ASMFC Striped Bass Technical Committee

Conference Call: December 19, 2008

Meeting Report

Participants

Michael Brown (ME)
Gary Nelson (MA)
Vic Crecco (CT)
Carol Hoffman (NY)
Russ Allen (NJ)
Des Kahn (DE, Chair)
Alexei Sharov (MD)
Daniel Ryan (DC)
Jed Brown (DC)
Rob O'Reilly (VA)
Charlton Godwin (NC)
Wilson Laney (FWS)
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Overview

On December 16, staff delivered a list of seven tasks from the Striped Bass Management Board (Board) to the Technical Committee (TC). The Board developed the task list following its October meeting and in anticipation of resuming discussion of an addendum to Amendment 6 at its next meeting on February 2, 2009. The list was later prioritized to address the concern that the TC may not have time to address all the tasks by the deadline.

Prior to the TC's review of the task list, the TC Chair advised the Board Chair that two other issues might take precedence over the task list. These two issues are: a new article by Gauthier *et al.* (2008) linking mycobacteriosis in the Chesapeake Bay to increasing natural mortality of striped bass; and evidence suggesting that MRFSS estimates of recreational effort and harvest are biased high. Because both issues have potential to affect stock assessment results, the Board Chair agreed to poll the Board for its priority. The Board placed greater priority on having the TC address the task list for its February meeting. Thus, this TC call was scheduled to review the task list and assign responsibilities and to circulate information on the other issues.

The call started with a brief discussion of the mycobacteriosis and MRFSS issues. The TC agreed that the new article deserves additional review and consideration at a subsequent TC meeting. The potential for a MRFSS bias because of increasing cell phone useage caused concern among some TC members, and it was suggested that another, non-species specific group be tasked with additional evaluation. Through later email discussion, it became evident that this was not a consesus recommendation. The TC agreed that the Board should be made aware of both issues and that they would be considering during future assessment modeling.

The TC then reviewed the task list and assigned members to each task (next page). A deadline of January 23rd was set for analyses to be sent to the TC Chair. An additional conference call to review and finalize the analyses during the week of January 26th was discussed but did not occur. As such, only preliminary analyses would be presented to the Board on February 2 (report attached). At that meeting, the TC Chair was expected to briefly present the mycobacteriosis paper and MRFSS concern before focusing on the task list.

<u>Tasks & Assignments</u> (due January 23)

1. Evaluate the effect of a range of percent increases (e.g., 15%, 20%, 25%) in the coastal commercial quota on the fishing mortality rate (F).

Gary Nelson & Gary Shepherd: projections with increase in commercial CAA.
Alexei Sharov: analysis using the percent of fish caught in coastal commercial fishery compared to total removals.
Vic Crecco: consider increase in M, and overestimation of recreational harvest.

2. Determine which recreational size limit options are conservation neutral in terms of SSB/R to two fish at 28” that maintain the two fish creel limit but allow for one smaller fish and one larger fish to be kept.

Vic Crecco: conservation equivalency analysis using Thompson-Bell. Vic will do one run using a higher level of M to mimic potential impacts of myco.

3. Determine how wide the gap between point estimates of Ftarget and Fthreshold must be to ensure that they are statistically different and advise on how estimates of terminal F should be compared to the reference points particularly when the point estimate of terminal F is above Ftarget but below Fthreshold.

No error distributions for Ftarget and Fthreshold to determine if statistically different.
Des Kahn & Alexei Sharov: present error distribution around terminal year estimate from Stock Assessment Report, and suggest a rule using confidence limits for assigning stock status. The estimate of F from the tag models will be displayed, with the caveat that the SARC Review Panel questioned whether it is comparable to the reference points. The retrospective effect on F will be included in this portrayal, indicating that there is instability in the terminal estimate of F from the CAA model. What level of risk is the Board willing to consider?

4. Analyze catch data from the wave 1 winter fisheries off North Carolina, Virginia, and Maryland to determine how this fishery affects the existing age structure of the striped bass population.

Rob O'Reilly/Joe Grist: estimate wave 1 harvest for VA and MD.
Gary Nelson: age harvest, show what percent of total CAA this wave 1 fishery contributes.

5. Assess the long-term effects of recreational and commercial discards on the striped bass population and how changes in these rates would affect the age structure and female spawning stock biomass.

Gary Shepherd (honorably nominated in absentia): projections with more and less discards in CAA.

6. Analyze recreational regulatory options that could increase the proportion of age 15+ striped bass in the population to 3% and 5% using size and bag restrictions.

Vic Crecco: analyses with increased size limits and/or bag limits. Will mention the issue of higher contaminant levels in larger fish.

7. Refine the age-length data used for the 2007 assessment using the stored otolith/scale samples collected in 2008 from striped bass 31 inches and larger.
Des Kahn: obtain new 2008 data, include in ALK, analyze effect on CAA.

ASMFC Atlantic Striped Bass Technical Committee
Report to the Management Board
February 2, 2009

The Striped Bass Technical Committee (TC) met via conference call on December 19, 2008 to review the list of seven tasks from the Management Board. Methods to address each task were developed and assigned to one or several TC members. The following report should be considered preliminary because the TC did not have the opportunity for a second meeting or call to review and approve the work completed by individual TC members.

Task 1. Evaluate the effect of a range of percent increases (e.g., 15%, 20%, 25%) in the coastwide [coastal] commercial quota on the fishing mortality rate (F).

Method A:
The commercial harvest numbers-at-age for each year from 2003 to 2006 were used to calculate the numbers-at-age that result from a 15-30% increase in quotas. Resulting numbers were added to the original 2006 catch-at-age matrix and the total catch and catch proportions were calculated from it for inclusion in the statistical catch at age (SCA) model. The SCA model was run for each percent increase and the estimates of the average F of ages 8-11 were obtained (Table 1). It was assumed that no reduction or increase in discards occurred with the increase in landings. Note that selectivity pattern for 1996-2006 also changed slightly because increases in harvest changed the proportions-at-age of total removals.

Table 1. Average F of ages 8-11 with commercial harvest increased 15-30% from 2003-2006

	2006	15% Inc.	20% Inc.	25% Inc	30% Inc.
Year	Avg F Orig	Avg F	Avg F	Avg F	Avg F
1982	0.45	0.45	0.45	0.45	0.45
1983	0.42	0.42	0.42	0.42	0.42
1984	0.31	0.31	0.31	0.31	0.31
1985	0.21	0.21	0.21	0.21	0.21
1986	0.15	0.15	0.15	0.15	0.15
1987	0.08	0.08	0.08	0.08	0.08
1988	0.14	0.14	0.14	0.14	0.14
1989	0.10	0.10	0.10	0.10	0.10
1990	0.12	0.12	0.12	0.11	0.11
1991	0.11	0.11	0.11	0.11	0.11
1992	0.09	0.09	0.09	0.09	0.09
1993	0.11	0.11	0.11	0.11	0.11
1994	0.12	0.12	0.12	0.12	0.12
1995	0.17	0.17	0.17	0.17	0.17
1996	0.19	0.19	0.19	0.19	0.19
1997	0.23	0.23	0.23	0.23	0.23
1998	0.19	0.19	0.19	0.19	0.19
1999	0.16	0.16	0.16	0.16	0.16
2000	0.22	0.21	0.21	0.21	0.21
2001	0.19	0.19	0.19	0.19	0.19
2002	0.18	0.18	0.18	0.18	0.18
2003	0.23	0.24	0.24	0.24	0.24
2004	0.26	0.27	0.27	0.27	0.27
2005	0.28	0.29	0.29	0.29	0.29
2006	0.31	0.32	0.32	0.33	0.33

