Northeast Fisheries Science Center Reference Document 08-12a

A Report of the 47th Northeast Regional Stock Assessment Workshop

47th Northeast Regional Stock Assessment Workshop (47th SAW)

Part A. Assessment Report

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

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FOREWORD

The Northeast Regional Stock Assessment Workshop (SAW) process has three parts: preparation of stock assessments by the SAW Working Groups and/or by ASMFC Technical Committees / Assessment Committees; peer review of the assessments by a panel of outside experts who judge the adequacy of the assessment as a basis for providing scientific advice to managers; and a presentation of the results and reports to the Region's fishery management bodies.

Starting with SAW-39 (June 2004), the process was revised in two fundamental ways. First, the Stock Assessment Review Committee (SARC) is now a smaller panel with panelists provided by the University of Miami's Independent System for Peer Review (Center of Independent Experts, CIE). Second, the SARC no longer provides management advice. Instead, Council and Commission teams (e.g., Plan Development Teams, Monitoring and Technical Committees) formulate management advice, after an assessment has been accepted by the SARC.

Reports that are produced following SAW/SARC meetings include: An *Assessment Summary Report* - a brief summary of the assessment results in a format useful to managers; this *Assessment Report* – a detailed account of the assessments for each stock; and the SARC panelist report – a summary of the reviewer's opinions and recommendations as well as individual reports from each panelist. SAW/SARC assessment reports are available online at http://www.nefsc.noaa.gov/nefsc/publications/series/crdlist.htm. The CIE review reports and assessment reports can be found at *http://www.nefsc.noaa.gov/nefsc/saw/*.

The 47th SARC was convened in Woods Hole at the Northeast Fisheries Science Center, June 16-20, 2008 to review one assessment (summer flounder *Paralichthys dentatus*). CIE reviews for SARC47 were based on detailed reports produced by the NEFSC Southern Dmersal Working Group. This Introduction contains a brief summary of the SARC comments, a list of SARC panelists, the meeting agenda, a list of working group meetings and a list of attendees (Tables 1 – 3). Maps of the Atlantic coast of the USA and Canada are also provided (Figures 1 - 4).

Outcome of Stock Assessment Review Meeting:

Based on the Review Panel reports (available at http://www.nefsc.noaa.gov/nefsc/saw/ under the heading "SARC 47 Panelist Reports"), the SARC review committee concluded that the assessment successfully met all of its terms of reference. The SARC felt that the extensive data for the assessment were correctly compiled, and the assessment was conducted in accord with good scientific practice. The review committee agreed that the 'ASAP' catch-age model best estimated stock status parameters, and that F35% and F40% were reasonable new proxies for the overfishing threshold and the target fishing mortality, respectively. The new assessment used a revised natural mortality rate value (changed from M = 0.20 to M = 0.25), which took account of differential longevity between the sexes. The SARC accepted this revision, but noted that model results are sensitive to M, and that estimation of M could be revisited in the future.

The SARC felt that: (1) combining separate surveys is a significant research question beyond the scope of this assessment; (2) treating zero catches from the survey as missing values was acceptable;

(3) alternative models were examined and adequately presented; (4) the final assessment model provides a credible basis for developing management advice; (5) the number of catch-at-age matrices and fleets that can be modeled separately is constrained by data availability; (6) spatial and temporal patterns in age compositions of both the commercial landings and trawl surveys were adequately explored; (7) sex ratios, and differences in growth and maturity between males and female summer flounder were explored, but only limited analyses could be undertaken as sex-specific data from the commercial and recreational fisheries (as well as from State surveys) are not available; and (8) the inclusion of certain environmental factors in the current model configurations did not improve model performance.

The SARC understood that a minimal number of projections were provided, and that additional projections would subsequently be prepared in consultation with fishery managers.

The SARC felt that comparison of the new assessment results with the "existing biological reference points" (developed in 2006) is not advisable - due to the changes this year in the assessment model and the yield per recruit inputs.

The SARC noted that the description of the commercial and recreational fisheries provided in the reports was incomplete. Furthermore, the Panel recommends that future reports contain a more synoptic and transparent description of the model specification and model building/selection procedures, including estimates of uncertainty in F/Fmsy and SSB/SSBmsy.

(EDITOR'S NOTE: The appendixes referred to in this Summer flounder Assessment Report are in Northeast Fisheries Science Center Reference Document (CRD) 08-12b.

Table 1. 47th Stock Assessment Review Committee Panel.

47th Northeast Regional Stock Assessment Workshop (SAW 47)
Stock Assessment Review Committee (SARC) Meeting

June 16-20, 2008
Woods Hole MA

SARC Chairman:

John T. Carmichael, chair
South Atlantic Fishery Management Council Office
4055 Faber Place Drive, Suite 201
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SARC Panelists (CIE):

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Table 2. Agenda, 47th Stock Assessment Review Committee Meeting.

47th Northeast Regional Stock Assessment Workshop (SAW 47)
Stock Assessment Review Committee (SARC) Meeting

Stephen H. Clark Conference Room – Northeast Fisheries Science Center
Woods Hole, Massachusetts

June 16 - 20, 2008
Sessions are open to the public, except where indicated.

DRAFT AGENDA (5-28-08)

TOPIC	PRESENTERS	RAPPORTEUR

Monday, 16 June (1:00 – 5:00 PM)……………………………………….………

Welcome	**James Weinberg**, SAW Chairman	
Introduction	**John Carmichael**, SARC Chairman	
Agenda		
Conduct of Meeting		
Summer flounder (A)	**M. Terceiro, J. Coakley, M. Maunder**	**Rich Wong**
SARC Discussion	**John Carmichael**	

Tuesday, 17 June (9 AM – Noon)……………………………………..……

Summer flounder (A) – finish presentations.

	M. Terceiro, J. Coakley, M. Maunder	**Rich Wong**
SARC Discussion	**John Carmichael**	

Tuesday, 17 June (1:15 PM – 5 PM)……..…………………………………

Q&A #1 between Reviewers and All Presenters, clarification of any issues. (Open Meeting)

		Rich Wong
SARC Discussion	**John Carmichael**	

Table 2 continued.

TOPIC	PRESENTERS	RAPPORTEUR

Wednesday, 18 June (9 AM – Noon) ………………………………….….……
SARC Panel deliberations/report writing (Closed Meeting).

Wednesday, 18 June (1:15 PM – 4 PM)……………………….….….……
Q&A #2 between Reviewers and All Presenters, clarification of any issues. (Open Meeting)

		Rich Wong
SARC Discussion	**John Carmichael**	

Wednesday, 18 June (4 PM – 5 PM) …………………………………….….……
SARC Report writing (Closed Meeting).

Thursday, 19 June (and possibly 20 June AM)………………………..……
SARC Report writing (Closed Meeting).

Table 3. 47th SAW/SARC, List of Attendees

Participation List
SARC 47
June 16-20, 2008

Name	Affiliation	Email Address
Mike Ruccio	NMFS/NERO	michael.ruccio@noaa.gov
Gary Shepherd	NMFS	gary.shepherd@noaa.gov
Emerson Hasbrook	Cornell Marine Program	ech12@cornell.edu
Bruce Freeman	JCAA	blfreeman@hotmail.com
James Fletcher	UNFM	123 Apple Rd # 27953
Bob O'Boyle	Beta Scientific	betasci@eastlink.ca
Eric Powell	Rutgers University	eric@hsrl.rutgers.edu
Paul Rago	NEFSC	paul.rago@noaa.gov
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John Carmichael	SAFMC	John.Carmichael@safmc.net
Kevin Stokes	SeaFIC	stokesk@seafood.co.nz
Mike Armstrong	CEFAS	Mike.Armstrong@cefac.co.uk
Rich Wong	DEDFW	
Yan Jiao	Virginia Tech	yjiao@vt.edu
Jim Weinberg	NEFSC	james.weinberg@noaa.gov

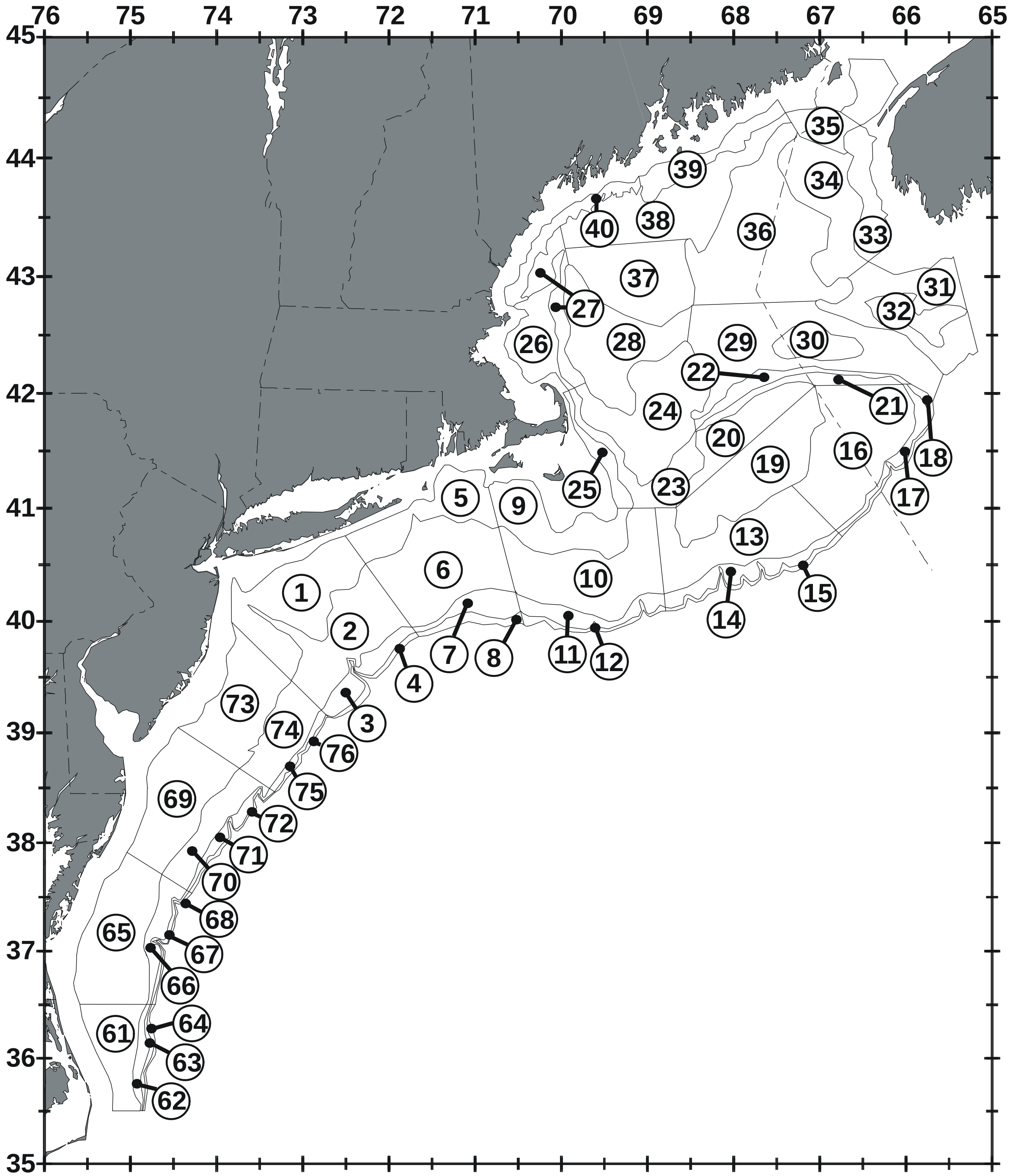

Figure 1. Offshore depth strata sampled during Northeast Fisheries Science Center bottom trawl research surveys.

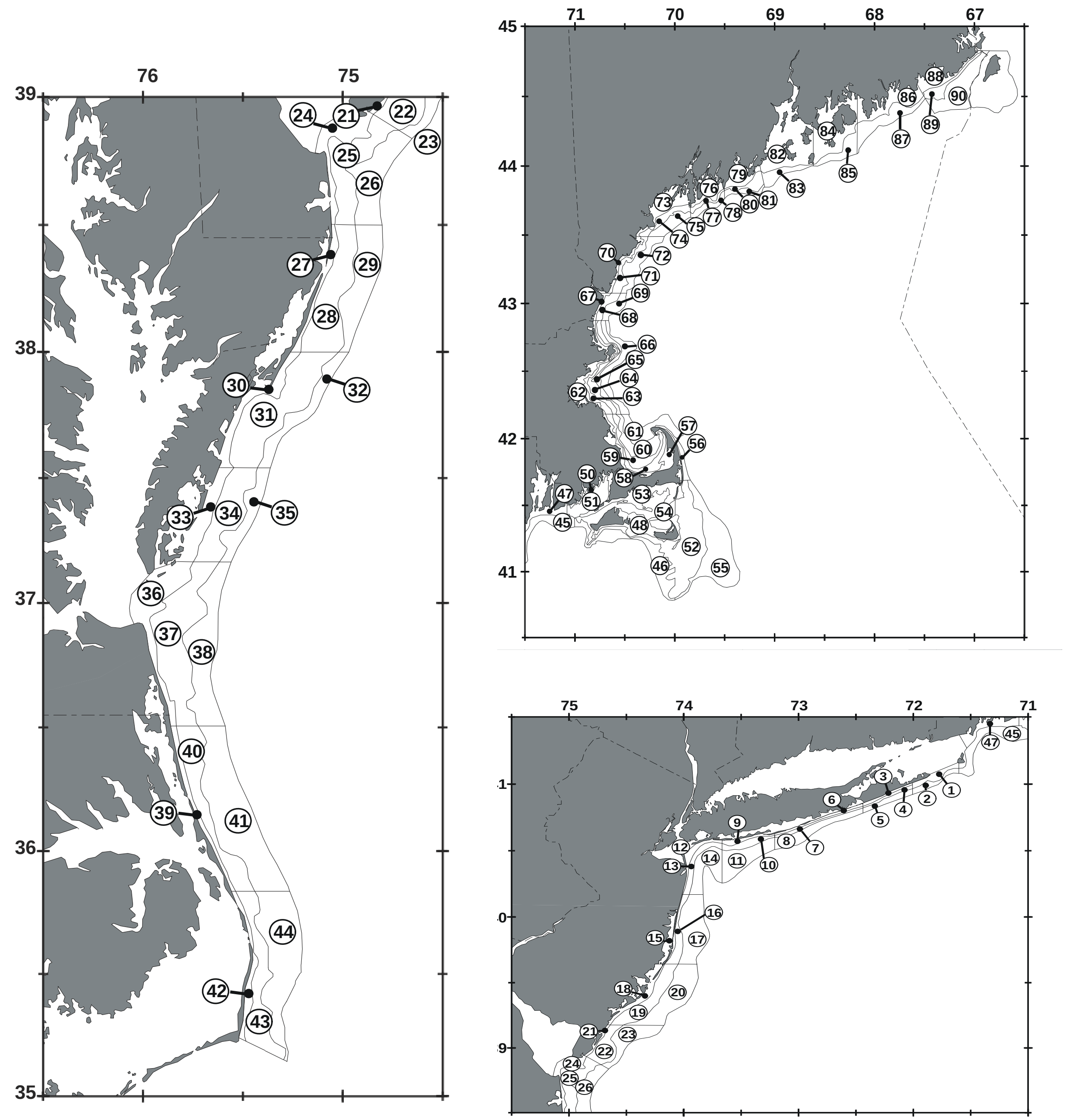

Figure 2. Inshore depth strata sampled during Northeast Fisheries Science Center bottom trawl research surveys.

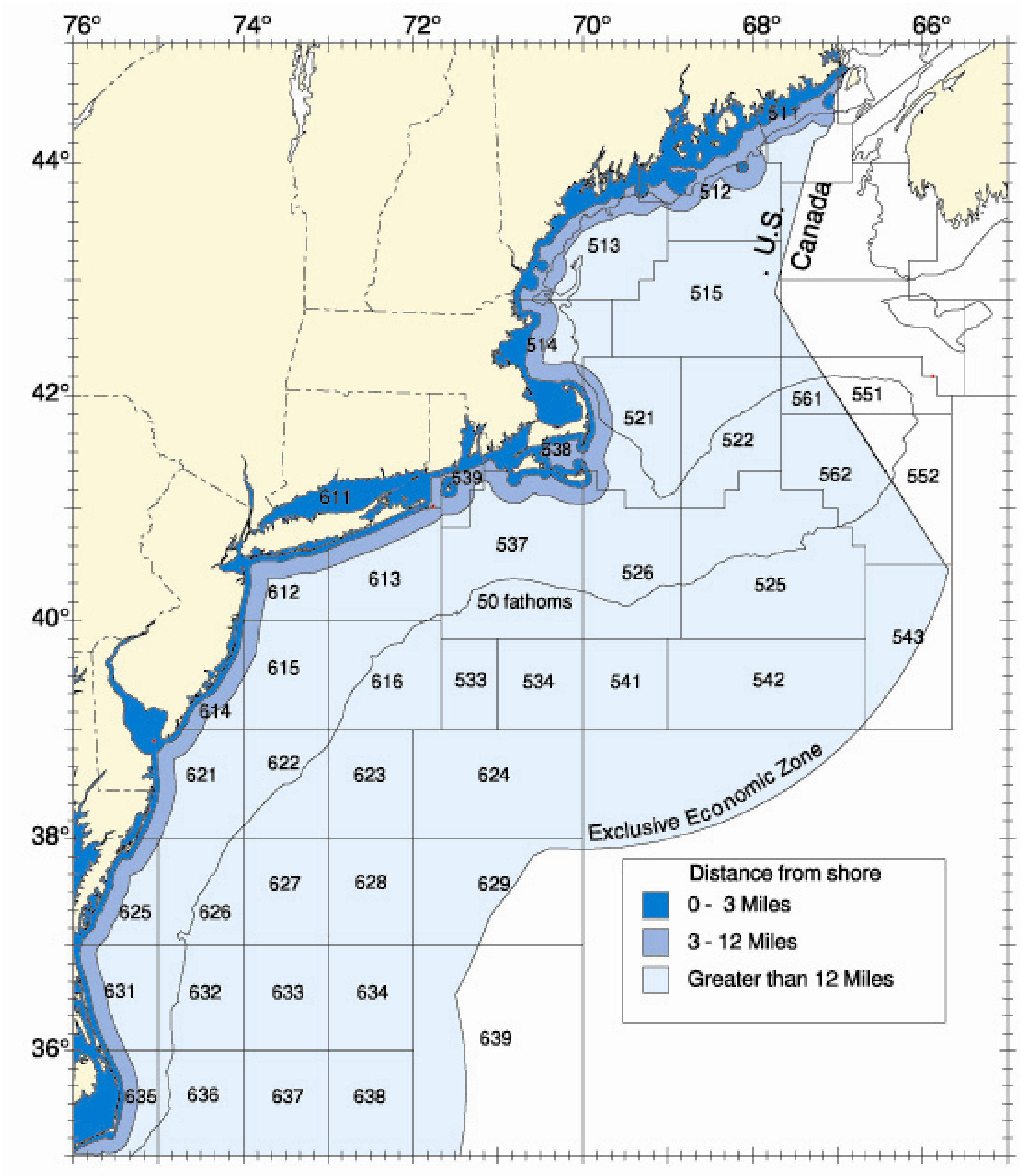

Figure 3. Statistical areas used for reporting commercial catches.

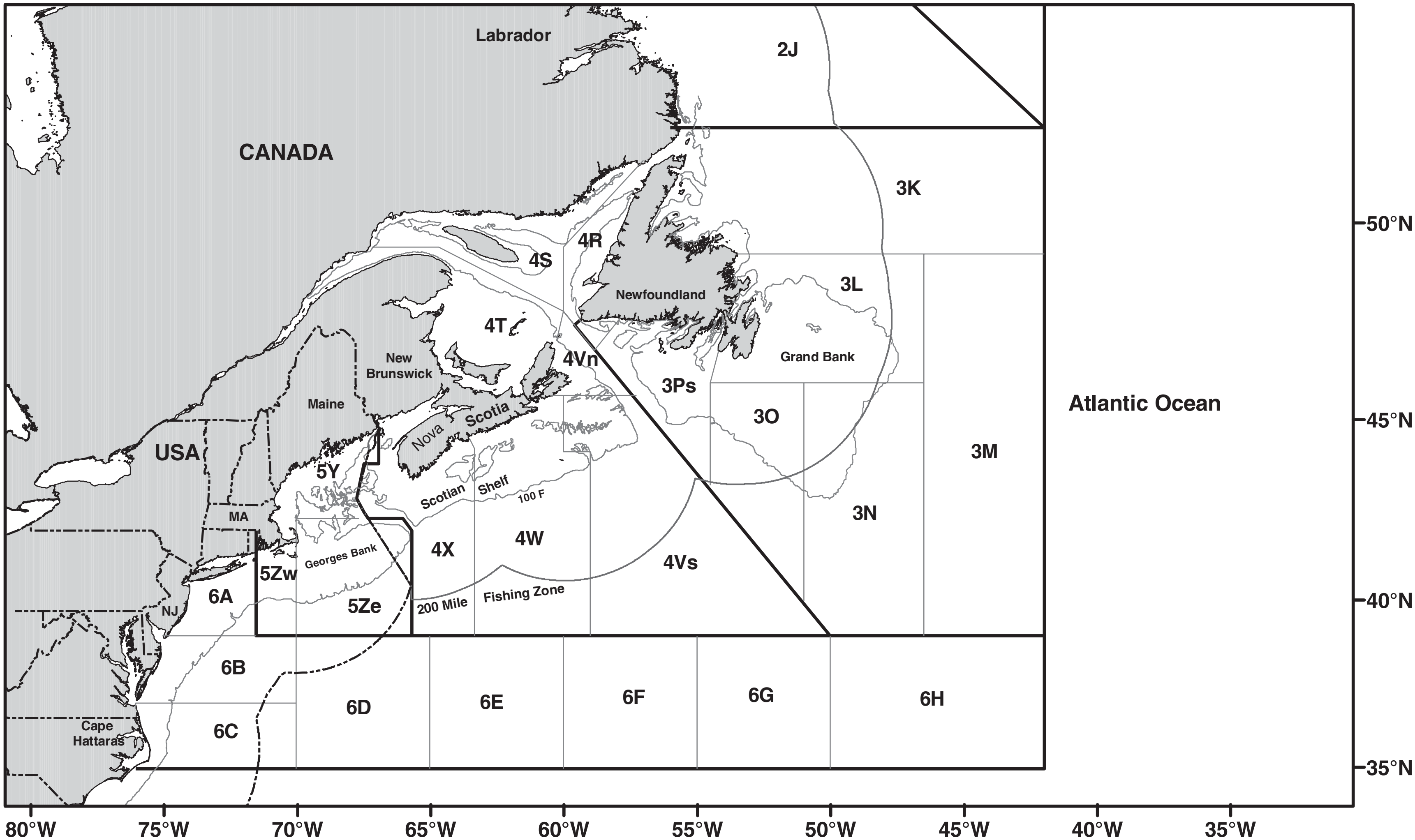

Figure 4. Catch reporting areas of the Northwest Atlantic Fisheries Organization (NAFO) for Subareas 3-6.

A. ASSESSMENT OF SUMMER FLOUNDER FOR 2008

by

SAW Southern Demersal Working Group
National Marine Fisheries Service
Northeast Fisheries Science Center
166 Water Street

EXECUTIVE SUMMARY

This June 2008 assessment of the summer flounder (*Paralichthys dentatus*) stock along the Atlantic coast (Maine to North Carolina) is an update through 2007 of commercial and recreational fishery catch data, research survey indices of abundance, and the analyses of the data. For 2007, commercial and recreational fishery final quotas were 4,401 mt and 3,030 mt, respectively, for a total of 7,431 mt. The first term of reference (TOR 1) was addressed and indicates that the reported commercial landings used in this assessment for 2007 were 4,489 mt, while estimated recreational landings were 4,445 mt, for a 2007 landings total of 8,934 mt. The 2008 commercial and recreational final quotas are 4,291 mt and 2,862 mt, respectively, for a total of 7,153 mt.

While the GLM integrated indices explored under TOR 2a provide a useful summary of mean survey trends, it was concluded that the use of integrated indices as VPA calibration input does not guarantee substantially more accurate or precise results than calibration using the original survey indices. Extensive work examining the effects of filling zero survey values under TOR 2b suggests that it is more appropriate to treat “zero” observations as “missing” in the survey series. Under TOR 3a there was consideration given to the use of a single catch at age matrix as has been done in previous assessments, two matrices for retained and discarded components of the fishery, and as many as six matrices; two matrices for retained and discarded components were used for this assessment. Exploratory analyses were conducted under TOR 3b to examine if some of the patterns observed in the summer flounder assessment (i.e. some retrospective pattern, large positive residuals primarily at ages 3 and 4 in NEFSC winter, spring, and CT, RI, and NJ indices) could be explained by changes in the spatial distribution of the commercial fishery and or the summer flounder stock. This work suggested that the development of assessment models which include a regional (spatial) component may be worthwhile. The assessment examined a variety of biological parameters (by year and sex), including maximum age, length-at-age, weight-at-age, growth rates, and sex ratios (TOR 3c). Consideration of the evidence to support an estimate of M (TOR 3d) resulted in the development of an abundance weighted combined sex M-schedule at age that ranged from 0.26 at age 0 to 0.24 at age 7+, with a mean of 0.25. Analyses were conducted to explore measured environmental factors such as regional water temperature anomalies and larger scale climate indices in relation to metrics of summer flounder recruitment success (TOR 6). Predictive relationships were not developed from this work.

Three modeling approaches were explored in detail for this assessment (TOR 4). A virtual population analysis (VPA) of commercial and recreational total catch at age (landings

plus discards) was conducted. In addition two statistical catch-at-age models were explored (Age Strucured Assessment Program [ASAP] and Stock Synthesis 2 [SS2]). The same suites of fishery-independent indices of recruitment and stock abundance were used in all three modeling approaches; these were developed from the Northeast Fisheries Science Center (NEFSC) winter, spring, and autumn surveys; Massachusetts spring and autumn surveys; Rhode Island survey; Connecticut spring and autumn surveys; and New Jersey trawl survey. Recruitment indices from surveys conducted by the states of North Carolina, Virginia, and Maryland were also used.

The Age-structured Assessment Program (ASAP) was selected as the best analytical tool to assess the summer flounder population and revised the biological reference points (TOR 5 and 7). The summer flounder stock is not overfished and overfishing is not occurring relative to the proposed 2008 assessment biological reference points. Fishing mortality calculated from the average of the currently fully recruited ages (3-7+) ranged between 1.143 and 2.042 during 1982-1996. The fishing mortality rate has declined to below 1.000 since 1996 and was estimated to be 0.288 in 2007, below the proposed fishing mortality reference point = F35% = FMSY = 0.310. There is an 80% probability that the fishing mortality rate in 2007 was between 0.253 and 0.325. Spawning stock biomass (SSB) declined from 24,674 mt in 1982 to 7,017 in 1989, then increased to 43,932 mt by 2004. SSB was estimated to be 43,363 in 2007, about 72% of the proposed SSB35% = SSBMSY reference point = 60,074 mt. There is an 80% chance that SSB in 2007 was between 39,325 and 48,122 mt. The arithmetic average recruitment from 1982 to 2007 is 41.6 million fish at age 0. The 1982 and 1983 year classes are the largest in the assessment time series, at 73.5 and 81.6 million fish; the 1988 year class is the smallest at only 12.8 million fish. The 2007 year class is estimated to be about 40.0 million fish, which is very close to the longterm average. The assessment has exhibited a retrospective pattern of underestimation of F and overestimation of SSB. There is no consistent retrospective pattern in recruitment evident. Over the last 3 years, the annual retrospective change in fishing mortality has ranged from +30 [2004] to -5% [2006]; over the last 3 years, the annual retrospective change in SSB has ranged from -29 [2004] to +6% [2006].

Future TALs (TOR 8) that correspond to fishing at or near the fishing mortality rate threshold (F35% = FMSY = 0.310) may result in overfishing if the assessment has underestimated F or overestimated B. Adopting TALs lower than those indicated by forecast median values would decrease the chance of overfishing. If landings in 2008 are 7,153 mt (15.8 million lbs; the 2008 TAL) and discards are 885 mt (2.0 million lbs), the forecast estimates a median (50% probability) F in 2008 = 0.238 and a median SSB on November 1, 2008 of 46,992 mt, above the proposed biomass threshold of one-half SSBMSY = 30,037 mt Fishing at Frebuild = 0.274 in 2009 results in forecast median (50%ile) landings of 9,211 mt (20.3 million lbs); the corresponding 25%ile of landings would be 8,653 mt (19.1 million lbs). Continued fishing at Frebuild = 0.274 during 2010-2012 is forecast to rebuild the stock to SSBMSY = 60,074 in 2012.

Current research recommendations were reviewed and new research recommendations were identified under TOR 9.

INTRODUCTION TO THE ASSESSMENT AND BACKGROUND

WORKING GROUP PROCESS

The Southern Demersal Working Group (WG) began work in 2007 to produce this benchmark assessment of summer flounder through 2007/2008. The WG met via conference call on November 2007 and in person in February 2008, April 2008, and May 2008. The Stock Assessment Workshop (SAW) was held during June 16-20, 2008 to present the benchmark assessment of summer flounder through 2007/2008 to the Stock Assessment Review Committee (SARC). The following scientists and managers participated in the WG meetings and benchmark assessment update:

Ken Able	Rutgers University
Jeff Brust	New Jersey Division of Fish and Wildlife (NJDFW)
Paul Caruso	Massachusetts Division of Marine Fisheries (MADMF)
Jessica Coakley (chair)	Mid-Atlantic Fishery Management Council (MAFMC)
Victor Crecco	Connecticut Department of Environmental Protection (CTDEP)
Greg DiDomenico	Garden State Seafood Association (GSSA)
Bruce Freeman	Partnership for Mid-Atlantic Fisheries Science (PMAFS)
Emerson Hasbrouck	Cornell University
Toni Kerns	Atlantic States Marine Fisheries Commission (ASMFC)
Laura Lee	Virginia Marine Resources Commission (VMRC)
Chris Legault	NMFS NEFSC
Brian Murphy	Rhode Island Department of Environmental Management, Division of Fish and Wildlife (RIDFW)
Mark Maunder	Quantitative Resource Assessment (QRA)
Paul Nitschke	NMFS NEFSC
Bill Overholtz	NMFS NEFSC
Eric Powell	Rutgers University
Paul Rago	NMFS NEFSC
Michael Ruccio	NMFS Northeast Regional Office (NMFS NERO)
Kathy Sosebee	NMFS NEFSC
Mark Terceiro	NMFS NEFSC
Alice Weber	New York Department of Environmental Conservation (NYDEC)
Greg Wojcik	Connecticut Department of Environmental Protection (CTDEP)
Richard Wong	Delaware Department of Fish and Wildlife (DEDFW)

Although they were unable to attend the meeting, David Simpson of the CTDEP, Don Byrne of the NJDFW, Stew Michels of the DEDFW, Steve Doctor of the Maryland Department of Natural Resources (MDDNR), Chris Bonzak of the Virginia Institute of Marine Science (VIMS), Rob O'Reilly of the VMRC, and Chris Batsavage of the North Carolina Division of Marine Fisheries (NCDMF) provided research survey and/or fisheries catch data used in the assessment.

STOCK UNIT

For assessment purposes, the previous definition of Wilk et al. (1980) of a unit stock extending from Cape Hatteras north to New England has been accepted in this and previous assessments (e.g., NEFSC 2002). The Mid-Atlantic Fishery Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plan (FMP) define the management unit for summer flounder as extending from the southern border of North Carolina, northward to the U.S.-Canadian border. A recent summer flounder genetics study, which revealed no population subdivision at Cape Hatteras (Jones and Quattro, 1999), is consistent with the definition of the management unit. Recent consideration of summer flounder stock structure incorporating new tagging data concluded that evidence supported the existence of stocks north and south of Cape Hatteras, with the stock north of Cape Hatteras possibly composed of two distinct spawning aggregations, off New Jersey and Virginia-North Carolina (Kraus and Musick, 2003). The conclusions of Kraus and Musick (2003) are consistent with the current assessment stock unit.

HISTORY OF MANAGEMENT AND THE ASSESSMENT

An overview of the history of the summer flounder FMP and assessment is provided in this section and the box below. Management of the summer flounder fishery began through the implementation of the original Summer Flounder FMP, which was approved by National Marine Fisheries Service in 1988. This 1988-1989 time period coincides with the lowest levels of stock biomass for summer flounder since 1982.

There are two management entities that cooperatively develop fishery regulations for this resource; the ASMFC and the MAFMC in conjunction with the National Marine Fisheries Service (NMFS) as the federal implementation and enforcement entity. The cooperative management endeavor was developed because a significant portion of the catch is taken from both state (0-3 miles offshore) and federal waters (3-200 miles offshore).

Amendment 1 to the FMP in 1990 established the fishing definition for summer flounder; it is the fishing mortality rate equal to F_{MAX}, initially estimated as 0.23 (NEFSC 1990). Amendment 2 (1992) established target fishing mortality rates for summer flounder for 1993-1995 as F = 0.53, and F_{MAX} = 0.23 for 1996 and beyond. Regulations enacted under Amendment 2 to meet those fishing mortality rate targets included: 1) an annual fishery landings quota, with 60% allocated to the commercial fishery and 40% to the recreational fishery, based on the historical (1980-1989) division of landings; the commercial allocation is further distributed among the states based on their share of commercial landings during 1980-1989; 2) commercial minimum landed fish size limit at 13 in (33 cm), as established in the original FMP; 3) a minimum mesh size of 5.5 in (140 mm) diamond or 6.0 in (152 mm) square for commercial vessels using otter trawls that possess 100 lbs (45 kg) or more of summer flounder, with exemptions for the flynet fishery and vessels fishing in an exempted area off southern New England (the Northeast Exemption Area) during 1 November to 30 April; 4) permit requirements for the sale and purchase of summer flounder; and 5) annually adjustable regulations for the recreational fishery, including seasons, a 14 in (36 cm) minimum landed fish size, and possession limits.

The results of previous assessments indicated that summer flounder abundance was not increasing as rapidly as projected when Amendment 2 regulations were implemented. In anticipation of the need to drastically reduce fishery quotas in 1996 to meet the management target of F_{MAX} , the MAFMC and ASMFC modified the fishing mortality rate reduction schedule in 1995 to allow for more stable landings from between years, while slowing the rate of stock rebuilding. Amendment 7 to the FMP set target fishing mortality rates of 0.41 for 1996 and 0.30 for 1997, with a target of F_{MAX} = 0.23 for 1998 and beyond. Total landings were to be capped at 8,400 mt (18.51 million lbs) in 1996-1997, unless a higher quota in those years provided a realized F = 0.23.

Amendment 12 (1999) defined overfishing for summer flounder as occurring when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Because F_{MSY} could not be reliably estimated for summer flounder, F_{MAX} = 0.24 was used as a proxy for F_{MSY}. This was also defined as the target fishing mortality rate (F_{TARGET}= F_{MSY}= F_{MAX}). Under this amendment, the stock was defined to be overfished when total stock biomass falls below the minimum biomass threshold of one-half of the biomass target, B_{MSY}. Because B_{MSY} could not be reliably estimated, the biomass target was defined as the product of total biomass per recruit and contemporary (1982-1996) median recruitment, at that time estimated to be 153,350 mt (338 million lbs), with the minimum biomass threshold defined as 76,650 mt (169 million lbs). Through the 1999 stock assessment (Terceiro 1999), those reference points were updated using updates of median recruitment (1982-1998) and mean weights at age (1997-1998), which resulted in a biomass target of 106,444 mt (235 million lbs) and minimum biomass threshold of 53,222 mt (118 million lbs). The Terceiro (1999) reference points were retained in the 2000 and 2001 stock assessments (NEFSC 2000, MAFMC 2001a) because of the stability of the input data. Concurrent with the development of the 2001 assessment, the MAFMC and ASMFC convened the ASMFC Summer Flounder Overfishing Definition Review Committee to review these biological reference points. The work of this Committee was later reviewed by the MAFMC Scientific and Statistical Committee (SSC) in August 2001. The SSC recommended that using the F_{MSY} proxy for F_{MAX} = 0.26 was appropriate and be retained for 2002, and endorsed the recommendation of SARC 31 (NEFSC 2000) which stated that "...the use of F_{MAX} as a proxy for F_{MSY} should be reconsidered as more information on the dynamics of growth in relation to biomass and the shape of the stock recruitment function become available" (MAFMC 2001b).

The benchmark stock assessment in 2002 (SAW 35; NEFSC 2002) indicated the summer flounder stock was overfished and overfishing was occurring relative to the current biological reference points. The fishing mortality rate had declined from 1.32 in 1994 to 0.27 in 2001, marginally above the overfishing reference point ($F_{THRESHOLD}$ = F_{TARGET} = F_{MAX} = 0.26). Total stock biomass in 2001 was estimated as 42,900 mt (94.6 million lbs), or 19% below the biomass threshold (53,200 mt; 117.3 million lbs). The review of the 2002 stock assessment (SARC 35) concluded that updating the biological reference points was not warranted at that time (NEFSC 2002). Updates to the stock assessment were completed in 2003 (Terceiro 2003a), 2004 (SDWG 2004), and 2005 (SAW 41; NEFSC 2005). While the 2003 assessment found the summer flounder stock was not overfished and no overfishing was occurring, the 2004 and 2005 assessments found the stock again experiencing overfishing. The 2005 SAW 41 assessment recommended updating the values for the fishing mortality and stock biomass reference points.

The most recent assessment peer review on summer flounder was the NMFS Office of Science and Technology Division (S&T) Peer Review of the 2006 SDWG assessment (October 2006; Terceiro 2006a, 2006b). This review made several recommendations, including modification of the definition of the overfished stock from what was originally defined under Amendment 2 to the FMP. Instead of using total stock biomass (as estimated on January 1), the stock was now considered overfished when November 1 spawning stock biomass fell below one-half SSBMSY = 44,706 mt (98.6 million lbs). The 2007 assessment update (SDWG 2007) found that relative to the biological reference points, the stock is overfished and overfishing is occurring. The fishing mortality rate estimated for 2006 was 0.35, a significant decline from the 1.32 estimated for 1994 but above the threshold F of 0.28. The assessment presented in this document builds off the recommendations of numerous peer reviews since the FMP was implemented that have facilitated methodological improvements in the assessment and reference point calculations.

Summary of the history of the Summer Flounder, Scup, and Black Sea Bass FMP.

Year	Document	Plan Species	Management Action
1988	Original FMP	summer flounder	- Established management plan for summer flounder
1991	Amendment 1	summer flounder	- Established an overfishing definition for summer flounder
1993	Amendment 2	summer flounder	- Established rebuilding schedule, commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements for summer flounder - Created the Summer Flounder Monitoring Committee
1993	Amendment 3	summer flounder	- Revised the exempted fishery line - Increased the large mesh net threshold - Established otter trawl retentions requirements for large mesh use
1993	Amendment 4	summer flounder	- Revised state-specific shares for summer flounder quota allocation
1993	Amendment 5	summer flounder	- Allowed states to combine or transfer commercial summer flounder quota
1994	Amendment 6	summer flounder	- Set criteria for allowance of multiple nets on board commercial vessels for summer flounder - Established deadline for publishing catch limits, commercial mgmt. measures for summer flounder
1995	Amendment 7	summer flounder	- Revised the F reduction schedule for summer flounder

Summary of the history of the Summer Flounder, Scup, and Black Sea Bass FMP.			
Year	**Document**	**Plan Species**	**Management Action**
1996	Amendment 8	summer flounder and scup	- Incorporated Scup FMP into Summer Flounder FMP and established scup measures including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements
1996	Amendment 9	summer flounder and black sea bass	- Incorporated Black Sea Bass FMP into Summer Flounder FMP and established black sea bass measures including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements
1997	Amendment 10	summer flounder, scup, and black sea bass	- Modified commercial minimum mesh requirements, continued commercial vessel moratorium, prohibited transfer of fish at sea, and established special permit for party/charter sector for summer flounder
1998	Amendment 11	summer flounder, scup, and black sea bass	- Modified certain provisions related to vessel replacement and upgrading, permit history transfer, splitting, and permit renewal regulations
1999	Amendment 12	summer flounder, scup, and black sea bass	- Revised FMP to comply with the SFA and established framework adjustment process
2001	Framework 1	summer flounder, scup, and black sea bass	-Established quota set-aside for research for all three species
2001	Framework 2	summer flounder	- Established state-specific conservation equivalency measures for summer flounder
2003	Amendment 13	summer flounder, scup, and black sea bass	- Addressed disapproved sections of Amendment 12 and included new EIS
2003	Framework 3	scup	- Allowed the rollover of winter scup quota - Revised start date for summer quota period for scup fishery
2003	Framework 4	scup	- Established system to transfer scup at sea
2004	Framework 5	summer flounder, scup, and black sea bass	- Established multi-year specification setting of quota for all three species
2006	Framework 6	summer flounder	- Established region-specific conservation equivalency measures for summer flounder
2007	Amendment 14	scup	- Established rebuilding schedule for scup
2007	Framework 7	summer flounder, scup, and black sea bass	- Built flexibility into process to define and update status determination criteria for each plan species - Scup GRAs made modifiable through framework adjustment process

TERMS OF REFERENCE

SARC 47 Summer flounder

1. Characterize the commercial and recreational catch, effort and CPUE, including descriptions of landings, discards and discard mortality.

2. Review methods for using fishery-independent surveys as abundance indices in assessment models.

    a. Evaluate whether to combine several of the surveys into a composite survey index. If appropriate, implement this approach.

    b. Develop and implement an appropriate statistical method to account for the probability of observing zeros in NEFSC survey tows.

3. Evaluate the feasibility of implementing alternative approaches to assess status of summer flounder stock and comment on any potential effects on estimates of F, SSB, and BRPs. Alternative approaches could consider:

    a. Separate Catch at age matrices for commercial and recreational fisheries, and resulting partial recruitment vectors for each fishery.

    b. Regional differences (north, south) in catch at age matrices.

    c. Potential gender differences in life span, growth rate, and natural mortality and implications of these factors for observed age- and length-specific sex ratios.

    d. Strength of evidence for natural mortality rate used in the assessment; Update the estimate if appropriate.

4. Compare results from alternative modeling approaches with those from the VPA model, to evaluate the robustness of VPA model results. Perform retrospective analyses of F, SSB, and recruitment for the models, and describe potential effects of retrospective patterns on assessment and rebuilding.

5. Based on the "best" model or models, estimate fishing mortality rate, recruitment, spawning stock biomass, and total stock biomass for the current year and characterize the uncertainty of those estimates. If possible, also include estimates for earlier years with uncertainty estimates.

6. Examine and evaluate the role of the environment on past and present summer flounder recruitment success.

7. Biological Reference Points

    a. Update or redefine biological reference points (BRPs; proxies for B_{MSY} and F_{MSY}), taking into account conclusions from earlier assessments and findings from TOR 6 (i.e., recruitment and the environment). Estimate uncertainty in BRPs. Comment on the scientific adequacy of existing and redefined BRPs.

b. Evaluate current stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 7a).

8. Stock Projections

a. Recommend what modeling approaches and data should be used for conducting single and multi-year stock projections, computing TACs or TALs, and measures of uncertainty.

b. If possible,

i. Provide numerical examples of short term projections (2-3 years) of biomass and fishing mortality rate, and characterize their uncertainty, under various TAC/F strategies and

ii. Compare projected stock status to existing rebuilding or recovery schedules, as appropriate.

9. Review, evaluate and report on the status of the Research Recommendations offered in recent SARC reviewed assessments and in the 2006 "Methot" Review.

1.0 Characterize the commercial and recreational catch, effort and CPUE, including descriptions of landings, discards and discard mortality.

1.1 Commercial Fishery Landings

Total U.S. commercial landings of summer flounder from Maine to North Carolina peaked in 1979 at nearly 18,000 mt (39.7 million lbs, Table 1, Figure 1). The reported landings in 2007 of 4,489 mt (9.89 million lbs) were slightly over the final 2007 quota of 4,401 mt (9.79 million lbs). Since 1980, about 70% of the commercial landings of summer flounder have come from the Exclusive Economic Zone (EEZ; greater than 3 miles from shore). Large variability in summer flounder landings exist among the states, over time, and the percent of total summer flounder landings taken from the EEZ has varied widely among the states.

Northeast Region (Maine to Virginia)

Annual commercial landings data for summer flounder in years prior to 1994 were obtained from trip-level detailed landings records contained in master data files maintained by the NEFSC (the "weighout system"; 1963-1993) and from summary reports of the Bureau of Commercial Fisheries and its predecessor the U.S. Fish Commission (1940-1962). Beginning in 1994, landings estimates were derived from mandatory dealer reports under the current NMFS Northeast Region (NER) summer flounder quota monitoring system.

Prior to 1994, summer flounder commercial landings were allocated to NEFSC 3-digit statistical area according to interview data (Burns et al. 1983). During 1994-2007, dealer landings were allocated to statistical area using fishing Dealer and fishing Vessel Trip Reports (VTR data) in a multi-tiered allocation procedure at the fishing-trip level (Wigley et al., 2007) A comparison of the distribution of landings by state and month as indicated by the dealer, VTR, and exact matched set data for trips with summer flounder landings during 1994-2007 is presented in Tables 2-15. Since the implementation of the annual commercial landings quota in 1993, the commercial landings have become concentrated during the first calender quarter of the year, with about 50% of the landings taken during the first quarter.

The distribution of Northeast Region (ME to VA) 1992-2007 landings by three-digit statistical area are presented in Table 16. Areas 537-539 (Southern New England), areas 611-616 (New York Bight), areas 621, 622, 625, and 626 (Delmarva region), and areas 631 and 632 (Norfolk Canyon area) have generally accounted for over 80% of the NER commercial landings. A summary of length and age sampling of summer flounder landings collected by the NEFSC commercial fishery port agent system in the NER is presented in Table 17. For comparability with the manner in which length frequency sampling in the recreational fishery has been evaluated, sampling intensity is expressed in terms of metric tons of landings (mt) per 100 fish lengths measured. The sampling is proportionally stratified by market category (jumbo, large, medium, small, and unclassified), with the sampling distribution generally reflecting the distribution of commercial landings by market category. Overall sampling intensity has improved markedly since 1995, from 165 mt per 100 lengths to 17 mt per 100 lengths (Table 17), and temporal and geographic coverage has generally improved as well (Tables 18-31).

The age composition of the NER commercial landings for 1994-2002 was generally estimated semiannually by market category and (usually) 1-digit statistical area (e.g., area 5 or area 6), using standard NEFSC procedures (market category length frequency samples converted to mean weights by length-weight relationships; mean weights in turn divided into landings to calculate numbers landed by market category; market category numbers at length apportioned to age by application of age-length keys, on semiannual area basis). For 2000-2002, sampling was generally sufficient to make quarterly estimates of the age composition in area 6 (in some cases, by division) for the large and medium market categories. For 2003-2007, sampling was generally sufficient to make quarterly estimates of the age composition in areas 5 and 6 for the jumbo, large, and medium market categories. The distribution of 1994-2007 length frequency samples by market category, 1- and 2-digit statistical area (division), and calendar quarter is presented in Tables 18-31.

NER landed numbers at age were raised to total NER (general canvas) commercial landings when necessary by assuming that landings not accounted for in the weighout/mandatory reporting system had the same age composition as that sampled. This was done as follows: calculate proportion at age by weight; apply proportions at age by weight to total NER commercial landings to derive total NER commercial catch at age by weight; divide by mean weights at age to derive total NER commercial landed numbers at age. The proportion of large and jumbo market category fish (generally of ages 3 and older) in the NER landings has increased since 1996, while the proportion of small market category landings (generally of ages 0 and 1) has become very low (Table 32, Figure 2). The mean size of fish landed in the NER commercial fishery has been increasing since 1993, and was 0.9-1.0 kg (2.0-2.2 lbs) during 2000-2007, typical of an age 3 summer flounder (Table 33).

North Carolina

The North Carolina winter trawl fishery accounts for about 99% of summer flounder commercial landings in North Carolina. A separate landings at age matrix for this component of the commercial fishery was developed from North Carolina Division of Marine Fisheries (NCDMF) length and age frequency sampling data. The NCDMF program samples about 10% of the winter trawl fishery landings annually, most recently (2005, 2006, and 2007) at a mean rate of 9 mt, 9 mt, and 5 mt of landings per 100 lengths measured, respectively (Table 34). All length frequency data used in construction of the North Carolina winter trawl fishery landings at age matrix were collected in the NCDMF program; age-length keys from NEFSC commercial data and NEFSC spring survey data (1982-1987) and NCDMF commercial fishery data (1988-2007) were combined by appropriate statistical area and semiannual period to resolve lengths to age. Fishery regulations in North Carolina also changed between 1987 and 1988, with increases in both the minimum mesh size of the codend and minimum landed fish size taking effect. It is not clear whether the change in regulations or the change in keys, or some combination, is responsible for the decreases in the numbers of age-0 and age-1 fish estimated in the North Carolina commercial fishery landings since 1987. Landed numbers at age (Figure 3) and mean weights at age from this fishery are shown in Tables 35-36.

1.2 Commercial Fishery Discards and Discard Mortality

In the 1993 SAW 16 assessment, analysis of variance of fishery observer data for summer flounder was used to identify stratification variables for an expansion procedure to estimate total landings and discards from the observer data kept and discard rates (weight per day fished) in the commercial fishery. Initial models included year, quarter, fisheries statistical division (2-digit area), area (divisions north and south of Delaware Bay), and tonnage class as main effects. Quarter and division consistently emerged as significant main effects without significant interaction with the year (NEFSC 1993). The estimation procedure expands transformation bias-corrected geometric mean catch (landings and discards) rates in year, quarter, and division strata by total days fished (days fished on trips landing any summer flounder by any mobile gear, including fish trawls and scallop dredges) to derive fishery landings and discards. The use of fishery effort as the multiplier (raising factor) allows estimation of landings from the fishery observer data for comparison with dealer reported landings, to help judge the potential accuracy of the procedure and/or sample data.

For strata with no fishery observer sampling, catch rates from adjacent or comparable strata were substituted as appropriate (except for Division 51, which generally has very low catch rates and negligible catch). Estimates of discard were stratified by 2 gear types (scallop dredges; trawls) for years when data were adequate (1992 and later years). Estimates at length and age were stratified by gear for 1994-2000 and 2002-2007, again due to sample size considerations. Only 11 fish were sampled from the sea scallop dredge fishery 2001, and so the scallop dredge discards were assumed to have the same length and age composition as the trawl fishery discards in 2001.

While estimates of catch rates from the NER fishery observer data were used in this assessment to estimate total discards, catch rate information is also reported in the VTR data. A comparison of discard to total catch ratios for the fishery observer and VTR data sets for trawl and scallop dredge gear indicates similar discard rates from the two data sources. Overall fishery observer and VTR discard to total catch ratios for 1994-2007 were generally within 10-15% of each other; 2001 was an exception, with an overall discard to total catch ratio of 49% in the fishery observer data and 29% in the VTR data.

The most recent year (2007) was also an exception with an overall discard to total catch ratio of 59% in the fishery observer data and 36% in the VTR data. Discard rates of summer flounder in the scallop dredge fishery were much higher than in the trawl fishery (Tables 37-38).

The change in mid-1994 from the interview/weighout data reporting system to the VTR/mandatory dealer report system required a change in the estimation of effort (days fished) to estimate total discards. An initial examination of days fished and catch per unit effort (CPUE; landings per day fished) for cod conducted at SAW 24 (NEFSC 1997a) compared these quantities as reported in the full weighout and VTR data sets (DeLong et al., 1997). This comparison indicated a shift to a higher frequency of short trips (trips with one or two days fished reported), and to a mode at a lower rate of CPUE. It was not clear at SAW 24 if these changes were due to the change in reporting system (units reported not comparable), or real changes in the fishery, and so effort data reported by the VTR system were not used quantitatively in the SAW 24 assessments. In the SAW 25 assessment for summer flounder (NEFSC 1997b), a slightly different comparison was made. The port agent interview data for 1991-93 and merged dealer/VTR data for 1994-1996 (the matched set data), which under each system serve as the "sample" to characterize the total commercial landings, were compared in relative terms (percent frequency). For summer flounder, the percent frequency of short trips (lower number of days fished per trip) increased during 1991-1996, but not to the degree observed for cod, and the mode of CPUE rates for summer flounder increased in spite of lower effort per trip. For the summer flounder fishery, these may reflect actual changes in the fishery, due to increased restrictions on allowable landings per trip (trip landings limits might lead to shorter trips) and stock size increases (higher CPUE). As for cod, however, the influence of each of these changes (reporting system, management changes, stock size changes) has not been quantified. Total days fished in the summer flounder fishery were comparable between the period from 1989-1993 and 1994 (Tables 39-45; WO DF and WO/VTR DF). Since 1994, total days fished have ranged from 20,670 days in 1999 to 8,872 days in 2007, with a mean of about 12,000 days, a substantial decline relative to the 1989-1993 mean of 22,000 days (Tables 46-73). Questions will remain about the accuracy of the VTR data. However, because the effort measure is critical to the estimation of discards for summer flounder, the VTR data were used as the best data source to estimate summer flounder fishery days fished for 1994-2007.

Two adjustments were made to the dealer/VTR matched data subset days fished estimates to fully account for summer flounder fishery effort during 1994-2007. First, the landings to days fished relationship in the matched set was assumed to be the same for unmatched trips, and so the days fished total in each discard estimation stratum (2-digit area and quarter) was raised by the dealer to matched set landings ratio. This step in the estimation accounted for days fished associated with trips landing summer flounder, and provided an estimate of discard for trips landing summer flounder (Tables 46-73, variable OB EST DISC 1).

Given the restrictions on the fishery however, there is fishing activity which results in summer flounder discards, but no landings, especially in the scallop dredge fishery. The days fished associated with these trips was accounted for by raising strata discard estimates by the ratio of the total days fished on trips catching any summer flounder (trips with landings and discard, plus trips with discard only) to the days fished on trips landing summer flounder (trips with landings and discard) (Tables 46-73, variable NO KEPT RATIO), for VTR trips reporting discard of any species (DeLong et al. 1997). For this step , it is necessary to assume that the discard rate (as indicated by the fishery observer data, which includes trips with discard but no landings, and which is used in previous estimation procedure steps) is the same for trips with only discards as for trips with both landings and discards.

Discard estimates for 1989-2007 are summarized in Tables 39-73 (variable OB EST DISC MT). Commercial fishery discard mortality in weight was highest in 1990-1991 and 1999, and lowest in 2004-2005 (Table 74). Estimates of landings from observer data ranged from +53% (1999) to -77% (2007) of the reported landings in the fisheries (Table 75), with discards ranging from 38% (1990) to 6% (1995) of the dealer reported landings. Total discards estimated for 2005, 2006, and 2007 were 10%, 10%, and 16% of the reported landings. Scallop dredge fishery discard to landed ratios are much higher than trawl fishery ratios, purportedly because of closures and trip limits. Although the scallop dredge landings of summer flounder are less than 5% of the total, the discards of summer flounder are of the same order of magnitude as in the trawl fishery.

The discard estimates described above were based only on the day fished data for ports in the NER during 1989-1996, and so it was necessary to raise the discard estimate to account for discarding occurring outside the NER reporting system (i.e., NER state reporting systems such as Connecticut and Virginia, and North Carolina). To determine the proper raising factor, landings accounted for by the NER reporting system (which result from the fishing effort on which the fishery observer discard estimate is based) were compared with total NER landings, plus that portion of North Carolina landings from the EEZ (it is assumed that only the North Carolina fishery in the EEZ would experience significant discard, as mesh regulations in state waters have resulted in very low discards in state waters since implementation of the regulation in 1989; R. Monaghan, NCDMF; personal communication, June 30, 1997). As a result of this exercise, the total discard estimates were raised by 11 to 38% for the 1989-1996 period. Since 1996, all states' landings and are included in the NER dealer reporting system, so no raising is necessary to account for missing landings. As recommended by SAW 16 (NEFSC 1993), a commercial fishery discard mortality rate of 80% was assumed to develop the final estimate of discard mortality (Table 66). The group did consider some preliminary information from a 2007 Cornell University Cooperative Extension study which conducted ten scientific trips that were made on inshore multispecies commercial trawling vessels to determine discard mortality rates relative to tow duration, fish size, and the amount of time fish were on the deck of the vessel (Working Paper 2; Appendix 1). The median mortality for all tows combined was 78.7%, very close to the estimated overall discard mortality of 80% currently used in the summer founder assessment. The mean of 64.6% however is considerably less. The SDWG recommended additional work be conducted to understand factors affecting discard mortality rates and the difference between the inshore (day-trip) and offshore (multi-day) components of the multispecies trawl fishery to facilitate future application of this information at a broader scale.

Existing fishery observer data were used to develop estimates of commercial fishery discard for 1989-2007. However, adequate data (e.g., interviewed trip data, survey data) are not available to develop summer flounder discard estimates for 1982-1988. Discard numbers were assumed to be very small relative to landings during 1982-1988 (because of the lack of a minimum size limit in the EEZ), but to have increased since 1989 with the implementation of fishery regulations under the FMP. It was recognized that not accounting directly for commercial fishery discards in 1982-1988 would result in an underestimation of fishing mortality and population sizes in these years.

NEFSC fishery observer length frequency samples were converted to sample numbers at age and sample weight at age frequencies by application of NEFSC survey length-weight relationships and fishery observer, commercial fishery, and survey age-length keys. Sample weight proportions at age were next applied to the raised fishery discard estimates to derive fishery total discard weight at age. Fishery discard weights at age were then divided by fishery observer mean weights at age to derive fishery discard numbers at age. Classification to age for 1989-1993 was done by semiannual (quarters 1 and 2 pooled, quarters 3 and 4 pooled) periods using NEFSC fishery observer age-length keys, except for 1989, when first period lengths were aged using combined commercial landings (quarters 1 and 2) and NEFSC spring survey age-length keys. For 1994-2007, only NEFSC winter, spring, and fall survey age-length keys were used, since fishery observer age-length keys were not yet available and commercial landings age-length keys contained an insufficient number of small summer flounder (<40 cm = 16 inches) that comprise most of the discards. Fishery observer sampling intensity and estimates are summarized in Table 74. Table 75 presents a comparison of commercial fishery dealer reported landings of summer flounder with estimates of summer flounder commercial landings from landings rates of NEFSC Domestic Observer sampling and commercial fishing effort (days fished) reported on commercial Vessel Trip Reports (VTR). Estimates of discarded numbers at age, mean length and mean weight at age are summarized in Tables 76-78.

The reason for discarding in the trawl and scallop dredge fisheries has been changing over time. During 1989 to 1995, the minimum size regulation was recorded as the reason for discarding summer flounder in over 90% of the observed trawl and scallop dredge tows. In 1999, the minimum size regulation was provided as the reason for discarding in 61% of the observed trawl tows, with quota or trip limits given as the discard reason in 26% of the observed tows, and high-grading in 11% of the observed tows. In the scallop fishery in 1999, quota or trip limits was given as the discard reason in over 90% of the observed tows. During 2000-2005, minimum size regulations were identified as the discard reason in 40-45% of the observed trawl tows, quota or trip limits in 25-30% of the tows, and high grading in 3-8%. In the scallop fishery during 2000-2005, quota or trip limits was given as the discard reason for over 99% of the observed tows. During 2006-2007, minimum size regulations were identified as the discard reason in 15-20% of the observed trawl tows, quota or trip limits in 60-70% of the tows, and high grading in 5-10%. In the scallop fishery during 2006-2007, quota or trip limits was given as the discard reason for about 40% of the observed tows, with about 50% reported as “unknown.” As a result of the increasing impact of trip limits, fishery closures, and high grading as reasons for discarding, the age structure of the summer flounder discards has also changed, with a higher proportion of older fish being discarded (Table 76, Figures 4 and 5).

The WG considered other methods for the calculation of the discard estimates (Working Paper 1; Appendix 1); but ultimately determined the current methods are appropriate for the current assessment (i.e. make no changes to the discard estimation approach used in the 2008 benchmark assessment). It was recommended, however, in the working paper that future work focus on trawl and scallop dredge gear; other approaches should be examined such as using sums of ratio (NBRD2) estimators with alternative landings or effort raising factors, possibly for a “characteristic” group of landed species trips in the trawl fishery (e.g., fluke, scup, black sea bass, *Loligo* and *Illex* squids, yellowtail flounder, winter flounder, cod, haddock, silver hake, etc.)

1.3 Recreational Fishery Landings

Summary landings statistics for the summer flounder recreational fishery (catch type A+B1) as estimated by the National Marine Fisheries Service (NMFS) Marine Recreational Fishery Statistics Survey (MRFSS) are presented in Tables 79 and 80. Recreational fishery landings decreased 19% by number and 12% by weight from 2006 to 2007, as the fishery landed 47% over (4,445 mt; 9.80 million lbs) the harvest limit established for 2007 of 3,030 mt (6.68 million lbs).

The commercial fishery VTR system provides an alternative set of reported recreational landings by the party/charter boat sector. A comparison of VTR reports and MRFSS estimates indicates that MRFSS estimates are higher by an average factor of 2.68 for the 1995-2007 period, with an increasing trend in recent years and ranging from a factor of 1.02 in 1998 to 5.47 in 2005 (Table 81). It is unclear if this is due mainly to under-reporting of party/charter boat recreational landings in the VTR system, or a systematic positive bias of MRFSS landings estimates for the party/charter boat sector.

Length frequency sampling intensity for the recreational fishery for summer flounder was calculated by MRFSS subregions (North - Maine to Connecticut; Mid - New York to Virginia; South - North Carolina) based on a metric tons of landings per hundred lengths measured basis (Burns et al. In Doubleday and Rivard, 1983). For 2007, aggregate sampling intensity averaged 132 mt of landings per 100 fish measured (Table 82).

MRFSS sample length frequency data, NEFSC commercial age-length data, and NEFSC survey age-length data were examined in terms of number of fish measured/aged on various temporal and geographical bases. Correspondences were made between MRFSS intercept date (quarter), commercial quarter, and survey season (spring and summer/fall), and between MRFSS subregion, commercial statistical areas, and survey depth strata to integrate data from the different sources. Based on the number, size range, and distribution of lengths and ages, a semiannual (quarters 1 and 2; quarters 3 and 4), subregional basis of aggregation was adopted for matching of commercial and survey age-length keys with recreational length frequency distributions to convert lengths to ages.

Limited MRFSS length sampling for larger fish resulted in a high degree of variability in mean length for older fish, especially at ages 5 and older during the first decade of the time series. Attempts to estimate length-weight relationships from the MRFSS biological sampling data provided unsatisfactory results. As a result, quarterly length (mm) to weight (g) relationships from Lux and Porter (1966) were used to calculate annual mean weights at age from the estimated age-length frequency distribution of the landings.

The recreational landings historically were dominated by relatively young fish. Over the 1982-1996 period, age 1 fish accounted for over 50% of the landings by number; summer flounder of ages 0 to 4 accounted for over 99% of landings by number. No fish from the recreational landings were determined to be older than age 7. With increases in the minimum size since 1996 (to 14.5 in [37 cm] in 1997, 15 in [38 cm] in 1998-1999, generally 15.5 in [39 cm] in 2000, and various state minimum sizes from 14.0 [36 cm] to 19.5 in [50 cm] in 2001-2007) and a trend to lower fishing mortality rates, the age composition of the recreational landings now includes mainly fish at ages 3 and 4. The number of summer flounder of ages 4 and older landed by the recreational fishery in 2007 (34% of the landings by number) was the highest in the time series (Table 83, Figure 6).

1.4 Recreational Fishery Discards and Discard Mortality

MRFSS catch estimates were aggregated on a subregional basis for calculation of the proportion of live discard (catch type B2) to total catch (catch types A+B1+B2) in the recreational fishery for summer flounder. The live discard has varied from about 18% (1985) to about 86% (2007) of the total catch during 1982-2007 (Table 84).

To account for all removals from the summer flounder stock by the recreational fishery, some assumptions about the biological characteristics and hooking mortality rate of the recreational live discard need to be made, because biological samples are not routinely taken of MRFSS catch type B2 fish. In previous assessments, data available from New York Department of Environmental Conservation (NYDEC) surveys (1988-92) of New York party boats suggested the following: 1) nearly all (>95%) of the fish released alive from boats were below the minimum regulated size (during 1988-92, 14 in [36 cm] in New York state waters); 2) nearly all of these fish were age 0 and age 1 summer flounder; and 3) age 0 and 1 summer flounder occurred in approximately the same proportions in the live discard as in the landings. It was therefore assumed that all B2 catch would be of lengths below regulated size limits, and be either age 0 or age 1 in all three subregions during 1982-1996. Catch type B2 was allocated on a semi-annual, subregional basis in the same ratio as the annual age 0 to age 1 proportion observed in the landings during 1982-1996. Mean weights at age were assumed to be the same as in the landings during 1982-1996.

The minimum landed size in federal and most state waters increased to 14.5 in (37 cm) in 1997, to 15.0 in (38 cm) in 1998-1999, and to 15.5 in (39 cm) in 2000. Applying the same logic used to allocate the 1982-1996 recreational released catch to size and age categories during 1997-2000 implied that the recreational fishery released catch included fish of ages 2 and 3. Investigation of data from the CTDEP Volunteer Angler Survey (VAS) for 1997-1999 and from the American Littoral Society (ALS) for 1999, and comparing the length frequency of released fish in these programs with the MRFSS data on the length frequency of landed fish below the minimum size, indicated this assumption was valid for 1997-1999 (MAFMC 2001a). The CTDEP VAS and ALS data, along with data from the NYDEC Party Boat Survey (PBS) was used to validate this assumption for 2000. For 1997-2000 all B2 catch was assumed to be of lengths below regulated size limits, and therefore comprised of ages 0 to 3. Catch type B2 was allocated on a sub-regional basis in the same ratio as the annual age 0 to age 3 proportions observed in the landings at lengths less than 37 cm in 1997, 38 cm in 1998-1999, and 39 cm in 2000.

In 2001, many states adopted different combinations of minimum size and possession limits to meet management requirements. As a result, minimum sizes for summer flounder ranged from 15.5 in (39 cm) in Federal, VA, and NC waters, 16 in (41 cm) in NJ, 16.5 in (42 cm) in MA, 17 in (43 cm) in MD and NY, to 17.5 in (44 cm) in CT, RI, and DE. Examination of data provided by MD sport fishing clubs, the CTDEP VAS, the ALS, and the NYDEC PBS indicated that the assumption that fish released are those smaller than the minimum size remained valid for 2001, and so catch type B2 was characterized by the same proportion at length as the landed catch less than the minimum size in the respective states. The differential minimum size by state has continued since 2001. For 2002-2007, increased samples of the recreational fishery discards by the CT VAS, NYDEC PBS, and the MRFSS For Hire Survey (FHS) has allowed direct characterization the length frequencies of the discards from sample data (Table 85).

Studies conducted to estimate hooking mortality for striped bass and black sea bass suggest a hooking mortality rate of 8% for striped bass (Diodati and Richards 1996) and 5% for black sea bass (Bugley and Shepherd, 1991). Work by the states of Washington and Oregon with Pacific halibut (a potentially much larger flatfish species, but otherwise morphologically similar to summer flounder) found "average hooking mortality...between eight and 24 percent" (IPHC, 1988). An unpublished tagging study by the NYDEC (Weber MS 1984) on survival of released sublegal summer flounder caught by hook-and-line suggested a total, non-fishing mortality rate of 53%, which included hooking plus tagging mortality as well as deaths by natural causes (i.e., predation, disease, senescence). Assuming deaths by natural causes to be about 18%, (an instantaneous rate of 0.20), an annual hooking plus tagging mortality rate of about 35% can be derived from the NYDEC results. In the SARC 25 (NEFSC 1997b) and earlier assessments of summer flounder, a 25% hooking mortality rate was assumed for summer flounder released alive by anglers.

However, two more recent investigations of summer flounder recreational fishery release mortality suggest that a lower release mortality rate is more appropriate. Lucy and Holton (1998) used field trials and tank experiments to investigate the release mortality rate for summer flounder in Virginia, and found rates ranging from 6% (field trials) to 11% (tank experiments). Malchoff and Lucy (1998) used field cages to hold fish angled in New York and Virginia during 1997 and 1998, and found a mean short term mortality rate of 14% across all trials. Given the results of these release mortality studies conducted specifically for summer flounder, a 10% release mortality rate was adopted in the Terceiro (1999) stock assessment and has been retained in all subsequent assessments. Ten percent of the total B2 catch at age is therefore the basis of estimates of summer flounder recreational fishery discard at age. In 2007, the number of fish discarded and assumed dead in the recreational fishery was 60% by number and 25% by weight of the total landed (Tables 84-86, Figure 7).

1.5 Total Catch Composition

NER commercial fishery landings and discards at age, North Carolina winter trawl fishery landings and discards at age, and MRFSS recreational fishery landings and discards at age totals were summed to provide a total fishery catch at age matrix for 1982-2007 (Table 88; Figure 8). The percentage of age-3 and older fish in the total catch in numbers has increased during the last decade from only 4% in 1993 to 68% in 2007. Overall mean lengths and weights at age in the total catch were calculated as weighted means (by number in the catch at age) of the respective mean values at age from the NER commercial (Maine to Virginia), North Carolina commercial, and recreational (Maine to North Carolina) fisheries (Tables 87-90; Figure 9). The recreational fishery component of the total summer flounder catch has generally increased since 1995 (Table 91; Figure 10).

2.0 Review methods for using fishery-independent surveys as abundance indices in assessment models.

Descriptions of the fishery independent surveys and their associated indices of recruitment and stock abundance are given below. A total of 51 age-specific indices were initially considered as input for the calibration of the assessment modeling frameworks. However, the final base run configurations for each of the modeling approaches under consideration (ADAPT VPA, ASAP, and SS2) included 39 survey indices at age (see section 4.2 for additional detail and discussion).

NEFSC spring

Long-term trends in summer flounder abundance were derived from a stratified random bottom trawl survey conducted in spring by NEFSC between Cape Hatteras and Nova Scotia since 1968 (Clark 1979). NEFSC spring survey indices suggest that total stock biomass last peaked during 1976-1977. The 2007 index (3.17 kg/tow) represents a time series high before falling by over half to 1.41 kg/tow in 2008 (Table 92, Figure 11). Age composition data from the NEFSC spring surveys indicate a substantial reduction in the number of ages in the stock between 1976-1990 (Table 93, Figure 12). For the period 1976-1981, fish of ages 5-8 were captured regularly in the survey, with the oldest individuals aged 8-10 years. From 1982-1986, fish aged 5 and older were only occasionally observed in the survey, and by 1986, the oldest fish observed in the survey were age 5. In 1990 and 1991, only three age groups were observed in the survey catch, and there was an indication that the 1988 year class was very weak. Since 1991, the survey age composition has expanded significantly. There is strong evidence in the 1998-2002 NEFSC spring surveys of increasing abundance of age-3 and older fish, due to increased survival of the 1994 and subsequent year classes. Mean lengths at age in the NEFSC spring survey are presented in Table 94.

NEFSC Autumn

Summer flounder are frequently caught in the NEFSC autumn survey at stations in inshore strata (< 27 meters = 15 fathoms = 90 feet) and at offshore stations in the 27-55 meter depth zone (15-30 fathoms, 90-180 feet) at about the same bathymetry as in the spring survey (Table 92). Furthermore, the autumn survey catches age-0 summer flounder in abundance, providing an index of summer flounder recruitment (Table 95, Figure 13). NEFSC autumn survey indices suggest improved recruitment since the late 1980s, and an increase in abundance of age-2 and older fish since 1995. The NEFSC autumn surveys indicate that the 1995 year class was the most abundant in recent years, and that subsequent, weaker year classes are experiencing increased survival (Table 95). Mean lengths at age in the NEFSC autumn survey are presented in Table 96.

NEFSC Winter

A new series of NEFSC winter trawl surveys was initiated in February 1992 to provide improved abundance indices for flatfish, including summer flounder. The surveys targeted flatfish when they are concentrated offshore during the winter. A modified 36 Yankee trawl was used that differed from the standard trawl employed during the spring and autumn surveys in that long trawl sweeps (wires) were added before the trawl doors to better herd fish to the mouth of the net, and the large rollers used on the standard gear were absent with only a chain "tickler" and small spacing "cookies" present on the footrope.

The design and conduct of the winter survey (timing, strata sampled, and the use of the modified 36 Yankee trawl gear) resulted in greater catchability of summer flounder compared to the other surveys. Most fish were captured in survey strata 61-76 (27-110 meters; 15-60 fathoms) off the Delmarva and North Carolina coasts. Other concentrations of fish were found in strata 1-12, south of the New York and Rhode Island coasts, in slightly deeper waters. Significant numbers of large summer flounder were often taken along the southern flank of Georges Bank (strata 13-18).

Indices of summer flounder abundance from the winter survey indicate stable stock size during 1992-1995, with catch per tow values ranging from 10.9 in 1995 to 13.6 in 1993 (Tables 93 and 97). For 1996, the winter survey index increased by 290% over 1995, from 10.9 to 31.2 fish per tow. The largest increases in 1996 occurred in the Mid-Atlantic Bight region (offshore strata 61-76), where increases up to an order of magnitude occurred in several strata, with the largest increases in strata 61, 62, and 63 off the northern coast of North Carolina. Most of the increased catch in 1996 consisted of age-1 summer flounder from the 1995 year class. In 1997, the index dropped to 10.3 fish per tow, due to the lower numbers of age-1 (1996 year class) fish caught. From 1998-2003, the Winter trawl survey indices increased; with the 2003 Winter survey number and weight per tow indices being the highest in the time series at 27.58 kg/tow (Tables 93 and 97, Figure 11). The Winter survey index was lower from 2004-2007, and values ranged from 10.3 to 15.9 fish per tow. Similar to the other NEFSC surveys, there is strong evidence in recent winter surveys of increased abundance of age-3 and older fish relative to earlier years in the time series (Table 98). Mean length at age in the NEFSC winter survey are presented in Table 99. TheWinter survey series ended in 2007.

Massachusetts DMF

Spring and fall bottom trawl surveys conducted by the Massachusetts Division of Marine Fisheries (MADMF) show a decline in abundance in numbers of summer flounder from high levels in 1986 to record lows in 1990 and 1991 (MADMF fall and spring survey, respectively). In 1994, the MADMF survey indices increased to values last observed during 1982-1986, but then declined substantially in 1995, although the indices remain higher than the levels observed in the late 1980s. Since 1996, both the MADMF spring and fall indices have increased to record high levels (Tables 100 and 101, Figure 14). The MADMF also captures a small number of age-0 summer flounder in a seine survey of estuaries, and these data constitute an index of recruitment (Table 102, Figure 15).

Connecticut DEP

Spring and fall bottom trawl surveys are conducted by the Connecticut Department of Environmental Protection (CTDEP). The CTDEP surveys show a decline in abundance in numbers of summer flounder from high levels around 1986 to record lows in 1989. The CTDEP surveys indicate recovery since 1989, and evidence of increased abundance at ages 2 and older since 1995. The 2003 spring and 2002 autumn indices were the highest in the respective time series; although index values decreased in 2004-2007 (Tables 103 and 104, Figure 16). An index of recruitment from the autumn series is available (Table 104, Figure 13).

Rhode Island DFW

Standardized bottom trawl surveys have been conducted since 1979 during the spring and fall months in Narragansett Bay and state waters of Rhode Island Sound by the Rhode Island Department of Fish and Wildlife (RIDFW). Indices of abundance at age for summer flounder have been developed from the autumn survey data using NEFSC autumn survey age-length keys. Survey indices show that the 1984-1987, 1999, 2000, and 2002 year classes are all strong. The autumn survey reached a time series high in 2003 (Table 105, Figure 14). An abundance index has also been developed from a set of fixed stations sampled monthly during 1990-2007. Age-1 indices from this series indicate that strong year classes recruited to the stock in 1996, 1999, 2000, 2002, and 2003 with age 2+ abundance peaking in 2003 (Table 106). Recruitment indices are available from both the autumn (Figure 15) and monthly fixed station surveys.

New Jersey BMF

The New Jersey Bureau of Marine Fisheries (NJBMF) has conducted a standardized bottom trawl survey since 1988. Indices of abundance for summer flounder incorporate data collected from April through October (Table 107, Figure 17). The NJBMF survey mean number per tow indices and frequency distributions were converted to age using the corresponding annual NEFSC combined spring and fall survey age-length keys. Indices of the 1995 year class at age-0 and at older ages in subsequent years indicate that this cohort is the strongest in the time series. Since 1998, most year classes are at or below average; however, the 2005 year class is above average (Figure 18).

Delaware DFW

The Delaware Division of Fish and Wildlife (DEDFW) has conducted a standardized bottom trawl survey with a 16 foot headrope trawl since 1980, and with a 30 foot headrope trawl since 1991. Recruitment indices (age 0 fish; one index from the Delaware estuary proper for 1980 and later, one from the inland bays for 1986 and later) have been developed from the 16 foot trawl survey data. Indices for age-0 to age-4 and older summer flounder have been compiled from the 30 foot headrope survey. The indices use data collected from June through October (arithmetic mean number per tow), with age 0 summer flounder separated from older fish by visual inspection of the length frequency. The 16 foot headrope survey indices suggest poor recruitment in 1983, 1988, and 1993, improved recruitment in 1994-1995, and above average recruitment in 2000 (Tables 108 and 109, Figure 18). The 30 foot headrope survey indices suggest stable stock sizes over the 1991-2001 time series, with strong recruitment in 1991, 1994, 1995, and 2000. The 2004 index from the 30 foot survey was a time series low, along with lower index values from 2002 onwards, with an increase in 2007 (Table 110, Figure 17). These lower index values presumably reflect decreased availability to the survey, rather than a true decrease in abundance.

Maryland DNR

The Maryland Department of Natural Resources (MDDNR) has conducted a standardized trawl survey in the seaside bays and estuaries around Ocean City, MD since 1972. Samples collected during May to October with a 16 foot bottom trawl have been used to develop a recruitment index for summer flounder for the period 1972-2007. This index suggests that weakest year class in the time series recruited to the stock in 1988 and the strongest in 1972, 1983, 1986, 1994, and 1998. The 2001 and 2007 index values were above average, while the 2002 to 2005 values were the lowest values in the last 10 years (Table 111, Figure 18).

Virginia Institute of Marine Science

The Virginia Institute of Marine Science (VIMS) conducts a juvenile fish survey using trawl gear in Virginia rivers and the mainstem of Chesapeake Bay. The time series for the rivers began in 1979. With the Bay included, the series is available only since 1988, but many more stations are included. Trends in the two time series are very similar. An index of recruitment developed from the rivers only series suggests weak year classes recruited to the stock in 1987 and 2005, with strong year classes recruiting during 1980-1984, and 1990, 1991, and 1994. Recruitment indices since 1990 have been below average (Table 112, Figure 19).

North Carolina DMF

The North Carolina Divisions of Marine Fisheries (NCDMF) has conducted a stratified random trawl survey using two 30 foot headrope nets with 3/4" mesh codend in Pamlico Sound since 1987. An index of recruitment developed from these data suggests weak year classes recruited to the stock in 1988 and 2000, with strong year classes in 1987, 1992, and 1996-1998, 2001, and 2002, and 2005 (Table 113, Figure 19). The survey normally takes place in mid-June, but in 1999 was delayed until mid-July. The 1999 index is therefore inconsistent with the other indices in the time series, and the 1999 value was excluded from the VPA calibration in the SARC 31 assessment (NEFSC 2000).

2.1 Evaluate whether to combine several of the surveys into a composite survey index. If appropriate, implement this approach.

2.1.1 Integration of Survey Indices

For this assessment, a working paper was prepared that examined methods to better integrate trends in abundance provided by survey indices, prior to their use in population model calibration. Past peer reviews of the summer flounder assessment (NEFSC 2005), as well as other Northeast species assessments, have recommended investigation of methods to better integrate trends in abundance provided by survey indices (state and federal), prior to their use in population model calibration. These recommendations stem, in part, from the realization that the abundance indices from some state surveys do not index trends for the entire stock, but merely components or substocks of the whole. While some state survey indices may in fact capture stock-wide trends, the peer-review panel research recommendations suggested that a method to statistically summarize and/or appropriately weight indices which are considered *a priori* to adequately characterize stock-wide trends - to Aintegrate them@ - will provide more reliable and transparent results than if the indices were simply used in their original form in Virtual Population Analysis (VPA) calibration. The complete working group paper is provided in Appendix 2. A summary of the methods and conclusions from this paper is provided below.

A GLM approach was used with research survey data to calculate integrated indices of abundance at age for use in a VPA calibration. Data from a recent NER assessment (NEFSC 2005) for summer flounder were used as an empirical test case. The time series of years for the fishery catch and research survey indices was 1982-2003/2004; the VPA calibration used survey indices at age (0-7+) from three seasonal NEFSC trawl survey series and 12 seasonal state surveys. The analytical approach is analogous to a GLM standardization analysis of commercial fishing vessel catch per unit effort data: with the Ayear@ main effect classification variable serves as the index of abundance, while the Asurvey@ classification variable is analogous to a Avessel@ classification variable, each with its= own time series of catch per unit effort that has some relationship to the underlying true abundance of the stock. The mean index of abundance is modeled as a log-linear function of the classification variables, with a log-normal error distribution assumption. The analysis could be expanded by including additional classification variables, such as the sampling gear type or tow duration, temporal variables (e.g., spring/fall; day/night) or environmental variables (e.g., water temperature anomalies). However, such details typically are not available for most assessments, and indices are most often presented as aggregate annual or seasonal indices at age. As configured here, the analysis provided average, or integrated, annual indices of abundance at age.

GLM models were constructed for ages 0, 1, 2, 3, 4, and 5-7+. Main effects were limited to the year of sampling (1982, 1983...2004) and the identity of the survey (NEFSC age 1, NEFSC age 2...NEFSC age 5-7+). The resulting year effect coefficients, corrected for lognormal-transformation bias and re-transformed to the original scale were used as a single index of abundance at age input to the VPA calibration in place of the original survey series. Results indicate that without the inclusion in the GLM model of significant main effects (beyond year of sampling and survey identity) that account for a large proportion of the variance of survey series at age from the simple overall means, use of a GLM to develop integrated indices at age provides no clear advantage over using the original indices as input to the VPA calibration. While the GLM integrated indices provide a useful summarization of mean survey trends, the use of integrated indices as VPA calibration input does not guarantee substantially more accurate or precise results than calibration using the original survey indices. The general linear modeling of integrated indices of abundance did provide a useful summarization of mean survey trends. However, the empirical example for summer flounder shows that the use of integrated indices as input to virtual population analysis calibration does not guarantee substantially more accurate or precise results than using the original survey indices.

2.2 Develop and implement an appropriate statistical method to account for the probability of observing zeros in NEFSC survey tows.

The problem of zeros in tuning indices is that a lognormal error distribution is assumed under many assessment frameworks. Since the logarithm of zero is undefined, these zero tuning indices must be either treated as missing data or else be replaced by a positive value. The issue of handling zero observations in the summer flounder assessment tuning indices is not new and has been addressed in a previous Southern Demersal Working Group (SDWG) working paper used in preparing the 2004 summer flounder assessment (SDWG 2003; beginning on page 8). That work responded to the 2002 SAW 35 (NEFSC 2002) summer flounder assessment Research Recommendation: *Explore the sensitivity of the VPA calibration to the addition of 1 and/or a small constant to values of survey series with "true zeros."* In the 2002 (NEFSC 2002) and 2003 (Terceiro 2003a) summer flounder assessments, the addition of the constant value of 1 was made for five age 0 recruitment indices: the MA DMF Seine, CT DEP fall trawl, RI DFW fall trawl, RI DFW monthly trawl, and DE DFW 16 foot bay trawl survey series (note that the latter series was not included in the final ADAPT VPA tuning configuration). No constant was added to survey series with "zero" observations for other age classes. The choice of the value of 1 as the additive constant was based on recommendations from statistical texts (e.g., Snedecor and Cochran 1967, Sokal and Rohlf 1981) for the ln-transformation of data.

Berry (1987) provides guidance on the objective selection of the appropriate value of the additive constant based on the statistical properties (skewness and kurtosis) of data series to be ln-transformed. Work using the procedures suggested by Berry (1987) with recreational fishery catch rates as indices of abundance indicated that the additive constant of 1 was an appropriate value for those data, typically with values between zero and 50 (Terceiro 2003b). The SDWG (2003) work applied the method suggested by Berry (1987) to summer flounder age 0 surveys with "zero" observations. Of the five age 0 series with "zero" observations, the MA DMF series varies between 0 and 70, while the other four series contained small values that varied between 0 and 1. The 2003 work (SDWG 2003) found that for the MA DMF series, the additive constant of 1 minimized the value of g. For the other four series, g was minimized by small values of the additive constant ranging from 0.001 to 0.1, with an "average" best additive constant of 0.1. The SDWG (2003) therefore recommended use of the revised, varying (1 or 0.1) additive constants in future assessments, and this revision was made in the 2004-2006 assessment, for age 0 survey series only. No constant was added for survey series of other age classes, pending further research.

