.86	17695	22806

Table 19.Time series of instantaneous fishing mortality estimates (F) adjusted for live release bias. Results are for striped bass >= 28 in TL. Reporting rate (DE) = 0.433.

Coast Programs

Year	MADFW	NYOHS	NJDEL	NCCOOP	Unweighted Average
1988		**		**	
1989		**	**	0.10	
1990		0.14	**	0.10	
1991		0.15	**	0.05	
1992	**	0.16	0.12	0.01	
1993	**	0.27	0.15	0.04	
1994	0.001	0.26	0.14	0.10	0.12
1995	0.063	0.05	0.08	0.08	0.07
1996	0.071	0.12	0.08	0.26	0.13
1997	0.091	0.22	0.17	0.25	0.18
1998	0.066	0.34	0.14	0.20	0.19
1999	0.084	0.39	0.08	0.20	0.19
2000	0.075	0.38	0.18	0.23	0.22

Producer Area Programs

Year	NYHUD	DE/PA	MDCB	VARAP	Weighted* Average
1988	0.03		**		
1989	**		**		
1990	0.08		0.24	0.20	
1991	0.16		0.11	0.18	
1992	0.11		0.12	0.13	
1993	0.14	**	0.12	0.22	
1994	0.14	**	0.11	0.25	
1995	0.17	0.24	0.19	0.28	0.21
1996	0.19	0.29	0.21	0.34	0.25
1997	0.12	0.35	0.22	0.32	0.25
1998	0.19	0.41	0.26	0.26	0.27
1999	0.17	0.47	0.26	0.29	0.28
2000	**	0.48	0.16	0.24	***

* - Weighting Scheme: Hudson (.13); Delaware (.09); Chesapeake Bay (.78)
Chesapeake Bay : MD (.67); VA (.33)

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

*** - No weighted estimate could be made due to Hudson F = 0

Table 20. Time series of survival and fishing mortality estimates adjusted for live release bias. Results are for striped bass >= 28 in. total length. Reporting rate (DE) = 0.433.

Coast Programs

Massachusetts

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1992	0.80	0.08	0.05	0.75	-0.086	0.87	-0.01	0.073	-0.090
1993	0.80	0.08	0.07	0.55	-0.089	0.87	-0.02	0.067	-0.091
1994	0.80	0.08	0.06	0.51	-0.075	0.86	0.00	0.085	-0.078
1995	0.76	0.13	0.07	0.37	-0.062	0.81	0.06	0.135	-0.005
1996	0.76	0.13	0.08	0.26	-0.055	0.80	0.07	0.144	0.004
1997	0.76	0.13	0.07	0.19	-0.037	0.79	0.09	0.166	0.021
1998	0.76	0.13	0.08	0.29	-0.062	0.81	0.07	0.144	-0.007
1999	0.76	0.13	0.06	0.24	-0.041	0.79	0.08	0.171	0.005
2000	0.77	0.11	0.06	0.21	-0.034	0.80	0.08	0.177	-0.017

New York - Ocean
Haul Seine

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1988	0.81	0.06	0.12	0.90	-0.234	1.063	-0.21	0.005	-0.323
1989	0.82	0.05	0.10	0.86	-0.191	1.008	-0.16	0.059	-0.268
1990	0.65	0.28	0.09	0.66	-0.135	0.749	0.14	0.308	0.010
1991	0.63	0.31	0.11	0.53	-0.147	0.738	0.15	0.262	0.061
1992	0.61	0.34	0.12	0.56	-0.166	0.734	0.16	0.229	0.096
1993	0.59	0.37	0.09	0.43	-0.094	0.654	0.27	0.368	0.192
1994	0.57	0.41	0.11	0.50	-0.132	0.661	0.26	0.432	0.125
1995	0.71	0.19	0.14	0.35	-0.130	0.817	0.05	0.232	-0.073
1996	0.67	0.24	0.14	0.30	-0.114	0.761	0.12	0.241	0.030
1997	0.63	0.31	0.15	0.21	-0.090	0.694	0.22	0.368	0.094
1998	0.59	0.39	0.10	0.19	-0.049	0.615	0.34	0.637	0.124
1999	0.56	0.44	0.15	0.10	-0.049	0.585	0.39	0.987	0.047
2000	0.53	0.48	0.14	0.23	-0.095	0.587	0.38	1.364	-0.072

New Jersey –
Delaware Bay

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1989	0.80	0.08	0.1	0.55	-0.13	0.92	-0.06	0.424	-0.232
1990	0.66	0.26	0.13	0.83	-0.25	0.88	-0.02	0.168	-0.162
1991	0.66	0.27	0.25	0.5	-0.39	1.07	-0.22	-0.052	-0.350
1992	0.66	0.26	0.08	0.76	-0.14	0.77	0.12	0.251	0.007
1993	0.66	0.26	0.1	0.45	-0.11	0.74	0.15	0.276	0.042
1994	0.66	0.26	0.1	0.49	-0.12	0.75	0.14	0.278	0.023
1995	0.71	0.20	0.1	0.45	-0.11	0.79	0.08	0.217	-0.025
1996	0.70	0.21	0.12	0.41	-0.13	0.80	0.08	0.175	-0.003
1997	0.68	0.23	0.08	0.29	-0.06	0.72	0.17	0.263	0.096
1998	0.67	0.25	0.16	0.22	-0.11	0.75	0.14	0.284	0.030
1999	0.67	0.26	0.12	0.54	-0.16	0.79	0.08	0.332	-0.084
2000	0.66	0.26	0.09	0.36	-0.08	0.72	0.18	0.556	-0.037

North Carolina - Cooperative
Trawl Cruise

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1988	0.72	0.18	0.10	0.75	-0.182	0.89	-0.04	-0.214	0.177
1989	0.70	0.21	0.06	0.72	-0.095	0.78	0.10	-0.048	0.281
1990	0.70	0.21	0.08	0.58	-0.103	0.78	0.10	-0.001	0.203
1991	0.69	0.22	0.09	0.69	-0.143	0.82	0.05	-0.041	0.146
1992	0.72	0.17	0.11	0.53	-0.138	0.85	0.01	-0.098	0.141
1993	0.71	0.20	0.09	0.65	-0.137	0.83	0.04	-0.054	0.135
1994	0.69	0.22	0.08	0.63	-0.111	0.78	0.10	-0.022	0.230
1995	0.68	0.23	0.10	0.52	-0.134	0.80	0.08	-0.082	0.267
1996	0.64	0.29	0.05	0.27	-0.032	0.66	0.26	0.127	0.409
1997	0.63	0.31	0.10	0.23	-0.057	0.67	0.25	0.080	0.451
1998	0.64	0.29	0.12	0.25	-0.080	0.70	0.20	0.028	0.418
1999	0.67	0.26	0.12	0.14	-0.047	0.70	0.20	0.002	0.457
2000	0.64	0.30	0.05	0.56	-0.061	0.68	0.23	0.049	0.461

Producer Area
Programs

New York - Hudson River
Spawning Stock

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1988	0.73	0.16	0.09	0.58	-0.12	0.834	0.03	0.175	-0.072
1989	0.73	0.16	0.11	0.73	-0.19	0.899	-0.04	0.100	-0.146
1990	0.63	0.31	0.13	0.66	-0.21	0.794	0.08	0.128	0.037
1991	0.63	0.31	0.11	0.51	-0.14	0.731	0.16	0.211	0.120
1992	0.63	0.31	0.13	0.58	-0.19	0.774	0.11	0.151	0.062
1993	0.63	0.31	0.13	0.49	-0.16	0.752	0.14	0.181	0.092
1994	0.63	0.31	0.12	0.53	-0.16	0.748	0.14	0.188	0.097
1995	0.65	0.28	0.12	0.35	-0.11	0.729	0.17	0.228	0.109
1996	0.65	0.28	0.13	0.25	-0.09	0.713	0.19	0.250	0.133
1997	0.65	0.28	0.16	0.32	-0.15	0.761	0.12	0.185	0.068
1998	0.65	0.28	0.13	0.24	-0.09	0.710	0.19	0.254	0.136
1999	0.65	0.28	0.13	0.30	-0.11	0.726	0.17	0.232	0.114
2000	0.79	0.09	0.09	0.38	-0.08	0.859	0.00	0.089	-0.063

Delaware / Pennsylvania -
Delaware River

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1993	0.86	0.00	0.106	0.33	-0.09	0.95	-0.10	0.316	-0.210
1994	0.86	0.00	0.11	0.29	0.37	0.63	-0.09	0.325	-0.201
1995	0.60	0.35	0.12	0.35	-0.11	0.68	0.24	0.460	0.078
1996	0.58	0.39	0.13	0.28	-0.10	0.64	0.29	0.454	0.155
1997	0.56	0.44	0.11	0.28	-0.08	0.60	0.35	0.540	0.205
1998	0.53	0.48	0.14	0.17	-0.07	0.57	0.41	0.702	0.190
1999	0.51	0.52	0.09	0.21	-0.05	0.54	0.47	0.952	0.156
2000	0.49	0.57	0.16	0.17	-0.08	0.53	0.48	1.153	0.073

Maryland - Chesapeake Bay Spring Spawning Stock

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1987	0.93	-0.08	0.03		0.00	0.93			
1988	0.93	-0.07	0.04	0.67	-0.06	0.99	-0.14	0.12	-0.20
1989	0.92	-0.07	0.05	0.79	-0.09	1.01	-0.16	0.06	-0.23
1990	0.62	0.33	0.07	0.57	-0.09	0.68	0.24	0.48	0.06
1991	0.64	0.30	0.12	0.59	-0.18	0.77	0.11	0.24	0.00
1992	0.66	0.27	0.11	0.51	-0.14	0.77	0.12	0.18	0.06
1993	0.67	0.24	0.10	0.46	-0.11	0.76	0.12	0.21	0.05
1994	0.69	0.22	0.09	0.46	-0.10	0.77	0.11	0.25	0.00
1995	0.66	0.27	0.12	0.26	-0.08	0.71	0.19	0.31	0.09
1996	0.65	0.28	0.10	0.28	-0.07	0.70	0.21	0.29	0.14
1997	0.64	0.30	0.11	0.22	-0.07	0.69	0.22	0.32	0.15
1998	0.63	0.31	0.09	0.18	-0.04	0.66	0.26	0.41	0.15
1999	0.62	0.32	0.11	0.18	-0.06	0.66	0.26	0.48	0.11
2000	0.70	0.20	0.08	0.19	-0.04	0.73	0.16	0.71	-0.08