Increases in total removals under each expected increase in commercial harvest are as follows:

15% increase in commercial harvest = 2.5% increase in total removals
20% increase in commercial harvest = 3.3% increase in total removals
25% increase in commercial harvest = 4.2% increase in total removals
30% increase in commercial harvest = 5.0% increase in total removals

Method B:

1. Total coastal commercial quota was calculated as the sum of state-specific coastal commercial fishery quotas as defined by Amendment 6 (Table 2). The coastwide coastal commercial quota adjusted for conservation equivalency changes in NY and MD is 3,217,384 lb.
2. An average weight of striped bass in coastal harvest in 2007 was estimated at 12.9 lb. This estimate was used to calculate quota increase in numbers of fish. Total commercial quota was converted to the number of fish as 3,217,384 / 12.9= 249,410 fish.
3. Quota increases between 10 and 25% were calculated at 5% increments (Table 3).
4. New quotas expressed in the number of fish were compared to the total harvest of 7+ and 8+ old fish (an approximation of the total number of harvested fish with total length 28 inches and larger, Table 4) for the period 2003-2006.
5. Assuming that 7+ or 8+ old fish (TL ≥ 28 inches) experience full fishing mortality (PR = 1, which is close to the last assessment results), the harvest (C) and full F in any particular year are related according to the classical Baranov's catch equation:

   $$C = N\frac{F}{F+M}(1-e^{-F-M})$$

   where N is the population size of fish ≥ 28 inches in length and M is natural mortality. An increase in commercial quota will lead to the increase in total catch and F. New catch (C_n) and fishing mortality (F_n) will be related in the same fashion

   $$C_n = N\frac{F_n}{F_n+M}(1-e^{-F_n-M})$$

   The ratio of observed and increased harvest C_n/C is equal to

   $$\frac{C_n}{C} = \frac{F_n}{F_n+M}\frac{F+M}{F}\frac{(1-e^{-F_n-M})}{(1-e^{-F-M})}$$

   This equation can be solved iteratively to estimate the new F that would be generated if an increased quota were harvested. The estimates of observed full F and new F that would have been generated if the commercial quota was increased in 2003 -2006 are presented in Table 5.

<u>Conclusion</u>

An increase in commercial coastal quota in the range of 10 - 25% leads to a very small increase of full F, not exceeding the value of 0.01 year $^{-1}$. Such increase would not be possible to detect given the uncertainty in the catch at age and relative indices of abundance.

Table 2. Coastal commercial quotas by state (lb) defined in Amendment 6 and adjusted for conservation equivalency in New York and Maryland.

State	Amendment 6	Amendment 6 with adjustments
MA	1,159,750	1,159,750
RI	243,625	243,625
NY	1,061,060	828,293
DE	193,447	193,447
MD	131,560	126,936
VA	184,853	184,853
NC	480,480	480,480
Total	3,454,775	3,217,384

Table 3. Adjusted for % increase total coastal commercial quota.

% increase	total, pounds	total, # fish
0	3,217,384	249,410
10	3,539,122	274,351
15	3,699,992	286,821
20	3,860,861	299,292
25	4,021,730	311,762

Table 4. Total number of harvested or otherwise killed fish of age 7 and older and 8 and older (as an approximation of total number of fish with TL ≥ 28 inches) in 2003 -2006.

	# fish	
year	Age 7+	Age 8+
2003	2,164,373	1,456,986
2004	2,435,321	1,918,330
2005	2,126,643	1,701,492
2006	2,225,131	1,864,732

Table 5. Changes in Full F as a result of increase in coastal commercial quota

% increase in quota		0	10	15	20	25
	year	F	F	F	F	F
age 7+	2003	0.24	0.243	0.245	0.246	0.248
	2004	0.27	0.273	0.275	0.276	0.278
	2005	0.29	0.294	0.296	0.298	0.300
	2006	0.32	0.324	0.326	0.328	0.331
age 8+	2003	0.24	0.245	0.247	0.249	0.252
	2004	0.27	0.274	0.276	0.278	0.280
	2005	0.29	0.295	0.297	0.300	0.302
	2006	0.32	0.325	0.328	0.330	0.333

Task 2. Determine which recreational size limit options are conservation neutral in terms of SSB/R to two fish at 28” that maintain the two fish creel limit but allow for one smaller fish and one larger fish to be kept.

In this analysis the Thompson-Bell Yield-Per-Recruit (YPR) model was used with a constant M of 0.15 for all ages (ages 1-20). It was assumed that current full F is 0.20. Because the request calls for equivalent conservation against a two fish creel at a 28” minimum size, a partial recruitment vector (PR) was used that most closely corresponded to a 28” minimum size limit based on results from Shepherd (1999). The PR vectors for all other size limit combinations were also taken from this report. At a 28” minimum size at an F of 0.2, SSB/R was equal to 6.07 kg/R. When the lower boundary of the dual minimum size was 18” with a one fish creel limit, the upper size limit corresponded to 40” and one fish creel in order to generate an SSB/R that was approximately (within 10%) equivalent to 6.07 kg/R. In order to achieve an exact equivalency to the SSB/R of 6.07 kg/R at 28”, the dual size limits, currently expressed in whole inches, would have to be interpolated into tenths of an inch (i.e., 18.2” and 40.3”). Expressing minimum sizes at this more refined level does not seem practical given the uncertainty and simplicity surrounding the equilibrium assumptions of YPR models. Given below are the dual size limit results:

18 in. minimum size- one fish creel, 40 in. minimum size- one fish creel
19 in. minimum size- one fish creel, 38 in minimum size -one fish creel
20 in minimum size -one fish creel, 36 in. minimum size- one fish creel
21 in. minimum size -one fish creel, 35 in. minimum size- one fish creel
22 in. minimum size -one fish creel, 34 in. minimum size -one fish creel
23 in. minimum size- one fish creel, 33 in. minimum size- one fish creel
24 in. minimum size- one fish creel, 32 in. minimum size- one fish creel

These results from equivalent conservation analysis were very robust to changes in the choice of constant M, to the choice of current F, and to the inclusion of density-dependent effects (use of stock-recruitment). The model results are sensitive to major (+/-20%) shifts in the age-specific PR vector at each minimum size, as well as changes in hook-release mortality. The results were particularly sensitive to a systematic rise in natural mortality over time and to time varying changes in somatic growth (weight-at-age) that might accompany the presence of a mycobacteria disease outbreak.