The 2006 assessment of summer flounder (Terceiro 2006b) was subject to a NMFS Office of Science and Technology (S&T) Peer Review (Methot 2006). Among the recommendations made by the S&T Peer Review panel was the following:

The Panel finds that one immediate modification of the VPA is justifiable and reduces the retrospective pattern in stock size during 2003-2005. The VPA model currently treats survey observations of zero as missing values. An observation of zero for a particular age of fish in a particular survey year does not mean that there are no fish of that age in the stock, only that the number of survey samples was not sufficient to detect any fish of that age. This VPA model, as with most assessment models, tunes to the logarithm of the survey observations so cannot explicitly deal with observations of zero. However, treating these zeroes as missing values can result in a bias because time periods of low abundance are underrepresented in the data input to the assessment model. In the case of summer flounder, the result may be an underestimate of the degree to which the stock has rebuilt since the low levels that occurred around 1990. The committee did not discuss this issue during the Sept 14-15 meeting, so is not prepared to present a definitive solution. An interim approach would use a small value in place of the zeroes. A value equal to one sixth of the smallest observed positive value would be reasonable until a more complete statistical solution can be developed.

As a result, the 2006 summer flounder assessment was revised (Terceiro 2006b). The previous treatment of "zero" observations for age 0 indices was retained (additive constant of 1 for MA DMF seine survey, 0.1 for the CT DEP fall trawl, RI DFW fall trawl, RI DFW monthly trawl, and DE DFW 16 foot bay trawl surveys) and age-1-7+ survey observations of zero were replaced with values equal to one sixth of the smallest observed positive value for those series. Typically, the minimum non-zero value in these series was 0.01, and so the additive constant was 0.001667 (Terceiro 2006b).

To more fully understand the implications of this recommendation three working group papers were prepared in support of the current assessment to explore methods to address observed zeros in survey indices and to determine how zeros in the tuning indices should be handles in the current assessment. The complete working group papers are provided in Appendix 2. A summary of the methods and conclusions from these papers are provided below. In addition, the WG examined the findings of the ICES working group ICES working group report on this issue entitled " Report of the Working Group on Methods of Fish Stock Assessment" ICES WGMG Report 2007 (ICES CM 2007/RMC:04).

The first working paper on this subject conducted two types of simulation analyses. The first was a simple spreadsheet example of how a single artificially generated time series is impacted by different levels of fish detection. This artificial population (which exhibited a decline and increase) included values that were rounded to two, one, and zero decimal places creating observations of zero for 2, 4, and 7 years, respectively. A series of constants was added to the time series ranging from 0.0001 to 10 so that the holes were filled and new catchability coefficients were calculated that minimized the difference between the true population and the observed [modified] survey time series. The differences between observed and predicted values depend strongly on the constant added to the time series. However, the more disturbing result demonstrated is that the addition of a constant value to replace the zeros in a survey time series artificially imposed a pattern that may not match the actual pattern in the population. This is most clearly seen in the round 0 case where seven zeros are filled with the same value even though the true population declines then increases during the seven year period.

The second simulation conducted generated many random sets of data for VPA from a known case, created zeros for some of the indices in some years, and compared different methods for dealing with these zeros, and including treating them as missing values, replacing the zeros with a fixed small value, and the one sixth of the smallest observation rule. The simulated population was loosely based on the summer flounder assessment with the population; exhibiting a population decline and increase, spanned 24 years, consisting of 8 age classes (last age class as a plus group), M=0.2, and variable recruitment and F. One index was generated for each age and the suites of identical (age-specific) indices were given four different treatments: Case 1 - actual values used, Case 2 - replaced with 0.0 and treated as missing, Case 3 - replaced with the arbitrary constant 0.01, Case 4 - replaced with 0.0 then a constant of 1/6 times the smallest non-zero element in the index vector added to all index vector elements including zeros. The median values of F and N at age from the 100 realizations of the VPA model under the four cases were compared with the true values from the simulated population. Due to the convergence properties of VPA, the medians from the 4 cases are essentially identical for years 1982-1994. The most striking feature seen is the poor performance of Case 3 (arbitrary constant of 0.01), with values well below the true values while the estimated population abundances were well above the true values, demonstrating the potential for introducing bias by replacing zeros in tuning index time series with an arbitrary constant. While not as clear, generally the Case 4 (add 1/6 of smallest non-zero element) estimates were more biased than the Case 2 (treat zeros as missing) estimates. The exception to this generality is seen in age 1 results where the VPA formulation had to be modified slightly to estimate only ages 3-8 in the terminal year +1 due to the lack of information for age 2 in the terminal year +1 when the index was zero. For older ages, Case 2 actually outperformed Case 1 (all data used) relative to the truth. It is not clear why this happened and may be an artifact of the bias introduced by the mis-ageing matrix used to generate the catch data. However, even if Case 1 is used as the basis for comparison, instead of the true values, Case 2 performs at least as well as Case 4 for all ages except age 1.

An alternative method to determining the constant to use in place of zeros consists of finding the constant that minimizes a function of the skewness plus kurtosis of the raw data Berry (1987). This approach was not considered appropriate for use with tuning index data because the residuals are assumed to follow a lognormal distribution, not the raw observations.

While the 1/6 of the smallest non-zero approach appears to provide reasonable results in some cases, it is an arbitrary rule. In some situations, 1/5 or 1/7 of the smallest non-zero index value would perform better than 1/6. However, filling zeros with a constant value, no matter how that constant is selected, creates a pattern that may not match reality and has the potential to bias the results. The simulations in this working paper demonstrated show that this approach can produce results further from the truth than treating zeros as missing values. In reality, zeros do have information; but results should be checked to ensure that predicted values are not high when index is zero. These two simulation studies demonstrated problems that can arise when tuning indices with zero values are replaced with arbitrary constants. This practice assumes that the correct magnitude can be chosen to fill the zeros and that it is better to provide the model with information that the index is low rather than treat the data as missing. Results demonstrate that this premise is not always correct. Thus, this working paper recommends the NEFSC treat zero values in tuning indices for VPA as missing values.

The second working paper on this subject included a simple regression example to further examine the consequences of adding 1/6 of the smallest non-zero value in tuning series to all values from that series. A 26 year population time series was simulated, with each value varying uniformly between zero and 50,000 fish. Four time series of values were created either with or without a constant of 1/6 of the smallest non-zero value (+c) in the observed time series: ln(obs), ln(obs+c), ln(pred), and ln(pred+c) where ln(obs) was missing when the observed value was zero. Two slopes were computed, one for ln(obs) vs ln(pred) denoted “missing” and the other for ln(obs+c) vs ln(pred+c) deonted “add c.” Since in both cases the only source of error is the lognormal error assumed around the observed values, the expectation is that both lines will have slope equal to one. Random series of populations and observation errors were drawn 10,000 times and the two slopes computed for each realization.

When zero observations were treated as missing, the slope was slightly negatively biased (mean 0.983; 90% CI (0.864, 1.109)) and when a constant of 1/6 the smallest non-zero value was added to all observed and predicted values, the slope was highly positively biased (mean 1.261; 90% CI (1.018, 1.483)). Note that the 90% confidence interval for the “add c” case does not overlap one and has a range nearly twice as large as the “missing” case. Under this regression example, the constant was added to both observed and predicted data because to ensure an appropriate comparison. However, in a separate simulation the author did not replace values less than 0.5 with zero and found nearly identical distributions for the “missing” and “add c” slopes; which demonstrated that filling of zeros causes the problem, not the addition of a constant. In order for the “add c” approach to be unbiased, the constant would have to be selected for each realization such that the average of the ln(pred+c) was the same as ln(obs+c) for the values when obs=0. This cannot happen because the predicted values are positive while the observed values are by definition set to zero. Thus, adding a constant to all values when a zero is in the time series will always bias the results. Therefore, the regression example documented in this working paper suggest that filling observed zeros in tuning indices causes a bias relative to the true population that is much greater than the bias introduced by treating the zeros as missing in this simple regression example.

A third working paper on this subject applied the Berry (1987) approach to the summer flounder survey series for all ages with observed “zeros” to determine the best additive constant to use to remove these “zero” observations from the ADAPT VPA calibration data. There were 24 survey series examined and these are characterized by non-zero values between 0.001 and 70, CVs that generally exceed 100%, positive skewness (long right hand tail), and significant kurtosis (high degree of peak, or contagion, near the mean). The proportion of “zeros” in the time series ranged from 1 of 31 = 3% (NEFSC Spring Age 3 index) to 13 of 28 = 46% (MA Fall 4).

Briefly, the methodology of Berry (1987) consists of 1) addition of a range of constants from very large (e.g., 100) to very small (e.g., 0.0001) to the original values in the series, 2) ln-transformation of the modified series, 3) calculation of the skewness and kurtosis of the modified series, and 4) summation of the absolute value of the skewness and kurtosis (providing the statistic g) of the modified series. The additive constant that minimizes g for a given series of data is the one that best minimizes the effect of outliers and normalizes residuals from the lognormal error distribution, hence best adhering to the assumption of the lognormal distribution. These methods applied to the 24 series produced values of g that were minimized for constants between 0.001 and 100, for the age 0, 1, 2, 3, 4, and 5-7+ (aggregate) survey indices (number per tow or haul). There was no statistically significant correlation between the value of the additive constant that minimizes g and the given statistical parameters. Examination of these results for the age-specific indices demonstrated that there is no consistent pattern in the identification of the additive constant that minimizes the absolute value of Berry's (1987) g statistic. There is no strong relationship between the absolute magnitude of the index values, the length of the time series, the number of zeros, the magnitude of the smallest observed value, or any of the usual statistical moments of the series (mean, maximum, non-zero minimum, CV, skewness, kurtosis), and the value of the additive constant that minimizes g. Further, while the "one-sixth" of the minimum observed value was identified as the "best" additive constant in 5 of the 24 (21%) cases examined, this level is not high enough to justify this approach as a reliable rule-of-thumb. In fact, the additive constant of 0.01 was identified as "best" for a higher percentage of series (6 of 24 = 25%). Given the inability to identify a constant that consistently minimizes g, the best rule is to maintain the current approach of making no adjustment and continue to treat "zero" observations as "missing."

The three working group papers developed for the current assessment all suggest that it is more appropriate to treat "zero" observations as "missing" in the survey series. The ICES "Report of the Working Group on Methods of Fish Stock Assessment" ICES WGMG Report 2007 (ICES CM 2007/RMC:04), suggests that it may be more appropriate to change the models to assume an error structure other than lognormal, as opposed to filling zero values in the survey series with small positive values.

3.0 Evaluate the feasibility of implementing alternative approaches to assess status of summer flounder stock and comment on any potential effects on estimates of F, SSB, and BRPs.

BIOLOGICAL DATA

Aging

Work performed for the SAW 22 assessment (NEFSC 1996b) indicated a major expansion in the size range of 1-year old summer flounder collected during the 1995 and 1996 NEFSC winter bottom trawl surveys. This also brought to light differences between ages determined by NEFSC and NCDMF fishery biology staffs; therefore, age structure (scale) exchanges were performed after the SAW 22 assessment to explore these differences. The results of the first two exchanges, reported at SAW 22 (NEFSC 1996b), indicated low levels of agreement between age readers at the NEFSC and NCDMF (31 and 46%). In 1996, research was conducted to determine inter-annular distances and to back-calculate mean length at age from scale samples collected on all NEFSC bottom trawl surveys (winter, spring and fall) for comparison with NCDMF samples. While mean length at age remained relatively constant from year to year, inter-annular distances increased sharply in the samples from the 1995-1996 winter surveys, and increased to a lesser degree in samples from other 1995-1996 surveys. As a result, further exchanges were suspended pending the resolution of an apparent aging problem.

Age samples from the winter 1997 bottom trawl survey, aged utilizing both scales and otoliths by only by one reader, indicated a similar pattern as the previous two winter surveys (i.e., several large age 1 individuals), and some disagreement between scale and otolith ages obtained from the same fish. Because of these problems, a team of five experienced NEFSC readers was formed to re-examine the scales aged from the winter survey. After examining several hundred scales, the team determined that re-aging all samples from 1995-1997 would be appropriate, including all winter, spring, and fall samples from the NEFSC and MA DMF bottom trawl surveys and all samples from the commercial fishery. The age determination criteria remained the same as those developed at the 1990 summer flounder workshop (Almeida et al. 1992) and described in the aging manual utilized by NEFSC staff (Dery 1997). Only those fish for which a 100% agreement of all group members was attained were included in the revised database, however. The data from the re-aged database were used in analyses in the SAW 25 assessment (NEFSC 1997b).

A third summer flounder aging workshop was held at the NEFSC in February, 1999, to continue the exchange of age structures and review of aging protocols for summer flounder (Bolz et al. 2000). Participants at this workshop concluded that the majority of aging disagreements in recent NEFSC-NCDMF exchanges arose from the interpretation of marginal scale increments due to highly variable timing of annulus formation, and from the interpretation of first year growth patterns and first annulus selection. The workshop recommended regular samples exchanges between NEFSC and NCDMF, and further analyses of first year growth. Recently, Sipe and Chittenden (2001) concluded that sectioned otoliths were the best structure for aging summer flounder over the age range from 0 to 10 years. Since 2001, both scales and otoliths have routinely been collected in all NEFSC trawl surveys for fish larger than 60 cm, and studies are underway to determine the best structure to use for aging these large summer flounder. An exchange of NEFSC and NCDMF aging structures for summer flounder occurred again in 2006, after the SAW SDWG listed the age sample exchange as a high research priority. This exchange examined samples from fish aged 1 to 9 (23-76 cm total length) and determined that the current consistency of aging between NCDMF and the NEFSC is at an acceptable level.

Maturity

The maturity schedule for summer flounder used in the 1990 SAW (SAW 11) and subsequent stock assessments through 1999 was developed by the SAW 11 Working Group using NEFSC Fall Survey maturity data for 1978-1989 and mean lengths at age from the NEFSC fall survey (G. Shepherd, NEFSC, personal communication, July 1, 1990; NEFSC 1990; Terceiro 1999). The SAW 11 work indicated that the median length at maturity (50^{th} percentile, L_{50}) was 25.7 cm for male summer flounder, 27.6 cm for female summer flounder, and 25.9 cm for the sexes combined. Under the aging convention used in the SAW 11 and subsequent assessments (Smith *et al.* 1981, Almeida *et al.* 1992, Szedlmayer and Able 1992, Bolz *et al.* 2000), the median age of maturity (50^{th} percentile, A_{50}) for summer flounder was determined to be 1.0 years for males and 1.5 years for females. Combined maturities indicated that at peak spawning time in the autumn, 38% of age-0 fish are mature, 72% of age-1 fish are mature, 90% of age-2 fish are mature, 97% of age-3 fish are mature, 99% of age-4 fish are mature, and 100% of age-5 and older fish are mature. The maturities for age-3 and older were rounded to 100% in the SAW 11 and subsequent assessments.

In the past series of summer flounder assessments, it has been noted that the NEFSC maturity schedules have been based on simple gross morphological examination of the gonads; therefore, they may not accurately reflect (i.e., may overestimate) the true spawning potential of the summer flounder stock (especially for age-0 and age-1 fish). It should also be noted, however, that spawning stock biomass (SSB) estimates based on age-2 and older fish show the same long term trends in SSB as estimates which include age 0 and 1 fish in the spawning stock. A research recommendation that the true spawning contribution of young summer flounder to the SSB be investigated has been included in the resulting research recommendations from summer flounder stock assessments since 1993 (NEFSC 1993). In light of the completion of a URI study to address this research recommendation, the maturity data for summer flounder for 1982-1998 were examined in the 2000 assessment (NEFSC 2000) to determine if changes in the maturity schedule were warranted.

The research at the University of Rhode Island (URI) by Drs. Jennifer Specker and Rebecca Rand Merson (hereafter referred to collectively as the "URI 1999" study) attempted to address the issue of the true contribution of young summer flounder to the spawning stock. The URI 1999 study examined the histological and biochemical characteristics of female summer flounder oocytes (1) to determine if age-0 and age-1 female summer flounder produce viable eggs, and (2) to develop an improved guide for classifying the maturity of summer flounder collected in NEFSC surveys (Specker *et al.* 1999, Merson *et al.* 2000). The URI 1999 study examined 333 female summer flounder (321 aged fish) sampled during the NEFSC Winter 1997 Bottom Trawl Survey (February 1997) and 227 female summer flounder (210 aged fish) sampled during the NEFSC Autumn 1997 Bottom Trawl Survey (September 1997) using radioimmunoassays to quantify the biochemical cell components characteristic of mature fish.

The NEFSC and URI 1999 maturity determinations disagreed for 13% of the 531 aged fish, with most (10%) of the disagreement due to NEFSC mature fish classified as immature by the URI 1999 histological and biochemical criteria. The URI 1999 criteria indicated that 15% of the age-0 fish were mature, 82% of the age-1 fish were mature, 97% of the age-2 fish were mature, and 100% of the age 3 and older fish were mature. When the proportions of fish mature at length and age were estimated by probit analysis, median length at maturity (50th percentile, L_{50}) was estimated to be 34.7 cm for female summer flounder, with the following proportions mature at age: age-0: 30%, age-1: 68%, age-2: 92%, age-3: 98%, and age-4: 100%. Median age of maturity (50th percentile, A_{50}) was estimated to be about 0.5 years. Based on this new information, SARC 31 (NEFSC 2000) considered 5 options for the summer flounder maturity schedule for the 2000 stock assessment:

1) No change, use the maturity schedule for combined sexes as in the SAW 11 and subsequent assessments (rounded to 0.38, 0.72, 0.90, 1.00, 1.00, and 1.00 as in the SAW 25 and Terceiro (1999) assessment analyses).

2) Consider only age-2 and older fish of both sexes in the SSB.

3) Knife edged, age-1 and older maturity for both sexes. This would eliminate age-0 fish of both sexes from the SSB, and assume that the proportions mature at age-1 "round" to 100%.

4) NEFSC 1982-1989, 1990-1998 for both sexes, assuming a 1:1 sex ratio in deriving a combined schedule.

5) NEFSC 1982-1989, 1990-1998 for males, URI 1999 for females, assuming a 1:1 sex ratio in deriving a combined schedule.

The 5 options produce the following maturity schedules for both sexes combined:

Option			Age			
	0	1	2	3	4	5+
1	0.38	0.72	0.90	1.00	1.00	1.00
2	0.00	0.00	0.90	1.00	1.00	1.00
3	0.00	1.00	1.00	1.00	1.00	1.00
4	0.45, 0.45	0.88, 0.82	0.97, 0.93	1.00, 0.98	1.00, 0.99	1.00, 1.00
5	0.29, 0.31	0.74, 0.76	0.95, 0.94	0.99, 0.98	1.00, 1.00	1.00, 1.00

SARC 31 concluded that some contribution to spawning from ages 0 and 1 should be included, eliminating options 2 and 3. The differences among remaining options 1, 4, and 5 were considered to be relatively minor, and so the SAW 11 schedule (Option 1) was retained for subsequent assessments (MAFMC 2001a, NEFSC 2002). SARC 31 recommended that more biochemical and histological work should be done for additional years to determine if the results of the URI 1999 study will be applicable over the full VPA time series. SARC 31 also noted the need for research to explore whether the viability of eggs produced by young, first time spawning summer flounder is comparable to the viability of eggs produced by older, repeat spawning summer flounder. In the 2005 SAW 41 work (NEFSC 2005), the maturity schedule was updated and broadened to include data from 1992-2004, covering the year range for individually measured and weighed fish sampled in NEFSC research surveys. The resulting combined sex maturity schedule (0.38, 0.91, 0.98, 1.00, 1.00, and 1.00; respectively for age-0 to 5+) was retained in the 2006 assessment and S&T peer review (Terceiro 2006b).

The SDWG examined the proportions of summer flounder mature at age from 1981-2007 as well as information on length and age at maturity from 1992-2007, and concluded that it was appropriate to retain the maturity schedule from the 2006 assessment. Using NEFSC Fall Survey maturity data from 1992-1997 and probit analysis, the median length at maturity (50th percentile, L_{50}) was estimated as 27.0 cm for male summer flounder, 30.3 cm for female summer flounder, and 27.6 cm for the sexes combined. The median age of maturity (50th percentile, A_{50}) for summer flounder was determined to be 1.1 years for males, 1.4 years for females, and 1.2 years for both sexes combined. These findings are consistent with the findings of SAW 11 and the URI 1999 study. In addition, an examination of the proportions of mature age-0 and age-1 fish did not indicate any trend which would warrant modification of the current maturity schedule (Figure 20).

3.1 Alternative approaches could consider separate Catch at age matrices for commercial and recreational fisheries, and resulting partial recruitment vectors for each fishery.

The SDWG considered the use of a single catch at age matrix as has been done in previous assessments, two matrices for retained and discarded components of the fishery, and as many as six matrices. These considerations are described in Sections 4.0 and 5.0 of this report.

3.2 Alternative approaches could consider regional differences (north, south) in catch at age matrices.

Exploratory analyses were conducted to examine if indeed some of the patterns observed in the summer flounder assessment (Terceriro 2006a, 2006b; i.e. retrospective pattern, large positive residuals primarily at ages 3 and 4 in NEFSC winter, spring, and CT, RI, and NJ indices) could be explained by changes in the spatial distribution of the commercial fishery and or the summer flounder stock. Therefore, the commercial landings data from 1967-2006 and NEFSC survey data were examined spatially. It should be noted that this data was compiled from a generalized data retrieval, therefore this numbers may differ slightly (within a few tons) from the assessment data tables.

Commercial landings were compiled by year, regional “division”, and calendar quarter (1-4). While the data were examined by calendar quarter, for simplicity, the discussion of here focuses only on year and “division”. These “divisions” were aggregations of the NEFSC commercial fishery statistical areas (SAs; Figure 22; units generally about 1 degree square) to allow for better investigation of regional differences. The following logical divisions were created based on the aggregation of statistical areas; Division 51 (Gulf of Maine) aggregates SAs 511-515; Division 52 (George’s Bank) aggregates SAs 521-526, 561, and 562; Division 53 (Southern New England) aggregates SAs 533-539; Division 61 (Northern Mid-Atlantic Bight) aggregates SAs 611-616; Division 62 (Southern Mid-Atlantic Bight) aggregates SAs 621-629; Division 63 (Virginia/North Carolina region) aggregates SAs 631-636; and Division 99 is all other landings outside these 6 regions (SAs not reported).

There are three time periods worth noting that may influence the pattern exhibited in the commercial landings data: 1967-1981; 1982-1992, and 1993-2006. The period 1967-1981 is prior to any collection of the commercial fishery length-age-composition data, and is the period before the first comprehensive management measures were enacted in 1982. In addition, for 1967-1981 the set of commercial landings with SAs available is incomplete, relative to the total commercial landings reported, due to limited participation of the states in the Federal data collection program (i.e. the "weighout" system). As shown in Table 114, Division totals for the 1960s and 1970s are well below the commercial total reported in the assessment tables, and are dominated by landings reported for Divisions 52, 53, and 61. Most states did not fully participate until 1982; New York and New Jersey began participating in 1986 and North Carolina joined in 1997. Therefore, comparing this earliest period (pre-1982) with more recent two periods (post-1982) is not consistent.

The time period 1982-1992 represents an era of pre-quota management; quota management (output controls) have only been in place since 1993. These regulatory changes may be reflected in changes in the Divisions accounting for most of the commercial landings between these periods, if substantial changes in the spatial distribution of the commercial fishery were occurring.

In addition, these three periods roughly coincide with the pre-age-structured assessment period (1967-1981), the period of time when the stock is estimated to have been decline (1982-1992), and the period during which rebuilding plans have been in place and the stock has been expanding (1993-present). The overall expansion, contraction, and expansion again of the length and age structure of the stock would be expected to coincide with these three periods. Given the migratory nature of summer flounder, and of the behavior of larger/older fish migrating further North, one might expect to see some changes in the spatial distribution of large fish (e.g. ages 3 and 4, and older) in both the commercial data and survey over these periods. The divisions that accounted for the greatest proportion of commercial landings in a given year during the latter two time periods (1982-1992; 1993-2006) were Division 61 and 62, the areas of the Northern and Southern Mid-Atlantic Bight, respectively. Division 61 accounted for the highest commercial landings 9% of the time (1 out of 11 years) for the period 1982-1992, while Division 62 accounted for the highest landings 29% of the time (4 out of 14 years) during the period 1993-2006. This suggests a shift in the fishery northwards (Figure 23). Drawing further insight from this exploratory work would require de-construction of the commercial and recreational expanded length and age frequencies; one would expect to find larger/older fish in the commercial landings from the more Northerly Divisions (mostly Division 53–Southern New England), compared to the more Southerly Divisions (61-63). There may however, be limits to this exercise depending on the sample sizes for the length-age data during some years of the time series, particularly the earlier and mid-parts of the data collection series and if the additional factor of calendar quarter is included. In addition to examining the commercial landings data, the NEFSC survey data may provide insight into some of the patterns observed in the summer flounder assessment.

The NEFSC Spring survey data was compiled into two regions. These “regions” were aggregations of the NEFSC Spring survey strata (strata; Figure 24), with a Northern region aggregating strata 1-12 and a Southern region aggregating strata 61-76. These offshore strata are the standard suite of those used for calculation of that spring tuning index. Because of the low numbers of summer flounder caught in the strata on George’s Bank, those strata are not used in calculation of the tuning indices and are not used in the exploratory analysis presenting here (Figure 25). As shown by Figure 26, indices of abundance over most of the last 40 years have generally been higher in the South, while the indices of biomass are comparable for the Northern and Southern strata. This is consistent with the expectation of older/larger fish being found in the North. Since around 2000, with the exception of 2004, both abundance and biomass have been higher in the North. An examination of length-frequencies for the period 2002-2004 by region (Northern versus Southern strata; Figure 27) are consistent with these findings and suggest that most of the differences in length frequencies appear between 40-50 cm, which are age-3 and age-4 fish.

The survey data do provide evidence of more older/larger fish being found in the NEFSC spring survey “Northern” strata (1-12) since around 2000. In addition, many of the Northern state-specific surveys show a similar pattern. This pattern appears to be more evident in the survey data than was shown in the commercial landings data examined. This exploratory analysis suggests that the development of assessment models which include a regional (spatial) component may be worthwhile and should continue to be included as a future research recommendation. It should be noted that this recommendation may be in conflict with TOR 2.1, which suggests development of integrated survey indices for use in the assessment.

3.3 Alternative approaches could consider potential gender differences in life span, growth rate, and natural mortality and implications of these factors for observed age- and length-specific sex ratios.

During the 2007 stock assessment update (SDWG 2007), it was noted that there is potential for change in certain biological parameters of the stock over the last few years.

Therefore, working group papers were developed (and summarized below) for this benchmark assessment to examine a variety of biological parameters and if there are changes in length-at-age, weight-at-age, and growth rates, and sex ratios (Working Papers 7 and 9; Appendix 3).

The first working paper examined trends in the NEFSC trawl data. Catches from the NEFSC trawl survey database (1992-2007) are subsampled and provide length, weight, age, and sex for summer flounder. Sample size at older ages was low, particularly during early years of this analysis corresponding to periods of lower abundance. The data were therefore limited to years and ages that had a sufficient sample size. Length at age calculations were developed from the NEFSC winter survey only and include 1999 to 2006, ages 0 through 4 for males, and 0 through 5 for females. Sample size for these years and ages are generally greater than 40 fish. Sex specific mean size at age was calculated for each year and SAS Proc REG (SAS 1990) was used to conduct regressions of size at age over time. The observed data were fit to a von Bertalanffy growth function using SAS Proc NLIN (SAS 1989a). Residuals were then resampled with replacement, by year, to develop 500 bootstrap datasets (Barker 2005), each of which was also fit using the von Bertalanffy growth function. Similarly, length-weight analysis was conducted using an allometric growth function and potential changes in weight-at-age were examined.

Mean lengths for males age 1 to 4 show no trends (given the limited data 1999-2006), and regression trends were not significant (α = 0.10 level). Trends in mean length at age for females were similar to males for ages 0 to 4; however, female mean length at age 5 decreased significantly between 1999 and 2006.Fitting bootstrap data to the von Bertalanffy growth function resulted in unrealistic parameter estimates for males in 2000 and 2006 ($L\infty$=100,000 cm) and for females in 2000. Regression results, using the von Bertalanffy estimates, for male length at ages 0 to 10 (the approximate age range observed in survey data) showed no significant trends. Regression results indicate no significant trend in predicted length at age for females ages 0 to 4; however, predicted length at ages five and older decreased significantly between 1999 and 2006. Combined sex regression results using von Bertalanffy predicted length at age were consistent with results of mean length at age. Length:weight analysis was conducted using the same subset of years and ages described above. Sample size was generally above 40 fish and no significant trends were observed for weight at length for males or females.

Maximum age, as identified through review of NEFSC spring, winter, and fall survey data, indicated that the maximum age for males generally varied between age 4 and 5 from 1985-1995, while female maximum age ranged from age 6 to 8 (Figure 21). By 2000, the maximum age of males increased to between 8 and 9, where it remained stable until 2007 when one 12 year old male was captured. Female maximum age has increased steadily since 1995, with a peak of 14 years in 2005. Dery (1988) suggested males and females reached maximum ages of 7 and 12 years, respectively. While this is consistent with maximum ages observed in NEFSC trawl surveys from 1992 to 2000, recent data suggest that maximum ages of at least 12 for males and 15 for females is more appropriate. Additional years of reduced fishing pressure may result in even older observed maximum ages.

Sex ratio (*i.e.* percent female) at size was analyzed using SAS Proc GENMOD (SAS 1989b) with a normal distribution and a logit link function (*i.e.* a logistic regression). From 1992 to 1997 overall sex ratio was about 54% female, then increased from 53 to 58% of the stock in 1997 to 2000, where it remained stable for 3 years. In 2003, the ratio dropped to 51% female and has varied in recent years. Sex ratios by age showed a decrease in percent female since the mid 1990s across all ages, although the declines are more evident for ages 2+ .When data are combined across years, logistic regression of percent female at size shows a 50:50 sex ratio at around 38 cm (15”). Fish smaller than this size are predominantly male, while larger fish are predominantly female. These findings are not new (*e.g.* Murawski and Figley 1977, Morse 1981), but this sexual dimorphism may have greater implications for management and stock rebuilding. For many ages, this decline has been observed over 15 years which is much longer than states have required large minimum sizes.

Natural mortality for each sex was estimated using 3 / T_{MAX} (Hoenig 1983), assuming maximum ages of 12 and 15 for males and females, respectively, and resulted in M=0.25 for males and M=0.20 for females Applying these to overall sex ratios to estimate annual M, M has remained relatively stable around 0.223, with a range of 0.221 in 2000 to 0.226 in 2005. A more comprehensive examination of methods to estimate M is available in Section 3.4.

Individual fecundity was estimated by applying the relationship of Morse (1981) to the mid-year length at age for females.

$$F = 0.0007975 * L^{3.402}$$

Mature females by age and year (in numbers) were determined by multiplying the VPA estimated abundance, sex ratios, and VPA input maturity schedule. Fecundity could only be evaluated for the years 1999 to 2006 due to low samples sizes. Theoretical fecundity of the stock increased from approximately 22.3 x 10^{12} eggs in 1999 to a maximum of over 36.5 x 10^{12} eggs in 2004, and decreased in to approximately 31.0 x 10^{12} eggs in 2006. Recruitment as calculated in the VPA remained relatively stable between 28 million and 38 million individuals, except for 2004 (17 million). The relationship between fecundity and recruitment is slightly negative, although this appears to be driven primarily by the 2004 data point (highest fecundity and lowest recruitment). It appears the increases in total abundance have outpaced any decreases in fecundity, resulting in theoretical stock fecundity increasing more than 50% from 1999 to 2004. Estimated fecundity declined in 2005 and 2006, coincident with slower stock growth; however, it is not clear there is a causal relationship.

In conclusion, this review of NEFSC trawl survey data do indicate that some life history parameters have changed since 1992; although many of the causal relationships have not be established. This descriptive information can be considered by the SDWG in development of the assessment, reference point calculations, and model projections.

A second working paper (summarized below) was developed to evaluate to describe information in the summer flounder biological data base (Working Paper 9; Appendix 3). This work attempted to answer the questions of whether the current data support development of and use of: 1) a sexually-explicit model for summer flounder 2) regionally-specific sex-at-age keys 3) differential natural mortality rate for male and female summer flounder or a nonlinear whole-stock natural mortality rate, or 4) regionally-specific age-length keys.

At the time of analysis, sex ratio data for young-of-the-year are not available prior to 1982; consequently analyses of sex ratio focus on 1982-2007. Due to data limitations, and regional variability in sex ratios as discussed in a subsequent section, data were excluded from southern New England north and also from Cape Hatteras south in this set of analyses as well as all age-year combinations where the number of sexed summer flounder is less than 20. For some analyses, data were parsed into six year groups with the central four being half-decadal (i.e. Year group 1 contains data from 1982-1985). The data suggest that young-of-the-year are dominantly male. A female-biased sex ratio for young-of-the-year summer flounder occurs only thrice in 26 years. The data also suggest a consistent change in sex ratio with age. Thus, summer flounder are consistently characterized by biased sex ratios regardless of age or half-decadal period within the time series and the direction of bias changes with age. In addition, the three years where females predominate in age-0 fish include the last two years. This is unexpected from the time series record. However, the sex ratio for age-1 fish from the 2006 cohort conforms with age-1 sex ratios from other years; thus, it is possible the 2006 young-of-the-year ratio is a sampling artifact. Second, the fraction of fish that are male at older age has increased over time, although remaining well below 0.5. This is particularly apparent for age-3 fish.

One explanation is that male fish are moderately more susceptible to the fishery at high fishing mortality rates. The dispersion of males and females as the cohort ages might support this first alternative. The same outcome would be obtained either if a reduction in natural mortality rate had occurred if the originating sex ratio was biased to a greater degree in favor of males. A number of potential reasons exist for the male-dominated sex ratios seen in young-of-the-year summer flounder. Females mature later than males. The observed females may under-represent the total number. The biological database also records undifferentiated fish. Assigning all of these fish to the female sex, however, does not markedly change the sex ratios summarized in the data. This suggests the maturity schedule along cannot explain the male-dominated sex ratios observed for age-0 fish. Young males may be more available to the survey. While this possibility cannot be excluded, the fact that females grow faster than males and that the male-biased sex ratios clearly are retained into age 2, albeit at diminishing intensity, suggest that availability is not an adequate explanation. Protandry would produce the observed age-dependent sequence of sex ratios. Protandry, however, is not reported in flatfish, and would almost assuredly have been observed were it to exist. Biased sex ratios have been observed by others in summer flounder, however. Morse (1981) and Smith and Daiber (1977) found that younger, smaller fish were much more likely to be male and that this trend quickly reversed with increasing age. Morse (1981) offers that an initially male-dominated sex ratio is necessary to offset an apparently higher natural mortality rate in males, thus promoting a more nearly 1:1 sex ratio in the spawning stock. One viable explanation for biased sex ratios in young-of-the-year summer flounder is temperature-dependent sex determination; this is consistent with some findings in the literature and has been observed in other flatfishes.

To examine this further by age, depth, region, and time, sex-ratio strata were allocated to three depth zones (<25 fm; 25-50 fm; >50 fm), five regions: southern New England (we included Georges Bank strata in this grouping), the northern Mid-Atlantic Bight, Delmarva, and the strata south of Cape Hatteras, and allocated to half-decadal year-groups: 1976-1980, 1981-1985, 1986-1990, 1991-1995, 1996-2000, 2001-2005, 2006-2007. We excluded all occurrences of age-year group, age-region, and age-depth combinations with sex ratios supported by a total count of males and females less than 30. ANOVAs were run by age using depth, year-group, and region as main effects. All interaction terms were included. Sex was implemented as a dependent variable by assigning a 0 to males and a 1 to females. Means, accordingly, were equivalent to the fraction female.

Examining the regional results for overall trends, it seems that the northern Mid-Atlantic and Delmarva regions have similar sex ratios regardless of age. In addition, the south Atlantic and southern New England regions have a tendency to be different from the Mid-Atlantic/Delmarva grouping, depending on age. When different, the southern New England and south Atlantic regions routinely have a higher fraction of males. This is what would be expected from the temperature-dependent determination of sex that produces an increase in fraction male at the temperature extremes; however, sex determination in the first year of life militates against this explanation as the main effect of region is observed only later. Thus, alternative biological explanations or determinants from differential fishing mortality must be sought. The depth and year-group effects are, as yet, unexplained.

The gradual shift in sex ratio from male-dominated to female-dominated with increasing age might accrue from differential mortality or differential availability. A higher natural mortality rate in males could potentially be explained by some type of biological refuge for females; less time spent in a predatory window. Female summer flounder are known to grow at a faster rate than males and may therefore be less prone to predation (Poole 1961). However, male and female growth rates are similar until age 2, so such an explanation would not be warranted when considering the apparent differential natural mortality in fish younger than age 2. Some precedent exists for higher morality rates in male relative to female flatfish. Morse (1981) already proposed a higher natural mortality rate for males in summer flounder. Santos (1994) computed natural mortality rates for the four-spot megrim (*Lepidorhombus boscii*) by sex. The natural mortality rate for males was 0.41, and for females 0.34. Pearson and McNally (2005) also calculated mortality rates, using three different methods, for the sand sole, *Psettyichthys melanostictus*. The natural mortality rate for females ranged between 0.35 and 0.45, whereas the mortality rate for males was estimated to fall between 0.40 to 0.60.

Additional non-paramentric analyses (categorical ANOVAs) examined region, depth, and year group, with length as the dependent, ranked variable. Depth significantly impacted length-at-age for males and females, ages 1 through 3 and age 4 for females. At age 0, summer flounder are only present in shallow waters, and at age 5 and older, depth no longer influences length-at-age, for the most part. Tukey's studentized range tests show that fish in deeper water are larger at a given age than fish in shallower water. Length at age varied significantly with region for male and female summer flounder, ages 0-4, but not at older ages. When regions did group together they did so in a north-central, south-central trend. In other words, the southern New England region never grouped with the south Atlantic or Delmarva regions, and the south Atlantic never grouped with the northern Mid-Atlantic and southern New England regions. Year-group consistently affected length at age for male and female summer flounder until age 6. Year-group no longer impacted length at age for male summer flounder at age 6 and older, but continued to do so for female fish.

Not considering the influence of fishing mortality on age-at-length, these trends could suggest that summer flounder either grow at faster rates in deeper water and northern latitudes or that larger fish at age preferentially aggregate in these regions. Alternatively, in shallow waters and at southern latitudes larger fish may be more accessible to the fishery. While the fishery may not keep younger fish due to minimum size restrictions, younger fish may still be removed by the fishery as discard mortality. Whether it be a biological reason (e.g., differential growth rates) or a fishery-related reason (bigger fish at any age are more accessible in shallow/southern water), it seems clear that the average size of fish at age is larger in deeper/northern water than in shallow/southern water. However, significant interaction terms also occur commonly in fish 4 years or less in age and these involve both depth and region with relatively equal frequency and intensity. The frequency of significant interaction terms including depth and region suggests that regionality in the trends in age at length for summer flounder cannot facilely be explained simply in terms of depth and latitude. A more complex mixture of biology and, perhaps, relative fishing impact is likely to be required.

Analyses were conducted that focused on the age-length keys for the Delmarva and northern Mid-Atlantic region and, independently, on the three depth zones previously described, as these two regions were most similar in length at age. To compare keys efficiently, lengths were combined into 12 units, the central 10 being 5 cm; this yielded three keys for the three depth zones and two for the two regions. Each of these returned a significant result from a by-region or by-depth chi-square test, and from a Cochran-Mantel-Haenszel test controlling for depth or region. To directly compare two keys, we used Geary's C and Moran's I statistics on the set of residuals obtained by calculating the expected key structure in one array from the observed key structure in the other.

From this work, it was concluded that young-of-the-year summer flounder are dominantly male. Sex ratio changes gradually with age such that male frequencies over 0.5 occur infrequently by age 2 and rarely exceed 0.3 by age 4. The biased sex ratio at birth may be the result of temperature-dependent sex determination. In additional, this data suggests the need to implement a sex-explicit and/ or spatially-explicit model for summer flounder. The change in sex ratio with age also suggests that separate natural mortality rates be considered for male and female summer flounder stock assessment models with a higher natural mortality rate in males. Spatial variation in length-at-age suggests that a single age-length key is not likely to be representative across all regions and in different depths. The differential with region and depth suggests that differential fishing pressure cannot be excluded as the mechanism generating these differences. The male age-length relationships are move variable over depth and region than the female ones, but each varies significantly. The analyses suggest that a single age-length key may not adequately describe the stock, particularly for the males.

The SDWG considered the information and concluded that while there were some significant interactions among sex-ratios and length-at-age by depth, region, and time period, the patterns and frequency of significant terms suggest the explanatory variables are not being adequately characterized (grouped). Therefore, additional work is needed to address what factors may be appropriate to characterize the observed patterns before a sex-specific or spatially-explicit model can be developed. There are many factors that may be interacting to cause spatial differences in summer flounder length-at-age and sex-ratios, which could include sampling effects, fishing mortality patterns (fishery behavior within year and over time), temperature, and predation patterns. While these analyses focused on NEFSC survey strata, the patterns observed in the fishery catch data (for which there is no sex-information collect), could be different.

This SDWG did, however, consider the information on natural mortality rates, which is discussed in greater detail in the next section (section 3.4).

3.4 Alternative approaches could consider the strength of evidence for natural mortality rate used in the assessment; Update the estimate if appropriate.

Natural Mortality Rate

The instantaneous natural mortality rate (M) for summer flounder was assumed to be 0.2 in past assessments (SAW 20; NEFSC 1996a). In the SAW 20 work, estimates of M were derived using methods described by: 1) Pauly (1980) using growth parameters derived from NC-DMF age-length data and a mean annual bottom temperature (17.5^{o}C) from NC coastal waters; 2) Hoenig (1983) using a maximum age for summer flounder of 15 years; and 3) consideration of age structure expected in unexploited populations (5% rule, 3/M rule, e.g., Anthony 1982).

SAW 20 (NEFSC 1996a) concluded that M = 0.2 was a reasonable value given the mean (0.23) and range (0.15-0.28) obtained from the various analyses, and this value for M has been used in all subsequent assessments.

For this assessment, a working paper was prepared that reviewed longevity- and life-history based estimators of M. These sex and age-specific estimates of M were calculated from current summer flounder age and growth data (1976-2007) from the NEFSC trawl surveys. The complete working group paper (Working Paper 8) is provided in Appendix 3. A summary of the methods and conclusions from this paper are provided here. Longevity based estimators of M are sensitive to critical underlying assumptions which include the value of p, or the small proportion of the population surviving to a given maximum age, and the maximum observed age under no or low exploitation conditions. Using a t_{MAX} (maximum age) of 15 years for summer flounder, and the methods of Hoenig (1983) and Hewitt and Hoenig (2005), longevity based estimates of M for combined sexes ranged from 0.20 to 0.36 depending on whether a p=1.5% or p=5% was assumed. Other life-history based were examined and included Pauly (1980), Jensen (1996), Gunderson & Dygert (1988), and Gunderson (1997), with resulting estimates ranging from 0.20 to 0.45; although again these estimates are highly dependent on their underlying assumptions. Age-specific and size variable estimates of M, based on the work of Peterson & Wroblewski (1984), Chen & Watanabe (1989), Lorenzen (1996), Lorenzen (2000), ranged from 0.19 to 0.90, with the highest values obviously associated with age-0-1 fish (fish at smaller lengths). While these exercises provided a wide range of methods and M estimates to be considered, each estimate involved a suite of underlying assumptions which were debated. In addition, the modeling frameworks of ADAPT, ASAP, and SS2 (see sections 4.2-4.4) allow for log-likelihood profiling of M to determine which M estimate provides the best model fit. Based on this exercise using the base cases, M that minimized the log-likelihood is 0.35, 0.20, and 0.25 under the models ADAPT, ASAP, and SS2, respectively (Figure 76B). The estimate of M that results in the lowest MSR (likelihood) is clearly sensitive to model selection, as the BASE case inputs were similar across the three models.

The SDWG considered the different methods of estimating M and after lengthy discussion assumed a natural mortality rate (M) of 0.20 for females and 0.30 for males for this June 2008 assessment based mainly on recently observed maximum ages (tmax) in NEFSC survey data of 14 years (76 cm, in NEFSC Winter Survey 2005) for females and 12 years (63 cm, in NEFSC Spring Survey 2007) for males, and the expectation that larger and older fish are likely if fishing mortality rates are maintained near current rates over the next several years. The assumptions were guided by the work above as well as the SDWG working papers on summer flounder growth and maturity prepared by Brust, Powell, and Wong (Working papers 8,9,10; Appendix 3). A combined sex M-schedule at age was developed by assuming these initial M rates by sex, an initial proportion of females at age 0 of 0.40 derived from the NEFSC Fall survey indices by age and sex, and population abundance decline over time at the sex specific M rates. The final abundance weighted combined sex M-schedule at age ranged from 0.26 at age 0 to 0.24 at age 7+, with a mean of 0.25. Additional details on the sensitivity of the assessment to an increase in M are discussed in Section 6.6.

4.0 Compare results from alternative modeling approaches with those from the VPA model, to evaluate the robustness of VPA model results. Perform retrospective analyses of F, SSB, and recruitment for the models, and describe potential effects of retrospective patterns on assessment and rebuilding.

4.1 A Stock Production Model Incorporating Covariates (ASPIC)

The SDWG did not repeat an ASPIC analysis in this assessment. Past attempts to apply this modeling approach to the summer flounder assessment are described in greater detail below; estimates from the model were not considered to be robust and the associated biological reference points were therefore considered to be unreliable. In addition, approaches suggested in a submitted working paper (Working Paper 10, Appendix 4) were not considered by the SDWG to be the most appropriate approach for the current benchmark assessment. The SDWG determined that the extensive age-information available for summer flounder should be utilized for this assessment and other modeling frameworks provide greater flexibility in developing the underlying assumptions, that are implicitly determined based on which surplus production approach is selected.

The non-equilibrium surplus production model incorporating covariates (ASPIC; Prager 1994, 1995) can be used to estimate maximum sustainable yield (MSY) and other biological reference points. An ASPIC analysis applied to summer flounder using various state and federal agency survey biomass indices (the 1998 analysis) was previously reviewed by the NEFMC Overfishing Review Panel (Applegate et al. 1998). Based on total weighted mean squared error (MSE), the NEFSC spring and autumn biomass indices gave the best fit to the data in that analysis. However, the Overfishing Review Panel concluded that biological reference points estimated in the 1998 analysis for summer flounder were unreliable, due to the short time series of reliable catch estimates and lack of dynamic range in the input data (Applegate et al. 1998).

An ASPIC analysis using projected catch and NEFSC survey biomass indices through 1999 was reviewed in the 1999 assessment (Terceiro 1999). Model results were examined for sensitivity by employing a Monte Carlo search routine and by initializing over a broad range the values of MSY (10,000 to 50,000 mt) and the intrinsic rate of increase (r : 0.12 to 1.25). The ratio of initial to current biomass (B1 ratio) was assigned a starting value of 0.50. Overall, the 1999 ASPIC model results for summer flounder were not well defined and suggested the possibility of numerous local minima in the sums of squared errors (SSE) response surface. The Monte Carlo search algorithm was employed in an attempt to provide a better search of the SSE response surface, and the this generated a range of estimates of MSY from 19,000 mt to 58,000 mt and of r from 0.49 to 1.08. Due to the number of iterations needed to reach convergence (>25) and the probable number of local minima, these results also appeared to be unreliable. Thus, biological reference points for summer flounder estimated by the 1999 ASPIC analysis were not considered to be robust.

4.2 ADAPT Virtual population analysis (VPA)

Fishing mortality rates in 2006 and stock sizes in 2007 were estimated using the ADAPT method for calibration of the VPA (Parrack 1986, Gavaris 1988, Conser and Powers 1990) as implemented in the NOAA Fisheries Toolbox (NFT) ADAPT VPA version 2.7.7. As recommended by the MAFMC SSC Committee during the review of the Terceiro (1999) assessment and by the National Research Council review of the summer flounder assessment (NRC 2000), ages 0-6 were included in the analysis as true ages, with ages 7 and older combined as a plus group. An instantaneous natural mortality rate of M = 0.2 was assumed for all ages in all years. Maturities were retained from the last revisions made in the 2005 SAW 41 assessment (NEFSC 2005); maturities at age for all years were 38% for age-0, 91% for age-1, 98% for age-

2, and 100% for ages 3 and older. Stock sizes in 2007 were directly estimated for ages 1-6, while the age 7+ group was calculated from Fs estimated in 2006. Fishing mortality on the oldest true age (6) in the years prior to the terminal year was estimated from back-calculated stock sizes for ages 3-6. Fishing mortality on the age 7+ group was assumed equal to the fishing mortality for age 6. Winter, spring, and mid-year (e.g., RIDFW monthly fixed station, DEDFW and NJBMF) survey indices and all survey recruitment (age-0) indices were compared to population numbers of the same age at the beginning of the same year. Fall survey indices were compared to population numbers one year older at the beginning of the next year. Tuning indices were *a priori* unweighted.

A number of ADAPT VPA runs using were made to examine the sensitivity of the analysis to several revisions to data and analyses that have been incorporated in this assessment. These changes include a) revisions to the historical time series of recreational fishery data, including state of North Carolina catch type B2 estimates (run INIT), b) use of the exact catch equation, as opposed to the Pope's approximation used previously (run EXACT), c) revisions to the MADMF trawl survey indices due to changes in stratum area specification (run MASV), d) treatment of survey zero values as missing data (run NOFILL), e) use of only NEFSC survey data in calibration (run NOFILL_NEC), and f) use of all survey indices (run F08_ALL). Of these changes from the 2007 final run configuration, the analysis was most sensitive to the treatment of zeros as missing (change from the MASV to NOFILL run).

A total of 51 age-specific indices were initially considered as input for the ADAPT VPA calibration and other models. The ADAPT VPA was used as the platform to select the base set of indices to carry forward because the existing NFT ADAPT software has very useful diagnostic features for judging the calibration performance of the indices. The inclusion of each survey index was considered based on a pre-calibration correlation analysis among all indices, a post-F08_ALL indices run correlation analysis among the indices and resulting ADAPT VPA estimates of stock size, and an examination of the analytical diagnostics (including the precision of each survey index series, the partial variance accounted for by each index, patterns in residuals, and the mean squared residual (MSR) of the calibrated solution). Survey indices with trends that did not reasonably match corresponding patterns in abundance as estimated by other indices and/or the F08_ALL run were eliminated from the tuning configuration.

The DEDFW 30 foot trawl indices of abundance were considered to be reflective of local population trends and not stock level trends. On that basis and the large amount of variance that the DEDFW indices contributed to the overall model fit, the DEDFW 30 foot trawl ages 0-3 indices were dropped. The MADMF spring age 1, MADMF fall age 1 (tuned to age 2), CTDEP spring age 1, and RIDFW fall age-1 (tuned to age-2) indices correlated poorly with other regional indices and exhibited large CVs and partial variances and were also dropped. The RIDFW fall, MADMF seine survey, DEDFW 16 foot Estuary trawl, and NCDMF age 0 (young-of-year) indices were also dropped due to large partial variance and poor correlation with F08_ALL estimates of recruitment.

The final base run configuration (run F08_BASE) includes 39 survey indices at age. This base set of calibration indices was also used in subsequent runs of the other age-structured models (ASAP and SS2) considered in the assessment. Figures 28-30 compare the estimates of Spawning Stock Biomass (SSB; mt), recruitment at age 0 (R; 000s) and fully-recruited fishing mortality rate (F, ages 3-5) from the alternative ADAPT VPA run configurations with the final F08_BASE run.

The annual partial recruitment of age-1 fish decreased from near 0.50 during the first half of the VPA time series to less than 0.30 since 1994, and to less than 0.20 during 2000-2006; the partial recruitment of age-2 fish has decreased from 1.00 in 1993 to about 0.50 during 2002-2006. These decreases in partial recruitment at age are in line with expectations given recent changes in commercial and recreational fishery regulations. For these reasons, summer flounder are currently considered to be fully recruited to the fisheries at age 3, and fully recruited fishing mortality is expressed as the unweighted average of fishing mortality at age for ages 3 to 5. Fishing mortality calculated from the average of the currently fully recruited ages (3-5) varied between 0.94 and 2.13 during 1982-1997, then declined substantially and was estimated to be 0.44 in 2006 (Figure 30).

Summer flounder spawn in the late autumn and early winter (peak spawning on November 1), and age 0 fish recruit to the fishery during the autumn after they are spawned. For example, summer flounder spawned in autumn 1987 (from the November 1, 1987 spawning stock biomass) recruit to the fishery in autumn 1988, and appear in VPA tables as age 0 fish in 1988. The F08_BASE run indicates that the 1982 and 1983 year classes were the largest of the VPA series, at 73 and 79 million fish, respectively. The 1988 year class was the smallest of the series, at only 13 million fish. The 2006 year class is estimated at 31 million fish, below the time series average of 36 million (Figure 29). Spawning stock biomass (SSB; Age 0+) declined 71% between 1983 and 1989 (23,900 mt to 6,900 mt), but has increased six-fold to 41,700 mt in 2005, before falling slightly to 40,500 mt in 2006 (Figure 28).

Retrospective analysis of the summer flounder ADAPT VPA F08_BASE run was carried out for terminal catch years 1995-2006. The retrospective analysis indicates a pattern of overestimation of fully recruited F (ages 3-5) for 1995-1997, followed by a pattern of underestimation of F for 1998-2005, continuing the pattern observed in the last several assessments (NEFSC 2000, MAFMC 2001a, NEFSC 2002, NEFSC 2005, Terceiro 2006b, S&T 2006)(Figure 31). For the last three years, fishing mortality was underestimated by 42% for 2003, by 25% for 2004, and by 15% for 2005, relative to the terminal year 2006 estimates. Spawning stock biomass has been generally been overestimated in the last 3 years, by 54% for 2003, 23% for 2004, and 7% for 2005, relative to the terminal year 2006 estimates (Figure 32). There is no consistent retrospective pattern in the estimation of the abundance of age 0 fish over the last three years (Figure 33).

As the previously accepted, peer-reviewed assessment model, the 2006 NMFS S&T ADAPT VPA (Terceiro 2006b) has been updated through 2007. The updated run (VPA_2007) exhibited the same time series trends and retrospective characteristics as the 2006 NMFS S&T run. Using the ADAPT VPA model assuming constant M = 0.20, the stock is overfished and overfishing is occurring when compared to existing BRPs (ADAPT VPA F2007 = 0.311, 11% above the existing F BRP = Fmax = FMSY = 0.280; ADAPT VPA SSB2007 = 42,142 mt, 47% of the existing SSB BRP = SSBMSY = 89,411 mt).

4.3 Age Structured Assessment Program (ASAP)

Fishing mortality rates and stock sizes were estimated using the ASAP model as implemented in the NOAA Fisheries Toolbox (NFT) ASAP version 2.0.9. The catch at age, mean weights at age, maturity at age, and survey index calibration time series were input as in the ADAPT VPA F08_BASE run (see section 4.2.1). An instantaneous natural mortality rate of M = 0.2 was assumed for all ages in all years. Fishery selectivities (partial recruitment) were estimated either at each age or by fitting a single (flat-topped) logistic curve. Winter, spring, and mid-year survey indices and all survey recruitment (age-0) indices were compared to population numbers of the same age at the beginning of the same year. Fall survey indices were compared to population numbers one year older at the beginning of the next year. In developing the ASAP2 F08_BASE run, lognormal error distributions were assumed for the total catch in weight, research survey catch at age calibration indices, internal Beverton-Holt stock-recruitment relationship and parameters, selectivity parameters, fishing mortality (Fmult) parameters, survey catchability parameters, and estimated stock numbers at age. A multinomial distribution was assumed for fishery catch at age. A number of additional initial model settings are required in ASAP, including specification of likelihood component emphasis factors (lambdas), size of deviation factors expressed as standard deviations, and penalty functions for extreme fishing mortality estimates. The settings were left at the default values in the first few runs, and changed as runs were developed.

Initial runs used a) the number of sampled commercial fishery trips (ranging from 30 per year in 1995 to 181 in 2006) as the lambda for the effective fishery age composition sample size (ESS), b) a total catch lambda of 10 and CV of 0.01, c) recruitment deviation lambda of 6.74 and CV of 0.5, d) Fmult lambda of 6.74 and CV of 0.9, e) survey index lambdas of 0.4 and CV of 0.9 for all indices and catchability deviations lambda of 10000 (i.e., constant) and CV of 0.9, f) s-r function lambdas of 6.74 and CV of 0.9, and g) N in year 1 lambda of 6.74 with CV of 0.9.

Run configurations adjusting the ESS, lambdas, survey CVs, and time blocks for the estimation of the fishery selectivity pattern were tested to judge the sensitivity of the analysis to these settings. The sequence of runs is summarized in Table 115. As a result of these tests, a) the ESS was set at 200, b) a total catch lambda was set at 10 with CV of 0.10, c) recruitment deviation lambda was set at 0.001 with CV of 0.5, d) Fmult lambda was set at 1.0 with CV of 0.9, e) survey index lambdas were set at 1.0 with CVs of NEC Winter = 0.15, NEC Spring = 0.25, and NEC Fall = 0.25, and catchability deviations lambda of 10000 (i.e., constant) and CVs of 0.9, f) s-r function lambdas were set at 0.001 with CVs of 0.9, and g) N in year 1 lambda was set at 1.0 with CV of 0.9. These settings provided a good fit to fishery total catch and age comps, reasonable fit to survey indices, and a smooth transition in F pattern through the selectivity break in 1994-1995, and resulted in run ASAP run SELEX_94_95 which was then renamed BASE for subsequent tuning.

The next steps were to a) include the additional state agency survey indices at age accepted for the base ADAPT VPA formulation, with initial lambdas set at 1.0 with CVs of 0.40, b) set s-r function lambdas and CVs to 0, and c) set the ESS to the numbers estimated in the BASE run. Subsequent tuning adjustments (runs T1 and T2) attempted to even out patterns in the estimated ESS and fishing mortality using changes in the at-age selectivity estimation (Table 116). Run T3 was fit using a single logistic pattern with a break at 1994/1995. This change provided a smoother F pattern, while maintaining the expected transition from full selection at age 2 in the first block (1982-1994) and full selection at age 3 in the second (1995-2006). Run T4 specified the survey CVs to more closely match the true time series means of CVs of the NEFSC and MADMF series (other state agency CVs not available), but this change failed to improve the model fit to the surveys, and degraded the fit to the fishery age compositions. Following guidance received from Ian Stewart of NMFS NWFSC (pers. comm.) and Chris Legault of NMFS NEFSC (pers. comm.), the final tuning step, run T5, increased the survey CVs by 1.5 to 2.0 times, to allow better fits to the survey indices while maintaining fit to the fishery age compositions. Changes in the stock size and fishing mortality estimates between the BASE and T1 through T5 run configurations were small (Figures 34-36). This last tuning configuration, F08_BASE_T5, was used as the final ASAP base run.

The annual selection of age-1 fish decreased from about 0.54 during the first time block of selectivity estimation (1982-1994) to about 0.16 during the second block, 1995-2006. The annual selection of age-2 fish decreased from about 0.97 during the first time block of selectivity estimation (1982-1994) to about 0.72 during the second block, 1995-2006. These decreases in selection at age are in line with expectations given changes in commercial and recreational fishery regulations. For these reasons, summer flounder are currently considered to be fully recruited to the fisheries at age 3, and fully recruited fishing mortality is expressed as the unweighted average of fishing mortality at age for ages 3 to 7+. Fishing mortality varied between 1.04 and 1.93 during 1982-1997, then declined substantially and was estimated to be 0.38 in 2006 (Figure 36).

The F08_BASE_T5 run indicates that the 1983 year class was the largest of the series, at 83 million fish. The 1988 year class was the smallest of the series, at only 12 million fish. The 2006 year class is estimated at 34 million fish, below the time series average of 36 million (Figure 35). Spawning stock biomass (SSB; Age 0+) declined 73% between 1983 and 1989 (23,300 mt to 6,300 mt), but increased six-fold to 39,900 mt in 2003, before falling to 38,600 mt in 2006 (Figure 34).

Retrospective analysis of the summer flounder ASAP F08_BASE_T5 run was carried out for terminal catch years 1997-2006 – earlier terminal years were not advisable due to the constraints of the selectivity blocks (2-3 years are recommended in each block; Chris Legault, NMFS NEFSC, pers.comm.). The retrospective analysis indicates a pattern of underestimation of fully recruited F (ages 3+) for 1997-2005 (Figure 37). For the last three years, fishing mortality was underestimated by 38% for 2003, by 32% for 2004, and by 9% for 2005, relative to the terminal year 2006 estimates. Spawning stock biomass has been generally been overestimated in the last 3 years, by 60% for 2003, 44% for 2004, and 9% for 2005, relative to the terminal year 2006 estimates (Figure 38). There is no consistent retrospective pattern in the estimation of the abundance of age 0 fish since 1997 (Figure 39).

4.4 Stock Synthesis 2 (SS2)

Fishing mortality rates and stock sizes were estimated using the Stock Synthesis 2 (SS2) model as implemented in the NOAA Fisheries Toolbox (NFT) SS2 version 2.00o. The catch at age, maturity at age, and survey index calibration time series were input as in the ADAPT VPA F08_BASE run (see section 4.2.1). For the population biology component of the SS2 model runs, growth patterns were estimated for combined sexes from NEFSC survey biological data for the period from 1992-2007, age structure was set at ages 0-15, and length structure at lengths 10 to 79 cm. Growth rates were estimated as of January 1. An instantaneous natural mortality rate of M = 0.2 was assumed for all ages in all years. Fishery selectivity (partial recruitment) was generally estimated by fitting a single (flat-topped) logistic curve, although dome-shaped patterns were explored. Winter, spring, and mid-year survey indices and all survey recruitment (age-0) indices were compared to population numbers of the same age at the beginning of the same year. Fall survey indices were compared to population numbers one year older at the beginning of the next year. In developing the SS2 F08_BASE run, lognormal error distributions were assumed for the total catch in weight, research survey catch at age calibration indices, internal Beverton-Holt stock-recruitment parameters, selectivity parameters, fishing mortality parameters, survey catchability parameters, and estimated stock numbers at age. When modeled with lognormal error, survey selectivity was specified as S = 1 for the relevant age or series of ages indexed by the survey. Normal error distributions were assumed for mean length at age and mean weight at age. A multinomial distribution was assumed for fishery catch at age.

A number of additional initial model settings are required in SS2, including specification of likelihood component emphasis factors (lambdas), size of deviation factors expressed as standard deviations, and penalty functions for extreme fishing mortality estimates. The lambdas were set at 1 for the likelihood components that were intended to influence model fit. Initial runs used a) the number of sampled commercial fishery trips (ranging from 30 per year in 1995 to 181 in 2006) as the lambda for the effective fishery age composition sample size (ESS), b) total catch lambda equal to the default value of 1, and c) initial CVs of 0.15 for the NEFSC Winter survey indices and 0.25 for the NEFSC Spring and Fall indices.

Initial runs used a single fishery catch at age matrix and NEFSC survey indices, and adjusted the number and timing of fishery selectivity blocks and the number of selectivity parameters estimated to judge the sensitivity of the analysis to these settings. The sequence of initial runs is summarized in Table 117.

These tests found that attempts to fit 3 parameters to describe a logistic selectivity pattern for the fishery generally resulted in gradients (a model fit diagnostic) that were too high. Fitting a single pattern for the entire 1982-2006 time series also generally provided gradients that were too high, or poor fits to the fishery age composition for some years in the early part of the time series. Initial runs with 3 time blocks and 1 or 2 selectivity parameters were judged to fit best. A second round of tests showed that the selectivity parameters for the first 2 periods were nearly the same and so subsequent runs included only 2 blocks: 1982-1994 and 1995-2006. Further testing indicated best fits for runs with 2 logistic selectivity parameters (SELEX pattern 20, parameters 1 (peak) and 3 (ascending limb width)), with a total catch weight lambda of 10 (Table 118). A third round of testing incorporated Working Group (WG) recommendations (Mark Maunder, Quantitative Resource Assessment LLC, pers. comm.) for general SS2 model settings, including estimation of R0, R1 deviations, testing of the start date for recruitment deviations, and testing of the effect of the s-r function lambda. These tests are summarized in Table 119., and provided a base configuration (F08_BASE) that would be subject to "tuning" by adjusting the observed ESS and survey index CVs.

The next steps were to include the additional state agency survey indices at age accepted for the base ADAPT VPA formulation and adjust likelihood component lambdas and survey index CVs. Survey CVs were re-set to 0.16 for the NEFSC Winter survey indices, 0.21 for the NEFSC Spring indices, 0.31 for the NEFSC Fall indices, 0.21 for the MADMF Spring and Fall indices (based on the average of the annual aggregate indices), and 0.40 for the CTDEP, RIDFW, NJDFW, DEDFW, MDDNR, VIMS, and NCDFW indices (no average values available; based on expectation that state survey indices at ages would be less precise than NEFSC surveys). The s-r function lambdas and CVs were set to 0 to remove the influence on the fit (as in the ASAP model building exercise), but allow internal estimation of the s-r function and reference points. The effects of these changes are summarized in Table 120 (run F08_BASE).

Following guidance received from Ian Stewart of NMFS NWFSC (pers. comm.) and Chris Legault of NMFS NEFSC (pers. comm.), the next step was to use the estimated ESS to observed sample size (OSS) ratio for the times series (1.863) to "tune" the model to the fishery age compositions by multiplying the input observed ESS by this ratio (run F08_BASE_T1). A recommended second tuning step was to increase the survey CVs by 1.5 to 2.0 times (variance adjustment in absolute terms of +0.14, +0.19, and +0.20), to allow better fits to the survey indices while maintaining fit to the fishery age compositions (run F08_BASE_T2). The ESS/OSS ratio tuning step had a greater effect on the results than did increasing the survey CVs (Table 120). Changes in the stock size and fishing mortality estimates between the BASE, T1 and T2 run configurations are presented in Figures 40-42. This last tuning configuration, F08_BASE_T2, was used as the final SS2 base run.

The annual selection of age-1 fish decreased from about 0.51 during the first time block of selectivity estimation (1982-1994) to about 0.15 during the second block, 1995-2006. The annual selection of age-2 fish decreased from about 1.00 during the first time block of selectivity estimation (1982-1994) to about 0.68 during the second block, 1995-2006. These decreases in selection at age are very similar to those estimated for the same time blocks using the ASAP model (see section 4.3), and are in line with expectations given changes in commercial and recreational fishery regulations. For these reasons, summer flounder are currently considered to be fully recruited to the fisheries at age 3, and fully recruited fishing mortality is expressed as the unweighted average of fishing mortality at age for ages 3 to 7+. Fishing mortality calculated from the average of fully recruited ages 3-5 varied between 1.14 and 1.84 during 1982-1996, then declined substantially and was estimated to be 0.43 in 2006 (Figure 42).

The F08_BASE_T2 run indicates that the 1983 year class was the largest of the series, at 64 million fish. The 1988 year class was the smallest of the series, at only 10 million fish. The 2006 year class is estimated at 32 million fish, equal to the time series average of 32 million (Figure 41). Spawning stock biomass (SSB; Age 0+) declined 68% between 1983 and 1990 (28,900 mt to 9,200 mt), but increased four-fold to 39,200 mt in 2005, before falling to 38,800 mt in 2006 (Figure 40).

Retrospective analysis of the summer flounder SS2 F08_BASE_T2 run was carried out for terminal catch years 1997-2006 – earlier terminal years were not advisable due to the constraints of the selectivity blocks (2-3 years are recommended in each block; Ian Stewart, NMFS NWFSC, pers. comm.; Chris Legault, NMFS NEFSC, pers. comm.). The retrospective analysis indicates a pattern of underestimation of fully recruited F for 1997-2005 (Figure 43). For the last three years, fishing mortality was underestimated by 42% for 2003, by 37% for 2004, and by 12% for 2005, relative to the terminal year 2006 estimates. Spawning stock biomass has been generally been overestimated in the last 3 years, by 51% for 2003, 38% for 2004, and 8% for 2005, relative to the terminal year 2006 estimates (Figure 44). There is no consistent retrospective pattern in the estimation of the abundance of age 0 fish since 1997 (Figure 45).

4.5 Considerations for Model Selection

4.5.1 Comparative BASE Model Results

Fishing mortality rates in 2006 and stock sizes in 2007 were estimated using a) the ADAPT method for calibration of the VPA (Parrack 1986, Gavaris 1988, Conser and Powers 1990) as implemented in the NOAA Fisheries Toolbox (NFT) ADAPT VPA version 2.7.7, b) the ASAP model as implemented in the NOAA Fisheries Toolbox (NFT) ASAP version 2.0.13, and c) the Stock Synthesis 2 (SS2) model as implemented in the NOAA Fisheries Toolbox (NFT) SS2 version 2.00o. The catch at age, maturity at age, and survey index calibration time series were input as in the ADAPT VPA F08_BASE run (see section 4.2.1), with fishery and survey data through 2006 (fishery) and 2007 (selected surveys) for ADAPT and through 2006 for ASAP and SS2. The ADAPT VPA was used as the platform to select the base set of indices to carry forward in the base case for all 3 models because the existing NFT ADAPT software has very useful diagnostic features for judging the calibration performance of the indices. The final base run configurations include 39 survey indices at age.

The ASAP and SS2 models require many additional assumptions and model settings as compared to the ADAPT VPA, including setting for emphasis factors (lambdas) and measures of deviation for the catch, survey and fishery age composition, and s-r function likelihood components. The base case ASAP and SS2 model configurations were developed in parallel fashion, although the experience gained in first developing the SS2 base case helped guide the ASAP base case formulation, especially with regards to the timing of selectivity blocks. Likewise, recommendations provided on the "tuning" of the SS2 model were adopted to guide the "tuning" of the ASAP model. Details are provided in section 4.3 for ASAP and section 4.4 for SS2. Figures 46-48 compare the estimates of Spawning Stock Biomass (SSB; mt), recruitment at age 0 (R; 000s) and fully-recruited fishing mortality rate (F, ages 3-5) from the base case configurations for the ADAPT VPA, ASAP, and SS2 models. In general, the 3 models provided similar results in terms of both the trend and current estimates of fishing mortality and stock size. The SS2 base case provided lower estimates of recruitment in the early years of the time series compared to the ADAPT VPA and ASAP models.

Retrospective analysis of the 3 models was carried out for terminal catch years 1995-2006 for the ADAPT VPA, and for 1997-2006 for ASAP and SS2 (1995-1996 were omitted to avoid estimation problems related to the selectivity block break between 1994 and 1995). For the ADAPT VPA over the last 3 years, fishing mortality was underestimated by 42% for 2003, by 25% for 2004, and by 15% for 2005, relative to the terminal year 2006 estimates. ADAPT VPA estimates of SSB were overestimated in the last 3 years, by 54% for 2003, 23% for 2004, and 7% for 2005, relative to the terminal year 2006 estimates. For ASAP over the last 3 years, fishing mortality was underestimated by 37% for 2003, by 32% for 2004, and by 9% for 2005, relative to the terminal year 2006 estimates. ASAP estimates of SSB were overestimated in the last 3 years, by 60% for 2003, 44% for 2004, and 9% for 2005, relative to the terminal year 2006 estimates. For SS2 over the last 3 years, fishing mortality was underestimated by 41% for 2003, by 37% for 2004, and by 12% for 2005, relative to the terminal year 2006 estimates. SS2 estimates of SSB were overestimated in the last 3 years, by 51% for 2003, 38% for 2004, and 8% for 2005, relative to the terminal year 2006 estimates. There was no consistent retrospective pattern in the estimation of the abundance of age 0 fish over the last three years for any of the 3 models.

Table 121 presents the calculated Mohn's rho diagnostic ([retro year estimate – current year estimate]/current year estimate) for the 3 models for SSB and F. If the cumulative value of rho is used to judge the performance of the model over the retrospective time interval, then the ASAP model performed best (smallest cumulative sum), with the ADAPT VPA and SS2 exhibiting more severe retrospective error in fishing mortality estimates (comparable larger cumulative sums). The ASAP model also exhibited the smallest retrospective error in SSB, followed by the SS2 and ADAPT VPA models. See the individual model sections (4.2-4.4) for the retrospective plots of F and SSB for each model.

Comparative BASE Model Characteristics (Pros and Cons)

ADAPT VPA

Pros: a) relatively simple model compared to the SCAA models, results dictated by the input data, within the constraints of the catch equation formulation, b) well developed bootstrap routine to estimate uncertainty of current year estimates, c) well developed interface with AGEPRO stochastic projection software.

Cons: a) current implementation lacks flexibility to model multiple fleets, multiple sexes, multiple areas, different selectivity assumptions, b) exhibits most severe retrospective error for the summer flounder data.

ASAP

Pros: a) current implementation is a moderately complex, flexible SCAA capable of modeling multiple fleets and multiple approaches to survey index modeling, b) well developed MCMC routine to estimate uncertainty of current year estimates, c) well developed interface with AGEPRO stochastic projection software, d) exhibits least severe retrospective error for the summer flounder data.

Cons: a) current implementation lacks flexibility to model multiple sexes or multiple areas.

SS2

Pros: a) current implementation is a very complex, flexible SCAA capable of modeling multiple fleets, multiple sexes, multiple areas, and multiple approaches to survey index modeling.

Cons: a) exhibits relatively severe retrospective error for the summer flounder data, b) current MCMC implementation lacks an interface with AGEPRO stochastic projection software.

4.5.2 Alternative ASAP and SS2 Model Configurations

ASAP

Alternative configurations of the ASAP v2.0.13 model were tested to investigate the sensitivity of the qualitative assessment conclusions to different ways of modeling the BASE case assessment data. In the BASE case, the fishery catch data are modeled as a single aggregate catch at age matrix, with multinomial error distribution, and a single, time-varying fishery selectivity pattern is estimated for the combined fisheries. In the BASE case, the survey indices at age are modeled as individual indices at age with lognormal error, and survey selectivity specified as S = 1 for the relevant age or series of ages indexed by the survey.

In the first alternative configuration (F08_MULTI), the six fishery catch at age components (NER [ME-VA] commercial landings, NC commercial landings, commercial trawl fishery discards, commercial scallop dredge fishery discards, recreational fishery landings, and recreational fishery discards) were modeled separately, each with a multinomial error assumption. Flat-topped (single logistic, asymptotic) time-varying selectivity patterns were modeled for landings; dome-shaped patterns were modeled for the discards. For the trawl and scallop discards the By-Age selectivity model, with S = 1 fixed at age 1 for the trawl fishery discards and S = 1 fixed at age 2 for the scallop fishery discards, was used to model a dome-shaped pattern that was constant for the time series. For the recreational discards, a time-varying double logistic model was used to model a dome-shaped pattern. In the F08_MULTI configuration, survey indices were modeled as in the BASE case.

In the second alternative configuration (F08_SVAge comp), the survey indices at age were modeled with a multinomial error assumption when feasible (e.g., NEFSC Winter survey indices at age, ages 1-7+). A constant, flat-topped selectivity pattern was used for surveys with a full range of ages. The NEFSC Winter, Spring and Fall, CTDEP Fall, RI Monthly, and NJDFW Monthly survey indices at age were modeled in this manner. The MADMF Spring and Fall, CTDEP Spring, and RIDFW Fall surveys were modeled using the By-Age model for the selected ages included in the BASE case tuning set. The stand-alone age 0 recruitment index series (DEDFW Inland, MDDNR and VIMS) were modeled as in the BASE case (lognormal, S= 1). In the F08_SVAgecomp configuration, the single fishery catch at matrix was modeled as in the BASE case.

In the third configuration (F08_MULTI_SVAGE), the F08_MULTI and F08_SVAgecomp configurations were combined, so that the 6 fishery catch at age components were modeled as in the MULTI configuration, while the survey indices at age were modeled as in the SVAgecomp configuration.

Table 122 summarizes the run diagnostics and results for the three ASAP alternative runs. No "tuning" steps were undertaken for the three ASAP alternatives. The diagnostics for the SVAgecomp configuration was acceptable. The MULTI and MULTI_SVAGE configurations both exhibited problems in the commercial trawl and scallop fishery discard selectivity fits and S-R function parameter estimation (due to very high recruitment estimates at low SSB). The multiple fisheries ASAP configuration results were sensitive to the method of selectivity for the commercial discards, and the estimated age compositions did not match the observed discard at age well. If may not be feasible to model the trawl and scallop fishery discards as separate fleets. Alternatively, future work might consider methods to extend the commercial fishery discard series back to 1982.

None of the three ASAP alternatives provided solutions that significantly reduced that pattern of positive residuals in aggregate indices or indices at age (mainly ages 3-5) during the late 1990s/early 2000s that was apparent in the BASE case ADAPT VPA, ASAP, and SS2 models.

The SVAgecomp configuration estimates most closely matched the ASAP BASE case. The MULTI_SVAGE configuration usually provided the most variable and/or highest F estimates when compared to the BASE case and two other alternative configurations. Figures 49-51 compare the estimates of Spawning Stock Biomass (SSB; mt), recruitment at age 0 (R; 000s) and fully-recruited fishing mortality rate (F, ages 3-5) from the ASAP BASE case configuration (F08_BASE_T5) with the three ASAP alternatives.

SS2

Alternative configurations of the SS2 model were tested to investigate the sensitivity of the qualitative assessment conclusions to different ways of modeling the BASE case assessment data. In the BASE case, the fishery catch data are modeled as a single aggregate catch at age matrix, with multinomial error distribution, and a single, time-varying fishery selectivity pattern is estimated for the combined fisheries. In the BASE case, the survey indices at age are modeled as individual indices at age with lognormal error, and survey selectivity specified as S = 1 for the relevant age or series of ages indexed by the survey.

In the first alternative configuration (F08_MULTI), the six fishery catch at age components were modeled separately, each with a multinomial error assumption and a time-varying selectivity pattern. Flat-topped (single logistic, asymptotic) selectivity patterns were modeled for landings; dome-shaped patterns were modeled for the discards. In the F08_MULTI configuration, survey indices were modeled as in the BASE case.

In the second alternative configuration (F08_SVAge comp), the survey indices at age were modeled with a multinomial error assumption (e.g., NEFSC Winter survey indices at age, ages 1-7+) and a constant, flat-topped selectivity pattern. The NEFSC Winter, Spring and Fall, MADMF Spring and Fall, CTDEP Spring and Fall, RIDFW Fall and Monthly, and NJDFW Monthly survey indices at age were modeled in this manner. Stand-alone age 0 recruitment index series (DEDFW Inland, MDDNR and VIMS) were modeled as in the BASE case (lognormal, S= 1). In the F08_SVAgecomp configuration, the single fishery catch at matrix was modeled as in the BASE case.

In the third configuration (F08_MULTI_SVAGE), the F08_MULTI and F08_SVAgecomp configurations were combined, so that the 6 fishery catch at age components were modeled as in the MULTI configuration, while the survey indices at age were modeled as in the SVAgecomp configuration.

Table 123 summarizes the run diagnostics and results for the three alternative SS2 runs. No “tuning” steps were undertaken for the three SS2 alternatives. The diagnostics for all three alternatives were generally acceptable. However, some parameter bounds (constraints) were hit during fitting of the selectivity patterns, and these parameters would need to be fixed near these bounds if one of the alternatives were accepted as the final assessment model run. For the commercial discard fleets modeled with a dome, the selection for the older ages (beyond the age range of the input catch, ages 8 and older) appeared infeasible for both time blocks (either near S = 1 for trawls, or near S = 0.50 for scallop dredges). If may not be feasible to model the trawl and scallop fishery discards as separate fleets. Alternatively, future work might consider methods to extend the commercial fishery discard series back to 1982.

None of the three SS2 alternatives provided solutions that significantly reduced that pattern of positive residuals in aggregate indices or indices at age (mainly ages 3-5) during the late 1990s/early 2000s that was apparent in the BASE case ADAPT VPA, ASAP, and SS2 models. The fishery selectivity pattern for 1995-2006 estimated in the F08_SVAgecomp configuration was “steeper,” with higher selectivity at age 2 (S = 0.85) and full recruitment (S = 1.0) by age 3, than in the F08_MULTI and F08_MULTI_SVAGE configurations, for which the landings selectivity patterns tended to have lower selection at age 2 (ranging from 0.30 to 0.65).

Figures 52-54 compare the estimates of Spawning Stock Biomass (SSB; mt), recruitment at age 0 (R; 000s) and fully-recruited fishing mortality rate (F, ages 3-5) from the SS2 BASE case configuration (F08_BASE_T2) with the three SS2 alternatives. The alternative configurations provided similar trends in fishing mortality and stock sizes, although the F08_BASE_T2 and F08_MULTI cases tended to estimate lower Fs and higher stock sizes over the time series. The exception was that the F08_MULTI_SVAGE configuration estimated the lowest F and highest stock sizes in 2005 and 2006.

4.5.3 More Alternative SS2 Model Configurations

More alternative configurations of the SS2 model were tested to investigate the sensitivity of the qualitative assessment conclusions to different ways of modeling the BASE case assessment data. In this case, an alternative sex-structured assessment model was developed for summer flounder. The goal of the analysis was to more accurately represent the population dynamics (e.g. include sex-structure) and extract more of the information contained in the data. The stock assessment model was developed using Stock Synthesis II (Rick Methot, NMFS). It is a sex- and age-structured model. The model starts at an exploited stock size in 1976. The initial age-structure in 1976 is parameterized with substantial flexibility and independent of prior catch. Age 15 is used as a plus group for the dynamics. The catch and catch-at-age data is separated into six fisheries: main commercial fishery, North Carolina commercial fishery, commercial discards, scallop trawl discards, recreational, and recreational discards. The three NMFS trawl surveys are used as relative indices of abundance. Sex-specific catch-at-age data are included for the surveys. Combined sex catch-at-age data are included for the fisheries. Age 11 is used as a plus group for the catch-at-age data. Growth rates differ between males and females. Natural mortality is assumed constant over time and age, but can differ between males and females and is estimated in the model. The proportion female at age zero is assumed to be 0.4. All selectivity curves are dome-shaped except for the winter trawl survey. Fishery selectivities are length-based to accommodate different selectivities at age between the sexes due to differences in growth. Survey selectivities are age based, but the same for each sex. The fishery selectivities have different parameters starting in 1995, except the North Carolina fishery for which the new parameters start in 1989. The fishery selectivities have temporal variability to accommodate the changes in management (e.g. minimum legal size) and spatial differences in size of the fish. The MSY quantities are calculated using the age-specific fishing mortality averaged over 2005-2007.

Several sensitivity analyses were conducted to investigate the model assumptions.

- Assuming asymptotic selectivities for all survey and fisheries, except the discard fisheries. (asymptotic)
- Setting the steepness of the Beverton-Holt stock-recruitment relationship to 0.75 (h75)
- Fixing M at 0.2 for both females and males (M0.2)
- Fixing M at 0.2 and 0.3 for females and males, respectively. (M0.2M0.3)
- Fixing M at 0.2 for females and estimating M for males. (M0.2Mest)
- Using age-specific selectivity for the fisheries (Sage)
- Starting the model in 1982 (Start82)
- Using iterative reweighting to estimate the effective sample size for the catch-at-age data and the standard deviations for the surveys.

The results of the basecase model are much more optimistic than the ASAP assessment (Table 124). The estimates of natural mortality are much higher than currently used and the rate for males (0.54) is higher than the rate for females (0.29). The spawning biomass was estimated to have declined during the late 1970's and 1980's and then rebuilt to above the initial level by 2008 (Figure 55). The initial level in 1976 was about 30% of the unfished level, indicating that by 1976 the stock had already been substantially depleted (Figure MM1, Table 125). The current spawning biomass level is estimated to be above the level that corresponds to MSY and the current fishing mortality is estimated to be below the level that corresponds to MSY.

Based on the change in likelihood of >400 units, the MLE estimate of female natural mortality was statistically significantly different from 0.2 (Figure 56, Table 124) and results are dependent on the value of natural mortality (Table 124). The Male natural mortality was consistently 0.25 units higher than the female natural mortality (x-axis of Figure 56, Table 124). This is presumably due to the information in the sex-specific survey catch-at-age data.

There is substantial scatter in the stock-recruitment estimates and there is no clear evidence of a stock-recruitment relationship (Figure 57). The sensitivity analysis with the steepness of the Beverton-Holt stock-recruitment relationship fixed at 0.75 fits the data significantly worse than the assessment without a stock recruitment relationship (Table 124). The estimates of natural mortality were higher than in the basecase.