Virginia - Rappahannock River

Year	S(unadj.)	F(unadj.)	Recovery	% Released	bias	S(adj.)	F(adj.)	LCLM (F)	UCLM (F)
1990	0.62	0.32	0.09	0.58	-0.12	0.71	0.20	0.110	0.297
1991	0.62	0.32	0.09	0.56	-0.13	0.72	0.18	0.096	0.279
1992	0.62	0.32	0.12	0.54	-0.18	0.76	0.13	0.043	0.226
1993	0.62	0.32	0.10	0.35	-0.09	0.69	0.22	0.136	0.322
1994	0.62	0.32	0.08	0.32	-0.07	0.67	0.25	0.155	0.348
1995	0.60	0.36	0.12	0.19	-0.07	0.65	0.28	0.174	0.410
1996	0.60	0.36	0.04	0.13	-0.01	0.61	0.34	0.230	0.464
1997	0.60	0.35	0.08	0.17	-0.04	0.63	0.32	0.206	0.440
1998	0.60	0.35	0.14	0.22	-0.09	0.66	0.26	0.147	0.384
1999	0.60	0.35	0.10	0.20	-0.06	0.64	0.29	0.174	0.428

Table 21. AIC weights used to derive model averaged parameter estimates given by program MARK. Results are for releases and recoveries of striped bass tagged at >= 28 inches TL.

Coast Programs

Model	MADFW	NYOHS	NJDEL	NCCOOP
S(Tp) r(Tp)	0.015	0.606	0.206	0.000
S(p) r(p)	0.247	0.059	0.027	0.267
S(v) r(p)	0.120	0.159	0.130	0.105
S(d) r(p)	0.226	0.162	0.123	0.000
S(.) r(.)	0.138	0.000	0.321	0.022
S(.) r(p)	0.212	0.001	0.055	0.098
S(.) r(t)	0.004	0.000	0.082	0.193
S(Tp) r(p)	0.034	0.010	0.016	0.089
S(t) r(t)	0.000	0.001	0.000	0.104
S(p) r(t)	0.002	0.001	0.016	0.078
S(Tp) r(t)	0.000	0.001	0.012	0.039
S(t) r(p)	0.002	0.001	0.011	0.004

Producer Area Programs

Model	NYHUD	DE/PA	MDCB	VARAP
S(d) r(p)	0.984	0.074	0.603	0.195
S(.) r(.)	0.000	0.036	0.000	0.422
S(Tp) r(t)	0.003	0.007	0.371	0.000
S(Tp) r(p)	0.000	0.355	0.002	0.017
S(p) r(p)	0.000	0.201	0.004	0.110
S(Tp) r(Tp)	0.000	0.205	0.001	0.005
S(.) r(p)	0.000	0.015	0.000	0.185
S(v) r(p)	0.000	0.098	0.006	0.040
S(p) r(t)	0.007	0.004	0.005	0.001
S(t) r(p)	0.000	0.004	0.008	0.000
S(.) r(t)	0.006	0.001	0.000	0.002
S(t) r(t)	0.000	0.000	0.000	0.000

Table 22. Total length frequency of tag releases by program for 2000.

	Coast Programs				**Producer Area Programs**			
TL	**MADFW**	**NYOHS**	**NJDEL**	**NC COOP**	**NYHUD**	**DE/PA**	**MDCB**	**VARAP**
249		0	0		0			
299		0	0		0		3	
349		1	0	10	0		27	
399		54	0	480	0	0	61	
449		191	2	1980	0	76	255	
499		166	22	2208	24	134	290	348
549	2	246	270	935	52	143	271	680
599	19	337	698	217	89	130	83	325
649	50	256	722	104	103	66	34	34
699	89	119	395	89	74	52	39	9
749	143	53	181	52	69	31	60	53
799	143	26	65	46	91	38	55	72
849	75	15	34	14	112	25	38	67
899	36	5	5	19	118	20	37	61
949	20	4	4	8	63	19	32	38
999	14	4	0	4	34	13	18	26
1049	8	2	0	2	11	5	8	27
1099	4	2	0		7	1	5	17
>1099		3.00	0.00		0.00	2.00	2	8
Total	603	1484	2398	6168	847	755	1318	1765

Table 23. Age frequency of tag recaptures by program for all 2000 recaptures.

	Coast Programs				**Producer Area Programs**			
AGE	**MADFW**	**NYOHS**	**NJDEL**	**NC COOP**	**NYHUD**	**DE/PA**	**MDCB**	**VARAP**
1								
2		2						
3		9					1	
4		52	30			16	9	61
5	2	17	93			14	9	42
6		23	93			23	5	5
7	3	36	78			34	16	14
8	2	7	30			12	5	3
9	4	8	21			8	2	3
10	2	4	29			9	4	5
11	9	9	22			12	8	3
12	6	9	13			7	5	2
13	4	6	1			3	4	7
14	3	1				0	7	2
15	1					1	2	0
16	1	3				1	2	0
17	1	3				1	3	1
18	1	1				0	2	1
19								1
	39	190	410			141	84	150

Table 24. Distribution of tag recaptures by state and month for all 2000 recaptures.

Coast Programs

Massachusetts

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME							2						2
NH													0
MA						4	15	14	4				37
RI						1			2				3
CT							1			1			2
NY					7	3				4	3		17
NJ					1					3	7		11
PA													0
DE													0
MD				4	4						3		11
VA											5	2	7
NC	1	1									1	1	4
Total	1	1	0	4	12	8	18	14	6	8	19	3	94

New York - Ocean Haul Seine

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME						5	7	4					16
NH						2							2
MA					9	13	5	6	5	1			39
RI					3	3	3	1	1	1	1		13
CT			2	1	1	2	4	2			1		13
NY			2	2	8	7	6	4	7	9	6	3	54
NJ		1	1	6	9	2	2		1	1	10	5	38
PA													0
DE			2							1			3
MD		1	1					1			1		4
VA	2				1						1	6	10
NC													0
Total	2	2	8	9	31	34	27	18	14	13	20	14	192

New Jersey - Delaware
Bay

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

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME						3	5	5					13
NH						2	1		1				4
MA				2	15	53	39	38	18	5		1	171
RI				1	5	13	10	6	9	1	2		47
CT					5	13	2	5	2	1			28
NY				8	23	32	22	13	14	22	10	1	145
NJ			2	8	15	12	7	5	2	9	13	1	74
PA						4	1						5
DE			3	5	3	5	3	2		1	1		23
MD	1	7	13	42	103	113	74	60	81	181	44	6	725
VA	5	20	50	27	28	35	3	11	10	64	102	64	419
NC	8	7	13			3		1	1	2	6	6	47
Total	14	34	81	93	197	288	167	146	138	286	178	79	1701

Producer Area Programs

New York - Hudson River Spawning Stock (recoveries 1988 - 2000)

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
NS									1				1
ME						9	30	12	6				57
NH						4	4	6	2				16
MA			1		5	72	150	70	42	17			357
RI					5	41	39	28	15	18	3		149
CT		1			4	61	84	44	29	16	6		245
NY	2		1	46	195	286	208	117	118	171	117	19	1280
NJ	2		6	12	14	31	45	14	15	68	100	16	323
PA													0
DE			7		1		1				7	1	17
MD	2		1		2	2	1	1		2	7	2	20
VA	3	4	6	2						1	9	19	44
NC	2	7	1			1					3	3	17
Total	11	12	23	60	226	507	562	292	228	293	252	60	2526

Delaware / Pennsylvania - Delaware River

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME													0
NH													0
MA						4	1	2	1	1			9
RI						1		1					2
CT						1				1			2
NY						2	1	1		1			5
NJ			1	1	13	9	8	4	4	15	13	1	69
PA					2	1	2		2	3	3		13
DE					5	2							7
MD		1			1	5	2	8	2	2	3	1	25
VA			1								4	5	10
NC													0
Total	0	1	2	1	21	25	14	16	9	23	23	7	142

Maryland - Chesapeake Bay Spring
Spawning Stock

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME													0
NH													0
MA						1	8	3	1	2	1		16
RI						2	2	1	2	1			8
CT						1					1		2
NY					3		1	1		4			9
NJ					2	2		2		3	1	1	11
PA													0
DE					1	2	2	1			1		7
MD		2	1	5	12	40	19	18	16	13	6	5	137
VA			1		2	8	7	2	1	12	12	5	50
NC			1				1						2
Total	0	2	3	5	20	56	40	28	20	35	22	11	242

Virginia -
Rappahannock River

State	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
ME													0
NH						1	1						2
MA						2	4	3	1				10
RI										1			1
CT													0
NY					3		3			1			7
NJ						2	1			1	1		5
PA													0
DE					1								1
MD		1	1	2	8	16	7	11	6	3	3		58
VA	1	1	13	51	25	11	2		3	8	5	6	126
NC													0
Total	1	2	14	53	37	32	18	14	10	14	9	6	210

Table 25. Time series of survival (S) and total mortality (Z) estimates adjusted for live release bias. Results are for age 1 and 2-3+ striped bass tagged during Western Long Island Survey. Reporting rate (DE) = 0.433.

Models and AIC weights used to derive model averaged parameter estimates given by program MARK. All other models tested has weights <1.0.