Task 3. Determine how wide the gap between point estimates of Ftarget and Fthreshold must be to ensure that they are statistically different and advise on how estimates of terminal F should be compared to the reference points particularly when the point estimate of terminal F is above Ftarget but below Fthreshold.

At this point, for any given set of estimates, the Board would have to make a decision in any given situation, with advice from the Technical Committee, whether an estimate of F is above a reference point. There are several considerations:

1) Uncertainty in the terminal estimate of F due to a retrospective pattern of changing estimates
Note that the Committee has determined that the SCA model has a retrospective bias or pattern. This means that the estimates of fishing mortality have declined as additional years of data have been added to the model. The most recent years' estimates are the most uncertain. In general, the influence of the tuning indices declines and the influence of the catch-at-age data increases as additional years of data are added. Our last assessment report indicated that the 2002 estimate of fishing mortality had declined from about 0.23 to about 0.17 after the addition of five more years of data (Figure 1). That suggests the possibility that the most recent estimate of F in 2006 = 0.31 could decline to about 0.25 with additional data. If that occurs, then if we determined that overfishing was occurring based on $F_{2006} = 0.31$, we would be in error, because when additional data was incorporated, the model would estimate $F_{2006} = 0.25$.

2) Uncertainty around the terminal year estimate due to 95% confidence interval
Statistical catch at age models produce confidence limits around the estimates, such that for the terminal estimate of F for 2006 from our last assessment, the 95% confidence interval ranged from 0.23 to 0.40 (Figure 2). While 0.31 was the point estimate, there was a 95% probability that fully recruited F was greater than 0.22 and less than 0.41. Note that the point estimate of the overfishing threshold $F_{MSY} = 0.34$ does fall in this range.

3) Uncertainty around the reference point
Helser, Sharov and Kahn (2000) portrayed the uncertainty around an overfishing reference point for the Delaware Bay blue crab stock. Sharov and Helser used a similar approach to portray the uncertainty around a similar overfishing threshold for striped bass based on stock-recruitment data (Figure 3). The distributions of the fishing mortality estimate and of the reference point have some overlap, but the question is at what point would we decide that the distribution of the F estimate significantly exceeded the distribution of the reference point.

4) The estimate from the tag-recapture F estimates should be part of the consideration
Over time, the tag-recapture F estimates have sometimes been higher than those produced by SCA (Figure 4). In recent years, the SCA estimate has trended higher, while the tag estimate has not increased, but declined to some extent. The two methods rely on different data. SCA relies on accurate catch information, but the tag-recapture estimates do not.

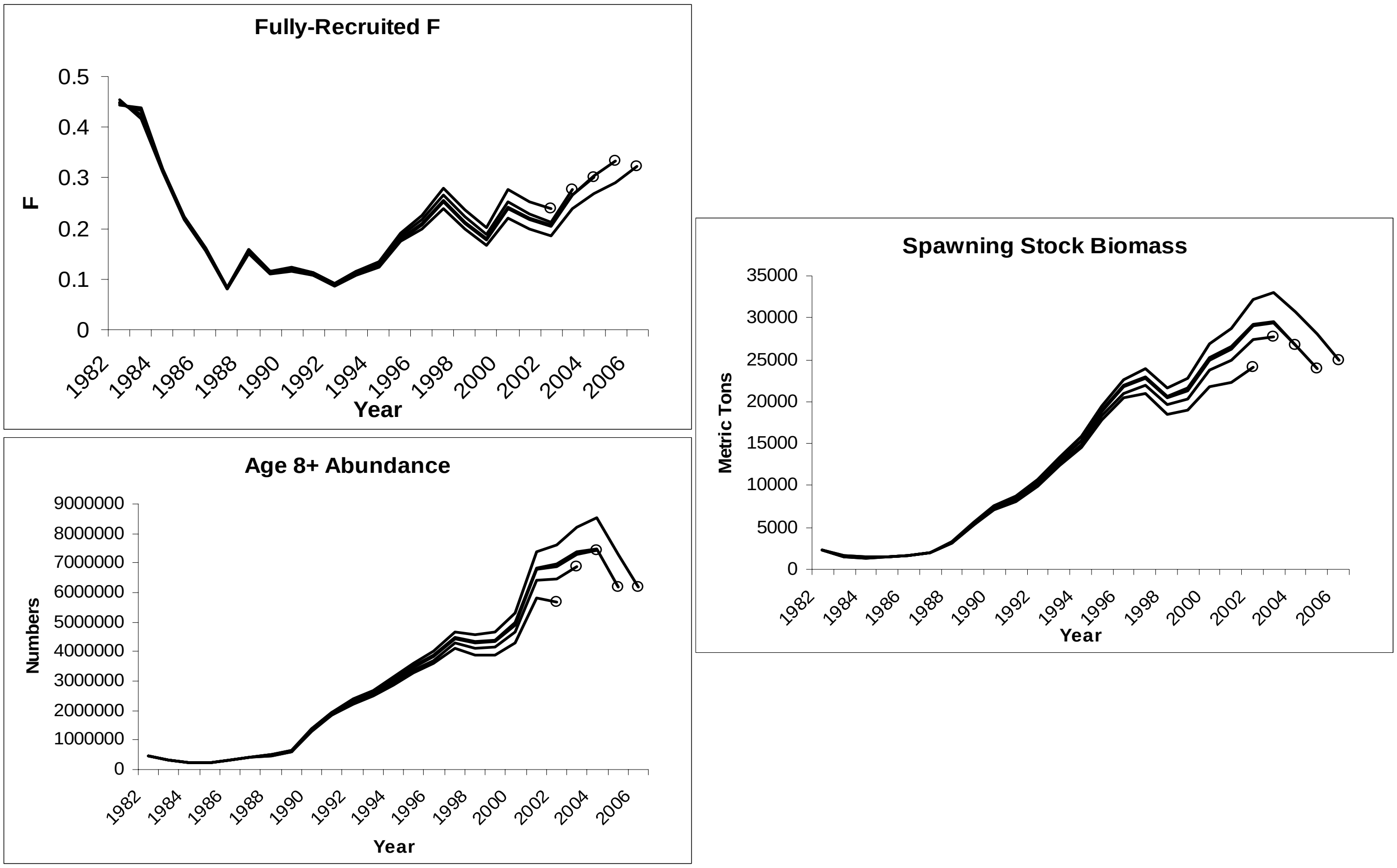


Figure 1. Retrospective analysis of fully-recruited fishing mortality, age 8+ abundance, and spawning stock biomass from the SCA model (Figure A7.14 from the 2007 stock assessment)