The asymptotic selectivity and age based fishery selectivity sensitivity analyses fit the data significantly worse than the basecase, but the estimates of natural mortality are still substantially higher than used in the ASAP assessment and the results more optimistic (Table 124).

The sensitivity analysis that starts in 1982 provides similar results to the basecase (Table 124). The sensitivity that iteratively reweights the catch-at-age sample size and the standard deviations for the survey likelihoods estimates higher values for natural mortality and is generally more optimistic (Table 124).

All the sensitivities, except when the steepness of the stock-recruitment relationship is fixed at 0.75, estimate that the spawning biomass in 2008 is above the value that corresponds to MSY (Table 124). All sensitivities estimate that the current fishing mortality rate is less than that corresponding to MSY. The spawning biomass corresponding to MSY as a fraction of the unfished spawning biomass is low due to the lack of a stock-recruitment relationship (Table 124). Under current levels of fishing, the base case assessment estimates that continuing at that rate would produce a spawning biomass of about 40% of the unfished level (Table 125)

All of the model runs have positive definite hessians, but the maximum gradient was often larger than that used for the stopping criteria. In some cases a local minima was obtained and the model had to be rerun. Usually, the local minimum was obtained at an unrealistic parameter value (e.g. the estimate of natural mortality was unrealistically low).

4.6 Selected Modeling Approach

4.6.1 Model Selection Justification

After considerable debate focused mainly on the assumption for the natural mortality rate (M), use of a single or two-sex model, and the characteristics of fishery selection patterns, the SDWG concluded that the final assessment for 2008 would be conducted using the ASAP model with two fleets (combined landings modeled with a flat-topped [single logistic] pattern and combined discards modeled with a dome-shaped [double logistic] pattern), a single sex using a combined sex vector of M at age, and surveys configured as indices at age with a lognormal error assumption.

A two-fleet configuration was chosen because it allowed the landings and discards selectivity patterns to be modeled separately, judged to be an improvement over the single fleet F08_BASE runs (see Section 4.3). Six-fleet configurations were also considered in both ASAP and SS2 (Section 4.5.2). In ASAP multiple fleet configurations, landings were modeled with flat-topped patterns (single logistic, asymptotic) for two time periods (break between 1994/1995) and discards were modeled with dome-shaped patterns (double logistic or by-age) for the same periods. In a six-fleet single-sex configuration in ASAP, the fishery selectivity patterns were not well estimated as some parameter estimates were constrained by bounds during fitting, and so the SDWG concluded that a six-fleet model in ASAP could not be currently be constructed without fixing some of the parameters. Comparable problems were encountered in a similarly constructed six-fleet single-sex SS2 model (Section 4.5.2). A six-fleet, two-sex model constructed in SS2 (Section 4.5.3) showed reduced estimation problems by modeling selection for the fleets as annual length-based double-logistic (domed) patterns, although some parameters were still constrained by bounds in model fitting. The domed-shaped patterns for both landings and discards fit better than flat-topped patterns in the SS2 six-fleet two-sex model. The SDWG concluded, however, that these strongly domed patterns and the "cryptic biomass" that was implied (biomass generated by the model that has not been observed in either the fishery or surveys) could not be accepted given the lack of supporting data or assumptions external to the model.

The two-sex configuration modeled in SS2 provided the ability to estimate differences in fishing mortality rates and stock size trends by sex (Section 4.5.3). However, the SDWG was unable to determine the effect on assessment results of modeling some of the surveys by sex, some as combined sexes, and the landings and discards as combined sexes. The ability to compile survey indices by sex is currently limited to the NEFSC surveys – much more future work will need to be completed by the SDWG to compile state survey indices by sex (which may be feasible since many of them are aged using NEFSC age-length keys).

A potentially more difficult task will be to re-compile the landings and discards at age by sex, because fishery dependent samples by sex are not available. The SDWG will need to perform future research to determine if a feasible approach can be developed to re-compile the fishery catch by sex.

The ADAPT VPA, ASAP and SS2 models provide comparable results when configured similarly (see Section 4.5.2). ASAP was chosen as the final model framework for the 2008 assessment mainly because ASAP a) provides the capability to model multiple fleets and multiple approaches to survey modeling, b) can incorporate data on changes in growth expressed as annual mean weights and maturity at age, c) exhibits the least severe retrospective pattern in a BASE run comparison among ADAPT VPA, ASAP, and SS2 (see section 4.5.1), d) provides a well developed MCMC routine to estimate the uncertainty of current year estimates and facilitate completion of TOR 5.0, and e) provides a well developed interface with the NOAA NFT AGEPRO stochastic projection software, to facilitate completion of TOR 8.0.

The SDWG assumed a natural mortality rate (M) of 0.20 for females and 0.30 for males based mainly on recently observed maximum ages (tmax) in NEFSC survey data of 14 years (76 cm, in NEFSC Winter Survey 2005) for females and 12 years (63 cm, in NEFSC Spring Survey 2007) for males, and the expectation that larger and older fish are likely if fishing mortality rates are maintained near current rates over the next several years. The assumptions were further guided by a) the 3/tmax (5% surviving to tmax at F = 0; Vetter 1988, Quinn and Deriso 1999) and 4.22/tmax (1.5% surviving to tmax at F = 0; Hewitt and Hoenig 2005) rule-of-thumb approaches, and b) the current SDWG working papers on summer flounder growth and maturity prepared by Brust, Powell, and Wong. A combined sex M-schedule at age was developed for use in ASAP by assuming these initial M rates by sex, an initial proportion of females at age 0 of 0.40 derived from the NEFSC Fall survey indices by age and sex, and population abundance decline over time at the sex specific M rates. The final abundance weighted combined sex M-schedule at age ranged from 0.26 at age 0 to 0.24 at age 7+, with a mean of 0.25. The new assumption for M (changed from M=0.2 for both sexes, all ages) resulted in substantial change in the summer flounder assessment by rescaling to increase estimates of stock size, biomass and fishing mortality rates, when compared to previous assessments and current BASE case runs.

4.6.2 Final ASAP Model with Terminal Year 2006

Subsequent to the April 2008 SDWG meeting, the final ASAP two-fleet single-sex model run with terminal year 2006 was subject to a single tuning step, by revising the input fleet Observed Sample Size for the two fleets by the ESS/OSS ratio, as in SS2 tuning. The ratio for the landings fleet was 0.95, and so no change from the input value of 200 was made. The ratio for the discards fleet was 9.4, and so the input value was increased from 10 to 90. Additional tuning by increasing the input survey CVs was not done at this stage, since tuning of the ASAP F08_BASE case run indicated that the impact of that tuning was minimal. The F08_FINAL_T2006 run exhibits a retrospective pattern in recent years similar to those of the BASE case runs in the other models – underestimation of F and overestimation of SSB, with no strong pattern evident for recruitment at age 0 (Figures 58-60).

Summer flounder stock size (SSB, R) and fishing mortality (F) as estimated by the S&T 2006 ADAPT VPA assessment (one fleet, mean M = 0.2), the ASAP F08_BASE case model run (one fleet, mean M = 0.20), and the F08_FINAL_T2006 run (two fleets, mean M = 0.25) are summarized in Figures 61-63. The three runs provide similar long term trend in stock size and F, with the F08_FINAL_T2006 run providing intermediate results in terms of recent SSB in comparison to the other two, but higher recent levels of recruitment and F.

The F08_FINAL_T2006 run was also compared with sensitivity runs for four alternative specifications of the M-schedule: 1) F1_M3 - female M = 0.10, male M = 0.30, mean = 0.18, 2) F2_M2 - female M = 0.20, male M = 0.20, mean = 0.20, 3) F2_M4 - female M = 0.20, male M = 0.40, mean = 0.29, and 4) F2_M5 -female M = 0.20, male M = 0.50, mean = 0.33. The F08_FINAL_T2006 results are compared with those from the four M alternative runs in Figures 64-66. The rescaling of the stock size and fishing mortality rate estimates as mean M increases or decreases is readily apparent, while time series trends are the same. The F08_FINAL_T2006 results are intermediate with respect to the alternative assumption M runs. The final ASAP model with terminal year 2007 (The F08_FINAL_T2007) is provided in the following section (5.0).

5.0 Based on the "best" model or models, estimate fishing mortality rate, recruitment, spawning stock biomass, and total stock biomass for the current year and characterize the uncertainty of those estimates. If possible, also include estimates for earlier years with uncertainty estimates.

5.1 Final ASAP Model with Terminal Year 2007

The F08_FINAL_T2006 run was updated with fishery catches and research survey indices through 2007 to create run F08_T2007_T1. Input survey CVs were maintained at the same tuning step values as in the F08_FINAL_T2006 run (NEFSC Winter = 0.3, NEFSC Spring = 0.4, NEFSC Fall = 0.6, all State Agency = 0.6). The input Observed Sample Sizes (OSS) were maintained at 200 for the Landings but reset to 10 for the Discards, as in the initial T2006 runs. The F08_T2007_T1 results were then used to calculate the Effective Sample Size (ESS) for the two fleets; the resulting ESS/OSS ratio was then used to revise the input OSS to 173 for the

Landings (0.86 ESS/OSS ratio) and to 101 for the Discards (10.10 ESS/OSS ratio) to configure the F08_T2007_T2 run.

Results for the F08_FINAL_T2006, F08_T2007_T1, and F08_T2007_T2 runs are compared in Figures 67-69; the long term trends are very similar. The only significant differences occur between the T2006 and T2007 runs in stock sizes (SSB and R) during 2003-2006. The patterns in fishing mortality rates are nearly identical. Differences between the two T2007 tuning runs are also very minor. The ASAP F08_T2007_T2 configuration was adopted as the final assessment model run.

The F08_T2007_T2 run exhibits a retrospective pattern in recent years similar to those of the BASE case runs in the other models and the F08_FINAL_T2006 run – generally an underestimation of F and overestimation of SSB since 1997, with no strong pattern evident for recruitment at age 0 (Figures 70-72). Over the last 3 years, the annual retrospective change in fishing mortality has ranged from +30% to -5%; the annual retrospective change in SSB has ranged from -29% to +6%; the annual retrospective change in recruitment has ranged from +12% to +44%.

The F08_T2007_T2 run was also compared with sensitivity runs for four alternative specifications of the M-schedule: 1) F1_M3: female M = 0.10, male M = 0.30, mean = 0.18, 2) F2_M2: female M = 0.20, male M = 0.20, mean = 0.20, 3) F2_M4: female M = 0.20, male M = 0.40, mean = 0.29, and 4) F2_M5: female M = 0.20, male M = 0.50, mean = 0.33. The F08_T2007_T2 results are compared with those from the four M alternative runs in Figures 73-75. As with the T2006 runs, the rescaling of the stock size and fishing mortality rate estimates as mean M increases or decreases is readily apparent, while time series trends are the same. The F08_T2007_T2 results are intermediate with respect to the alternative assumption M runs. The results of likelihood profiling of M for the F08_T2007_T2 run indicates lower normalized MSR (greater likelihood) at higher M (Figure 76A). A comparison of these results to likelihood profiles of M for the ADAPT, ASAP, and SS2 BASE cases suggest the model preferred M (as indicted by lower likelihood) is highly sensitive to both model selection and configuration (Figure 76B).

Summary estimates for the 2008 assessment final model ASAP F08_T2007_T2 run are provided in Table 126, and population number and fishing mortality estimates at age are provided in Tables 127 and 128. The full report of the F08_T2007_T2 run is provided in the TOR 5 Appendix. Fishing mortality calculated from the average of the currently fully recruited ages (3-7+) was very high, varying between 1.143 and 2.042 during 1982-1996. The fishing mortality rate has declined to below 1.00 since 1996 and was estimated to be 0.288 in 2007 (Figure 77). There is an 80% probability that the fishing mortality rate in 2007 was between 0.253 and 0.325 (Figures 78 and 79). Spawning stock biomass (SSB) declined from 24,674 mt in 1982 to 7,017 in 1989, then increased to 43,932 mt by 2004. SSB was estimated to be 43,363 in 2007 (Figure 80). There is an 80% chance that SSB in 2007 was between 39,325 and 48,122 mt (Figures 81 and 82). The arithmetic average recruitment from 1982 to 2007 is 41.6 million fish at age 0. The 1982 and 1983 year classes are the largest in the VPA time series, at 73.5 and 81.6 million fish; the 1988 year class is the smallest at only 12.8 million fish. The 2007 year class is currently estimated to be about 40.0 million fish (Figure 80).

6.0 Examine and evaluate the role of the environment on past and present summer flounder recruitment success.

The SDWG has prepared two working group papers in support of this term of reference. The complete working group papers (Working Paper 11 and 12) are provided in Appendix 6, with a summary of these papers provided and findings given below.

The first document explored the hypothesis that relatively cold water temperature, or some mechanism associated with cold and/or severe weather, is correlated with poor recruitment success for summer flounder. Therefore, the relationships between water temperature anomalies, NAO indices and metrics of summer flounder recruitment success were examined by applying the general approaches of Brodziak and O'Brien (2005) and Megrey et al. (2005) to summer flounder Recruit-Spawner (RS) data and relevant environmental data. Brodziak and O'Brien (2005) examined relationships between environmental indices and summer flounder Recruit-Spawner Anomalies (RSAs) and found the NAO winter index forward lagged by two years was a significant predictor of summer flounder RS ratios, with positive NAO anomalies (wet and mild winters) correlating with positive RSAs (high recruit survival rate).

Spawning stock biomass (SSB), Recruit-Spawner Anomalies (RSAs), and absolute recruitment estimates (VPA0; as suggested by Megrey et al (2005)), were computed using data from a version of the 2007 assessment update Virtual Population Analysis (VPA). NEFSC research survey surface and bottom water temperature anomalies for the Mid-Atlantic Bight North (MABN; Nantucket Shoals to Hudson Canyon) and South regions (MABS; Hudson Canyon to Cape Hatteras) were obtained from the NEFSC database and seasonal temperatures anomalies were computed for the two regions for winter/spring (season 1; January-June) and fall (July-December; lagged forward) for both surface and bottom water temperatures. North Atlantic Oscillation (NAO) climate index monthly values were obtained from the University of East Anglia database and winter (December-March) and fall (September- November) indices were computed (contemporary and forward lagged one or two years).

The current work first attempted to identify potentially significant relationships by using correlation analyses among the environmental factors and SSB, RSAs, and absolute estimates of recruitment (VPA0). A Generalized Additive Model (GAM; Hastie and Tibshirani 1990) was then used to model relationships for environmental (predictive) factors initially identified by the correlation analysis (significant at the $p = 0.10$ level). The GAM approach is a nonparametric regression technique that relaxes error distribution assumptions in modeling the relationships between independent predictive variables and dependent response variables; it was suggested by Daskalov (1999), Megrey et al. (2005), and Brodziak and O’Brien (2005) as an effective tool for modeling biological responses to environmental factors. The initial null predictive model in the GAM framework used smoothing splines with 3 degress of freedom for each predictive factor. Following the procedures suggested by Brodziak and O’Brien (2005), a stepwise model-selection process was applied to eliminate predictive factors from the model if they had a p-value $<= 0.20$, with the step repeated until only predictive factors with $p <= 0.20$ were included in the model. Finally, the time series of the environmental factors with best fitting GAM models were used in an exercise to investigate their performance as potential VPA recruitment calibration indices.

Prominent features of the summer flounder absolute recruitment series (VPA0) include the strong year class that recruited in 1983 and the two weak year classes that recruited in 1988 and 2005; the recruit-spawner anomaly (RSA) series exhibited generally positive anomalies before 1996, and the uniformly negative anomalies since. The strong negative RSAs in 1988 and 2005 correspond to the weak absolute magnitude of recruitments (VPA0) in those years. The pattern of relatively low (negative) RSA since 1995 is one that would be expected for a fish stock exhibiting a Beverton-Holt (1957) asymptotic stock-recruitment relationship as that stock grows toward SSBMSY (Terceiro 2006b).

Several of the regional, seasonal temperature anomalies exhibit significant statistical correlation over the time series. However, the initial GAMs related only those factors that exhibited the strongest statistical correlations; either absolute recruitment (VPA0) or recruit-spawner anomaly (RSA) to the Mid-Atlantic North and South region winter-spring bottom temperature anomalies (MAN_BT1 and MAS_BT2) and the fall and winter NAO Climate indices (NAO_FAL, NAO_FAL_1, and NAO_WIN). There were two final GAMs (GAM1 and GAM2) that were developed relating either the RSA or the VPA0 to predictive factors. The final GAM relating RSA to the predictive factors (GAM1) included only the NAO_WIN index as the predictive factor on the x-axis (i.e., $p <= 0.20$). Comparison of the observed NAO_WIN index and estimated RSA indicates a positive and fairly strong predicative relationship, consistent with the results of the correlation analysis.

The final GAM relating VPA0 to the predictive environmental factors included the Mid-Atlantic South region winter-spring bottom temperature anomaly (MAS_BT2) and the and the fall and winter NAO Climate indices (NAO_WIN and NAO_FAL_1; i.e., $p <= 0.20$). The NAO_WIN index emerged as a significant predictive factor for VPA0 in the GAM model, even though the correlation of this factor with VPA0 was not initially identified as significant ($r = 0.08$, $p = 0.72$). It should also be noted that the NAO_FAL index failed to be retained in the GAM (i.e., $p > 0.20$) even though NAO_FAL was significantly correlated with VPA0 ($r = 0.34$, $p = 0.09$). Under GAM2, the combined predictive fit of the retained predictive factors (x-axis) on the absolute magnitude of summer flounder recruitment (VPA0; y-axis) characterizes the strong 1983 year class and the weak 1988 and 2005 year classes relatively well. However, the relationship between VPA0 and the individual environmental factors is relatively weak as evidenced by the wide confidence intervals of the predicted VPA0.

The time series of predictive factors from the GAM2 model (NAO_WIN, NAO_FAL_1 and MAS_BT2) were included as indices of age 0 recruitment (VPA0) in three derivative configurations of the summer flounder ADAPT VPA F07_ALL run to investigate their performance as potential calibration indices (i.e., as proxy indices of recruitment). Inclusion of these predictive factors resulted in increases in the magnitude of the MSR for the alternative runs (MSR = Mean Squared Residual = total sum of squared residuals divided by degrees of freedom), indicating that the inclusion of these environmental factors as recruitment calibration indices degraded the overall fit of the VPA. Estimates of the strong 1983 and weak 1988 year classes, estimated in the converged (stabilized) part of the VPA, were unchanged by the inclusion of the environmental factors; however the estimates of the weak 2005 year class increased by up to 30% in the alternative runs and estimates of the average 2006 year class increased by up to 13% in the alternative runs.

In summary, the results of this work suggest there are relationships between commonly measured environmental factors such as regional water temperature anomalies and larger scale climate indices and metrics of summer flounder recruitment success. However, these relationships are no stronger than those currently modeled using research survey indices of abundance. Inclusion of these environmental factors in alternative configurations of the current summer flounder assessment VPA does not significantly change the pattern of the recruitment time series or increase the precision of current recruitment estimates. The inclusion of the environmental factors in other summer flounder population dynamics models would not be expected to improve the reliability of forecasts or biological reference points.

A second working group paper was developed and applied the time series approach of wavelet analysis to identify if a relationship exists between summer flounder spawning stock biomass and recruitment estimates and two climatic signals that are considered significant in affecting oceanographic and estuarine processes in the Mid-Atlantic Bight. The North Atlantic Oscillation (NAO) is closely related to the Arctic Oscillation (AO) and primarily affects temperature; it has a well-described 8-year cycle and indications of a 4-yr periodicity that are superimposed on longer-term trends. The Pacific North American (PNA) has a well-described teleconnection with the El Niño-Southern Oscillation (ENSO) and has a dominant effect on precipitation and, thus, freshwater inflow, in the northeast region. These periodicities are known to profoundly effect estuarine oyster populations, including recruitment and mortality.

Monthly values for the NAO and PNA indices were obtained from the National Weather Service Climate Prediction Center. Spawning stock biomass (SSB) and absolute recruitment estimates (VPA0) were computed using data from a version of the 2007 assessment update Virtual Population Analysis (VPA).

Wavelet analysis was used to resolve localized variations in the strength of a signal (i.e., the wave) within a time series. With this approach, the original time series is decomposed into a time-frequency space, which allows the dominant components (i.e., the wavelets) that make up the wave to be identified. Soniat et al (2006) provide references to source the mathematical details of the technique. Earlier analyses by conducted by the Rutgers University group evaluated the use of a number of mother wavelets (e.g., Paul, Morlet). Comparison of the two mother wavelets show that, for applications of the type that follows, the Morlet wavelet provides adequate time resolution and superior frequency resolution over the results obtained from the Paul wavelet. As a consequence, the Morlet wavelet is used here. Four wavelet analyses were reported as representative of a number of different analyses. Each is a cross-wavelet analysis, equivalent to a cross-correlational analysis, comparing either the NAO or PNA to either the VPA0 or the spawner-recruit (VPA0/SSB) index.

No evidence exists for a relationship between the PNA and summer flounder recruitment. On the other hand, a relationship between the NAO and summer flounder recruitment is strongly supported. The 8-year periodicity, the dominant periodicity in the NAO, is identified as significantly correlated with an 8-year periodicity in the recruitment indices in all analyses. The significance level consistently exceeds $\alpha = 0.05$. No substantive phase shift occurs. The two periodicities are in near-synchrony so that high NAO and high recruitment indices occur more or less simultaneously. In most analyses, a 4-year periodicity also occurs, although sometimes at a weaker level of significance. This interaction is consistently associated with a phase shift between 1995 and 2000. Such phase shifts are frequently associated with substantive long-term changes in population dynamics. However, this periodicity was no longer significant after the long-term trend in the spawner-recruit data was eliminated. This suggests that the interaction of the two time series was primarily associated with subsets of the time series record. A detailed examination of the coherence over the time series suggests that the 4-year periodicity was stronger pre-1995 and post-2000 and that the phase shift was coincident with a decline in the significance of this periodicity during the intervening years.

The NAO is consistently associated with temperature shifts in the North Atlantic. The present analysis suggest that some portion of the variability in summer flounder recruitment since 1982 can be explained by this climate forcer and its expression in changes in the temperature regime experienced by the fish.

7.0 Biological Reference Points

7.1 Update or redefine biological reference points (BRPs; proxies for BMSY and FMSY), taking into account conclusions from earlier assessments and findings from TOR 6 (i.e., recruitment and the environment). Estimate uncertainty in BRPs. Comment on the scientific adequacy of existing and redefined BRPs.

Background

The calculation of biological reference points for summer flounder based on yield per recruit analysis using the Thompson and Bell (1934) model was first detailed in the 1990 Stock Assessment Workshop (SAW) 11 assessment (NEFC 1990). The 1990 analysis estimated that F_{max} = 0.23. In the 1997 SAW 25 assessment (NEFSC 1997), an updated yield per recruit analysis reflecting the partial recruitment pattern and mean weights at age for 1995-1996 estimated that F_{max} = 0.24. The analysis in the Terceiro (1999) assessment, reflecting partial recruitment and mean weights at age for 1997-1998, estimated that F_{max} = 0.263.

The Overfishing Definition Review Panel (Applegate *et al.* 1998) recommended that the Mid-Atlantic Fishery Management Council (MAFMC) base MSY proxy reference points on yield per recruit analysis, and this recommendation was adopted in formulating the FMP Amendment 12 Overfishing Definition (MAFMC 1999). These reference points were based on the 1999 assessment (Terceiro 1999) and followed what would later be described as the Anon-parametric approach@ (i.e., biomass reference points calculated as the product of biomass per recruit and a reference period recruitment level; NEFSC 2002a). The 1999 assessment indicated that $F_{threshold} = F_{target} = F_{max}$ = 0.263, yield per recruit (Y/R) at F_{max} was 0.55219 kg/recruit, and January 1 Total Stock Biomass per recruit (TSB/R) at F_{max} was 2.8127 kg/recruit. The median number of summer flounder recruits estimated from the 1999 Virtual Population Analysis (VPA) for 1982-1998 was 37.844 million age-0 fish. Based on this median recruitment level, maximum sustainable yield (Y_{max} as a proxy for MSY) was estimated to be 20,897 mt (46 million lbs) at a Total Stock Biomass (TSB_{max} as a proxy for B_{MSY}) of 106,444 mt (235 million lbs). The biomass threshold, one-half TSB_{max} as a proxy for one-half B_{MSY}, was therefore estimated to be 53,222 mt (118 million lbs). The Terceiro (1999) reference points were retained in the 2000 SAW 31 assessment (NEFSC 2000) because of the stability of the input data and resulting biological reference point estimates.

The MAFMC Science and Statistical Committee (SSC) conducted a peer review of the summer flounder Overfishing Definition in concert with the 2001 assessment update (MAFMC 2001a, b). The SSC reviewed six analyses to estimate biological reference points for summer flounder conducted by members of the Atlantic States Marine Fisheries Commission (ASMFC) Summer Flounder Biological Reference Point Working Group. After considerable discussion, the SSC decided that although the new analyses conducted by the ASMFC Working Group had resulted in a wide range of estimates, they did not provide a reliable alternative set of reference points for summer flounder. The SSC therefore recommended that F_{target} remain F_{max} = 0.263 because a better estimate had not been established by any of the new analyses. The SSC also reviewed the biomass target (B_{MSY}) and threshold (one-half B_{MSY}) components of the Overfishing Definition and concluded that the new analyses did not justify an alternative estimate of the B_{MSY} proxy. The SSC endorsed the recommendations of SAW 31 which stated that Athe use of F_{max} as a proxy for F_{MSY} should be reconsidered as more information on the dynamics of growth in relation to biomass and the shape of the stock recruitment function become available@ (NEFSC 2000). The SSC agreed that additional years of stock and recruitment data should be collected and encouraged further model development, including model evaluation through simulation studies. They also encouraged the evaluation of alternative proxies for biological reference points that might be more appropriate for an early maturing species like summer flounder and the development and evaluation of management strategies for fisheries where B_{MSY} is unknown. The SSC indicated that as the stock size increases, population dynamic processes that could reflect density dependent mechanisms should be more closely monitored and corresponding analyses should be expanded, i.e., rates of size and age, maturity, fecundity, and egg viability should be closely monitored as potential indicators of compensation at higher stock sizes. Finally, the SSC recommended that potential environmental influences on recruitment, including oceanographic changes and predation mortality, should be reevaluated as additional recruitment data become available. As a result of the SSC peer review (MAFMC 2001a) the Terceiro (1999) reference points were retained in the 2001 stock assessment (MAFMC 2001b). In the review of the 2002 stock assessment (NEFSC 2002b), SAW 35 concluded that revision of the reference points was not warranted at that time due to the continuing stability of the input data and resulting reference point estimates. The Terceiro (1999) reference points were subsequently retained in the 2003 (Terceiro 2003a) and 2004 (SDWG 2004) assessment updates.

The biological reference points for summer flounder were next peer-reviewed by the 2005 SAW 41, based on the 2005 assessment update using fishery data through 2004 and research survey data through 2004/2005 (NEFSC 2005). The SAW 41 Review Panel noted that the Beverton-Holt (Beverton and Holt, 1957; Mace and Doonan 1988; BH) model fit the observed stock-recruitment data well, and provided reference points comparable to those derived from a non-parametric (yield and biomass per recruit) approach. The SAW 41 Panel noted, however, that the quantity of observed stock-recruitment data was limited (22 years), and the data during the early part of the time series, when the SSB was at the lowest observed levels, indicated a level of recruitment near the estimated R_{max}, and exerted a high degree of leverage on the estimation of the model parameters. This leverage resulted in a high value (0.984) for the subsequently calculated steepness of the BH curve, outside of the $\pm$ one standard error interval of the estimate for Pleuronectid flatfish (0.8 $\pm$ 0.1) indicated by Myers (1999). The BH model results suggested that summer flounder SSB could fall to very low levels (<2,000 mt) and still produce recruitment near that produced at SSB_{MSY}. The SAW 41 Panel concluded a) that this result might not be reasonable for the long term, given the recent stock-recruitment history of the stock (i.e., production of a very poor year class in 1988), b) the BH model estimated parameters might prove to be sensitive to subsequent additional years of S-R data, especially if they accumulated at higher levels of SSB and recruitment in the near term, and c) the BH model fit might also be sensitive to the magnitude of recently estimated spawning stock and recruitment, given the recent retrospective pattern of overestimation of stock size evident in the assessment. The SAW 41 Panel recognized that the limited time series of observed stock-recruitment data impacted both reference point estimation approaches (non-parametric and parametric stock-recruitment model) in terms of the potential spawning stock biomass and recruitment levels that might be realized from the stock if fished at fishing mortality rates in the 0.2-0.3 range over the long term. Given these concerns, the SAW 41 Panel advised that the BH model estimates were not suitable for use as biological reference points for summer flounder, and recommended continued use of reference points developed using the non-parametric model approach. FMP biological reference points from the 2005 assessment were $F_{max} = F_{MSY} = 0.276$, $Y_{max} = MSY =$

19,072 mt (42.0 million lbs), TSB_{max} = B_{MSY} = 92,645 mt (204.2 million lbs), and biomass threshold of 0.5*TSB_{max} = 46,323 mt (102.1 million lbs; NEFSC 2005).

The most recent peer review of biological reference points for summer flounder occurred in 2006 and was conducted by the National Marine Fisheries Service (NMFS) Office of Science and Technology (S&T) (Methot 2006). The 2006 S&T Peer Review recommended using SSB, rather than TSB as in previous assessments, as the metric for the biomass reference point proxy. The product of the mean recruitment (37.010 million fish) and Y/R at F_{max} was 21,444 mt = 47.276 million lbs (current FMP Amendment 12 proxy for MSY); the product of the mean recruitment and SSB/R at F_{max} was 89,411 mt = 197.118 million lbs (current FMP Amendment 12 proxy for $B_{MSY;}$ Terceiro 2006b). The 2006 S&T Peer Review Panel (Methot 2006) recommended adoption of these biological reference points from the non-parametric approach for summer flounder, advising:

"The low level of recruitment observed in 2005 is essentially the same as the low 1988 recruitment, so it is within the range of recruitment fluctuation used in calculating the expected time to rebuild this stock. The Panel finds that the most representative approach to calculating BRPs and rebuilding rates would be to use the entire set of recruitments from 1982-2005. The average, not median, of these recruitments should be used for calculation of biological reference points because much of the stock's accumulated biomass comes from the larger recruitments. Random draws from this set of recruitments would provide a probability distribution of rebuilding rates that is consistent with the occasional occurrence of small recruitments (1988 and 2005) and large recruitments (1982-1987). There is no documented and obvious reason why recruitments were higher during 1982-1987. If such recruitment levels become more common as the stock rebuilds, then the stock may rebuild to an even higher level than is currently targeted. If such recruitment levels do not occur during the next few years of the rebuilding, then the rebuilding target may be not be achieved by the target time to rebuild. More precise forecasts than this are not feasible."

Estimation Methodology

The two biological reference point estimation approaches previously used in the 2005 SAW 41 (NEFSC 2005) and 2006 S&T Peer Review (Terceiro 2006b) assessments were again applied in the 2008 assessment work, so as to be potentially complementary and supportive and because using both should build confidence in the results. Objective application of either approach is often compromised by lack of sufficient observation on stock and recruitment over a range of biomass to provide suitable contrast. Thus, it is often necessary to extrapolate beyond the range of observation and to infer the shape of the stock-recruit relationship from limited and variable observations (NEFSC 2002a). The 2001 MAFMC SSC review of summer flounder reference points also noted this concern (MAFMC 2001a).

The non-parametric approach was to evaluate various statistical moments (mean, variance, percentiles) of the observed series of recruitment data and apply the estimated spawning stock biomass and yield per recruit associated with common F reference points to derive the implied spawning stock biomass and equilibrium total yield (landings plus discards). The biomass and yield per recruit models were fit using the NOAA Fisheries Toolbox (NFT) YPR version 2.7.2 software (NFT 2008a). The full time series of recruitment during 1982-2007 as estimated by the 2008 assessment final model ASAP F08_T2007_T2 run was used in the yield and spawning stock biomass calculations at fishing mortality reference points, as per the 2006 S&T Peer Review Panel recommendation. The non-parametric approach assumes that compensatory mechanisms such as impaired growth, maturity, or recruit survival are negligible over the range of biomass considered (NEFSC 2002a). Once the F_{max} reference point (i.e., the F_{max} proxy for F_{MSY}) was determined, a long-term (100 year) stochastic projection of stock sizes and catches was done to provide better consistency between the estimated medians of the BRP calculations and shorter-term (e.g., 1-5 year) projections (Legault 2008 MS).

The parametric approach used fitted parametric stock-recruitment models along with yield and spawning biomass per recruit information to calculate MSY-based reference points following the procedure of Sissenwine and Shepherd (1987). Stock-recruitment models were fit using the NFT SRFIT version 6.3 software (NFT 2008b). Since a wide range of models (Beverton-Holt [BH] and Ricker [RK] models, incorporating autoregressive error, and Bayesian priors for various parameters) had been tested in the 2005 SAW 41 work, the current parametric model exercise was limited to the simple Beverton-Holt and Ricker models (Beverton and Holt 1957, Mace and Doonan 1988, Ricker 1954).

For the 2008 assessment, the ASAP F08_T2007_T2 model (where "ASAP": Age Structured Assessment Program; "F08": Fluke 2008; "T2007": terminal year 2007; and "T2": 2nd run) provides the basis for the 2008 proposed biological reference points and stock status. Average values of mean weights at age in the catch and stock, maturity schedule, and partial recruitment pattern for the period 2005-2007 were used as input for ages 0-7+ for BRP calculations (Table 129). In previous assessments (NEFSC 2005 and earlier) for older aged fish (ages 8-15) with very limited or missing samples, Gompertz functions based on younger ages were used to estimate mean weights for the older ages in the BRP calculations. However, the practice of extending the age structure to age 15 and use of Gompertz weights for the older ages results in inconsistency between the BRP biomass estimates based on long-term stochastic projections and shorter-term (e.g., 1-5 year) projections used for Total Allowable Landings (TAL) calculations (NEFSC 2002a, Legault 2008 MS). Therefore, to increase consistency between these two types of projections, the age range of the BRP and projection calculations as been set at 0-7+, with 8 additional ages (to age 15) included in the plus group calculation of yield and spawning biomass per recruit (NFT 2008a). The mean weight at age for the plus group (age 7+; ages 7 and older) was updated for this assessment in a new way, by using a weighted average of mean weights for ages 7-15 (observed catch weights for ages 7-10; calculated Gompertz weights for ages 11-15 as estimated from observed ages 0-10) based on the relative proportions at age given a 2007 total mortality rate of 0.55 (mean M = 0.25 + 2007 F = 0.30; this value is coincidently consistent with the proposed F35% proxy for FMSY).

2008 Assessment Biological Reference Points

Summer flounder stock size (SSB, R) and fishing mortality (F) as estimated by the S&T 2006 assessment (ADAPT VPA, terminal year 2005, one fleet, mean M = 0.2), the S&T 2006 ADAPT VPA assessment model updated with current catch data through 2007 (VPA_T2007; terminal year 2007, one fleet, mean M = 0.2), the F08_T2007_T2_M20 run (terminal year 2007, two fleets, mean M = 0.20), and the F08_T2007_T2 run (terminal year 2007, two fleets, mean M = 0.25) are summarized in Figures 83-85. The four runs provide similar long term trends in stock size and F, with the ASAP F08_T2007_T2 run using mean M = 0.25 generally providing higher stock sizes (SSB and R) since 1995 than the S&T 2006 ADAPT VPA, the ADAPT VPA_T2007, and ASAP F08_T2007_T2_M20 runs using mean M = 0.20.

The combined effects of the new assumption for M and the modeling of landings and discards as distinct fleets (which results in a slightly domed-shaped combined fishery selectivity pattern) result in higher estimates of F reference points, lower estimates of MSY, lower estimates of SSB reference points, and improved stock status with respect to both the F and SSB reference points as compared to the S&T 2006 assessment (Tables 129-131). For the 2008 assessment, the ASAP F08_T2007_T2 model run provides the basis for the 2008 proposed biological reference points and evaluation of stock status that follows.

The reference points estimated from the parametric approach were suspect because the Beverton-Holt function steepness parameters were always very near 1.0 (Table 130). Therefore Fmax, F40%, and F35% (and their corresponding biomass reference points) from the non-parametric approach were considered as candidate proxies for FMSY and BMSY. Fmax has been used in previous assessments as the proxy for FMSY. The current estimate of Fmax using mean M = 0.25 and updated fishery selectivity and mean weights at age is relatively high (0.558) and the YPR to F relationship does not indicate a well defined peak (Figure 86). As a result, there is little gain in YPR (<5%) at fishing mortality rates higher than F35% = 0.310. However, the corresponding decline in SSBR between F35% = 0.310 (~1.48 kg/r) and Fmax = 0.558 (~0.93 kg/r) is about 37%. The WG concluded that F40% = 0.254 and F35% = 0.310 were candidate proxies that provided sufficient YPR (F40% YPR = 92% of Fmax YPR; F35% YPR = 97% of Fmax YPR) to allow for productive fisheries while also providing for substantial SSBR (F40% SSBR = 176% of Fmax SSBR; F35% SSBR = 155% of Fmax SSBR) to buffer against short-term declines in recruitment. Recommended proxies for FMSY and SSBMSY (Table 131) are F35% = 0.310 and the associated MSY (13,122 mt) and SSBMSY (60,074 mt) estimates from long-term stochastic projections. F40% (= 0.254) is recommended as a fishing mortality rate target for management.

Table 131 attempts to build a bridge between past and present assessments. The table includes results from the 2006 ADAPT VPA assessment (page 1 of Table 131; S&T 2006; Methot 2006, Terceiro 2006b), an updated ADAPT VPA run (page 2 of Table 131 "T2007"), and the 2008 ASAP assessment (page 3 of Table 131). Results are based on the non-parametric Biological Reference Point approach. For each assessment model, Table 131 also explores the sensitivity of assessment results to assumed natural mortality rate, M (M=0.25 is preferred). Compared to Page 1 of Table 131, Page 2 is based on two additional years of data. In addition Page 2 results are based on modeling decisions that were adopted for the 2008 assessment (e.g., handling of zeros in survey catches, the particular suite of survey indices included, and updated weights at age.).

7.2 Evaluate current stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 7a).

The preferred age-structured assessment model for summer flounder changed from an ADAPT VPA model to a forward projecting ASAP model. A new value for natural mortality has been adopted, changing from a constant value of M = 0.20 to age- and sex-specific values that result in a mean value of M = 0.25. Biological reference points have therefore also been revised; the recommended proxy for FMSY changed from Fmax to F35%, and F40% is recommended as an Ftarget.

Based on the proposed 2008 assessment biological reference points (Table 131 – see 3rd page of Table, center column; Figure 87) the summer flounder stock is not overfished and overfishing is not occurring. Fishing mortality calculated from the average of the currently fully recruited ages (3-7+) ranged between 1.143 and 2.042 during 1982-1996. The fishing mortality rate has declined to below 1.000 since 1996 and was estimated to be 0.288 in 2007, below the proposed fishing mortality reference point = F35% = FMSY = 0.310. There is an 80% probability that the fishing mortality rate in 2007 was between 0.253 and 0.325. Spawning stock biomass (SSB) declined from 24,674 mt in 1982 to 7,017 in 1989, then increased to 43,932 mt by 2004. SSB was estimated to be 43,363 in 2007, about 72% of the proposed SSB35% = SSBMSY reference point = 60,074 mt. There is an 80% chance that SSB in 2007 was between 39,325 and 48,122 mt.

The previously accepted, peer-reviewed 2006 NMFS S&T ADAPT VPA assessment model (Terceiro 2006b) has also been updated through 2007. Using that run of the VPA and assuming constant M = 0.20, the stock would be considered overfished and overfishing would be occurring when compared to existing BRPs (ADAPT VPA F2007 = 0.311, 11% above the existing F BRP = Fmax = FMSY = 0.280; ADAPT VPA SSB2007 = 42,142 mt, 47% of the existing SSB BRP = SSBMSY = 89,411 mt).

8.0 Stock Projections

8.1, 8.2, and 8.3: Recommend what modeling approaches and data should be used for conducting single and multi-year stock projections, computing TACs or TALs, and measures of uncertainty. If possible, provide numerical examples of short term projections (2-3 years) of biomass and fishing mortality rate, and characterize their uncertainty, under various TAC/F strategies. If possible, compare projected stock status to existing rebuilding or recovery schedules, as appropriate.

Stochastic projections were made to provide forecasts of stock size and catches in 2008-2012 consistent with the proposed biological reference points. The projections do not explicitly account for the recent retrospective pattern in the assessment, as per the 2006 S&T Peer Review advice (Terceiro 2006b). The projections assume that recent (2005-2007) patterns of discarding will continue over the time span of the projections. Different patterns that could develop in the future due to different trip and bag limits and fishery closures have not been evaluated. To increase consistency between the proposed reference points and stock projections, the input fishery selectivity pattern, M-pattern, and mean weights at age were configured in the same way (Table 132). One hundred projections were made for each of the 1000 MCMC realizations of 2008 stock sizes from the final assessment ASAP model F08_T2007_T2 run using NFT AGEPRO version 3.1.3 (NFT 2008). Future recruitment at age 0 was generated randomly from a cumulative density function of the F08_T2007_T2 run recruitment series for 1982-2007 (mean recruitment = 41.6 million fish).

If landings in 2008 are 7,153 mt (15.8 million lbs; the 2008 TAL) and discards are 885 mt (2.0 million lbs), the forecast estimates a median (50% probability) F in 2008 = 0.238 and a median SSB on November 1, 2008 of 46,992 mt, above the proposed biomass threshold of one-half SSBMSY = 30,037 mt (Table 133, Figure 87). Fishing at Frebuild = 0.274 in 2009 results in forecast median (50%ile) landings of 9,211 mt (20.3 million lbs); the corresponding 25%ile of landings is 8,653 mt (19.1 million lbs) (Table 133). Continued fishing at Frebuild = 0.274 during 2010-2012 is forecast to rebuild the stock to SSBMSY = 60,074 in 2012 (Figure 88). Fishing at F35% = 0.310 during 2009-2012 is forecast to result in SSB = 56,471 mt in 2012, below the proposed SSBMSY (Figure 89). Fishing at F40% = 0.255 during 2009-2012 is forecast to result in SSB = 62,181 mt in 2012, above the proposed SSBMSY (Figure 90).

9.0 Review, evaluate and report on the status of the Research Recommendations offered in recent SARC reviewed assessments and in the 2006 "Methot" Review.

Major data and analytical needs for future assessments have been identified in the SAW 35 review of the 2002 assessment (NEFSC 2002a), the SDWG assessment updates for 2003 and 2004 (Terceiro 2003a; SDWG 2004), the SAW 41 assessment update (NEFSC 2005), the 2006 assessment and S&T peer review (Terceiro 2006a, 2006b; Methot et al. 2006), the SDWG 2007 assessment update, and by the SDWG for this current benchmark assessment (SDWG 2008). Research recommendations "never die", and are retained in these documents until they are addressed (completed). Therefore, these remaining recommendations have been subset as those that have been completed (between the last benchmark and the current assessment), in progress at present or to be addressed (previously identified), and new (identified by the SDWG for this benchmark assessment (SDWG 2008)).

9.1 Completed

9.1.1 2008 SDWG Responses to Summary Findings of the 2006 NMFS Office of Science and Technology Peer Review

1. Retain the non-parametric approach to biological reference points; there is insufficient contrast to estimate Spawner-Recruitment steepness.
The non-parametric reference points have been retained in this 2008 benchmark assessment.

2. For the non-parametric approach, use SSB to track status of the stock. This is a much more accurate proxy for the reproductive potential of the stock and is consistent with current consideration of spawner-recruitment models as possible replacement for the non-parametric approach. The past use of Jan 1 total stock biomass as the measure of reproductive potential over-represents the contribution of age 0 fish.

SSB has been used as the basis to track the status of the stock with respect to the biomass reference point.

3. Use long-term (1982-2005) average body weight-at-age for calculation of biological reference points. The recent downturn in mean weight-at-age is influenced by shifting sex ratio and should only be used for short-term TAL and SSB calculations.

Due to recent trends in the biological characteristics of the stock, the SDWG concluded that short-term (2005-2007) average body weight-at-age was more appropriate for calculation of biological reference points and projections in this 2008 benchmark assessment.

4. Discount the recent downtrend in recruits per spawner. Such a trend is exactly what is expected from near constant recruitment and reduced fishing mortality which allows more

spawning biomass per recruit. Further declines are expected as the stock approaches the rebuilt level.

5. Use the arithmetic mean (not median) of long-term (1982-2005) recruitment as the basis for the average level of recruitment expected from a rebuilt stock. Although the five highest recruitments in this time period occur in the first five years, there is no reason to discount the occasional occurrence of such recruitment levels from a rebuilt stock. Median recruitment underestimates the level of biomass expected from a rebuilt stock because most biomass comes from the larger recruitments.

With respect to Findings 4 & 5: as recommended, the recent downturn in R/SSB was discounted in the calculation of reference points in this 2008 benchmark assessment. The arithmetic mean of long-term (1982-2007) recruitment was used as the basis for the long term level of recruitment expected from a rebuilt stock in calculation of the reference points.

6. Revise the survey input to the VPA model so that observations of zero are replaced with a small positive value. This VPA model, as with most assessment models, fits to the logarithm of the observations so cannot explicitly deal with observations of zero. However, the current VPA practice of treating these observations as missing values is probably underestimating the degree to which the stock has rebuilt since the low level in 1990.

As recommended, survey inputs to the VPA model with zero values were replaced with small positive values in the 2007 update. Since then, work performed by the SDWG and Groundfish Assessment Review Meeting (GARM) working groups has indicated that zeros should not be filled with a small value, and so this practice (retain zeros – treat as missing values) has been re-instituted in this 2008 benchmark assessment. The assessment model is now ASAP.

7. Do not make an explicit adjustment for the retrospective pattern in the VPA results. The pattern diminishes in the last year, its cause is not clear, and past patterns in the opposite direction have also diminished after a few years. The several survey indices included in the model increased greatly during the late 1990s and the indices of the oldest age groups have continued to increase. The current model does not track these changes closely, so exploration of alternative models and data interpretations that better reconcile this recent pattern should be a higher priority than the retrospective pattern.

As recommended, no explicit adjustment for the retrospective pattern was made to the 2008 assessment model results or projections.

9.1.2 Other Completed Research Recommendations

1) Evaluate use of a forward calculating age-structured model for comparison with VPA. Forward models would facilitate use of expanding age/sex structure and allow inclusion of historical data. If sex-specific assessments are explored, the implications on YPR should also be investigated.

SDWG Response: This recommendation was addressed for the current (June 2008) benchmark assessment through modeling exercises utilizing the forward projecting models ASAP and SS2 (section 4.0 and 5.0 of this assessment report).

2) Evaluate trends in the regional components of the NEFSC surveys and contrast with the state surveys that potentially index components of the stock.

SDWG Response: This recommendation was addressed for the current (June 2008) benchmark assessment through TOR 2.1 (section 2.0) which examined the potential for an integrated index approach and TOR 3.2 which examined regional difference in the CAA data. There is very limited spatial and/or temporal overlap to allow for an equivalent comparison; therefore, the analyses that were completed were considered adequate.

3) Explore statistical methods to develop "combined" survey abundance indices (by age if possible) from state agency survey data, for use in calibration of analytical assessment models.

SDWG Response: This recommendation was addressed for the current (June 2008) benchmark assessment through TOR 2.1 (section 2.0) which examined the potential for an integrated index approach.

4) Consider examining alternative expansion factors (i.e, summer flounder landings, all species landings) for discards and subsequent effect on retrospective pattern.

SDWG Response: This recommendation was addressed for the current (June 2008) benchmark assessment under TOR 1.0 (section 1.0), although the conclusions of that working paper (Estimation of Commercial Fishery Discards of Summer Flounder: Update 2007 or Revise the 1989-2007 Time Series) recommend no change to the current methodology and additional research into the merits of other estimation methods.

5) Consider treating discards as a separate catch-at-age component, once the summer flounder assessment is implemented in a statistical catch at age framework.

SDWG Response: The current (June 2008) benchmark assessment examined separation of the catch-at-age into smaller components (multiple matrices) and utilized two matrices (retained and discarded fish) for the working group preferred model (section 4.0 and 5.0).

6) Present the VTR Party/Charter boat to MRFSS/FHS comparison in more detail, including stratification by state/federal waters for federal permit holders in the Party/Charter sector.

SDWG Response: A comparison of the VTR Party/Charter boat to MRFSS/FHS was presented in greater detail for the current (June 2008), while the latter part of this recommendation still needs to be addressed. No changes were made to the manner in which the recreational data were handled for this assessment.

7) Consider alternative weighting schemes to explore the sensitivity of the VPA calibration to perceived survey index outliers.

SDWG Response: The current (June 2008) benchmark assessment addressed this recommendation through TOR 2.1 (section 2.0) which examined the potential for an integrated index approach for the various state surveys, as well as the sensitivity of the assessment to different weighting schemes applied to those surveys.

8) For the maximum age plots, consider comparing the 90th percentile of max age, which may more effectively show time series trends (particularly for the males).

SDWG Response: While the working group did not specifically examine the 90^{th} percentile of max age, a detailed examination of maximum age (by sex) was conducted for this benchmark assessment.

9) Explore the sensitivity of the VPA results to separating the summer flounder stock into multiple components.

SDWG Response: The current (June 2008) benchmark assessment examined the sensitivity of the assessment to configuration such as multiple catch components (ASAP and SS2) and sexes within the SS2 model (section 4.0).

9.2 To Be Addressed or In Progress

High

1) Develop a program to annually sample the length and age frequency of summer flounder discards from the recreational fishery.

SDWG Response: To date, ongoing programs are in place only in the MRFSS, MRFSS For-hire survey, ALS, Connecticut (CTDEP Volunteer Anglers), Maryland (MD-DNR Volunteer Anglers), to sample lengths of recreational discards. Progress has been made but more synoptic data are needed including the age- and sex-frequency.

2) The SDWG noted that more comprehensive collection of otoliths, for all components of the catch-at-age matrix, needs to be collected on a continuing basis for fish larger than 60 cm (~7 years). The collection of otoliths and the proportion at sex for all of the catch components could provide a better indicator of stock productivity.

SDWG Response: This recommendation has not been addressed and remains an ongoing data collection need.

3) The SDWG recommends that a reference collection of summer flounder scales and otoliths be developed to facilitate future quality control of summer flounder production aging. In addition, a comparison study between scales and otoliths as aging structures for summer flounder should be completed.

SDWG Response: An exchange of aging structures between NEFSC and NCDMF was completed and a report was reviewed by the 2007 SDWG, in response to a 2005 SAW 41 high priority Research Recommendation. The SDWG noted that while the Fall 2006 aging exchange between NC-DMF and the NEFSC indicated that the current level of aging consistency between NC and NEFSC is acceptable, there is a need to conduct and fund these exchanges more frequently, on a schedule consistent with benchmark assessments.

4) The SDWG noted that the observed change in the sex ratio in NEFSC survey samples may result in the SSB estimates not translating as directly to egg production since there are more males proportionally in those older age-categories. Collecting information on overall fecundity for the stock, both egg condition and production may be a better indicator of stock productivity.

SDWG Response: This recommendation has not been addressed and remains an ongoing data collection need.

5) Investigate trends in sex ratios and mean lengths and weights of summer flounder in state agency and federal surveys catches.

SDWG Response: While these trends have not been examined in the state survey catches, these trends were examined in the NEFSC spring, autumn, and winter survey data. Additional work to examine and explain these trends in greater detail should be conducted.

Medium

6) Use NEFSC fishery observer age-length keys for 1994 and later years (as they become available) to supplement NEFSC survey data in aging the commercial fishery discard.

SDWG Response: This recommendation has not been addressed by the SDWG, as the age data are not yet available.

7) Consider use of management strategy evaluation techniques to address the implications of harvest policies that incorporate consideration of retrospective patterns (see ICES Journal of Marine Science issue of May 2007).

SDWG Response: This recommendation has not been addressed by the SDWG.

Low

8) Consider treating scallop closed areas as separate strata in calculations of summer flounder discards in the commercial fisheries.

SDWG Response: This recommendation has not been addressed.

9.3 New

The following major data and analytic needs for future assessments were identified by the SDWG in completing the 2008 June benchmark assessment.

1) Examine the sensitivity of the summer flounder assessment to the various unit stock hypotheses and evaluate spatial aspects of the stock to facilitate sex and spatially-explicit modeling of summer flounder.

2) Conduct further research to examine the predator-prey interactions of summer flounder and other species, including food habitat studies, to better understand the influence of these other factors on the summer flounder population.

3) Collect and evaluate information on the reporting accuracy of recreational discards estimates in the recreational fishery.

4) Examine male female ratio at age-0 and potential factors (eg. environmental) that may influence determination of that ratio.

5) Evaluate potential changes in fishery selectivity relative to the spawning potential of the stock; analysis should consider the potential influence of the recreational and commercial fisheries.

6) Collect data to determine the sex ratio for all of the catch components.

7) Determine the appropriate level for the steepness of the S-R relationship and investigate how that influences the biological reference points

10.0 Major sources of assessment uncertainty

The SDWG identified the following as ongoing sources of uncertainty in the current assessment.

1) The landings from the commercial fisheries used in this assessment assume no under reporting of summer flounder landings. Therefore, reported landings and associated effort from the commercial fisheries should be considered minimal estimates.

2) The recreational fishery landings and discards used in the assessment are estimates developed from the Marine Recreational Fishery Statistics Survey (MRFSS). While the estimates of summer flounder catch are considered to be among the most reliable produced by the MRFSS, they are subject to error. The MRFSS program has been reviewed; the program is being redesigned in light of the outcome of the NRC Review of the MRFSS methodology.

3) The length and age composition of the recreational discards are based on data from a limited geographic area (MRFSS, MRFSS For-hire survey, ALS, Connecticut (CTDEP Volunteer Anglers), Maryland (MD-DNR Volunteer Anglers). Sampling of recreational fishery discards on an annual, synoptic basis is needed.

4) The current estimate of M remains an ongoing source of uncertainty. M is highly influential on the assessment results and has a “rescaling affect” on SSB, F, R, point calculations, and the associated perception of current stock status.

5) Estimation of the mean weight at age for older fish (i.e. age 10+) remains an ongoing source of uncertainty.

6) Sex specific differences in life history parameters may have a affect on the assessment model.

ACKNOWLEDGMENTS

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[Note: Literature cited in specific working group papers can be found in their respective appendices]

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11.0 Tables

Table 1. Summer Flounder Commercial Landings by State (thousands of lb) and coastwide (thousands of pounds (>000 lbs), metric tons (mt)).

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD+	VA+	NC+	Total '000 lbs	mt
1940	0	0	2847	258	149	1814	3554	3	444	1247	498	10814	4905
1941	na	na	na	na	na	na	na	na	183	764	na	947	430
1942	0	0	193	235	126	1286	987	2	143	475	498	3945	1789
1943	0	0	122	202	220	1607	2224	11	143	475	498	5502	2496
1944	0	0	719	414	437	2151	3159	8	197	2629	498	10212	4632
1945	0	0	1730	467	270	3182	3102	2	460	1652	1204	12297	5578
1946	0	0	1579	625	478	3494	3310	22	704	2889	1204	14305	6489
1947	0	0	1467	333	813	2695	2302	46	532	1754	1204	11146	5056
1948	0	0	2370	406	518	2308	3044	15	472	1882	1204	12219	5542
1949	0	0	1787	470	372	3560	3025	8	783	2361	1204	13570	6155
1950	0	0	3614	1036	270	3838	2515	25	543	1761	1840	15442	7004
1951	0	0	4506	1189	441	2636	2865	20	327	2006	1479	15469	7017
1952	0	0	4898	1336	627	3680	4721	69	467	1671	2156	19625	8902
1953	0	0	3836	1043	396	2910	7117	53	1176	1838	1844	20213	9168
1954	0	0	3363	2374	213	3683	6577	21	1090	2257	1645	21223	9627
1955	0	0	5407	2152	385	2608	5208	26	1108	1706	1126	19726	8948
1956	0	0	5469	1604	322	4260	6357	60	1049	2168	1002	22291	10111
1957	0	0	5991	1486	677	3488	5059	48	1171	1692	1236	20848	9456
1958	0	0	4172	950	360	2341	8109	209	1452	2039	892	20524	9310
1959	0	0	4524	1070	320	2809	6294	95	1334	3255	1529	21230	9630
1960	0	0	5583	1278	321	2512	6355	44	1028	2730	1236	21087	9565
1961	0	0	5240	948	155	2324	6031	76	539	2193	1897	19403	8801
1962	0	0	3795	676	124	1590	4749	24	715	1914	1876	15463	7014
1963	0	0	2296	512	98	1306	4444	17	550	1720	2674	13617	6177
1964	0	0	1384	678	136	1854	3670	16	557	1492	2450	12237	5551
1965	0	0	431	499	106	2451	3620	25	734	1977	272	10115	4588
1966	0	0	264	456	90	2466	3830	13	630	2343	4017	14109	6400
1967	0	0	447	706	48	1964	3035	0	439	1900	4391	12930	5865
1968	0	0	163	384	35	1216	2139	0	350	2164	2602	9053	4106
1969	0	0	78	267	23	574	1276	0	203	1508	2766	6695	3037
1970	0	0	41	259	23	900	1958	0	371	2146	3163	8861	4019
1971	0	0	89	275	34	1090	1850	0	296	1707	4011	9352	4242
1972	0	0	93	275	7	1101	1852	0	277	1857	3761	9223	4183
1973	0	0	506	640	52	1826	3091	*	495	3232	6314	16156	7328
1974	*	0	1689	2552	26	2487	3499	0	709	3111	10028	22581	10243
1975	0	0	1768	3093	39	3233	4314	5	893	3428	9539	26311	11934
1976	*	0	4019	6790	79	3203	5647	3	697	3303	9627	33368	15135
1977	0	0	1477	4058	64	2147	6566	5	739	4540	10332	29927	13575
1978	0	0	1439	2238	111	1948	5414	1	676	5940	10820	28586	12966
1979	5	0	1175	2825	30	1427	6279	6	1712	10019	16084	39561	17945

* = less than 500 lb; na = not available; + = NMFS did not identify flounders to species prior to 1978 for NC and 1957 for both MD and VA and thus the numbers represent all unclassified flounders.

Sources: 1940-1977 USDC 1984; 1978-1979 unpublished NMFS General Canvas data

Table 1 continued.

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD+	VA+	NC+	Total '000 lbs	mt
1980	4	0	367	1277	48	1246	4805	1	1324	8504	13643	31216	14159
1981	3	0	598	2861	81	1985	4008	7	403	3652	7459	21056	9551
1982	18	*	1665	3983	64	1865	4318	8	360	4332	6315	22928	10400
1983	84	0	2341	4599	129	1435	4826	5	937	8134	7057	29548	13403
1984	2	*	1488	4479	131	2295	6364	9	813	9673	12510	37765	17130
1985	3	*	2249	7533	183	2517	5634	4	577	5037	8614	32352	14675
1986	0	*	2954	7042	160	2738	4017	4	316	3712	5924	26866	12186
1987	8	*	3327	4774	609	2641	4451	4	319	5791	5128	27052	12271
1988	5	0	2421	4719	741	3439	6006	7	514	7756	6770	32377	14686
1989	9	0	1878	3083	513	1464	2865	3	204	3689	4206	17913	8125
1990	3	0	628	1408	343	405	1458	2	138	2144	2728	9257	4199
1991	0	0	1124	1672	399	719	2341	4	232	3715	3516	13722	6224
1992	*	*	1383	2532	495	1239	2871	12	319	5172	2576	16599	7529
1993	6	0	903	1942	225	849	2466	6	254	3052	2894	12599	5715
1994	4	0	1031	2649	371	1269	2356	4	179	3091	3571	14525	6588
1995	5	0	1128	2325	319	1248	2319	4	174	3304	4555	15381	6977
1996	8	0	800	1763	266	936	2369	8	266	2286	4218	12920	5861
1997	3	0	745	1566	257	823	1321	5	215	2370	1501	8806	3994
1998	6	0	707	1712	263	822	1863	11	224	2616	2967	11190	5076
1999	6	0	813	1637	245	804	1918	8	201	2196	2801	10627	4820
2000	7	0	789	1703	240	800	1848	12	252	2206	3354	11211	5085
2001	22	0	694	1800	267	751	1745	7	223	2660	2789	10958	4970
2002	1	0	1009	2286	357	1053	2407	3	327	2970	4078	14491	6573
2003	0	0	926	2178	272	1073	2384	6	329	3492	3559	14219	6450
2004	0	0	1193	3085	406	1594	2831	8	284	3906	4834	18141	8228
2005	3	0	1274	2926	449	1804	2529	5	333	3869	4059	17253	7826
2006	7	0	910	2120	314	1262	2346	4	248	2669	3926	13806	6262
2007	3	0	660	1515	207	939	1698	3	178	2025	2669	9897	4489

* = less than 500 lb; na = not available;

Sources: 1980-2006 State and Federal reporting systems

Table 2. 1994 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata). Most landings for the first quarter of 1994 (Jan-Mar) were reported under the previous NER weighout system and are not included here; the total will therefore not match that for 1994 in Table 1.

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	0.1	0.0	3.0	0.2	0.0	0.0
NH	0.0	0.0	0.0	0.0	0.0	0.0
MA	352.6	16.4	265.8	13.0	109.5	10.3
RI	476.5	22.1	393.2	19.2	253.5	23.9
CT	0.0	0.0	0.0	0.0	0.0	0.0
NY	121.1	5.6	373.8	18.2	67.4	6.4
NJ	633.1	29.4	535.2	26.1	404.0	38.0
DE	0.0	0.0	56.0	2.7	0.0	0.0
MD	45.2	2.1	39.7	1.9	37.2	3.5
VA	524.5	24.4	382.2	18.7	190.3	17.9
Unknown	0.0	0.0	1.1	0.0	0.0	0.0
Total	2152.9	100.0	2049.9	100.0	1061.8	100.0
Month	mt	%	mt	%	mt	%
Jan	0.0	0.0	0.0	0.0	0.0	0.0
Feb	5.2	0.2	0.0	0.0	0.0	0.0
Mar	0.0	0.0	6.8	0.3	0.0	0.0
Apr	114.6	5.3	138.8	6.8	68.6	6.5
May	235.3	10.9	221.0	10.8	92.2	8.8
Jun	228.0	10.6	174.9	8.5	72.2	6.8
Jul	198.2	9.2	186.7	9.1	111.7	10.5
Aug	210.0	9.8	228.1	11.1	104.7	9.9
Sep	355.7	16.5	384.3	18.8	230.3	21.7
Oct	302.4	14.1	301.6	14.7	146.6	13.8
Nov	204.3	9.5	158.3	7.7	99.0	9.3
Dec	299.2	13.9	249.3	12.2	135.5	12.8
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	2152.9	100.0	2049.9	100.0	1061.8	100.0

Table 3. 1995 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata). North Carolina landings not reported through the Dealer/VTR system; the total will therefore not match that for 1995 in Table 1.

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	2.4	0.1	9.8	0.2	2.4	0.1
NH	0.0	0.0	7.5	0.2	0.0	0.0
MA	511.7	10.4	487.9	10.5	179.1	8.1
RI	1054.8	21.5	914.9	19.8	569.5	25.6
CT	144.5	2.9	113.1	0.0	0.0	0.0
NY	566.1	11.5	648.5	14.0	141.5	6.4
NJ	1052.0	21.4	984.4	21.3	594.1	26.7
DE	1.9	0.0	0.0	0.0	0.0	0.0
MD	78.8	1.6	56.0	1.2	45.8	2.1
VA	1498.5	30.5	1390.0	30.0	690.2	31.1
Unknown	0.0	0.0	41.1	0.0	0.0	0.0
Total	4910.7	100.0	4666.7	100.0	2222.5	100.0
Month	mt	%	mt	%	mt	%
Jan	1550.1	31.6	1636.6	35.1	749.4	33.7
Feb	692.4	14.1	768.1	16.5	416.5	18.7
Mar	128.8	2.6	137.4	2.9	52.7	2.4
Apr	130.1	2.7	140.5	3.0	80.2	3.6
May	268.3	5.5	304.5	6.5	101.6	4.6
Jun	203.0	4.1	192.9	4.1	67.7	3.1
Jul	188.0	3.8	131.4	2.8	64.7	2.9
Aug	350.0	7.1	325.8	7.0	138.5	6.2
Sep	300.0	6.1	288.7	6.2	145.7	6.6
Oct	338.6	6.9	326.1	7.0	196.9	8.9
Nov	305.3	6.2	141.7	3.0	82.0	3.7
Dec	436.5	8.9	272.9	5.9	126.6	5.7
Unknown	19.8	0.4	0.0	0.0	0.0	0.0
Total	4910.7	100.0	4666.7	100.0	2222.5	100.0

Table 4. 1996 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata). North Carolina landings not reported through the Dealer/VTR system; the total will therefore not match that for 1996 in Table 1.

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	3.7	0.1	5.3	0.2	1.4	0.1
NH	0.0	0.0	26.5	0.8	0.0	0.0
MA	363.0	9.8	336.9	10.4	167.0	9.7
RI	799.8	21.5	654.8	20.3	441.7	25.5
CT	120.5	0.0	98.0	3.0	0.0	0.0
NY	424.8	11.1	374.6	11.6	99.5	5.8
NJ	1074.6	28.7	974.9	30.2	561.6	32.4
DE	3.6	0.0	0.4	0.0	0.0	0.0
MD	120.4	2.7	91.3	2.8	79.9	4.6
VA	1036.8	26.2	634.0	19.7	381.0	22.0
Unknown	0.0	0.0	113.9	3.4	0.0	0.0
Total	3947.3	100.0	3310.6	100.0	1732.1	100.0
Month	mt	%	mt	%	mt	%
Jan	1290.9	33.0	1049.3	31.7	442.2	25.5
Feb	433.0	11.6	418.0	12.6	232.4	13.4
Mar	26.9	0.6	63.9	1.9	13.3	0.8
Apr	127.7	3.0	131.0	4.0	29.6	1.7
May	330.7	8.4	188.4	5.7	109.4	6.3
Jun	233.6	5.9	204.8	6.2	116.2	6.7
Jul	256.6	6.5	204.2	6.2	120.3	6.9
Aug	268.8	6.6	243.2	7.4	116.9	6.8
Sep	611.5	15.4	583.6	17.6	391.1	22.6
Oct	342.8	8.8	209.4	6.3	148.9	8.6
Nov	13.4	0.2	10.4	0.3	10.1	0.6
Dec	10.8	0.1	4.6	0.1	1.9	0.6
Unknown	0.7	0.0	0.0	0.0	0.0	0.0
Total	3947.3	100.0	3310.6	100.0	1732.1	100.0

Table 5. 1997 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	1.3	0.0	1.4	0.0	1.4	0.1
NH	0.0	0.0	0.0	0.0	0.0	0.0
MA	338.0	8.5	259.4	7.7	108.1	5.9
RI	710.0	17.8	593.4	17.6	416.0	22.6
CT	116.6	2.9	76.3	2.3	0.0	0.0
NY	373.3	9.3	343.3	10.2	72.4	3.9
NJ	599.2	15.0	541.9	16.0	443.0	24.1
DE	2.4	0.1	0.1	0.0	0.0	0.0
MD	97.5	2.4	80.0	2.4	73.1	4.0
VA	1075.1	26.9	817.4	24.2	624.1	33.9
NC	681.0	17.0	663.6	19.6	100.3	5.5
Unknown	0.0	0.0	0.4	0.0	0.0	0.0
Total	3994.4	100.0	3377.2	100.0	1838.4	100.0
Month	mt	%	mt	%	mt	%
Jan	1684.7	42.2	1427.5	42.3	624.6	34.0
Feb	195.6	4.9	206.3	6.1	76.4	4.2
Mar	216.5	5.4	217.2	6.4	115.3	6.3
Apr	240.1	6.0	193.7	5.7	125.6	6.8
May	213.2	5.3	165.6	4.9	111.9	6.1
Jun	245.2	6.1	192.9	5.7	124.1	6.8
Jul	267.2	6.7	188.5	5.6	94.6	5.1
Aug	202.3	5.1	154.7	4.6	75.2	4.1
Sep	356.6	8.9	312.9	9.3	238.9	13.0
Oct	334.5	8.4	286.8	8.5	233.5	12.7
Nov	24.2	0.6	17.1	0.5	11.7	0.6
Dec	14.3	0.4	13.8	0.4	6.6	0.4
Unknown	0.0	0.0	0.2	0.0	0.0	0.0
Total	3994.4	100.0	3377.2	100.0	1838.4	100.0

Table 6. 1998 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	2.6	0.1	3.8	0.1	0.0	0.0
NH	0.0	0.0	0.1	0.0	0.0	0.0
MA	320.5	6.3	221.7	5.6	98.5	3.8
RI	776.6	15.3	569.7	14.4	421.4	16.4
CT	119.2	2.3	101.7	2.6	0.0	0.0
NY	372.6	7.3	297.7	7.5	52.6	2.0
NJ	845.0	16.6	784.2	19.8	642.3	24.9
DE	5.0	0.1	0.1	0.0	0.0	0.0
MD	101.7	2.0	73.5	1.9	68.1	2.6
VA	1186.5	23.4	1017.4	25.6	797.9	31.0
NC	1346.0	26.5	857.3	21.6	494.9	19.2
Unknown	0.0	0.0	41.2	1.0	0.0	0.0
Total	5075.7	100.0	3968.4	100.0	2575.7	100.0
Month	mt	%	mt	%	mt	%
Jan	1631.4	32.1	1325.6	33.4	898.4	34.9
Feb	474.9	9.4	442.6	11.2	191.7	7.4
Mar	211.8	4.2	186.5	4.7	109.3	4.2
Apr	260.3	5.1	226.3	5.7	154.0	6.0
May	307.9	6.1	217.5	5.5	149.3	5.8
Jun	211.7	4.2	122.2	3.1	75.4	2.9
Jul	275.5	5.4	159.7	4.0	77.4	3.0
Aug	172.7	3.4	112.3	2.8	55.5	2.2
Sep	404.1	8.0	337.2	8.5	284.6	11.0
Oct	53.3	1.0	44.2	1.1	13.8	0.5
Nov	539.4	10.6	495.1	12.5	385.6	15.0
Dec	532.7	10.5	299.0	7.5	180.1	7.0
Unknown	0.0	0.0	0.2	0.0	0.6	0.0
Total	5075.7	100.0	3968.4	100.0	2575.7	100.0

Table 7. 1999 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	2.6	0.1	3.9	0.1	2.5	0.1
NH	0.0	0.0	0.3	0.0	0.0	0.0
MA	368.6	7.6	246.9	6.4	138.8	5.8
RI	742.3	15.4	612.1	15.8	437.5	18.2
CT	111.2	2.3	82.0	2.1	2.2	0.1
NY	364.7	7.6	271.5	7.0	40.7	1.7
NJ	870.0	18.0	818.5	21.1	586.6	24.3
DE	3.4	0.1	0.0	0.0	0.0	0.0
MD	91.2	1.9	62.8	1.6	59.7	2.5
VA	996.0	20.7	715.7	18.5	517.5	21.5
NC	1270.4	26.4	1004.1	25.9	624.8	25.9
Unknown	0.0	0.0	54.7	1.4	0.0	0.0
Total	4820.4	100.0	3872.5	100.0	2410.3	100.0
Month	mt	%	mt	%	mt	%
Jan	1673.4	34.7	1603.0	41.4	1011.3	42.0
Feb	505.3	10.5	539.5	13.9	264.0	11.0
Mar	238.9	5.0	212.1	5.5	109.3	4.5
Apr	294.4	6.1	237.6	6.1	125.4	5.2
May	290.7	6.0	196.2	5.1	144.8	6.0
Jun	165.1	3.4	92.4	2.4	63.6	2.6
Jul	279.7	5.8	134.0	3.5	88.3	3.7
Aug	146.9	3.0	89.1	2.3	66.0	2.7
Sep	325.6	6.8	250.4	6.5	197.6	8.2
Oct	186.6	3.9	161.9	4.2	124.3	5.2
Nov	276.5	5.7	215.3	5.6	137.8	5.7
Dec	437.3	9.1	139.9	3.6	77.5	3.2
Unknown	0.0	0.0	1.1	0.0	0.5	0.0
Total	4820.4	100.0	3872.5	100.0	2410.3	100.0

Table 8. 2000 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	3.1	0.1	5.4	0.1	0.0	0.0
NH	0.0	0.0	2.3	0.1	0.0	0.0
MA	357.9	7.0	226.0	5.1	66.5	2.5
RI	772.7	15.2	570.2	12.9	420.1	15.6
CT	108.7	2.1	84.8	1.9	0.0	0.0
NY	362.8	7.1	265.4	6.0	42.5	1.6
NJ	838.3	16.5	831.9	18.8	650.8	24.1
DE	5.6	0.1	0.1	0.0	0.0	0.0
MD	114.2	2.2	86.1	1.9	70.0	2.6
VA	1000.9	19.7	928.0	21.0	669.3	24.8
NC	1521.2	29.9	1381.7	31.2	778.2	28.9
Unknown	0.0	0.0	42.5	1.0	0.0	0.0
Total	5085.4	100.0	4424.4	100.0	2697.4	100.0
Month	mt	%	mt	%	mt	%
Jan	1149.5	22.6	1105.6	25.0	733.3	27.2
Feb	1175.1	23.1	1119.9	25.3	658.8	24.4
Mar	347.8	6.8	317.9	7.2	161.7	6.0
Apr	226.9	4.5	198.5	4.5	117.4	4.4
May	311.3	6.1	216.4	4.9	136.1	5.0
Jun	169.7	3.3	82.7	1.9	46.6	1.7
Jul	324.1	6.4	203.4	4.6	111.3	4.1
Aug	159.9	3.1	110.6	2.5	52.7	2.0
Sep	334.1	6.6	261.9	5.9	201.6	7.5
Oct	54.6	1.1	33.2	0.8	17.8	0.7
Nov	484.3	9.5	473.2	10.7	325.4	12.1
Dec	348.1	6.8	301.1	6.8	134.7	5.0
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	5085.4	100.0	4424.4	100.0	2697.4	100.0

Table 9. 2001 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	10.0	0.2	17.8	0.4	9.1	0.3
NH	0.0	0.0	0.2	0.0	0.0	0.0
MA	314.8	6.3	248.1	5.9	68.8	2.6
RI	815.9	16.4	594.4	14.2	426.6	16.2
CT	121.2	2.4	86.9	2.1	0.2	0.0
NY	340.8	6.9	241.4	5.8	44.5	1.7
NJ	791.7	15.9	745.3	17.8	611.9	23.2
DE	3.4	0.1	0.1	0.0	0.0	0.0
MD	101.0	2.0	73.0	1.7	65.1	2.5
VA	1206.4	24.3	1044.8	24.9	705.1	26.7
NC	1265.1	25.5	1104.6	26.4	707.9	26.8
Unknown	0.0	0.0	35.4	0.8	0.0	0.0
Total	4970.3	100.0	4192.0	100.0	2639.2	100.0
Month	mt	%	mt	%	mt	%
Jan	1617.0	32.5	1474.6	35.2	983.1	37.2
Feb	467.1	9.4	417.5	10.0	212.3	8.0
Mar	199.8	4.0	171.1	4.1	80.5	3.0
Apr	246.4	5.0	219.6	5.2	157.0	5.9
May	236.0	4.7	148.7	3.5	91.0	3.4
Jun	188.9	3.8	100.3	2.4	61.8	2.3
Jul	271.4	5.5	175.1	4.2	103.9	3.9
Aug	198.1	4.0	133.7	3.2	48.1	1.8
Sep	304.6	6.1	259.2	6.2	193.4	7.3
Oct	81.6	1.6	50.5	1.2	26.0	1.0
Nov	578.3	11.6	545.5	13.0	356.3	13.5
Dec	581.1	11.7	496.2	11.8	325.9	12.3
Unknown	0.0	0.0	0.0	0.0		0.0
Total	4970.3	100.0	4192.0	100.0	2639.2	100.0

Table 10. 2002 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	0.2	0.0	0.7	0.0	0.0	0.0
NH	0.0	0.0	0.2	0.0	0.0	0.0
MA	457.9	7.0	325.1	5.6	90.9	2.6
RI	1037.1	15.8	788.8	13.5	553.0	15.7
CT	161.8	2.5	145.1	2.5	0.0	0.0
NY	477.6	7.3	394.7	6.8	79.8	2.3
NJ	1091.8	16.6	1061.9	18.2	808.5	23.0
DE	1.2	0.0	0.0	0.0	0.0	0.0
MD	148.2	2.3	106.5	1.8	88.8	2.5
VA	1347.3	20.5	1221.9	20.9	744.0	21.2
NC	1849.9	28.1	1762.1	30.2	1151.0	32.7
Unknown	0.0	0.0	36.7	0.6	0.0	0.0
Total	6573.0	100.0	5843.6	100.0	3516.0	100.0
Month	mt	%	mt	%	mt	%
Jan	1107.7	16.9	1067.8	18.3	666.6	19.0
Feb	1020.2	15.5	979.1	16.8	550.8	15.7
Mar	877.5	13.4	848.9	14.5	466.8	13.3
Apr	501.1	7.6	434.2	7.4	281.1	8.0
May	247.4	3.8	162.8	2.8	97.3	2.8
Jun	286.9	4.4	180.9	3.1	94.4	2.7
Jul	283.5	4.3	213.6	3.7	105.7	3.0
Aug	389.4	5.9	261.6	4.5	153.5	4.4
Sep	422.2	6.4	367.0	6.3	248.5	7.1
Oct	161.1	2.5	126.9	2.2	75.1	2.1
Nov	646.7	9.8	587.5	10.1	387.0	11.0
Dec	629.2	9.6	613.4	10.5	389.3	11.1
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	6573.0	100.0	5843.6	100.0	3516.0	100.0

Table 11. 2003 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	0.0	0.0	0.8	0.0	0.0	0.0
NH	0.0	0.0	0.1	0.0	0.0	0.0
MA	419.9	6.5	241.2	5.2	67.3	2.5
RI	988.1	15.3	609.5	13.2	408.4	14.9
CT	123.6	1.9	107.2	2.3	0.0	0.0
NY	486.9	7.5	319.4	6.9	60.6	2.2
NJ	1081.2	16.8	906.9	19.6	699.9	25.6
DE	2.5	0.0	0.0	0.0	0.0	0.0
MD	149.4	2.3	87.9	1.9	74.3	2.7
VA	1583.8	24.6	901.1	19.5	557.6	20.4
NC	1614.4	25.0	1367.8	29.6	863.6	31.6
Unknown	0.0	0.0	77.6	1.7	0.0	0.0
Total	6449.7	100.0	4619.4	100.0	2731.7	100.0
Month	mt	%	mt	%	mt	%
Jan	983.7	15.3	1018.2	22.0	585.0	21.4
Feb	1147.8	17.8	1066.9	23.1	575.6	21.1
Mar	1099.3	17.0	1028.2	22.3	644.9	23.6
Apr	197.4	3.1	167.8	3.6	112.0	4.1
May	288.8	4.5	191.1	4.1	121.0	4.4
Jun	245.2	3.8	141.4	3.1	69.8	2.6
Jul	313.2	4.9	214.4	4.6	118.2	4.3
Aug	283.2	4.4	158.6	3.4	70.6	2.6
Sep	288.7	4.5	193.2	4.2	141.4	5.2
Oct	307.8	4.8	207.7	4.5	143.0	5.2
Nov	696.4	10.8	152.8	3.3	111.5	4.1
Dec	598.3	9.3	79.2	1.7	38.8	1.4
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	6449.7	100.0	4619.4	100.0	2731.7	100.0

Table 12. 2004 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	0.1	0.0	4.3	0.1	0.0	0.0
NH	0.1	0.0	0.1	0.0	0.0	0.0
MA	541.2	6.6	436.9	6.1	139.9	3.3
RI	1399.1	17.0	881.1	12.3	592.6	14.0
CT	184.2	2.2	155.7	2.2	53.0	1.3
NY	723.2	8.8	641.3	9.0	155.4	3.7
NJ	1283.9	15.6	1249.8	17.5	973.7	23.0
DE	3.4	0.0	0.0	0.0	0.0	0.0
MD	128.8	1.6	121.8	1.7	91.1	2.2
VA	1771.8	21.5	1642.4	22.9	1018.9	24.1
NC	2192.7	26.6	1957.1	27.3	1208.7	28.6
Unknown	0.0	0.0	71.5	1.0	0.0	0.0
Total	8228.5	100.0	7162.1	100.0	4233.2	100.0
Month	mt	%	mt	%	mt	%
Jan	1229.3	14.9	1067.2	14.9	696.4	16.5
Feb	1822.1	22.1	1637.0	22.9	898.2	21.2
Mar	960.9	11.7	916.4	12.8	569.3	13.4
Apr	317.7	3.9	319.7	4.5	163.9	3.9
May	304.4	3.7	228.7	3.2	123.4	2.9
Jun	354.5	4.3	267.3	3.7	153.0	3.6
Jul	321.0	3.9	232.4	3.2	141.8	3.4
Aug	305.5	3.7	216.6	3.0	100.5	2.4
Sep	449.8	5.5	369.2	5.2	241.1	5.7
Oct	370.1	4.5	357.6	5.0	199.0	4.7
Nov	895.5	10.9	801.3	11.2	510.5	12.1
Dec	897.7	10.9	748.8	10.5	436.1	10.3
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	8228.5	100.0	7162.1	100.0	4233.2	100.0

Table 13. 2005 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	1.6	0.0	2.4	0.0	0.3	0.0
NH	0.0	0.0	0.2	0.0	0.0	0.0
MA	578.1	7.4	544.3	8.0	191.8	4.8
RI	1327.4	17.0	936.9	13.7	645.4	16.2
CT	203.5	2.6	162.6	2.4	121.3	3.1
NY	818.2	10.5	723.9	10.6	246.5	6.2
NJ	1147.2	14.7	1126.0	16.5	901.8	22.7
DE	2.5	0.0	0.0	0.0	0.0	0.0
MD	151.2	1.9	102.1	1.5	84.7	2.1
VA	1755.0	22.4	1543.3	22.6	875.2	22.0
NC	1841.2	23.5	1570.3	23.0	906.7	22.8
Unknown	0.0	0.0	112.5	1.6	0.0	0.0
Total	7825.8	100.0	6824.4	100.0	3973.7	100.0
Month	mt	%	mt	%	mt	%
Jan	1324.6	16.9	1349.9	19.8	723.8	18.2
Feb	1537.7	19.6	1471.6	21.6	785.2	19.8
Mar	1119.9	14.3	972.9	14.3	523.1	13.2
Apr	572.0	7.3	536.5	7.9	365.4	9.2
May	320.5	4.1	252.2	3.7	153.2	3.9
Jun	333.8	4.3	242.0	3.5	154.4	3.9
Jul	322.4	4.1	233.1	3.4	145.6	3.7
Aug	398.0	5.1	292.8	4.3	185.2	4.7
Sep	384.2	4.9	328.6	4.8	202.0	5.1
Oct	247.9	3.2	209.6	3.1	139.9	3.5
Nov	609.0	7.8	505.8	7.4	307.5	7.7
Dec	656.0	8.4	429.4	6.3	288.4	7.3
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	7825.8	100.0	6824.4	100.0	3973.7	100.0

Table 14. 2006 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	3.0	0.0	2.8	0.1	1.1	0.0
NH	0.0	0.0	0.4	0.0	0.0	0.0
MA	413.0	6.6	324.1	5.8	132.0	4.6
RI	961.6	15.4	748.6	13.4	431.7	15.2
CT	142.3	2.3	113.5	2.0	76.3	2.7
NY	572.2	9.1	541.7	9.7	161.7	5.7
NJ	1064.3	17.0	1118.1	20.0	718.5	25.2
DE	2.0	0.0	0.0	0.0	0.0	0.0
MD	112.4	1.8	73.7	1.3	32.6	1.1
VA	1210.7	19.3	1110.8	19.9	451.5	15.9
NC	1780.8	28.4	1546.8	27.7	841.9	29.6
Unknown	0.0	0.0	6.2	0.1	0.0	0.0
Total	6262.2	100.0	5586.7	100.0	2847.4	100.0
Month	mt	%	mt	%	mt	%
Jan	1090.0	17.4	1136.9	20.3	632.9	22.2
Feb	1165.9	18.6	1123.0	20.1	620.4	21.8
Mar	943.2	15.1	872.0	15.6	511.4	18.0
Apr	343.3	5.5	348.0	6.2	211.2	7.4
May	239.4	3.8	178.8	3.2	105.5	3.7
Jun	239.7	3.8	163.1	2.9	94.1	3.3
Jul	260.1	4.2	181.1	3.2	110.1	3.9
Aug	353.8	5.6	243.4	4.4	137.3	4.8
Sep	277.0	4.4	248.0	4.4	153.1	5.4
Oct	302.1	4.8	302.5	5.4	128.6	4.5
Nov	563.6	9.0	457.3	8.2	54.6	1.9
Dec	484.2	7.7	332.8	6.0	88.5	3.1
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	6262.2	100.0	5586.7	100.0	2847.4	100.0

Table 15. 2007 Summer flounder landings (mt, live and percent) from the Dealer Report data, Vessel Trip Report data, and the matched set, by state and month of landing (proration strata).