Model	AIC Weights
S(1,2-3+ * t) r(1,2-3+)	0.688
S(1,2-3+ * t) r(a)	0.296

Age	recovery rate	LCLM	UCLM
r1	0.026	0.02	0.03
r2	0.155	0.13	0.18
r3+	0.158	0.14	0.18

Age 1 Survival

Year	S(unadj.)	Z(unadj.)	Recovery	% Released	bias	S(adj.)	Z(adj.)	LCLM (Z)	UCLM (Z)
1988	0.26	1.35	0.02	1	-0.05	0.27	1.29	2.08	0.68
1989	0.33	1.11	0.01	1	-0.02	0.34	1.08	1.58	0.68
1990*	0.00		0.06	0.87	-0.12	0.00			
1991	0.45	0.79	0.03	0.91	-0.06	0.48	0.73	1.18	0.40
1992	0.31	1.17	0.01	0.8	-0.02	0.32	1.15	1.86	0.62
1993	0.11	2.20	0.03	0.88	-0.07	0.12	2.13	3.56	0.94
1994	0.06	2.77	0.02	0.86	-0.03	0.06	2.74	3.74	1.81
1995	0.49	0.71	0.01	0.75	-0.02	0.50	0.69	1.76	0.18
1996	0.17	1.79	0.01	0.77	-0.02	0.17	1.77	2.63	1.04
1997	0.18	1.71	0.07	1	-0.15	0.21	1.54	3.59	0.23
1998	0.40	0.93	0.02	1	-0.04	0.41	0.89	2.11	0.23
1999	0.57	0.55	0.01	1	-0.03	0.59	0.53	1.36	0.14
2000	0.44	0.82	0.01	0.94	-0.03	0.45	0.79	1.88	0.22

Age 2-3+ Survival

Year	S(unadj.)	Z(unadj.)	Recovery	% Released	bias	S(adj.)	Z(adj.)	LCLM (Z)	UCLM (Z)
1988	0.70	0.35	0.05	1	-0.11	0.79	0.24	0.61	0.04
1989	0.56	0.58	0.07	0.96	-0.16	0.66	0.41	0.63	0.24
1990	0.51	0.68	0.09	0.91	-0.19	0.62	0.47	0.66	0.31
1991	0.51	0.67	0.08	1	-0.18	0.62	0.47	0.63	0.33
1992	0.61	0.50	0.09	0.91	-0.17	0.73	0.31	0.45	0.20
1993	0.56	0.57	0.07	1	-0.15	0.66	0.41	0.57	0.28
1994	0.70	0.36	0.03	0.9	-0.06	0.74	0.30	0.43	0.20
1995	0.66	0.41	0.08	0.87	-0.15	0.77	0.26	0.41	0.14
1996	0.65	0.43	0.05	0.89	-0.10	0.72	0.32	0.50	0.19
1997	0.63	0.46	0.05	0.78	-0.09	0.70	0.36	0.60	0.19
1998	0.73	0.31	0.05	0.65	-0.08	0.80	0.23	0.42	0.10
1999	0.82	0.20	0.03	0.8	-0.05	0.87	0.14	0.28	0.06
2000	0.88	0.13	0.04	0.92	-0.08	0.95	0.05	0.14	-0.01

* - 1990 age 1 survival estimate was 0 and the confidence limits could not be calculated

Only 33 age 1 were released in 1990 and only 2 were recaptured

Table 26. Total length of WLI 2000 tag release, and age of WLI 2000 tag recaptures.

TL	WLI
199	178
249	421
299	280
349	78
399	29
449	12
499	6
549	10
599	4
649	6
699	2
749	3
799	1
849	
899	
949	
999	
1049	
1099	
>1099	
Total	1030

AGE	WLI
1	10
2	10
3	6
4	3
5	2
6	1
Total	32

Table 27. Distribution of tag recaptures by State and Month for all recaptures 1988 - 2000.

State	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
NB								1	1				2
ME						3	2	5	1				11
NH													0
MA					5	12	9	2		3		1	32
RI				3	5	2		1	2	2	1		16
CT			1		6	3	2	2	2	3	1	1	21
NY	5	2	6	29	52	66	62	58	78	111	70	13	552
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	3
NC												1	1
Total	6	3	10	34	73	86	76	72	85	125	84	21	675

Table 28. 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	*	0.05	*	*	*	0.03	0.08	*	*
1988	*	0.04	0.08	*	*	0.13	0.04	*	0.11
1989	0.02	0.06	0.05	*	*	0.01	0.04	*	0.08
1990	0.04	0.06	0.08	*	*	0.09	0.08	*	0.14
1991	0.33	0.13	0.07	0.04	0.11	0.12	0.13	*	0.10
1992	0.07	0.14	0.13	0.07	0.03	0.12	0.12	0.18	0.15
1993	0.09	0.14	0.11	0.04	0.09	0.16	0.12	0.21	0.17
1994	0.05	0.20	0.09	0.05	0.14	0.10	0.12	0.12	0.12
1995	0.10	0.14	0.14	0.09	0.23	0.30	0.20	0.16	0.15
1996	0.20	0.48	0.12	0.14	0.23	0.04	0.17	0.33	0.23
1997	0.25	0.13	0.20	0.10	0.64	0.19	0.24	0.32	0.34
1998	0.32	0.34	0.20	0.08	0.16	0.32	0.20	0.30	0.22
1999	0.13	0.26	0.24	0.14	0.01	0.23	0.20	0.18	0.22
2000	0.13	0.00	0.06	0.05	*	0.11	0.25	0.32	0.14

* Years when striped bass were not tagged and released.

Table 29. 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	*	0.28	*	*	*	0.39	0.08	*	*
1988	*	0.22	0.24	*	*	0.31	0.09	*	0.22
1989	0.24	0.21	0.14	*	*	0.09	0.10	*	0.29
1990	0.52	0.22	0.17	*	*	0.20	0.18	*	0.36
1991	0.62	0.34	0.20	0.15	0.16	0.21	0.27	*	0.25
1992	0.21	0.27	0.26	0.13	0.09	0.22	0.24	0.18	0.30
1993	0.20	0.27	0.28	0.11	0.21	0.27	0.22	0.33	0.35
1994	0.24	0.35	0.21	0.16	0.28	0.19	0.22	0.20	0.26
1995	0.23	0.27	0.28	0.19	0.31	0.34	0.27	0.25	0.25
1996	0.33	0.59	0.15	0.24	0.29	0.07	0.26	0.36	0.33
1997	0.44	0.13	0.25	0.20	0.93	0.23	0.30	0.35	0.44
1998	0.35	0.39	0.26	0.16	0.20	0.42	0.23	0.35	0.30
1999	0.28	0.26	0.27	0.15	0.07	0.27	0.24	0.20	0.32
2000	0.21	0.02	0.13	0.06	*	0.17	0.30	0.40	0.22

* Years when striped bass were not tagged and released.

Table 30. 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	*	0.02	*	*	*	0.05	0.08	*	*
1988	*	0.03	0.04	*	*	0.13	0.02	*	0.06
1989	0.03	0.03	0.03	*	*	0.05	0.01	*	0.06
1990	0.09	0.04	0.07	*	*	0.12	0.07	*	0.09
1991	0.04	0.05	0.08	0.05	0.11	0.07	0.10	0.03	0.08
1992	0.05	0.05	0.15	0.06	0.10	0.06	0.14	0.13	0.10
1993	0.03	0.05	0.11	0.04	0.10	0.11	0.11	0.12	0.12
1994	0.03	0.06	0.09	0.04	0.09	0.10	0.12	0.12	0.08
1995	0.06	0.04	0.14	0.06	0.17	0.20	0.19	0.13	0.13
1996	0.10	0.06	0.11	0.11	0.16	0.13	0.17	0.16	0.17
1997	0.09	0.03	0.16	0.10	0.22	0.20	0.20	0.15	0.25
1998	0.12	0.05	0.14	0.06	0.17	0.15	0.20	0.15	0.18
1999	0.05	0.04	0.22	0.09	0.12	0.15	0.16	0.12	0.15
2000	0.07	0.02	0.08	0.03	*	0.09	0.19	0.15	0.10

* Years when striped bass were not tagged and released.

Table 31. 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	*	0.01	*	*	*	0.08	0.16	*	*
1988	*	0.02	0.21	*	*	0.27	0.10	*	0.19
1989	0.27	0.02	0.12	*	*	0.21	0.08	*	0.23
1990	0.44	0.03	0.18	*	*	0.28	0.13	*	0.29
1991	0.20	0.03	0.20	0.03	0.25	0.16	0.19	0.10	0.27
1992	0.21	0.03	0.28	0.03	0.34	0.13	0.24	0.21	0.24
1993	0.17	0.03	0.21	0.02	0.24	0.21	0.18	0.25	0.29
1994	0.18	0.04	0.19	0.02	0.25	0.18	0.22	0.23	0.21
1995	0.20	0.02	0.23	0.04	0.29	0.26	0.28	0.26	0.22
1996	0.26	0.04	0.15	0.07	0.22	0.19	0.28	0.23	0.29
1997	0.27	0.02	0.22	0.06	0.30	0.24	0.30	0.26	0.36
1998	0.28	0.03	0.24	0.03	0.23	0.22	0.28	0.26	0.26
1999	0.18	0.03	0.27	0.05	0.16	0.22	0.23	0.19	0.23
2000	0.19	0.01	0.15	0.02	*	0.14	0.32	0.27	0.20

* Years when striped bass were not tagged and released.

Figure 1. Recreational and commercial catch (harvest and discard) in number for 2000.