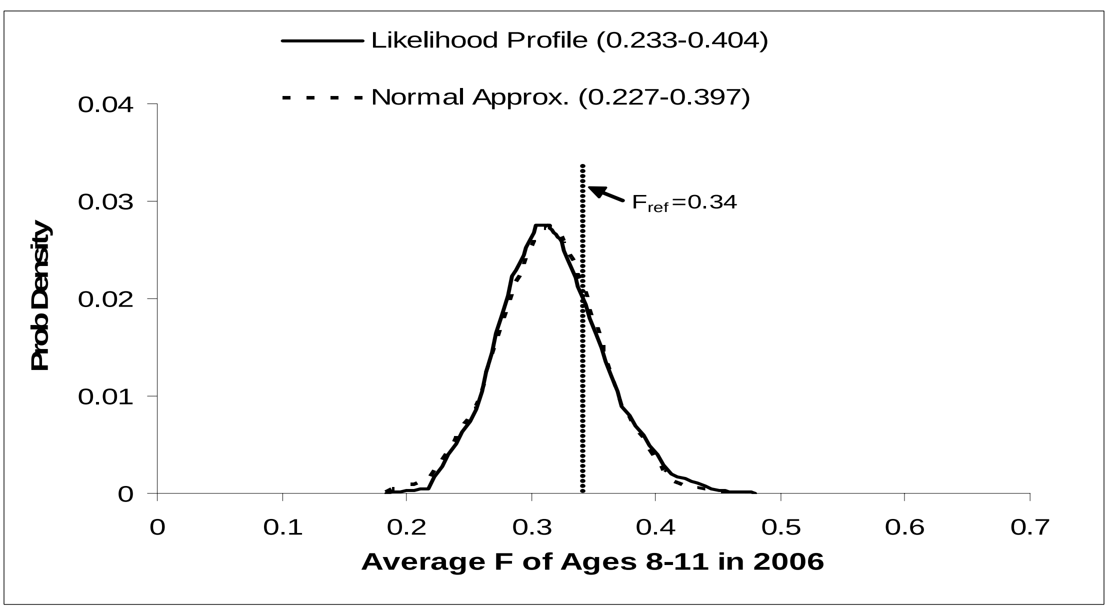


Figure 2. Confidence interval around the estimate of 2006 fully-recruited fishing mortality and the overfishing threshold $F_{MSY} = 0.34$.

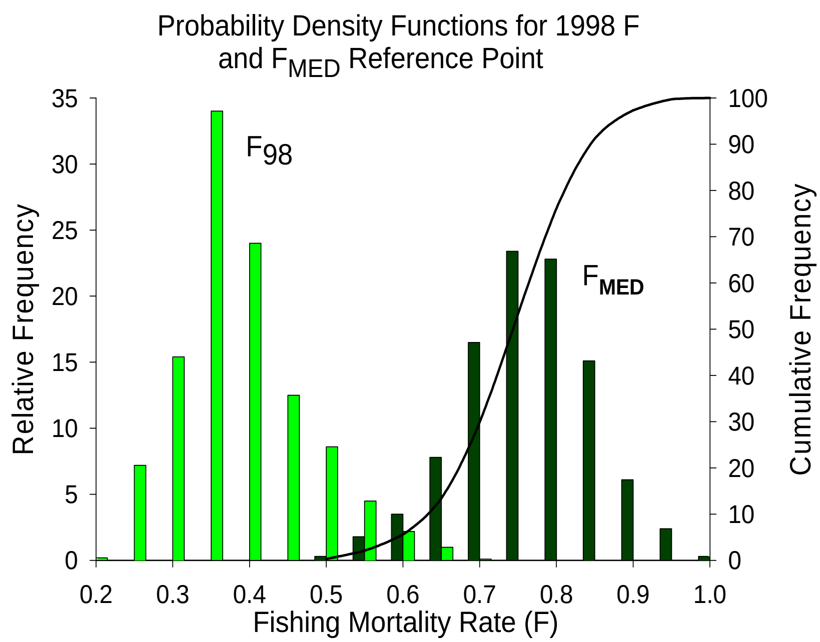


Figure 3. Example of a comparison of the uncertainty around an estimate of fishing mortality and the uncertainty around an estimate of a biological reference point (Sharov and Helser presentation 2003)

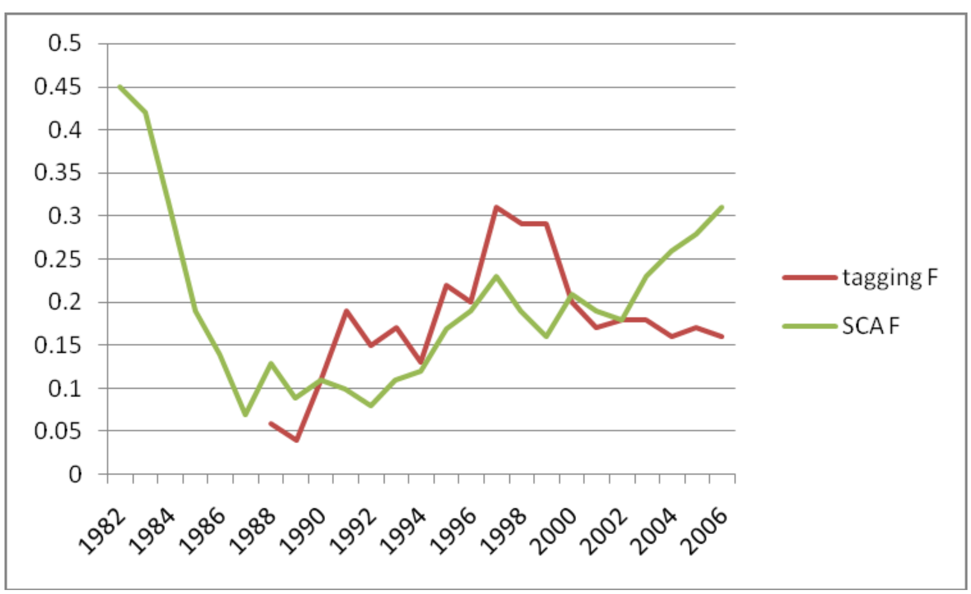


Figure 4. Time series of fishing mortality estimates from the SCA model and the tag-recapture model.

Task 4. Analyze catch data from the wave 1 winter fisheries off North Carolina, Virginia, and Maryland to determine how this fishery affects the existing age structure of the striped bass population.

The Striped Bass Stock Assessment Subcommittee has estimated wave 1 harvest for Virginia from 1996 to 2006 and for North Carolina from 1996 to 2004. Wave 1 estimates in North Carolina have been estimated by MRFSS beginning in 2005. Additional Virginia wave 1 harvests will be estimated during the next update assessment. Table 6 shows the available wave 1 estimates for the two states.

Table 6. Wave 1 harvest estimates for North Carolina and Virginia.

Year	NC	VA
1996	18,860	5,985
1997	49,037	83,793
1998	15,088	89,778
1999	18,860	107,734
2000	7,544	53,867
2001	18,860	53,867
2002	75,442	89,778
2003	79,214	53,867
2004	139,528	155,616
2005	72,050	35,991
2006	85,884	84,144
2007	36,909	NA
2008 *	42,889	NA

* = preliminary data, NA = not available

The 2006 harvest numbers-at-age for NC/VA in wave 1 were divided by the total removals and total harvest numbers-at-age for 2006 and multiplied by 100 to obtain the percentage that the NC/VA harvest comprised the total removals and total harvest-at-age (Table 7). The 2006 numbers-at-age for NC/VA over the ages were also summed and the percentage of total removals and total harvest for 2006 were calculated (shown below Table 7).