	Dealer Report		Vessel Trip Report		Matched Set	
State	mt	%	mt	%	mt	%
ME	1.3	0.0	1.0	0.0	0.9	0.0
NH	0.0	0.0	0.1	0.0	0.0	0.0
MA	299.5	6.7	185.7	4.6	79.1	3.4
RI	687.4	15.3	545.5	13.4	369.1	15.7
CT	93.7	2.1	66.0	1.6	43.6	1.9
NY	426.0	9.5	437.4	10.7	125.7	5.3
NJ	770.0	17.2	784.4	19.2	601.3	25.6
DE	1.5	0.0	0.0	0.0	0.0	0.0
MD	80.5	1.8	73.5	1.8	55.9	2.4
VA	918.5	20.5	817.3	20.0	487.3	20.7
NC	1210.8	27.0	1164.8	28.6	589.1	25.0
Unknown	0.0	0.0	2.6	0.1	0.0	0.0
Total	4489.1	100.0	4078.2	100.0	2352.0	100.0
Month	mt	%	mt	%	mt	%
Jan	1074.9	23.9	994.8	24.4	562.3	23.9
Feb	791.8	17.6	794.1	19.5	368.8	15.7
Mar	599.9	13.4	572.7	14.0	347.6	14.8
Apr	301.2	6.7	297.0	7.3	206.2	8.8
May	235.2	5.2	183.7	4.5	106.5	4.5
Jun	217.2	4.8	142.7	3.5	76.8	3.3
Jul	327.3	7.3	204.4	5.0	124.8	5.3
Aug	110.6	2.5	80.2	2.0	35.0	1.5
Sep	288.1	6.4	279.1	6.8	176.2	7.5
Oct	164.2	3.7	162.0	4.0	100.6	4.3
Nov	223.0	5.0	216.3	5.3	161.4	6.9
Dec	155.7	3.5	151.3	3.7	85.7	3.6
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	4489.1	100.0	4078.2	100.0	2352.0	100.0

Table 16. Distribution of Northeast Region (ME-VA) commercial fishery landings by statistical area.

Area	1992	1993	1994	1995	1996	1997	1998	1999
511	0	0	0	0	1	0	0	0
512	0	0	0	0	1	1	0	0
513	0	3	0	0	2	0	0	2
514	9	11	10	12	3	15	17	11
515	0	0	0	0	0	0	0	0
521	8	3	14	4	16	2	9	2
522	8	8	7	6	13	6	2	3
561	2	1	0	0	1	1	3	2
562	6	4	5	10	1	1	0	3
525	22	35	26	85	140	16	27	28
526	294	242	193	128	45	22	33	17
533	0	0	0	0	6	2	3	5
537	916	557	707	770	553	449	417	354
538	228	255	341	332	273	270	229	275
539	217	157	223	258	248	284	373	418
611	117	35	181	283	170	141	204	230
612	404	393	169	221	353	297	316	403
613	237	167	280	242	188	194	128	171
614	81	97	141	129	18	41	41	13
615	61	15	49	99	20	37	41	44
616	532	476	743	730	474	245	280	122
621	1028	526	258	279	325	266	286	304
622	299	363	323	522	264	53	141	301
623	0	6	0	14	28	0	1	0
625	289	227	122	118	282	227	142	91
626	743	601	821	347	395	94	502	415
631	655	98	219	220	21	174	258	140
632	160	77	60	43	75	30	41	79
635	45	45	77	55	29	418	228	97
636	0	0	0	4	2	27	8	20
Total	6361	4402	4969	4911	3947	3313	3730	3550

Table 16 continued.

Area	2000	2001	2002	2003	2004	2005	2006	2007
511	1	0	0	0	1	0	0	0
512	1	0	0	0	3	0	1	3
513	0	1	0	1	1	5	1	0
514	2	1	2	2	3	14	4	3
515	0	0	3	1	2	0	0	0
521	4	15	31	12	11	12	3	4
522	6	5	12	10	18	10	14	3
561	4	7	8	1	0	1	1	0
562	8	3	24	9	5	11	3	4
525	41	29	43	32	67	93	38	40
526	16	23	23	17	36	75	25	20
533	10	2	1	2	6	6	4	6
537	326	337	446	451	875	860	635	475
538	260	214	257	275	290	223	255	203
539	455	432	543	551	500	455	386	276
611	142	155	206	217	317	389	369	299
612	308	379	613	606	685	611	603	422
613	170	162	241	240	319	284	304	191
614	3	11	26	25	30	48	12	33
615	70	115	90	63	87	68	126	94
616	384	247	218	359	600	722	524	574
621	208	274	533	303	397	270	285	179
622	101	234	153	394	614	424	360	34
623	8	18	3	14	28	74	22	3
625	60	129	296	261	156	326	123	121
626	697	510	648	763	899	880	331	197
631	185	142	189	119	13	68	13	70
632	39	41	8	82	39	54	31	12
635	54	212	99	21	9	1	8	12
636	1	7	5	4	27	1	0	0
Total	3564	3705	4723	4835	6036	5985	4481	3278

Table 17. Summary of sampling of the commercial fishery for summer flounder, ME-VA.

Year	Lengths	Ages	NER Landings (MT)	Sampling Intensity (mt/100 lengths)
1982	8,194	2,288	7,536	92
1983	6,893	1,347	10,202	148
1984	5,340	1,794	11,455	215
1985	6,473	1,611	10,767	166
1986	7,840	1,967	9,499	121
1987	6,605	1,788	9,945	151
1988	9,048	2,302	11,615	128
1989	8,411	1,325	6,217	74
1990	3,419	853	2,962	87
1991	4,627	1,089	4,626	100
1992	3,385	899	6,361	188
1993	3,638	844	4,402	121
1994	3,950	956	4,969	126
1995	2,982	682	4,911	165
1996	4,580	1,235	3,947	86
1997	8,855	2,332	3,313	37
1998	10,055	2,641	3,730	37
1999	10,460	3,244	3,550	34
2000	10,952	3,307	3,564	33
2001	10,310	2,838	3,705	36
2002	7,422	1,870	4,723	64
2003	8,687	2,210	4,835	56
2004	13,970	3,560	6,036	43
2005	17,188	4,903	5,985	35
2006	18,118	5,062	4,481	25
2007	19,581	6,247	3,278	17

Table 18. Distribution of 1994 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639.MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 1,323 mt; 26.7% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	2 188	1 100	1 76	2 127	6 491
61			2 192		2 192
62	1 100			2 200	3 300
63					
Total	3 288	1 100	3 268	4 327	11 983

MC = Medium, 1212 Landings = 2,212 mt; 44.5% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51		1 122	1 87		2 209
52					
53	3 300	3 310	3 323	3 298	12 1,231
61			2 200	1 96	13 296
62	1 100	1 100		2 200	4 400
63					
Total	4 400	5 532	6 610	6 594	21 2,136

Table 18 continued.

MC = Small, 1214   Landings = 511 mt; 10.3% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51		1 103			1 103
52					
53					
61			1 56		1 56
62	1 50	1 50		2 152	4 252
63					
Total	1 50	2 153	1 56	2 152	6 411

MC = Jumbo, 1218   Landings = 315 mt; 6.3% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	1 36		1 22	1 57	3 115
61					
62			1 18	1 100	1 118
63					
Total	1 36		2 40	2 157	5 233

Table 18 continued.

MC = Unclassified, 1219   Landings = 608 mt; 12.2% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53					
61		1 46		1 36	2 82
62			2 105		2 105
63				1 36	1 36
Total		1 46	2 105	1 36	4 187

Table 19. Distribution of 1995 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639.MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 1,800 mt; 36.7% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	2 201	1 88			3 289
61	1 105	2 133		1 39	4 277
62	2 201		1 100	1 100	4 401
63					
Total	5 507	3 221	1 100	2 139	11 967

MC = Medium, 1212 Landings = 1,988 mt; 40.5% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51		2 110			2 110
52					
53	3 285	4 353			7 638
61	1 98	1 100		1 69	3 267
62	2 201		1 100	1 100	4 401
63					
Total	6 584	7 563	1 100	2 169	16 1,416

Table 19 continued.

MC = Small, 1214   Landings = 345 mt; 7.0% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52					
53					
61		1 44			1 44
62	2 150		1 50	1 50	4 250
63					
Total	2 150	1 44	1 50	1 50	5 294

MC = Jumbo, 1218   Landings = 370 mt; 7.5% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52					
53					
61					
62	2 187				2 187
63					
Total	2 187				2 187

Table 19 continued.

MC = Unclassified, 1219   Landings = 408 mt; 8.3% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53					
61		1 62			1 62
62			1 56		1 56
63					
Total		1 62	1 56		2 118

Table 20. Distribution of 1996 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639.MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 1,151 mt; 29.2% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	2 20	3 240			5 260
53	1 78		1 100		2 178
61	3 167	4 409			7 576
62			3 300		3 300
63					
Total	6 265	7 649	4 400		17 1314

MC = Medium, 1212 Landings = 1,649 mt; 41.8% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	1 62	2 200			3 262
53	1 146		1 100	2 204	4 450
61	2 175	4 401	2 156		8 732
62			2 200	2 187	4 387
63				1 83	1 83
Total	4 383	6 601	5 456	5 474	20 1914

Table 20 continued.

MC = Small, 1214   Landings = 420 mt; 10.6% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52		2 105			2 105
53					
61	1 50	3 181	1 50		5 281
62			3 150	1 50	4 200
63					
Total	1 50	5 286	4 200	1 50	11 586

MC = Jumbo, 1218   Landings = 366 mt; 9.3% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	2 25	2 201			4 226
53			2 131		2 131
61	1 100	3 132			4 232
62			1 100		1 100
63					
Total	3 125	5 333	3 231		11 689

Table 20 continued.

MC = Unclassified, 1219 Landings = 361 mt; 9.1% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53					
61		1 32	1 45		2 77
62					
63					
Total		1 32	1 45		2 77

Table 21. Distribution of 1997 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639.MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 1,125 mt; 34.0% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51			1 12		1 12
52					
53	3 331				3 331
61	3 300	5 454	5 435		13 1189
62	4 400	3 300	1 100	4 192	12 992
63	1 100				1 100
Total	11 1131	8 754	7 547	4 192	30 2624

MC = Medium, 1212 Landings = 1,305 mt; 39.4% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51		1 117	2 199		3 316
52			1 116		1 116
53	3 305	3 325	2 214		8 844
61	6 628	7 651	6 499		19 1778
62	6 601	4 343	3 182	1 43	14 1169
63	4 400				4 400
Total	19 1934	15 1436	14 1210	1 43	49 4623

Table 21 continued.

MC = Small, 1214   Landings = 86 mt; 2.6% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53					
61	1 50				1 50
62	1 100				1 100
63	1 50				1 50
Total	3 200				3 200

MC = Jumbo, 1218   Landings = 398 mt; 12.0% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52		1 41			1 41
53	2 196	1 100			3 296
61	7 495	1 28			8 523
62	1 100	1 10	1 10	2 110	5 230
63	1 72				1 72
Total	11 863	4 179	1 10	2 110	18 1162

Table 21 continued.

MC = Unclassified, 1219   Landings = 399 mt; 12.1% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52					
53		1 101			1 101
61	1 106			1 39	2 145
62					
63					
Total	1 106	1 101		1 39	3 246

Table 22. Distribution of 1998 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639.MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 1,577 mt; 42.3% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51		1 30	2 109		2 139
52					
53	1 100				1 100
61	9 791	4 403	9 913		22 2107
62	4 400	2 146	3 91	4 347	13 984
63	1 100			4 402	5 502
Total	15 1391	7 579	14 1113	8 749	43 3832

MC = Medium, 1212 (1,447 mt) plus Small, 1214 (5 mt); Landings = 1,452 mt, 38.9% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51		1 104	4 302		5 406
52		1 72			1 72
53	1 98	2 204			3 302
61	8 809	4 408	8 710	1 102	21 2029
62	5 440	2 166	1 80	4 377	12 1063
63	6 636			6 604	12 1240
Total	20 1983	10 954	13 1092	11 1083	54 5112

Table 22 continued.

MC = Jumbo, 1218   Landings = 372 mt; 10.0% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51	1 124				1 124
52					
53	1 47				1 47
61			3 37		3 37
62	2 200			1 100	3 300
63				4 400	4 400
Total	4 371		3 37	5 500	12 908

MC = Unclassified, 1219 Landings = 328 mt; 8.8% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53					
61	2 116	1 87			3 203
62					
63					
Total	2 116	1 87			2 203

Table 23. Distribution of 1999 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639.MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 1,550 mt; 44% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	1 101		8 577		9 678
61	5 490	5 508		5 504	15 1502
62	6 364		2 70	7 634	15 1068
63	3 300			5 424	8 724
Total	15 1255	5 508	10 647	17 1562	47 3972

MC = Medium, 1212 (1,212 mt) plus Small, 1214 (8 mt); Landings = 1,220 mt, 34% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	3 416		2 202		5 618
61	9 902	6 613		5 503	20 2018
62	9 619	4 203	8 325	12 843	33 1990
63	4 363			3 298	7 661
Total	25 2300	10 816	10 527	20 1644	65 5287

Table 23 continued.

MC = Jumbo, 1218 Landings = 501 mt; 14% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52					
53			1 37		1 37
61	3 174	1 26			4 200
62	1 59			3 229	4 288
63				6 368	6 368
Total	4 233	1 26	1 37	9 597	15 893

MC = Unclassified, 1219 Landings = 279 mt; 8% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52					
53		3 246	1 62		4 308
61					
62					
63					
Total		3 246	1 62		4 308

Table 24. Distribution of 2000 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639.MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured. Samples include data collected by the NEFSC (119 samples, 9,513 fish), the VMRC (65 samples, 1,091 fish), and MADMF (5 samples, 348 fish)

MC = Large, 1210 Landings = 1,485 mt; 42% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	5 619				5 619
61	13 1226		4 380		17 1606
62	5 284	3 72	4 94	6 444	21 894
63	5 497	6 274	6 84	7 66	24 921
Total	28 2626	9 346	14 558	13 510	64 4040

MC = Medium, 1212 (1,258 mt) plus Small, 1214 (7 mt); Landings = 1,265 mt, 35% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	1 144				1 144
53	2 226		1 83	1 102	4 411
61	14 1365		6 593		20 1958
62	7 573	6 228	4 161	5 435	22 1397
63	3 227	6 66	13 91	8 123	30 507
Total	27 2535	12 294	24 928	14 660	77 4417

Table 24 continued.

MC = Jumbo, 1218 Landings = 641 mt; 18% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	1 104				1 104
53	3 207				3 207
61	5 357				5 357
62	3 139			6 471	9 610
63	4 255	2 181		2 19	8 455
Total	16 1062	2 181		8 490	26 1733

MC = Unclassified, 1219 Landings = 173 mt; 5% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53		1 41	5 352		6 393
61	1 100				1 100
62					
63	3 31	6 176	4 42	2 20	15 269
Total	4 131	7 217	9 394	2 20	22 762

Table 25. Distribution of 2001 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639. MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured. Samples include data collected by the NEFSC (118 samples, 9,521 fish), the VMRC (1 sample, 63 fish), and MADMF (6 samples, 726 fish)

MC = Large, 1210 Landings = 1,515 mt; 41% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	4 291		1 20		5 311
53	1 102	1 49	3 74	2 142	7 367
61	10 902				10 902
62	8 839	5 289	6 458	5 500	24 1986
63	5 504				5 504
Total	28 2538	6 338	10 552	7 642	51 4070

MC = Medium, 1212 (1,183 mt) plus Small, 1214 (10 mt); Landings = 1,193mt, 32% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	2 235				2 235
53	1 105		2 116	1 95	4 316
61	8 684				8 684
62	9 770	8 675	5 427	4 403	26 2275
63	3 304				3 304
Total	23 2098	8 675	7 543	5 498	43 3814

Table 25 continued.

MC = Jumbo, 1218 Landings = 690 mt; 19% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52	2 26		6 250		8 276
53		1 104			1 104
61	3 248				3 248
62	4 372	1 46	1 74	2 201	8 693
63	2 189	1 100			3 289
Total	11 835	3 250	7 324	2 201	23 1610

MC = Unclassified, 1219 Landings = 308 mt; 8% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52					
53		6 726			6 726
61	1 27				1 27
62		1 63			1 63
63					
Total	1 27	7 789			8 816

Table 26. Distribution of 2002 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639. MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured. Samples include data collected by the NEFSC (94 samples, 7,199 fish), and the MADMF (12 samples, 223 fish)

MC = Large, 1210 Landings = 1,911 mt; 40% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	3 270				3 270
53	4 227		5 134		9 361
61	3 211	2 127	4 400	1 95	10 833
62	6 461	4 264		4 403	14 1128
63	3 301	1 100			4 401
Total	19 1470	7 491	9 534	5 498	40 2993

MC = Medium, 1212 (1,570 mt) plus Small, 1214 (16 mt); Landings = 1,586 mt, 34% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	3 341	3 175	4 100		10 616
61	1 102	2 168	3 268	1 100	7 638
62	7 701	3 170		2 200	12 1071
63	4 401	1 101			5 502
Total	15 1545	9 614	4 368	3 300	34 2827

Table 26 continued.

MC = Jumbo, 1218 Landings = 811 mt; 17% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	1 31				1 31
53	3 176	1 41	5 61		9 278
61	4 164	3 77	1 65		8 306
62	4 377	1 21	1 25	3 303	9 726
63	1 85	1 28			2 113
Total	13 833	6 167	7 151	3 303	29 1454

MC = Unclassified, 1219 Landings = 416 mt; 9% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53					
61			3 148		3 148
62					
63					
Total			3 148		3 148

Table 27. Distribution of 2003 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639. MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured. Samples include data collected by the NEFSC (136 samples, 8,505 fish), and the VAMRC (1 sample, 65 fish)

MC = Large, 1210 Landings = 2,089 mt; 43% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51			1 65		1 65
52	2 76			1 65	3 141
53	1 102		8 147	2 52	11 301
61	3 248	5 303	4 307	2 227	14 1085
62	6 550	2 35		5 483	13 1068
63	3 300				3 300
Total	15 1276	6 322	13 519	10 827	44 2961

MC = Medium, 1212 (1,579 mt) plus Small, 1214 (4 mt); Landings = 1,583 mt, 33% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51	1 16				1 16
52	1 26	1 37		1 54	3 117
53	2 188	3 220	7 128	2 188	14 724
61	3 268	5 427	4 407	2 137	14 1239
62	10 926	1 13		3 224	14 1163
63	2 200				2 200
Total	19 1624	9 684	11 535	7 580	48 3461

Table 27 continued.

MC = Jumbo, 1218 Landings = 939 mt; 19% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	2 130		2 62		4 192
53	3 148		1 49		4 197
61	4 210	3 97	1 40	1 44	9 391
62	4 400			2 124	6 524
63	2 201				2 201
Total	15 1089	3 97	4 151	2 168	25 1505

MC = Unclassified, 1219 Landings = 225 mt; 5% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53			1 25		1 25
61		6 215	13 372	2 83	21 670
62					
63				1 65	
Total		6 215	14 397	3 148	23 760

Table 28. Distribution of 2004 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639. MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured. Samples include data collected by the NEFSC (199 samples; 13,894 fish), and the VAMRC (3 samples; 76 fish)

MC = Large, 1210 Landings = 2,720 mt; 45% of NER Total

DIV	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
51					
52	1 38	1 35	1 32		3 105
53	6 627	1 119	2 45	3 257	12 1048
61	13 1213	13 860	9 466	1 102	36 2640
62	7 684			6 594	13 1278
63	3 19			1 100	4 119
Total	27 2581	15 1014	12 543	11 1052	65 5190

MC = Medium, 1212 (1,804 mt) plus Small, 1214 (9 mt); Landings = 1,813 mt, 30% of NER Total

DIV	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
51					
52	2 169				2 169
53	2 197	5 190	3 207		10 594
61	11 1249	9 627	6 418	3 279	29 2514
62	7 703	1 95	2 207	8 785	18 1790
63	3 34			1 101	4 135
Total	25 2352	15 853	11 832	12 1165	63 5202

Table 28 continued.

MC = Jumbo, 1218   Landings = 1,066 mt;   18% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52			3 91		3 91
53	6 451	3 83		7 368	16 902
61	5 366	6 67	3 99	2 114	16 646
62	3 222			3 302	6 524
63	3 23				3 23
Total	17 1062	9 150	6 190	12 784	44 2186

MC = Unclassified, 1219 Landings = 437 mt;   7% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53					
61	1	16 215	13 372	1 83	31 670
62				1	
63					
Total	1 22	16 676	13 511	2 124	32 1333

Table 29. Distribution of 2005 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639. MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 2,606 mt; 44% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52		1 50	2 110	3 198	6 358
53	6 349	1 38		6 334	13 721
61	8 474	9 246	29 1691	10 794	56 3205
62	7 651	2 200	1 64	9 882	19 1797
63		1 100		1 100	2 200
Total	21 1474	14 634	32 1865	29 2308	96 6281

MC = Medium, 1212 (1,850 mt) plus Small, 1214 (20 mt); Landings = 1,870 mt, 31% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	2 244		2 3	2 105	6 352
53	2 156	2 149	1 35	3 210	8 550
61	7 608	14 688	24 1698	9 802	54 3796
62	12 1222	3 300	2 310	11 1807	29 2919
63		1 100		1 100	2 200
Total	23 2230	20 1237	30 2046	26 2304	99 7817

Table 29 continued.

MC = Jumbo, 1218   Landings = 999 mt; 17% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	1 49		2 32	3 104	6 185
53	4 369	2 88	1 27	6 170	13 654
61	3 201	6 64	17 645	4 177	30 1087
62	4 400	1 32		1 93	6 525
63					
Total	17 1019	9 184	6 704	12 544	44 2457

MC = Unclassified, 1219 Landings = 510 mt; 9% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	2 146		1 53		3 199
61		4 136	6 176	1 28	11 340
62			1 100		1 100
63					
Total	2 146	4 136	8 329	1 28	15 639

Table 30. Distribution of 2006 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639. MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 2,016 mt; 45% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	1 114	5 87	1 41		7 242
53	6 532	2 37		2 107	10 676
61	13 1094	7 461	12 617	12 1035	44 3207
62	7 666		2 193	13 1276	22 2135
63	1 100	2 200			3 300
Total	28 2506	16 785	15 851	27 2418	86 6560

MC = Medium, 1212 (1,511 mt) plus Small, 1214 (4 mt); Landings = 1,515 mt, 34% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52					
53	5 466	2 145		3 165	10 776
61	15 1354	12 780	13 934	8 823	48 3891
62	8 795	2 205	8 797	10 935	28 2732
63		1 100			1 200
Total	28 2615	17 1230	21 1731	21 1923	87 7499

Table 30 continued.

MC = Jumbo, 1218   Landings = 748 mt; 17% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52		3 37	3 83		6 120
53	4 192			2 54	6 246
61	4 328	5 107	5 38	6 306	20 779
62	2 155	1 100	2 123	6 388	11 766
63					
Total	10 675	9 244	10 244	14 748	43 1911

MC = Unclassified, 1219 Landings = 202 mt;   4% of NER Total

DIV	Quarter 1	2	3	4	Total
51					
52					
53					
61	1 10	3 103	8 213	1 23	13 349
62				1 101	1 101
63	1 407	1 119		2 1,115	4 1,681
Total	2 417	4 222	8 213	4 1,279	18 2,131

Table 31. Distribution of 2007 NER commercial fishery length frequency samples. Two digit divisions (DIV) defined as: 51 = 511 to 515, 52 = 521 to 562, 53 = 533 to 539, 61 = 611 to 616, 62 = 621 to 629, 63 = 631 to 639. MC = landings market category defined as: 1210 = large, 1212 = medium, 1214 = small, 1218 = jumbo, 1219 = unclassified. Top entry in each table cell is the number of samples, bottom entry is the number of fish measured.

MC = Large, 1210 Landings = 1,604 mt; 49% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	3 147	2 116	2 105	1 44	8 412
53	7 257	2 202	1 11	12 636	22 1106
61	27 2162	18 944	40 2340	2 39	87 5485
62	5 428	3 206	7 661	4 397	19 1692
63	3 304				3 304
Total	45 3298	25 1468	50 3117	19 1116	139 8999

MC = Medium, 1212 (935 mt) plus Small, 1214/1215 (4 mt); Landings = 939 mt, 29% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	4 65	1 4	2 19		7 88
53	4 294	1 100		3 184	8 578
61	19 1680	14 921	26 2011	2 89	61 4701
62	5 511	6 534	4 394	4 406	19 1845
63	2 211				2 211
Total	34 2761	22 1559	32 2424	9 679	97 7423

Table 31 continued.

MC = Jumbo, 1218   Landings = 527 mt; 16% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	4 113	4 63	8 155	2 19	18 350
53	2 35	1 10	3 93	8 170	14 308
61	5 388	8 90	11 114	5 64	29 656
62			2 102	4 315	6 417
63					
Total	11 536	13 163	24 464	19 568	67 1731

MC = Unclassified, 1219 Landings = 219 mt; 6% of NER Total

	Quarter				
DIV	1	2	3	4	Total
51					
52	1 36				1 36
53					
61	1 50	14 466	25 667	4 109	44 1292
62	1 2016	2 712	1 91	1 780	5 3599
63					
Total	3 2102	16 1178	26 758	5 889	50 4927

Table 32. Commercial landings at age of summer flounder ('000), ME-VA. Does not include discards, assumes catch not sampled by NEFSC has same biological characteristics as port sampled catch.

					Age						
Year	0	1	2	3	4	5	6	7	8	9+	Total
1982	1,441	6,879	5,630	232	61	97	57	22	2	0	14,421
1983	1,956	12,119	4,352	554	30	62	13	17	4	2	19,109
1984	1,403	10,706	6,734	1,618	575	72	3	5	1	4	21,121
1985	840	6,441	10,068	956	263	169	25	4	2	1	18,769
1986	407	7,041	6,374	2,215	158	93	29	7	2	0	16,326
1987	332	8,908	7,456	935	337	23	24	27	11	0	18,053
1988	305	11,116	8,992	1,280	327	79	18	9	5	0	22,131
1989	96	2,491	4,829	841	152	16	3	1	1	0	8,430
1990	0	2,670	861	459	81	18	6	1	1	0	4,097
1991	0	3,755	3,256	142	61	11	1	1	0	0	7,227
1992	114	5,760	3,575	338	19	22	0	1	0	0	9,829
1993	151	4,308	2,340	174	29	43	19	2	1	0	7,067
1994	119	3,698	3,692	272	64	12	6	0	5	0	7,868
1995	46	2,566	4,280	241	40	8	2	1	0	0	7,184
1996	0	1,401	3,187	798	156	15	3	0	1	0	5,561
1997	0	380	2,442	1,214	261	69	10	4	0	0	4,380
1998	0	196	1,719	2,022	437	72	15	1	0	0	4,462
1999	0	123	1,570	1,522	585	160	26	8	0	0	3,994
2000	0	212	1,934	1,083	449	119	47	15	6	2	3,867
2001	0	706	1,402	1,000	331	155	59	16	4	3	3,676
2002	0	406	2,706	1,375	383	133	75	9	0	1	5,088
2003	0	470	2,112	1,353	532	255	110	39	17	3	4,891
2004	0	287	2,609	1,765	748	301	120	58	32	10	5,930
2005	0	506	1,373	1,629	1,091	675	364	182	127	62	6,009
2006	0	375	2,221	1,110	578	276	132	49	19	4	4,764
2007	0	160	762	1,449	485	225	115	43	16	10	3,265

Table 33. Mean weight (kg) at age of summer flounder landed in the commercial fishery, ME-VA.

	Age										
	0	1	2	3	4	5	6	7	8	9+	ALL
1982	0.260	0.420	0.620	1.840	2.330	2.940	2.710	4.040	5.990	0.000	0.545
1983	0.310	0.460	0.800	1.400	2.350	1.850	2.760	3.300	4.170	4.370	0.562
1984	0.280	0.390	0.600	1.090	1.430	2.160	3.210	3.620	4.640	4.030	0.540
1985	0.330	0.440	0.590	1.080	1.730	2.220	2.590	4.710	4.780	4.800	0.587
1986	0.300	0.440	0.630	1.110	1.760	1.890	3.140	2.960	4.810	0.000	0.629
1987	0.270	0.450	0.620	1.060	2.000	2.850	3.080	3.020	4.140	0.000	0.590
1988	0.360	0.460	0.600	1.210	2.070	2.880	3.980	3.910	4.500	0.000	0.596
1989	0.357	0.554	0.738	1.062	1.833	2.466	3.568	3.592	2.251	0.000	0.736
1990	0.000	0.518	0.857	1.374	1.835	2.134	3.212	3.915	5.029	0.000	0.724
1991	0.000	0.482	0.748	1.538	2.257	3.012	3.908	3.873	0.000	0.000	0.642
1992	0.340	0.500	0.820	1.880	2.680	3.090	0.000	4.590	0.000	0.000	0.673
1993	0.354	0.488	0.751	1.625	2.099	1.786	2.810	4.136	5.199	0.000	0.623
1994	0.389	0.552	0.616	1.426	2.266	3.083	3.323	0.000	3.703	0.000	0.632
1995	0.328	0.542	0.704	1.532	2.373	2.916	3.500	4.094	0.000	0.000	0.684
1996	0.000	0.544	0.577	1.137	1.881	2.845	3.776	0.000	4.762	0.000	0.694
1997	0.000	0.544	0.637	0.842	1.310	2.101	2.559	3.429	0.000	0.000	0.756
1998	0.000	0.550	0.643	0.845	1.386	2.307	2.524	3.983	0.000	0.000	0.837
1999	0.000	0.523	0.615	0.862	1.359	1.928	2.838	3.618	0.000	0.000	0.889
2000	0.000	0.566	0.676	0.972	1.459	2.125	2.514	2.600	3.303	3.530	0.923
2001	0.000	0.588	0.762	1.031	1.721	2.376	2.847	3.566	3.898	4.940	1.008
2002	0.000	0.596	0.711	1.006	1.652	2.162	2.845	3.601	3.357	2.983	0.928
2003	0.000	0.611	0.705	0.998	1.414	1.890	2.528	3.181	3.535	4.032	0.988
2004	0.000	0.555	0.716	0.995	1.427	1.914	2.488	2.984	3.138	3.874	1.018
2005	0.000	0.556	0.627	0.793	1.056	1.385	1.692	1.989	2.274	3.210	0.996
2006	0.000	0.580	0.651	0.935	1.319	1.788	2.333	2.828	3.253	3.791	0.940
2007	0.000	0.559	0.683	0.866	1.202	1.696	2.256	2.424	2.724	3.700	1.004

Table 34. Summary of North Carolina Division of Marine Fisheries (NCDMF) sampling of the commercial winter trawl fishery for summer flounder.

Year	Lengths	Ages	Total Landings (MT)	Total MT per 100 lengths
1982	5,403	0	2,864	53
1983	8,491	0	3,201	38
1984	14,920	0	5,674	38
1985	13,787	0	3,907	28
1986	15,754	0	2,687	17
1987	12,126	0	2,326	19
1988	13,377	189	3,071	23
1989	15,785	106	1,908	12
1990	15,787	191	1,237	8
1991	24,590	534	1,595	6
1992	14,321	364	1,168	8
1993	18,019	442	1,313	7
1994	21,858	548	1,620	7
1995	18,410	548	2,066	11
1996	17,745	477	1,913	11
1997	12,802	388	681	5
1998	21,477	476	1,346	6
1999	11,703	412	1,271	11
2000	24,177	568	1,521	6
2001	19,655	499	1,265	6
2002	21,653	609	1,841	8
2003	17,476	610	1,615	9
2004	20,436	553	2,182	11
2005	20,598	620	1,827	9
2006	20,911	682	1,781	9
2007	26,187	697	1,211	5

Table 35. Number ('000) of summer flounder at age landed in the North Carolina commercial winter trawl fishery. The 1982-1987 NCDMF length samples were aged using NEFSC age-lengths keys for comparable times and areas (i.e., same quarter and statistical areas). Since 1987, the NCDMF length samples have been aged using NCDMF age-lengths keys.

	Age									
Year	0	1	2	3	4	5	6	7	8+	Total
1982	981	3,463	1,021	142	52	19	6	4	2	5,690
1983	492	3,778	1,581	287	135	41	3	3	<1	6,321
1984	907	5,658	3,889	550	107	18	<1	0	0	11,130
1985	196	2,974	3,529	338	85	24	5	<1	0	7,152
1986	216	2,478	1,897	479	29	32	1	1	<1	5,134
1987	233	2,420	1,299	265	28	1	0	0	0	4,243
1988	0	2,917	2,225	471	227	39	1	6	<1	5,887
1989	2	49	1,437	716	185	37	1	2	0	2,429
1990	2	142	730	418	117	12	1	<1	0	1,424
1991	0	382	1,641	521	116	20	2	<1	0	2,682
1992	0	36	795	697	131	21	2	<1	0	1,682
1993	0	515	1,101	252	44	1	<1	0	0	1,913
1994	6	258	1,262	503	115	14	3	<1	0	2,161
1995	<1	181	1,391	859	331	53	2	<1	0	2,817
1996	0	580	2,187	554	132	56	13	<1	2	3,526
1997	0	17	625	378	18	3	<1	0	0	1,041
1998	18	548	694	230	28	3	<1	0	0	1,520
1999	1	70	504	579	152	88	6	3	<1	1,403
2000	0	50	398	906	345	55	18	1	2	1,775
2001	0	79	408	556	334	63	18	5	<1	1,463
2002	0	79	574	1,032	460	70	30	3	<1	2,248
2003	0	43	336	712	362	124	50	8	<1	1,635
2004	0	24	608	863	449	238	57	22	2	2,263
2005	0	17	471	832	389	143	44	14	3	1,913
2006	0	18	436	658	447	258	95	26	9	1,947
2007	0	12	120	581	345	135	54	25	14	1,286

Table 36. Mean weight (kg) at age of summer flounder landed in the North Carolina commercial winter trawl fishery.

	Age									
	0	1	2	3	4	5	6	7	8+	ALL
1982	0.340	0.456	0.756	1.284	1.658	2.054	2.116	2.231	2.577	0.531
1983	0.319	0.452	0.746	1.140	1.262	1.488	1.729	2.428	2.696	0.572
1984	0.331	0.475	0.704	1.059	1.504	2.167	3.482	0.000	0.000	0.585
1985	0.377	0.460	0.664	1.203	1.675	2.485	3.073	4.571	0.000	0.617
1986	0.360	0.512	0.674	1.092	1.623	1.955	3.398	3.233	3.626	0.636
1987	0.334	0.512	0.655	1.086	1.878	2.944	0.000	0.000	0.000	0.590
1988	0.000	0.411	0.598	0.926	1.189	1.702	2.241	2.982	3.412	0.565
1989	0.118	0.380	0.603	0.988	1.161	2.095	3.086	2.496	0.000	0.779
1990	0.079	0.483	0.664	0.867	1.306	2.095	1.897	3.972	0.000	0.773
1991	0.000	0.448	0.655	1.072	1.729	2.252	2.508	3.126	4.097	0.767
1992	0.000	0.363	0.504	0.851	1.198	1.457	2.302	0.000	0.000	0.713
1993	0.000	0.489	0.608	1.128	1.371	2.946	3.406	0.000	0.000	0.663
1994	0.272	0.451	0.618	1.270	2.039	2.443	2.888	5.780	0.000	1.414
1995	0.038	0.210	0.461	0.853	1.474	2.492	3.792	3.815	0.000	1.299
1996	0.000	0.420	0.470	0.730	1.350	1.720	2.290	3.200	2.860	0.564
1997	0.000	0.407	0.616	0.760	1.323	2.069	3.248	0.000	0.000	0.682
1998	0.405	0.714	0.890	1.237	1.491	2.802	3.381	0.000	0.000	0.889
1999	0.144	0.578	0.729	0.919	1.402	1.682	2.609	3.063	3.904	0.945
2000	0.000	0.558	0.656	0.801	1.201	1.963	2.590	3.307	3.521	0.898
2001	0.000	0.594	0.674	0.758	1.065	1.716	2.388	3.067	4.240	0.865
2002	0.000	0.520	0.650	0.760	0.990	1.650	2.200	3.030	4.420	0.821
2003	0.000	0.460	0.700	0.890	1.550	2.480	3.250	3.870	4.820	1.194
2004	0.000	0.510	0.640	0.820	1.120	1.410	2.140	2.990	3.980	0.948
2005	0.000	0.580	0.670	0.870	1.150	1.650	2.430	2.900	3.730	0.989
2006	0.000	0.600	0.669	0.815	1.070	1.427	1.842	2.573	3.370	1.004
2007	0.000	0.550	0.680	0.780	1.010	1.420	1.730	2.160	2.760	0.986

Table 37. Summary NER Fishery Observer data for trips catching summer flounder. Total trips (trips are not split for multiple areas), observed tows, total summer flounder catch (lb), total summer flounder kept (lb), and total summer flounder discard (lb), and percentage of summer flounder discard (lb) to summer flounder catch (lb).

Year	Gear	Trips	Obs Tows	Total Catch	Total Kept	Total Discard	Discard: Total (%)
1989	All	57	413	53,714	48,406	5,308	9.9
1990	All	61	463	47,954	35,972	11,982	25.0
1991	All	82	635	61,650	50,410	11,240	18.2
1992	Trawl	66	643	136,632	118,026	18,606	13.6
	Scallop	8	178	1,477	767	710	48.1
	All	74	821	138,109	118,793	19,316	14.0
1993	Trawl	37	410	74,982	67,603	7,379	9.8
	Scallop	15	671	2,967	1,158	1,809	61.0
	All	52	1,081	77,949	68,761	9,188	11.8
1994	Trawl	51	574	174,347	163,734	10,612	6.1
	Scallop	14	651	5,811	435	5,376	92.5
	All	65	1,225	180,158	164,169	15,988	8.9
1995	Trawl	134	1,004	242,784	235,011	7,773	3.2
	Scallop	19	1,051	10,044	2,247	7,778	77.4
	All	153	2,055	252,828	237,258	15,551	6.2
1996	Trawl	111	653	101,389	90,789	10,600	10.5
	Scallop	24	1,083	9,575	1,345	8,230	86.0
	All	135	1,736	110,964	92,134	18,830	17.0
1997	Trawl	59	334	31,707	26,475	5,232	16.5
	Scallop	23	835	5,721	583	5,138	89.8
	All	82	1,169	37,428	27,058	10,370	27.7

Table 37 continued.

Year	Gear	Trips	Obs Tows	Total Catch	Total Kept	Total Discard	Discard: Total (%)
1998	Trawl	53	329	72,396	65,507	6,889	9.5
	Scallop	22	359	1,962	652	1,310	66.8
	All	75	688	74,358	66,159	8,199	11.0
1999	Trawl	56	374	60,733	45,987	14,746	24.3
	Scallop	10	247	3,199	458	2,741	85.7
	All	66	621	63,932	46,445	17,487	27.4
2000	Trawl	115	688	162,015	144,752	17,263	10.7
	Scallop	23	608	8,457	501	7,956	94.1
	All	138	1,296	170,472	145,253	25,219	14.8
2001	Trawl	137	605	109,910	61,625	48,295	43.9
	Scallop	68	1,606	11,622	800	10,822	93.1
	All	205	2,211	121,532	62,425	59,117	48.6
2002	Trawl	175	837	141,246	124,053	17,193	12.2
	Scallop	55	2,522	25,871	887	24,984	96.6
	All	230	3,359	167,117	124,940	42,177	25.2
2003	Trawl	212	1,316	235,685	195,371	40,314	17.1
	Scallop	79	3,248	37,021	2,378	34,643	93.6
	All	291	4,564	272,706	197,749	74,957	27.5
2004	Trawl	546	2,570	561,689	477,634	84,055	15.0
	Scallop	132	4,444	59,787	4,016	55,771	93.3
	All	678	7,014	621,476	481,650	139,826	22.5
2005	Trawl	906	5,993	800,082	580,949	219,133	27.4
	Scallop	136	3,786	38,227	2,805	35,422	92.7
	All	1,042	9,779	838,309	583,754	254,555	30.4

Table 37 continued.

Year	Gear	Trips	Obs Tows	Total Catch	Total Kept	Total Discard	Discard: Total (%)
2006	Trawl	578	4,017	566,458	309,915	256,544	45.3
	Scallop	117	1,488	15,687	1,323	14,364	91.6
	All	695	5,505	582,145	311,238	270,908	46.5
2007	Trawl	682	3,972	759,360	332,373	426,987	56.2
	Scallop	233	4,059	58,865	729	56,136	95.4
	All	915	8,031	818,225	333,102	483,123	59.0

Table 38. Summary NER Vessel Trip Report (VTR) data for trips reporting discard of any species and catching summer flounder. Total trips, total summer flounder catch (lb), total summer flounder kept (lb), total summer flounder discard (lb), and percentage of summer flounder discard (lb) to summer flounder catch (lb).

Year	Gear	Trips	Total Catch	Total Kept	Total Discard	Discard: Total (%)
1994	Trawl	4,267	2,149,332	2,015,296	134,036	6.2
	Scallop	85	70,353	22,877	47,476	67.5
	All	4,352	2,219,685	2,038,173	181,512	8.2
1995	Trawl	3,733	2,444,231	2,332,516	111,715	4.6
	Scallop	113	78,758	25,084	53,674	68.2
	All	3,846	2,522,989	2,357,600	165,389	6.6
1996	Trawl	2,990	1,662,313	1,459,155	203,158	12.2
	Scallop	79	69,557	16,657	52,900	76.1
	All	3,069	1,731,870	1,475,812	256,058	14.8
1997	Trawl	3,044	988,599	851,090	137,509	13.9
	Scallop	51	21,553	4,665	16,888	78.4
	All	3,095	1,010,152	855,755	154,397	15.3
1998	Trawl	3,004	1,128,578	868,706	259,872	23.0
	Scallop	62	23,538	10,323	13,215	56.1
	All	3,066	1,152,116	879,029	273,087	23.7
1999	Trawl	2,884	959,275	772,924	186,351	19.4
	Scallop	41	26,334	14,324	12,010	45.6
	All	2,925	985,609	787,248	198,361	20.1
2000	Trawl	3,140	1,048,791	786,576	262,215	25.0
	Scallop	41	12,183	3,798	8,385	68.8
	All	3,181	1,060,974	790,374	270,600	25.5
2001	Trawl	3,035	1,086,331	783,900	307,156	28.3
	Scallop	71	14,662	1,349	13,313	90.8
	All	3,106	1,100,993	785,249	320,469	29.1

Table 38 continued.

Year	Gear	Trips	Total Catch	Total Kept	Total Discard	Discard: Total (%)
2002	Trawl	3,549	1,163,898	924,590	239,448	20.6
	Scallop	107	23,027	6,913	16,966	73.7
	All	3,656	1,186,925	931,503	256,414	21.6
2003	Trawl	3,008	1,481,531	877,458	606,618	40.9
	Scallop	72	15,565	6,028	15,162	97.4
	All	3,080	1,497,096	883,486	621,780	41.5
2004	Trawl	3,607	1,863,192	1,511,013	355,529	19.1
	Scallop	69	20,221	9,478	15,336	75.8
	All	3,676	1,883,413	1,520,491	370,865	19.7
2005	Trawl	2,475	1,869,259	1,542,640	327,662	17.5
	Scallop	55	7,216	5,364	6,041	83.7
	All	2,530	1,876,475	1,548,004	333,703	17.8
2006	Trawl	2,575	1,361,765	974,264	398,806	29.3
	Scallop	144	17,613	3,091	14,522	82.5
	All	2,719	1,379,378	977,355	413,328	30.0
2007	Trawl	2,633	1,242,145	822,298	431,480	34.7
	Scallop	167	25,669	12,379	20,558	80.1
	All	2,800	1,267,814	834,677	452,038	35.7

Table 39. Summary of fishery observer data for summer flounder by NAFO division and quarter for 1989: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout database days fished on trips landing any summer flounder (WO DF), estimate of landings calculated from observed kept rates and NEFSC weighout database days fished (OB EST LAND MT), landings as recorded in the NEFSC weighout database (WO LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO DF	OB EST LAND MT	WO LAND MT	OB EST DISC MT
51	1	0	0	0	85	0	2	0
	2	1	66	<1	137	9	4	<1
	3	0	0	0	75	0	3	0
	4	1	19	<1	157	3	3	<1
52	1	1	756	48	1319	998	687	64
	2	5	3	8	1250	4	129	10
	3	2	280	<1	536	150	9	<1
	4	1	35	40	1545	54	98	61
53	1	4	588	41	689	405	473	29
	2	10	68	<1	2045	138	224	2
	3	5	260	2	1619	421	298	4
	4	3	91	6	898	82	330	6
61	1	4	544	51	1661	904	528	84
	2	5	107	4	1391	149	165	5
	3	0	213	24	513	109	106	13
	4	5	142	38	575	82	125	22
62	1	5	934	84	1867	1744	1460	158
	2	2	244	101	922	225	85	93
	3	8	213	24	216	46	104	5
	4	1	672	17	1118	752	361	19
63	1	2	1116	110	490	546	323	54
	2	0	244	101	41	10	9	4
	3	0	213	24	40	9	<1	1
	4	0	672	17	616	415	292	10
TOTAL; MEAN (CV%)		65	296 (22.4)	28 (32.7)	19,805	7,255	5,817	642

Table 40. Summary of fishery observer data for summer flounder by NAFO division and quarter for 1990: number of observed trips trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout database days fished on trips landing any summer flounder (WO DF), estimate of landings calculated from observed kept rates and NEFSC weighout database days fished (OB EST LAND MT), landings as recorded in the NEFSC weighout database (WO LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO DF	OB EST LAND MT	WO LAND MT	OB EST DISC MT
51	1	0	0	0	9	0	<1	0
	2	0	0	0	78	0	<1	0
	3	0	0	0	29	0	<1	0
	4	0	0	0	82	0	<1	0
52	1	1	15	5	581	9	148	3
	2	2	12	7	1107	13	31	8
	3	2	14	205	332	5	9	68
	4	3	12	<1	818	10	40	<1
53	1	6	113	3	577	65	129	2
	2	3	50	1	1212	60	51	1
	3	0	92	6	1194	110	187	7
	4	8	92	6	1052	97	288	6
61	1	10	222	40	716	159	84	29
	2	5	14	23	1153	16	22	27
	3	0	91	55	580	53	150	32
	4	3	367	115	535	197	131	62
62	1	4	446	253	2040	911	333	517
	2	9	19	49	558	11	8	27
	3	7	221	74	227	50	126	17
	4	8	360	43	1779	641	368	77
63	1	1	505	321	650	328	258	209
	2	0	19	49	47	1	1	2
	3	0	221	74	0	0	0	0
	4	0	360	43	625	225	384	27
TOTAL; MEAN (CV%)		72	166 (21.3)	56 (31.9)	15,980	2,959	2,749	1,121

Table 41. Summary of fishery observer data for summer flounder by NAFO division and quarter for 1991: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout database days fished on trips landing any summer flounder (WO DF), estimate of landings calculated from observed kept rates and NEFSC weighout database days fished (OB EST LAND MT), landings as recorded in the NEFSC weighout database (WO LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO DF	OB EST LAND MT	WO LAND MT	OB EST DISC MT
51	1	0	0	<1	29	0	<1	0
	2	0	0	<1	79	0	1	0
	3	0	0	<1	43	0	1	0
	4	1	31	<1	188	6	2	<1
52	1	3	218	128	1254	274	79	161
	2	2	88	3	1756	154	44	5
	3	1	13	<1	706	9	17	<1
	4	1	26	<1	1721	44	53	<1
53	1	7	117	9	806	94	242	7
	2	9	55	1	1688	92	147	2
	3	6	92	1	1401	128	279	1
	4	10	163	4	1475	240	259	6
61	1	6	173	49	2763	477	384	134
	2	5	43	37	2983	128	184	111
	3	1	577	1	572	330	260	1
	4	15	187	24	1855	347	225	45
62	1	5	97	9	1981	192	673	19
	2	4	169	143	1203	203	78	172
	3	4	953	177	555	529	236	98
	4	10	249	38	1935	482	602	73
63	1	0	97	9	382	37	231	4
	2	0	169	143	2	<1	<1	<1
	3	0	953	177	19	18	12	3
	4	4	492	212	702	346	346	149
TOTAL; MEAN (CV%)		94	196 (12.5)	42 (30.5)	26,096	4,133	4,355	993

Table 42. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1992: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout database days fished on trips landing any summer flounder (WO DF), estimate of landings calculated from observed kept rates and NEFSC weighout database days fished (OB EST LAND MT), landings as recorded in the NEFSC weighout database (WO LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO DF	OB EST LAND MT	WO LAND MT	OB EST DISC MT
51	1	0	0	0	39	0	<1	0
	2	0	0	0	80	0	2	0
	3	0	0	0	35	0	1	0
	4	1	17	<1	225	4	5	0
52	1	4	427	26	441	188	107	12
	2	1	85	<1	1476	126	112	1
	3	0	11	<1	397	5	11	0
	4	1	11	<1	622	7	72	0
53	1	13	157	11	823	129	386	9
	2	1	21	<1	1836	38	215	1
	3	1	<1	<1	1603	<1	311	0
	4	7	236	13	1561	368	367	20
61	1	16	313	17	757	237	333	13
	2	2	169	36	1350	228	306	49
	3	1	1009	23	954	961	417	22
	4	5	130	6	558	73	208	3
62	1	13	350	23	1589	556	709	37
	2	3	150	71	657	99	88	47
	3	6	502	164	782	392	724	127
	4	4	606	131	925	561	610	121
63	1	4	420	90	491	206	192	44
	2	0	150	71	34	5	1	2
	3	0	502	164	1	1	<1	0
	4	2	381	7	912	347	597	7
TOTAL; MEAN (CV%)		85	300 (11.8)	38 (32.8)	18148	4532	5776	517

Table 43. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1992: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout database days fished on trips landing any summer flounder (WO DF), estimate of landings calculated from observed kept rates and NEFSC weighout database days fished (OB EST LAND MT), landings as recorded in the NEFSC weighout database (WO LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO DF	OB EST LAND MT	WO LAND MT	OB EST DISC MT
51	1	0	0	0	3	0	<1	0
	2	0	0	0	5	0	<1	0
	3	0	0	0	2	0	<1	0
	4	0	0	0	20	0	<1	0
52	1	0	232	0	961	223	4	0
	2	3	29	<1	1845	53	6	0
	3	1	22	0	443	10	1	0
	4	0	34	10	1079	36	11	11
53	1	1	232	<1	38	9	<1	0
	2	0	29	<1	6	<1	<1	0
	3	1	37	<1	8	<1	<1	0
	4	0	34	10	294	10	17	3
61	1	1	137	<1	1749	239	33	1
	2	0	11	17	909	10	9	15
	3	0	37	<1	152	6	<1	0
	4	1	34	10	1342	45	56	14
62	1	1	75	129	1000	75	45	129
	2	1	11	17	691	8	7	12
	3	0	37	<1	22	<1	<1	0
	4	0	34	10	1480	50	63	15
63	1	1	93	129	224	21	13	29
	2	0	11	17	281	3	4	5
	3	0	0	0	0	0	0	0
	4	0	34	10	283	10	12	3
TOTAL; MEAN (CV%)		11	47 (28.2)	3 (62.1)	12837	811	290	237

Table 44. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1993: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout database days fished on trips landing any summer flounder (WO DF), estimate of landings calculated from observed kept rates and NEFSC weighout database days fished (OB EST LAND MT), landings as recorded in the NEFSC weighout database (WO LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO DF	OB EST LAND MT	WO LAND MT	OB EST DISC MT
51	1	0	0	0	77	0	<1	0
	2	0	12	4	58	0	8	0
	3	0	0	0	78	0	3	0
	4	1	<1	55	9	0	<1	0
52	1	4	1018	44	836	851	204	37
	2	3	12	4	1024	13	38	4
	3	0	21	6	390	8	8	2
	4	2	21	6	143	3	24	1
53	1	9	429	58	857	368	344	49
	2	5	105	2	1687	176	109	3
	3	2	143	26	1541	220	304	40
	4	8	121	7	1093	132	138	7
61	1	7	534	48	576	308	393	28
	2	3	29	23	1147	34	181	26
	3	0	526	63	514	274	266	32
	4	2	526	63	114	60	42	7
62	1	1	52	3	1503	78	811	5
	2	0	52	3	601	31	98	2
	3	4	646	177	1120	724	298	200
	4	3	693	55	488	338	411	26
63	1	0	52	3	123	6	63	1
	2	0	52	3	6	<1	<1	0
	3	0	646	177	3	2	<1	1
	4	2	604	18	324	196	131	6
TOTAL; MEAN (CV%)		56	368 (20.2)	29 (21.2)	14312	3823	3878	477

Table 45. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1993:number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout database days fished on trips landing any summer flounder (WO DF), estimate of landings calculated from observed kept rates and NEFSC weighout database days fished (OB EST LAND MT), landings as recorded in the NEFSC weighout database (WO LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO DF	OB EST LAND MT	WO LAND MT	OB EST DISC MT
51	1	0	0	0	0	0	0	0
	2	0	0	0	18	0	0	0
	3	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0
52	1	1	32	<1	141	4	1	0
	2	3	31	5	1401	44	6	7
	3	0	31	5	109	3	0	1
	4	1	140	61	28	4	0	2
53	1	0	32	<1	61	2	<1	0
	2	0	31	5	32	1	<1	0
	3	0	31	5	3	0	0	0
	4	1	56	9	22	1	5	0
61	1	2	22	16	798	18	16	13
	2	4	12	20	1013	12	9	20
	3	0	<1	15	155	0	0	2
	4	2	97	13	122	12	6	2
62	1	2	88	335	515	46	39	173
	2	2	1	62	295	0	4	18
	3	1	<1	15	12	0	0	0
	4	0	97	13	311	30	9	4
63	1	0	88	335	243	21	13	81
	2	0	1	62	255	<1	4	16
	3	0	0	0	0	0	0	0
	4	0	97	13	101	10	3	1
TOTAL; MEAN (CV%)		19	11 (37.7)	10 (31.2)	5635	209	117	340

Table 46. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1994:number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout (WO, quarter 1) and vessel trip report (VTR, quarter 2-4) database prorated days fished on trips landing any summer flounder (WO/VTR DF), estimate of landings calculated from observed kept rates and NEFSC WO (quarter 1) and VTR (quarter 2-4) database days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC WO and dealer (DEAL, quarter 2-4) database (WO/DEAL LAND MT), an interim step fishery observer estimate of discard in mt (OB EST DISC 1), a raising factor to account for fishing effort and discards which occur with landings (NO KEPT RATIO), and the raised fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO/VTR DF	OB EST LAND MT	WO/DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	0	0	40	0	0	0	1.0	0
	2	0	0	0	73	0	7	0	1.0	0
	3	0	0	0	6	0	2	0	1.0	0
	4	0	0	0	0	0	0	0	1.0	0
52	1	2	9	6	526	5	217	3	1.0	3
	2	5	165	3	163	27	14	1	1.0	1
	3	0	165	3	378	62	13	1	2.8	3
	4	1	<1	14	4	0	1	0	2.8	0
53	1	10	756	40	924	698	460	37	1.0	37
	2	0	165	3	819	135	234	3	1.1	3
	3	2	387	5	1337	517	371	6	1.0	6
	4	8	167	20	678	113	205	14	1.0	14
61	1	12	380	31	737	280	487	23	1.0	23
	2	0	380	31	1497	569	406	46	1.0	46
	3	1	278	7	603	168	460	4	1.1	4
	4	4	50	23	611	31	188	14	1.0	14
62	1	7	1538	77	1437	2211	1016	111	1.0	111
	2	1	845	177	419	354	96	74	1.1	78
	3	5	241	36	189	45	130	7	1.0	7
	4	2	530	103	500	265	184	51	1.0	51
63	1	1	1538	77	73	112	41	6	1.0	6
	2	0	845	177	38	32	8	7	1.2	8
	3	0	241	36	1	0	0	0	1.0	0
	4	5	451	27	519	234	250	14	1.0	14
TOTAL; MEAN (CV%)		66	240 (14.8)	18 (36.4)	11572	5858	4790	422	1.0	429

Table 47. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1994: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC weighout (WO, quarter 1) and vessel trip report (VTR, quarter 2-4) database prorated days fished on trips landing any summer flounder (WO/VTR DF), estimate of landings calculated from observed kept rates and NEFSC WO (quarter 1) and VTR (quarter 2-4) database days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC WO and dealer (DEAL, quarter 2-4) database (WO/DEAL LAND MT), an interim step fishery observer estimate of discard in mt (OB EST DISC 1), a raising factor to account for fishing effort and discards which occur with landings (NO KEPT RATIO), and the raised fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	WO/VTR DF	OB EST LAND MT	WO/DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	0	0	0	0	0	0	1.0	0
	2	0	0	0	0	0	0	0	1.0	0
	3	0	0	0	0	0	0	0	1.0	0
	4	0	0	0	0	0	0	0	1.0	0
52	1	0	25	37	211	5	1	8	5.0	39
	2	1	25	37	318	8	<1	12	5.0	58
	3	1	<1	36	0	0	0	0	1.0	0
	4	1	<1	64	0	0	0	0	1.0	0
53	1	0	25	37	37	1	<1	1	1.0	1
	2	0	25	37	0	0	1	0	1.0	0
	3	0	<1	36	0	0	1	0	1.0	0
	4	1	<1	58	0	0	1	0	1.0	0
61	1	5	4	59	445	2	6	26	1.0	26
	2	1	<1	66	2282	1	2	151	1.2	186
	3	0	0	0	0	0	0	0	1.0	0
	4	1	110	<1	175	19	11	0	1.0	0
62	1	4	4	126	1031	4	65	130	1.0	130
	2	3	1	35	386	1	4	13	2.5	34
	3	0	0	0	0	0	0	0	1.0	0
	4	0	110	<1	701	77	41	1	1.4	1
63	1	2	42	111	531	23	30	59	1.4	83
	2	0	1	35	678	1	9	24	1.4	33
	3	0	0	0	0	0	0	0	1.0	0
	4	0	110	<1	35	4	4	0	10.3	0
TOTAL; MEAN (CV%)		20	3 (60.7)	44 (29.7)	6830	146	178	425	1.4	591

Table 48. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1995: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	3	<1	14	52	<1	<1	1	1.0	1
	2	1	<1	2	97	<1	5	0	1.0	0
	3	0	25	<1	23	1	6	<1	1.0	<1
	4	0	<1	45	11	0	0	0	1.0	0
52	1	6	735	3	438	322	201	1	1.0	1
	2	4	97	21	313	30	25	6	1.0	6
	3	1	25	<1	81	2	3	0	1.0	0
	4	1	<1	45	1	0	<1	0	1.0	0
53	1	3	1245	1	1111	1380	431	1	1.0	1
	2	5	293	6	1180	346	184	7	1.1	8
	3	9	494	1	1429	706	423	2	1.0	2
	4	9	213	2	822	175	326	1	1.0	1
61	1	10	1304	27	951	1229	869	25	1.0	25
	2	14	93	9	807	75	292	7	1.0	7
	3	20	27	7	945	26	319	7	1.0	7
	4	13	118	7	552	65	190	4	1.0	4
62	1	12	1047	32	847	882	748	27	1.0	27
	2	12	141	6	204	29	70	1	1.0	1
	3	25	104	31	209	22	71	6	1.0	6
	4	8	399	30	629	251	341	19	1.0	19
63	1	3	621	68	100	68	114	7	1.0	7
	2	1	1005	5	23	23	9	<1	1.0	<1
	3	0	0	0	0	0	0	0	1.0	0
	4	2	703	16	314	221	190	5	1.0	5
TOTAL; MEAN (CV%)		162	140 (10.1)	8 (17.1)	11139	5855	4819	129		130

Table 49. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1995: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	0	0	1	0	<1	0	1.0	0
	2	0	0	0	0	0	0	0	1.0	0
	3	0	0	0	0	0	0	0	1.0	0
	4	1	38	<1	0	0	0	0	1.0	0
52	1	1	29	<1	14	<1	<1	0	1.0	0
	2	0	<1	126	0	0	0	0	1.0	0
	3	1	<1	33	4	0	0	0	1.0	0
	4	2	0	75	0	0	1	0	1.0	0
53	1	0	29	<1	191	6	0	0	1.0	0
	2	1	<1	126	<1	0	0	0	1.0	0
	3	0	0	0	0	0	0	0	1.0	0
	4	0	<1	76	5	0	0	<1	1.0	<1
61	1	8	16	21	496	8	9	10	1.2	12
	2	5	9	38	472	4	3	18	1.5	27
	3	0	7	112	45	0	0	5	1.0	5
	4	2	7	112	411	3	18	46	1.6	74
62	1	6	5	61	654	3	34	40	1.3	51
	2	3	3	55	257	1	4	14	2.3	33
	3	0	0	0	0	0	0	0	1.0	0
	4	1	30	<1	345	10	9	0	1.0	0
63	1	0	5	61	55	0	11	3	1.3	4
	2	1	<1	29	65	0	1	2	2.3	4
	3	0	0	0	0	0	0	0	1.0	0
	4	0	30	<1	13	0	0	0	1.0	0
TOTAL; MEAN (CV%)		32	5 (58.5)	25 (26.9)	3029	36	92	139		212

Table 50. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1996: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	12	38	1	0	1	0	1.0	0
	2	0	32	4	55	2	2	0	1.0	0
	3	0	242	7	36	9	4	<1	3.0	<1
	4	0	0	0	0	0	0	0	3.0	0
52	1	3	12	38	189	2	87	7	1.0	7
	2	1	32	4	981	31	105	4	1.0	4
	3	0	242	7	229	55	13	2	3.9	6
	4	0	0	0	0	0	0	0	3.0	0
53	1	0	2051	87	750	1539	411	65	1.0	65
	2	14	156	2	1030	160	236	2	1.0	2
	3	9	242	7	1898	459	348	13	1.0	13
	4	5	4	106	329	1	23	35	1.6	56
61	1	4	2051	87	937	1922	469	81	1.0	91
	2	11	143	12	561	82	210	7	1.0	7
	3	21	99	5	968	96	439	5	1.0	5
	4	16	1	37	98	0	25	4	1.6	6
62	1	4	688	45	619	426	611	28	1.0	28
	2	12	19	25	117	2	50	3	1.0	3
	3	9	183	13	164	30	261	2	1.0	2
	4	9	30	53	326	10	268	17	1.0	17
63	1	1	1307	124	84	110	72	10	1.0	10
	2	2	1964	54	23	46	28	1	1.0	1
	3	1	<1	6	2	0	0	0	1.0	0
	4	0	30	53	10	0	15	1	1.0	1
TOTAL; MEAN (CV%)		122	36 (32.1)	12 (17.5)	9407	4982	3678	288		319

Table 51. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1996: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	0	0	0	0	0	0	1.0	0
	2	0	0	0	0	0	0	0	1.0	0
	3	0	0	0	0	0	0	0	1.0	0
	4	0	0	0	0	0	0	0	1.0	0
52	1	0	0	0	0	0	0	0	1.0	0
	2	9	<1	68	43	0	0	3	2.0	6
	3	0	0	0	0	0	0	0	1.0	0
	4	0	0	0	0	0	0	0	1.0	0
53	1	0	0	0	0	0	0	0	1.0	0
	2	0	0	0	0	0	0	0	1.0	0
	3	0	0	0	0	0	0	0	1.0	0
	4	0	0	0	0	0	0	0	1.0	0
61	1	5	23	44	95	2	5	4	2.0	9
	2	6	2	46	51	<1	0	2	9.5	22
	3	6	1	67	0	0	0	<1	2.3	<1
	4	0	0	0	0	0	0	0	1.0	0
62	1	3	93	85	116	11	10	10	1.8	18
	2	3	1	56	115	<1	7	6	7.3	46
	3	0	0	0	0	0	0	0	1.0	0
	4	1	<1	11	393	<1	6	4	1.0	4
63	1	2	201	126	131	26	12	16	1.8	30
	2	0	0	0	0	0	0	0	1.0	0
	3	0	0	0	0	0	0	0	1.0	0
	4	0	0	0	0	0	0	0	1.0	0
TOTAL; MEAN (CV%)		35	2 (54.7)	53 (12.2)	944	42	40	46		135

Table 52. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1997: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	48	7	1	0	0	0	1.2	0
	2	0	14	<1	38	0	6	0	1.0	0
	3	0	85	22	24	2	10	1	1.6	1
	4	0	<1	36	3	0	0	0	5.1	1
52	1	5	48	7	285	14	29	2	1.0	2
	2	1	14	<1	253	4	10	0	1.0	0
	3	0	85	22	135	11	6	3	1.0	3
	4	0	<1	36	19	0	0	1	1.1	1
53	1	14	131	15	852	112	306	13	1.0	13
	2	9	66	5	1293	85	286	6	1.0	6
	3	0	85	22	1223	104	348	27	1.0	27
	4	0	<1	36	769	0	58	27	1.1	30
61	1	20	81	11	1027	83	385	11	1.0	11
	2	2	396	25	739	293	245	18	1.0	18
	3	8	85	22	584	50	287	13	1.0	13
	4	1	<1	36	367	0	29	13	1.2	16
62	1	6	182	55	185	34	113	10	1.0	10
	2	0	396	25	187	74	109	5	1.0	5
	3	0	85	22	139	12	153	3	1.0	3
	4	0	<1	416	201	0	286	83	1.0	86
63	1	3	2578	56	684	1761	1279	38	1.2	45
	2	0	396	25	17	7	13	1	1.0	1
	3	0	85	22	5	0	0	0	1.0	0
	4	1	<1	416	17	0	11	7	1.0	7
TOTAL; MEAN (CV%)		70	44 (33.7)	10 (23.4)	9047	2646	3969	282		299

Table 53. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1997: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	2	1	34	0	0	0	0	1.0	0
	2	0	1	34	0	0	0	0	3.1	0
	3	0	9	19	0	0	0	0	4.5	0
	4	0	9	19	0	0	0	0	1.0	0
52	1	0	1	34	0	0	0	0	1.0	0
	2	5	1	65	148	0	0	10	3.1	30
	3	0	9	19	15	0	0	0	4.5	0
	4	0	9	19	0	0	0	0	1.0	0
53	1	0	1	34	0	0	0	0	1.0	0
	2	0	1	65	9	0	0	1	1.0	1
	3	0	9	19	0	0	0	0	1.0	0
	4	0	9	19	0	0	0	0	1.0	0
61	1	7	5	67	244	1	3	16	1.0	16
	2	4	11	43	857	10	15	37	1.2	43
	3	3	9	19	0	0	0	0	4.5	0
	4	0	9	19	563	5	6	11	1.5	16
62	1	4	8	58	16	0	0	1	1.0	1
	2	2	1	27	30	0	1	1	1.2	1
	3	0	9	19	0	0	0	0	4.5	0
	4	0	9	19	46	1	0	0	1.0	0
63	1	0	8	58	0	0	0	0	1.0	0
	2	0	1	27	0	0	0	0	3.1	0
	3	0	9	19	0	0	0	0	4.5	0
	4	0	9	19	0	0	0	0	1.0	0
TOTAL; MEAN (CV%)		27	2 (34.7)	39 (23.9)	1928	17	25	77		108

Table 54. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1998: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	45	158	21	1	3	4	1.0	4
	2	0	180	13	204	37	8	3	1.0	3
	3	0	42	268	6	0	6	2	1.4	3
	4	0	10	26	1	0	0	0	13.4	0
52	1	2	45	158	134	6	30	21	1.0	21
	2	0	180	13	449	81	35	6	1.6	9
	3	2	42	268	42	2	6	11	1.0	12
	4	0	10	26	140	1	1	4	1.0	4
53	1	8	287	19	1281	368	362	24	1.0	24
	2	4	180	13	1354	243	345	16	1.0	16
	3	0	237	7	1299	308	286	9	1.1	10
	4	0	10	26	1078	11	40	29	1.3	36
61	1	10	159	29	743	118	373	22	1.0	22
	2	2	351	20	731	257	235	15	1.0	15
	3	1	237	7	1037	245	335	8	1.0	8
	4	19	10	26	324	3	45	8	1.3	11
62	1	9	123	11	518	64	530	5	1.0	5
	2	2	463	74	370	171	131	27	1.0	27
	3	0	237	7	184	44	200	1	1.0	1
	4	0	10	26	441	5	353	11	1.0	11
63	1	4	1471	51	1091	1604	963	56	1.0	56
	2	0	351	20	54	19	22	1	1.0	1
	3	0	237	7	28	7	6	0	1.6	0
	4	0	10	26	715	7	715	19	1.0	19
TOTAL; MEAN (CV%)		63	59 (23.2)	18 (17.5)	12245	3602	5030	302		318

Table 55. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1998: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	1	22	0	0	0	0	1.0	0
	2	0	1	22	0	0	0	0	1.5	0
	3	0	1	56	0	0	0	0	1.0	0
	4	0	1	44	0	0	0	0	6.6	0
52	1	0	1	22	16	0	1	1	1.0	1
	2	1	1	22	228	0	1	5	1.5	8
	3	2	1	56	0	0	0	0	1.0	0
	4	4	1	44	0	0	0	0	6.6	0
53	1	0	1	22	0	0	2	0	1.0	0
	2	0	1	22	54	0	2	1	1.0	1
	3	0	1	56	0	0	0	0	1.0	0
	4	0	1	44	0	0	1	0	1.0	0
61	1	0	23	90	158	4	3	14	1.3	19
	2	3	14	20	379	5	6	7	2.2	16
	3	3	46	31	173	8	3	5	3.7	19
	4	5	92	9	113	10	2	1	1.0	1
62	1	1	23	90	240	5	8	22	1.0	22
	2	5	4	16	320	1	4	5	1.0	5
	3	0	46	31	662	30	2	21	1.0	21
	4	1	2	81	165	1	4	13	1.0	13
63	1	0	23	90	437	10	7	40	1.1	42
	2	0	4	16	77	1	1	1	1.0	1
	3	0	46	31	0	0	0	0	1.0	0
	4	0	2	81	0	0	3	0	1.0	0
TOTAL; MEAN (CV%)		25	5 (32.0)	21 (26.2)	3022	75	50	136		169

Table 56. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 1999: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	288	160	37	11	17	6	1	6
	2	0	9	10	12	0	0	0	1	0
	3	0	9	10	6	0	3	0	4.2	0
	4	0	1	24	9	0	0	1	37.2	8
52	1	2	288	160	359	103	45	57	1	58
	2	6	9	10	300	3	10	3	1.1	3
	3	0	9	10	24	0	2	1	1.4	1
	4	1	1	24	29	0	3	1	2.3	2
53	1	5	95	80	1009	96	317	81	1	81
	2	12	106	11	2682	285	283	30	1	30
	3	4	1203	217	1170	1406	390	254	1	257
	4	4	61	19	529	32	71	10	1.1	11
61	1	5	462	205	462	214	374	95	1	98
	2	9	52	31	827	43	234	26	1	27
	3	4	11	7	623	7	215	4	1	4
	4	7	102	11	371	37	188	4	1	4
62	1	0	462	205	694	321	618	142	1	142
	2	1	99	493	300	30	147	148	1	148
	3	0	99	493	121	12	101	60	1	60
	4	5	2416	289	831	2008	413	240	1	240
63	1	8	1000	84	1279	1279	1098	107	1	107
	2	0	99	493	42	4	13	21	1	21
	3	0	99	493	20	2	1	10	1	10
	4	0	2416	289	547	1321	219	158	1	158
TOTAL; MEAN (CV%)		73	91 (24.1)	23 (32.9)	12283	7214	4762	1459		1476

Table 57. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 1999: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	1	237	0	0	0	0	1	0
	2	0	1	237	0	0	0	0	1	0
	3	0	1	125	0	0	0	0	1	0
	4	0	1	125	0	0	0	0	1	0
52	1	0	1	237	0	0	0.1	0	1	0
	2	0	1	237	0	0	0	0	1	0
	3	1	1	125	0	0	0	0	1	0
	4	0	1	125	0	0	0	0	1	0
53	1	0	1	237	20	1	0.1	5	1	5
	2	1	1	237	0	0	0.4	0	1	0
	3	0	1	125	0	0	0	0	1	0
	4	0	1	125	0	0	0	0	1	0
61	1	0	38	46	189	7	3	8	1.3	11
	2	2	38	46	1549	59	3	71	2.8	196
	3	3	28	113	52	1	2	6	2.8	16
	4	2	1	87	142	0	3	12	1	13
62	1	0	28	46	2468	95	14	113	1.3	144
	2	1	1	14	3519	1	16	51	1	51
	3	1	1	262	32	0	0.6	8	1	8
	4	2	64	19	158	10	5	3	1	3
63	1	0	28	46	197	8	8	9	1.3	11
	2	0	1	14	61	0	1	1	1	1
	3	0	1	262	0	0	0	0	1	0
	4	0	64	19	0	0	2	0	1	0
TOTAL; MEAN (CV%)		13	3 (52.3)	64 (38.9)	8387	182	58	287		459

Table 58. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2000: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	104	1	1	0	1	0	1.1	0
	2	1	1	4	41	0	2	0	1.5	0
	3	0	5	241	1	0	1	0	36.8	9
	4	2	1	6	0	0	0	0	10.1	0
52	1	3	104	1	443	46	62	1	1	1
	2	4	27	8	327	9	13	3	1	3
	3	3	5	241	115	1	10	28	1.1	30
	4	4	14	129	71	1	3	9	1.3	12
53	1	4	344	194	1104	380	305	214	1	214
	2	20	91	59	1314	119	259	78	1.1	82
	3	6	1034	191	717	742	376	137	1	141
	4	10	90	56	593	54	129	33	1	34
61	1	11	343	32	550	189	518	18	1	18
	2	10	204	16	752	154	225	12	1	12
	3	12	28	20	409	11	294	8	1.1	9
	4	3	35	217	207	7	38	45	1.1	49
62	1	19	617	24	1270	784	785	30	1	31
	2	4	126	4	411	52	181	2	1	2
	3	1	708	55	134	95	139	7	1	7
	4	7	1723	15	269	464	350	4	1	4
63	1	9	2584	65	1209	3125	1001	78	1	78
	2	0	126	4	25	3	19	0	1	0
	3	0	708	55	2	2	1	0	1	0
	4	0	1723	15	250	430	358	4	1	4
TOTAL; MEAN (CV%)		133	128 (18.0)	25 (21.3)	10215	6668	5070	711		740

Table 59. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2000: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	2	1	45	0	0	0	0	1.8	0
	2	0	54	9	0	0	0	0	1.8	0
	3	0	92	64	0	0	0	0	3.8	0
	4	0	2	141	0	0	0	0	3.8	0
52	1	0	1	53	0	0	0	0	1.8	0
	2	0	54	9	4	0	0	0	1.8	0
	3	0	92	64	0	0	0	0	3.8	0
	4	0	2	141	0	0	0	0	3.8	0
53	1	0	1	53	0	0	0	0	1.8	0
	2	0	54	9	0	0	0	0	1.8	0
	3	0	92	64	0	0	0	0	3.8	0
	4	0	2	141	0	0	0	0	3.8	0
61	1	4	1	53	48	0	1	3	1.8	5
	2	5	54	9	299	16	3	3	1.8	5
	3	4	92	64	34	3	1	2	3.8	8
	4	6	2	141	80	0	1	11	3.8	43
62	1	3	14	31	225	3	4	7	5	35
	2	1	85	1	123	10	5	0	5	0
	3	0	92	64	0	0	0	0	2.2	0
	4	0	2	141	234	1	8	33	2.2	71
63	1	0	14	31	0	0	0	0	5	0
	2	0	85	1	6	1	0	0	5	0
	3	0	92	64	0	0	0	0	2.2	0
	4	0	2	141	0	0	0	0	2.2	0
TOTAL; MEAN (CV%)		25	6 (49.5)	33 (18.6)	1053	34	23	59		167

Table 60. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2001: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	1	15	7	0	1	0	1	0
	2	0	3	13	6	0	1	0	2.5	0
	3	0	1	71	1	0	1	0	1	0
	4	2	1	60	0	0	0	0	1	0
52	1	2	1	15	336	0	31	5	1	5
	2	4	3	13	309	1	25	4	1.1	5
	3	2	1	72	316	0	18	23	1	23
	4	5	3	76	91	0	8	7	1	7
53	1	9	76	41	779	59	254	32	1	32
	2	10	62	14	1295	81	258	18	1	18
	3	16	624	21	1022	638	290	22	1	22
	4	4	207	32	463	96	187	15	1	15
61	1	17	56	118	646	36	442	76	1	76
	2	17	35	4	711	25	169	3	1	3
	3	7	30	4	412	13	340	2	1	2
	4	13	177	17	532	94	158	9	1	9
62	1	9	323	42	478	154	559	20	1.2	23
	2	3	38	14	297	11	160	4	1	4
	3	27	330	23	48	16	103	1	1	1
	4	8	18	7	569	10	649	4	1	4
63	1	0	323	42	819	264	962	35	1	36
	2	0	38	14	17	1	46	0	1	0
	3	0	330	23	21	7	4	1	1	1
	4	0	18	7	158	3	206	1	1	1
TOTAL; MEAN (CV%)		155	69 (27.8)	16 (35.3)	9333	1509	4872	282		287

Table 61. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2001: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	0	113	0	0	0	0	1	0
	2	0	0	113	0	0	0	0	1	0
	3	0	0	113	0	0	0	0	1	0
	4	0	0	113	0	0	0	0	1	0
52	1	0	0	113	0	0	0	0	1	0
	2	1	0	113	0	0	0	0	1	0
	3	0	0	113	0	0	0	0	1	0
	4	0	0	113	0	0	0	0	1	0
53	1	0	0	113	0	0	0	0	1	0
	2	0	0	113	0	0	0	0	1	0
	3	0	0	113	0	0	0	0	1	0
	4	0	0	113	0	0	0	0	1	0
61	1	2	2	53	154	0.5	2	8	10	82
	2	19	1	26	135	0.1	1	4	13	44
	3	6	1	42	0	0	0	0	1	0
	4	9	2	94	551	1	7	52	1	52
62	1	0	2	53	390	1	17	21	3	68
	2	30	1	30	135	0.1	1	4	3	13
	3	2	65	13	0	0	1	0	1	0
	4	17	1	53	723	0.6	15	38	1	38
63	1	0	2	53	0	0	0	0	3	0
	2	0	1	30	0	0	0	0	3	0
	3	0	65	13	0	0	0	0	1	0
	4	1	1	11	0	0	0	0	1	0
TOTAL; MEAN (CV%)		87	1 (123.4)	77 (11.5)	2088	3.3	44	127		297

Table 62. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2002: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	1	1	18	0	0	0	0	1	0
	2	0	1	18	20	0	5	0	1	0
	3	2	1	77	0	0	1	0	1	0
	4	13	1	14	0	0	0	0	1	0
52	1	1	186	128	670	125	68	86	1	86
	2	7	8	7	654	5	38	5	1	5
	3	12	75	20	324	23	35	7	1	7
	4	22	1	17	100	0	1	1	1	1
53	1	1	3402	245	595	2023	351	146	1	146
	2	10	60	11	1038	63	408	11	1	11
	3	9	559	31	821	459	354	26	1	26
	4	16	294	60	396	116	131	24	1	24
61	1	4	2069	5	547	1132	320	3	1	3
	2	12	205	17	649	133	326	11	1	11
	3	15	279	8	625	174	497	5	1	5
	4	4	117	5	524	62	264	2	1	2
62	1	11	720	9	832	599	1226	8	1	8
	2	1	34	46	284	10	207	13	1	13
	3	31	420	21	92	39	206	2	1	2
	4	2	813	9	844	687	826	7	1	7
63	1	8	1182	34	681	804	1031	23	1	23
	2	0	34	46	49	2	47	2	1	2
	3	0	420	21	0	0	0	0	1	0
	4	0	813	9	188	153	195	2	1	2
TOTAL; MEAN (CV%)		182	72 (17.9)	15 (20.9)	9933	6609	6537	384		384

Table 63. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2002: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	2	95	0	0	0	0	1	0
	2	0	1	42	0	0	0	0	1	0
	3	0	0	93	0	0	0	0	1	0
	4	0	0	52	0	0	0	0	1	0
52	1	0	2	95	0	0	0	0	1	0
	2	0	1	42	0	0	0	0	1	0
	3	5	0	93	0	0	0	0	1	0
	4	4	0	52	0	0	0	0	1	0
53	1	0	2	95	0	0	0	0	1	0
	2	0	1	42	0	0	0	0	1	0
	3	0	0	93	0	0	0	0	1	0
	4	0	0	52	0	0	0	0	1	0
61	1	8	2	95	813	1.6	4	77	1	77
	2	19	1	42	102	0.1	1	4	1	4
	3	10	2	19	0	0	1	0	1	0
	4	20	2	81	275	0.4	5	23	1	23
62	1	9	1	84	643	0.9	5	54	1	54
	2	14	1	47	20	0	3	1	1	1
	3	4	4	10	0	0	1	0	1	0
	4	16	1	40	482	0.6	14	19	1	19
63	1	0	1	84	0	0	0	0	1	0
	2	0	1	47	0	0	0	0	1	0
	3	0	4	10	0	0	0	0	1	0
	4	0	1	40	0	0	0	0	1	0
TOTAL; MEAN (CV%)		109	1 (57.5)	47 (24.8)	2335	3.6	34	178		178

Table 64. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2003: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	3	1	6	15	0	1	0	1	0
	2	4	1	5	91	0	2	1	1	1
	3	0	4	10	0	0	1	0	1	0
	4	2	4	10	0	0	0	0	1	0
52	1	21	26	7	310	8	45	2	1	2
	2	26	7	3	291	2	9	1	1	1
	3	20	6	60	824	5	25	49	1	49
	4	17	2	22	1347	3	54	31	1	31
53	1	14	802	41	777	623	444	31	1	31
	2	16	66	15	1278	84	245	19	1	19
	3	10	336	195	1198	403	386	234	1	234
	4	16	105	3	682	72	209	2	1	2
61	1	4	291	19	413	120	399	8	1	8
	2	17	441	46	682	301	289	31	1	31
	3	11	428	75	445	191	352	33	1	33
	4	16	707	9	800	566	604	7	1	7
62	1	9	3005	86	925	2780	1718	76	1	76
	2	10	617	8	269	166	162	2	1	2
	3	4	281	71	118	33	121	8	1	8
	4	8	451	14	630	284	580	9	1	9
63	1	8	683	24	365	249	614	9	1	9
	2	0	617	8	162	100	12	1	1	1
	3	0	281	71	1	0	0	0	1	0
	4	0	451	14	118	0	135	2	1	2
TOTAL; MEAN (CV%)		236	64 (17.0)	13 (18.7)	11741	5990	6407	556		556

Table 65. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2003: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	1	145	0	0	0	0	1	0
	2	0	1	145	0	0	0	0	1	0
	3	0	11	75	0	0	0	0	1	0
	4	0	50	70	0	0	0	0	1	0
52	1	0	1	145	0	0	0	0	1	0
	2	2	1	145	0	0	0	0	1	0
	3	2	11	75	7	<1	0	1	1	1
	4	2	50	70	0	0	0	0	1	0
53	1	0	1	145	0	0	0	0	1	0
	2	0	1	145	0	0	0	0	1	0
	3	0	11	75	0	0	0	0	1	0
	4	1	1	45	0	0	0	0	1	0
61	1	22	1	70	159	<1	0	11	1	11
	2	9	3	39	0	0	0	0	1	0
	3	2	1	40	0	0	0	0	1	0
	4	15	1	91	0	0	0	0	1	0
62	1	15	4	84	284	2	9	24	1	24
	2	14	2	26	271	1	12	7	1	7
	3	4	1	19	0	0	0	0	1	0
	4	18	1	64	948	1	20	61	1	61
63	1	0	4	84	3	<1	<1	0	1	0
	2	0	2	26	0	0	0	0	1	0
	3	0	1	19	0	0	0	0	1	0
	4	0	1	64	2	<1	<1	0	1	0
TOTAL; MEAN (CV%)		106	1 (35.1)	56 (14.1)	1674	8	43	104		104

Table 66. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2004: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	3	16	6	26	1	1	0	1	0
	2	5	1	6	80	1	2	0	1	0
	3	2	434	1	27	12	1	0	1	0
	4	10	9	3	158	1	8	0	1	0
52	1	15	9	6	333	3	83	2	1	2
	2	32	2	11	425	1	9	5	1	5
	3	34	20	36	10	1	8	0	1	0
	4	12	14	20	35	1	16	1	1	1
53	1	17	1609	112	764	1229	501	86	1	86
	2	51	209	22	802	168	247	18	1	18
	3	88	926	30	600	556	440	18	1	18
	4	31	622	2	305	190	314	1	1	1
61	1	39	669	15	461	308	793	7	1	7
	2	61	443	19	952	422	492	18	1	18
	3	47	241	24	623	150	473	15	1	15
	4	85	412	10	450	186	528	5	1	5
62	1	42	1720	14	825	1419	2105	12	1	12
	2	4	492	25	266	131	159	7	1	7
	3	4	83	18	118	10	83	1	1	1
	4	17	208	22	515	107	954	11	1	11
63	1	2	1180	15	76	90	189	1	1	1
	2	0	492	25	6	3	28	0	1	0
	3	0	83	12	4	1	1	0	1	0
	4	1	1	29	168	1	282	5	1	5
TOTAL; MEAN (CV%)		602	218 (9.8)	15 (17.8)	8029	4992	7717	213		213

Table 67. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2004: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	2	217	0	0	0	0	1	0
	2	0	1	66	0	0	0	0	1	0
	3	0	1	109	0	0	0	0	1	0
	4	3	1	19	0	0	0	0	1	0
52	1	0	2	217	0	0	0	0	1	0
	2	0	1	66	0	0	0	0	1	0
	3	4	1	124	0	0	0	0	1	0
	4	5	1	110	0	0	0	0	1	0
53	1	0	2	217	0	0	0	0	1	0
	2	0	1	66	0	0	0	0	1	0
	3	1	1	109	0	0	0	0	1	0
	4	0	1	110	0	0	0	0	1	0
61	1	10	2	217	31	0	1	7	1	7
	2	37	1	66	3	0	0	0	1	0
	3	14	1	15	0	0	0	0	1	0
	4	22	1	42	0	0	0	0	1	0
62	1	10	4	83	739	3	19	61	1	61
	2	25	1	28	130	0	1	4	1	4
	3	6	1	22	0	0	0	0	1	0
	4	16	5	56	327	2	9	18	1	18
63	1	0	4	83	29	0	1	2	1	2
	2	0	1	28	0	0	0	0	1	0
	3	0	1	22	0	0	0	0	1	0
	4	0	5	56	0	0	0	0	1	0
TOTAL; MEAN (CV%)		153	1 (46.8)	47 (11.1)	1259	5	31	92		92

Table 68. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2005: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	3	4	432	1	5	2	1	2
	2	3	3	4	0	0	0	0	1	0
	3	7	6	2	17	0	9	0	1	0
	4	17	4	3	55	1	6	0	1	0
52	1	105	58	10	815	48	134	8	1	8
	2	180	6	14	349	2	23	5	1	5
	3	84	22	53	738	16	26	39	1	39
	4	115	5	44	830	4	58	36	1	36
53	1	68	1137	23	368	419	544	9	1	9
	2	66	479	20	592	283	361	12	1	12
	3	201	668	8	783	523	351	6	1	6
	4	40	231	5	411	95	352	2	1	2
61	1	46	897	15	751	674	1206	11	1	11
	2	40	344	17	722	249	477	12	1	12
	3	71	457	11	742	339	635	8	1	8
	4	53	211	6	415	88	354	2	1	2
62	1	21	475	15	993	472	1973	15	1	15
	2	7	27	1	345	10	314	0	1	0
	3	2	872	135	88	76	44	12	1	12
	4	20	64	22	467	30	575	10	1	10
63	1	7	2597	54	27	71	148	2	1	2
	2	0	28	1	29	1	44	0	1	0
	3	0	872	135	0	0	0	0	1	0
	4	3	201	1	113	23	126	0	1	0
TOTAL; MEAN (CV%)		1156	89 (8.6)	13 (16.1)	10082	3425	7765	191		191

Table 69. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2005: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	2	54	0	0	0	0	1	0
	2	0	1	57	0	0	0	0	1	0
	3	0	1	168	0	0	0	0	1	0
	4	0	1	98	0	0	0	0	1	0
52	1	4	2	54	5	0	0	0	1	0
	2	5	1	57	0	0	0	0	1	0
	3	23	1	168	0	0	0	0	1	0
	4	19	1	98	0	0	0	0	1	0
53	1	2	179	29	0	0	0	0	1	0
	2	0	179	29	0	0	0	0	1	0
	3	0	1	318	0	0	0	0	1	0
	4	1	1	318	0	0	0	0	1	0
61	1	30	1	54	0	0	0	0	1	0
	2	32	1	45	22	0	1	1	1.1	1
	3	10	2	16	0	0	0	0	1	0
	4	18	9	34	7	0	1	0	1	0
62	1	24	3	36	749	3	19	27	1	27
	2	12	1	44	1304	1	6	58	1	58
	3	3	1	9	994	1	25	9	1	9
	4	25	6	21	52	0	3	1	1	1
63	1	1	1	137	0	0	0	0	1	0
	2	0	1	44	0	0	0	0	1	0
	3	0	1	9	0	0	0	0	1	0
	4	0	6	21	0	0	0	0	1	0
TOTAL; MEAN (CV%)		209	1 (29.2)	44 (12.9)	3133	5	55	96		96

Table 70. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2006: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	6	7	3	11	0	0	0	1	0
	2	0	7	3	195	1	2	1	1	1
	3	1	1	10	1	0	2	0	1	0
	4	2	0	40	0	0	0	0	1	0
52	1	88	17	96	129	2	58	12	1	12
	2	77	10	15	679	7	11	10	1	10
	3	81	23	49	451	11	13	22	1	22
	4	15	0	34	0	0	0	0	1	0
53	1	61	466	46	510	237	626	24	1	24
	2	24	117	12	785	92	212	9	1	9
	3	25	478	54	976	466	336	53	1	53
	4	20	198	31	64	13	32	2	1	2
61	1	33	355	22	691	245	1176	16	1	16
	2	37	260	38	878	228	395	34	1	34
	3	38	216	15	661	143	460	10	1	10
	4	30	73	7	561	41	711	4	1	4
62	1	15	276	15	582	161	1202	9	1	9
	2	5	111	7	140	16	196	1	1	1
	3	5	26	2	46	1	59	0	1	0
	4	8	136	12	390	53	637	5	1	5
63	1	6	60	1	51	3	90	0	1	0
	2	0	60	1	1	1	5	0	1	0
	3	0	89	76	0	0	0	0	1	0
	4	1	89	76	736	66	38	56	1	56
TOTAL; MEAN (CV%)		578	56 (2.4)	26 (2.6)	8538	1787	6261	268		268

Table 71. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2006: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), prorated landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	1	54	0	0	0	0	1	0
	2	0	1	114	0	0	0	0	1	0
	3	0	1	84	0	0	0	0	1	0
	4	0	1	73	0	0	0	0	1	0
52	1	4	1	55	0	0	0	0	1	0
	2	15	1	114	0	0	0	0	1	0
	3	26	1	84	0	0	0	0	1	0
	4	9	1	73	0	0	0	0	1	0
53	1	0	1	55	0	0	0	0	1	0
	2	0	1	114	0	0	0	0	1	0
	3	3	1	66	0	0	0	0	1	0
	4	0	1	66	0	0	0	0	1	0
61	1	6	3	40	1488	5	9	59	1	59
	2	0	3	40	0	0	1	0	1	0
	3	19	4	19	0	0	2	0	1	0
	4	15	9	59	0	0	18	0	1	0
62	1	7	4	24	749	3	40	18	1	18
	2	0	4	24	0	0	3	0	1	0
	3	4	1	14	994	1	9	13	1	13
	4	9	4	29	87	0	5	3	1	3
63	1	0	4	24	0	0	0	0	1	0
	2	0	4	24	0	0	0	0	1	0
	3	0	1	14	0	0	0	0	1	0
	4	0	4	29	0	0	0	0	1	0
TOTAL; MEAN (CV%)		117	2 (15.9)	45 (2.9)	3318	9	87	93		93

Table 72. Summary of TRAWL GEAR (>05') fishery observer data for summer flounder by NAFO division and quarter for 2007: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	3	1	25	2	0	0	0	1	0
	2	3	1	6	9	0	1	0	1	0
	3	0	1	25	27	0	2	1	1	1
	4	9	1	25	0	0	3	0	1	0
52	1	40	19	81	355	7	85	29	1	29
	2	82	8	18	356	3	9	6	1	6
	3	61	4	114	246	1	11	28	1	28
	4	47	1	133	84	0	1	11	1	11
53	1	19	194	37	439	85	357	16	1	16
	2	38	94	29	786	74	278	22	1	22
	3	56	39	77	558	22	227	43	1	43
	4	13	101	223	271	27	98	60	1	60
61	1	27	374	10	766	287	1245	8	1	8
	2	71	198	9	822	162	315	7	1	7
	3	147	304	14	573	174	435	8	1	8
	4	37	27	31	130	3	162	4	1	4
62	1	8	112	25	140	16	278	4	1	4
	2	5	363	6	89	32	145	1	1	1
	3	12	422	5	46	19	50	0	1	0
	4	21	186	133	155	29	206	21	1	21
63	1	14	68	12	340	23	399	4	1	4
	2	0	68	12	4	1	6	0	1	0
	3	0	298	28	0	0	0	0	1	0
	4	9	298	28	84	25	72	2	1	2
TOTAL; MEAN (CV%)		722	41 (2.6)	27 (1.5)	6282	990	4385	275		275

Table 73. Summary of SCALLOP DREDGE (>13') fishery observer data for summer flounder by NAFO division and quarter for 2007: number of observed trips (OBTRIPS; trips in more than one statistical area are split) kept and discard rates (K_DF, D_DF; kg per day fished), NEFSC vessel trip report (VTR) database prorated days fished on trips landing any summer flounder (VTR DF), estimate of landings calculated from observed kept rates and NEFSC VTR database prorated days fished (OB EST LAND MT), landings as recorded in the NEFSC dealer (DEAL) database (DEAL LAND MT), and the fishery observer estimate of discard in mt (OB EST DISCARD).