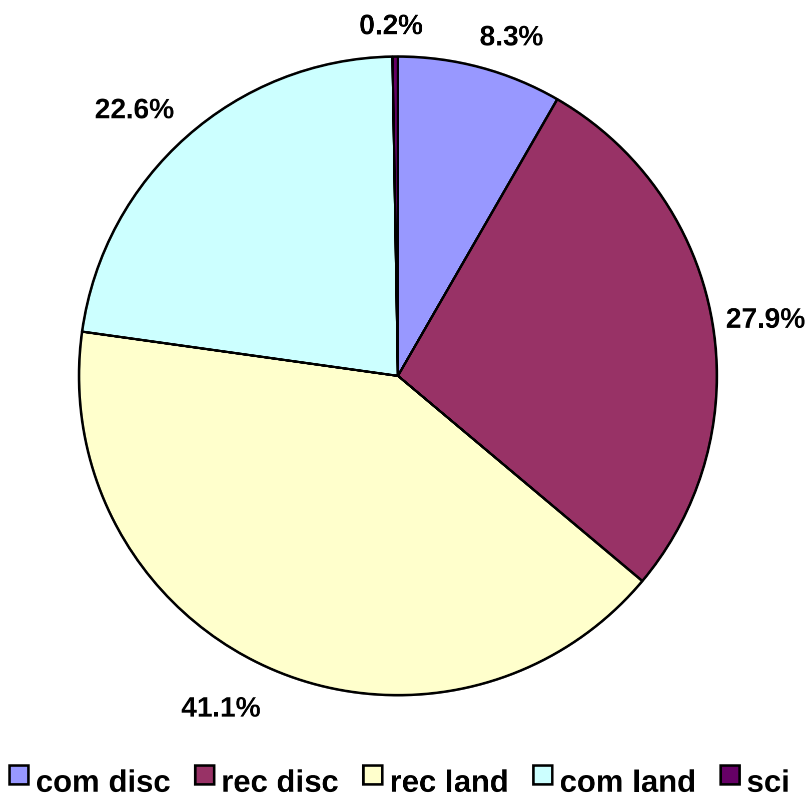

Figure 2. Maryland Spawning Stock Index, ages 2-15+, 1985-2001.

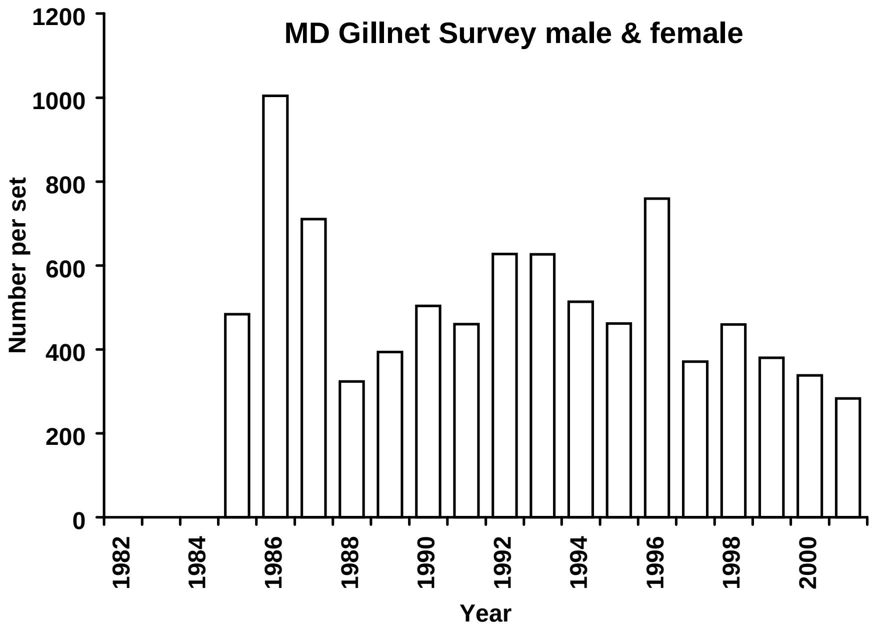

Figure 3. New York Ocean Haul Seine, Total CPUE ages 5-15+.

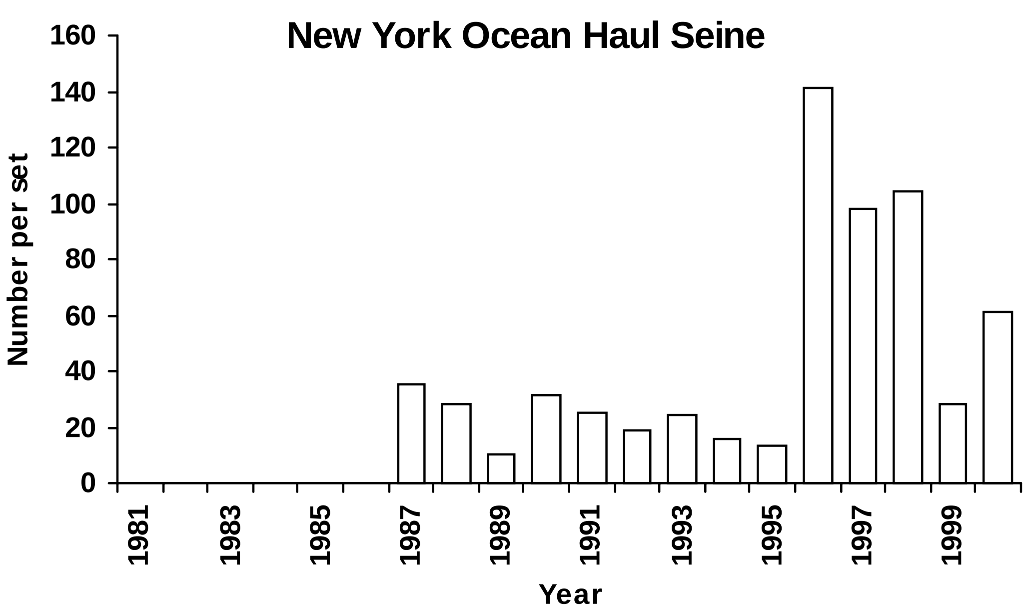

Figure 4. NMFS/NEFSC cruise CPUE Ages 2-15.

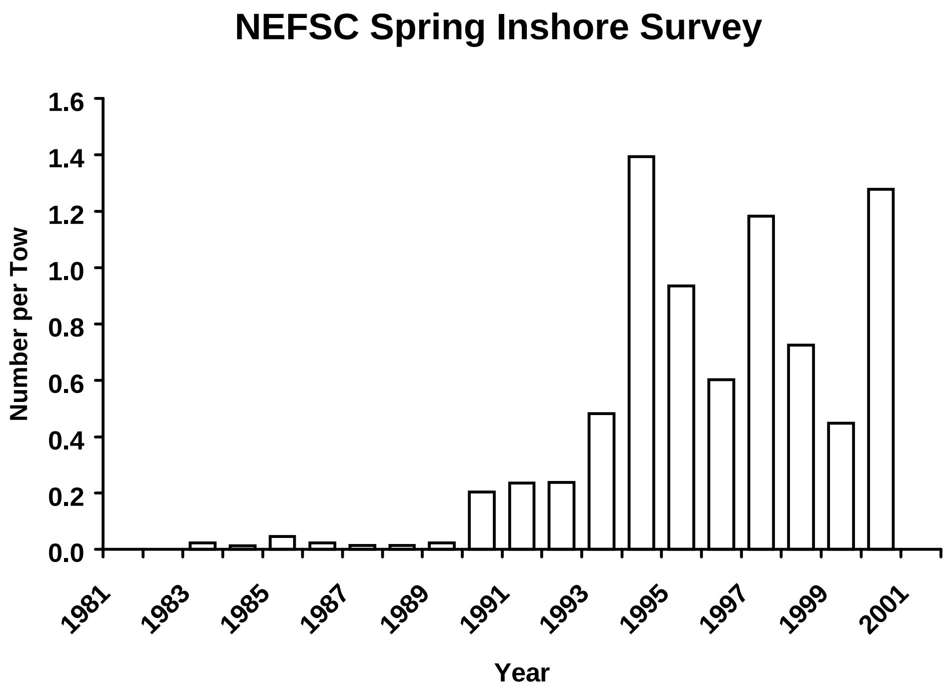

Figure 5. Virginia Rappahannock River Pound Net CPUE.

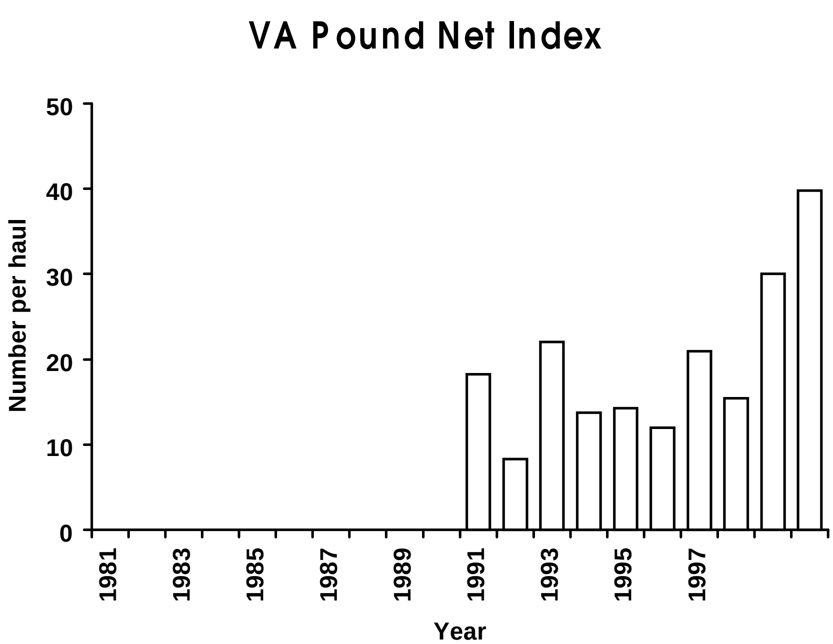

Figure 6. Age aggregated trawl CPUE, Delaware, New Jersey, and Connecticut.