Table 7. Wave 1 NC/VA Harvest

Age												
1	2	3	4	5	6	7	8	9	10	11	12	13+
Percent of Total Removals at Age in 2006												
0	0	0	0	0.1	0.2	1.0	4.7	9.7	10.6	11.1	9.2	6.7
Percent of Total Harvest At Age in 2006												
0	0	0	0	0.1	0.3	1.2	5.6	11.0	11.8	12.1	10.1	7.2

NC/VA Wave 1 Harvest as the:
Percentage of Total Removals = 2.8
Percentage of Total Harvest = 4.4

Task 5. Assess the long-term effects of recreational and commercial discards on the striped bass population and how changes in these rates would affect the age structure and female spawning stock biomass.

Evaluating the effects of increased discarding on the age structure and spawning stock biomass (SSB) is not a straightforward analysis. Altering the discards requires a separate selectivity vector for discards and landings. However, the striped bass model was developed with a single selectivity for the fishery removals. In addition, the effect on SSB is dependent on the location of the removals. Since migration differs between sexes, the mature females are affected more by coastal fisheries than estuarine fisheries. Consequently, evaluating SSB requires a selectivity and partial F for coastal fisheries, which does not exist in the current model. There is also the question of possible compensation for discards (e.g., if discards increase does that imply landings decrease or simply that the mortality rate of discards increases?).

To analyze the requested scenario, the long-term implications of an increase in fishing mortality presumably due to increased losses from discards were evaluated. This approach assumes the same selectivity as the overall fisheries projected from the SCA terminal year population estimates at age. Starting stock size at age is drawn from a distribution of N values generated from the terminal year values in SCA and the corresponding standard deviation. Recruitment was based on the average recruitment from the 1990-2006 period (when recruitment was relatively stable relative to SSB). Random recruits were drawn from 1000 values of a normal distribution developed using the recruitment time series mean (12,745,000) and standard deviation (1,045,064) (Figure 5). Three discrete values of F were evaluated; 0.32 which is the fully recruited F in the terminal year of SCA, 0.34 which is the current estimate of Fmsy, and 0.4 which represents a previous estimate of Fmsy. Population size, SSB, and 8+ abundance (to reflect age structure) were estimated through 500 iterations (Figures 6-8). Mean and 95% CI were calculated for each year 2007 through 2017.

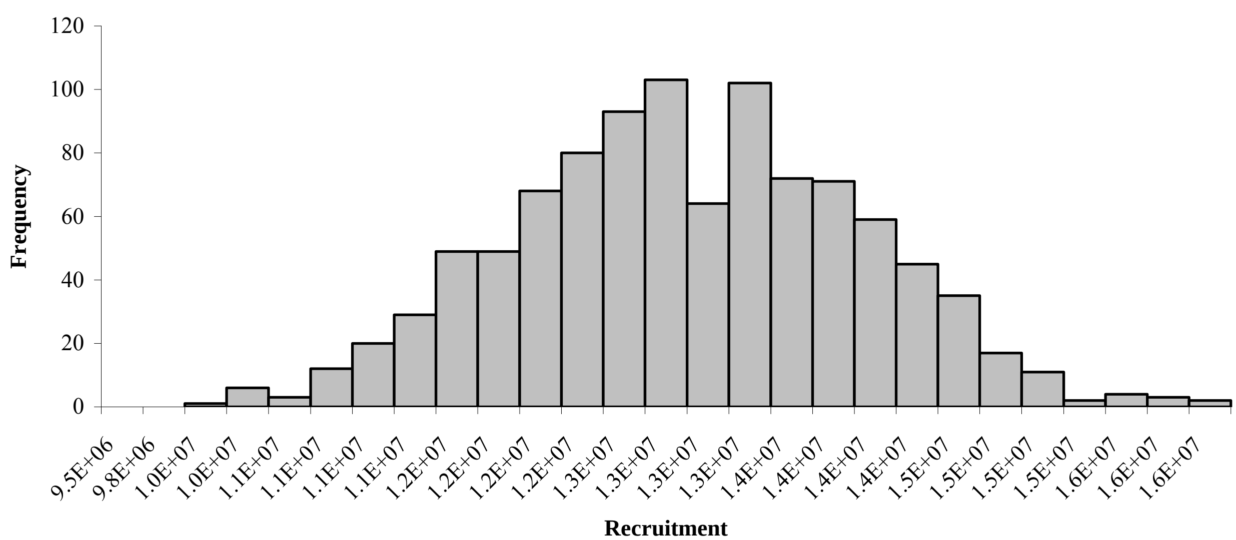


Figure 5. Distribution of recruits randomly selected for 500 iterations.

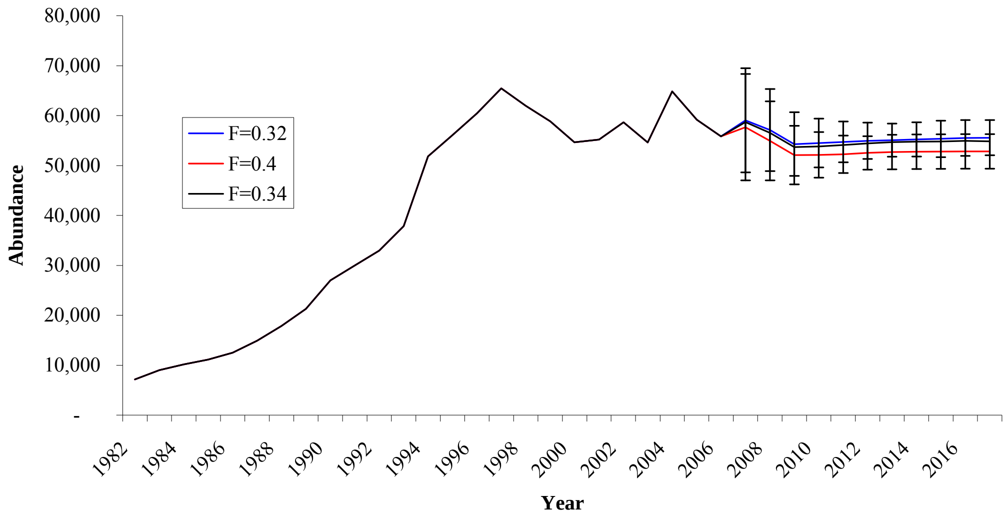


Figure 6. Projected estimates of total population abundance under fishing mortalities of 0.32, 0.34 and 0.4. 95% confidence intervals are shown.