DIV	QTR	OBTRIPS	K_DF	D_DF	VTR DF	OB EST LAND MT	DEAL LAND MT	OB EST DISC 1	NO KEPT RATIO	OB EST DISC MT
51	1	0	1	43	0	0	0	0	1	0
	2	0	1	138	0	0	0	0	1	0
	3	0	1	92	0	0	0	0	1	0
	4	0	1	133	0	0	0	0	1	0
52	1	3	1	43	0	0	0	0	1	0
	2	43	8	138	0	0	0	0	1	0
	3	59	4	92	0	0	0	0	1	0
	4	14	1	133	0	0	0	0	1	0
53	1	1	1	47	0	0	0	0	1	0
	2	0	1	47	0	0	0	0	1	0
	3	2	1	238	0	0	0	0	1	0
	4	0	1	238	0	0	0	0	1	0
61	1	19	1	40	847	1	26	34	1	34
	2	24	1	23	0	0	1	0	1	0
	3	7	1	43	0	0	0	0	1	0
	4	17	1	72	0	0	0	0	1	0
62	1	16	1	86	749	1	17	64	1	64
	2	13	1	51	0	0	1	0	1	0
	3	1	20	7	994	20	1	7	1	7
	4	25	1	81	0	0	0	0	1	0
63	1	0	1	86	0	0	0	0	1	0
	2	0	1	51	0	0	0	0	1	0
	3	0	20	7	0	0	0	0	1	0
	4	0	1	81		0	0	0	1	0
TOTAL; MEAN (CV%)		244	1 (19.5)	72 (1.1)	2590	22	46	105		105

Table 74. Summary of Northeast Region fishery observer data to estimate summer flounder discard at age in the commercial fishery. Estimates developed using fishery observer length samples, age-length data, and estimates of total discard in mt. An 80% discard mortality rate is assumed. 1994-2006 lengths converted to age using 1994-2006 NEFSC trawl survey age-length keys; n/a = not available.

Year	Gear	Lengths	Ages	Fishery observer Discard Estimate (mt)	Sampling Intensity (mt per 100 lengths)	Raised Discard Estimate (mt)	Raised Estimate with 80% mortality rate (mt)
1989	All	2,337	54	642	27	886	709
1990	All	3,891	453	1,121	29	1,517	1,214
1991	All	5,326	190	993	19	1,315	1,052
1992	All	9,626	331	755	8	862	690
1993	All	3,410	406	817	24	1,057	846
1994	Trawl	2,338	---	429	18	542	434
	Scallop	660	---	590	89	590	472
	All	2,998	354	1,019	34	1,132	906
1995	Trawl	1,822	---	130	7	173	138
	Scallop	731	---	212	29	212	170
	All	2,553	n/a	342	13	385	308
1996	Trawl	1,873	---	319	17	444	355
	Scallop	854	---	135	16	135	108
	All	2,727	n/a	454	17	579	463
1997	Trawl	839		299	36	299	239
	Scallop	556		108	19	108	86
	All	1,395	n/a	407	29	407	326

Table 74 continued.

Year	Gear	Lengths	Ages	Fishery Observer Discard Estimate (mt)	Sampling Intensity (mt per 100 lengths)	Raised Discard Estimate (mt)	Raised Estimate with 80% mortality rate (mt)
1998	Trawl	721		318	44	318	254
	Scallop	150		169	113	169	135
	All	871	n/a	487	56	487	389
1999	Trawl	1,145		1,476	129	1,476	1,181
	Scallop	216		459	213	459	367
	All	1,361	n/a	1,935	142	1,935	1,548
2000	Trawl	1,470		740	50	740	592
	Scallop	2,611		167	6	167	134
	All	4,081	n/a	907	22	907	726
2001	Trawl	1,528		287	19	287	230
	Scallop	705		297	42	297	238
	All	2,233	n/a	584	26	584	468
2002	Trawl	3,438		384	11	384	307
	Scallop	2,952		178	6	178	142
	All	6,390	n/a	562	9	562	449
2003	Trawl	4,233		556	13	556	445
	Scallop	2,594		104	4	104	83
	All	6,827	n/a	660	10	660	528
2004	Trawl	5,760		213	4	213	170
	Scallop	8,811		92	1	92	74
	All	14,571	n/a	305	2	305	244
2005	Trawl	9,562		191	2	191	153
	Scallop	4,690		96	2	96	77
	All	14,252	n/a	287	2	287	230

Table 74 continued.

Year	Gear	Lengths	Ages	Fishery Observer Discard Estimate (mt)	Sampling Intensity (mt per 100 lengths)	Raised Discard Estimate (mt)	Raised Estimate with 80% mortality rate (mt)
2006	Trawl	8,283		268	3	268	214
	Scallop	1,911		93	5	93	74
	All	10,194	n/a	361	4	361	288
2007	Trawl	12,725		275	2	275	220
	Scallop	4,972		105	2	105	84
	All	17,697	n/a	380	2	380	304

Table 75. Comparison of commercial fishery dealer reported landings of summer flounder with estimates of summer flounder commercial landings from landings rates of NEFSC Domestic Observer sampling and commercial fishing effort (days fished) reported on commercial Vessel Trip Reports (VTR). Dealer and Landings estimates prior to 1997 do not reflect NC landings and effort.

Year	VTR Days Fished (>000)	Observed Landings Estimate (mt)	Dealer landings Estimate (mt)	Percent Difference (Obs-Dealer)
1989	19,805	7,255	5,817	25
1990	15,980	2,959	2,749	8
1991	26,096	4,123	4,355	-5
1992	18,148	5,343	6,066	-12
1993	19,947	4,032	3,995	1
1994	18,402	6,004	4,968	21
1995	14,168	5,891	4,911	20
1996	10,351	5,024	3,718	35
1997	10,975	2,663	3,994	-33
1998	15,267	3,677	5,076	-28
1999	20,670	7,396	4,820	53
2000	11,268	6,702	5,085	32
2001	11,421	1,509	4,970	-70
2002	12,268	6,609	6,573	1
2003	13,415	5,786	6,450	-10
2004	9,288	4,997	8,228	-39
2005	13,215	3,478	7,826	-56
2006	11,856	1,794	6,262	-71
2007	8,872	1,012	4,431	-77

Table 76. Estimated summer flounder discard at age in the in the commercial fishery. Lengths converted to age using annual NEFSC trawl survey age-length keys. Includes an assumed 80% discard mortality rate.

Discard numbers at age (000s)

Year	Gear	0	1	2	3+	Total
1989	All	775	1,628	94	0	2,497
1990	All	1,441	2,755	67	0	4,263
1991	All	891	3,424	<1	0	4,315
1992	All	1,155	1,544	36	3	2,738
1993	All	1,041	1,532	179	1	2,753
1994	Trawl	571	1,014	95	0	1,680
	Scallop	0	663	398	36	1,097
	All	571	1,677	493	36	2,777
1995	Trawl	141	294	58	2	495
	Scallop	0	114	148	20	282
	All	141	408	206	22	777
1996	Trawl	23	417	167	56	663
	Scallop	<1	221	72	5	298
	All	23	638	239	61	961
1997	Trawl	8	215	203	50	476
	Scallop	0	34	98	22	154
	All	8	249	301	72	630
1998	Trawl	26	132	146	95	399
	Scallop	1	42	73	52	168
	All	27	174	219	157	567
1999	Trawl	95	1,159	1,012	255	2,521
	Scallop	1	64	239	176	480
	All	96	1,223	1,251	431	3,001
2000	Trawl	20	118	378	303	819
	Scallop	2	46	82	49	179
	All	22	164	460	352	998
2001	Trawl	11	86	56	128	281
	Scallop	0	13	50	142	205
	All	11	99	106	270	486
2002	Trawl	12	94	137	106	349
	Scallop	1	30	83	63	177
	All	13	124	220	169	526
2003	Trawl	2	221	208	84	515
	Scallop	0	43	48	20	111
	All	2	264	256	104	626
2004	Trawl	1	25	70	70	166
	Scallop	<1	14	64	27	105
	All	2	39	134	98	271
2005	Trawl	4	33	44	65	146
	Scallop	<1	8	52	40	100
	All	4	41	96	105	246
2006	Trawl	4	38	102	82	226
	Scallop	<1	11	79	34	124
	All	4	49	181	115	350
2007	Trawl	9	26	29	108	172
	Scallop	<1	3	51	55	109
	All	9	29	80	163	

Table 77. Estimated summer flounder discard mean length at age in the commercial fishery. Lengths converted to age using NEFSC trawl survey age-length keys.

Discard mean length (cm) at age						
Year	Gear	0	1	2	3+	All
1989	All	25.9	31.5	44.2		30.2
1990	All	29.0	31.7	38.9		30.9
1991	All	24.0	30.9	37.0		29.5
1992	All	29.3	30.0	36.6	51.2	29.8
1993	All	30.0	32.5	34.8	55.0	31.7
1994	Trawl	26.0	31.3	34.5		29.7
	Scallop		30.8	38.2	52.1	34.2
	All	26.0	31.1	37.5	52.1	31.5
1995	Trawl	29.6	29.4	37.0	50.9	30.4
	Scallop		30.7	40.6	52.4	37.4
	All	29.6	29.8	39.6	52.5	33.0
1996	Trawl	28.9	32.0	38.1	55.8	35.5
	Scallop	31.4	30.7	38.2	48.5	32.8
	All	29.0	31.6	38.1	55.2	34.7
1997	Trawl	26.9	32.1	37.8	46.6	36.0
	Scallop		32.5	37.2	45.9	37.5
	All	26.9	32.2	37.6	46.3	36.4
1998	Trawl	26.0	32.5	37.5	48.3	37.7
	Scallop	30.0	35.0	39.7	48.9	41.3
	All	26.1	33.1	38.2	48.5	38.8
1999	Trawl	25.8	32.0	35.9	48.5	34.9
	Scallop	31.0	33.2	36.3	48.8	40.5
	All	25.9	32.1	36.0	48.6	35.9
2000	Trawl	17.2	32.6	37.7	46.3	39.5
	Scallop	26.8	34.4	39.5	47.6	40.3
	All	18.1	33.2	38.0	46.5	39.6
2001	Trawl	22.9	33.7	39.6	47.7	40.8
	Scallop		37.1	40.6	49.1	46.3
	All	22.9	34.2	40.1	48.5	43.1
2002	Trawl	27.7	32.4	37.6	53.6	40.7
	Scallop	27.7	35.1	39.1	48.1	41.5
	All	27.7	33.1	38.1	51.6	41.0
2003	Trawl	27.4	33.6	38.3	54.4	38.9
	Scallop		34.6	40.1	50.1	39.7
	All	27.4	33.8	38.6	53.6	39.0
2004	Trawl	28.4	33.6	38.8	51.8	43.4
	Scallop	29.1	32.9	37.9	47.4	39.7
	All	28.5	33.3	38.4	50.6	42.0
2005	Trawl	28.4	33.3	38.7	52.3	43.3
	Scallop	30.7	31.2	37.2	46.9	40.6
	All	28.4	32.9	37.9	50.3	42
2006	Trawl	25.8	33.9	37.6	50.5	41.4
	Scallop	25.0	33.9	36.2	43.9	38.1
	All	25.8	33.9	37.0	48.6	40.3
2007	Trawl	26.1	32.8	41.1	51.4	45.5
	Scallop	24.3	31.6	38.2	44.5	41.2
	All	26.1	32.7	39.3	49.0	43

Table 78. Estimated summer flounder discard mean weight at age in the in the commercial fishery. Lengths converted to age using NEFSC trawl survey age-length keys.

Discard mean weight (kg) at age						
Year	Gear	0	1	2	3+	All
1989	All	0.182	0.296	0.909		0.284
1990	All	0.235	0.304	0.559		0.285
1991	All	0.124	0.275	0.491		0.244
1992	All	0.238	0.256	0.498	1.450	0.252
1993	All	0.253	0.332	0.413		0.307
1994	Trawl	0.177	0.291	0.392		0.258
	Scallop		0.287	0.565	1.565	0.430
	All	0.177	0.289	0.532	1.565	0.326
1995	Trawl	0.244	0.242	0.522	1.505	0.280
	Scallop		0.281	0.702	1.604	0.595
	All	0.244	0.253	0.651	1.597	0.395
1996	Trawl	0.226	0.312	0.586	2.004	0.521
	Scallop	0.305	0.274	0.572	1.254	0.363
	All	0.227	0.299	0.582	1.937	0.472
1997	Trawl	0.178	0.327	0.560	1.088	0.504
	Scallop		0.331	0.553	1.044	0.558
	All	0.178	0.328	0.558	1.075	0.517
1998	Trawl	0.158	0.332	0.533	1.346	0.637
	Scallop	0.247	0.421	0.651	1.357	0.808
	All	0.161	0.353	0.572	1.350	0.688
1999	Trawl	0.156	0.317	0.462	1.300	0.468
	Scallop	0.275	0.355	0.478	1.310	0.767
	All	0.157	0.319	0.465	1.304	0.516
2000	Trawl	0.055	0.355	0.555	1.114	0.722
	Scallop	0.174	0.412	0.643	1.023	0.741
	All	0.066	0.371	0.571	1.138	0.725
2001	Trawl	0.114	0.373	0.642	1.210	0.797
	Scallop		0.510	0.692	1.339	1.127
	All	0.114	0.391	0.665	1.278	0.936
2002	Trawl	0.194	0.331	0.538	1.851	0.871
	Scallop	0.195	0.429	0.608	1.235	0.795
	All	0.194	0.355	0.565	1.623	0.845
2003	Trawl	0.186	0.371	0.583	1.871	0.701
	Scallop		0.413	0.672	1.430	0.705
	All	0.186	0.378	0.600	1.788	0.701
2004	Trawl	0.220	0.386	0.599	1.625	0.996
	Scallop	0.223	0.352	0.554	1.234	0.698
	All	0.220	0.374	0.578	1.508	0.880
2005	Trawl	0.214	0.366	0.597	1.669	1.015
	Scallop	0.268	0.290	0.520	1.162	0.752
	All	0.214	0.351	0.555	1.480	0.908
2006	Trawl	0.157	0.382	0.547	1.505	0.860
	Scallop	0.137	0.374	0.468	0.976	0.597
	All	0.157	0.380	0.513	1.352	0.767
2007	Trawl	0.161	0.338	0.717	1.548	1.152
	Scallop	0.133	0.302	0.558	0.962	0.755
	All	0.161	0.334	0.616	1.349	0.998

Table 79. Estimated total landings (catch types A + B1, [000s]) of summer flounder by recreational fishermen. SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR										
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
North											
Shore	167	144	62	10	70	39	42	4	16	9	26
P/C Boat	138	201	5	3	48	7	1	1	1	8	1
P/R Boat	1,293	747	568	382	2,562	648	377	137	99	173	211
TOTAL	1,598	1,092	635	395	2,680	694	420	142	116	190	238
Mid											
Shore	682	3,296	977	272	478	251	596	84	96	505	200
P/C Boat	5,745	3,321	2,381	1,068	1,541	1,143	1,134	141	412	589	374
P/R Boat	5,731	12,345	11,764	8,454	5,924	5,499	7,153	1,141	2,658	4,573	3,983
TOTAL	12,158	18,962	15,122	9,794	7,943	6,893	8,883	1,366	3,166	5,667	4,557
South											
Shore	272	523	316	504	689	115	308	91	150	51	50
P/C Boat	53	52	110	81	20	1	1	1	1	1	1
P/R Boat	1,392	367	1,292	292	289	162	348	117	361	159	156
TOTAL	1,717	942	1,718	877	998	278	657	209	512	211	207
All											
Shore	1,121	3,963	1,355	786	1,237	405	946	179	262	565	276
P/C Boat	5,936	3,574	2,496	1,152	1,609	1,151	1,136	143	414	598	376
P/R Boat	8,416	13,459	13,624	9,128	8,775	6,309	7,878	1,395	3,118	4,905	4,350
TOTAL	15,473	20,996	17,475	11,066	11,621	7,865	9,960	1,717	3,794	6,068	5,002
PSE (%)	26	7	8	12	7	5	4	6	4	4	4

Table 79 continued.

	YEAR										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
North											
Shore	37	47	19	22	27	44	34	61	5	18	26
P/C Boat	14	25	7	5	22	26	19	49	14	21	36
P/R Boat	298	584	388	702	669	970	769	1,448	555	401	487
TOTAL	349	656	414	729	718	1,040	822	1,558	574	440	549
Mid											
Shore	186	217	173	134	195	243	157	467	199	123	145
P/C Boat	999	809	260	650	907	333	281	600	316	238	353
P/R Boat	4,579	4,633	2,330	5,137	5,059	4,972	2,610	4,802	3,878	2,272	3,424
TOTAL	5,764	5,659	2,763	5,921	6,161	5,548	3,048	5,869	4,393	2,633	3,922
South											
Shore	118	183	49	50	33	30	22	41	22	14	32
P/C Boat	1	3	1	5	2	1	<1	1	<1	3	<1
P/R Boat	262	202	99	292	253	360	214	332	304	172	55
TOTAL	381	388	149	347	288	391	237	374	327	189	88
All Regions											
Shore	341	447	241	206	255	317	213	569	226	155	203
P/C Boat	1,014	837	268	660	931	360	301	650	331	262	390
P/R Boat	5,139	5,419	2,817	6,131	5,981	6,302	3,593	6,582	4,737	2,845	3,966
TOTAL	6,494	6,703	3,326	6,997	7,167	6,979	4,107	7,801	5,294	3,262	4,559
PSE (%)	4	4	4	3	4	4	4	3	4	4	4

Table 79 continued.

	YEAR			
	2004	2005	2006	2007
North				
Shore	21	22	12	2
P/C Boat	25	33	37	55
P/R Boat	740	550	539	360
TOTAL	786	605	588	417
Mid				
Shore	143	109	90	145
P/C Boat	467	518	258	327
P/R Boat	2,988	2,751	2,965	2,319
TOTAL	3,598	3,378	3,313	2,791
South				
Shore	46	14	25	14
P/C Boat	3	1	1	20
P/R Boat	124	112	125	151
TOTAL	173	127	151	185
All				
Shore	210	145	127	161
P/C Boat	495	552	296	402
P/R Boat	3,852	3,413	3,629	2,830
TOTAL	4,557	4,110	4,052	3,393
PSE (%)	4	5	5	5

Table 80. Estimated total landings (catch types A + B1, [mt]) of summer flounder by recreational fishermen. SHORE mode includes fish taken from beach/bank and man-made structures. P/C indicates catch taken from party/charter boats, while P/R indicates fish taken from private/rental boats. Proportional Standard Error (PSE) is for the TOTAL landings estimate.

	YEAR										
	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
North											
Shore	87	59	17	7	25	21	32	2	16	6	20
P/C Boat	85	87	4	2	45	4	<1	<1	<1	6	<1
P/R Boat	875	454	388	328	2,597	582	290	141	89	150	175
TOTAL	1,047	600	409	337	2,667	607	323	144	106	162	196
Mid											
Shore	295	1,254	399	140	293	129	330	52	56	306	126
P/C Boat	3,112	2,196	1,426	609	1,093	1,098	776	125	264	364	267
P/R Boat	3,085	8,389	5,686	4,187	3,521	3,596	4,928	985	1,665	2,673	2,536
TOTAL	6,492	11,839	7,511	4,936	4,907	4,823	6,034	1,162	1,985	3,343	2,929
South											
Shore	87	134	98	230	425	34	113	57	76	25	25
P/C Boat	12	12	23	20	7	1	<1	<1	<1	<1	<1
P/R Boat	629	102	471	142	96	54	163	71	161	80	91
TOTAL	728	248	592	392	528	89	277	129	238	106	117
All											
Shore	469	1,447	514	377	743	184	475	111	148	337	171
P/C Boat	3,209	2,295	1,453	631	1,145	1,103	778	127	266	371	269
P/R Boat	4,589	8,945	6,545	4,657	6,214	4,232	5,381	1,197	1,915	2,903	2,802
TOTAL	8,267	12,687	8,512	5,665	8,102	5,519	6,634	1,435	2,329	3,611	3,242
PSE (%)	25	7	8	11	9	9	4	6	4	4	4

Table 80 continued.

	YEAR										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
North											
Shore	26	29	14	15	17	56	27	73	6	20	32
P/C Boat	10	14	6	8	17	22	18	43	16	30	35
P/R Boat	214	401	320	518	445	833	738	1,536	695	559	540
TOTAL	250	444	340	541	479	911	783	1,652	717	609	607
Mid											
Shore	94	122	108	78	127	160	136	363	187	135	148
P/C Boat	617	499	179	414	712	274	286	649	349	274	457
P/R Boat	2,833	2,958	1,721	3,246	3,898	4,096	2,461	4,596	3,842	2,517	4,009
TOTAL	3,544	3,579	2,008	3,738	4,737	4,530	2,883	5,608	4,378	2,926	4,614
South											
Shore	61	102	30	26	18	18	13	24	15	9	22
P/C Boat	<1	1	<1	2	1	1	<1	<1	<1	1	<1
P/R Boat	150	105	80	147	147	199	115	185	168	88	35
TOTAL	212	208	111	175	166	218	129	210	184	98	58
All											
Shore	181	253	152	119	162	234	176	460	208	164	202
P/C Boat	628	514	186	424	730	297	305	693	366	305	493
P/R Boat	3,197	3,464	2,121	3,911	4,490	5,128	3,314	6,317	4,705	3,164	4,584
TOTAL	4,006	4,231	2,459	4,454	5,382	5,659	3,795	7,470	5,279	3,632	5,279
PSE (%)	4	4	5	3	4	5	5	4	4	4	4

Table 80 continued.

	YEAR			
	2004	2005	2006	2007
North				
Shore	23	13	11	2
P/C Boat	18	25	16	75
P/R Boat	962	679	816	504
TOTAL	1,003	717	843	581
Mid				
Shore	147	100	81	136
P/C Boat	297	505	208	430
P/R Boat	3,374	3,321	3,766	3,167
TOTAL	3,818	3,926	4,055	3,733
South				
Shore	30	10	17	9
P/C Boat	4	<1	1	16
P/R Boat	77	70	76	106
TOTAL	110	81	94	131
All				
Shore	200	123	109	147
P/C Boat	318	531	225	521
P/R Boat	4,413	4,070	4,658	3,777
TOTAL	4,931	4,724	4,992	4,445
PSE (%)	4	5	5	5

Table 81. Comparison of Vessel Trip Report (VTR) reported landings of summer flounder by Party (VTRPB) and charter (VTRCB) boats, with landings estimated by the MRFSS for the Party/Charter boat (P/C Boat) sector. Data are numeric landings in thousands of fish.

Year	VTRPB	VTRCB	VTR P/C Boat Total	MRFSS P/C Boat Total	Ratio MRFSS to VTR
1995	189	44	233	268	1.15
1996	289	58	347	660	1.90
1997	302	68	370	931	2.52
1998	281	73	354	361	1.02
1999	190	50	240	301	1.25
2000	208	75	283	650	2.30
2001	105	42	147	331	2.25
2002	104	40	144	262	1.82
2003	123	44	167	392	2.35
2004	101	32	133	494	3.71
2005	80	21	101	552	5.47
2006	42	20	62	296	4.77
2007	64	28	92	402	4.37

Table 82. Recreational fishery sampling intensity for summer flounder by subregion. Includes both MRFSS and state agency lengths.

Year	Subregion	Landings (A+B1; mt)	Number of Summer Flounder Measured	mt/100 Lengths
1982	North	1,047	231	453
	Mid	6,492	2,896	224
	South	728	576	126
	TOTAL	8,267	3,703	223
1983	North	600	311	192
	Mid	11,839	4,712	251
	South	248	170	146
	TOTAL	12,687	5,193	244
1984	North	409	168	243
	Mid	7,511	2,195	342
	South	592	283	209
	TOTAL	8,512	2,646	322
1985	North	337	78	432
	Mid	4,936	1,934	255
	South	392	274	143
	TOTAL	5,665	2,286	248
1986	North	2,667	266	1,003
	Mid	4,907	1,808	271
	South	528	288	183
	TOTAL	8,102	2,362	343
1987	North	607	217	280
	Mid	4,823	1,897	254
	South	89	445	20
	TOTAL	5,519	2,559	216

Table 82 continued.

Year	Subregion	Landings (A+B1; mt)	Number of Summer Flounder Measured	mt/100 Lengths
1988	North	323	310	104
	Mid	6,034	2,865	214
	South	277	743	38
	TOTAL	6,634	3,918	172
1989	North	144	107	135
	Mid	1,162	1,582	73
	South	129	358	36
	TOTAL	1,435	2,047	70
1990	North	106	110	96
	Mid	1,985	2,667	74
	South	238	1,293	18
	TOTAL	2,329	4,070	57
1991	North	162	189	86
	Mid	3,343	4,648	72
	South	106	820	13
	TOTAL	3,611	5,657	64
1992	North	196	425	46
	Mid	2,929	4,504	65
	South	117	566	21
	TOTAL	3,242	5,495	59
1993	North	250	338	63
	Mid	3,544	4,174	74
	South	212	995	20
	TOTAL	4,006	5,507	63
1994	North	444	621	75
	Mid	3,579	3,834	90
	South	208	1,467	14
	TOTAL	4,231	5,922	69

Table 82 continued.

Year	Subregion	Landings (A+B1; mt)	Number of Summer Flounder Measured	mt/100 Lengths
1995	North	340	501	68
	Mid	2,008	1,470	137
	South	111	485	23
	TOTAL	2,459	2,456	100
1996	North	541	919	59
	Mid	3,738	3,373	111
	South	175	1,188	15
	TOTAL	4,454	5,480	81
1997	North	480	786	61
	Mid	4,736	2,988	159
	South	166	1,026	16
	TOTAL	5,382	4,800	112
1998	North	911	857	106
	Mid	4,530	3,205	141
	South	218	1,259	17
	TOTAL	5,659	5,321	106
1999	North	783	442	177
	Mid	2,883	1,584	182
	South	129	564	23
	TOTAL	3,795	2,590	147
2000	North	1,652	707	234
	Mid	5,608	1,892	296
	South	210	722	29
	TOTAL	7,470	3,321	225
2001	North	717	351	204
	Mid	4,378	2,963	148
	South	184	933	20
	TOTAL	5,279	4,247	124

Table 82 continued.

Year	Subregion	Landings (A+B1; mt)	Number of Summer Flounder Measured	mt/100 Lengths
2002	North	609	366	166
	Mid	2,925	2,695	109
	South	98	596	16
	TOTAL	3,632	3,657	99
2003	North	607	514	118
	Mid	4,614	3,003	154
	South	58	139	42
	TOTAL	5,279	3,656	144
2004	North	1,003	1,548	65
	Mid	3,818	2,486	154
	South	110	276	40
	TOTAL	4,931	4,310	114
2005	North	717	551	130
	Mid	3,926	1,994	197
	South	81	269	30
	TOTAL	4,724	2,814	168
2006	North	843	987	85
	Mid	4,055	1,423	285
	South	94	281	33
	TOTAL	4,992	2,691	186
2007	North	581	1,209	48
	Mid	3,733	1,863	200
	South	131	291	45
	TOTAL	4,445	3,363	132

Table 83. Estimated recreational landings at age of summer flounder (000s), (catch type A + B1).

					AGE					
Year	0	1	2	3	4	5	6	7	8+	Total
1982	2,750	8,445	3,498	561	215	<1	4	0	0	15,473
1983	2,302	11,612	4,978	1,340	528	220	0	16	0	20,996
1984	2,282	9,198	4,831	1,012	147	5	<1	0	0	17,745
1985	1,002	5,002	4,382	473	148	59	0	0	0	11,066
1986	1,169	6,404	2,784	1,088	129	15	28	0	0	11,621
1987	466	4,674	2,083	448	182	1	5	0	0	7,865
1988	429	5,742	3,311	387	88	3	0	0	0	9,960
1989	74	539	946	135	16	2	5	0	0	1,717
1990	353	2,770	529	118	23	<1	1	0	0	3,794
1991	86	3,611	2,251	79	40	1	0	0	0	6,068
1992	82	3,183	1,620	90	<1	27	0	0	0	5,002
1993	79	3,929	2,323	159	<1	2	0	0	0	6,494
1994	790	3,998	1,698	184	28	1	4	0	0	6,703
1995	231	1,510	1,426	116	26	16	1	0	0	3,326
1996	116	2,935	3,468	354	123	1	0	0	0	6,997
1997	4	1,148	4,188	1,465	274	88	0	0	0	7,167
1998	0	768	2,915	2,714	515	63	4	0	0	6,979
1999	0	201	1,982	1,520	325	60	19	0	0	4,107
2000	0	578	4,121	2,284	643	170	0	0	0	7,801
2001	0	838	1,975	1,781	539	121	36	4	0	5,294
2002	1	194	1,327	1,204	421	92	20	1	2	3,262
2003	0	237	1,674	1,751	648	171	62	16	0	4,559
2004	24	213	1,554	1,720	681	220	120	25	0	4,557
2005	3	184	1,197	1,539	755	238	99	60	35	4,110
2006	4	72	1,412	1,319	729	317	135	40	24	4,052
2007	2	70	577	1,580	714	286	103	33	28	3,393

Table 84. Estimated summer flounder recreational landings (catch types A + B1), live discard (catch type B2), and total catch (catch types A + B1 + B2) in numbers (000s), Proportional Standard Error (PSE) of the total catch estimate, and live discard (catch type B2) as a proportion of total catch. Catch type B2 uses estimates for NC from NCDMF (C.Batsavage, pers. comm)

	Numbers (000s)				
Year	A+B1	B2	A+B1+B2	PSE (%)	B2 / (A+B1+B2)
1982	15,473	8,084	23,557	59	0.343
1983	20,996	11,026	32,022	16	0.344
1984	17,475	12,307	29,782	11	0.413
1985	11,066	2,460	13,526	15	0.182
1986	11,621	13,655	25,276	8	0.540
1987	7,865	13,472	21,337	6	0.631
1988	9,960	7,201	17,161	6	0.420
1989	1,717	908	2,625	10	0.346
1990	3,794	5,283	9,077	5	0.582
1991	6,068	9,870	15,938	5	0.619
1992	5,002	7,540	12,542	5	0.601
1993	6,494	17,741	24,235	5	0.732
1994	6,703	12,332	19,035	5	0.648
1995	3,326	13,568	16,894	5	0.803
1996	6,997	12,987	19,984	4	0.650
1997	7,167	13,854	21,021	4	0.659
1998	6,979	16,960	23,939	4	0.708
1999	4,107	17,833	21,940	5	0.813
2000	7,801	18,643	26,444	4	0.705
2001	5,294	24,049	29,343	3	0.820
2002	3,262	13,386	16,648	3	0.804
2003	4,559	15,776	20,335	4	0.776
2004	4,557	17,009	21,566	4	0.789
2005	4,110	23,135	27,245	5	0.849
2006	4,052	17,516	21,568	5	0.812
2007	3,393	20,428	23,821	5	0.858

Table 85. Recreational fishery sample size for summer flounder discard mortality assumption. Includes MRFSS landed fish sampling, American Littoral Society (ALS) reported released lengths, CT Volunteer Angler Survey (CTVAS) reported released lengths, MADMF party boat sampling (MADMF), NYDEC Party Boat Survey sampling (NYPBS), MDDNR Volunteer Angler Logs (MDVAL), and MRF For-Hire Survey (MRF FHS) reported released lengths. Number of MRFSS lengths is for landed fish measured that were less than the state or federal minimum landed size, and assumed to be indicative of the length frequency of the discarded catch. This length frequency was used to characterize the length frequency of the released catch. All other sources of released lengths were used to verify this assumption. In 2002 and 2003, samples of discarded summer flounder from CTVAS and NYPBS used to directly characterize the discard in those states. The MRF FHS began sampling in 2005. B2 mt estimates use NC from NCDMF (C. Batsavage, pers. comm.)

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100 Lengths
1982	MRFSS		2,048	
	ALS		1	
	Total	296	2,049	14
1983	MRFSS		2,683	
	ALS			
	Total	376	2,683	14
1984	MRFSS		1,521	
	ALS		1,134	
	Total	415	2,683	15
1985	MRFSS		1,032	
	ALS		695	
	Total	92	1,727	5
1986	MRFSS		976	
	ALS		1,445	
	Total	578	2,421	24
1987	MRFSS		1,164	
	ALS		1,496	
	Total	522	2,660	20
1988	MRFSS		1,065	
	ALS		1,640	
	Total	341	2,705	13
1989	MRFSS		448	
	ALS		171	
	Total	45	619	7

Table 85 continued.

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100 Lengths
1990	MRFSS		1,588	
	ALS		1,318	
	Total	234	2,906	8
1991	MRFSS	429	2,230	
	ALS		2,126	
	Total	429	4,356	10
1992	MRFSS		1,401	
	ALS		1,807	
	Total	344	3,208	11
1993	MRFSS		966	
	ALS		3,923	
	Total	910	4,889	19
1994	MRFSS		1,079	
	ALS		3,061	
	Total	687	4,140	17
1995	MRFSS		267	
	ALS		2,307	
	Total	753	2,574	29
1996	MRFSS		639	
	ALS		2,383	
	Total	681	3,022	23
1997	MRFSS		221	
	ALS		2,468	
	Total	556	2,689	21
1998	MRFSS		1,083	
	ALS		3,015	
	Total	734	4,098	18
1999	MRFSS		429	
	ALS		3,688	
	Total	711	4,117	17

Table 85 continued.

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100 Lengths
2000	MRFSS		421	
	ALS		5,962	
	CTVAS		2,893	
	NYPBS		681	
	Total	952	9,957	10
2001	MRFSS		637	
	ALS		3,453	
	CTVAS		999	
	NYPBS		834	
	MDVAL		2,316	
	Total	1,274	8,239	15
2002	MRFSS		721	
	CTVAS		1,526	
	ALS		2,931	
	NYPBS		1,840	
	MADMF		12	
	Total	777	7,030	11
2003	MRFSS		215	
	ALS		2,466	
	CTVAS		1,407	
	NYPBS		2,167	
	Total	882	6,255	14
2004	MRFSS		321	
	ALS		2,153	
	CTVAS		661	
	NYPBS		1,222	
	Total	1,034	4,357	24
2005	MRFSS		142	
	ALS		3,398	
	CTVAS		1,199	
	MRF FHS		3,210	
	Total	999	7,949	13

Table 85 continued.

Year	Source	Discard Mortality (B2; mt)	Number of Lengths	mt/100 Lengths
2006	MRFSS		180	
	ALS		3,104	
	CTVAS		1,124	
	MDVAL		2,944	
	MRF FHS		2,924	
	Total	795	10,276	8
2007	MRFSS		266	
	ALS		4,072	
	CTVAS		1,038	
	MRF FHS		3,364	
	Total	1,130	8,740	13

Table 86. Estimated recreational fishery discard at age of summer flounder (catch type B2). NC estimates by NCMDF. Discards during 1982-1996 allocated to age groups in same relative proportions as ages 0 and 1 in the subregional catch. Discards during 1997-2000 allocated to age groups in same relative proportions as fish less than the annual EEZ minimum size in the subregional catch. Discards in 2001-2007 allocated to age groups either in the same relative proportion as fish less than the minimum size in the respective state catch, and as indicate by state agency or ALS sampling of the released catch. All years assume 10% release mortality.

	Numbers at age (000s)					Metric Tons at age				
Year	0	1	2	3+	Total	0	1	2	3+	Total
1982	172	636	0	0	808	39	257	0	0	296
1983	175	932	0	0	1,107	31	345	0	0	376
1984	210	1,020	0	0	1,230	43	372	0	0	415
1985	40	206	0	0	246	10	82	0	0	92
1986	150	1,217	0	0	1,367	34	544	0	0	578
1987	106	1,210	0	0	1,316	24	498	0	0	522
1988	55	665	0	0	720	16	325	0	0	341
1989	13	83	0	0	96	3	42	0	0	45
1990	60	470	0	0	530	18	216	0	0	234
1991	24	977	0	0	1,001	6	423	0	0	429
1992	17	674	0	0	691	4	340	0	0	344
1993	34	1,740	0	0	1,774	8	902	0	0	910
1994	216	1,017	0	0	1,233	94	593	0	0	687
1995	189	1,168	0	0	1,357	81	672	0	0	753
1996	50	1,249	0	0	1,299	17	664	0	0	681
1997	24	820	522	23	1,389	5	323	218	10	556
1998	0	685	875	136	1,696	0	274	396	64	734
1999	84	587	987	125	1,783	11	222	421	57	711
2000	0	587	1,097	180	1,864	0	281	574	97	952
2001	0	1,261	888	256	2,405	0	595	506	173	1,274
2002	75	565	569	198	1,407	15	237	378	147	777
2003	49	785	599	208	1,641	8	330	386	158	882
2004	85	508	794	314	1,701	22	231	538	243	1,034
2005	254	1,153	739	168	2,314	53	413	406	127	999
2006	155	552	887	160	1,754	24	192	464	115	795
2007	101	667	674	586	2,028	17	224	400	489	1,130

Table 87. Mean weight (kg) at age of summer flounder catch in the recreational fishery.

	Age									
	0	1	2	3	4	5	6	7	8+	All
1982	0.224	0.404	0.570	1.326	1.846	1.885	2.978	0.000	0.000	0.459
1983	0.176	0.370	0.633	0.927	1.194	1.396	0.000	0.000	0.000	0.472
1984	0.205	0.364	0.620	0.968	1.771	2.197	4.166	0.000	0.000	0.453
1985	0.242	0.398	0.626	1.101	1.748	2.441	0.000	0.000	0.000	0.530
1986	0.225	0.447	0.751	1.290	1.740	2.719	3.482	5.960	0.000	0.584
1987	0.230	0.412	0.761	1.340	1.839	3.050	4.808	4.640	0.000	0.559
1988	0.293	0.488	0.707	1.114	1.921	2.316	0.000	0.000	0.000	0.582
1989	0.263	0.512	0.813	1.232	1.784	3.333	1.576	0.000	0.000	0.728
1990	0.303	0.460	0.968	1.440	1.677	2.895	6.456	0.000	0.000	0.542
1991	0.273	0.433	0.670	1.306	1.372	2.450	0.000	0.000	0.000	0.521
1992	0.225	0.504	0.717	1.617	2.279	3.340	0.000	0.000	0.000	0.591
1993	0.246	0.518	0.715	1.871	2.442	3.027	0.000	0.000	0.000	0.597
1994	0.436	0.583	0.694	1.438	1.923	2.831	3.897	0.000	0.000	0.615
1995	0.426	0.575	0.816	1.457	2.603	2.930	3.537	0.000	0.000	0.677
1996	0.343	0.532	0.622	1.338	1.341	2.361	0.000	0.000	0.000	0.612
1997	0.225	0.450	0.648	0.902	1.153	2.377	0.000	0.000	0.000	0.679
1998	0.000	0.466	0.618	0.813	1.257	2.508	0.000	0.000	0.000	0.708
1999	0.127	0.411	0.613	0.908	1.549	2.330	2.604	0.000	0.000	0.737
2000	0.000	0.514	0.710	0.952	1.307	2.388	3.481	0.000	0.000	0.819
2001	0.000	0.531	0.783	0.993	1.515	2.089	2.291	3.738	0.000	0.852
2002	0.206	0.437	0.827	1.043	1.505	2.287	2.604	3.200	4.213	0.918
2003	0.169	0.480	0.840	1.097	1.585	2.018	2.807	2.714	0.000	0.993
2004	0.331	0.507	0.792	1.006	1.409	1.905	2.316	3.002	0.000	0.965
2005	0.208	0.387	0.747	1.096	1.405	1.756	2.330	2.357	2.341	0.903
2006	0.156	0.379	0.728	1.050	1.337	1.692	2.266	3.310	3.250	0.950
2007	0.170	0.351	0.688	1.055	1.430	1.797	2.148	2.878	3.522	0.930

Table 88. Total catch at age of summer flounder (000s), ME-NC.

	Age										
Year	0	1	2	3	4	5	6	7	8	9+	Total
1982	5,344	19,423	10,149	935	328	116	67	26	4	0	36,392
1983	4,925	28,441	10,911	2,181	693	323	16	36	5	2	47,533
1984	4,802	26,582	15,454	3,180	829	95	4	5	1	4	50,956
1985	2,078	14,623	17,979	1,767	496	252	30	5	2	1	37,233
1986	1,942	17,140	11,055	3,782	316	140	58	12	3	0	34,448
1987	1,137	17,212	10,838	1,648	544	25	29	33	11	0	31,477
1988	789	20,440	14,528	2,138	642	121	19	15	6	0	38,698
1989	959	4,789	7,308	1,692	353	55	9	3	1	0	15,169
1990	1,856	8,808	2,187	995	221	30	8	2	1	0	14,108
1991	1,001	12,145	7,152	742	217	32	3	1	0	0	21,294
1992	1,369	11,213	6,009	1,128	150	70	2	1	0	0	19,942
1993	1,305	12,024	5,943	586	75	46	19	2	1	0	20,001
1994	1,702	10,648	7,145	995	207	27	13	0	5	0	20,742
1995	607	5,833	7,303	1,238	397	77	5	1	0	0	15,461
1996	189	6,803	9,082	1,767	411	72	16	1	3	0	18,344
1997	36	2,614	8,078	3,152	553	160	10	4	0	0	14,607
1998	45	2,370	6,422	5,249	980	138	19	1	0	0	15,224
1999	181	2,204	6,294	4,177	1,062	308	51	11	0	0	14,288
2000	22	1,591	8,010	4,805	1,437	344	70	16	8	2	16,305
2001	11	2,983	4,779	3,846	1,221	339	113	25	4	3	13,324
2002	89	1,368	5,396	3,978	1,264	295	125	13	2	1	12,531
2003	51	1,799	4,977	4,066	1,581	560	232	66	17	3	13,352
2004	110	1,071	5,699	4,708	1,907	768	304	111	34	10	14,722
2005	261	1,901	3,876	4,212	2,265	1,069	517	264	150	77	14,592
2006	163	1,066	5,137	3,284	1,796	869	373	123	42	14	12,867
2007	112	938	2,213	4,217	1,645	670	284	106	43	25	10,253

Table 89. Mean length (cm) at age of summer flounder catch, ME-NC.

	Age										
	0	1	2	3	4	5	6	7	8	9+	ALL
1982	29.4	34.5	38.8	50.7	55.3	61.0	60.7	68.0	71.2	0.0	35.7
1983	28.8	34.5	40.9	46.5	48.8	51.6	60.7	60.9	69.3	72.0	36.3
1984	29.4	33.8	39.1	45.9	51.3	57.9	66.8	68.4	74.0	70.7	36.1
1985	30.6	34.8	38.8	46.8	53.9	58.6	61.5	74.5	73.3	75.0	37.5
1986	29.7	35.6	39.9	47.5	54.0	56.2	65.8	66.4	72.8	0.0	38.2
1987	29.9	35.3	39.7	46.9	55.8	63.3	65.9	63.2	73.5	0.0	37.7
1988	32.4	35.8	39.1	46.6	53.1	60.2	69.6	68.5	72.7	0.0	37.9
1989	27.1	35.7	40.8	45.5	50.6	58.5	59.1	63.1	59.0	0.0	39.1
1990	29.6	35.1	41.9	46.8	51.4	57.4	66.4	71.7	75.2	0.0	36.6
1991	24.8	34.5	40.4	47.1	54.3	61.0	61.7	68.1	0.0	0.0	36.7
1992	29.6	36.0	41.2	46.9	49.7	61.0	58.8	72.2	0.0	0.0	37.9
1993	30.3	36.6	40.7	50.6	53.1	54.7	62.6	70.6	75.5	0.0	37.9
1994	32.3	37.2	39.3	49.7	57.2	63.4	66.1	82.6	68.5	0.0	38.4
1995	33.8	37.1	39.9	44.9	52.4	62.2	68.8	71.9	0.0	0.0	39.4
1996	32.7	36.9	38.2	45.7	51.4	54.4	58.5	63.0	62.1	0.0	38.8
1997	28.6	36.1	39.7	43.4	48.3	58.1	60.8	66.3	0.0	0.0	40.4
1998	28.7	37.1	40.0	43.4	49.5	59.3	48.0	71.1	0.0	0.0	41.5
1999	25.3	33.6	38.8	43.9	50.7	55.5	62.2	67.1	69.0	0.0	40.8
2000	18.1	37.2	40.9	44.2	49.3	58.1	60.9	61.8	66.1	67.7	42.8
2001	21.1	37.8	41.9	45.0	50.4	57.2	60.4	66.4	68.9	73.8	43.3
2002	28.5	36.4	41.6	44.7	49.6	57.0	61.3	68.0	6.6	64.0	43.4
2003	26.7	36.7	42.0	45.9	51.7	56.9	62.1	65.0	67.2	69.1	44.7
2004	31.6	37.2	41.6	45.2	49.8	53.9	59.1	64.0	64.8	73.6	44.6
2005	28.5	35.1	40.7	44.4	47.8	51.5	55.2	57.4	58.7	66.1	43.8
2006	26.0	35.6	40.5	44.8	48.7	52.7	57.7	62.7	64.5	70.7	43.8
2007	26.0	34.5	40.0	45.0	49.1	53.5	57.2	60.3	62.4	69.4	44.5

Table 90. Mean weight (kg) at age of summer flounder catch, ME-NC.

	Age										
	0	1	2	3	4	5	6	7	8	9+	ALL
1982	0.255	0.419	0.616	1.447	1.907	2.795	2.673	3.758	4.408	0.000	0.504
1983	0.243	0.419	0.716	1.075	1.257	1.495	2.572	2.594	3.849	4.030	0.522
1984	0.251	0.398	0.632	1.046	1.500	2.163	3.302	3.620	4.640	4.030	0.518
1985	0.290	0.429	0.613	1.109	1.726	2.297	2.671	4.682	4.780	4.800	0.575
1986	0.256	0.453	0.668	1.160	1.739	1.994	3.311	4.000	4.432	0.000	0.613
1987	0.263	0.446	0.651	1.140	1.941	2.862	3.377	3.314	4.140	0.000	0.581
1988	0.319	0.462	0.624	1.130	1.738	2.485	3.888	3.545	4.316	0.000	0.588
1989	0.207	0.459	0.723	1.044	1.479	2.249	2.399	2.861	2.251	0.000	0.668
1990	0.250	0.429	0.810	1.169	1.538	2.121	3.461	3.951	5.029	0.000	0.540
1991	0.140	0.404	0.702	1.186	1.811	2.527	2.837	3.586	0.000	0.000	0.537
1992	0.246	0.467	0.749	1.222	1.390	2.696	2.302	4.479	0.000	0.000	0.595
1993	0.264	0.482	0.700	1.475	1.679	1.859	2.816	4.136	0.000	0.000	0.572
1994	0.346	0.524	0.631	1.333	2.063	2.494	3.010	5.780	2.233	0.000	0.657
1995	0.376	0.536	0.710	1.094	1.601	2.529	3.784	3.825	0.000	0.000	0.748
1996	0.329	0.503	0.569	1.077	1.548	1.958	2.546	3.200	3.164	0.000	0.620
1997	0.215	0.452	0.639	0.866	1.233	2.252	2.572	3.429	0.000	0.000	0.696
1998	0.259	0.522	0.653	0.859	1.321	2.410	2.000	3.983	0.000	0.000	0.763
1999	0.143	0.372	0.594	0.895	1.439	1.998	2.716	3.496	3.904	0.000	0.754
2000	0.066	0.507	0.691	0.924	1.330	2.219	2.599	2.728	3.359	3.532	0.847
2001	0.114	0.542	0.765	0.968	1.449	2.145	2.597	3.459	3.915	4.935	0.899
2002	0.209	0.481	0.739	0.954	1.372	2.101	2.666	3.728	4.232	2.983	0.902
2003	0.144	0.499	0.761	1.030	1.527	2.072	2.764	3.175	3.570	3.912	1.001
2004	0.304	0.516	0.737	0.969	1.350	1.757	2.357	3.024	3.176	3.736	0.983
2005	0.201	0.433	0.691	0.932	1.193	1.508	1.895	2.155	2.299	2.213	0.952
2006	0.158	0.453	0.682	0.961	1.264	1.645	2.184	2.943	3.135	3.787	0.950
2007	0.181	0.388	0.683	0.949	1.276	1.694	2.119	2.540	2.954	3.734	0.998

Table 91. Commercial and recreational fishery landings, estimated discard, and total catch statistics (metric tons) as used in the assessment of summer flounder, Maine to North Carolina.

	Commercial			Recreational			Total		
Year	Landings	Discard	Catch	Landings	Discard	Catch	Landings	Discard	Catch
1982	10.400	n/a	10.400	8.267	296	8.563	18.667	296	18.963
1983	13.403	n/a	13.403	12.687	376	13.063	26.090	376	26.466
1984	17.130	n/a	17.130	8.512	415	8.927	25.642	415	26.057
1985	14.675	n/a	14.675	5.665	92	5.757	20.340	92	20.432
1986	12.186	n/a	12.186	8.102	578	8.680	20.288	578	20.866
1987	12.271	n/a	12.271	5.519	522	6.041	17.790	522	18.312
1988	14.686	n/a	14.686	6.634	341	6.975	21.320	341	21.661
1989	8.125	709	8.834	1.435	45	1.480	9.560	754	10.314
1990	4.199	1.214	5.413	2.329	234	2.563	6.528	1.448	7.976
1991	6.224	1.052	7.276	3.611	429	4.040	9.835	1.481	11.316
1992	7.529	690	8.219	3.242	344	3.586	10.771	1.034	11.805
1993	5.715	846	6.561	4.006	910	4.916	9.721	1.756	11.477
1994	6.588	906	7.494	4.231	687	4.918	10.819	1.593	12.412
1995	6.977	308	7.285	2.459	752	3.211	9.436	1.060	10.496
1996	5.861	463	6.324	4.454	681	5.135	10.315	1.144	11.459
1997	3.994	326	4.320	5.382	556	5.938	9.376	882	10.258
1998	5.076	389	5.465	5.659	734	6.393	10.735	1.123	11.858
1999	4.820	1.548	6.368	3.795	711	4.506	8.615	2.259	10.874
2000	5.085	726	5.811	7.470	952	8.422	12.555	1.678	14.233
2001	4.970	468	5.438	5.279	1.274	6.553	10.249	1.742	11.991
2002	6.573	449	7.022	3.632	777	4.409	10.205	1.226	11.431
2003	6.450	528	6.978	5.279	882	6.161	11.729	1.410	13.139
2004	8.228	244	8.472	4.831	1.034	5.865	13.059	1.278	14.337
2005	7.826	230	8.056	4.724	999	5.723	12.550	1.229	13.779
2006	6.262	288	6.550	4.992	795	5.787	11.254	1.083	12.337
2007	4.489	304	4.793	4.445	1.130	5.575	8.934	1.434	10.368
Mean	8.210	632	8.665	5.288	617	5.904	13.498	1.072	14.570

Table 92. NEFSC research trawl survey indices of abundance. Indices are stratified mean numbers (n) and weight (kg) per tow. Spring indices are for offshore strata 1-12 61-76; autumn indices are for offshore strata 1-2, 5-6, 9-10, 61, 65, 69, and 73. Winter indices (1992-2007) are for NEFSC offshore strata 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, and 73-75. n/a = not available due to incomplete coverage (spring) or end of survey (winter). Note that door and vessel conversion factors are not significant; gear conversion factors have not been included due to limited sample size and extreme violation of underlying assumptions in experimental work.

Year	Spring (n)	Spring (kg)	Autumn (n)	Autumn (kg)
1967	n/a	n/a	1.35	1.25
1968	0.15	0.16	1.10	1.00
1969	0.19	0.16	0.59	0.61
1970	0.09	0.09	0.15	0.13
1971	0.22	0.28	0.42	0.27
1972	0.47	0.21	0.39	0.27
1973	0.76	0.54	0.87	0.63
1974	1.37	1.26	1.70	1.86
1975	1.97	1.61	3.00	2.48
1976	2.83	2.00	1.14	0.85
1977	2.84	1.74	2.17	1.75
1978	2.55	1.40	0.32	0.40
1979	0.40	0.35	1.17	0.94
1980	1.30	0.78	0.94	0.57
1981	1.50	0.80	0.91	0.72
1982	2.27	1.11	1.57	0.90
1983	0.95	0.53	0.90	0.47
1984	0.66	0.38	0.99	0.65
1985	2.38	1.20	1.24	0.87
1986	2.14	0.82	0.68	0.45
1987	0.93	0.38	0.26	0.28
1988	1.50	0.68	0.11	0.11
1989	0.32	0.24	0.20	0.08
1990	0.72	0.27	0.27	0.19
1991	1.08	0.35	0.51	0.17

Table 92 continued.

Year	Winter (n)	Winter (kg)	Spring (n)	Spring (kg)	Autumn (n)	Autumn (kg)
1992	12.30	4.90	1.20	0.46	0.85	0.49
1993	13.60	5.50	1.27	0.48	0.11	0.04
1994	12.05	6.03	0.93	0.46	0.60	0.35
1995	10.93	4.81	1.09	0.46	1.13	0.83
1996	31.25	12.35	1.76	0.67	0.71	0.45
1997	10.28	5.54	1.06	0.61	1.32	0.92
1998	7.76	5.13	1.19	0.76	2.32	1.58
1999	11.06	7.99	1.60	1.01	2.42	1.66
2000	15.76	12.59	2.14	1.70	1.90	1.82
2001	18.59	15.68	2.69	2.16	1.56	1.55
2002	22.68	18.43	2.47	2.29	1.32	1.40
2003	35.62	27.48	2.91	2.42	2.00	1.93
2004	17.77	15.25	3.03	2.43	3.00	3.06
2005	12.89	10.32	1.81	1.59	1.57	1.83
2006	21.04	15.93	1.77	1.34	2.10	1.79
2007	16.83	12.89	3.25	3.17	2.21	2.45
2008	nla	nla	1.41	1.39	n/a	n/a

Table 93. NEFSC spring trawl survey (offshore strata 1-12, 61-76) stratified mean number of summer flounder per tow at age.

	Age										
Year	1	2	3	4	5	6	7	8	9	10+	ALL
1976	0.03	1.77	0.71	0.29	0.01	0.01	0.01				2.83
1977	0.61	1.31	0.71	0.10	0.09	0.01		0.01			2.84
1978	0.68	0.93	0.64	0.19	0.04	0.03	0.03			0.01	2.55
1979	0.06	0.18	0.08	0.04	0.03			0.01			0.40
1980	0.01	0.70	0.31	0.14	0.02	0.06	0.03	0.02		0.01	1.30
1981	0.60	0.54	0.17	0.08	0.05	0.03	0.02	0.01			1.50
1982	0.70	1.43	0.12	0.02							2.27
1983	0.32	0.39	0.19	0.03	0.01				0.01		0.95
1984	0.17	0.33	0.09	0.05		0.01	0.01				0.66
1985	0.55	1.56	0.21	0.04	0.02						2.38
1986	1.48	0.43	0.20	0.02	0.01						2.14
1987	0.47	0.43	0.02	0.01							0.93
1988	0.60	0.81	0.07	0.02							1.50
1989	0.06	0.23	0.02	0.01							0.32
1990	0.63	0.03	0.06								0.72
1991	0.79	0.27		0.02							1.08
1992	0.77	0.41	0.01		0.01						1.20
1993	0.73	0.50	0.04								1.27
1994	0.35	0.53	0.04	0.01							0.93
1995	0.79	0.27	0.02				0.01				1.09
1996	1.08	0.56	0.12								1.76
1997	0.29	0.67	0.09	0.01							1.06
1998	0.27	0.52	0.32	0.06	0.01	0.01					1.19
1999	0.22	0.74	0.48	0.13	0.02	0.01					1.60
2000	0.19	1.03	0.63	0.12	0.15	0.02					2.14
2001	0.48	0.89	1.02	0.20	0.05	0.04	0.01				2.69
2002	0.34	0.89	0.74	0.31	0.10	0.03	0.05	0.01			2.47
2003	0.54	1.29	0.59	0.29	0.13	0.06	0.01	0.01			2.91
2004	0.30	1.45	0.85	0.27	0.05	0.06	0.04				3.03
2005	0.26	0.65	0.58	0.15	0.10	0.05	0.02		0.001		1.81
2006	0.04	1.04	0.24	0.25	0.09	0.06	0.02	0.01		0.018	1.77
2007	0.24	0.52	1.46	0.57	0.18	0.13	0.07	0.04	0.010	0.030	3.25
2008	0.25	0.34	0.31	0.29	0.11	0.09	0.02				1.41
Mean	0.45	0.72	0.35	0.13	0.06	0.04	0.02	0.01	0.01	0.02	1.70

Table 94. NEFSC spring trawl survey (offshore strata 1-12, 61-76) summer flounder mean length (cm) at age.

	Age											
Year	1	2	3	4	5	6	7	8	9	10	11	12
1976	25.9	36.0	43.1	53.5	60.8	70.0	72.0					
1977	25.2	35.0	43.4	51.7	59.6	63.0		74.0				
1978	27.3	34.8	40.9	46.9	53.3	59.5	64.0				65.0	75.0
1979	25.1	37.0	43.2	51.5	54.8			77.0				
1980	29.0	28.8	38.1	44.2	51.1	53.0	67.7	77.0		81.0		
1981	25.3	32.2	39.8	48.9	55.7	62.9	67.8	74.0				
1982	28.6	36.2	47.3	46.7								
1983	25.5	37.7	43.4	53.3	61.4				77.0			
1984	27.1	33.9	41.8	56.7		63.0	56.0					
1985	26.8	36.1	42.8	57.2	54.5							
1986	28.6	36.3	46.0	56.0	63.0							
1987	27.8	37.7	47.3	58.0								
1988	27.7	36.3	47.8	45.0								
1989	30.4	39.2	51.5	60.0								
1990	28.3	47.7	48.6									
1991	27.0	38.8		42.1								
1992	27.9	37.7	57.0		72.0							
1993	27.5	37.9	51.9									
1994	33.0	36.8	48.0	53.1								
1995	29.4	40.0	46.4				72.0					
1996	29.8	36.2	47.2									
1997	29.4	38.3	49.4	54.1								
1998	27.6	39.1	42.7	50.5	50.0	60.0						
1999	28.5	35.8	42.9	49.1	57.7	64.0						
2000	29.5	37.9	44.3	49.4	55.4	60.5						
2001	29.6	39.1	44.9	53.4	60.5	63.8	55.0					
2002	29.7	39.3	45.8	52.7	58.1	63.5	62.1	66.0	54.0	68.0		
2003	32.4	39.3	46.5	51.4	57.5	65.2	51.0	65.0				
2004	29.5	37.6	46.1	50.4	56.9	61.9	63.3					
2005	29.2	39.1	45.1	50.9	55.0	58.3	71.3				73.0	
2006	28.3	36.3	42.1	47.6	51.8	54.0	57.0	63.0		62.0	66.0	
2007	28.3	38.7	43.0	48.2	55.2	53.9	60.4	65.6	61.0	69.4		63.0
2008	30.7	37.3	45.1	49.0	55.9	59.6	57.9					
Mean	28.4	37.3	45.4	51.1	57.2	60.9	62.7	70.2	64.0	70.1	68.0	69.0

Table 95. NEFSC autumn trawl survey (inshore strata 1-61, offshore strata <= 55 m (1,5,9,61,65,69,73)) mean number of summer flounder per tow at age.

				Age						
Year	0	1	2	3	4	5	6	7+		ALL
1982	0.55	1.52	0.40	0.03						2.50
1983	0.96	1.46	0.34	0.12	0.01	0.01				2.90
1984	0.18	1.39	0.43	0.07	0.01	0.01	<0.01			2.09
1985	0.59	0.80	0.46	0.05		0.02				1.92
1986	0.39	0.83	0.11	0.11		<0.01				1.44
1987	0.07	0.58	0.20	0.03	0.02					0.90
1988	0.06	0.62	0.18	0.03						0.89
1989	0.31	0.21	0.05							0.57
1990	0.44	0.38	0.03	0.04		<0.01				0.89
1991	0.76	0.84	0.09		0.01	<0.01	<0.01			1.70
1992	0.99	1.04	0.25	0.03	0.01	<0.01				2.32
1993	0.23	0.80	0.03	0.01			<0.01			1.07
1994	0.75	0.67	0.09	0.01	0.01					1.53
1995	0.93	1.16	0.28	0.02	0.01					2.40
1996	0.11	1.24	0.57	0.04						1.96
1997	0.17	1.29	1.14	0.29	0.02	0.01	0.01	<0.01		2.93
1998	0.38	2.13	1.63	0.33	0.04	0.01				4.52
1999	0.21	1.73	1.49	0.31	0.04	0.01				3.79
2000	0.22	1.20	1.22	0.40	0.15	0.06	0.03	0.04		3.32
2001	0.12	1.36	0.93	0.37	0.11	0.10		0.01		3.00
2002	0.06	1.17	0.86	0.35	0.11	0.03	0.03	0.02		2.63
2003	0.18	1.31	1.03	0.25	0.10	0.03	0.07	0.01		2.98
2004	0.36	1.49	1.37	0.66	0.19	0.07	0.06	0.04		4.24
2005	0.16	1.14	0.54	0.47	0.18	0.10	0.13	0.03		2.75
2006	0.31	0.72	1.22	0.35	0.17	0.06	0.07	0.02		2.91
2007	0.12	0.84	0.91	0.96	0.31	0.09	0.09	0.04		3.36
Mean	0.37	1.07	0.61	0.22	0.08	0.04	0.05	0.02	0.0	2.37

Table 96. NEFSC autumn trawl survey (inshore strata 1-61, offshore strata <= 55 m (1,5,9,61,65,69,73)) summer flounder mean length (cm) at age.

	Age							
Year	0	1	2	3	4	5	6	7+
1982	28.2	35.1	43.3	47.1				
1983	24.5	33.5	42.7	52.3	60.0	58.0		
1984	23.5	33.6	41.1	46.5	62.6	65.0	70.0	
1985	25.5	35.4	43.1	53.0		63.0		
1986	23.1	35.7	40.8	53.5		57.0		
1987	27.4	34.4	46.0	53.6	47.7			
1988	30.1	35.9	43.4	61.7				
1989	25.8	35.8	48.2	60.0				
1990	24.8	36.0	45.2	54.9	60.0	68.0		
1991	23.2	34.7	43.7	59.0	61.2	67.0	69.0	
1992	25.3	34.4	42.7	51.3	58.8	68.0		
1993	29.9	35.1	44.0	58.1	59.0		70.0	
1994	27.5	38.0	44.3	61.5	57.0			
1995	26.5	36.7	47.4	59.0	65.0			
1996	26.6	35.4	41.6	56.1				
1997	28.4	35.1	40.3	46.5	51.7	59.3	56.0	63.0
1998	24.0	34.7	42.6	50.2	58.2	68.6		
1999	24.1	34.7	40.0	48.5	55.6	56.8		
2000	25.2	35.7	42.1	48.6	53.5	59.9	68.0	66.5
2001	21.8	36.3	42.6	50.0	54.0	62.1		67.0
2002	25.4	36.8	43.8	49.5	55.3	61.4	67.9	69.9
2003	23.2	37.0	43.4	51.8	56.8	59.5	58.5	72.0
2004	23.9	36.8	43.5	48.4	56.2	59.4	60.7	71.2
2005	28.8	34.2	42.2	47.5	51.6	56.4	63.5	63.8
2006	21.5	35.9	41.1	48.1	52.9	55.2	57.6	63.5
2007	22.7	34.2	41.9	46.4	52.4	55.1	58.7	71.0
Mean	25.4	35.4	43.1	52.4	56.5	61.1	63.6	67.5

Table 97. NEFSC Winter trawl survey (offshore strata from 27-185 meters (15-100 fathoms): 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, 73-75; Southern Georges Bank to Cape Hatteras): mean number and mean weight (kg) per tow.

Year	Stratified mean number per tow	Coefficient of variation	Stratified mean weight (kg) per tow	Coefficient of variation
1992	12.30	15.6	4.90	15.4
1993	13.60	15.2	5.50	11.9
1994	12.05	17.8	6.03	16.1
1995	10.93	12.0	4.81	11.6
1996	31.25	24.2	12.35	22.0
1997	10.28	24.0	5.54	16.6
1998	7.76	20.7	5.13	16.6
1999	11.06	13.3	7.99	11.4
2000	15.76	13.0	12.59	12.8
2001	18.59	11.4	15.68	13.2
2002	22.55	15.6	18.71	15.7
2003	35.62	18.7	27.48	19.1
2004	17.77	13.9	15.25	14.6
2005	12.89	14.6	10.32	20.0
2006	21.04	13.9	15.93	13.6
2007	16.83	12.8	12.89	14.7

Table 98. NEFSC Winter trawl survey (offshore strata from 27-185 meters (15-100 fathoms): 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, 73-75; Southern Georges Bank to Cape Hatteras): mean number at age per tow.

Year	Age											
	1	2	3	4	5	6	7	8	9	10	11	12+	Total
1992	7.15	4.74	0.33	0.04	0.01	0.03							12.29
1993	6.50	6.70	0.31	0.05	0.02	0.02							13.60
1994	3.76	7.20	0.82	0.26			0.01						12.05
1995	6.07	4.59	0.25	0.02									10.93
1996	22.17	8.33	0.60	0.12	0.03								31.25
1997	3.86	4.80	1.04	0.43	0.11	0.04							10.28
1998	1.68	3.25	2.29	0.42	0.10	0.01				0.01			7.76
1999	2.11	4.80	2.90	0.84	0.28	0.06	0.04	0.02		0.01			11.06
2000	0.70	6.52	4.96	2.51	0.78	0.17	0.08	0.04	0.01				15.76
2001	3.07	5.33	6.42	2.44	0.80	0.37	0.09	0.05	0.01		0.01	0.01	18.59
2002	2.77	10.74	5.58	2.26	0.85	0.32	0.13	0.02	0.01				22.68
2003	8.17	14.36	8.48	2.67	1.04	0.39	0.32	0.15	0.05		0.01		35.62
2004	1.45	8.68	4.56	1.64	0.62	0.41	0.19	0.16	0.02	0.03	0.01		17.77
2005	2.96	4.03	3.07	1.34	0.70	0.33	0.17	0.13	0.12	0.03		0.01	12.89
2006	2.64	9.06	4.29	2.47	1.32	0.56	0.24	0.22	0.14	0.07	0.01	0.04	21.04
2007	2.77	6.18	5.15	1.54	0.58	0.31	0.16	0.05	0.08	0.01			16.83
Mean	4.84	6.82	3.22	1.19	0.52	0.23	0.14	0.09	0.06	0.02	0.01	0.02	16.89

Table 99. NEFSC Winter trawl survey (offshore strata from 27-185 meters (15-100 fathoms): 1-3, 5-7, 9-11, 13-14, 16-17, 61-63, 65-67, 69-71, 73-75; Southern Georges Bank to Cape Hatteras): summer flounder mean length (cm) at age.

	Age											
Year	1	2	3	4	5	6	7	8	9	10	11	12+
1992	28.0	38.4	48.8	60.0	70.0	69.0						
1993	27.9	37.3	49.4	58.7	58.5	65.0						
1994	28.0	37.5	46.1	56.4			69.0					
1995	27.4	40.2	50.8	59.6								
1996	30.9	38.2	51.4	61.2	63.6							
1997	29.2	37.8	44.5	50.0	57.3	62.5						
1998	28.4	38.0	43.3	52.2	59.7	66.3				64.0		
1999	28.4	36.9	44.5	51.6	59.2	64.1	70.2	68.8		78.0		
2000	28.2	35.9	41.4	49.0	56.3	62.2	68.2	67.1	77.0			
2001	28.3	37.3	43.6	50.2	56.3	61.0	65.3	69.4	58.6		70.0	74.0
2002	30.0	38.5	44.5	51.4	58.1	62.2	66.4	62.7	75.0			
2003	30.8	39.2	45.2	51.4	55.9	61.0	65.6	67.8	67.1		67.0	
2004	28.8	38.6	44.5	50.8	55.0	60.2	65.0	66.6	67.1	72.4	69.0	
2005	27.7	37.6	44.1	48.9	53.3	56.4	60.8	64.1	65.3	70.6		71.5
2006	30.9	36.8	41.0	46.7	51.2	54.6	60.2	61.4	62.1	68.2	65.0	73.3
2007	27.8	38.2	43.5	49.1	53.8	57.3	62.1	63.6	66.0	65.0		
Mean	28.8	37.9	45.4	52.9	57.7	61.7	65.3	65.7	67.3	69.7	67.8	72.9

Table 100. MADMF Spring survey cruises: stratified mean number per tow at age.

Year	Age									
	0	1	2	3	4	5	6	7	8+	Total
1978		0.102	0.547	0.288	0.232		0.045			1.214
1979			0.087	0.090	0.152	0.050	0.011			0.390
1980		0.056	0.062	0.053	0.077	0.054	0.056	0.012		0.370
1981		0.431	0.593	0.079	0.033	0.046	0.064		0.032	1.278
1982		0.350	1.584	0.142	0.042	0.022			0.010	2.150
1983		0.051	0.599	0.450	0.024	0.009	0.022		0.012	1.167
1984		0.044	0.078	0.067	0.116					0.305
1985		0.154	1.260	0.036	0.051	0.004				1.505
1986		0.995	0.522	0.185	0.009					1.711
1987		0.656	0.640	0.013			0.011			1.320
1988		0.211	1.005	0.123	0.014					1.353
1989			0.363	0.102			0.011			0.476
1990		0.257	0.021	0.081	0.013					0.372
1991		0.032	0.050	0.011						0.093
1992		0.280	0.342	0.090		0.012	0.011			0.735
1993		0.126	0.492	0.065	0.010				0.022	0.715
1994		1.860	1.217	0.048	0.023		0.011			3.159
1995		0.104	1.302	0.053						1.459
1996		0.076	0.686	0.114	0.012					0.888
1997		0.544	1.279	0.181	0.116		0.006			2.126
1998		0.144	1.212	0.659	0.049	0.050				2.114
1999		0.078	0.878	1.112	0.302	0.029		0.016		2.415
2000		0.237	1.659	1.205	0.305	0.232	0.054			3.692
2001		0.186	1.026	0.730	0.229	0.057				2.228
2002		0.151	1.511	0.397	0.102	0.066	0.026	0.014	0.019	2.286
2003		0.206	1.440	0.624	0.185	0.118	0.012	0.023		2.608
2004		0.027	0.283	0.323	0.061	0.061	0.026	0.023	0.010	0.814
2005		0.136	0.351	1.029	0.315	0.132	0.074	0.053	0.107	2.197
2006		0.049	2.440	0.975	0.229	0.070	0.086	0.020	0.021	3.890
2007		0.254	0.392	1.008	0.102	0.080	0.051	0.012		1.899
Mean		0.278	0.797	0.344	0.112	0.064	0.034	0.022	0.029	1.564

Table 101. MADMF Autumn survey cruises: stratified mean number per tow at age.

Year	Age									
	0	1	2	3	4	5	6	7	8+	Total
1978		0.039	0.442	0.085		0.025				0.591
1979			0.050	0.109		0.020				0.179
1980		0.123	0.351	0.022	0.022	0.009				0.527
1981	0.010	0.400	0.405	0.012						0.827
1982	0.038	0.234	1.662	0.019						1.953
1983		0.033	0.625	0.154	0.006					0.818
1984	0.033	0.485	0.267	0.127		0.011				0.923
1985	0.057	0.117	1.895	0.039						2.108
1986	0.145	2.316	0.679	0.214	0.008	0.003				3.365
1987		1.202	0.663	0.011	0.006					1.882
1988		0.474	0.429	0.006	0.007	0.006				0.922
1989			0.317	0.016			0.012			0.345
1990		0.113		0.011						0.124
1991	0.024	0.531	0.288	0.005						0.848
1992		1.181	0.186							1.367
1993	0.009	0.335	0.478	0.030	0.022					0.874
1994	0.052	2.234	0.077							2.363
1995	0.011	0.342	0.507							0.860
1996		0.761	1.282	0.114	0.006					2.163
1997		0.494	1.508	0.351	0.020	0.036				2.409
1998		0.012	0.590	0.262	0.018	0.011				0.893
1999	0.061	0.347	0.940	0.379	0.037					1.764
2000	0.074	1.383	2.303	0.494	0.100	0.092	0.014	0.028		4.488
2001	0.011	1.244	1.083	0.307	0.027		0.011	0.017		2.700
2002	0.325	2.681	1.302	0.178	0.047	0.036				4.569
2003	0.133	3.059	1.254	0.256	0.037	0.028	0.006		0.010	4.783
2004	0.026	0.589	1.455	0.136	0.011	0.010				2.227
2005		1.557	2.049	1.350	0.446	0.096	0.015	0.015	0.017	5.545
2006	0.336	0.586	3.745	0.559	0.043	0.023	0.016			5.308
2007	0.399	0.500	0.401	1.039	0.168	0.067	0.016			2.590
Mea	0.103	0.835	0.939	0.233	0.057	0.032	0.013	0.020	0.014	2.011

Table 102. MADMF seine survey: total catch of age-0 summer flounder.

Year	Total catch
1982	3
1983	3
1984	1
1985	19
1986	5
1987	4
1988	2
1989	3
1990	11
1991	4
1992	0
1993	2
1994	1
1995	13
1996	7
1997	0
1998	12
1999	13
2000	10
2001	1
2002	70
2003	11
2004	4
2005	0
2006	43
2007	
Mean	10

Table 103. CTDEP spring trawl survey: summer flounder index of abundance, geometric mean number per tow at age. CTDEP lengths aged with NEFSC spring trawl survey age-length keys.

Year	Age								
	0	1	2	3	4	5	6	7+	Total
1984	0.000	0.314	0.271	0.044	0.000	0.000	0.000	0.000	0.629
1985	0.000	0.015	0.325	0.040	0.058	0.003	0.000	0.000	0.441
1986	0.000	0.753	0.100	0.082	0.008	0.006	0.000	0.000	0.949
1987	0.000	0.951	0.086	0.014	0.004	0.001	0.000	0.001	1.057
1988	0.000	0.232	0.223	0.035	0.009	0.001	0.000	0.000	0.500
1989	0.000	0.013	0.049	0.024	0.016	0.000	0.000	0.000	0.102
1990	0.000	0.304	0.022	0.013	0.006	0.001	0.000	0.001	0.347
1991	0.000	0.392	0.189	0.029	0.028	0.001	0.000	0.000	0.639
1992	0.000	0.319	0.188	0.021	0.004	0.023	0.000	0.000	0.555
1993	0.000	0.320	0.151	0.015	0.018	0.003	0.000	0.001	0.508
1994	0.000	0.496	0.314	0.025	0.018	0.005	0.000	0.002	0.860
1995	0.000	0.199	0.051	0.020	0.005	0.000	0.000	0.006	0.281
1996	0.000	0.578	0.266	0.086	0.023	0.004	0.000	0.004	0.961
1997	0.000	0.391	0.507	0.057	0.036	0.004	0.002	0.002	0.999
1998	0.000	0.064	0.594	0.503	0.116	0.006	0.025	0.002	1.310
1999	0.000	0.245	0.593	0.385	0.139	0.053	0.025	0.000	1.440
2000	0.000	0.321	0.726	0.524	0.074	0.111	0.034	0.000	1.790
2001	0.000	0.841	0.340	0.365	0.120	0.043	0.032	0.007	1.748
2002	0.000	1.057	1.264	0.465	0.233	0.087	0.044	0.035	3.185
2003	0.000	1.608	1.016	0.395	0.232	0.085	0.046	0.039	3.421
2004	0.000	0.259	0.818	0.410	0.194	0.032	0.077	0.048	1.838
2005	0.000	0.253	0.264	0.150	0.033	0.036	0.039	0.029	0.804
2006	0.000	0.038	0.360	0.068	0.065	0.034	0.026	0.022	0.613
2007	0.000	1.152	0.210	0.560	0.316	0.115	0.089	0.065	2.507
Mean	0.000	0.463	0.372	0.180	0.073	0.027	0.018	0.011	1.145

Table 104. CTDEP autumn trawl survey: summer flounder index of abundance, geometric mean number per tow at age. CTDEP lengths aged with NEFSC autumn trawl survey age-length keys.