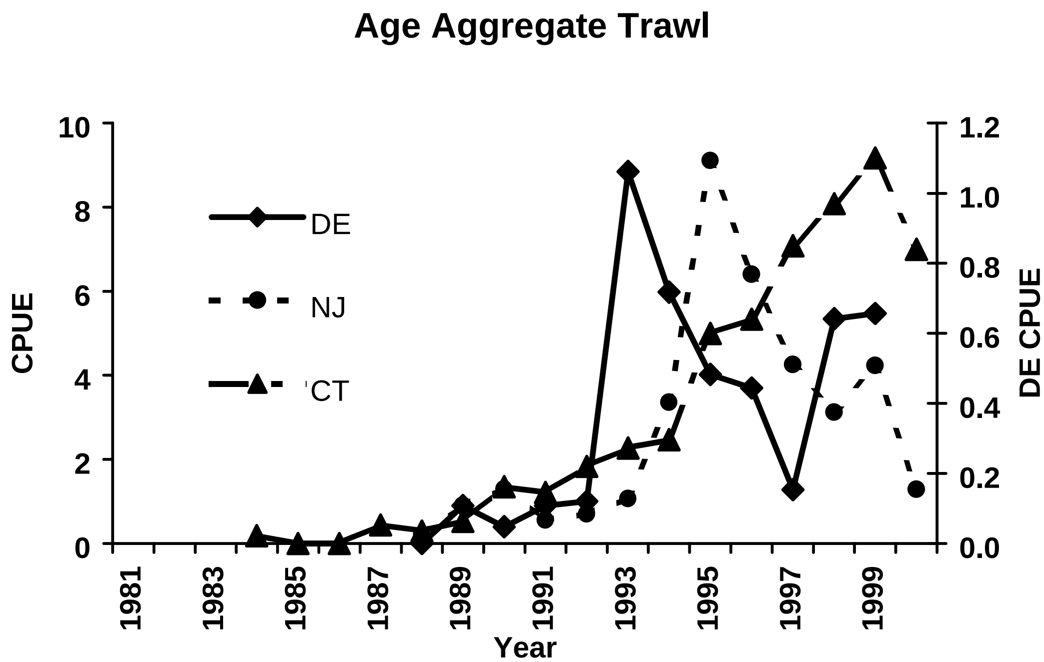

Figure 7. Indices of young of the year abundance for the Chesapeake Stock, Maryland and Virginia surveys, 1981-2000.

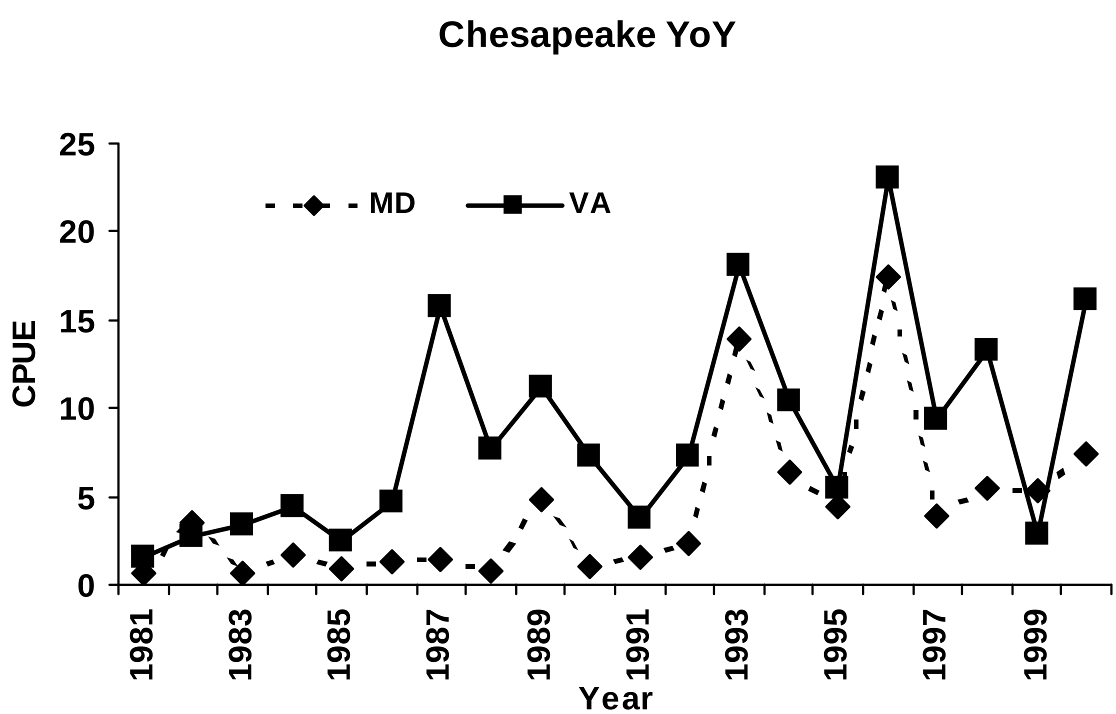

Figure 8. Young of the year survey values for the Hudson (NY) and Delaware Bay (DE, NJ) stocks, 1981-2000.

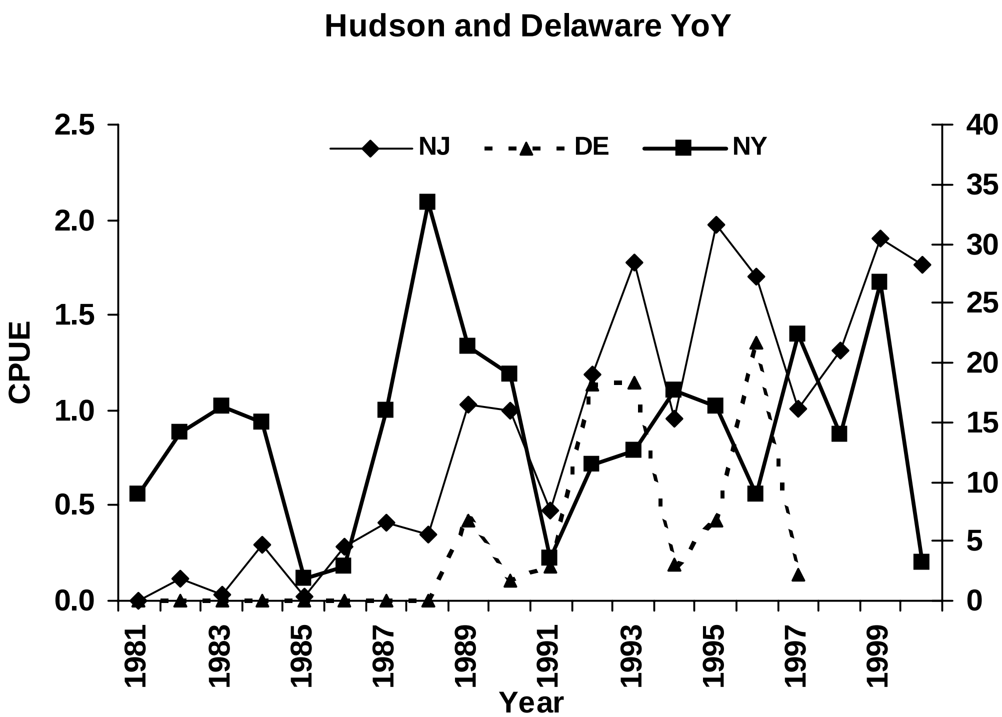

Figure 9. Indices of age-1 striped bass abundance for Long Island and Maryland.

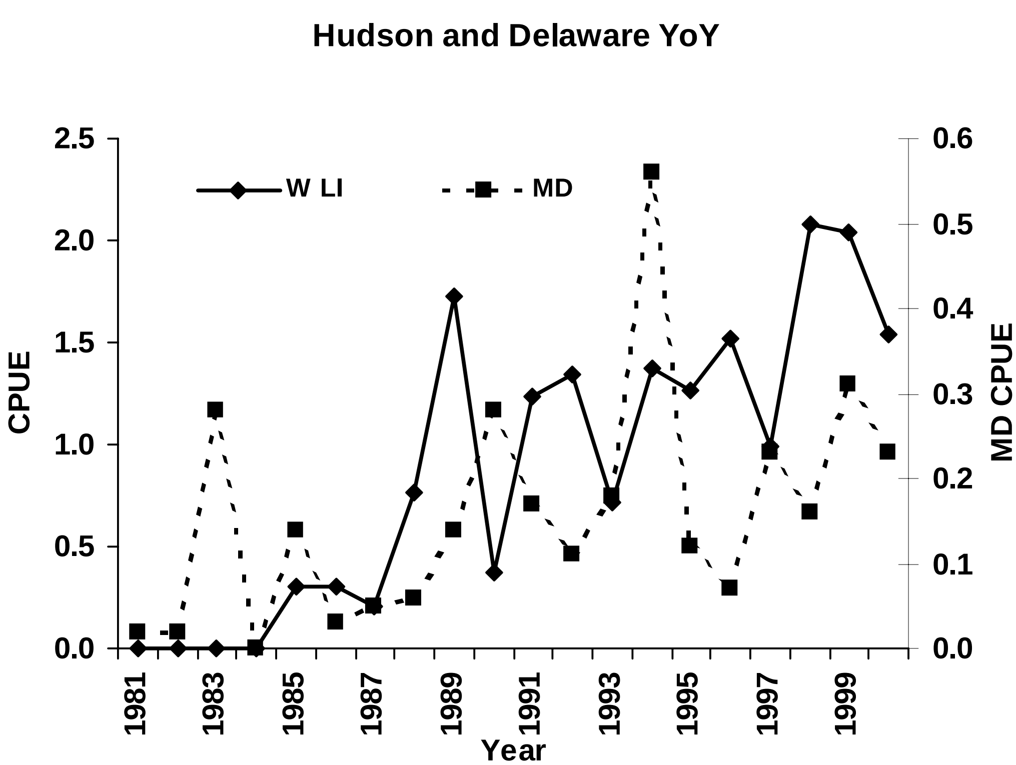

Figure 10. Massachusetts total age 8-15 CPUE, 1990-2000.