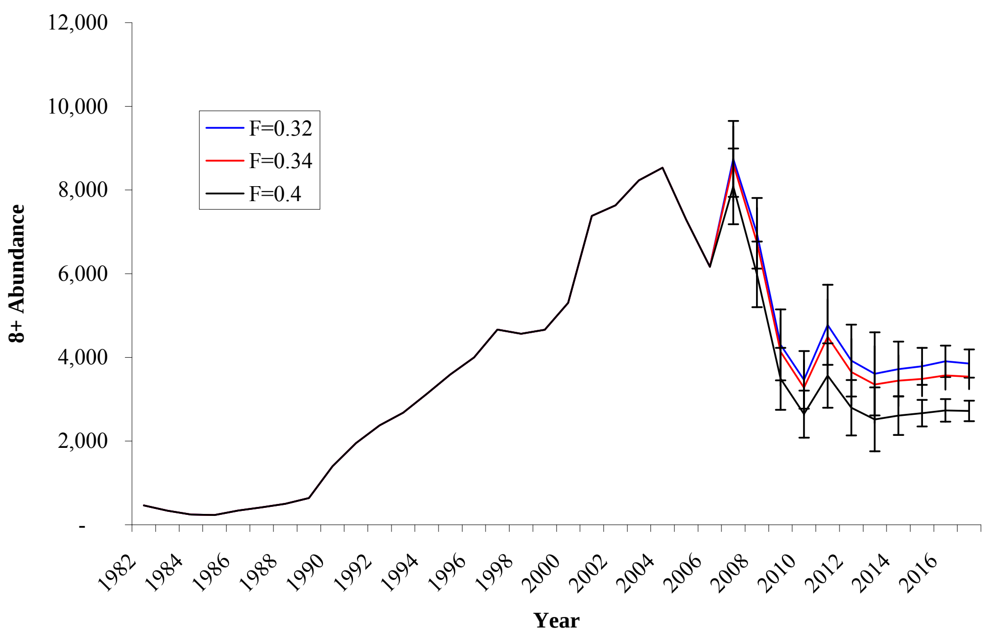


Figure 7. Abundance of fish age 8 and greater under three scenarios; F=0.32, F=0.34 and F=0.4. 95% confidence intervals are shown.

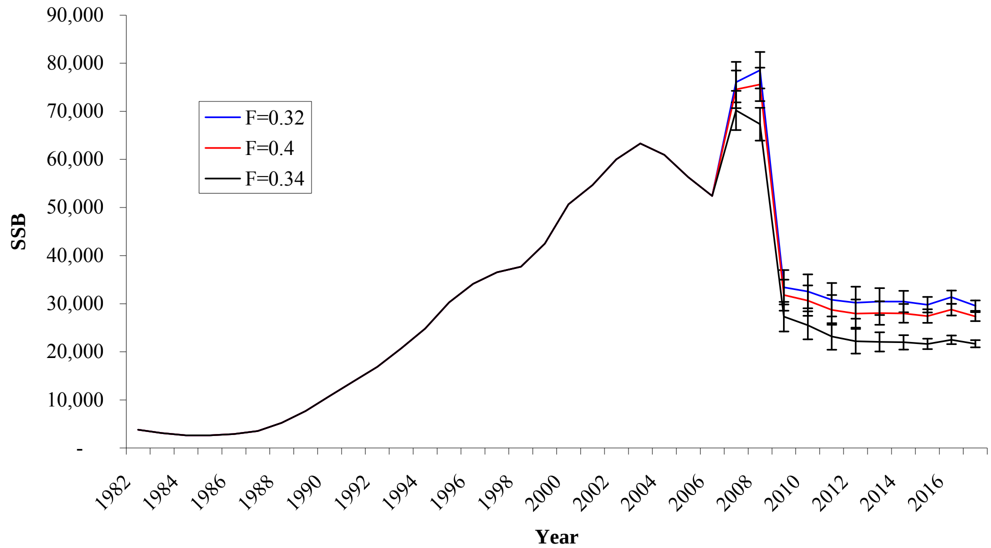


Figure 8. Female SSB projected under Fs of 0.32, 0.34 and 0.4. The assumption that overall selectivity applies equaling to mature females is unlikely.

Task 6. Analyze recreational regulatory options that could increase the proportion of age 15+ striped bass in the population to 3% and 5% using size and bag restrictions.

The Technical Committee was unable to address this task in the allotted time, but will report on it at a later date if requested. An analysis previously provided to the Board is relevant and presented below.

Potential age structure was modeled assuming a recruitment level equal to the average 1989-2006 age-1 abundance (Jan. 1 abundance) estimated in the catch at age assessment model. Current selectivity pattern was also taken from the assessment model. Population abundance at age was estimated to age 25 as a function of selectivity and selected fishing mortalities (assuming M=0.15). Alternative selectivity patterns for slot size limits were also examined (Figure 9). The alternative selectivities at age were based on an approximation of the age related to two slot limits: 1 fish 20-26" and 1 fish >40", and 1 fish 20-28" and 1 fish >40". Variations in bag limits or quotas were examined indirectly by variations in fishing mortality with the selectivity (Figure 10). The effect of changing the age at 50% selection between 1 and 15 under two F levels (0.20 and 0.30) was also examined (Figure 11). In these cases, attaining a population with 3-5% at age 15+ is more a major factor of fishing mortality rather than selection. These examples are only intended to illustrate the potential influence of changes in fishing mortality and selectivity on the abundance of age 15 and older fish. Bear in mind that the actual age structure in the population would also depend on the strength of incoming cohorts.

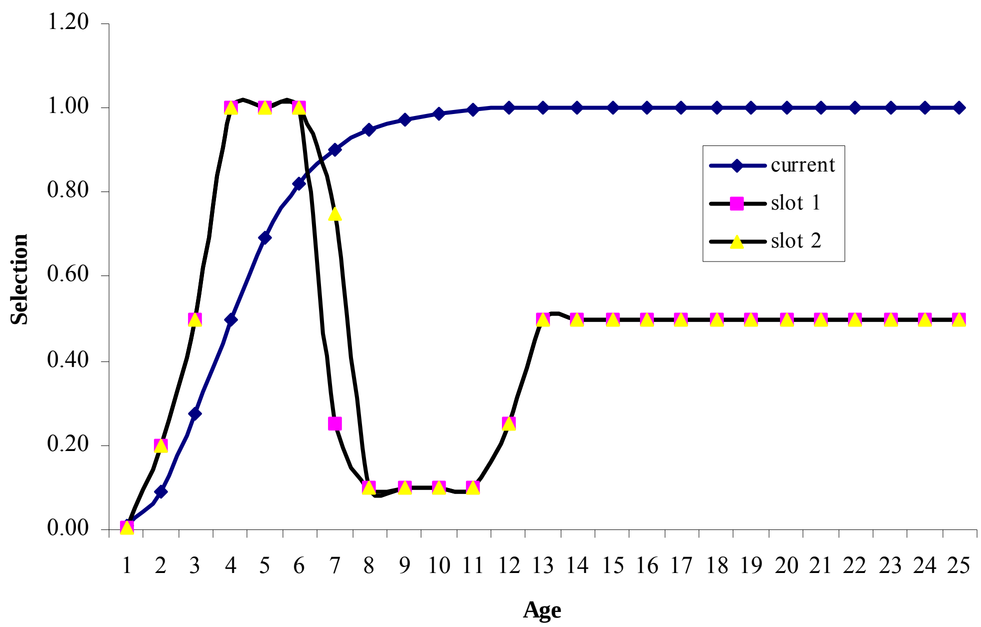


Figure 9. Selectivity at age for the current fishery and two alternative slot limits