Year	Age								
	0	1	2	3	4	5	6	7	Total
1984	0.000	0.571	0.331	0.072	0.014	0.004	0.004	0.003	0.999
1985	0.240	0.339	0.528	0.075	0.001	0.008	0.000	0.000	1.191
1986	0.172	1.170	0.298	0.072	0.006	0.001	0.000	0.000	1.719
1987	0.075	1.067	0.223	0.033	0.003	0.000	0.000	0.000	1.401
1988	0.015	0.884	0.481	0.037	0.002	0.001	0.000	0.000	1.420
1989	0.000	0.029	0.095	0.015	0.001	0.000	0.000	0.000	0.140
1990	0.032	0.674	0.110	0.042	0.007	0.005	0.000	0.000	0.870
1991	0.036	0.826	0.340	0.036	0.013	0.005	0.004	0.000	1.260
1992	0.013	0.570	0.366	0.046	0.016	0.009	0.000	0.000	1.020
1993	0.084	0.827	0.152	0.039	0.003	0.001	0.002	0.001	1.109
1994	0.132	0.300	0.085	0.024	0.009	0.000	0.000	0.000	0.550
1995	0.023	0.384	0.117	0.012	0.002	0.001	0.000	0.002	0.541
1996	0.069	0.887	1.188	0.042	0.005	0.000	0.000	0.000	2.191
1997	0.033	0.681	1.373	0.373	0.021	0.014	0.004	0.001	2.500
1998	0.000	0.269	1.054	0.321	0.054	0.021	0.000	0.000	1.719
1999	0.044	0.679	1.484	0.346	0.114	0.011	0.002	0.000	2.680
2000	0.112	0.395	0.871	0.341	0.124	0.043	0.011	0.013	1.910
2001	0.021	2.689	1.137	0.436	0.110	0.018	0.005	0.001	4.417
2002	0.442	3.087	1.930	0.479	0.123	0.031	0.024	0.005	6.121
2003	0.000	1.459	1.319	0.407	0.087	0.091	0.016	0.009	3.388
2004	0.255	0.385	0.755	0.440	0.080	0.024	0.015	0.000	1.954
2005	0.067	1.093	0.744	0.355	0.087	0.032	0.012	0.020	2.410
2006	0.098	0.217	0.592	0.230	0.096	0.044	0.021	0.018	1.315
2007	0.130	0.567	0.387	0.468	0.201	0.078	0.041	0.016	1.888
Mean	0.087	0.835	0.665	0.198	0.049	0.018	0.007	0.004	1.863

Table 105. RIDFW autumn trawl survey summer flounder index of abundance. RIDFW lengths aged with NEFSC autumn trawl survey age-length keys.

Year	Age										
	0	1	2	3	4	5	6	7	8	9	Total
1981	0.30	0.97	1.74	0.20	0.01	0.00	0.00	0.00	0.00	0.00	3.24
1982	0.02	0.21	0.52	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.83
1983	0.03	0.14	0.42	0.11	0.01	0.00	0.00	0.00	0.00	0.00	0.71
1984	0.02	0.74	0.49	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.35
1985	0.35	0.31	0.28	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.97
1986	0.35	2.45	0.51	0.13	0.00	0.01	0.00	0.00	0.00	0.00	3.46
1987	0.04	0.94	0.37	0.02	0.04	0.00	0.00	0.00	0.00	0.00	1.42
1988	0.00	0.34	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58
1989	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
1990	0.05	0.67	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84
1991	0.00	0.12	0.08	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.22
1992	0.01	0.77	0.41	0.11	0.07	0.00	0.00	0.00	0.00	0.00	1.38
1993	0.01	0.41	0.22	0.07	0.00	0.00	0.03	0.00	0.00	0.00	0.74
1994	0.04	0.12	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
1995	0.02	0.53	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.76
1996	0.10	0.95	1.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	2.09
1997	0.03	0.56	0.96	0.30	0.02	0.02	0.00	0.00	0.00	0.00	1.89
1998	0.00	0.09	0.36	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.54
1999	0.02	1.04	1.91	0.35	0.02	0.01	0.00	0.00	0.00	0.00	3.35
2000	0.40	0.50	1.24	0.45	0.14	0.03	0.00	0.00	0.00	0.00	2.76
2001	0.00	1.05	0.63	0.30	0.09	0.07	0.01	0.00	0.00	0.00	2.15
2002	0.44	2.42	1.38	0.40	0.08	0.02	0.03	0.03	0.00	0.00	4.79
2003	0.10	2.35	2.08	0.49	0.12	0.04	0.06	0.00	0.00	0.00	5.24
2004	0.03	0.48	1.30	0.78	0.19	0.06	0.01	0.00	0.00	0.00	2.85
2005	0.01	0.84	1.38	0.69	0.15	0.14	0.01	0.04	0.03	0.00	3.29
2006	0.10	0.14	1.13	0.44	0.16	0.02	0.01	0.00	0.00	0.00	2.00
2007	0.08	0.43	0.86	1.35	0.34	0.13	0.08	0.02	0.00	0.03	3.32
Mean	0.09	0.72	0.74	0.24	0.05	0.02	0.01	0.00	0.00	0.00	1.89

Table 106. RIDFW monthly fixed station trawl survey summer flounder index of abundance. RIDFW lengths aged with NEFSC spring and autumn trawl survey age-length keys.

Year					Age							
	0	1	2	3	4	5	6	7	8	9	2+	Total
1990	0.02	0.17	0.04	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.10	0.29
1991		0.07	0.08								0.08	0.15
1992	0.01	0.15	0.13	0.04	0.01						0.18	0.34
1993	0.01	0.11	0.09	0.04			0.01				0.14	0.26
1994	0.04	0.08	0.04		0.01						0.05	0.17
1995	0.03	0.02	0.02	0.01							0.03	0.08
1996	0.02	0.41	0.40	0.13							0.53	0.96
1997	0.04	0.17	0.38	0.13	0.01						0.52	0.73
1998		0.07	0.24	0.11	0.01						0.36	0.43
1999	0.03	0.26	0.37	0.17	0.05	0.02					0.61	0.90
2000	0.09	0.63	1.22	0.49	0.12	0.05	0.01				1.89	2.61
2001	0.01	0.42	0.28	0.15	0.06	0.04	0.02				0.55	0.98
2002	0.11	0.81	0.63	0.30	0.11	0.05		0.02			1.11	2.03
2003	0.05	1.48	1.44	0.45	0.24	0.08	0.04				2.25	3.78
2004	0.10	0.54	0.88	0.46	0.13	0.04	0.02				1.53	2.17
2005	0.04	0.55	0.98	0.53	0.17	0.16	0.02	0.03	0.01		1.90	2.49
2006	0.00	0.24	0.47	0.29	0.23	0.06	0.02	0.01			1.08	1.32
2007	0.04	0.25	0.51	0.55	0.20	0.07	0.05	0.01			1.39	1.68
Mean	0.04	0.36	0.46	0.24	0.10	0.06	0.02	0.01	0.01	0.00	0.79	1.19

Table 107. NJBMF trawl survey, April - October: index of summer flounder abundance. NJBMF lengths aged with NEFSC autumn trawl survey age-length keys.

Year	Age					
	0	1	2	3	4+	Total
1988	0.17	3.06	1.03	0.00	0.00	4.26
1989	1.00	0.51	0.18	0.00	0.00	1.69
1990	1.28	1.44	0.11	0.03	0.00	2.86
1991	1.00	2.69	0.27	0.02	0.00	3.98
1992	1.10	3.00	0.57	0.06	0.02	4.75
1993	2.55	5.69	0.20	0.01	0.01	8.46
1994	1.66	1.07	0.08	0.00	0.02	2.83
1995	4.95	2.93	0.28	0.05	0.16	8.37
1996	1.66	5.10	2.70	0.18	0.05	9.69
1997	1.65	8.25	5.25	1.02	0.18	16.35
1998	0.67	5.80	2.67	0.29	0.04	9.47
1999	1.03	6.12	3.46	0.65	0.18	11.44
2000	0.95	3.91	1.82	0.45	0.22	7.35
2001	0.62	3.32	1.18	0.41	0.15	5.68
2002	1.51	9.11	4.13	1.28	0.81	16.84
2003	0.60	5.61	2.55	0.57	0.51	9.84
2004	0.90	6.27	2.49	0.57	0.43	10.66
2005	3.11	5.99	1.24	0.53	0.32	11.19
2006	0.81	5.74	3.22	0.48	0.40	10.65
2007	0.64	4.10	2.49	1.22	0.53	8.98
Mean	1.39	4.49	1.80	0.39	0.20	8.27

Table 108. DEDFW 16 foot trawl survey: index of summer flounder recruitment at age-0 in the Delaware Estuary.

Year	Geometric Mean number per tow
1980	0.12
1981	0.06
1982	0.11
1983	0.03
1984	0.08
1985	0.06
1986	0.10
1987	0.14
1988	0.01
1989	0.12
1990	0.23
1991	0.07
1992	0.31
1993	0.03
1994	0.29
1995	0.17
1996	0.03
1997	0.02
1998	0.03
1999	0.05
2000	0.18
2001	0.07
2002	0.07
2003	0.09
2004	0.10
2005	0.00
2006	0.02
2007	0.03
Mean	0.09

Table 109. DEDFW 16 foot trawl survey: index of summer flounder recruitment at age-0 in the Delaware Inland Bays.

Year	Geometric Mean number per tow
1986	0.317
1987	0.258
1988	0.013
1989	0.139
1990	0.361
1991	0.378
1992	0.368
1993	0.047
1994	0.571
1995	0.301
1996	0.080
1997	0.222
1998	0.390
1999	0.350
2000	0.205
2001	0.142
2002	0.125
2003	0.214
2004	0.268
2005	0.012
2006	0.170
2007	0.170
Mean	0.232

Table 110. DEDFW Delaware Bay 30 foot trawl survey: index of summer flounder abundance.

Year	Age					
	0	1	2	3	4+	Total
1991	1.44	1.13	0.18	0.04	0.00	2.79
1992	0.47	0.28	0.08	0.00	0.00	0.83
1993	0.04	1.56	0.73	0.07	0.00	2.40
1994	2.28	0.14	0.22	0.08	0.00	2.72
1995	0.94	1.00	0.28	0.10	0.09	2.41
1996	0.46	0.73	0.48	0.10	0.02	1.79
1997	0.03	0.12	0.49	0.47	0.16	1.27
1998	0.11	0.31	0.83	0.29	0.12	1.66
1999	0.20	0.06	0.77	0.47	0.19	1.69
2000	0.79	0.24	0.30	0.28	0.23	1.84
2001	0.34	1.55	0.49	0.26	0.13	2.77
2002	0.04	0.23	0.09	0.00	0.03	0.39
2003	0.15	0.14	0.29	0.15	0.12	0.85
2004	0.02	0.07	0.06	0.01	0.02	0.18
2005	0.00	0.30	0.11	0.02	0.01	0.44
2006	0.41	0.10	0.23	0.07	0.02	0.83
2007	0.11	0.14	0.83	0.09	0.12	1.29
Mean	0.46	0.48	0.38	0.15	0.07	1.54

Table 111. MD DNR Coastal Bays trawl survey: index of summer flounder recruitment at age-0. Geometric mean (re-transformed ln[number per hectare + 1])

Year	Geometric mean number/tow	Lower 95% CI	Upper 95% CI
1972	34.351	1.532	87.888
1973	10.321	1.356	19.267
1974	12.311	1.277	20.165
1975	3.606	1.190	5.104
1976	4.207	1.218	6.246
1977	4.337	1.258	6.894
1978	5.731	1.203	8.295
1979	6.715	1.279	11.060
1980	7.395	1.357	13.837
1981	8.849	1.261	14.123
1982	3.408	1.405	6.983
1983	17.699	4.384	10223.618
1984	13.310	1.359	24.738
1985	12.843	1.305	22.076
1986	59.526	1.616	161.427
1987	7.584	1.444	16.018
1988	1.763	1.135	2.267
1989	2.855	1.162	3.843
1990	4.733	1.142	6.156
1991	7.337	1.156	9.772
1992	8.487	1.164	11.461
1993	4.145	1.141	5.383
1994	22.311	1.165	30.194
1995	13.067	1.156	17.404
1996	6.493	1.147	8.509
1997	7.997	1.161	10.752
1998	14.983	1.149	19.708
1999	8.565	1.152	11.326
2000	9.874	1.167	13.407
2001	13.543	1.169	18.442
2002	5.406	1.145	7.066
2003	8.180	1.163	11.035
2004	6.993	1.158	9.350
2005	2.198	1.112	2.709
2006	9.658	1.155	12.843
2007	15.438	1.156	20.573
Mean	10.728		

Table 112. VIMS juvenile fish trawl survey: index of summer flounder recruitment at age-0. Includes all available data and incorporates gear conversion factors from studies conducted in the late 1990s. There was no survey in 1960.

Year	Geometric mean catch per trawl	Lower 95% confidence limit	Upper 95% confidence limit	Number of stations
1955	0.00	0.00	0.00	2
1956	4.44	2.91	6.56	29
1957	2.14	1.22	3.42	28
1958	1.48	0.23	4.00	27
1959	0.06	-0.03	0.15	27
1960				
1961	0.19	0.12	0.61	11
1962	0.00	0.00	0.00	7
1963	2.07	0.78	4.29	12
1964	0.65	0.54	0.76	16
1965	0.74	0.27	1.39	13
1966	0.00	0.00	0.00	17
1967	0.43	-0.17	1.46	27
1968	0.14	-0.05	0.36	27
1969	0.20	0.04	0.38	27
1970	0.04	-0.02	0.10	29
1971	3.72	3.43	4.04	129
1972	0.85	0.79	0.92	84
1973	1.27	0.77	1.89	94
1974	0.82	0.31	1.51	32
1975	0.14	0.00	0.30	22
1976	0.57	0.32	0.86	68
1977	1.67	1.16	2.31	36
1978	1.24	0.47	2.40	36
1979	2.94	2.74	3.15	50
1980	10.69	6.49	17.25	70
1981	3.97	2.39	6.31	67
1982	2.27	1.54	3.21	64
1983	5.01	3.62	6.82	60
1984	1.58	0.96	2.39	41
1985	1.26	0.52	2.37	27
1986	1.26	0.77	1.89	53
1987	0.39	0.20	0.63	52
1988	0.54	0.35	0.75	143
1989	1.24	0.94	1.58	162

Table 112 continued.

Year	Geometric mean catch per trawl	Lower 95% confidence limit	Upper 95% confidence limit	Number of stations
1990	2.54	2.06	3.09	162
1991	2.64	2.14	3.22	207
1992	0.89	0.68	1.12	187
1993	0.50	0.36	0.65	185
1994	2.41	1.91	2.99	186
1995	0.63	0.46	0.82	218
1996	0.81	0.62	1.02	224
1997	0.89	0.69	1.12	226
1998	0.73	0.55	0.93	226
1999	0.53	0.41	0.67	219
2000	0.57	0.43	0.73	227
2001	0.47	0.34	0.61	236
2002	0.77	0.54	1.04	179
2003	0.44	0.33	0.56	225
2004	1.30	1.03	1.60	225
2005	0.35	0.25	0.46	225
2006	0.80	0.60	1.02	203
2007				
Mean	1.41			

Table 113. North Carolina Division of Marine Fisheries (NCDMF) Pamlico Sound trawl survey: June index of summer flounder recruitment at age-0.

Year	Mean number per tow	CV (%)
1987	19.86	14
1988	2.61	34
1989	6.63	17
1990	4.27	18
1991	5.85	24
1992	9.14	19
1993	5.13	24
1994	8.17	24
1995	6.65	25
1996	30.67	18
1997	14.14	21
1998	10.44	41
1999	n/a	n/a
2000	3.94	21
2001	22.03	15
2002	18.28	18
2003	7.23	24
2004	5.90	20
2005	9.88	22
2006	1.96	22
2007	3.62	22
Mean	9.82	22

Table 114. Commercial fishery landings (by year and division), 1967-2006.

	Divisions						
YEAR	**51**	**52**	**53**	**61**	**62**	**63**	**99**
1967	1	210	177	0			104
1968		42	93	33	4		42
1969	0	24	59	26	0		29
1970	1	12	42	26			34
1971	0	29	48	23			37
1972		10	55	39	1		34
1973	0	47	282	67	3	0	64
1974	27	289	1189	183	3		148
1975	17	279	1508	174	0		157
1976	23	648	2604	1312	52		166
1977	26	817	937	526	3	1	96
1978	8	668	1112	1032	1536	8	99
1979	5	764	766	1092	1840		87
1980	4	302	341	912	1289		47
1981	19	569	763	901	975	0	142
1982	214	787	1355	1041	2429	609	165
1983	61	1110	1628	1026	3762	1526	148
1984	18	1130	1040	1273	4050	2303	243
1985	80	1406	2259	1494	2854	975	346
1986	24	1232	2535	2723	1871	569	349
1987	22	948	2322	2152	3130	749	193
1988	81	1055	1825	2684	4467	802	151
1989	13	926	1488	994	2078	625	80
1990	2	228	725	412	873	644	80
1991	5	193	972	1119	1666	590	100
1992	9	325	1250	1390	2317	819	251
1993	11	287	816	1222	1777	216	153
1994	37	336	958	1465	1583	351	250
1995	22	336	978	1657	1361	295	261
1996	14	251	734	1314	1248	136	249
1997	21	103	699	1132	811	905	321
1998	11	96	769	1212	1271	1177	539
1999	8	132	748	1180	1439	777	533
2000	13	128	760	1547	1552	568	526
2001	12	120	723	1401	1638	583	484
2002	28	189	899	1915	2428	561	551
2003	26	212	1019	1986	2309	417	515
2004	7	232	1496	2705	2925	340	439
2005	24	240	1035	2334	3271	453	468
2006	17	110	860	2787	1954	175	359
Total	912	16822	39869	46511	60771	17173	9041

Table 115. Initial run configurations tested in building the ASAP model framework for summer flounder.

Run ID	Obj Func	Selex Blocks	Selex Est	Fishery ESS	SV CVs	SSB2006	F2006	Notes
SELEX_2_NEC	3958.1	2; 1994/1995	By Age; 0-3	Comm trips	0.40 all	21,248	0.81	Lambdas defaults
Next, iterated FISHERY ESS to find a reasonable constant level								
SELEX_2_NEC_300	4184.6	2; 1994/1995	By Age; 0-3	300	0.40 all	25,190	0.63	ESS set too high
SELEX_2_NEC_200	3007.3	2; 1994/1995	By Age; 0-3	200	NECW = 0.15 NECS = 0.25 NECF = 0.25	26,880	0.55	ESS Pattern even
Next, tested sensitivity to SELEX blocks; based on pattern in CAA								
SELEX_93_94	2979.8	2; 1993/1994	By Age; 0-3	200	same	29,570	0.49	Noisy F-pattern near break
SELEX_94_95	3007.3	2; 1994/1995	By Age; 0-3	200	same	26,880	0.55	Smooth F-pattern through break
SELEX_95_96	2972.8	2; 1995/1996	By Age; 0-3	200	same	24,183	0.64	Big shift in F-pattern at break
SELEX_96_97	2927.7	2; 1996/1997	By Age; 0-3	200	same	21,550	0.76	Big shift in F-pattern at break
SELEX_97_98	2975.8	2; 1997/1998	By Age; 0-3	200	same	22,700	0.70	Big shift in F-pattern at break
Therefore, retained 1994/1995 SELEX break for blocks								

Table 116. Tuning run configurations tested in building the ASAP model framework for summer flounder.

Starting Point is Run SELEX_94_95, based on diagnostics and fit chracterisitcs
Add agreed State SV Indices from ADAPT VPA F08_BASE Index selection exercise
Tuning of run using Fishery ESS and SV CVs, SELEX pattern
Catch Lambda = 10, all SVs = 1, all SELEX parms = 1, S-R = 0

Run ID	**Obj Func**	**Selex Blocks**	**Selex Est**	**Fishery ESS**	**SV CVs**	**SSB2006**	**F2006**	**Notes**
SELEX_94_95	3304.6	2; 1994/1995	By-Age; 0-3	200	NECW = 0.15	35,943	0.41	Large Spike in 1990 ESS, but F-pattern good
(BASE)					NECS, F = 0.25			Block 1 SELEX has "dip" at age 3
					State = 0.4			
F08_BASE_T1	3238.2	2; 1994/1995	By-Age; 0-3	Input BASE	NECW = 0.15	36,625	0.40	Large Spike in 1990 ESS, but rest fit well
S-R function Lambdas set to 0				Estimated	NECS, F = 0.25			Good fit to Fishery age-comps
					State = 0.4			Block 1 SELEX still has "dip" at age 3
F08_BASE_T2	3309.6	2; 1994/1995	By-Age; 0-3	Average Block	NECW = 0.15	36,200	0.41	Did not fix SELEX "dip"
				ESS (186, 181)	NECS, F = 0.25			
					State = 0.4			
F08_BASE_T3	3268.7	2; 1994/1995	Fit Single	Input BASE	NECW = 0.15	36,400	0.40	Fixed SELEX "dip"
			Logistic	Estimated	NECS, F = 0.25			Block 1: S1 @ age 2
					State = 0.4			Block 2: S1 @ age 3
F08_BASE_T4	3621.5	2; 1994/1995	Fit Single	Input BASE	NECW = 0.16	38,044	0.38	Different spikes in ESS (85,89,92)
			Logistic	Estimated	NECS = 0.21			Poorer fit to Fish age-comps
					NECF = 0.31			Hard to discern sig. better fit to indices
					MAS,F = 0.21			
					State = 0.40			
F08_BASE_T5	2432.13	2; 1994/1995	Fit Single	Input BASE	NECW = 0.30	38,570	0.38	One "unfit" spike in ESS (88)
Increased SV CVs			Logistic	Estimated	NECS = 0.40			Slightly better fit to Fish age-comps
by ~1.5-2X					NECF = 0.60			Marginally better fit to indices
					State = 0.60			

USED F08_BASE_T5 as basis for RETRO, MCMC, and BRPs

Table 117. Initial run configurations tested in building the SS2 model framework for summer flounder.

Run ID	**Parm N**	**Like**	**Gradient**	**Selex**	**SSB2006**	**F2006**
SELEX_1_p1	56	1525	0.001860	Est. peak @ 3-4	49,000	0.31
SELEX_1_p2	57	1226	7.486000	Est. peak @ 2	46,000	0.30
SELEX_1_p3	58	1226	2.214000	Est. peak @ 2	46,000	0.30
SELEX_1_p3A	*58*	*1197*	*0.005829*	*Allowed Dome @ 5+*	*67,000*	*0.33*
SELEX_2_p1	57	1561	0.000598	Est. peak @ 2 to 3	64,000	0.22
SELEX_2_p2	59	1233	0.002427	Est. peak @ 2 to 3	54,000	0.25
SELEX_2_p3	61	1234	5.255000	Est. peak @ 2 to 3	54,000	0.25
SELEX_3_p1	**58**	**1502**	**0.025160**	**Est. peak @ 2 to 4**	**51,000**	**0.31**
SELEX_3_p2	**61**	**1174**	**0.001670**	**Est peak @ 2 to 3**	**50,000**	**0.28**
SELEX_3_p3	64	1174	5.463000	Est peak @ 2 to 3	50,000	0.28

SELEX_2 time period are 1982-1988, 1989-2006
SELEX_3 time period are 1982-1988, 1989-1992, 1993-2006
All runs except SELEX_1_p3A fit logistic fishery selection

Attempts to fit 3 selex params: gradient too high
Attempts to fit 1 period: gradient too high, and/or relatively poor fit to fishery age comps
Runs with 3 time blocks and 1 or 2 SELEX params estimated fit fishery age comps best

Next step: alter dimensions of 3 periods, fit 1 or 2 SELEX params

Table 118. Second round of configurations tested in building the SS2 model framework for summer flounder.

Run ID	Parm N	Like	Gradient	Selex	SSB2006	F2006	
SELEX_3A time period are 1982-1988, 1989-1994, 1995-2006							
SELEX_3A_p1	58	1444	0.188900	age 3/4 to age 4/5	31,000	0.71	**NOTE; Hit Finitial constraint = F = 2.0**
SELEX_3A_p2	61	1170	0.013730	age 2 to 3	34,000	0.46	**NOTE: Periods 1 and 2 have nearly same selex pattern**
SELEX_2B time period are 1982-1994, 1995-2006							
SELEX_2B_p2	59	1171	0.000638	age 2 to 3	34,000	0.46	NOTE: Eff N to Obs N good; follows age comps well
CL100	59	1168	0.000318	age 2 to 3	33,600	0.47	NOTE: Eff N to Obs N good; follows age comps well
CL10	59	1147	0.000068	age 2 to 3	31,700	0.51	NOTE: Eff N to Obs N often >1; follows age comps well
CL1	59	1171	0.000638	age 2 to 3	33,800	0.46	NOTE: Eff N to Obs N good; follows age comps well

Table 119. Third round of configurations tested in building the SS2 model framework for summer flounder.

Run ID	Parm N	Like	Gradient	Selex	SSB2006	F2006	NOTES
Starting from SELEX_2B_p2_CL10							
Incorporate MMs recommendations to configure F08_NEC							
F08_NEC	68	1642	0.000200	age 2; 0.99 to 0.94	91,672	0.15	**Recruit (YOY) and Age-1 estimates do not follow indices**
Recruit devs begin in 1972							**SELEX barely changes**
Recruits devs follow S-R function							
Estimate R0 and R1 offset							
F08_NEC_SR1	58	647	0.000085	age 2; 0.99 to 0.94	92,200	0.15	**Recruit (YOY) and Age-1 estimates do not follow indices**
Recruit devs begin in 1982							**Allows more variability than F08_NEC, however**
							SELEX barely changes
F08_NEC_SR2	58	1152	0.000185	age 2; 0.99 to 0.70	31,627	0.54	**Recruit (YOY) and Age-1 estimates follow indices**
S-R function lambda set = 0.0001							**SELEX changes substantially (as expected)**
F08_NEC_SR3	59	1152	0.000424	age 2; 0.99 to 0.70	32,587	0.54	**Recruit (YOY) and Age-1 estimates follow indices**
S-R function lambda set = 0							**SELEX changes substantially (as expected)**
Estimate S-R steepness, R0, R1 offset							**Recruits in 1982-1983 low relative to other models**
							B-H Steepness = 0.93
F08_NEC_SR4	69	1145	0.000029	age 2; 0.99 to 0.70	31,803	0.54	**WARNING: Hessian not positive definite**
S-R function lambda set = 0							**B-H Steepness = 0.99**
Estimate S-R steepness, R0, R1 offset							**No improvement in SV fits**
Reset Recruit devs to begin in 1972							
So, go back to F08_NEC_SR3 and add State Indices to build F08_BASE							

Table 120. Tuning run configurations tested in building the SS2 model framework for summer flounder.

Run ID	Parm N	Like	Gradient	Selex	SSB2006	F2006	NOTES
Incorporate State SV Indices to F08_NEC_SR3 to build F08_BASE							
F08_BASE	59	3026	0.000027	age 2; 0.99 to 0.77	44,430	0.34	**Recruit (YOY) and Age-1 estimates follow indices**
S-R function lambda set = 0							**SELEX changes substantially (as expected)**
Estimate S-R steepness, R0, R1 offset							**Recruits in 1982-1983 low relative to other models**
Recruit devs to begin in 1982							**B-H Steepness = 0.92**
							B-H Alpha ~45% higher than in ASAP T5 run
F08_BASE_T1	59	3068	0.000077	age 2; 0.99 to 0.71	39,950	0.40	**Recruit (YOY) and Age-1 estimates follow indices**
Used ESS/OSS ratio							**SELEX changes substantially (as expected)**
to tune Fishery age comps							**Recruits in 1982-1983 low relative to other models**
Var. adj. = 1.863x							**B-H Steepness = 0.94**
							B-H Alpha ~20% higher than in ASAP T5 run
							Improved ESS/OSS ratio
F08_BASE_T2	59	1050	0.000543	age 2; 0.99 to 0.68	38,820	0.43	**Recruit (YOY) and Age-1 estimates follow indices**
Increased SV CVs to 0.3, 0.4, 0.6							**SELEX changes substantially (as expected)**
(as in ASAP T5 run)							**Recruits in 1982-1983 low relative to other models**
Var. Adj. = +0.14, +0.19, +0.20							**B-H Steepness = 0.94**
							B-H Alpha ~30% higher than in ASAP T5 run
							Change due to SV CVs smaller than change due to ESS/OSS ratio
							Increased SV CV allows more fits thru CIs; doesn't fix 2000s resids
							Good fits to Fishery agecomps; no residual patterns

Table 121. Mohn's rho diagnostic statistic from retrospective analyses for the ADAPT VPA, ASAP, and SS2 BASE case model runs.

Mohn rho
(Relative Proportional Difference from Terminal Year = 2006)

F (3-5)

Year	ADAPT	ASAP	SS2
1997	0.2460	-0.2719	-0.5658
1998	-0.3178	-0.1133	-0.4886
1999	-0.5637	-0.0619	-0.2764
2000	-0.6018	-0.2570	-0.2972
2001	-0.6091	-0.2594	-0.3180
2002	-0.4943	-0.3555	-0.3638
2003	-0.4248	-0.3783	-0.4181
2004	-0.2526	-0.3232	-0.3708
2005	-0.1492	-0.0924	-0.1189
Sum	-3.1673	-2.1129	-3.2175

SSB

Year	ADAPT	ASAP	SS2
1997	0.2924	0.0714	0.4273
1998	0.2194	-0.0753	0.3297
1999	0.5344	-0.0451	0.1178
2000	0.7069	0.1988	0.1935
2001	0.5506	0.2808	0.2692
2002	0.5960	0.4007	0.3361
2003	0.5449	0.6018	0.5121
2004	0.2286	0.4355	0.3822
2005	0.0727	0.0877	0.0788
Sum	3.7459	1.9563	2.6465

Table 122. Alternative configurations tested for the ASAP model framework for summer flounder.

Starting Point is Run F08_BASE_T5

Run ID	Obj Func	Selex Blocks	Selex Est	Fishery ESS	SV CVs	SSB2006	F2006	Notes
F08_MULTI	15241	variable	variable	Input BASE Estimated or 10	Like BASE T4	24,900	0.55	Variable early Fs Lower than BASE Generally Lower SSB than BASE Difficulty fitting Comm Disc Ages Late 90s/Early 00s SV resids still evident S-R params infeasible
F08_SVAgecomp	28953	2; 1994/1995	single logistic	Input BASE Estimated or 10	Like BASE T4	39173	0.38	Comparable to BASE Matches fishery age comps well Late 90s/Early 00s SV resids still evident S-R steepness = 1
F08_MULTI_SVAge	45830	variable	variable	Input BASE Estimated or 10	Like BASE T4	23800	0.59	Variable mid-series F pattern Generally Lowest SSB estimates Difficulty fitting Comm Disc Ages Late 90s/Early 00s SV resids still evident in most SVs S-R params infeasible

Table 123. Alternative configurations tested for the SS2 model framework for summer flounder.

Run ID	Parm	N Like	Gradient	Selex	SSB2006	F2006	NOTES
Alternative configurations using F08_BASE_T2 data and general settings							
F08_MULTI	200	4950.8	0.003016	variable	39,500	0.43	**Comm & Rec Land SELEX "steeper" than BASE_F2**
Models each fishery component seperately - 6 fishery CAA							**TRWL Disc SELEX flat**
Landings use flat pattern							**SCAL Disc and REC disc strongly domed**
Discards use dome pattern							**B-H Steepness = 0.88**
"Untuned"							**Slightly Higher historical F than BASE_T2**
							Some SELEX bounds hit
							Positive late90s/early00s resids persist in age 3-5 SVs
F08_SVAgecomp	79	2882.8	0.000087	age 2	36,500	0.44	**Fishery SELEX "steeper" than BASE_F2**
Single fishery CAA - flat pattern							**Surveys SELEX full (S=1) at ages 1 to 3**
Surveys with multiple ages modeled as multinomial							**B-H Steepness = 0.95**
Stand-alone age 0 inidces modeled as lognormal							**10% to 40% higher historical F than BASE_T2**
"Untuned"							**Some SELEX bounds hit**
							Positive late90s/early00s resids in all aggregate SVs
F08_MULTI_SVAGE	220	4856.1	0.000140	variable	48,300	0.35	**Comm & Rec Land SELEX LESS "steep" than BASE_F2**
Combines MULTI and SVAgecomp configurations							**TRWL Disc SELEX flat**
"Untuned"							**SCAL Disc and REC disc strongly domed**
							Surveys SELEX full (S=1) at ages 1 to 3
							B-H Steepness = 0.94
							Higher historical F than BASE_T2
							Lowest Current F; highest SSB
							Some SELEX bounds hit
							Positive late90s/early00s resids in all aggregate SVs

Table 124. Results from the sex-structured stock assessment model and sensitivity analyses. Fmult is the amount that the 2005-2007 average fishing mortality would have to be scaled to produce MSY.

	Basecase	asymptotic	h75	M0.2	MFem0.2 MMale0.3	MFem0.2 MMaleest	Sage	Start82	Re-weighting
Likelihood	2744.4	3710.4	2887.5	3491.11	3060.5	2749.7	2839.4	2415.8	756.2
Gradient	0.0008	0.0059	0.0011	0.0004	0.0008	0.0769	0.0008	0.0342	0.0011
S1976/S0	0.31	0.41	0.23	0.20	0.19	0.17	0.28		0.41
S2008/S0	0.26	0.25	0.18	0.25	0.23	0.18	0.24	0.22	0.44
Smsy/S0	0.14	0.13	0.25	0.15	0.13	0.12	0.17	0.13	0.14
Smsy	17242	12984	44290	21510	20795	23804	20272	18385	15949
S2008	32757	24731	31006	36480	37093	33987	28788	30359	51659
S2008/Smsy	1.90	1.90	0.70	1.70	1.78	1.43	1.42	1.65	3.24
C/B1976	0.35	0.33	0.34	0.38	0.40	0.40	0.40		0.29
C/B2007	0.19	0.23	0.19	0.15	0.17	0.20	0.21	0.21	0.13
MSY/B	0.56	0.78	0.30	0.42	0.45	0.44	0.53	0.50	0.70
Fmult	4.69	15.19	1.86	2.85	2.88	2.46	4.08	3.28	12.08
MSY	17893	19607	21780	17618	17628	17475	19189	16450	21389
Mfemale	0.29	0.37	0.34	0.20	0.2	0.20	0.29	0.25	0.35
Mmale	0.54	0.63	0.60	0.20	0.3	0.46	0.46	0.51	0.60
h	1.00	1.00	0.75	1.00	1.00	1.00	1.00	1.00	1.00

Table 125. MSY related quantities from the sex-structured stock assessment model compared to arbitrary Spawning Biomass Ratio (SBR) targets. SBR is the spawning biomass relative to the spawning biomass in the absence of fishing. Fmult is the amount that the 2005-2007 average fishing mortality would have to be scaled to produce the associated SBR.

	Basecase	SBR = 0.3	SBR = 0.4
SBRmsy	0.14	0.30	0.40
Fmult	4.69	1.55	1.07
MSY	17893	16000	14118
SBR2008	0.26	0.26	0.26

Table 126. Summary results for the 2008 assessment final model ASAP F08_T2007_T2 run.

Year	SSB (mt)	Recruits (age 0, 000s)	F (age 3-7+)
1982	24674	73512	1.163
1983	24637	81631	1.481
1984	20984	46683	1.614
1985	18724	56277	1.529
1986	17691	62128	1.737
1987	18338	47220	1.453
1988	10861	12831	2.042
1989	7017	28920	1.544
1990	9576	36843	1.143
1991	9152	31065	1.491
1992	10536	35647	1.527
1993	12099	37235	1.288
1994	15053	42313	1.216
1995	20671	49515	1.712
1996	23327	36764	1.438
1997	24650	36984	0.886
1998	27654	40570	0.797
1999	28054	32113	0.565
2000	30321	39385	0.679
2001	35651	37171	0.498
2002	40412	42130	0.437
2003	43673	31684	0.420
2004	43932	48991	0.457
2005	42081	23981	0.467
2006	41671	28819	0.370
2007	43363	39972	0.288
Mean	24800	41553	1.086

Table 127. January 1 population number (N, 000s) estimates from the 2008 assessment final model ASAP F08_T2007_T2 run.

	Year								
	1982	1983	1984	1985	1986	1987	1988	1989	1990
Age									
0	73512	81631	46683	56277	62128	47220	12831	28920	36843
1	46051	55147	60800	34658	41946	45895	35129	9428	20978
2	20734	21418	22397	23291	13978	14998	18608	11149	3089
3	3070	5228	3980	3664	4136	2029	2859	2017	1923
4	666	748	927	618	619	568	370	290	336
5	237	162	132	144	104	85	103	37	48
6	61	58	29	21	24	14	15	10	6
7+	17	19	14	7	5	4	3	2	2
Total	144349	164410	134963	118678	122941	110813	69919	51853	63225

	Year								
	1991	1992	1993	1994	1995	1996	1997	1998	1999
Age									
0	31065	35647	37235	42313	49515	36764	36984	40570	32113
1	26963	22583	26134	27237	31195	37734	28067	28335	31082
2	8147	9103	8050	9741	10968	20134	25027	19658	19876
3	782	1478	1605	1778	2312	2859	6234	10951	9006
4	478	137	250	345	411	332	538	2020	3855
5	83	84	23	54	80	57	61	171	703
6	12	15	14	5	12	11	10	19	60
7+	2	2	3	4	2	2	2	4	8
Total	67533	69048	73315	81476	94495	97894	96923	101728	96703

	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Age								
0	39385	37171	42130	31684	48991	23981	28819	39972
1	24552	30156	28492	32340	24322	37607	18405	22135
2	21317	17123	21393	20605	23399	17584	27135	13429
3	9906	10272	9231	12197	11854	13205	9846	16180
4	3866	3871	4793	4613	6194	5816	6408	5263
5	1685	1512	1817	2396	2346	3036	2821	3428
6	313	667	718	915	1228	1158	1483	1519
7+	31	137	385	560	762	990	1059	1380
Total	101054	100909	108958	105311	119095	103376	95976	103307

Table 128. Fishing mortality (F) estimates from the 2008 assessment final model ASAP F08_T2007_T2 run.

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990
0	0.027	0.035	0.038	0.034	0.043	0.036	0.048	0.061	0.052
1	0.506	0.641	0.700	0.648	0.769	0.643	0.888	0.856	0.686
2	1.118	1.423	1.550	1.468	1.670	1.397	1.962	1.498	1.113
3	1.162	1.480	1.612	1.528	1.735	1.452	2.040	1.542	1.142
4	1.164	1.481	1.614	1.530	1.737	1.454	2.042	1.544	1.143
5	1.164	1.481	1.614	1.530	1.737	1.454	2.042	1.544	1.143
6	1.164	1.481	1.614	1.530	1.737	1.454	2.043	1.544	1.143
7+	1.164	1.481	1.614	1.530	1.737	1.454	2.043	1.544	1.143

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	0.059	0.050	0.053	0.045	0.012	0.010	0.006	0.006	0.008
1	0.826	0.772	0.727	0.650	0.178	0.151	0.096	0.095	0.117
2	1.447	1.476	1.250	1.178	1.084	0.912	0.567	0.521	0.436
3	1.490	1.526	1.287	1.215	1.690	1.420	0.877	0.794	0.596
4	1.492	1.527	1.288	1.217	1.727	1.451	0.894	0.805	0.577
5	1.492	1.527	1.288	1.217	1.718	1.443	0.888	0.798	0.558
6	1.492	1.527	1.288	1.217	1.713	1.438	0.885	0.794	0.549
7+	1.492	1.527	1.288	1.217	1.711	1.436	0.884	0.792	0.546

Age	2000	2001	2002	2003	2004	2005	2006	2007
0	0.007	0.006	0.004	0.004	0.004	0.005	0.004	0.005
1	0.100	0.083	0.064	0.064	0.064	0.066	0.055	0.064
2	0.470	0.358	0.302	0.293	0.312	0.320	0.257	0.228
3	0.690	0.512	0.444	0.428	0.462	0.473	0.376	0.306
4	0.689	0.506	0.443	0.426	0.463	0.474	0.376	0.295
5	0.677	0.495	0.436	0.418	0.456	0.466	0.369	0.284
6	0.671	0.490	0.432	0.415	0.452	0.463	0.366	0.279
7+	0.669	0.488	0.431	0.413	0.451	0.461	0.365	0.277

Table 129. 2008 assessment Biological Reference Point input data.

Mean Natural Mortality (M) =	0.25
Proportion of mortality before spawning =	0.83

Age	Selectivity on F	Selectivity on M	Jan 1 Stock Weights	Catch Weights	Nov 1 SSB Weights	Maturity
0	0.01	1.00	0.000	0.180	0.243	0.380
1	0.16	0.99	0.296	0.425	0.501	0.910
2	0.70	0.98	0.554	0.685	0.765	0.980
3	1.00	0.97	0.812	0.947	1.038	1.000
4	0.99	0.96	1.087	1.244	1.358	1.000
5	0.97	0.95	1.422	1.616	1.756	1.000
6	0.96	0.94	1.839	2.066	2.225	1.000
7+	0.96	0.92	3.008	3.008	3.122	1.000

Table 130. Comparison of Biological Reference Points from the 2006 assessment (S&T 2006; Methot 2006, Terceiro 2006b) and 2008 assessment (= F08) alternatives. "Deterministic" and "stochastic" refer to estimation method for MSY and SSBMSY.

	ADAPT VPA S&T 2006	ASAP F08_T2007_T2_M20	ASAP F08_T2007_T2
NON-PARAMETRIC	(deterministic) M=0.2	(stochastic) M=0.20	(stochastic) M=0.25
Mean R (000s)	37,010	35,594	41,553
FMSY Proxy	**Fmax**	**F35%**	**F35%**
Fmax or F35% = FMSY	0.280	0.263	0.310
Y/R (kg)	0.579	0.458	0.358
SSB/R (kg)	2.416	2.078	1.443
Mean R MSY (mt)	21,444	16,974	13,122
Mean R SSBMSY(mt)	89,411	85,570	60,074
F40% = Ftarget	0.183	0.219	0.255
Y/R (kg)	0.563	0.442	0.345
SSB/R (kg)	3.397	2.375	1.649
Mean R MSY (mt)	20,837	16,632	12,807
Mean R SSBMSY(mt)	125,723	98,024	68,743
PARAMETRIC			
External Beverton-Holt			
Alpha	36,079	42,126	42,126
Steepness	0.996	0.982	0.997
FMSY	0.260	0.376	0.526
MSY	19,595	19,612	15,754
SSBMSY	92,744	62,583	40,589
Internal Beverton-Holt			
Alpha	n/a	33,373	39,140
Steepness	n/a	0.999	0.999
FMSY	n/a	0.308	0.420
MSY	n/a	16,199	14,686
SSBMSY	n/a	61,664	43,898
External Ricker			
Alpha	n/a	1.750	1.749
Beta	n/a	-0.00005	-0.00005
FMSY	n/a	1.314	1.266
MSY	n/a	19,158	16,919
SSBMSY	n/a	25,922	24,011

Table 131. (page 1). Evaluation of stock status with respect to the 2006 assessment (page 1 of Table; S&T 2006; Methot 2006, Terceiro 2006b), the ADAPT VPA T2007 run (page 2 of Table), and 2008 assessment (page 3 of Table). Biological Reference Point alternatives are based on non-parametric approach. Each page of the table gives results for three values of natural mortality, M. Terminal Year ("term") for "S&T 2006" (page 1) is 2005. For other runs (pages 2 and 3) "term" is 2007. For more details, see "Biological Reference Points" section of this report.

	ADAPT VPA S&T 2006	**ADAPT VPA S&T 2006**	**ADAPT VPA S&T 2006**
NON-PARAMETRIC	(deterministic) M = 0.20	(deterministic) mean M=0.25	(deterministic) mean M=0.33
Fmax	0.280	0.372	0.462
MSY (mt)	21,444	19,096	17,372
SSBMSY(mt)	89,411	65,606	53,650
Fterm	0.410	0.520	0.527
Yterm	13,779	13,779	13,779
SSBterm	47,498	41,449	42,441
Fterm/Fmax	1.46	1.40	1.14
Yterm/MSY	0.64	0.72	0.79
SSBterm/SSBMSY	0.53	0.63	0.79
F35%	0.218	0.265	0.291
MSY (mt)	21,429	18,715	16,934
SSBMSY(mt)	109,994	85,127	74,639
Fterm	0.410	0.520	0.527
Yterm	13,779	13,779	13,779
SSBterm	47,498	41,449	42,441
Fterm/Fmax	1.88	1.96	1.81
Yterm/MSY	0.64	0.74	0.81
SSBterm/SSBMSY	0.43	0.49	0.57
F40%	0.183	0.220	0.238
MSY (mt)	20,837	18,163	16,385
SSBMSY(mt)	125,723	97,306	85,325
Fterm	0.410	0.520	0.527
Yterm	13,779	13,779	13,779
SSBterm	47,498	41449	42441
Fterm/Fmax	2.24	2.36	2.21
Yterm/MSY	0.66	0.76	0.84
SSBterm/SSBMSY	0.38	0.43	0.50

Table 131. (Continued, page 2)

NON-PARAMETRIC	ADAPT VPA T2007_M20 (stochastic) mean M=0.20	ADAPT VPA T2007_M25 (stochastic) mean M=0.25	ADAPT VPA T2007_M33 (stochastic) mean M=0.33
Fmax	0.419	0.604	1.769
MSY (mt)	14,629	13,120	10,155
SSBMSY(mt)	53,384	39,314	18,489
Fterm	0.311	0.311	0.317
Yterm	10,368	10,368	10,368
SSBterm	42,142	42,919	43,711
Fterm/Fmax	0.74	0.51	0.18
Yterm/MSY	0.71	0.79	1.02
SSBterm/SSBMSY	0.79	1.09	2.36
F35%	0.281	0.337	0.379
MSY (mt)	14,767	13,389	12,055
SSBMSY(mt)	73,624	60,333	54,061
Fterm	0.311	0.311	0.317
Yterm	10,368	10,368	10,368
SSBterm	42,142	42,919	43,711
Fterm/Fmax	1.11	0.92	0.84
Yterm/MSY	0.70	0.77	0.86
SSBterm/SSBMSY	0.57	0.71	0.81
F40%	0.234	0.276	0.307
MSY (mt)	14,480	13,070	11,551
SSBMSY(mt)	84,306	69,133	60,907
Fterm	0.311	0.311	0.317
Yterm	10,368	10,368	10,368
SSBterm	42,142	42,919	43,711
Fterm/Fmax	1.33	1.13	1.03
Yterm/MSY	0.72	0.79	0.90
SSBterm/SSBMSY	0.50	0.62	0.72

Table 131. (Continued, page 3)

NON-PARAMETRIC	ASAP F08_T2007_T2_M20 (stochastic) mean M=0.20	ASAP F08_T2007_T2 (stochastic) mean M=0.25	ASAP F08_T2007_T2_M33 (stochastic) mean M=0.33
Fmax	0.393	0.558	1.710
MSY (mt)	16,834	12,868	10,967
SSBMSY(mt)	61,653	38,547	20,973
Fterm	0.300	0.288	0.290
Yterm	10,368	10,368	10,368
SSBterm	42,185	43,363	44,066
Fterm/Fmax	0.76	0.52	0.17
Yterm/MSY	0.62	0.81	0.95
SSBterm/SSBMSY	0.68	1.12	2.10
F35%	0.263	0.310	0.352
MSY (mt)	16,974	13,122	12,026
SSBMSY(mt)	85,570	60,074	53,811
Fterm	0.300	0.288	0.290
Yterm	10,368	10,368	10,368
SSBterm	42,185	43,363	44,066
Fterm/Fmax	1.14	0.93	0.82
Yterm/MSY	0.61	0.79	0.86
SSBterm/SSBMSY	0.49	0.72	0.82
F40%	0.219	0.255	0.285
MSY (mt)	16,632	12,807	11,515
SSBMSY(mt)	98,024	68,743	60,016
Fterm	0.300	0.288	0.290
Yterm	10,368	10,368	10,368
SSBterm	42,185	43,363	44,066
Fterm/Fmax	1.37	1.13	1.02
Yterm/MSY	0.62	0.81	0.90
SSBterm/SSBMSY	0.43	0.63	0.73

Table 132. 2008 assessment projection input data.

Mean Natural Mortality (M) = 0.25
Proportion of mortality before spawning = 0.83

Age	Selectivity on F	Selectivity on M	Jan 1 Stock Weights	Catch Weights	Nov 1 SSB Weights	Maturity
0	0.01	1.00	0.000	0.180	0.243	0.380
1	0.16	0.99	0.296	0.425	0.501	0.910
2	0.70	0.98	0.554	0.685	0.765	0.980
3	1.00	0.97	0.812	0.947	1.038	1.000
4	0.99	0.96	1.087	1.244	1.358	1.000
5	0.97	0.95	1.422	1.616	1.756	1.000
6	0.96	0.94	1.839	2.066	2.225	1.000
7+	0.96	0.92	3.008	3.008	3.122	1.000

Table 133. Forecasts of landings, discards, and SSB for summer flounder during 2008-2009 for proposed fishing mortality reference points: Frebuild = 0.274, FMSY = F35% = 0.310, Ftarget = F40% = 0.255.

Forecast Table

2008 Landings = 7,153 mt; F2008 = 0.238

2008-2009 recruitment drawn from distribution of 1982-2007 ASAP estimates

Forecast probabilities are 25% and 50% intervals of landings* for F

Landings, Discards, and Spawning Stock Biomass (SSB) in mt

	2008			2009		
Frebuild = 0.274	Land	Disc	SSB	Land	Disc	SSB
25%ile	7153	885	46992	8653	1132	54253
50%ile	7153	885	46992	9211	1208	51663

	2008			2009		
FMSY = F35%=0.310	Land	Disc	SSB	Land	Disc	SSB
25%ile	7153	885	46992	9627	1265	53171
50%ile	7153	885	46992	10249	1350	50632

	2008			2009		
Ftarget = F40%=0.255	Land	Disc	SSB	Land	Disc	SSB
25%ile	7153	885	46992	8104	1057	54861
50%ile	7153	885	46992	8626	1129	52246

* based on previous TAL specification percentiles

12.0 Figures

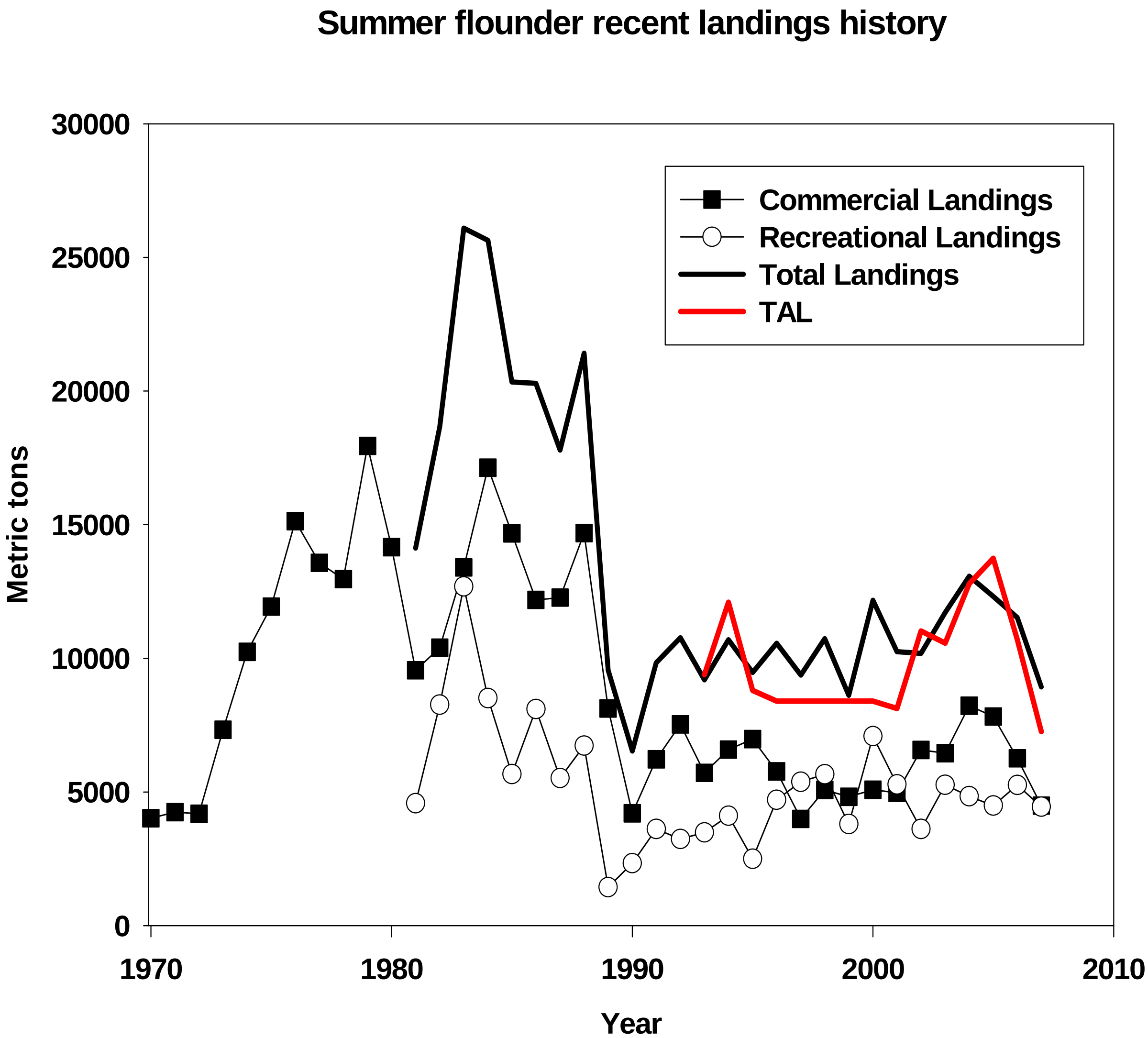


Figure 1. Summer flounder recent commercial (1970-2007), recreational (1981-2007), total fishery (1981-2007) landings, and the corresponding fishery Total Allowable Landings (TAL).

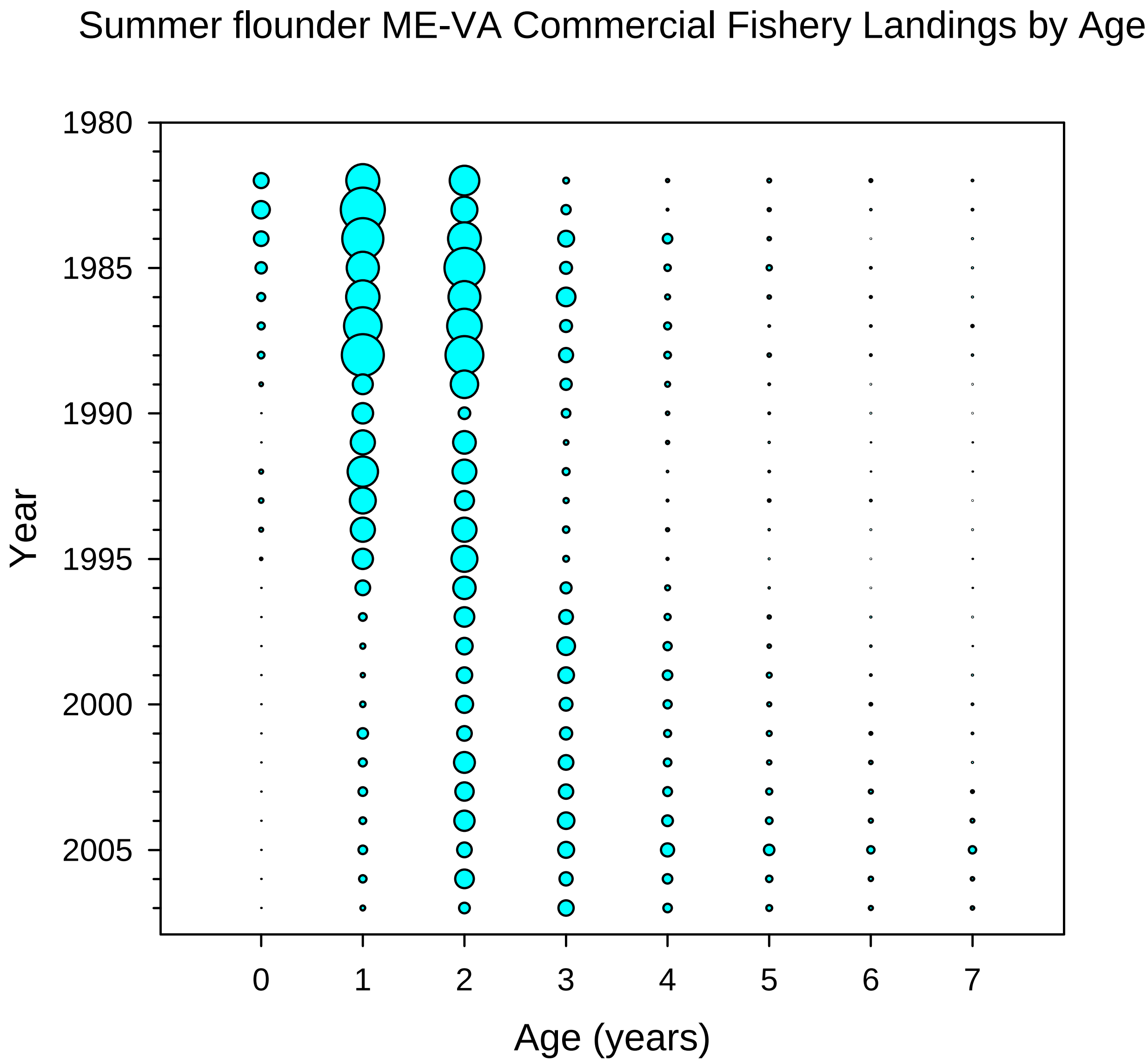


Figure 2. Age composition of NER (ME-VA) commercial landings.

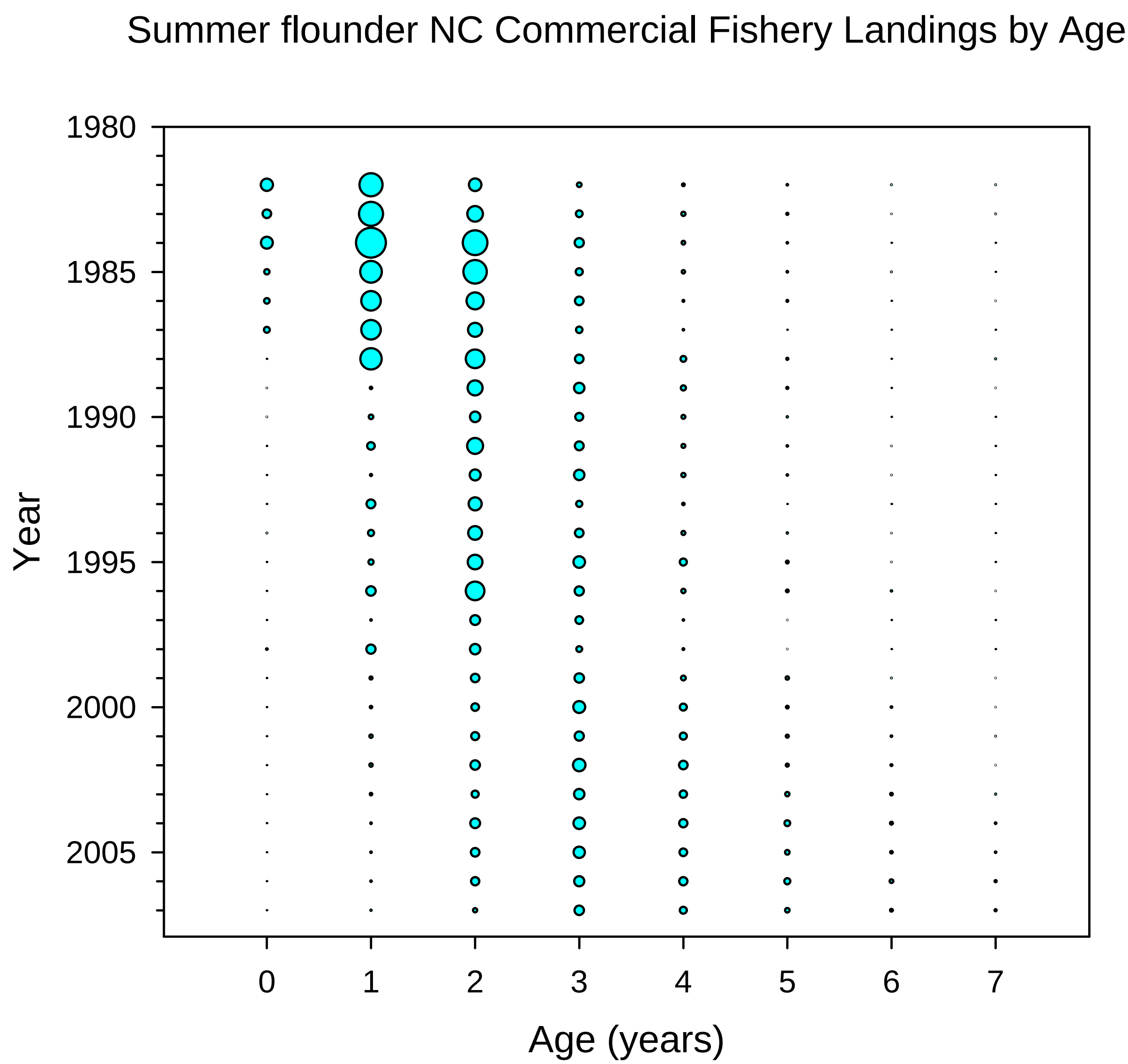


Figure 3. Age composition of North Carolina (NC) commercial landings.

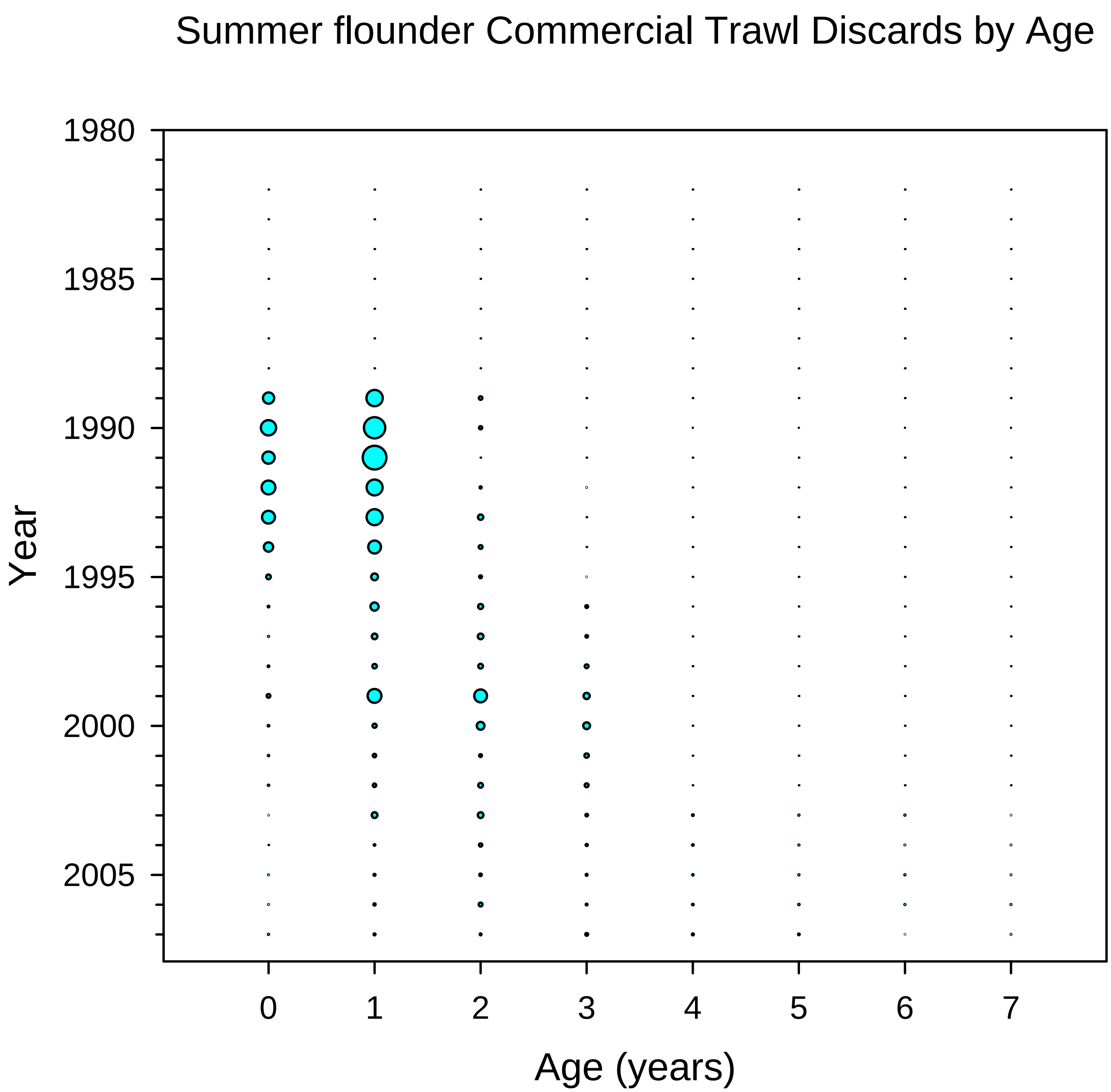


Figure 4. Age composition of commercial trawl discards.

Figure 5. Age composition of commercial scallop dredge discards.

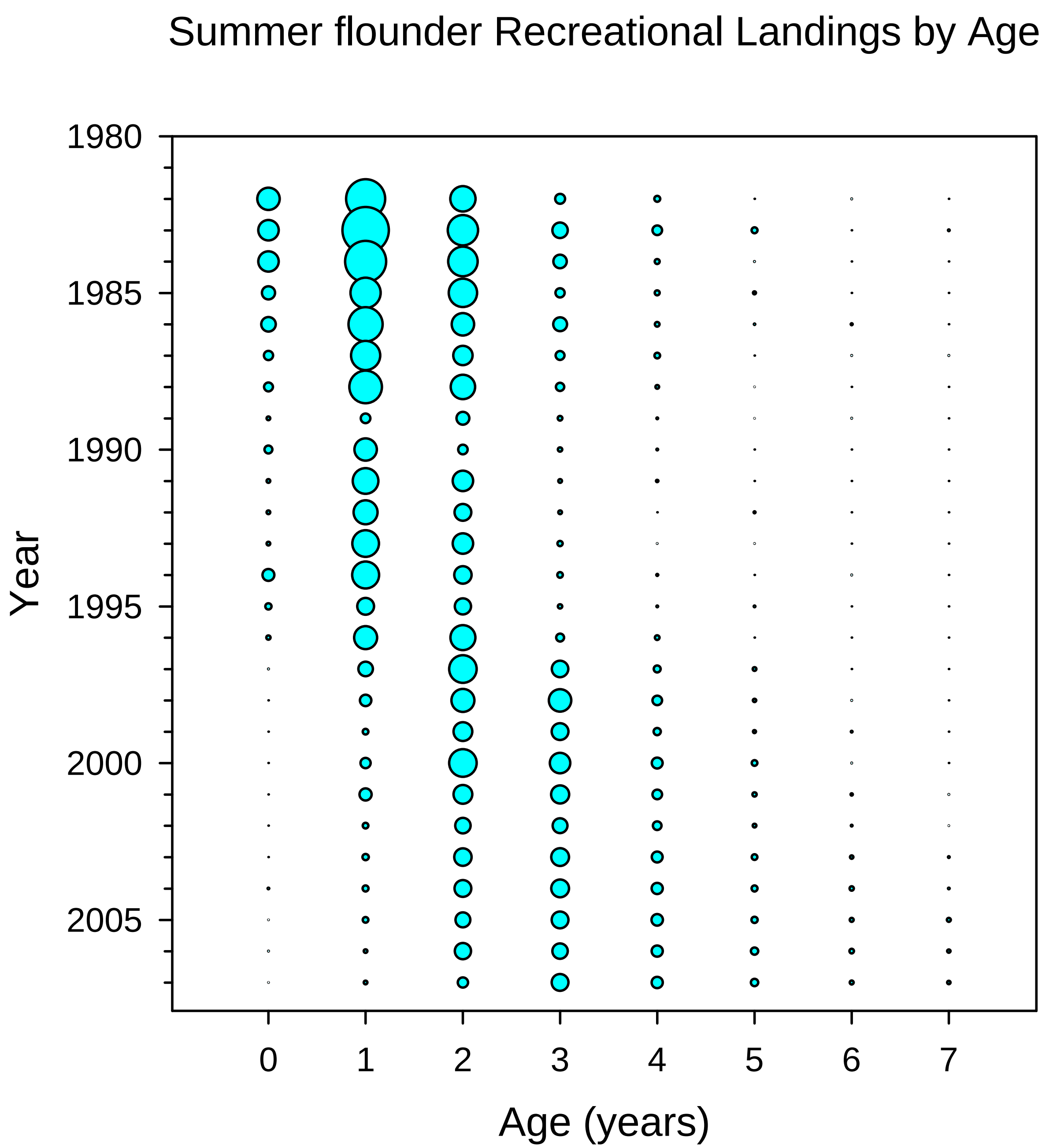


Figure 6. Age composition of recreational landings.

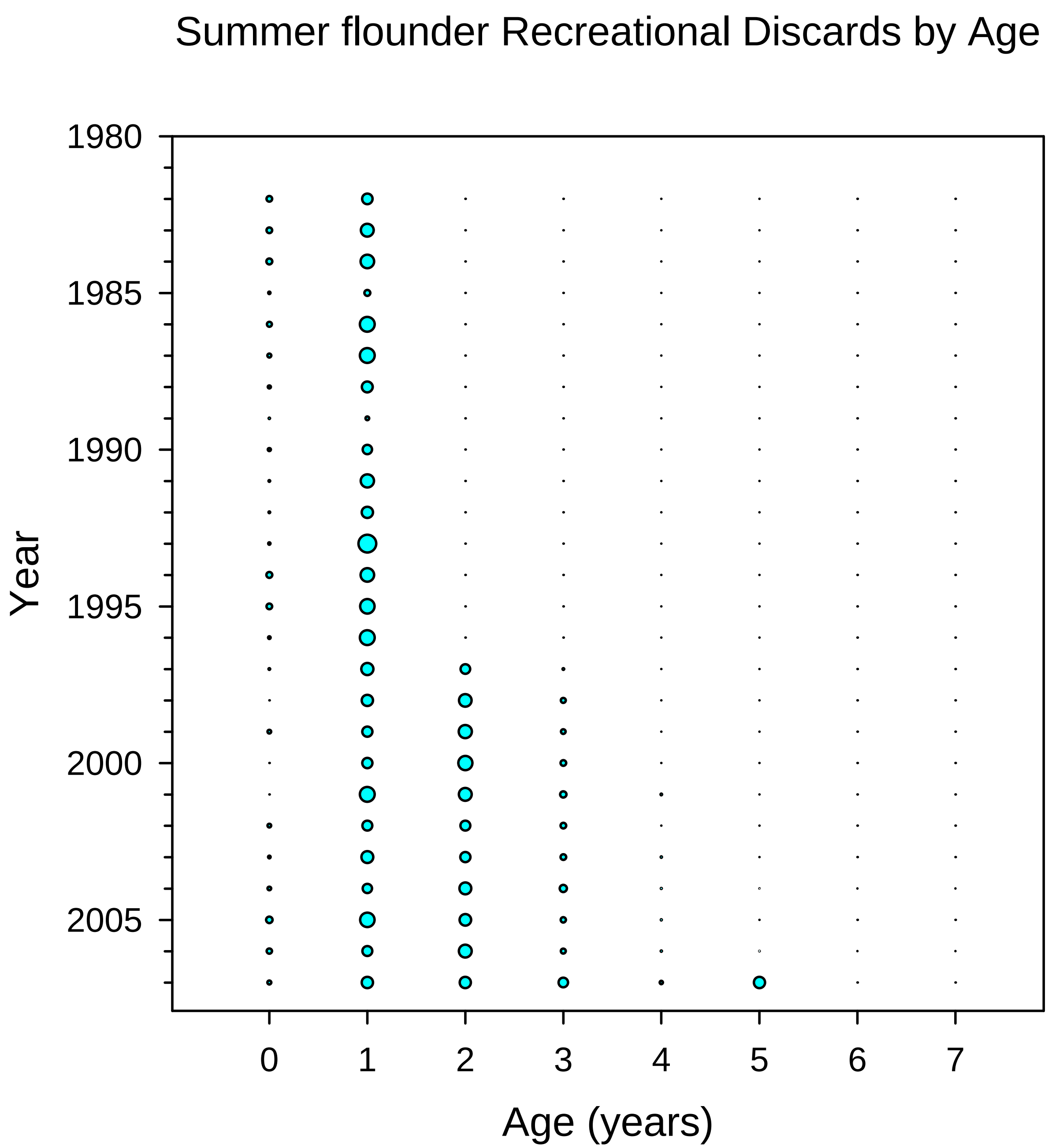


Figure 7. Age composition of recreational discards.

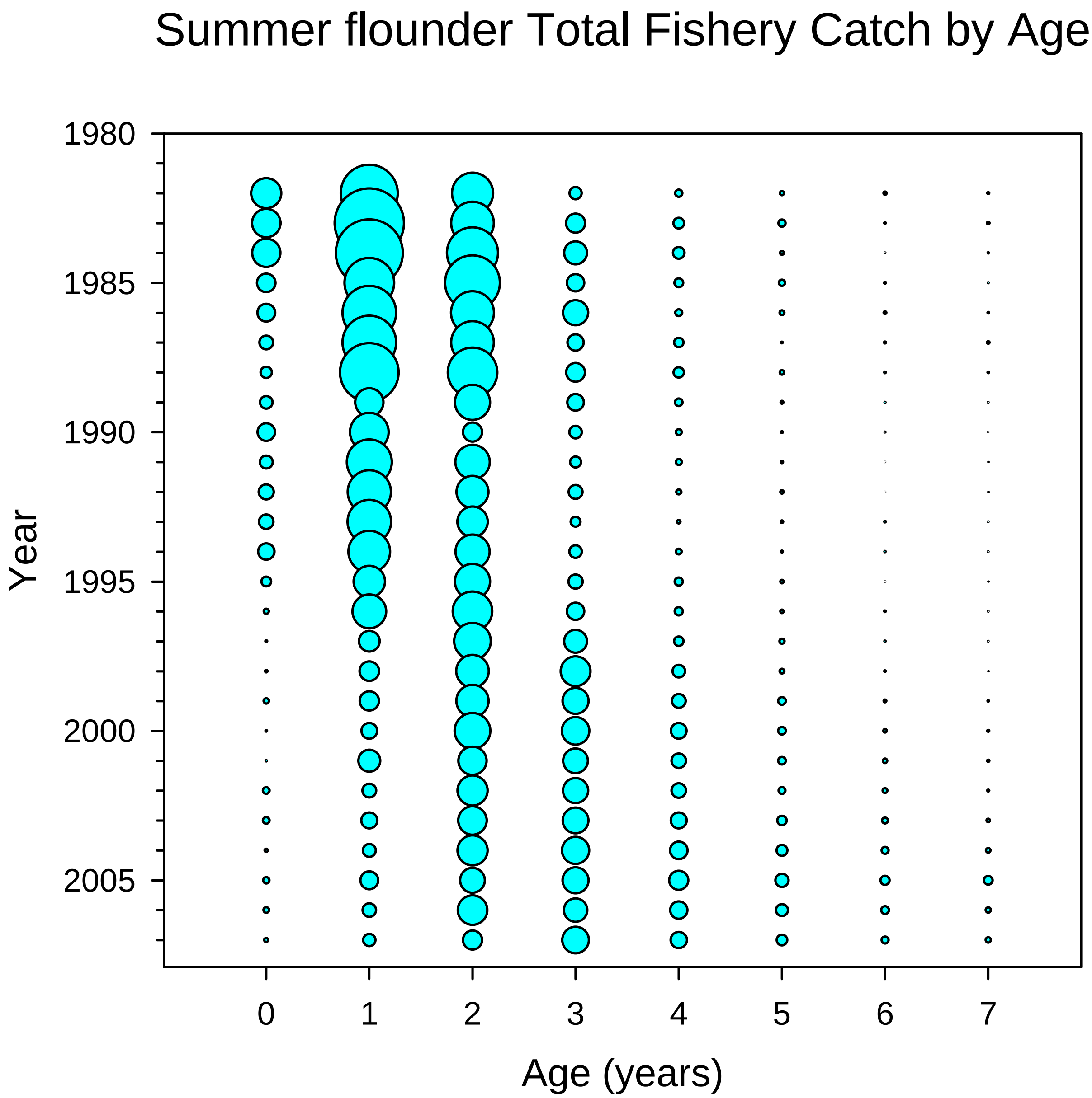


Figure 8. Age composition of total fishery catch.

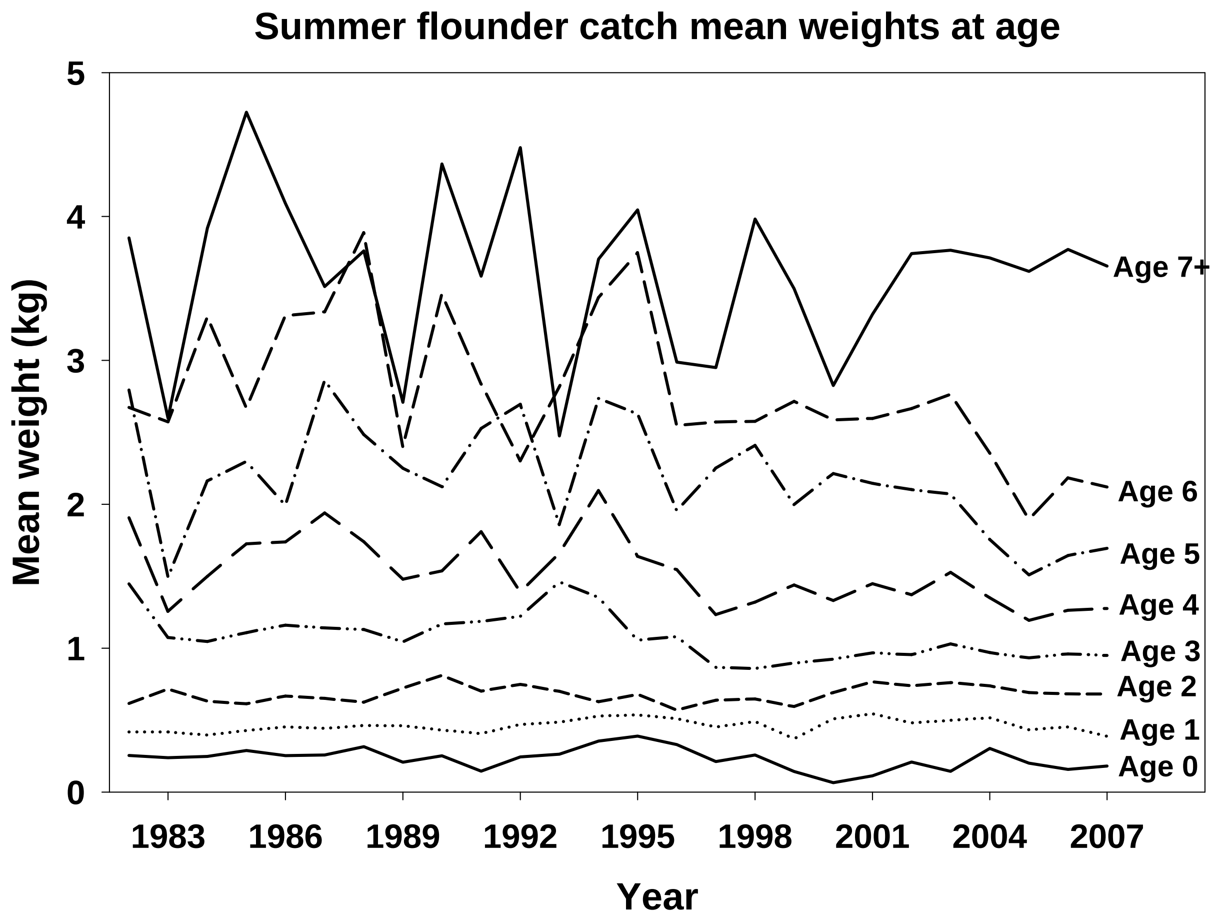


Figure 9. Trends in mean weight at age in the total catch of summer flounder.

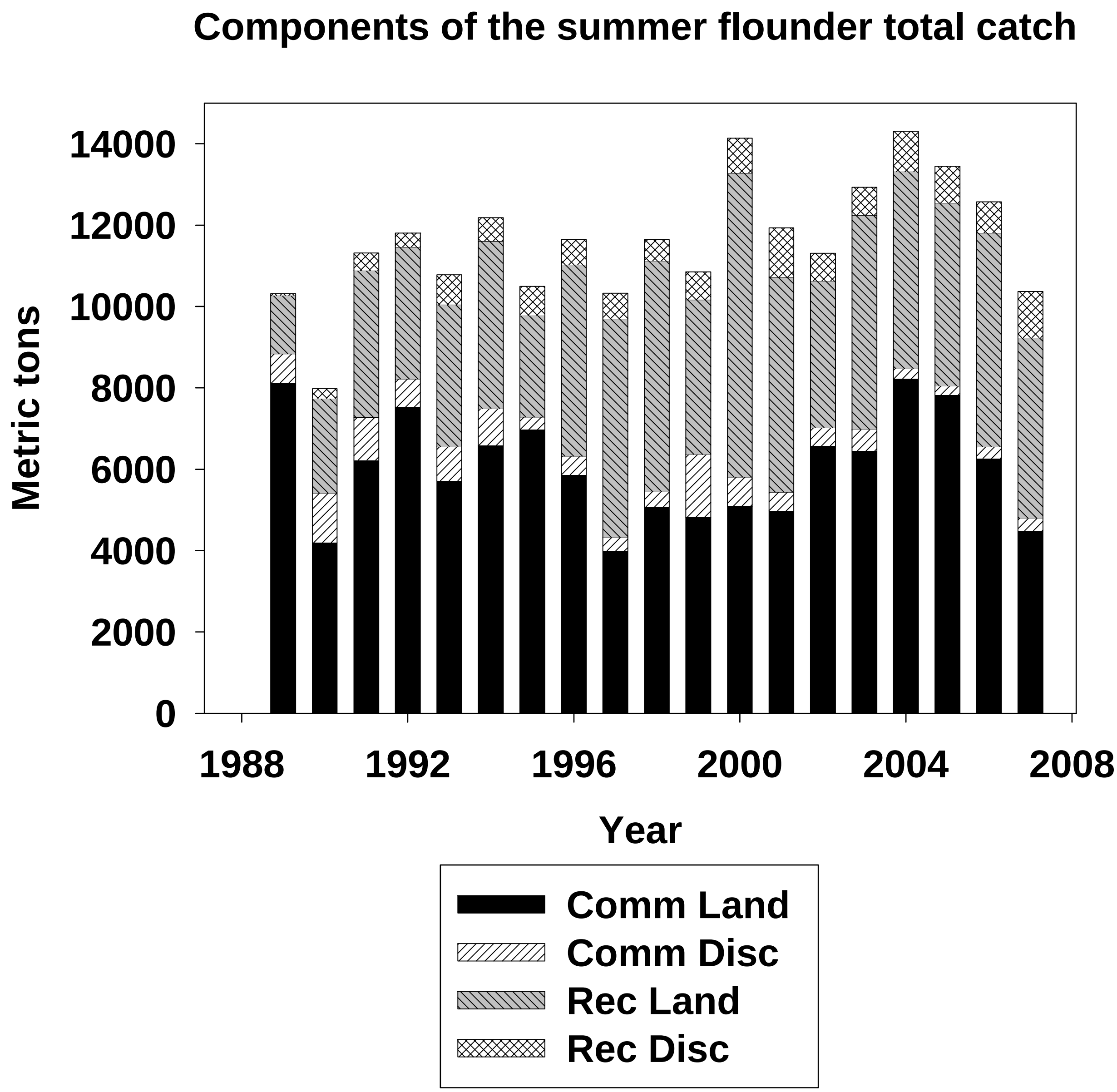


Figure 10. Components of the summer flounder total catch.