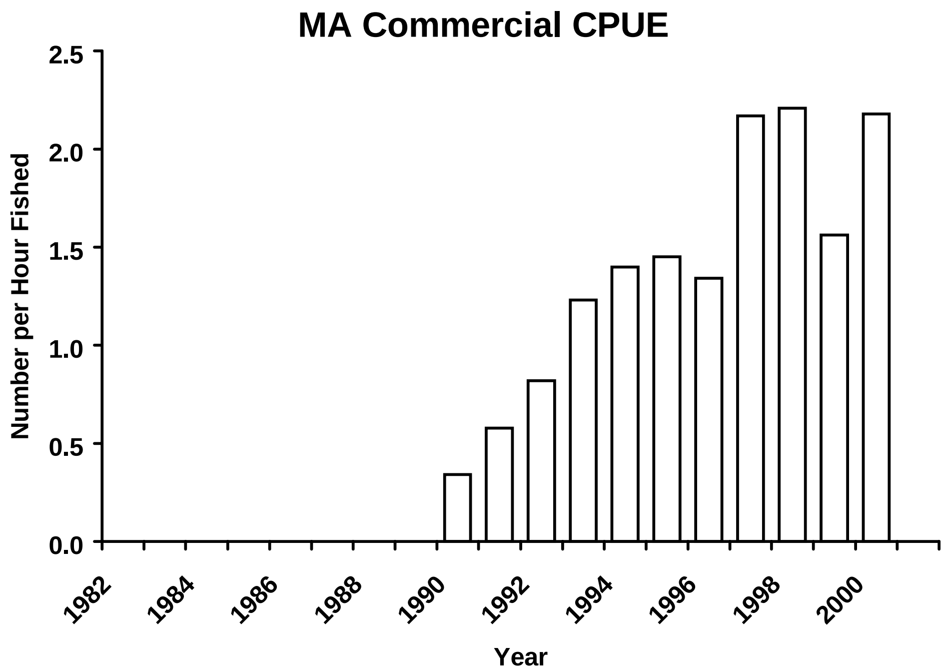

Figure 11. Connecticut total ages 2-15 CPUE, 1981-1999.

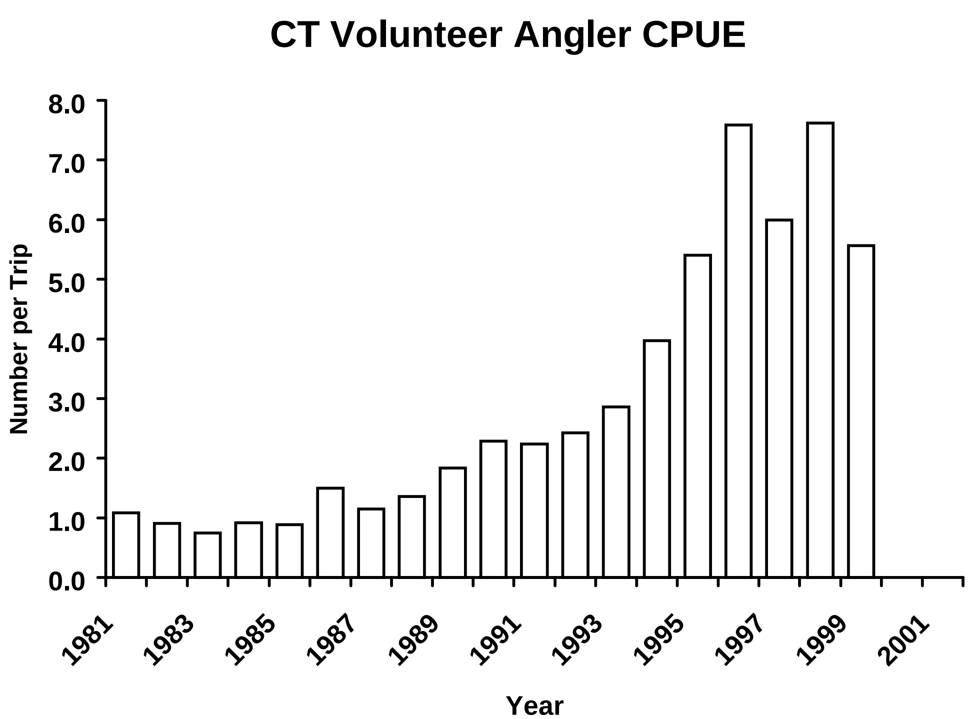

Figure 12. Hudson River shad bycatch indices of striped bass abundance.

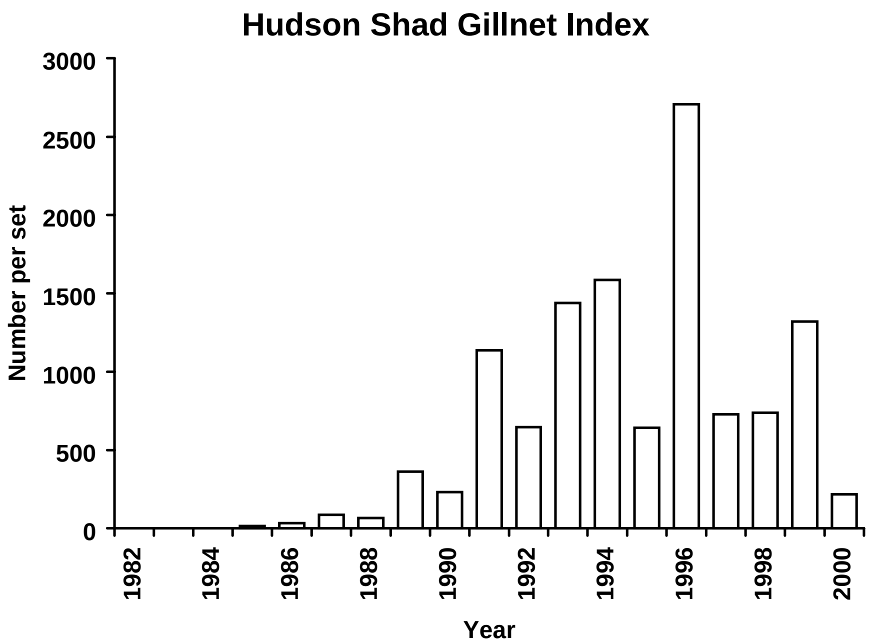

Figure 13. Age frequency of 2000 total catch of striped bass.

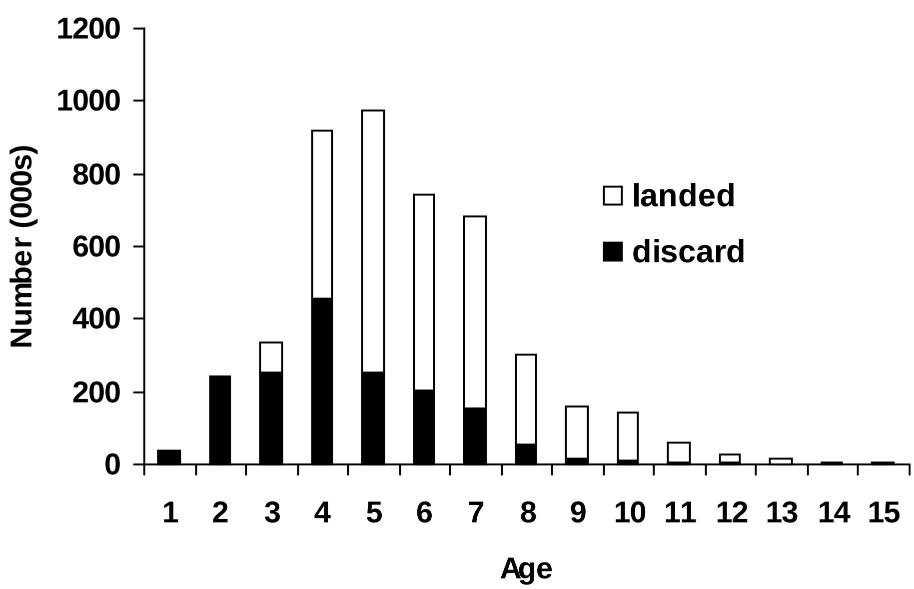

Figure 14. Striped bass fishing mortality from the 2000 VPA results and the current target F.

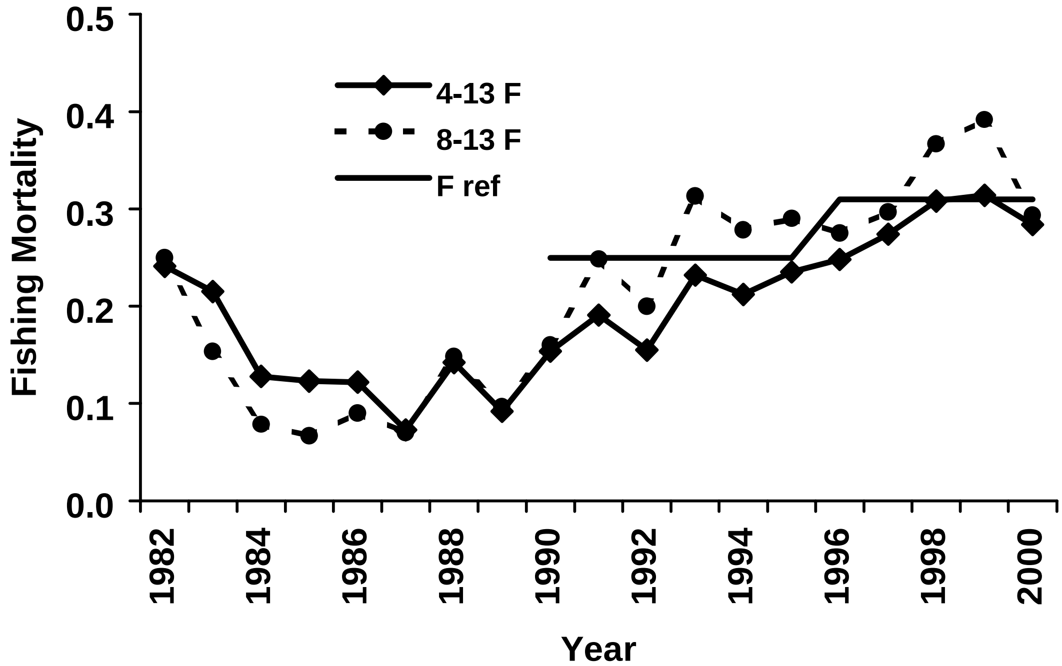

Figure 15. Striped bass population abundance from the 2000 VPA results.