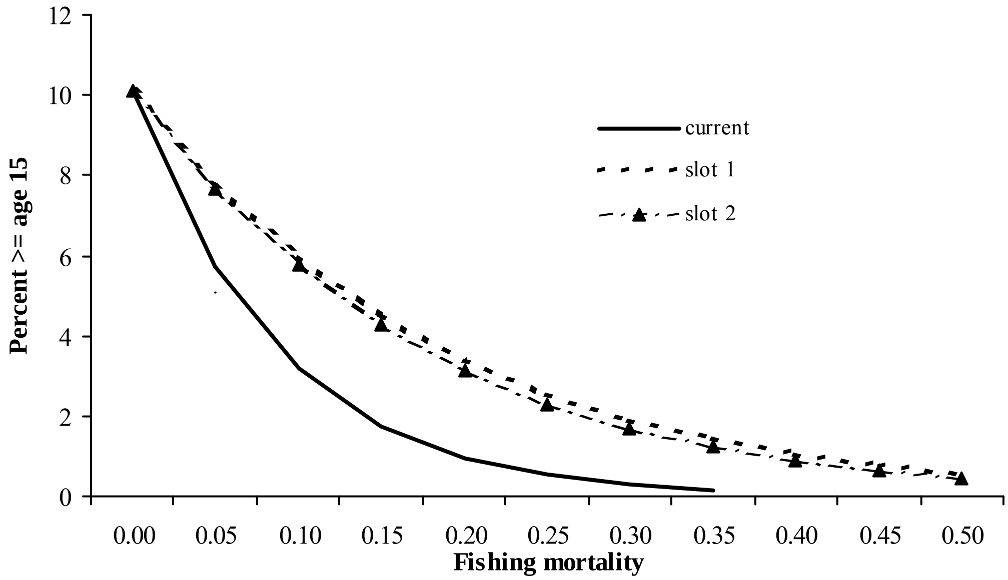


Figure 10. Percent of population age 15+ based on selectivity pattern and three regulatory scenarios

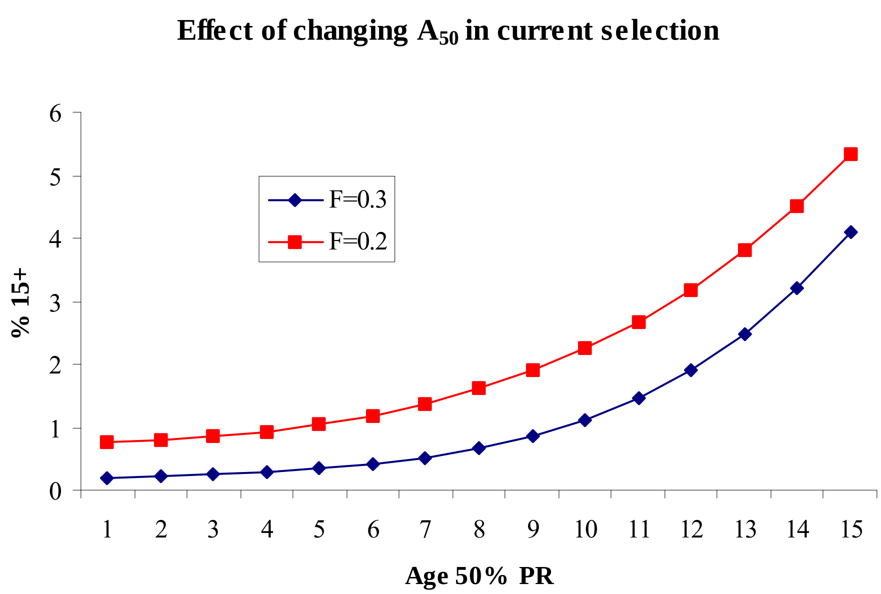


Figure 11. Percent of population age 15+ based on the age at 50 percent selection (1 to 15), under two fishing mortality levels (F = 0.20, and 0.30)

Task 7. Refine the age-length data used for the 2007 assessment using the stored otolith/scale samples processed in 2008 from striped bass 31 inches and larger.

The basic problem with scale ageing occurs primarily with older fish. As fish age, their growth per year declines. This decline is reflected in their scales, which expand by a smaller amount each year. Consequently, their annuli become harder to distinguish, because they become more crowded around the edge of the scales. In general, the annuli on otoliths do not become so crowded with age. Conversely, otoliths extraction kills fish and is more difficult and time-consuming than scale collection. Otoliths also take more time to process before they can be read. For these reasons, they are more difficult and expensive to collect and read. The Commission has been engaged in an effort to encourage states to obtain otoliths from older striped bass and the TC can now compare the ages from these two methods for a sample of fish. Patrick Campfield has been instrumental in co-coordinating this effort. Old Dominion University's Center for Quantitative Fishery Ecology processed the otoliths. Otolith data from several previous years is now available from the states of Virginia, Maryland, New Jersey, and Massachusetts. Delaware and several other states collected otoliths in 2008, but the otoliths have not been processed and read.

Figure 12 uses data collected by the Virginia Marine Resources Commission. The figure compares ages obtained from otoliths with ages obtained by reading scales from the same fish. The line shows perfect agreement between otolith and scale ages. Note that at older ages, the points lie below the line, indicating that scale ages are less than older ages for older fish. In this small sample, fish older than about 10 or 11 tend to have a lower age on average with scales than with otoliths. This means that if otoliths are used to age larger fish, the resulting estimate of the age structure of the striped bass stocks will be more extended with more old fish. This finding would result in lower estimates of mortality rates, since fish are living longer.