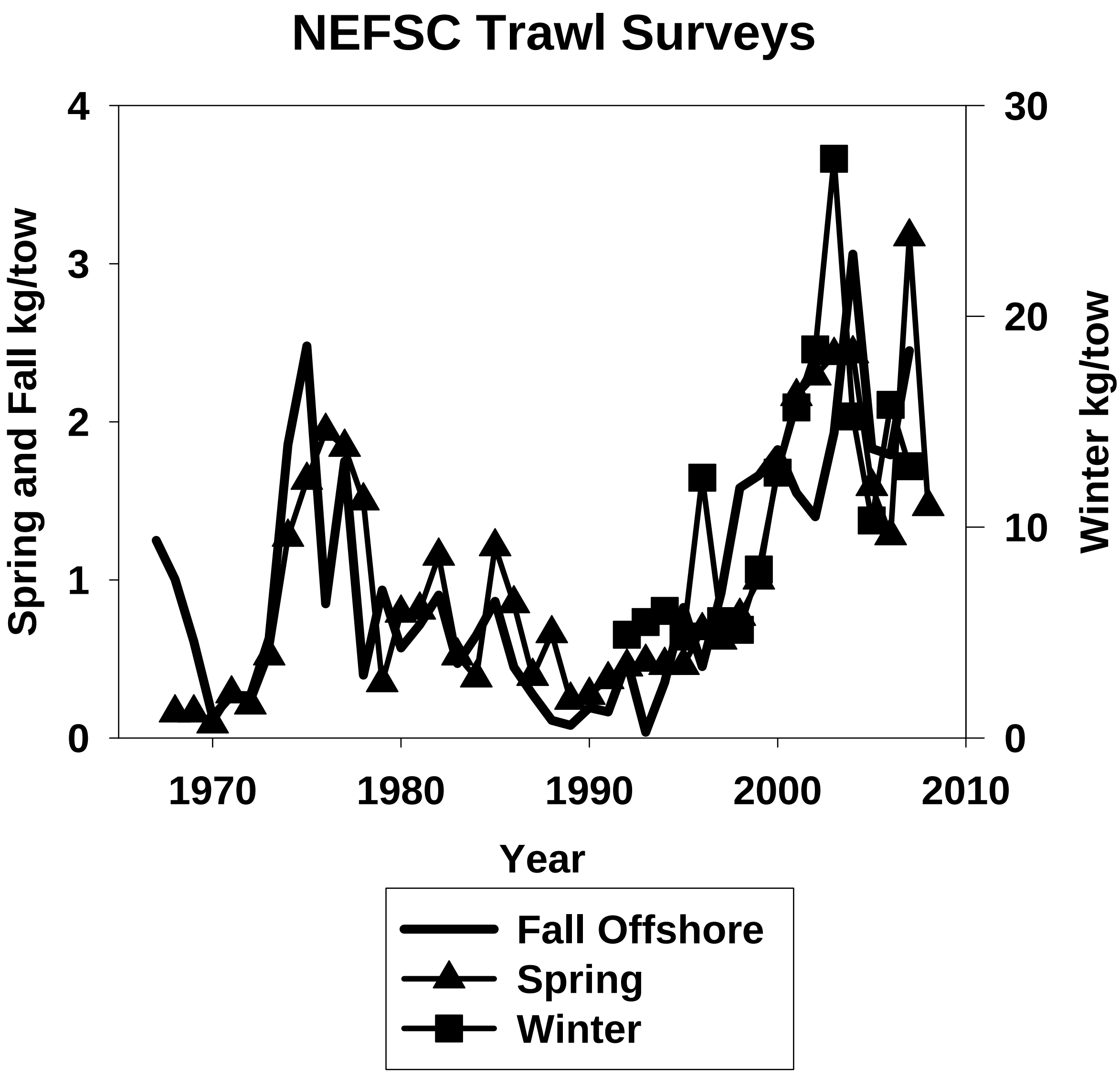


Figure 11. Trends in NEFSC trawl survey biomass indices for summer flounder.

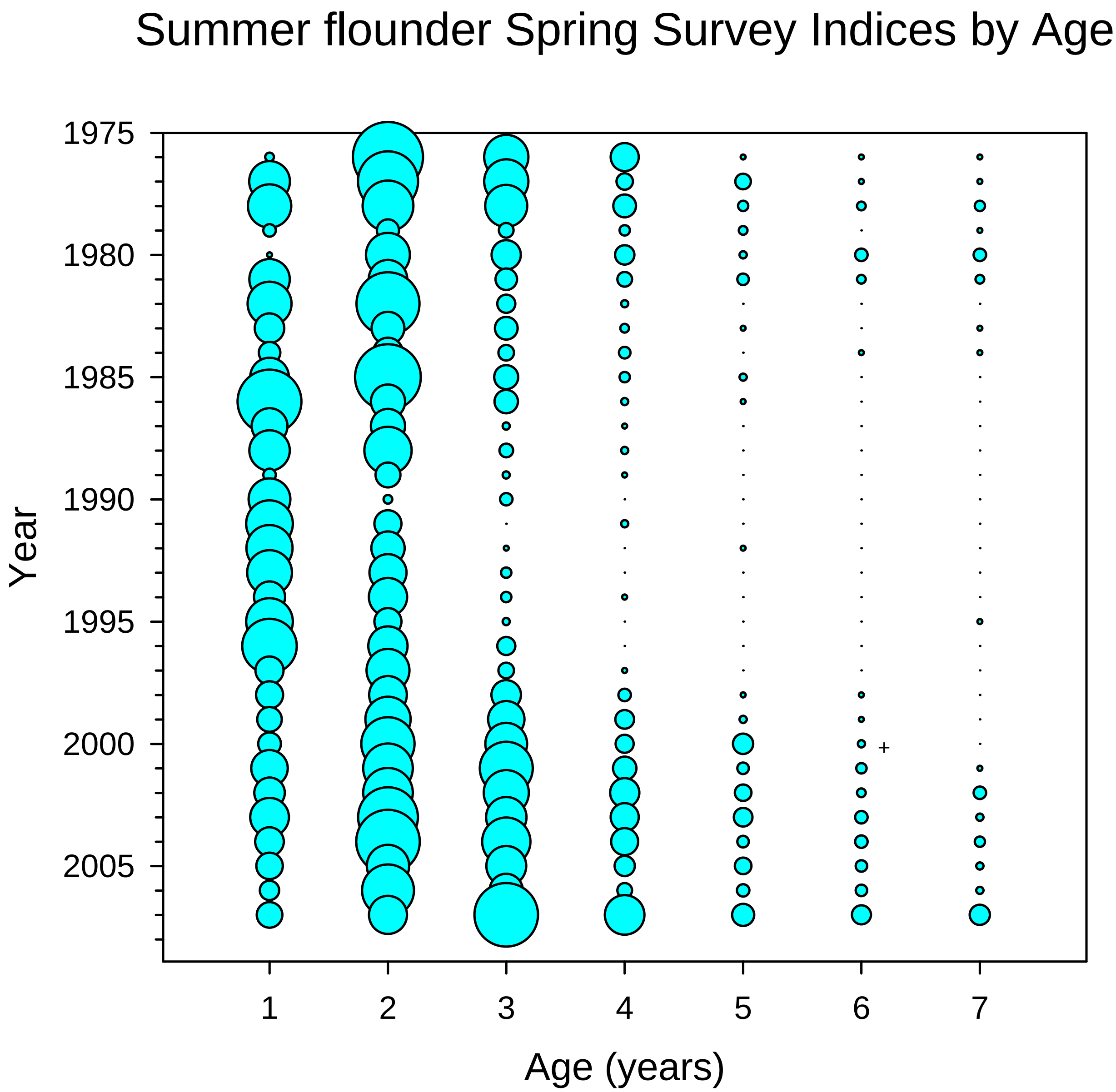


Figure 12. Age composition of the NEFSC spring trawl survey catch.

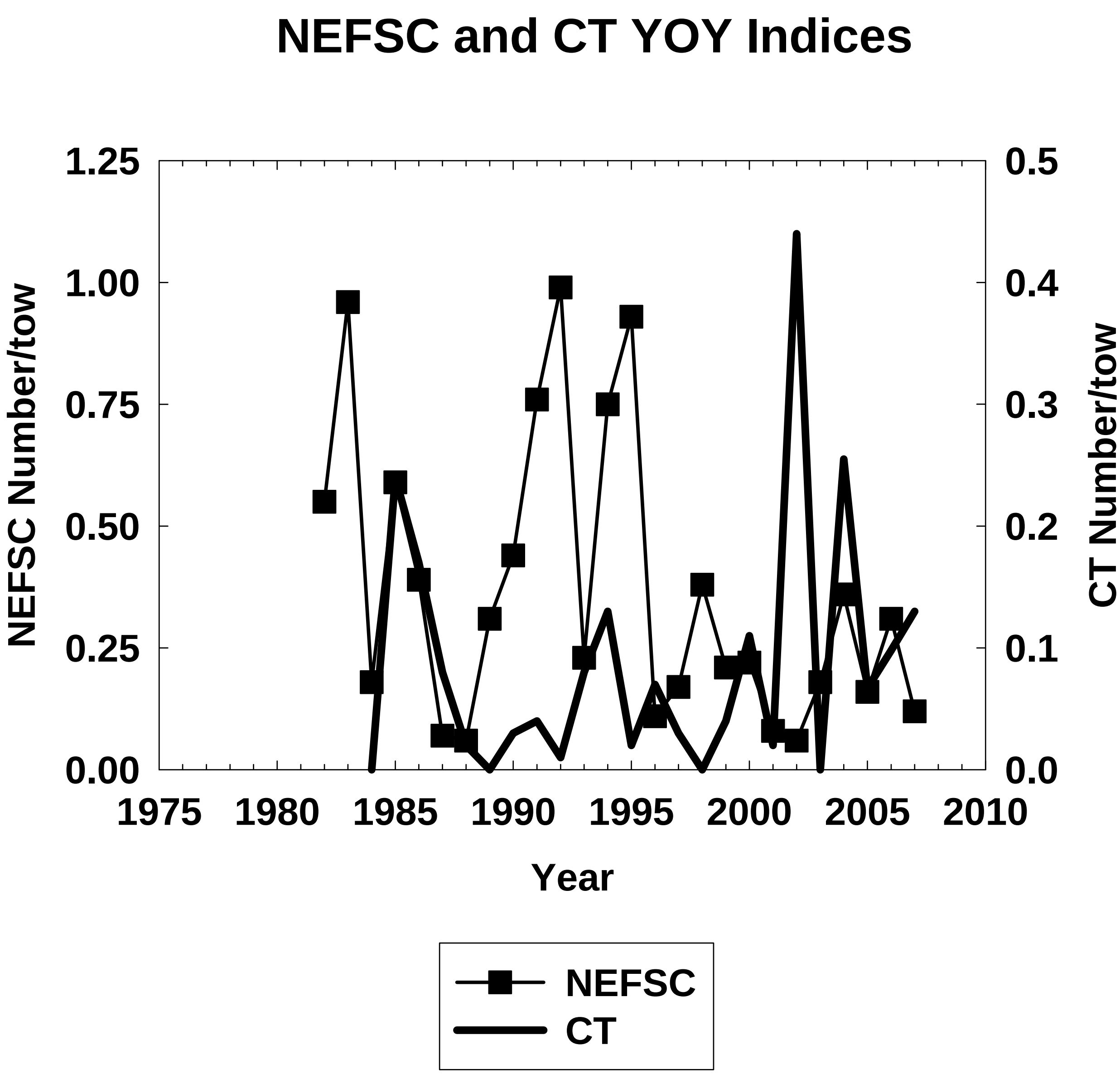


Figure 13. Trends in NEFSC and CT trawl survey recruitment indices for summer flounder.

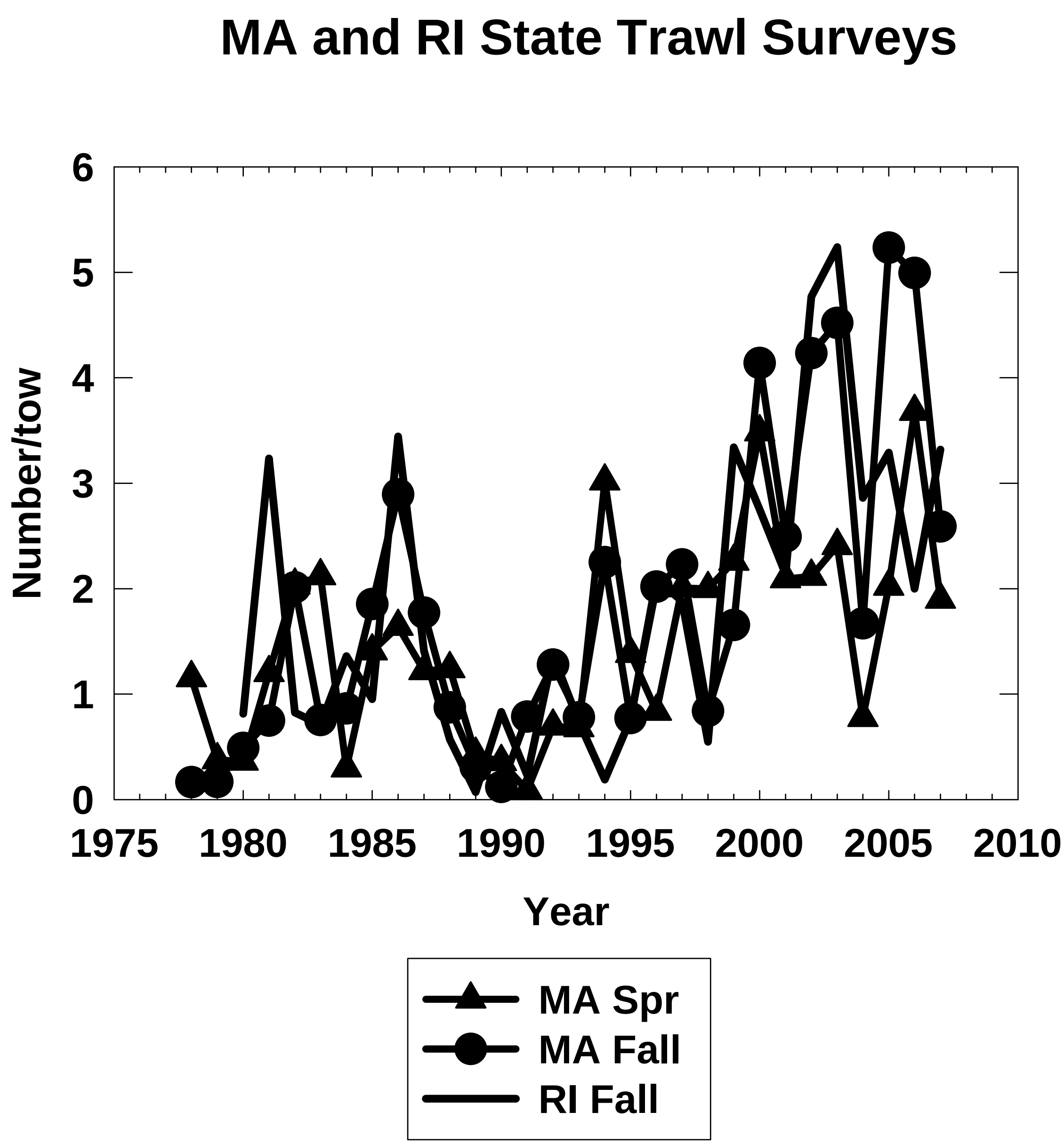


Figure 14. Trends in MA and RI trawl survey abundance indices for summer flounder.

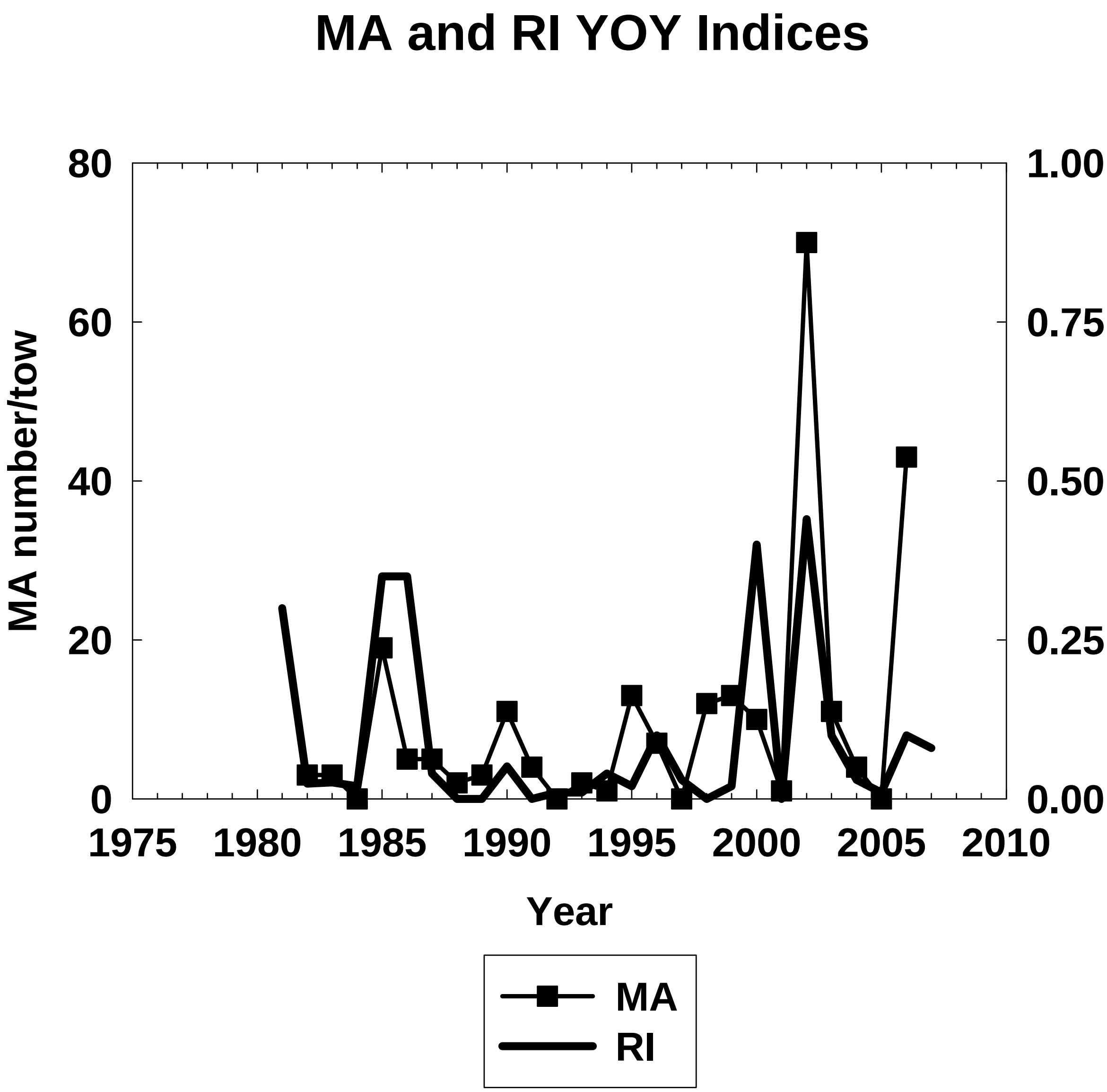


Figure 15. Trends in MA and RI survey recruitment indices for summer flounder.

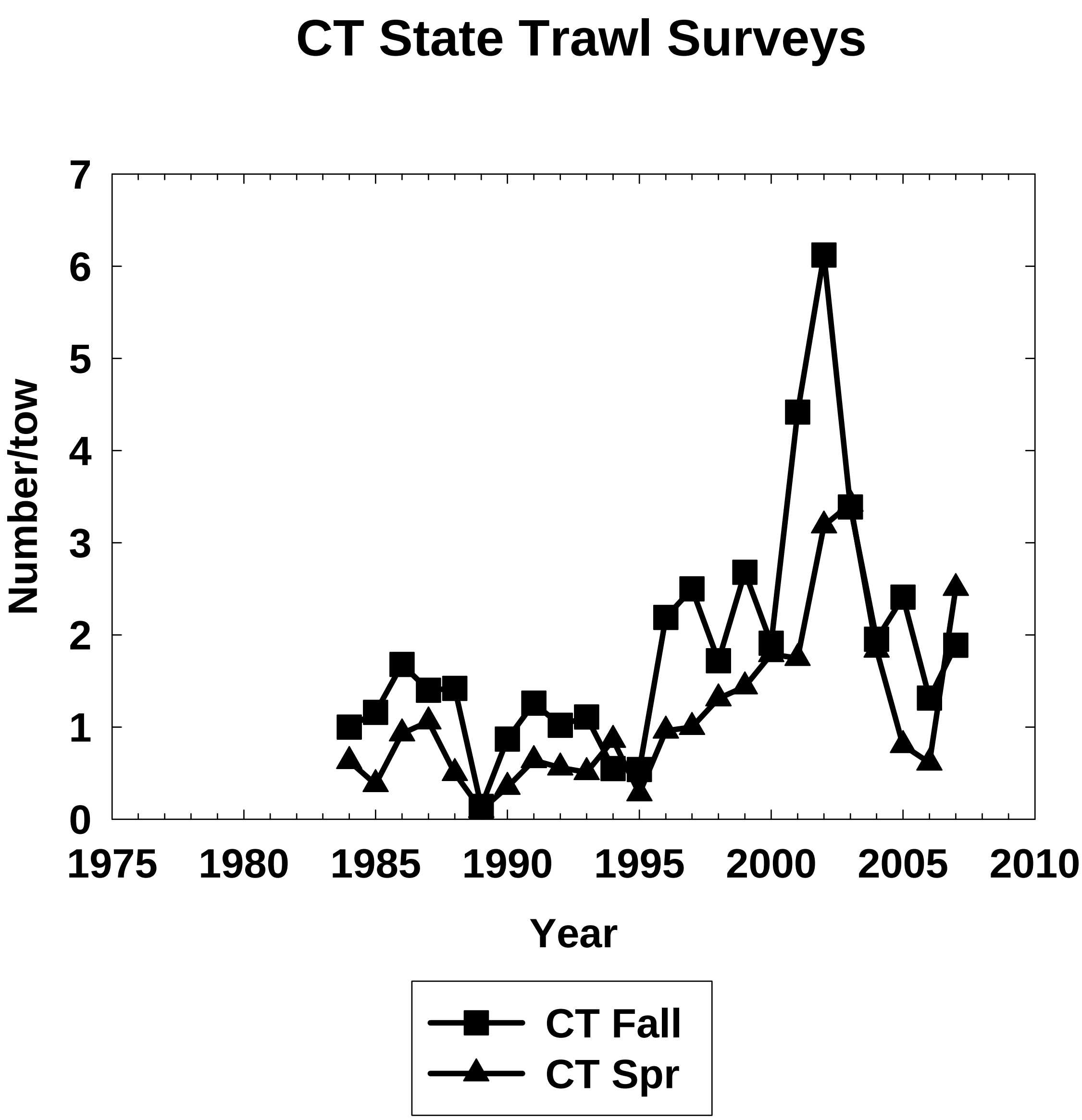


Figure 16. Trends in CT trawl survey abundance indices for summer flounder.

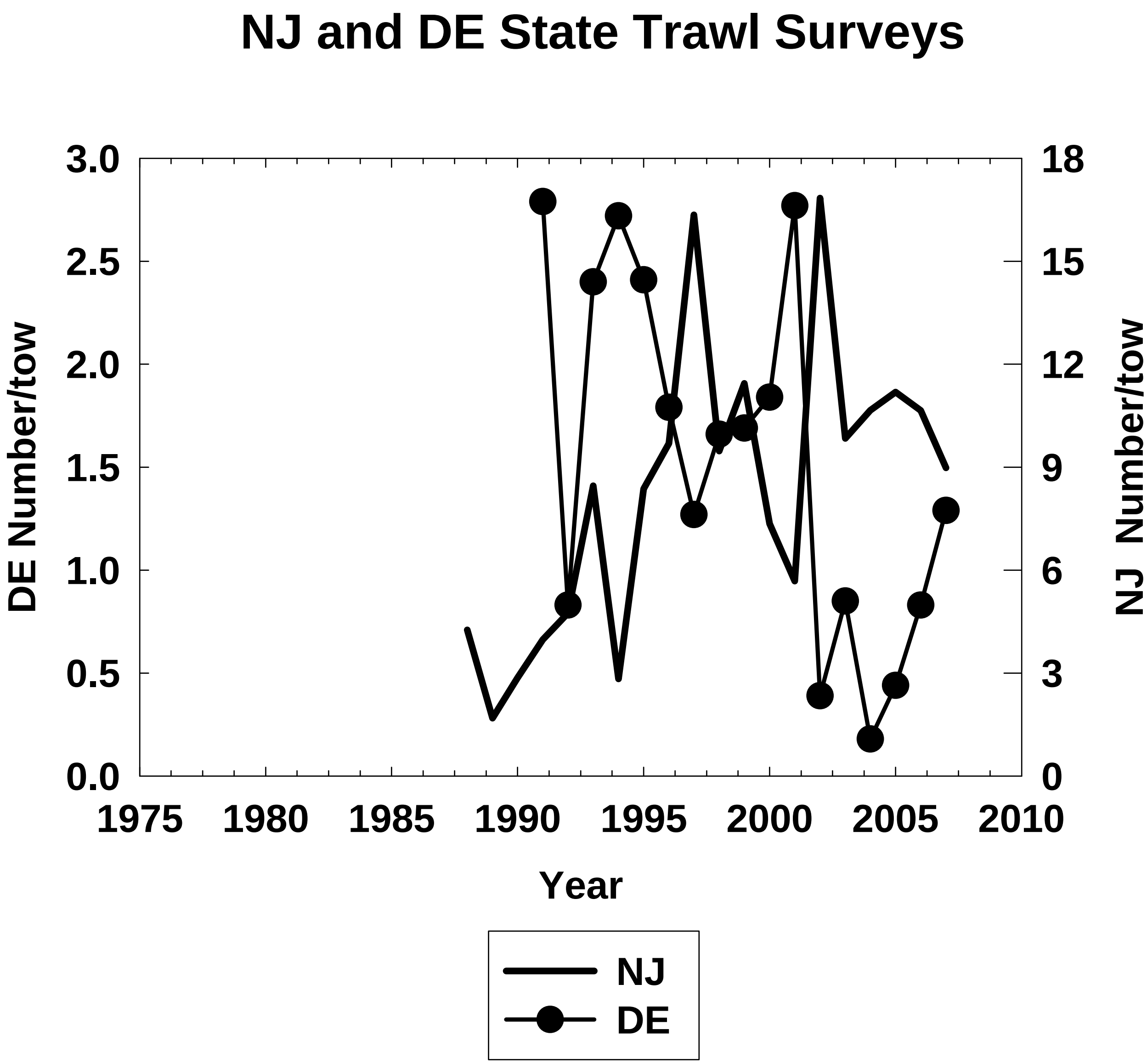


Figure 17. Trends in NJ and DE trawl survey abundance indices for summer flounder.

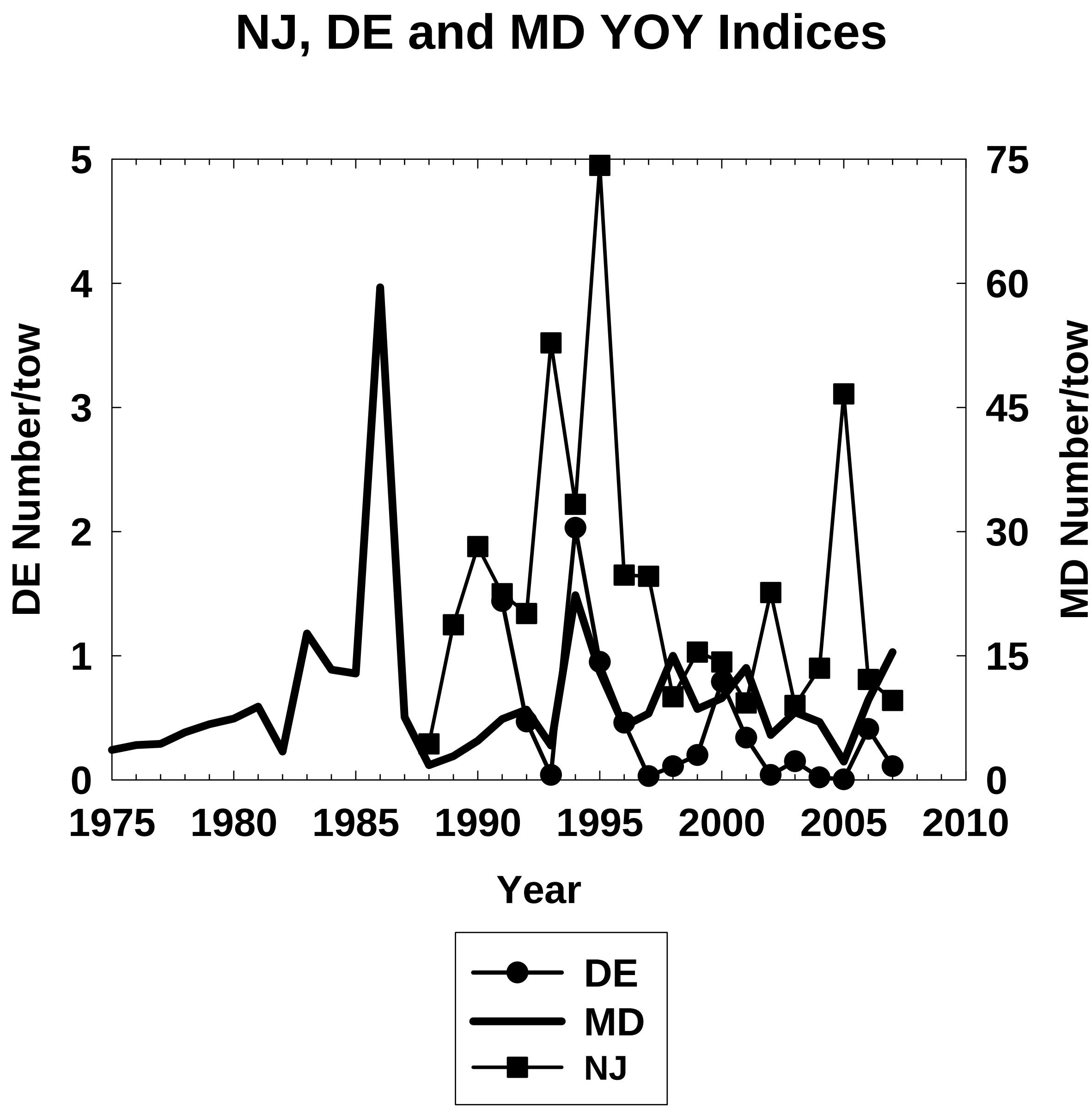


Figure 18. Trends in NJ, DE and MD survey recruitment indices for summer flounder.

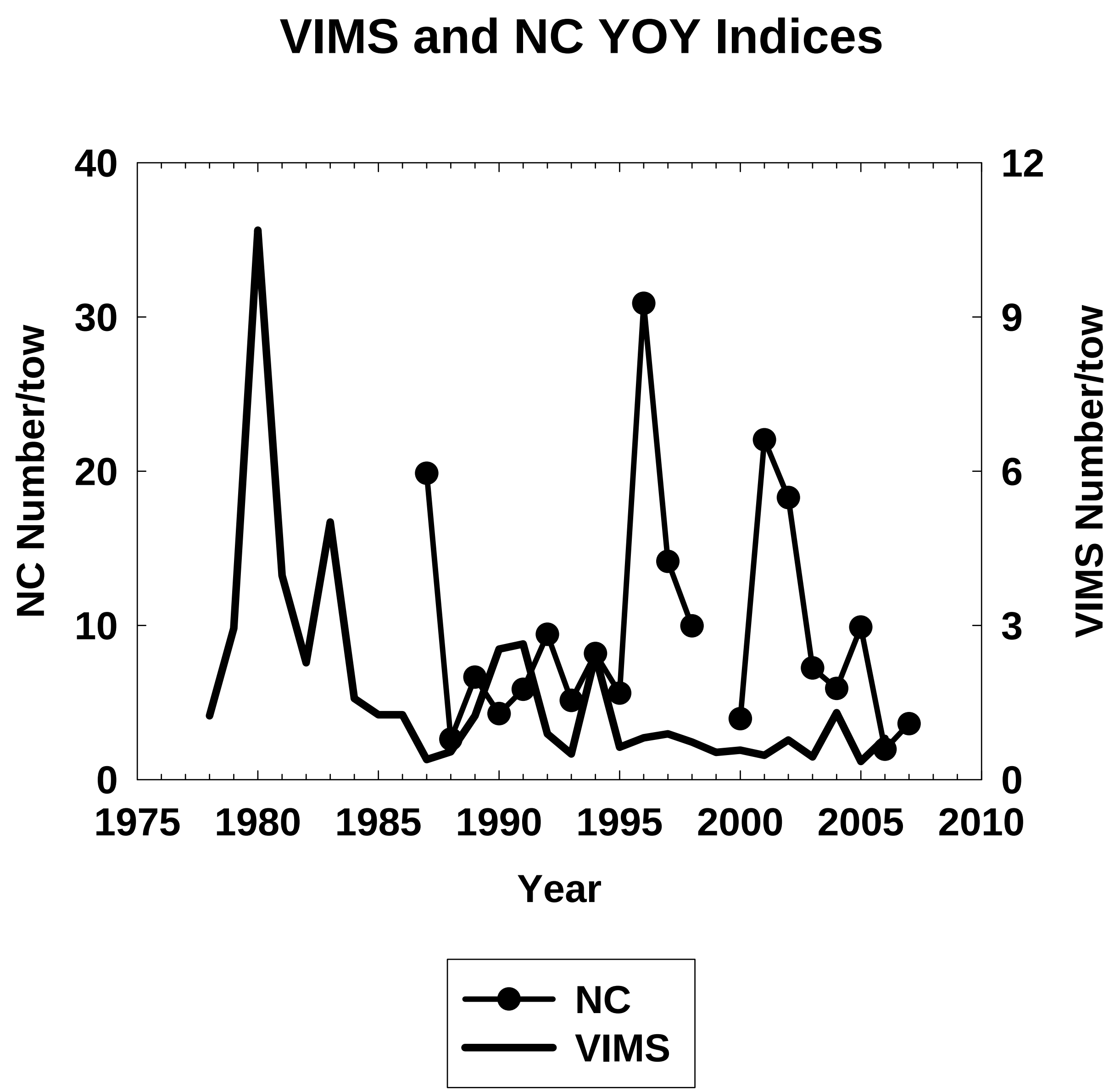
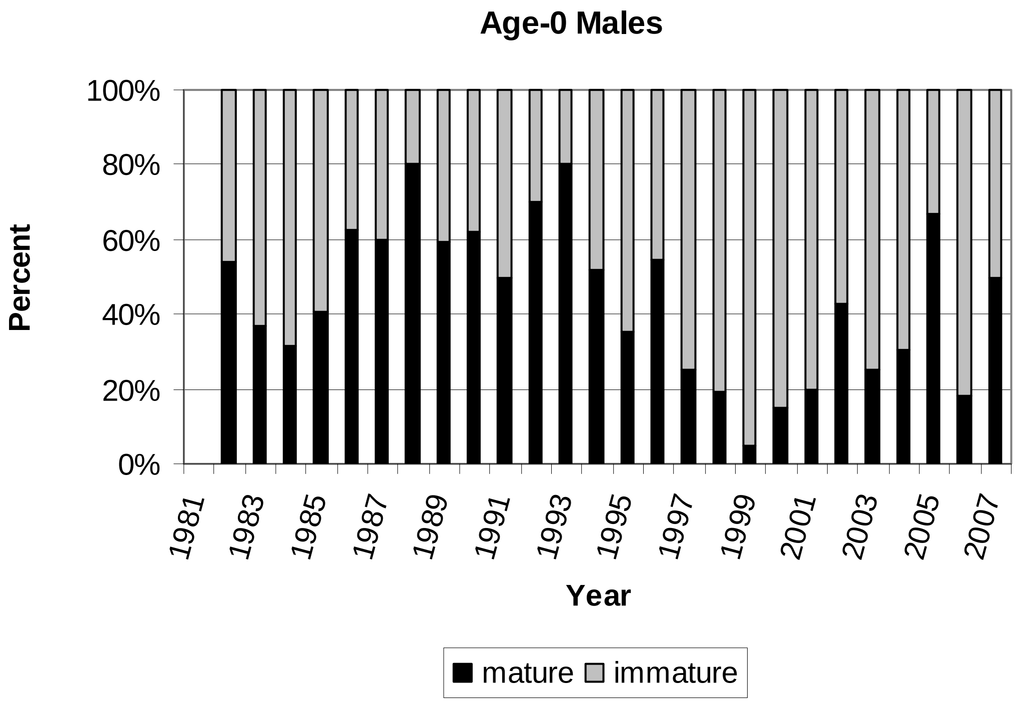


Figure 19. Trends in VIMS and NC trawl survey recruitment indices for summer flounder.



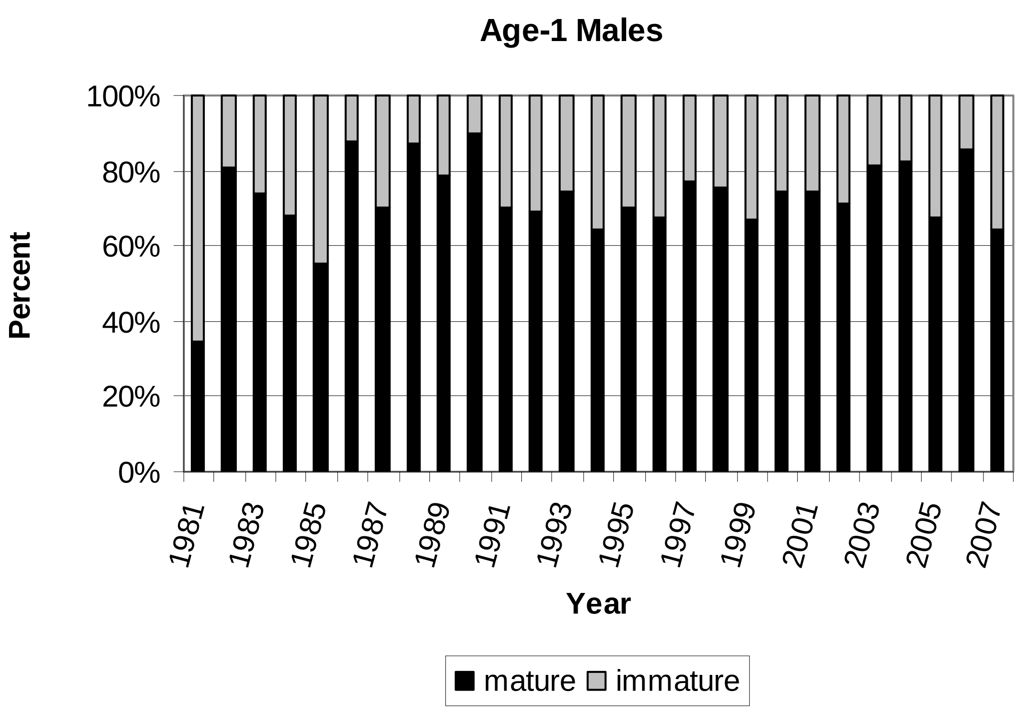
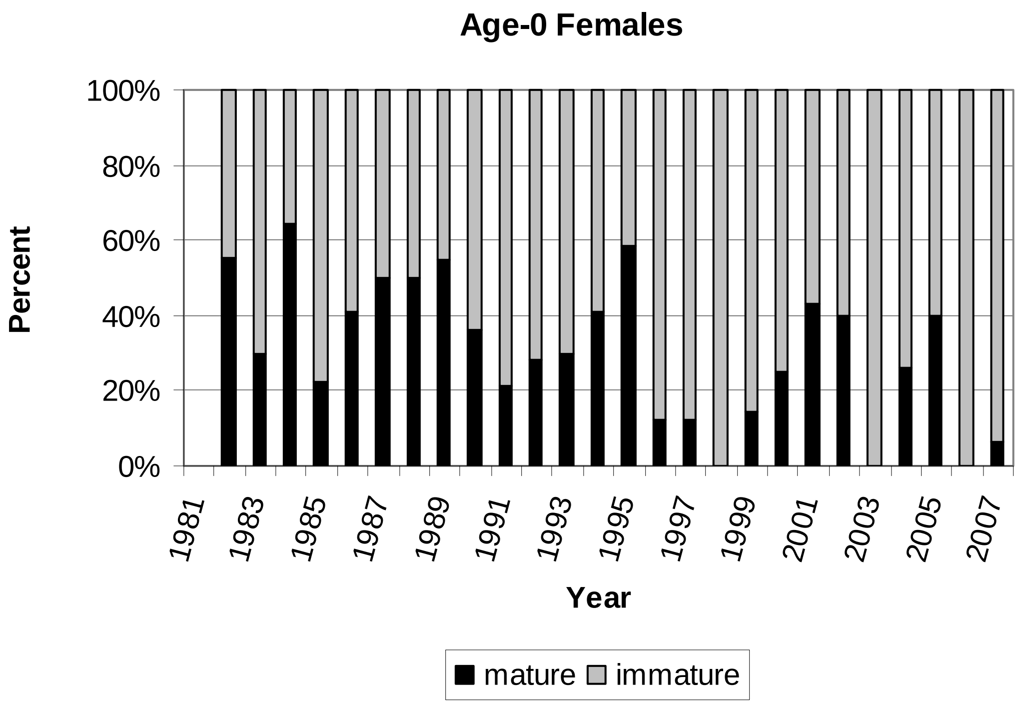


Figure 20. Summer flounder maturity based on the NEFSC spring, fall, and winter trawl survey data; the proportion mature at age-0 and 1, by sex, 1981-2007.



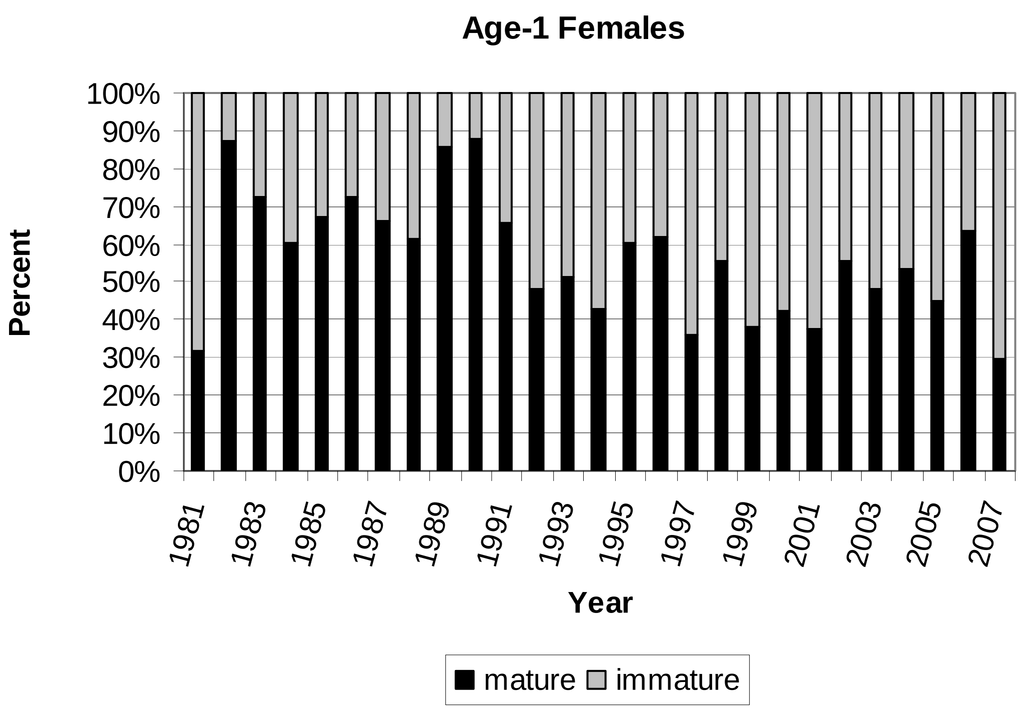


Figure 20. Continued. Summer flounder maturity based on the NEFSC spring, fall, and winter trawl survey data; the proportion mature at age-0 and 1, by sex, 1981-2007.

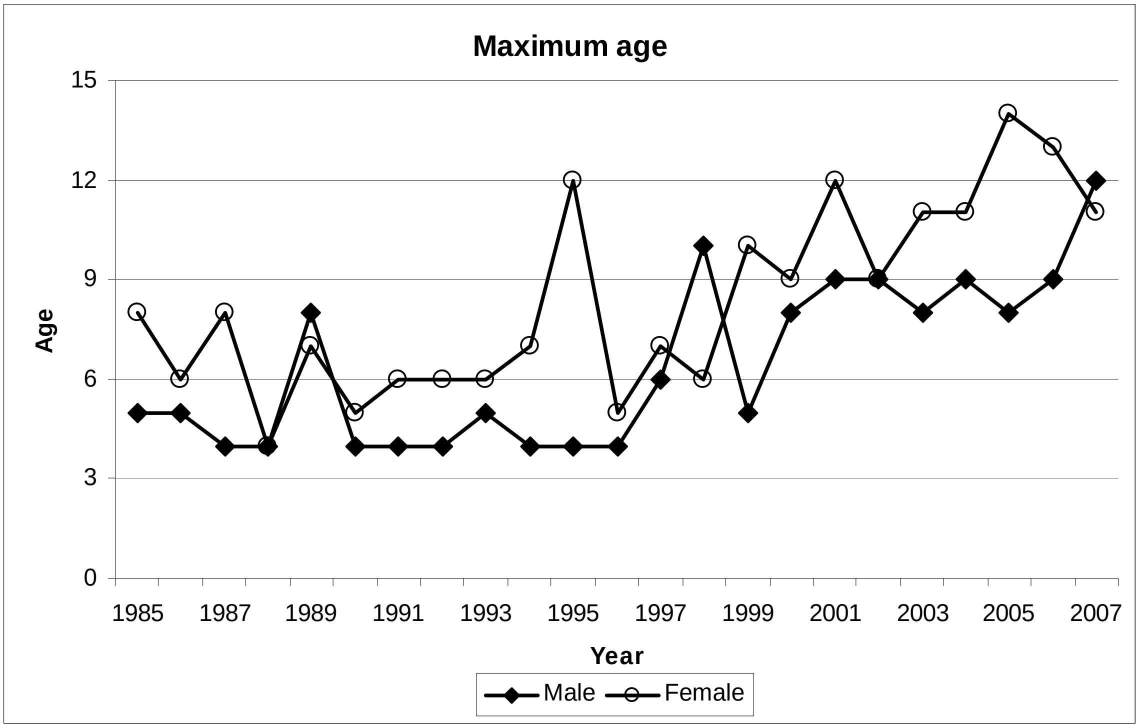


Figure 21. Maximum age by sex from the NEFSC spring, winter, and fall survey data, 1985-1995.

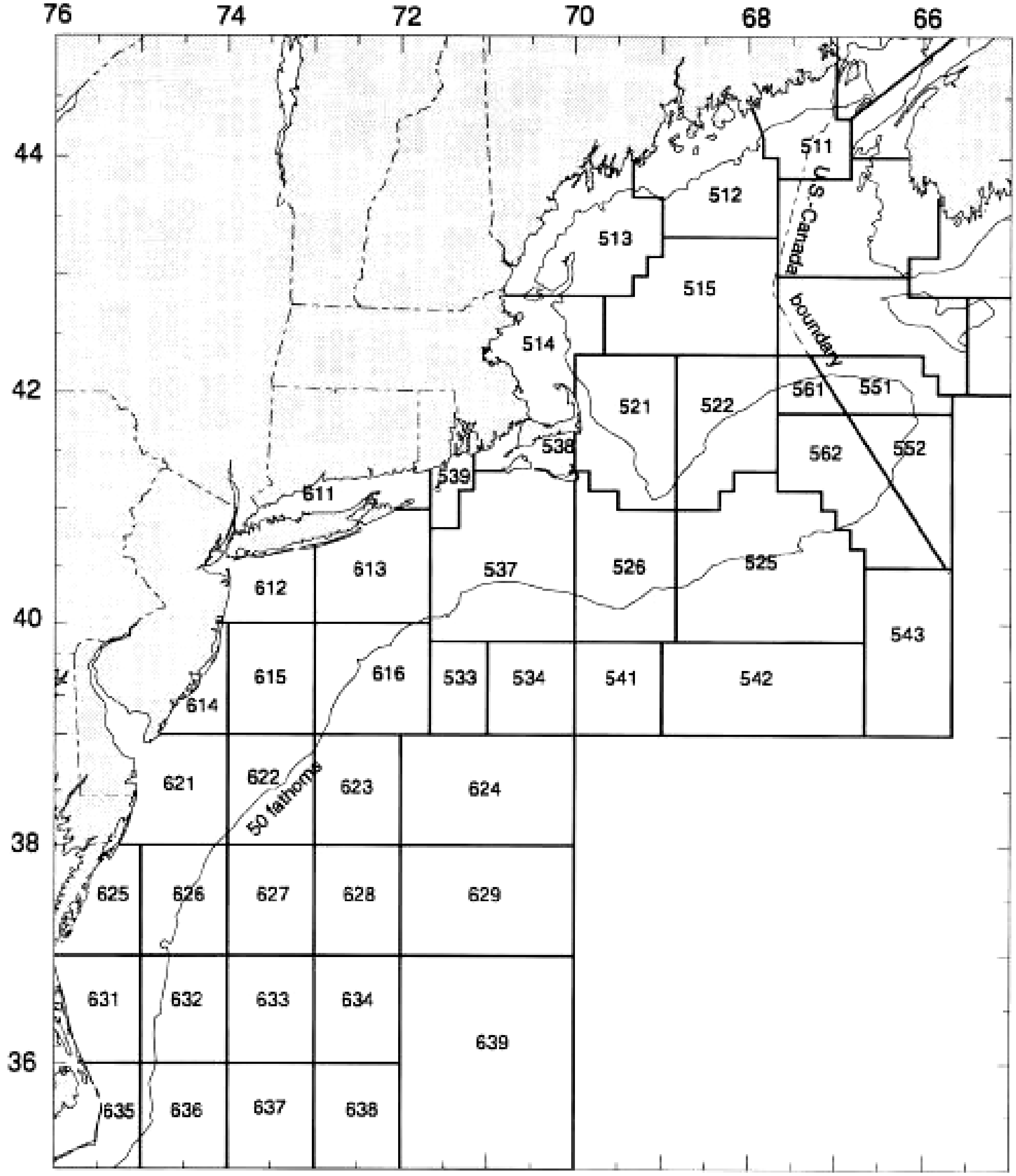
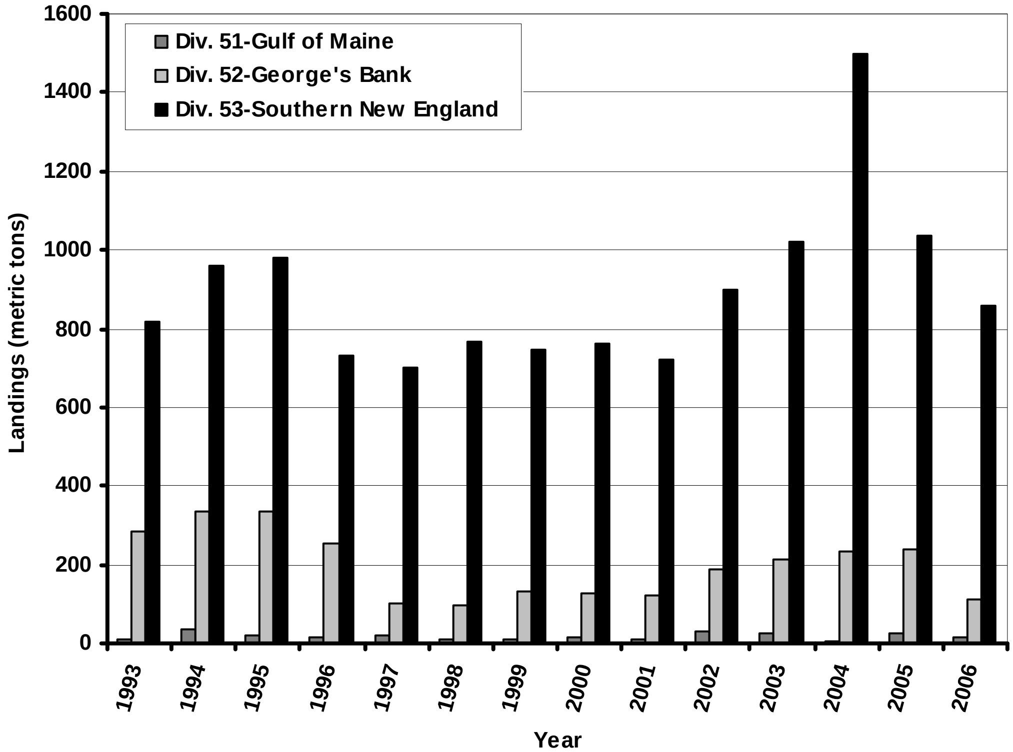


Figure 22. Commercial statistical areas.



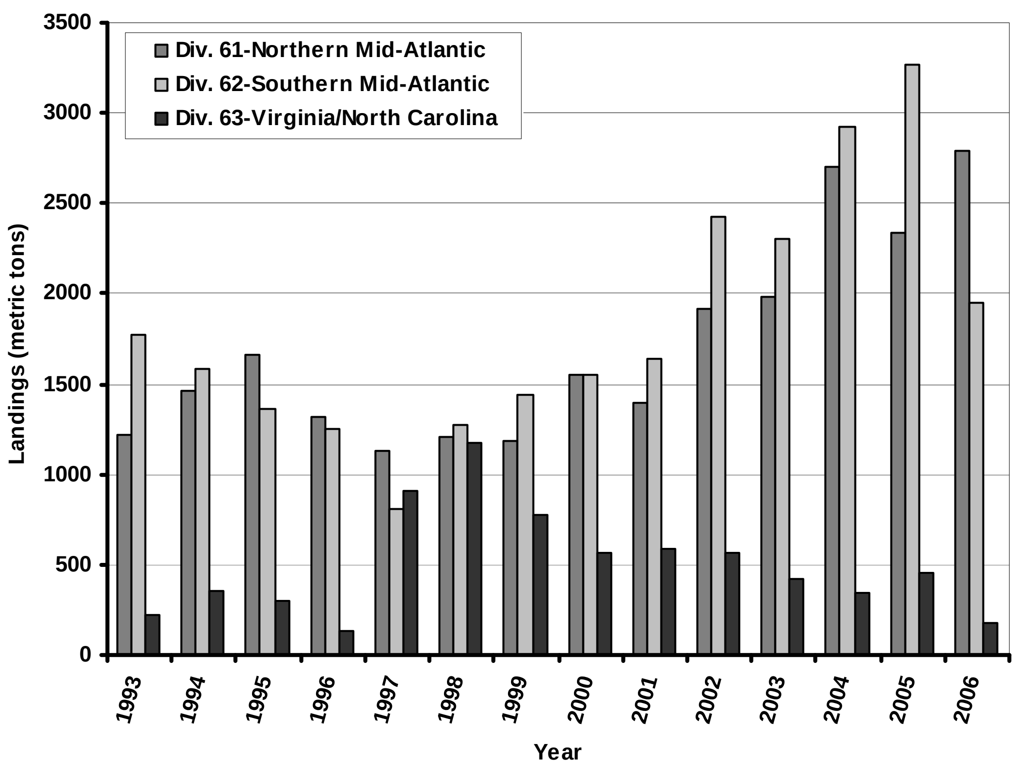


Figure 23. Commercial Landings (mt) for Divisions 51-53 and 61-63, for 1993-2006.

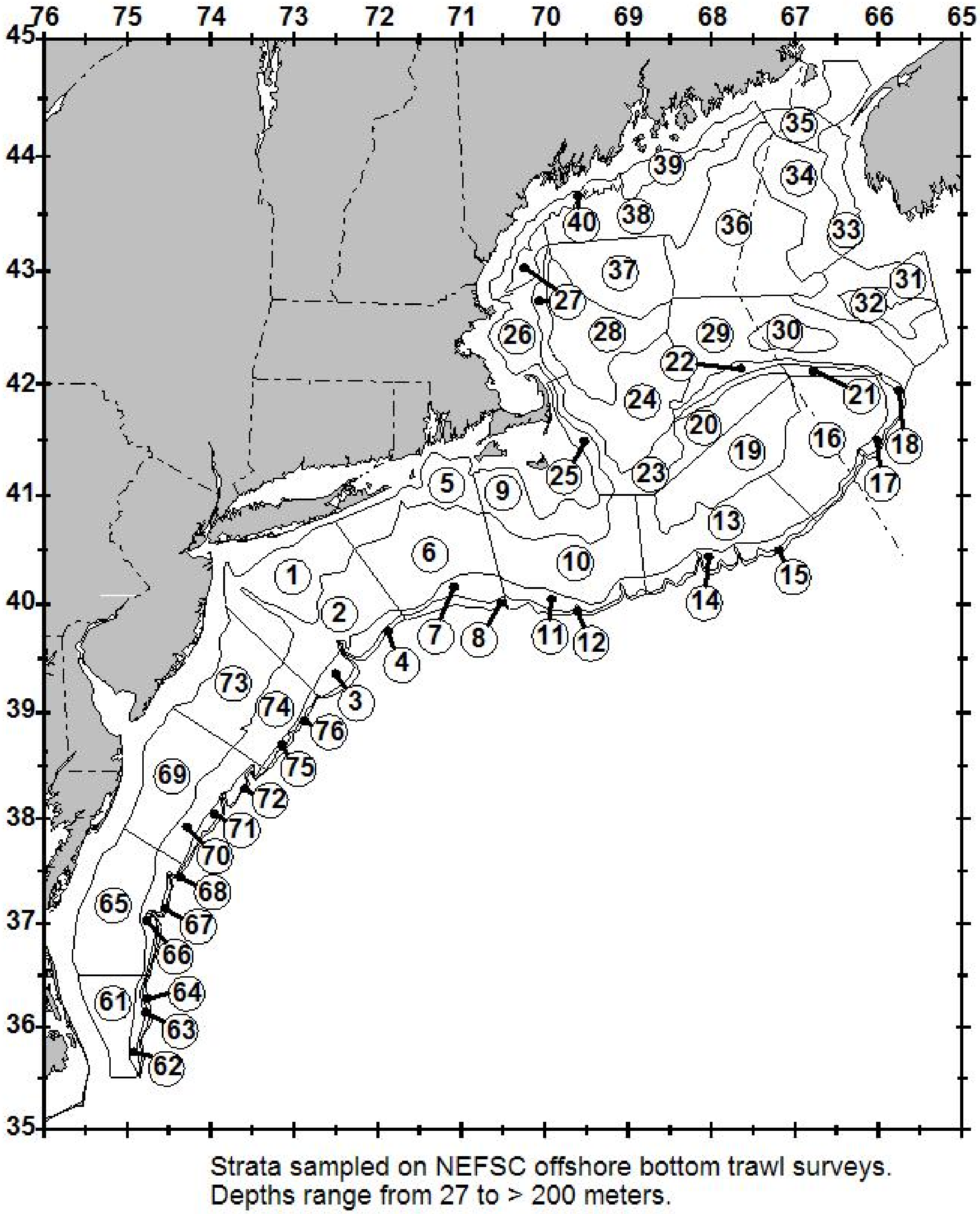
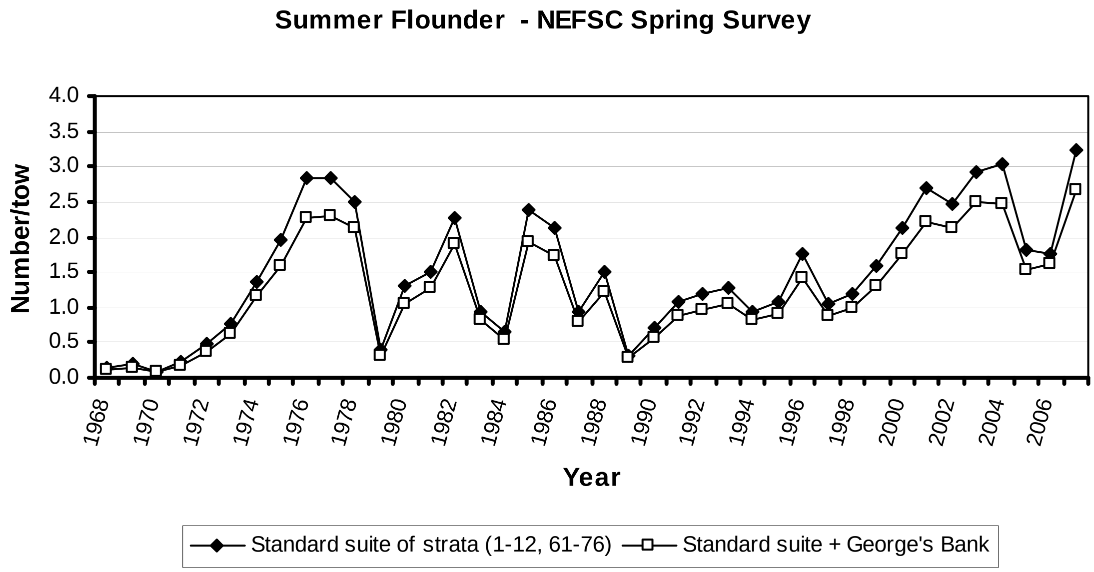


Figure 24. NEFSC survey strata.



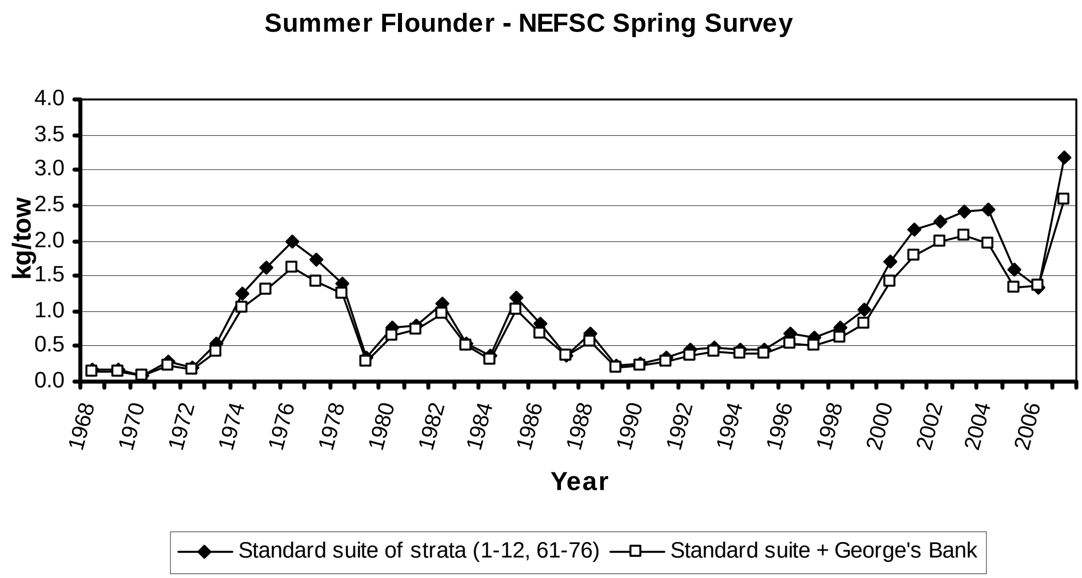
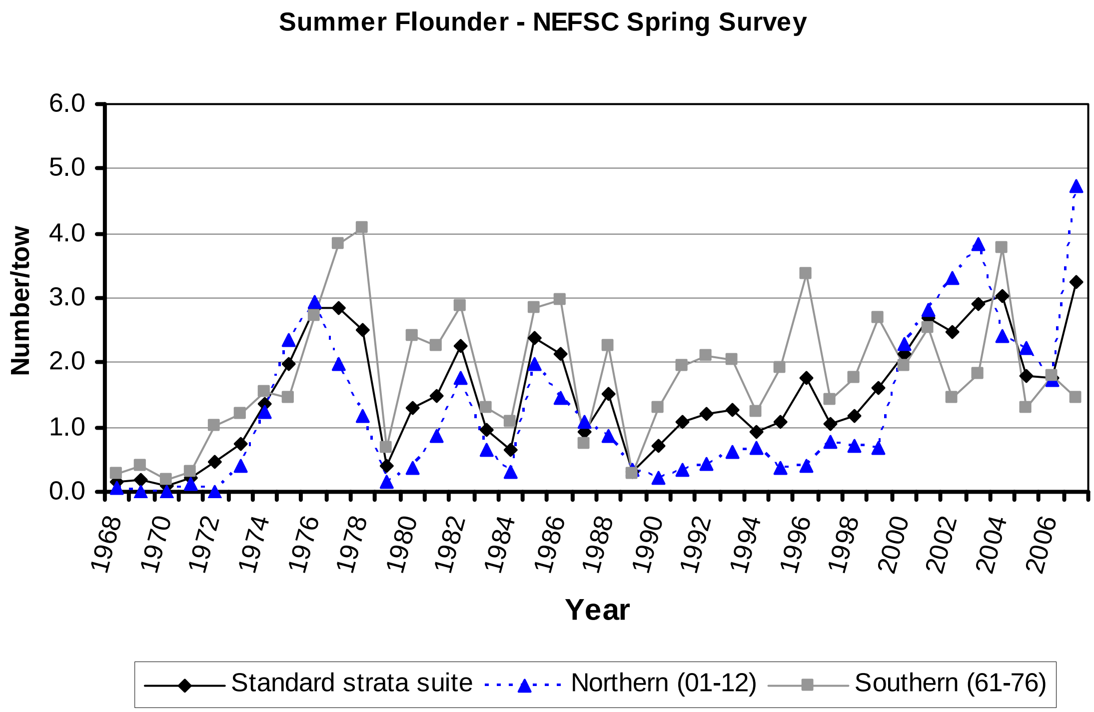


Figure 25. NEFSC Spring survey summer flounder indices (no./tow and kg/tow) with and without the George's Bank survey strata, 1968-2007.



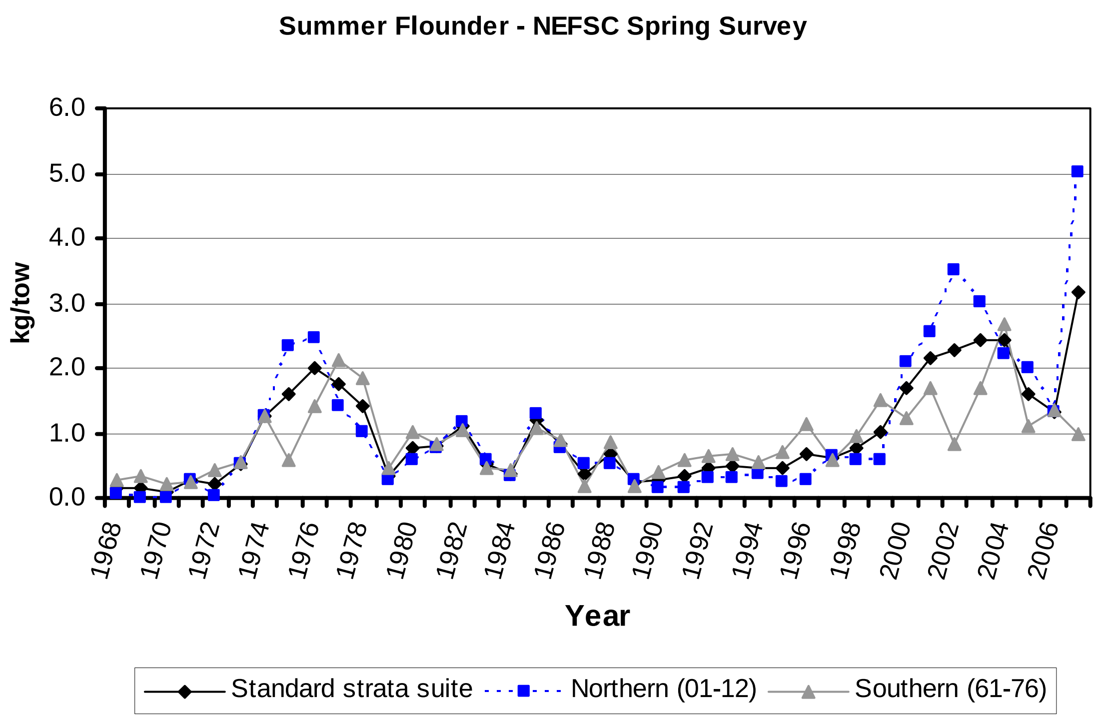
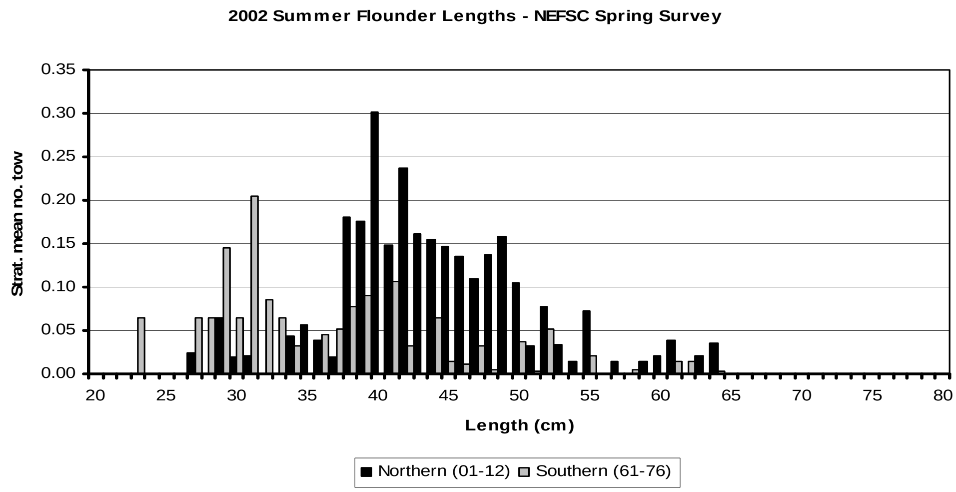
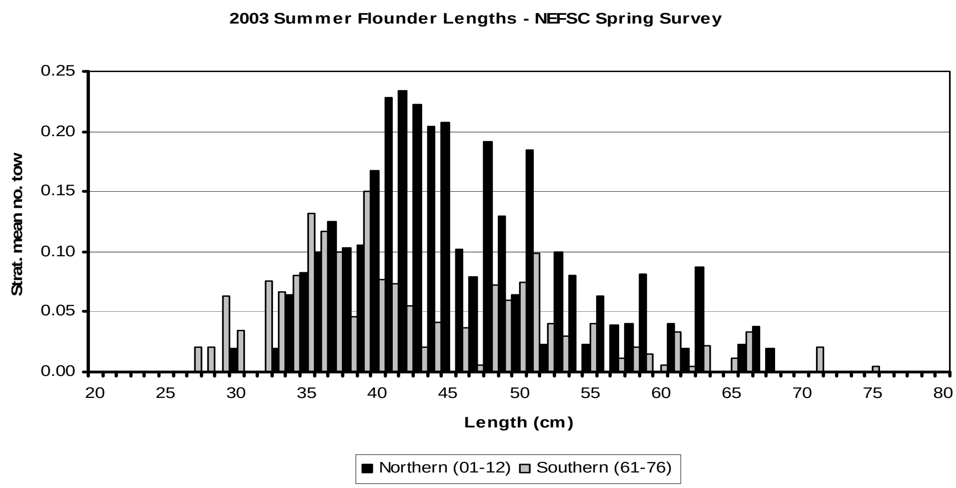


Figure 26. NEFSC Spring survey summer flounder indices (no./tow and kg/tow) with the standard, Northern, and Southern suites of survey strata, 1968-2007.





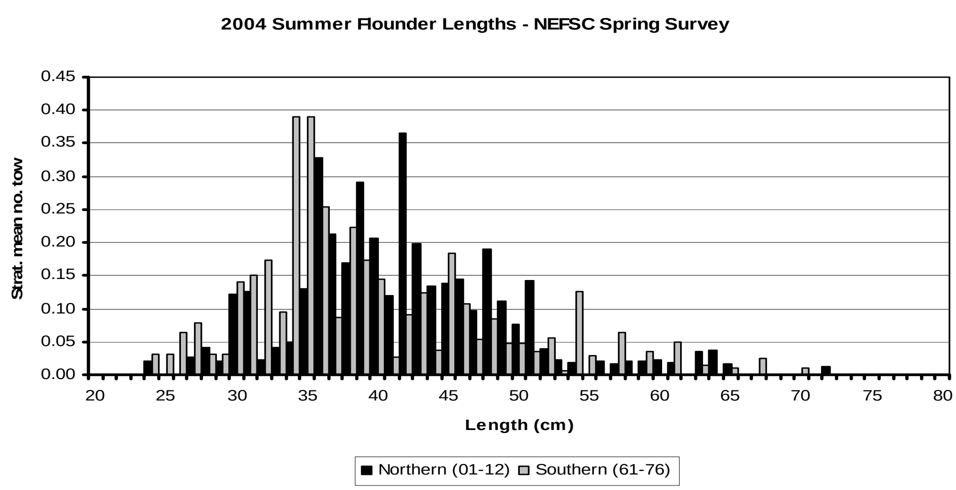


Figure 27. NEFSC Spring survey summer flounder lengths (stratified mean no./tow) for the Northern and Southern suites of survey strata, 2002-2004.

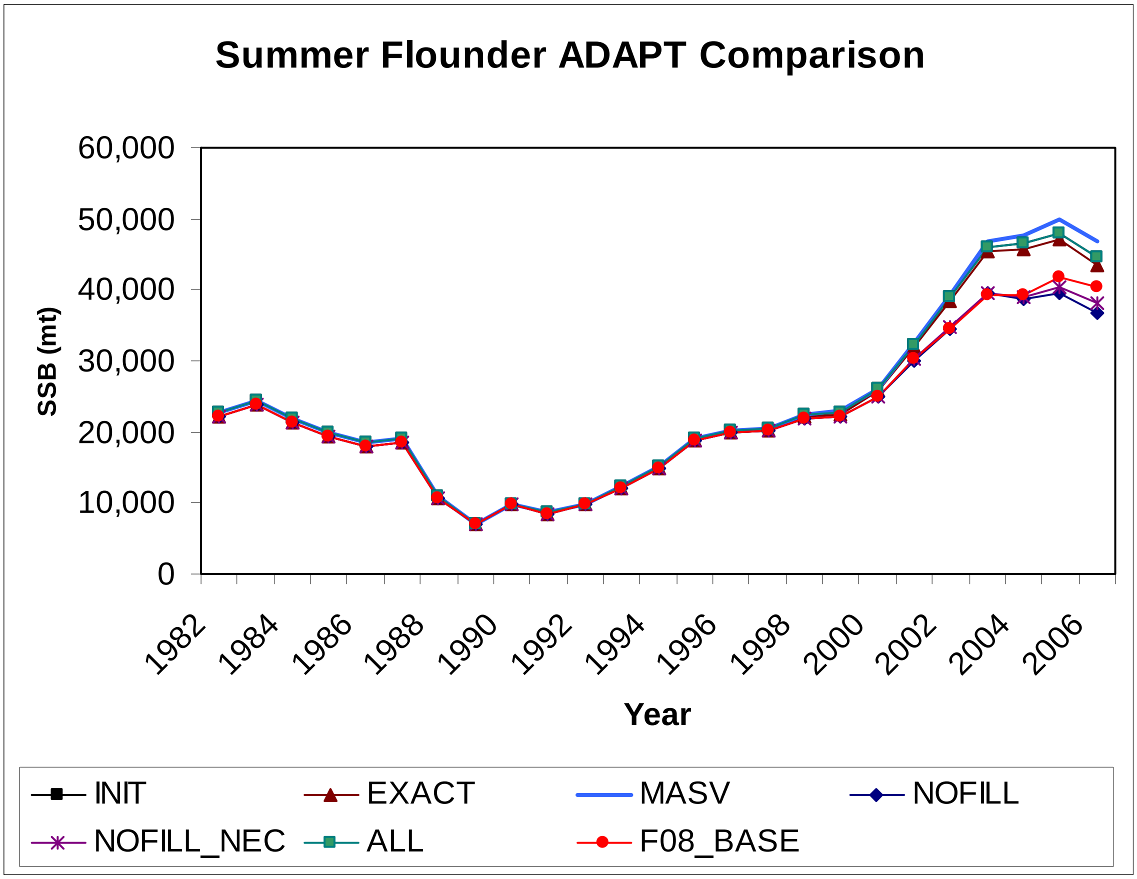


Figure 28. Spawning Stock Biomass (SSB) estimates for alternative ADAPT VPA model configurations. F08_BASE is the final run configuration with catch data through 2006.

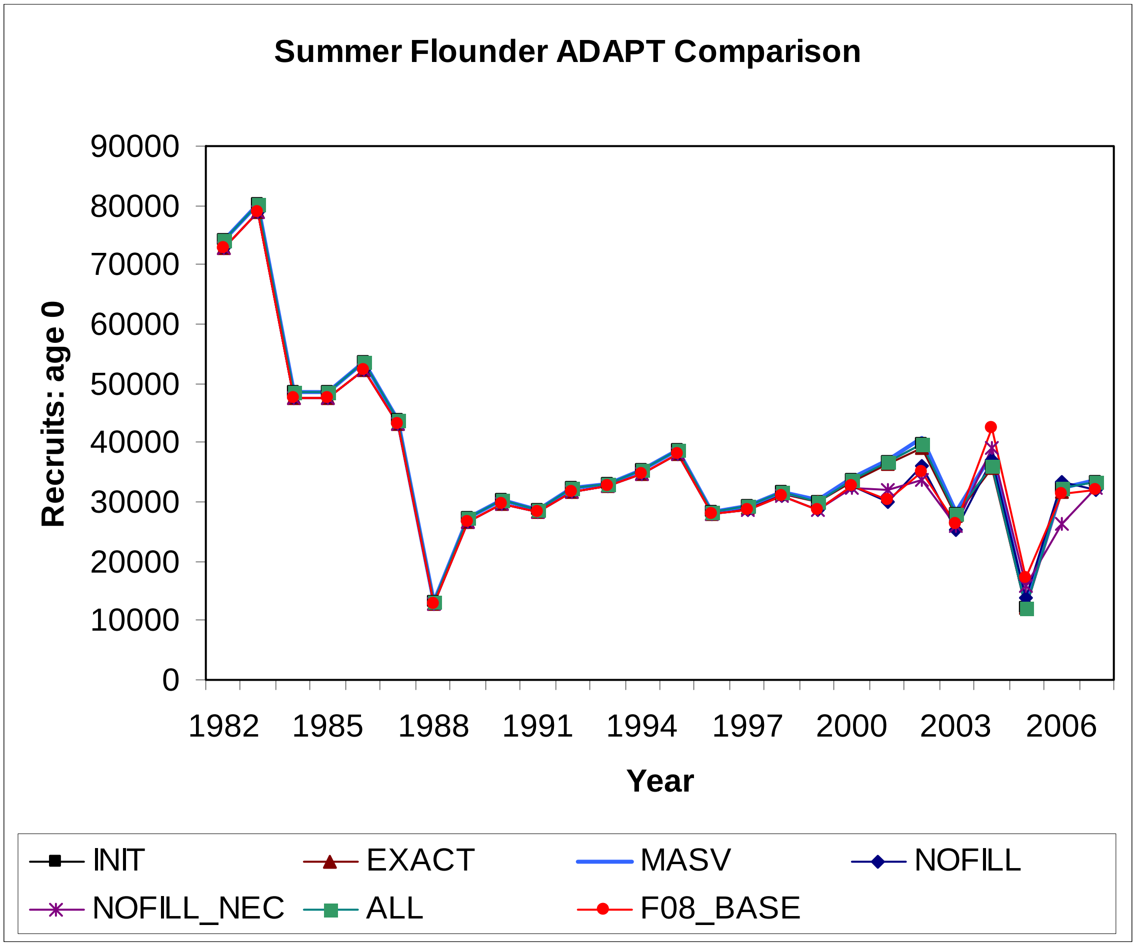


Figure 29. Recruitment at age 0 (R) estimates for alternative ADAPT VPA model configurations. F08_BASE is the final run configuration with catch data through 2006.

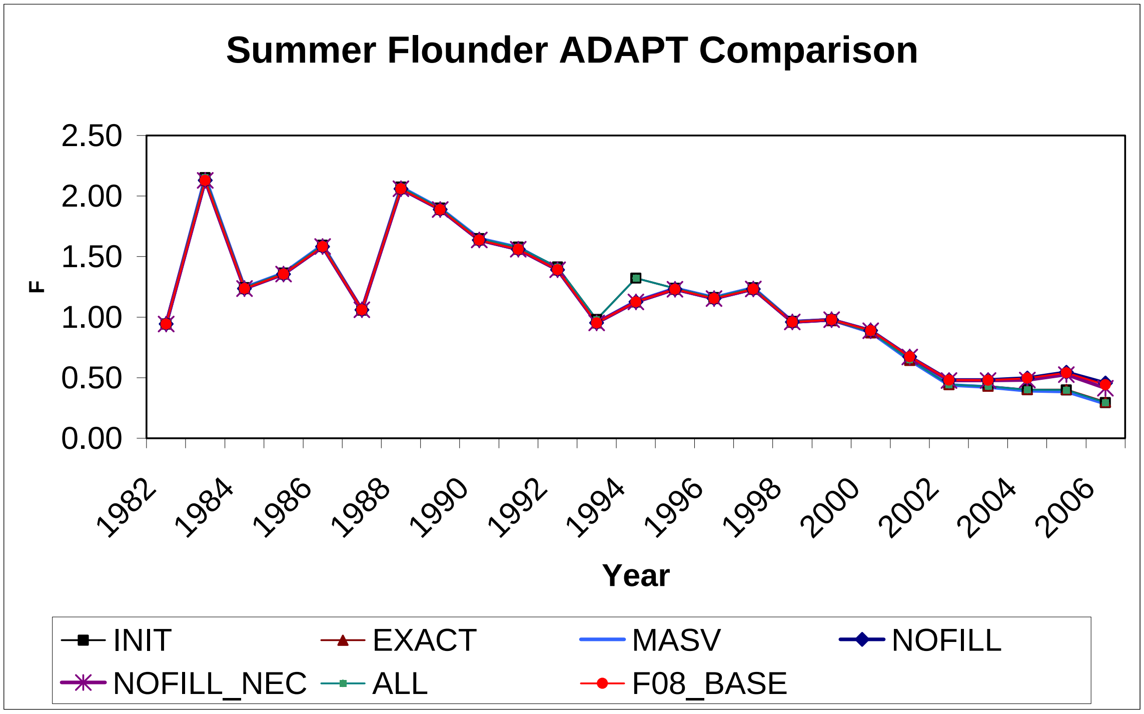


Figure 30. Fishing mortality rate (F, ages 3-5) estimates for alternative ADAPT VPA model configurations. F08_BASE is the final run configuration with catch data through 2006.