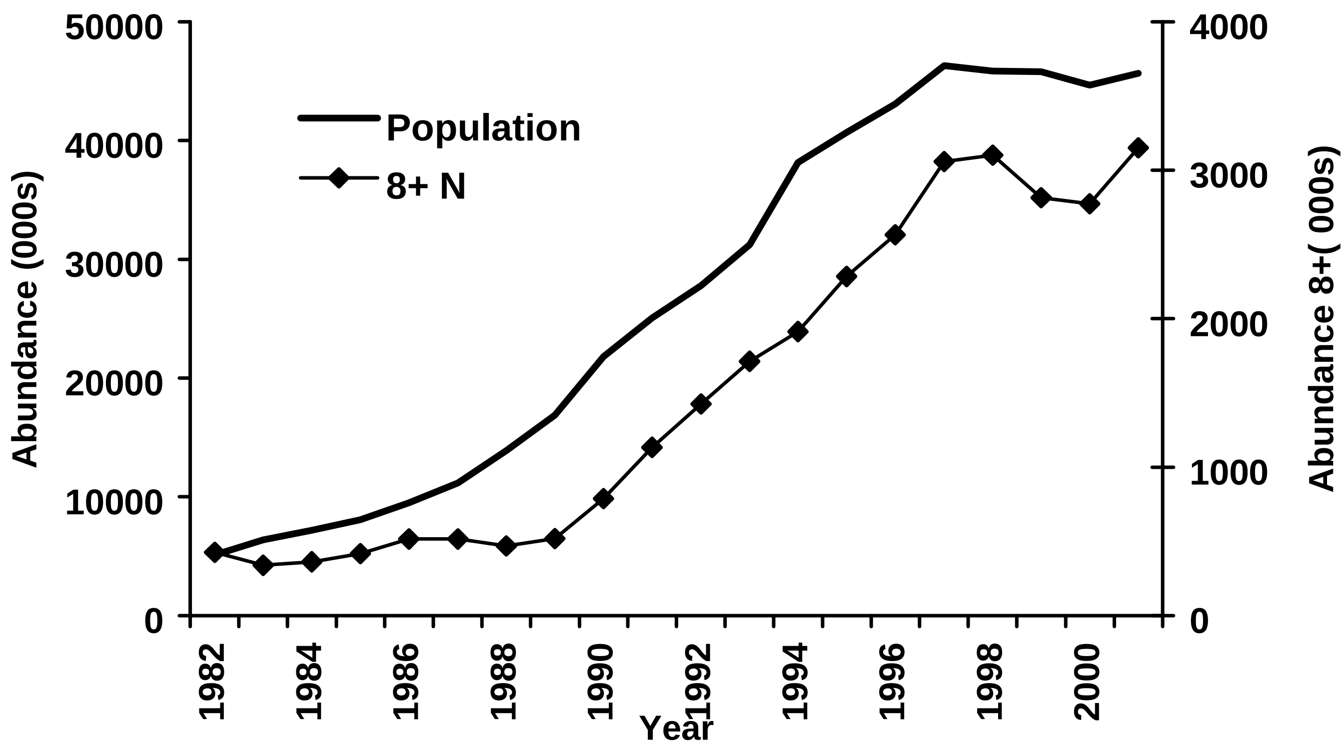

Figure 16. Striped bass recruitment in thousand age-1 fish from the 2000 VPA results.

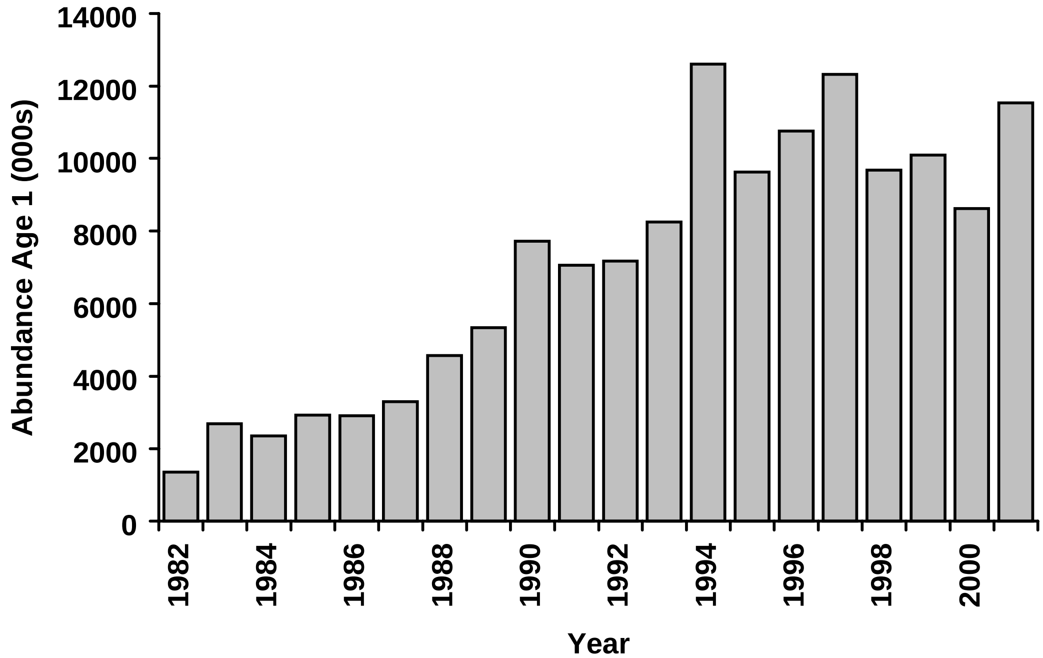

Figure 17. Trend in female spawning stock biomass, 1982-2000.

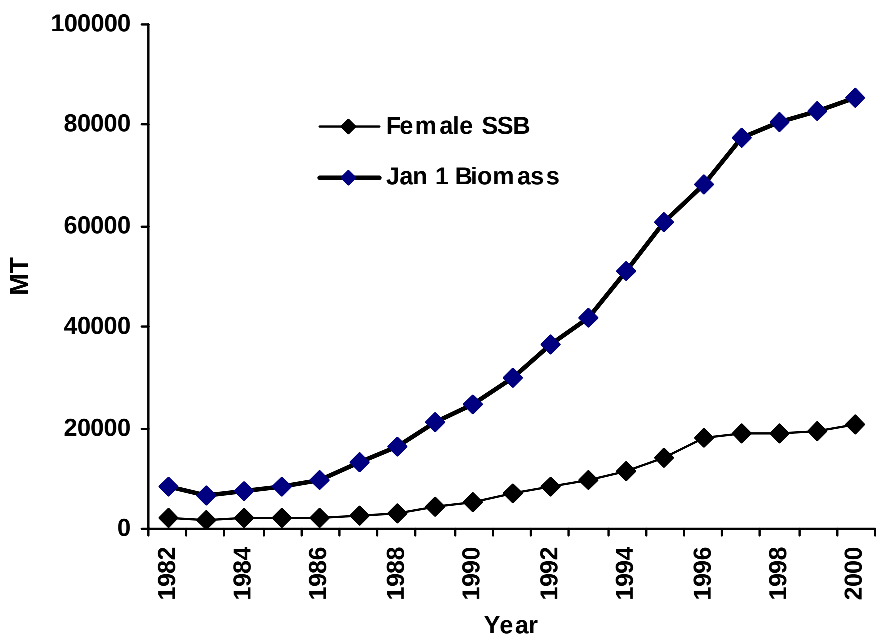

Figure 18. Terminal full F distribution based on 500 bootstrap iterations, with 80% probability bounds.

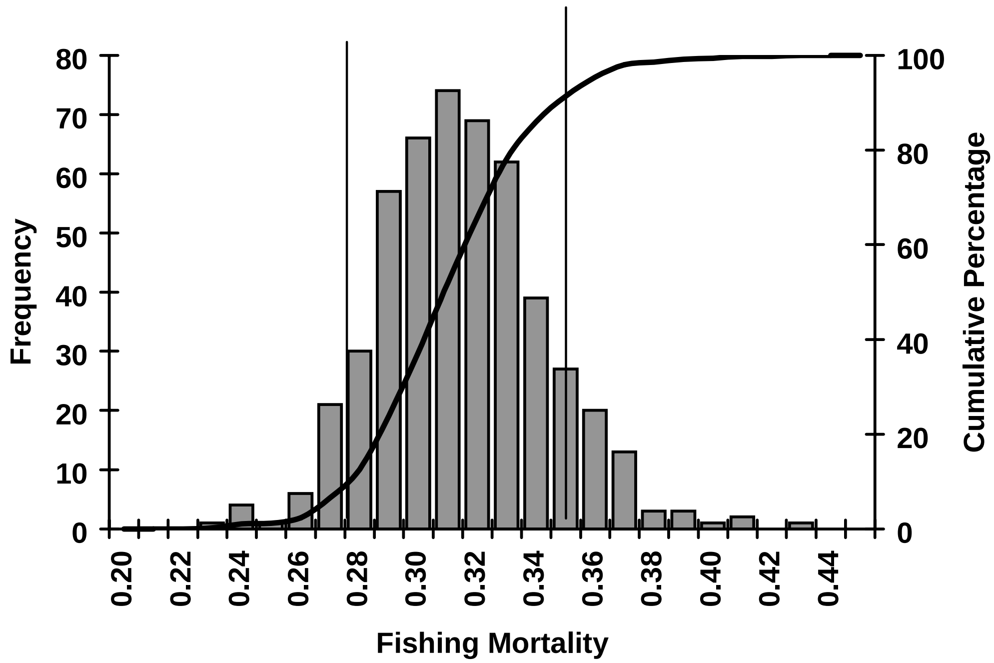

Figure 19. Distribution of 2001 striped bass abundance estimates based on 500 bootstrap iterations.