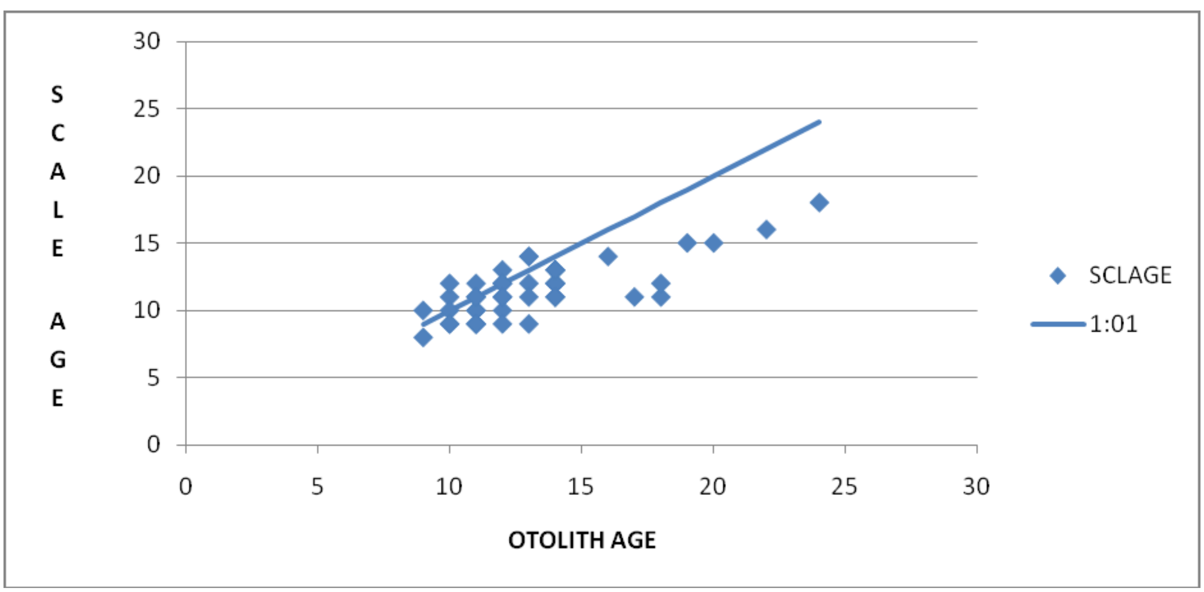


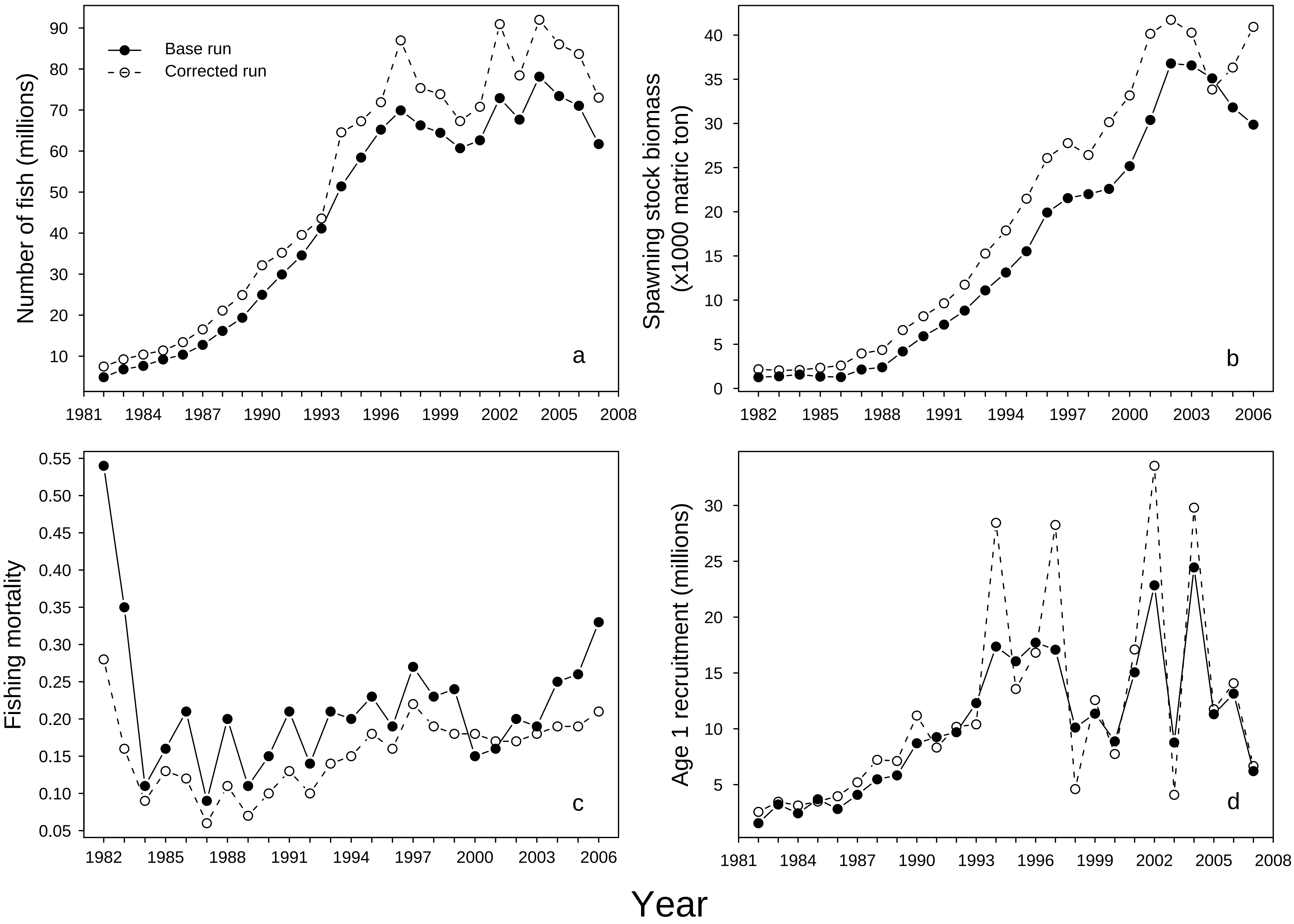
Figure 12. Comparison of otolith and scale age

Currently, however, the catch at age aggregates all fish age 13 and older in one group, referred to as the "plus" group. One reason for this is that ages of larger fish obtained from scales are considered less reliable. Second, when the Stock Assessment Subcommittee (SAS) ran the older ADAPT model on various groupings, the 13+ group performed best. However, if otolith ages were available for larger fish, the SAS could possibly revise the plus grouping.

The request from the Board asked to use otolith ages for fish greater than 31 inches and to revise the catch-at-age matrix to see what effect it would have. This would be a major project because each state has from two to several age-length keys each year. The SAS may investigate this issue this summer when developing the update stock assessment. One question is whether adequate numbers and distribution of otolith data exists.

A manuscript is in preparation on this subject by Hank Liao, Cynthia Jones, and Alexei Sharov. They used Virginia otolith data and converted the striped bass catch-at-age matrix from the 2007 assessment into otolith ages. They then analyzed the resulting modified catch-at-age matrix with ADAPT VPA.

The figures on the following page are from their manuscript comparing the two analyses, one with the scale ages, labeled the "Base Run" and the new model results, labeled the "Corrected Run". The upper figures portray the time series of stock numbers and spawning stock biomass through time. Notice that the "corrected" data using otolith ages resulted in stock size estimates that are 10% to 15% larger than the base run using scale ages. Spawning stock biomass estimated with otolith ages shows an increase in recent years, in contrast to the decline depicted with scale ages. The lower left figure depicts the time series of fully-recruited fishing mortality estimates. Otolith ages produce lower estimates of fishing mortality, indeed quite similar to the estimates obtained from the tag-recapture data, below 0.20 since 1997, which was also about the peak year in F estimated from the tag-recapture data. The last figure indicates that estimated recruitment based on otolith ages is much more erratic. The scale ageing tends to reduce differences between year classes, a well-known effect of ageing error. The various young-of-year indices produced by field surveys in the producing areas tend to be much more similar to the picture produced by otoliths.


Base run
Corrected run
Number of fish (millions)
a
Spawning stock biomass (x1000 matric ton)
b
Fishing mortality
c
Age 1 recruitment (millions)
d
Year