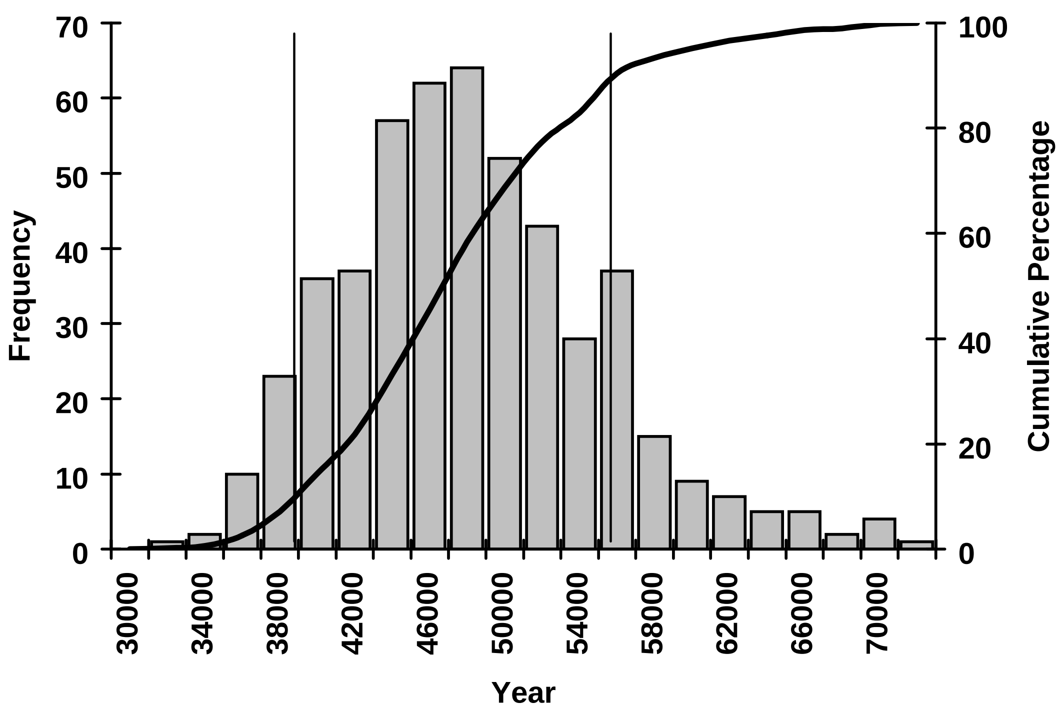

Figure 20. Retrospective trend in age 5-13 fishing mortality, for 1995-2000 terminal years.

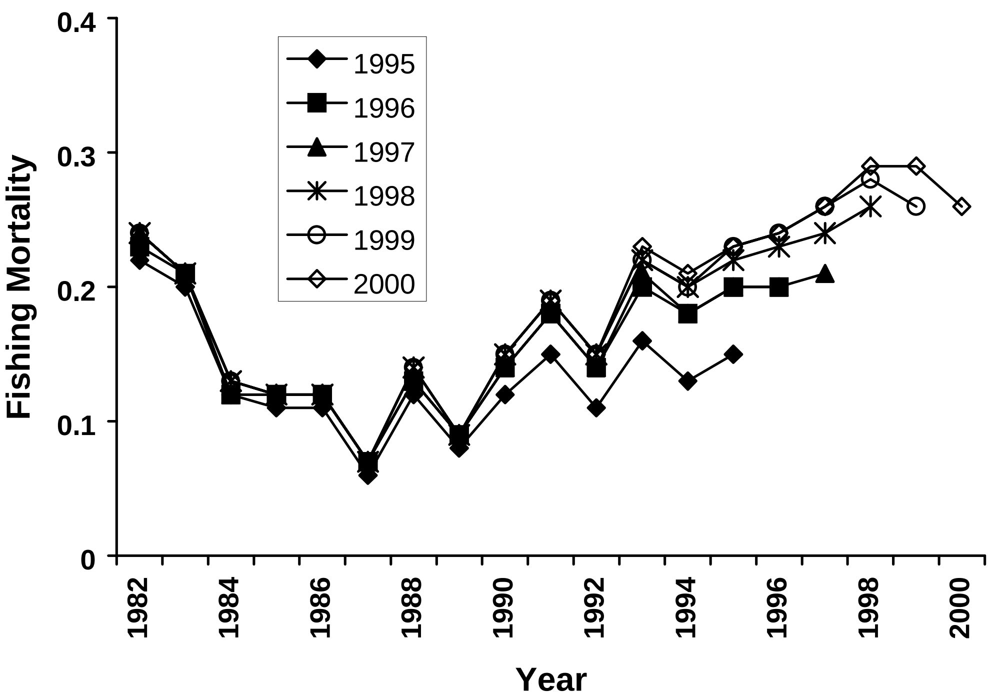

Figure 21. Retrospective trends in age 2+ population abundance, for terminal years 1995-2000.

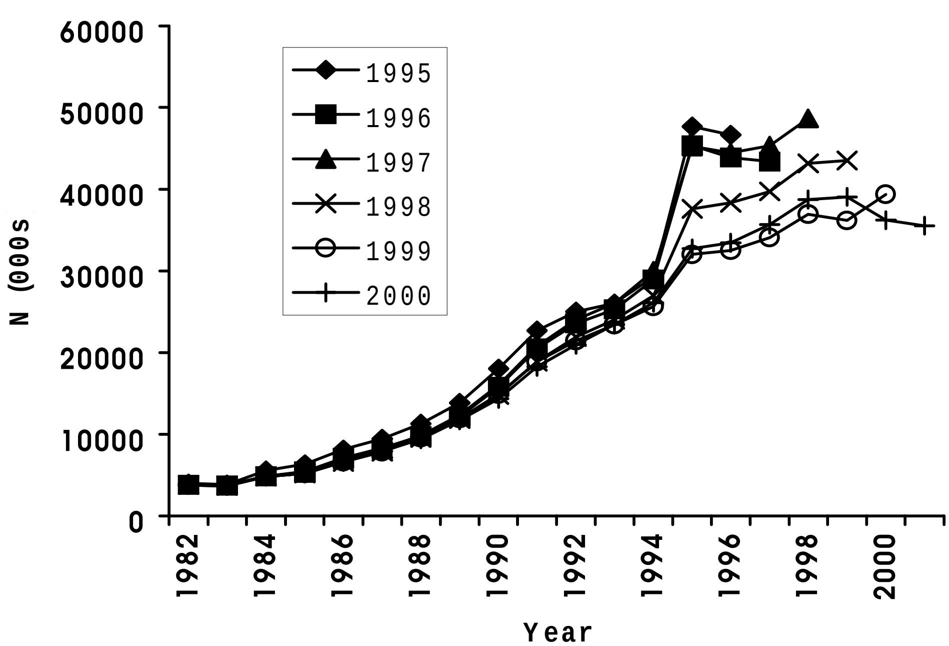

Figure 22. Historic trends in estimates of F from time series of VPA analyses.

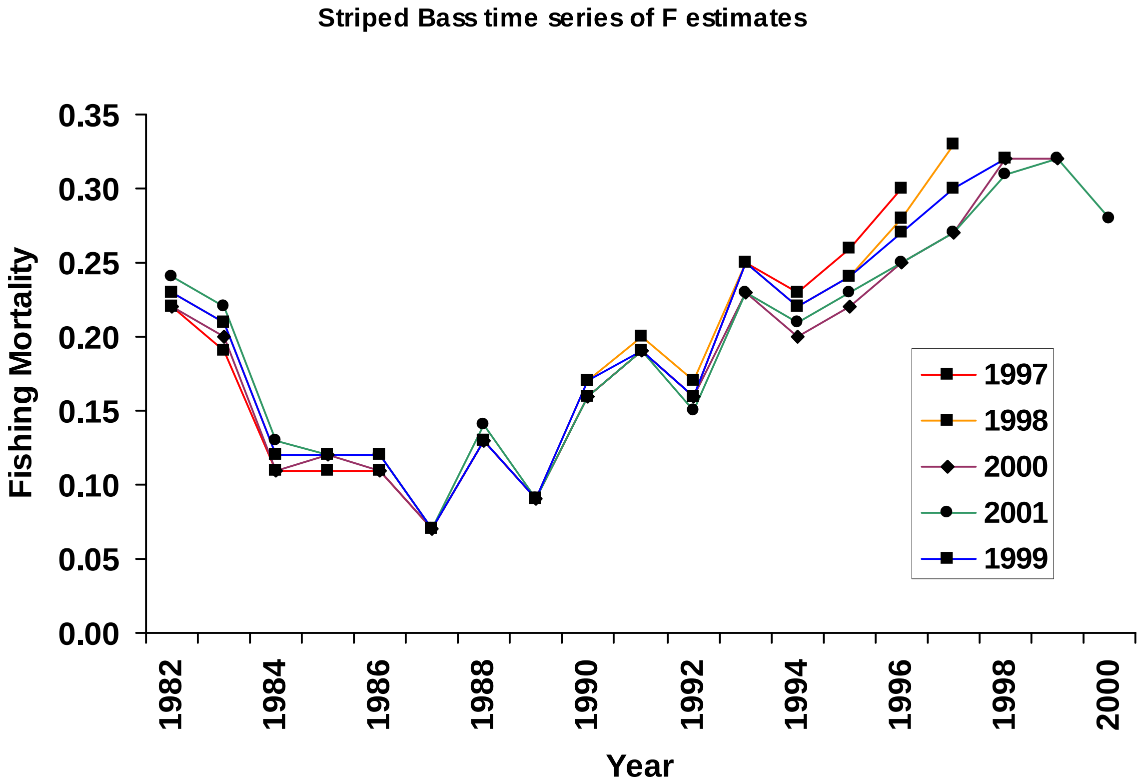

Figure 23. Estimated age 4-13 Jan. 1striped bass abundance for 1982-2001, total age 4-13 striped bass catch for 1982-2000, and age 4-13 striped bass fishing mortality for 1982-2000.