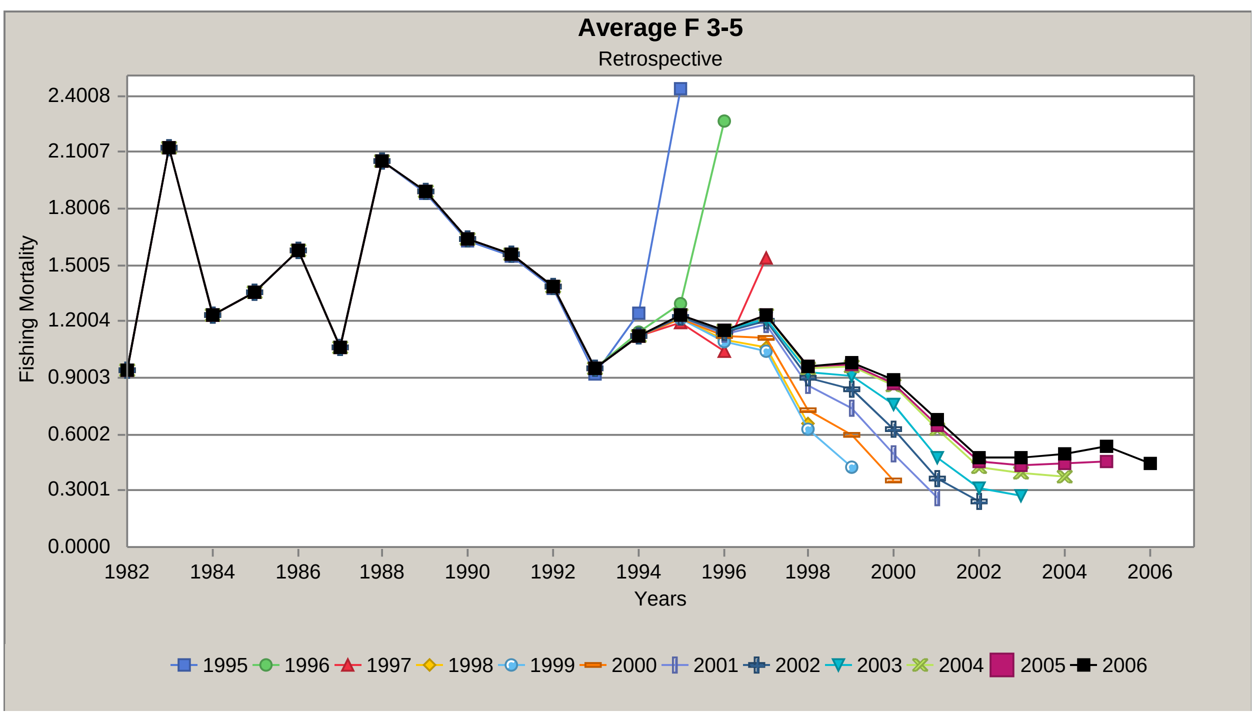


Figure 31. Retrospective analysis of Fishing Mortality (F, ages 3-5) for ADAPT VPA F08_BASE run.

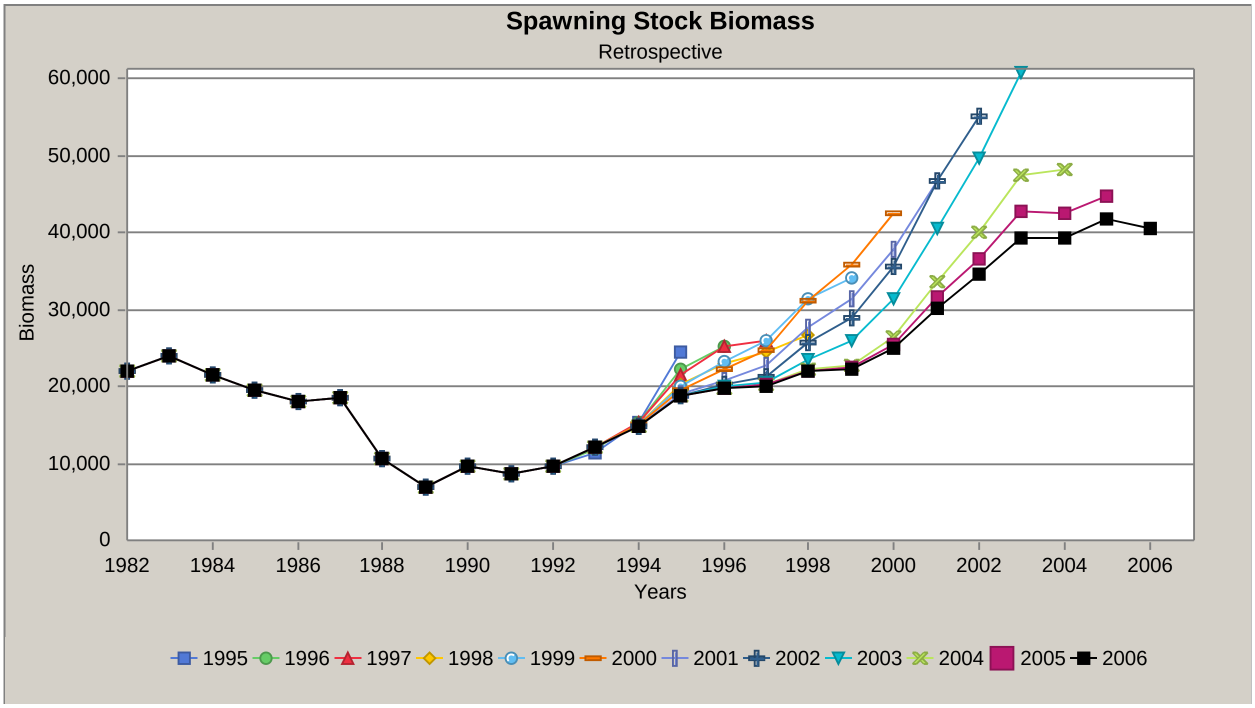


Figure 32. Retrospective analysis of Spawning Stock Biomass (SSB) for ADAPT VPA F08_BASE run.

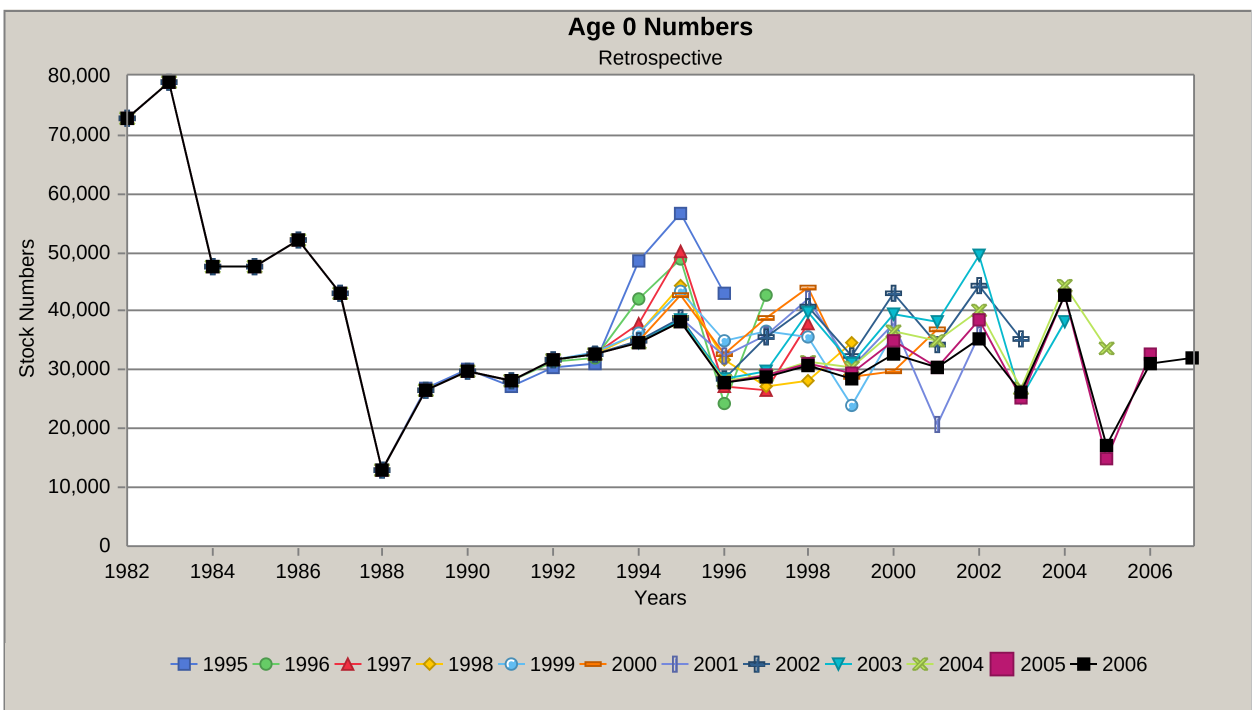


Figure 33. Retrospective analysis of Recruitment at age 0 (R) for ADAPT VPA F08_BASE run.

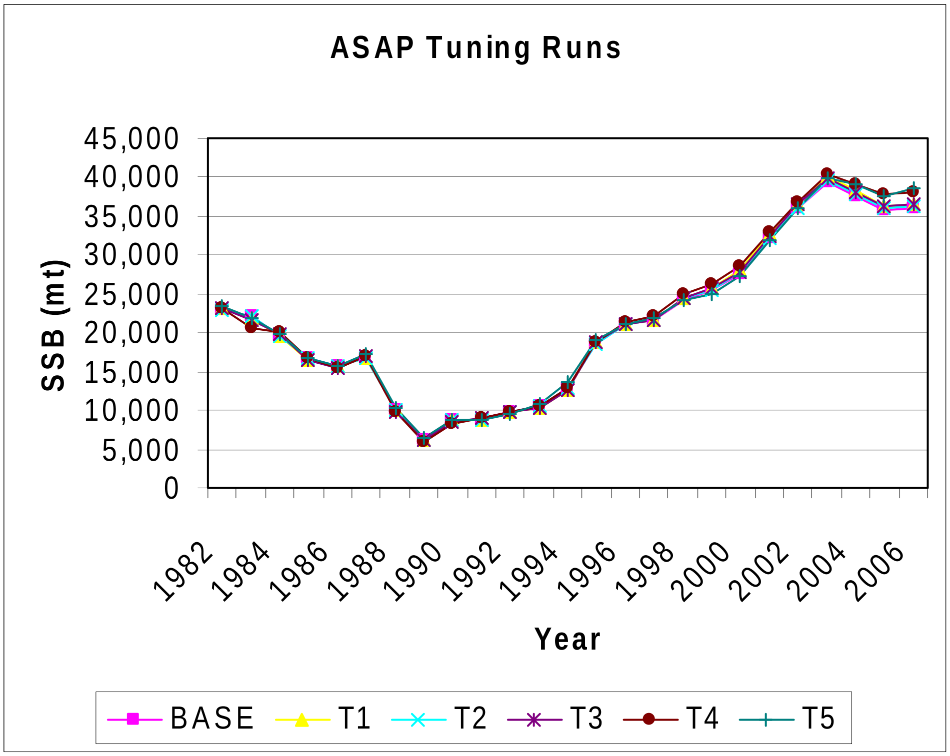


Figure 34. Spawning Stock Biomass (SSB) estimates for ASAP model tuning configurations. F08_BASE_T5 is the final run configuration with catch data through 2006.

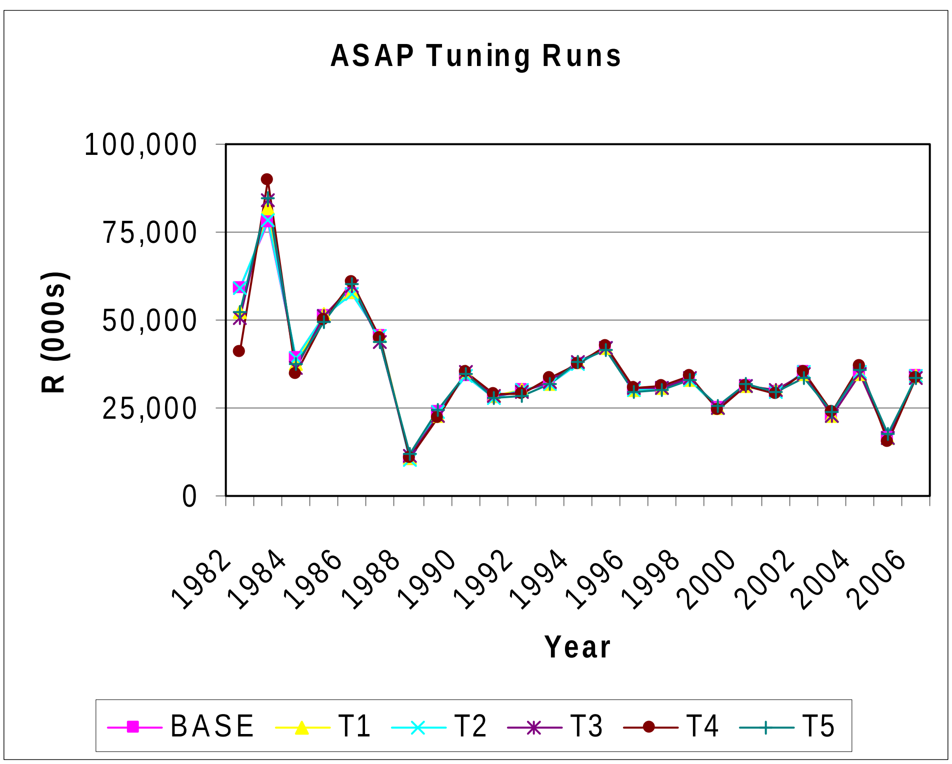


Figure 35. Recruitment at age 0 (R) estimates for alternative ASAP model configurations. F08_BASE_T5 is the final run configuration with catch data through 2006.

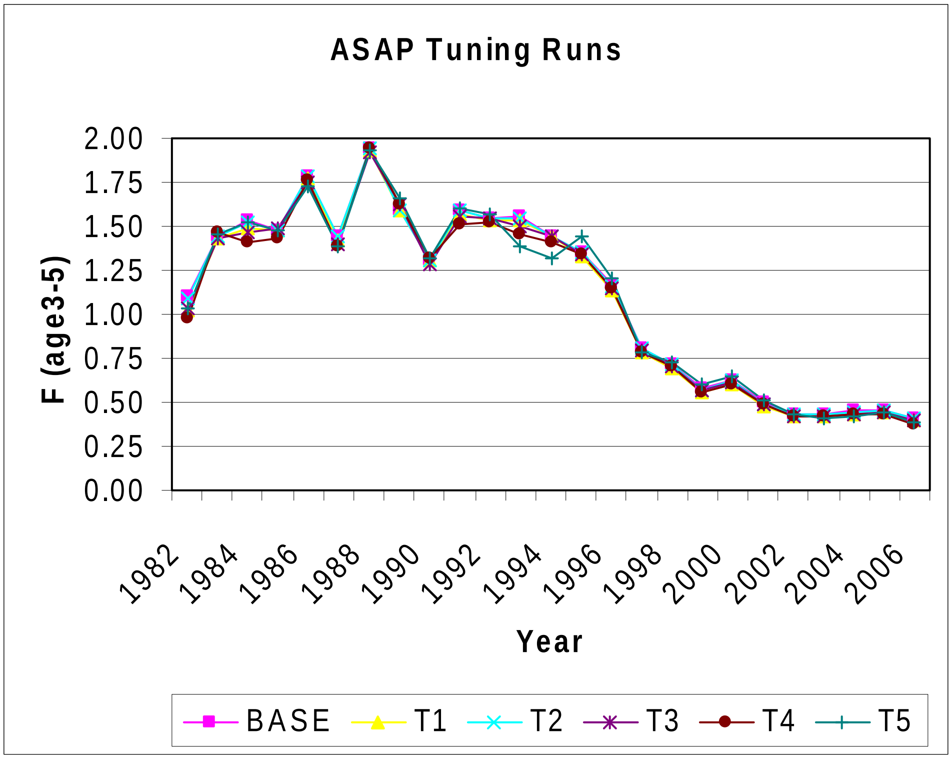


Figure 36. Fishing mortality rate (F, ages 3-5) estimates for alternative ASAP model configurations. F08_BASE_T5 is the final run configuration with catch data through 2006.

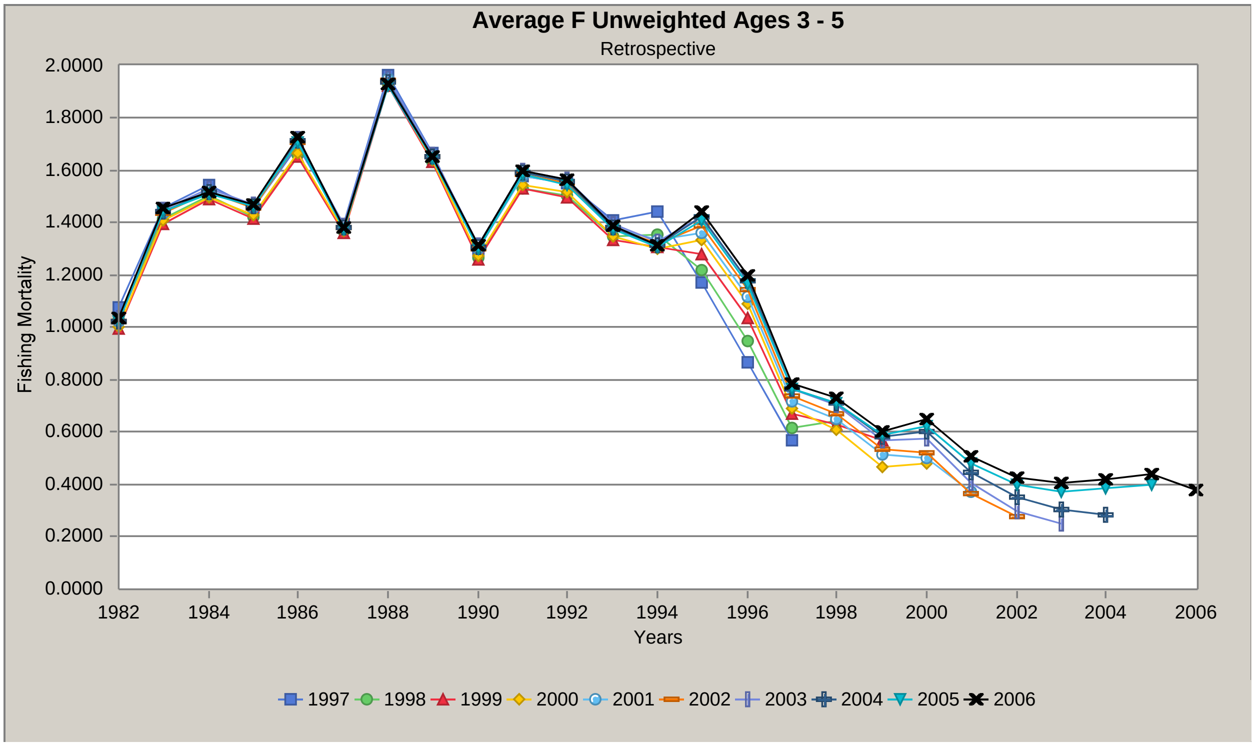


Figure 37. Retrospective analysis of Fishing Mortality (F, ages 3-5) for ASAP F08_BASE_T5 run.

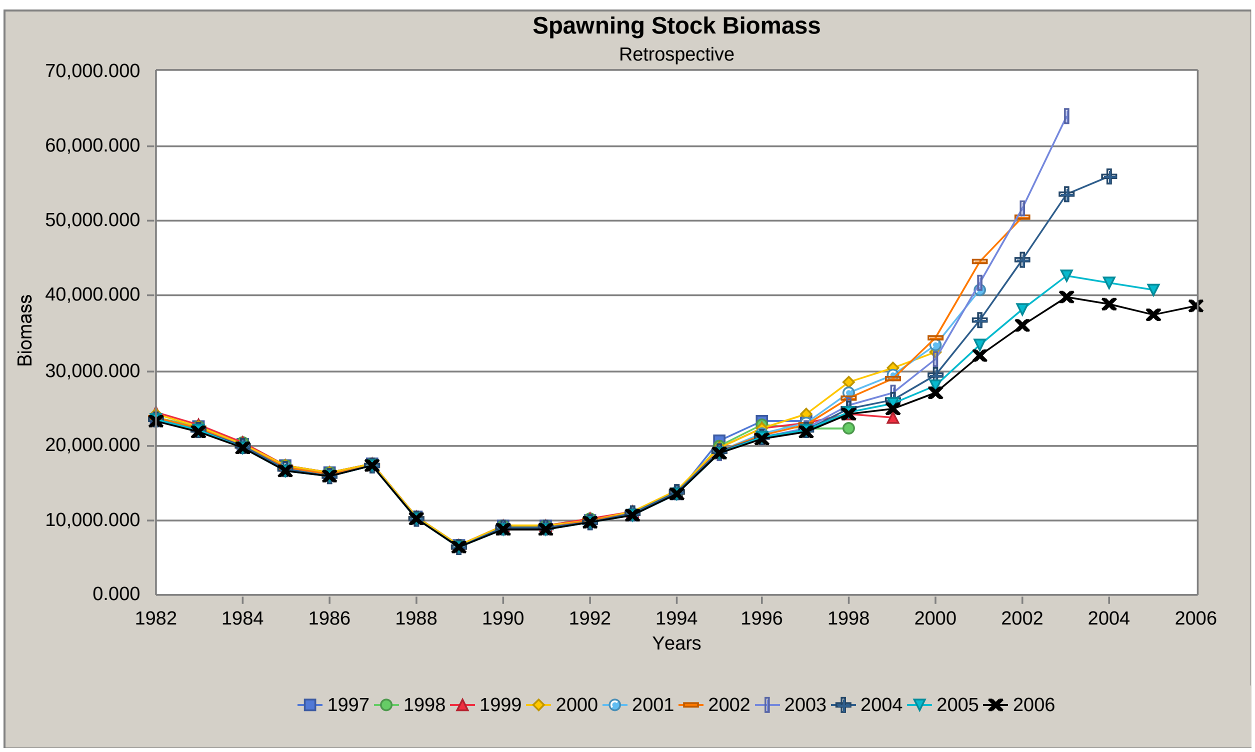


Figure 38. Retrospective analysis of Spawning Stock Biomass (SSB) for ASAP F08_BASE_T5 run.

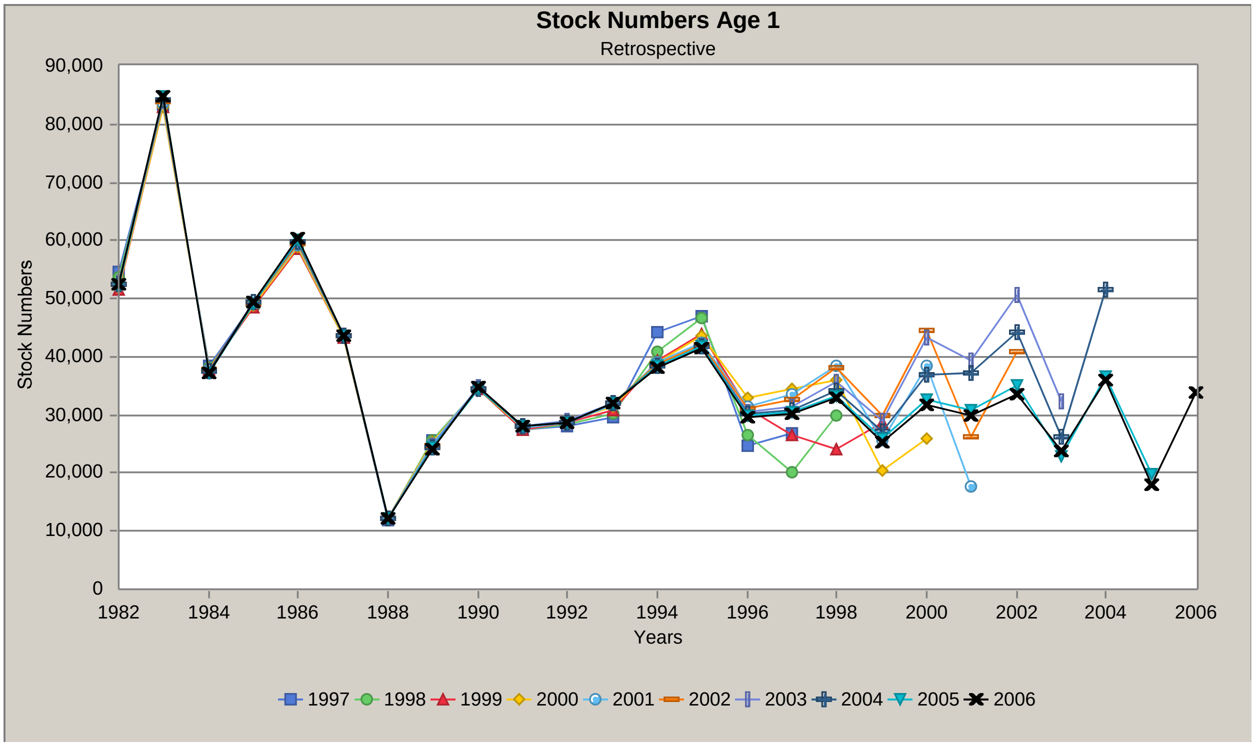


Figure 39. Retrospective analysis of Recruitment at age 0 (R) for ASAP F08_BASE_T5 run. Note that ASAP age 1 is true age 0.

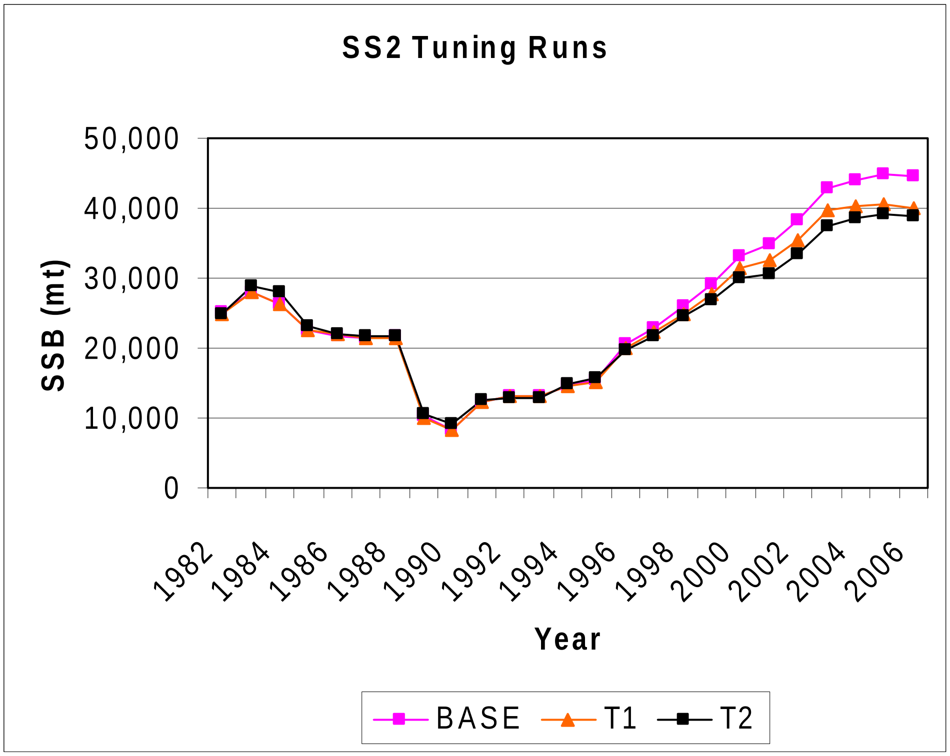


Figure 40. Spawning Stock Biomass (SSB) estimates for SS2 model tuning configurations. F08_BASE_T2 is the final run configuration with catch data through 2006.

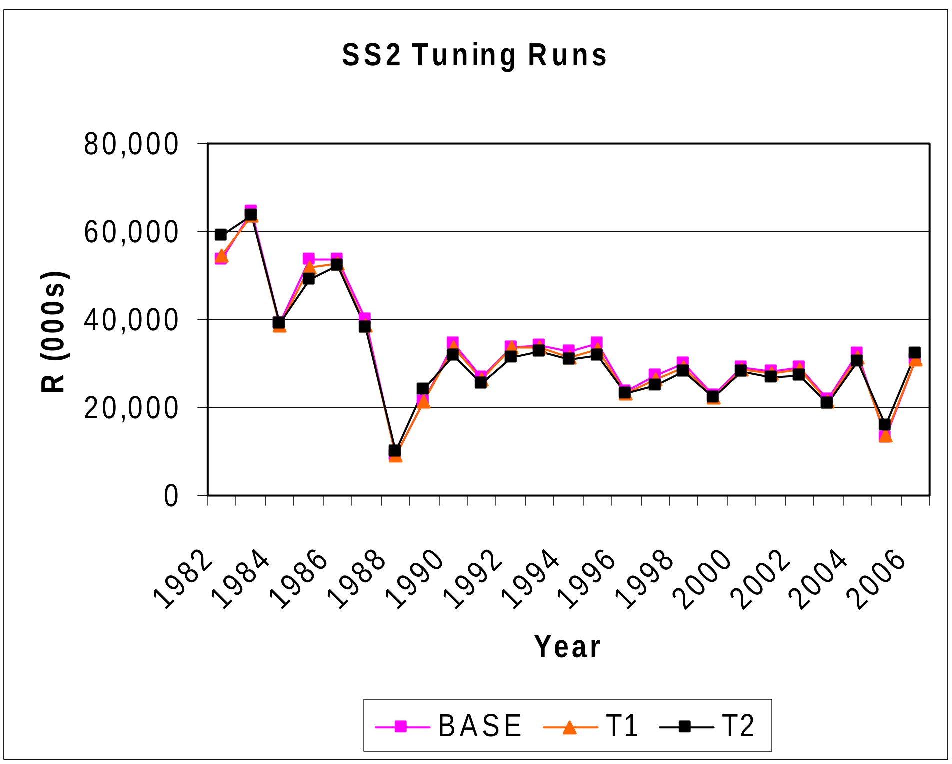


Figure 41. Recruitment at age 0 (R) estimates for alternative SS2 model configurations. F08_BASE_T2 is the final run configuration with catch data through 2006.

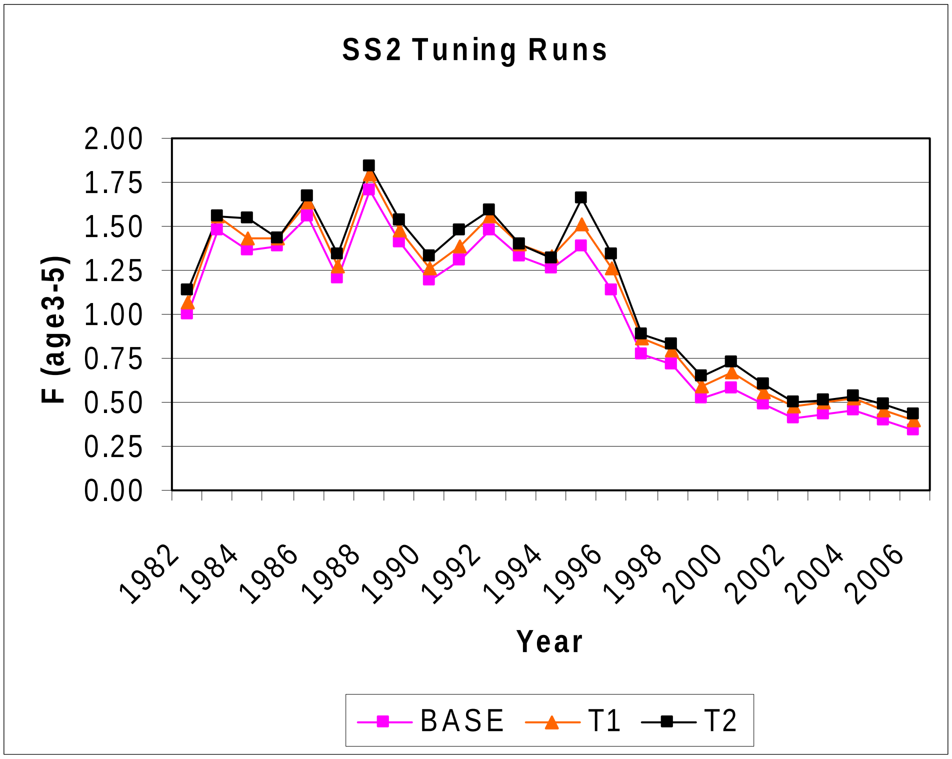


Figure 42. Fishing mortality rate (F, ages 3-5) estimates for alternative SS2 model configurations. F08_BASE_T2 is the final run configuration with catch data through 2006.

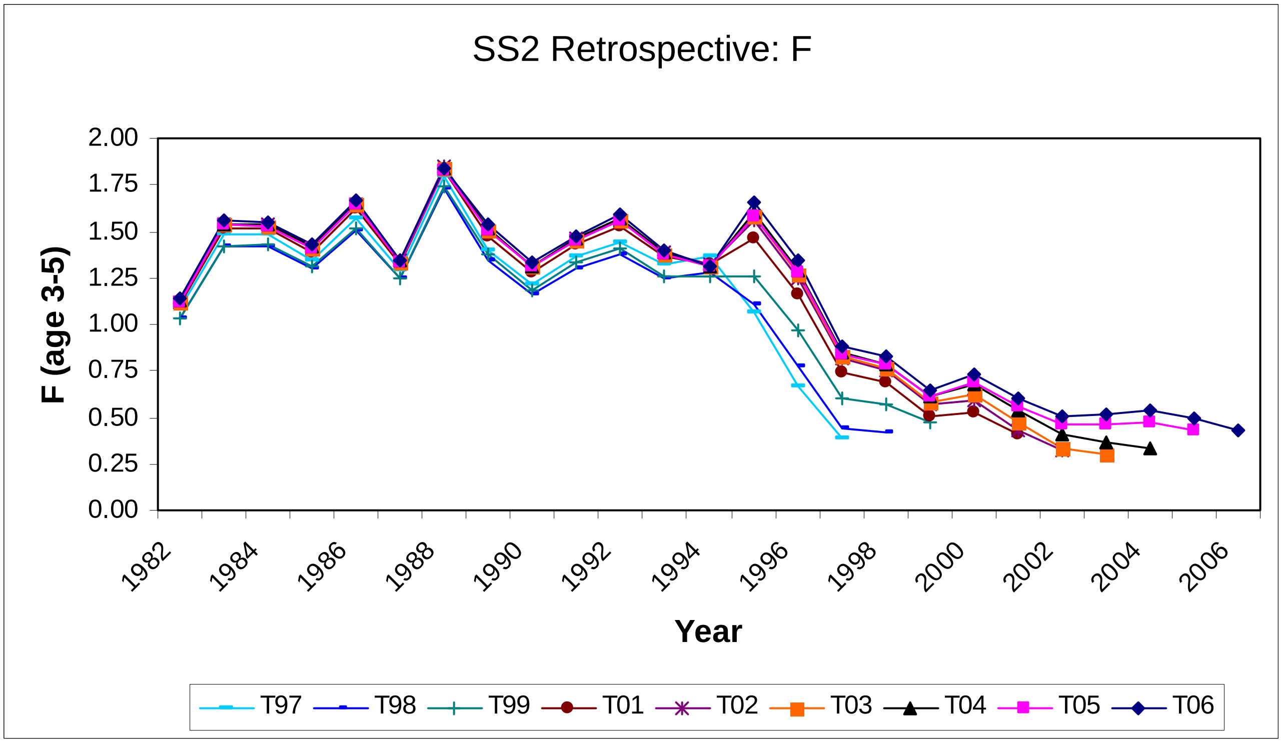


Figure 43. Retrospective analysis of Fishing Mortality (F, ages 3-5) for SS2 F08_BASE_T2 run.

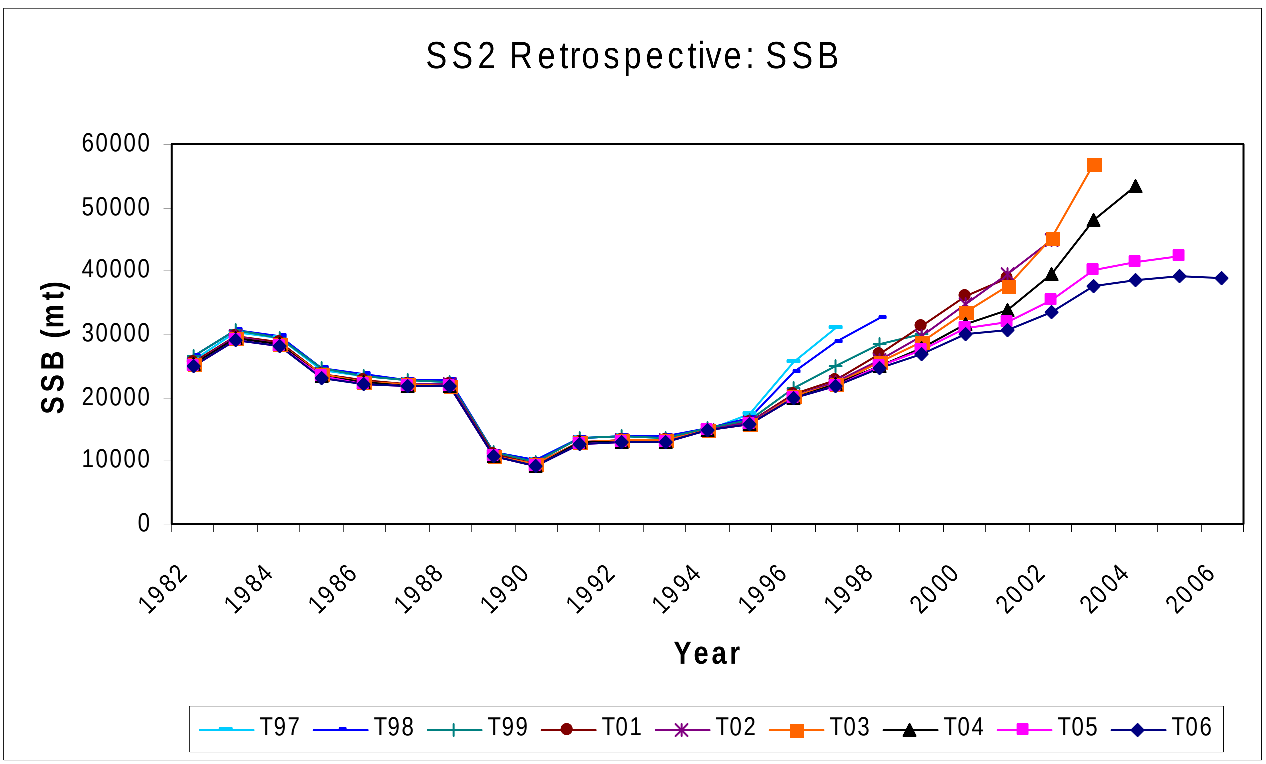


Figure 44. Retrospective analysis of Spawning Stock Biomass (SSB) for SS2 F08_BASE_T2 run.

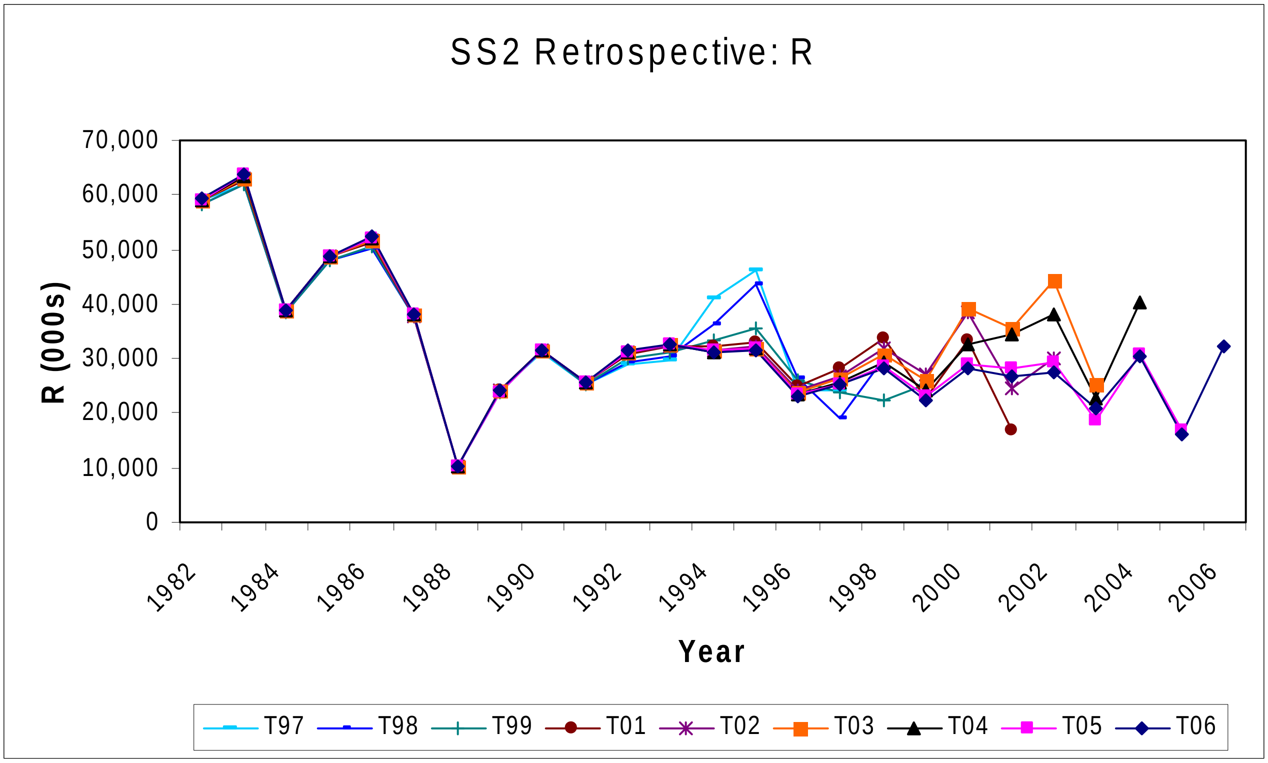


Figure 45. Retrospective analysis of Recruitment at age 0 (R) for SS2 F08_BASE_T2 run.

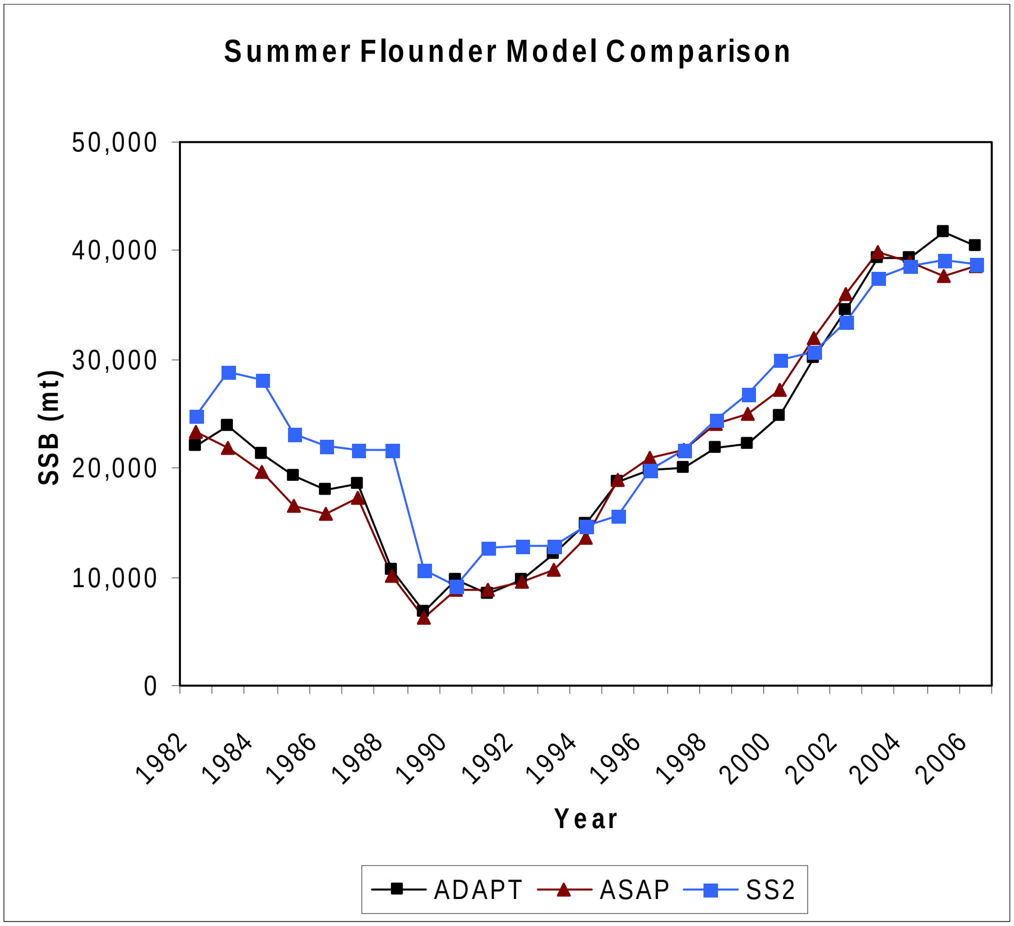


Figure 46. Spawning Stock Biomass (SSB) estimates from ADAPT VPA, ASAP, and SS2 BASE case models.

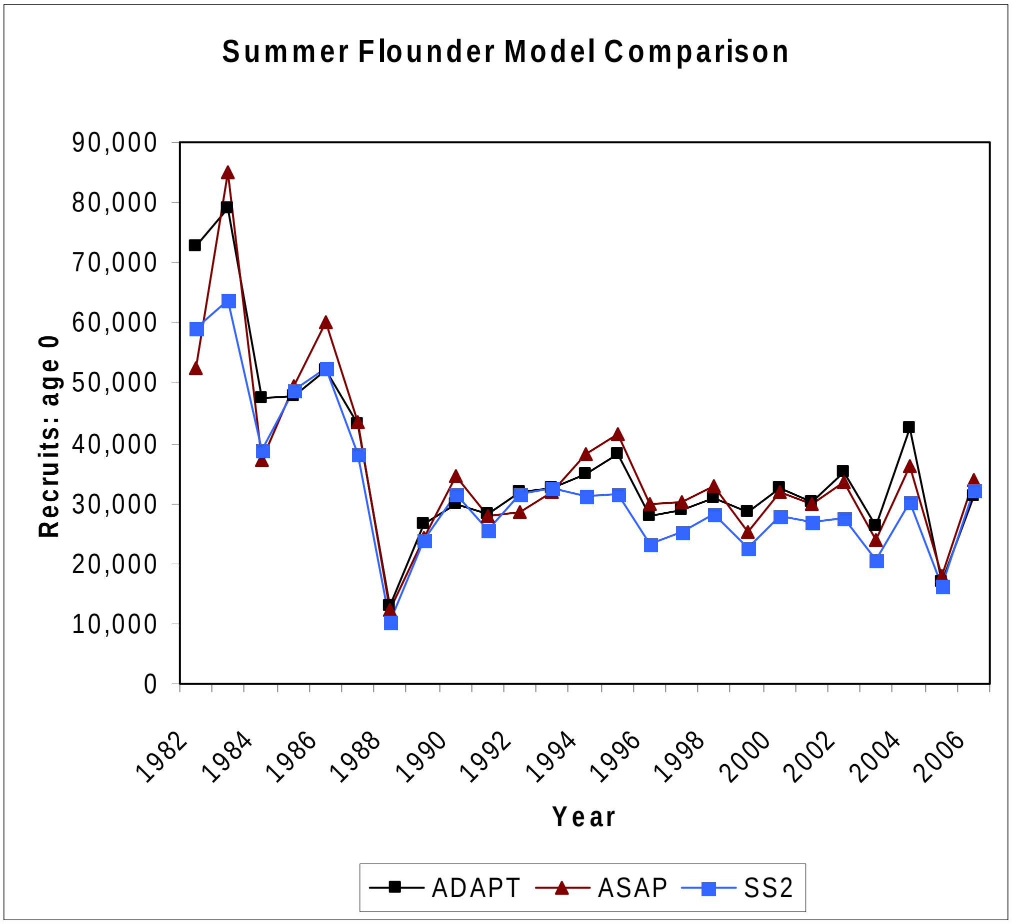


Figure 47. Recruitment at age 0 (R) estimates for ADAPT VPA, ASAP, and SS2 BASE case models.

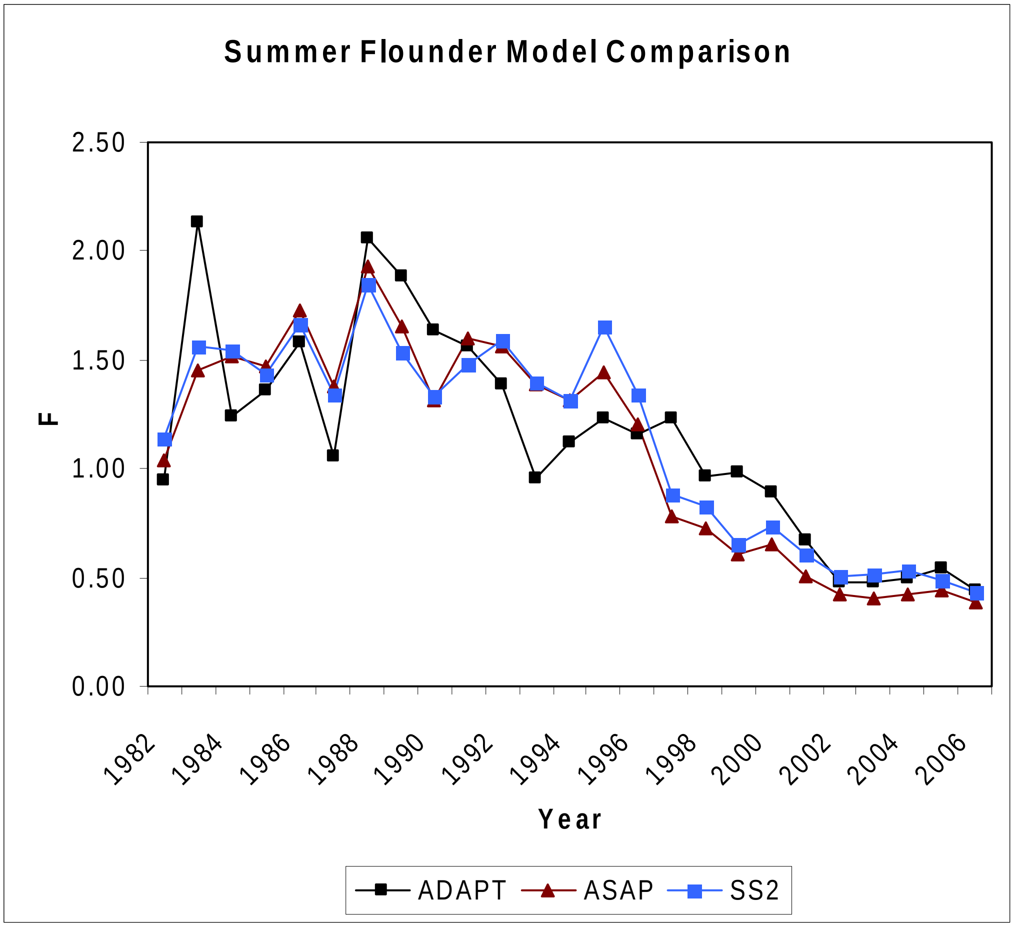


Figure 48. Fishing mortality rate (F, ages 3-5) estimates for ADAPT VPA, ASAP, and SS2 BASE case models.

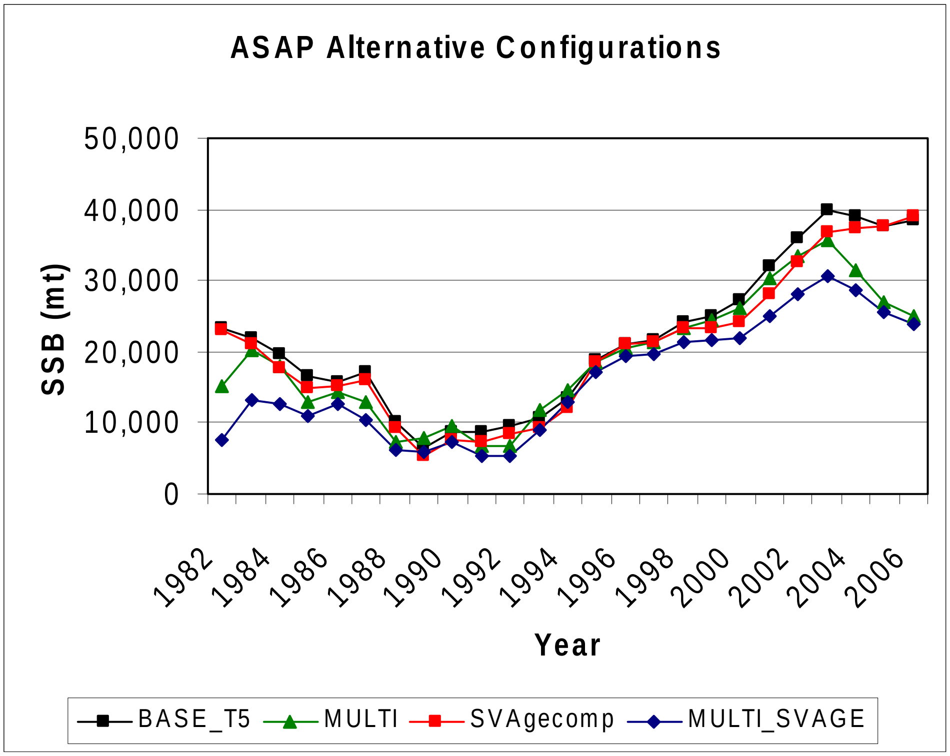


Figure 49. Spawning Stock Biomass (SSB) estimates from the ASAP BASE case and three alternative configuration models.

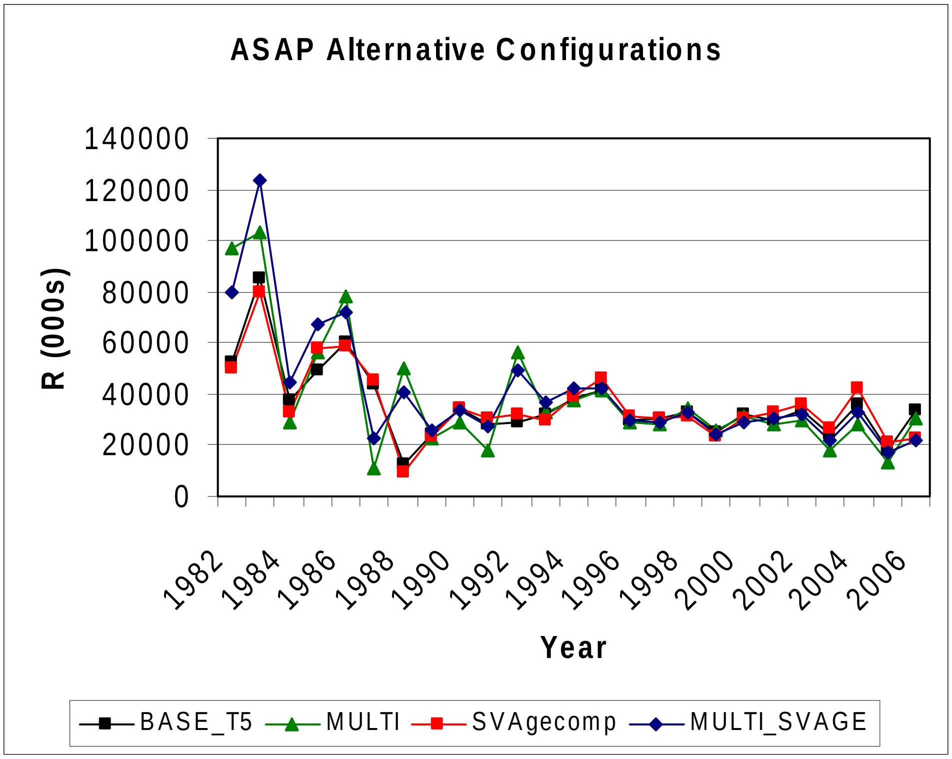


Figure 50. Recruitment at age 0 (R) estimates from the ASAP BASE case and three alternative configuration models.

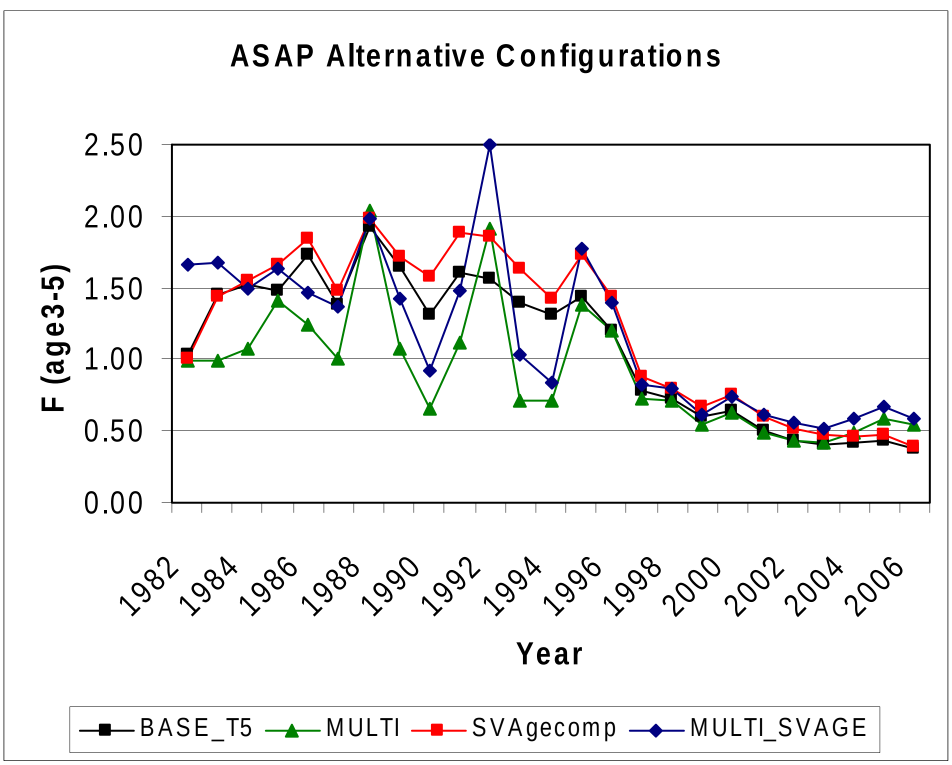


Figure 51. Fishing mortality rate (F, S = 1) estimates from the ASAP BASE case and three alternative configuration models.

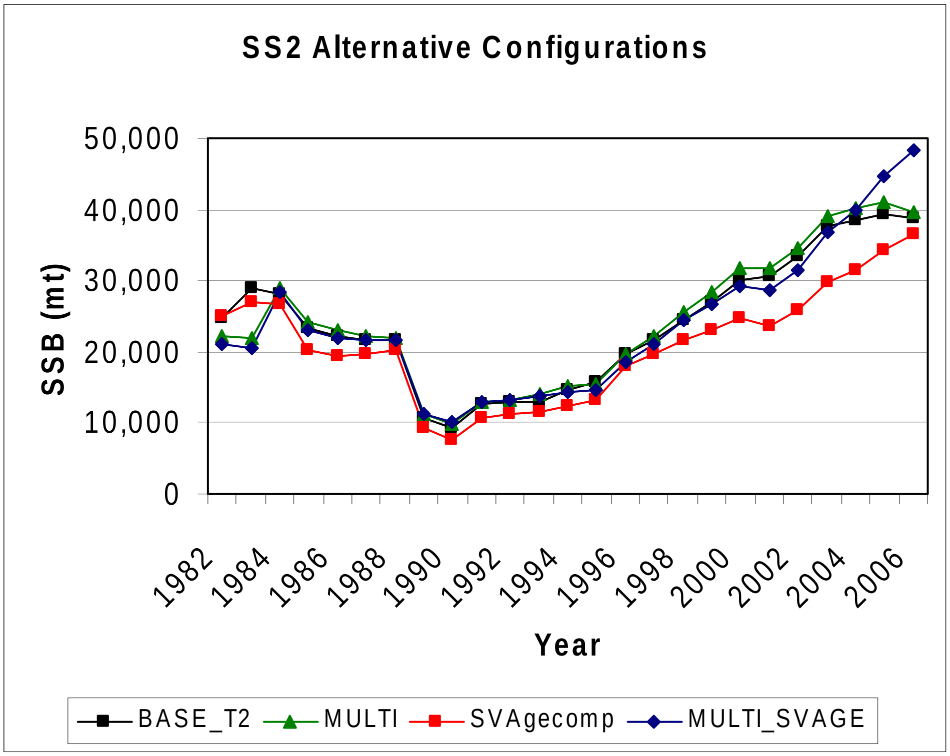


Figure 52. Spawning Stock Biomass (SSB) estimates from the SS2 BASE case and three alternative configuration models.

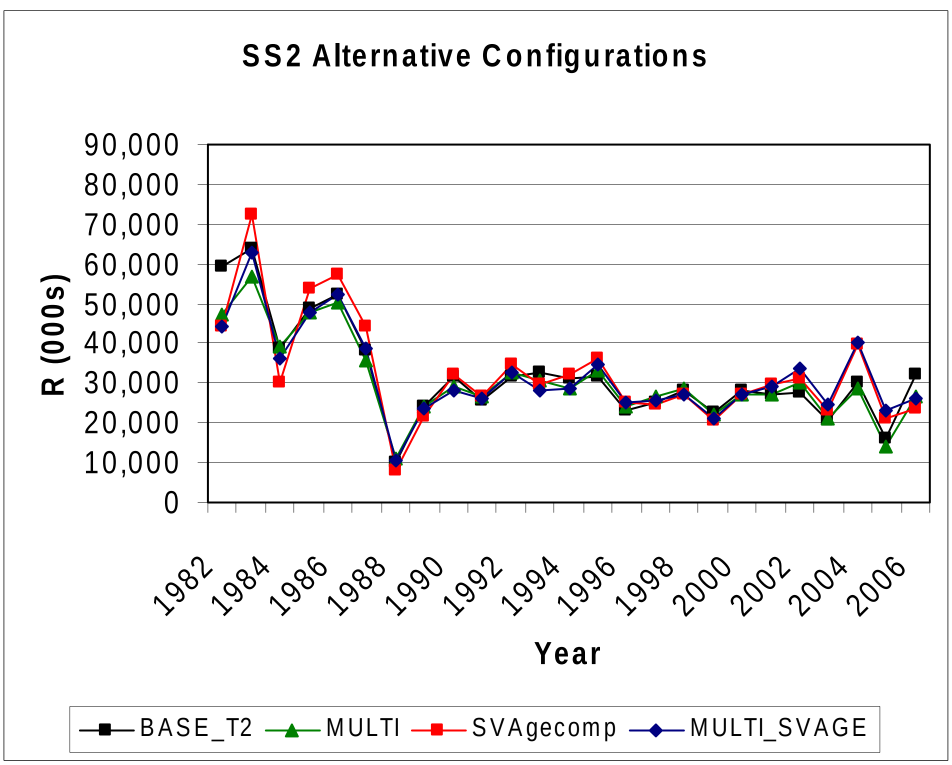


Figure 53. Recruitment at age 0 (R) estimates from the SS2 BASE case and three alternative configuration models.

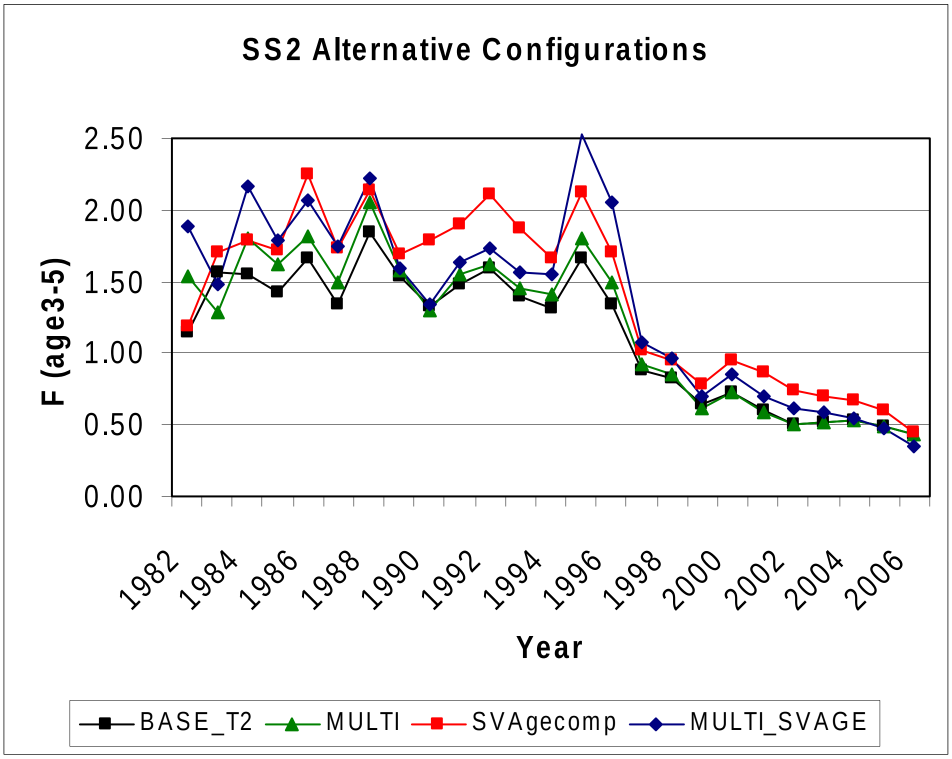
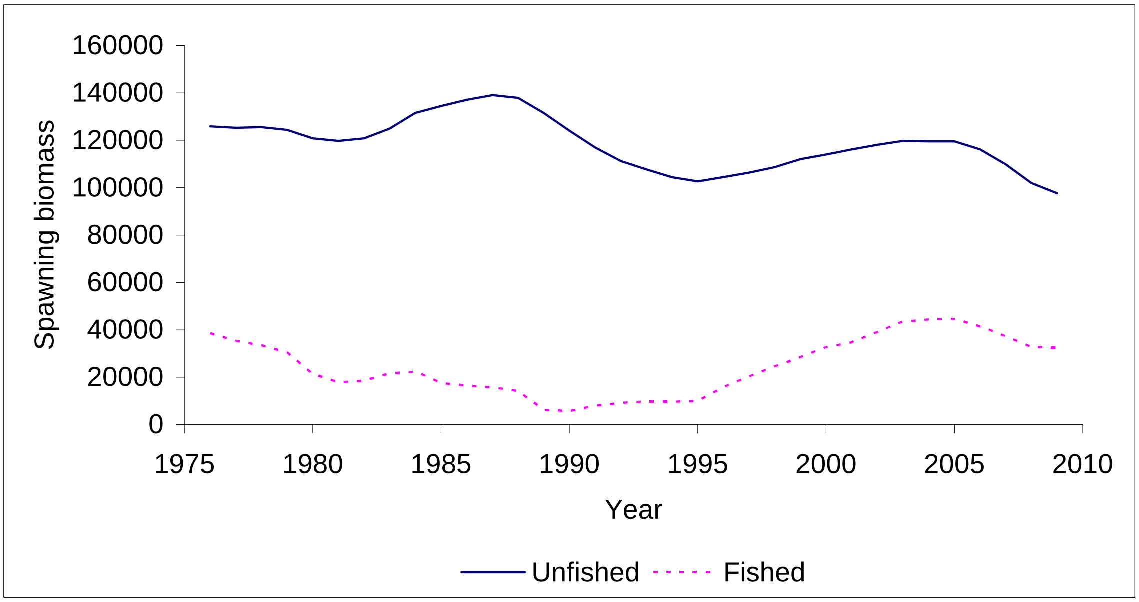


Figure 54. Fishing mortality rate (F, S = 1) estimates from the SS2 BASE case and three alternative configuration models.



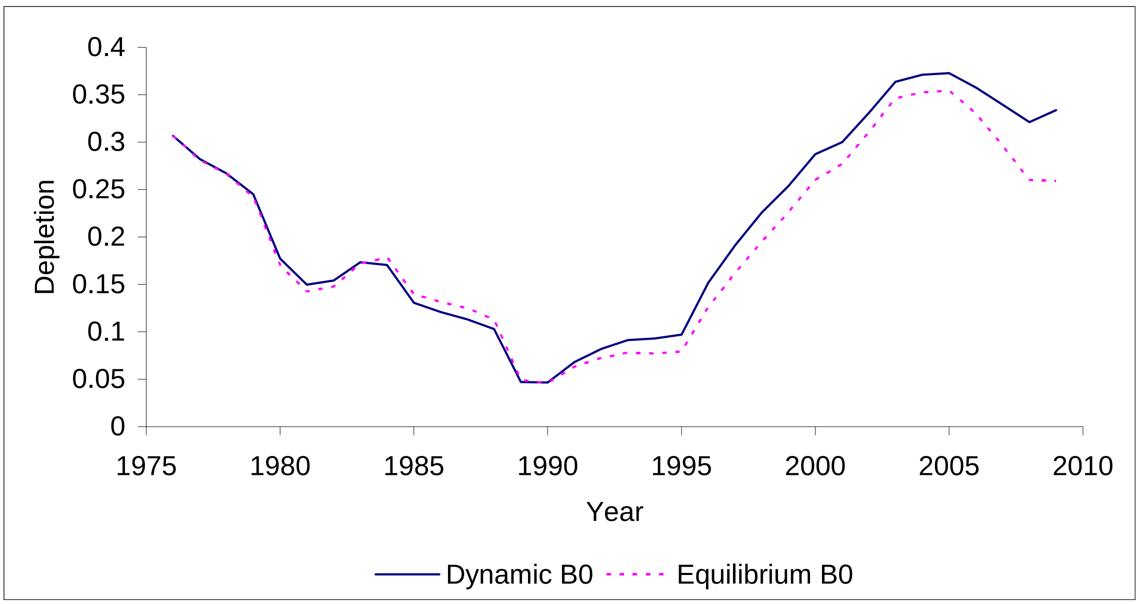


Figure 55. Time series of spawning biomass (top) estimated from the sex-structured stock assessment (fished) compared to the theoretical spawning biomass that would have been present in the absence of fishing (unfished). Time series of depletion levels (bottom) estimated from the sex-structured stock assessment using either the average unfished biomass (Equilibrium B0) or the theoretical spawning biomass that would have been present in the absence of fishing (Dynamic B0).

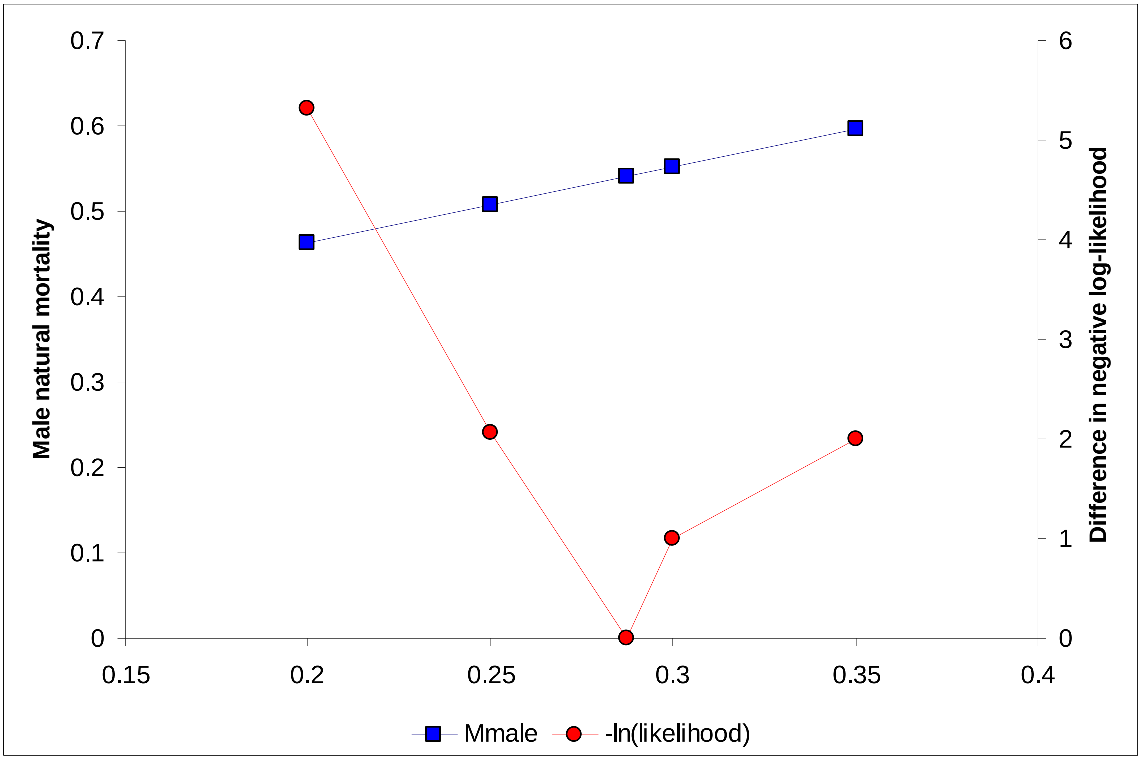


Figure 56. Profile likelihood of female natural mortality (right axis) with the corresponding estimates of male natural mortality (left axis). Female natural mortality is plotted on the x-axis. The SS2 model estimates female natural mortality at 0.28, corresponding to the zero value for the difference in log likelihood.

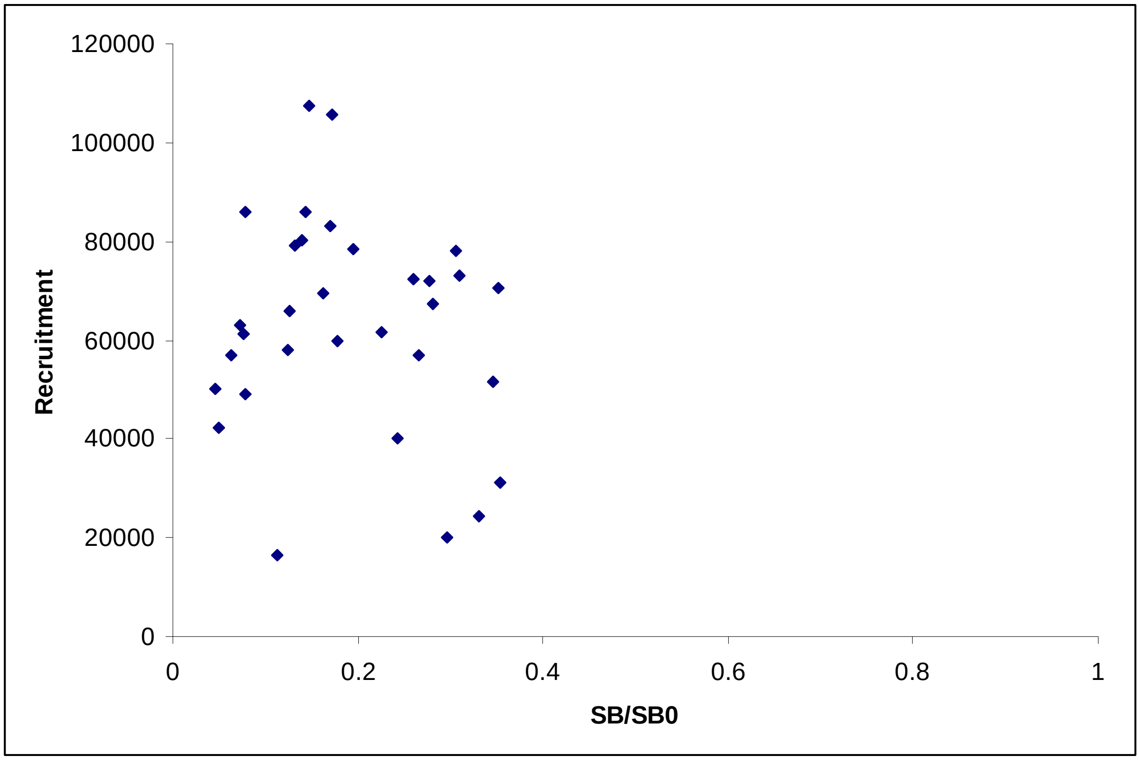


Figure 57. The relationship between recruitment and spawning stock size. Spawning stock size is shown as the spawning stock size relative to the average spawning stock size in the absence of fishing.

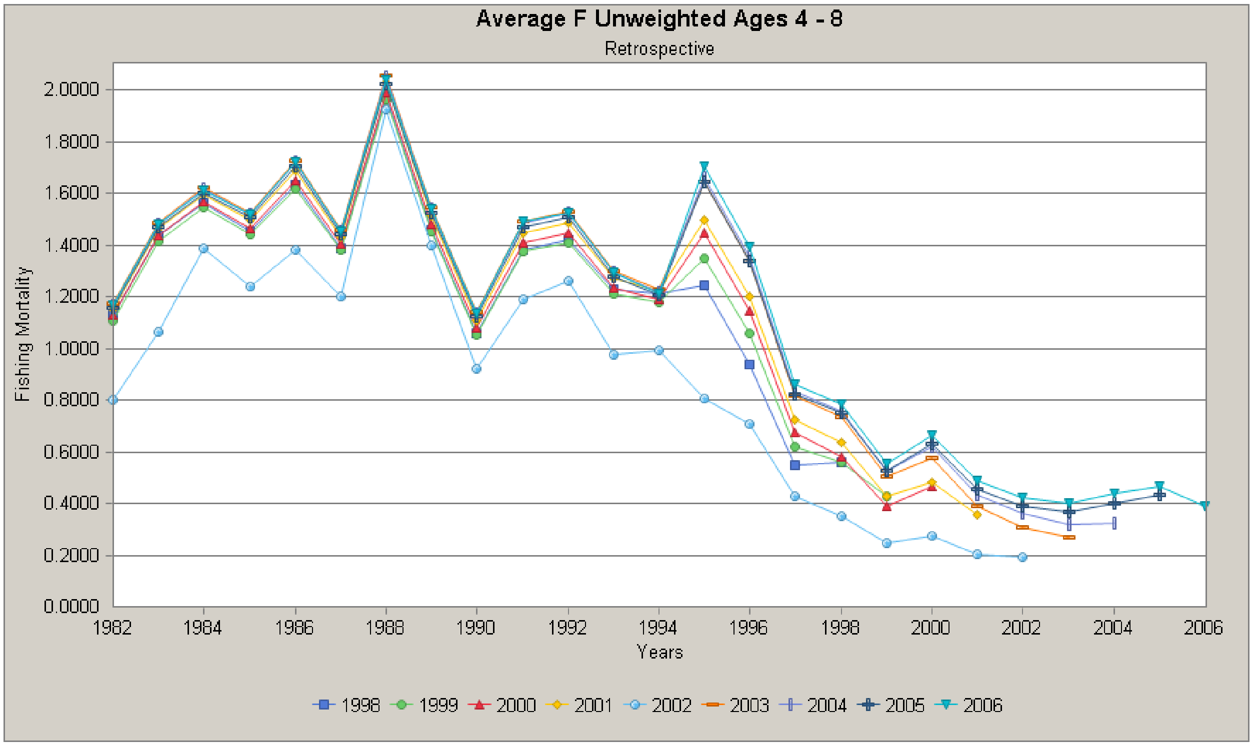


Figure 58. Retrospective analysis of Fishing Mortality (F, ages 3+) for ASAP F08_FINAL_T2006 run. Note that ASAP ages 4-8 are true ages 3-7+.

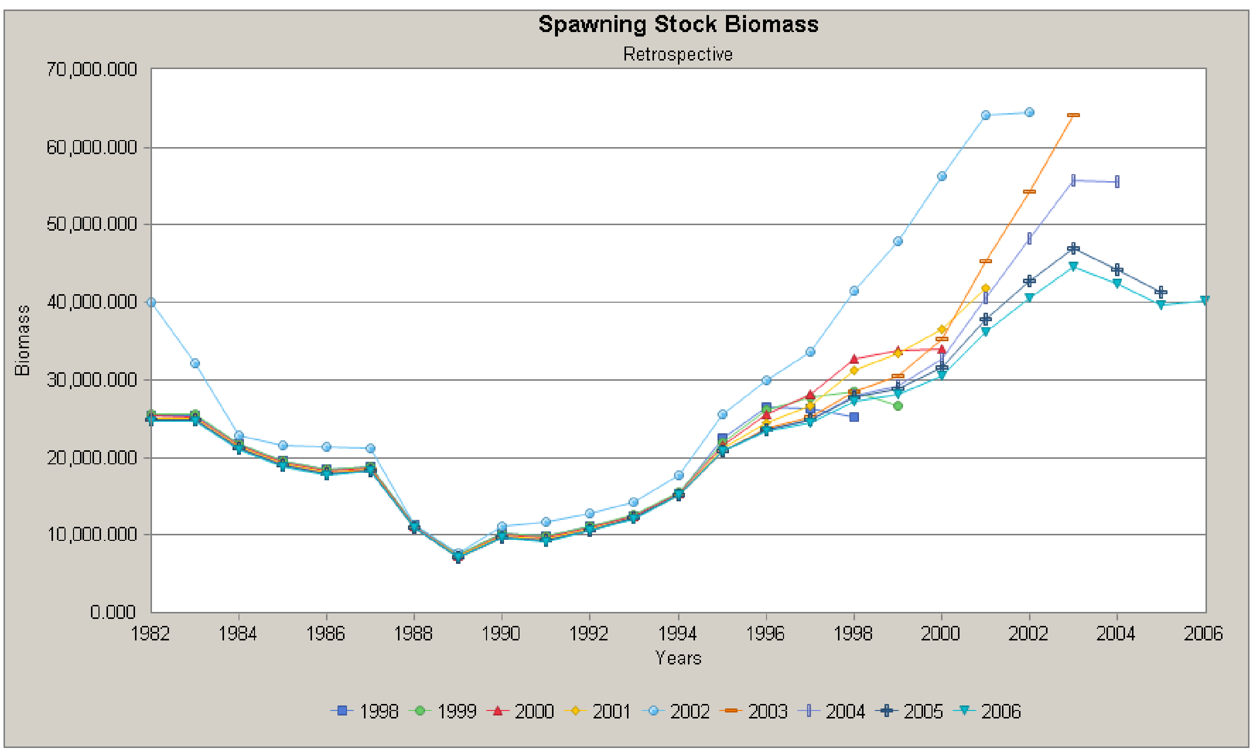


Figure 59. Retrospective analysis of Spawning Stock Biomass (SSB) for ASAP F08_FINAL_T2006 run.

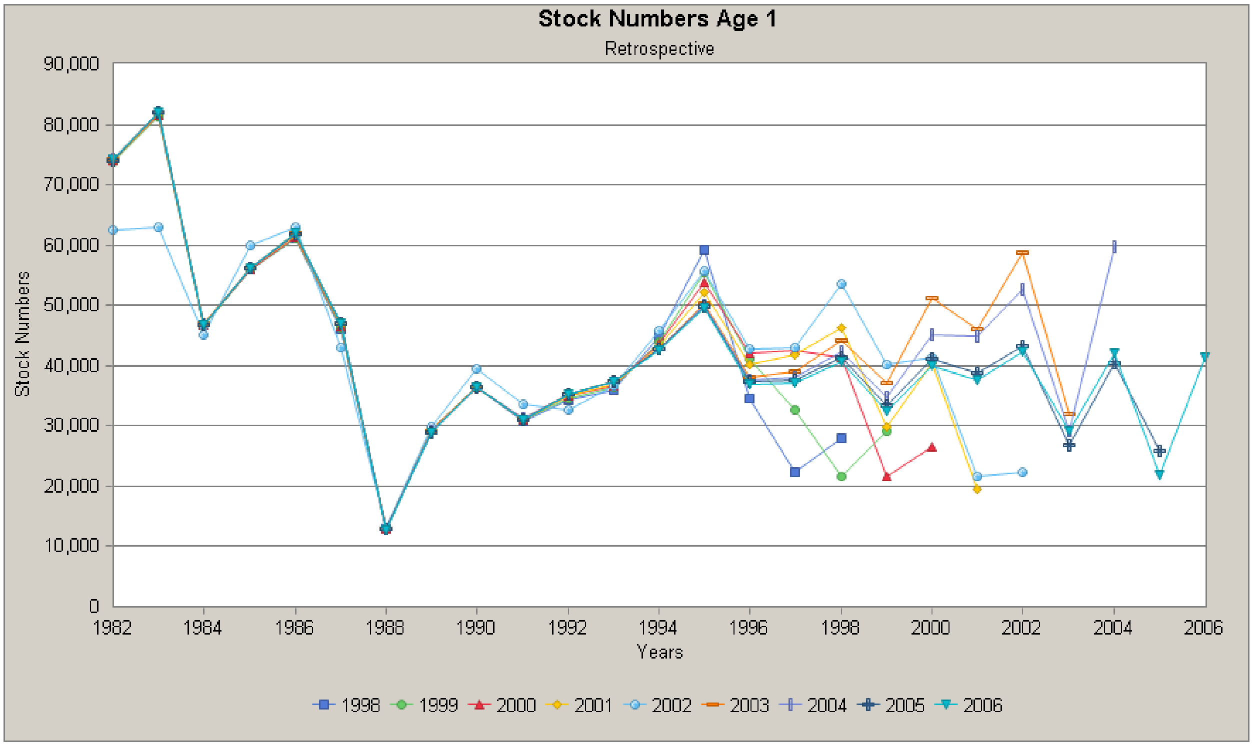


Figure 60. Retrospective analysis of Recruitment (R, age 0) for ASAP F08_FINAL_T2006 run. Note that ASAP age 1 is true age 0.

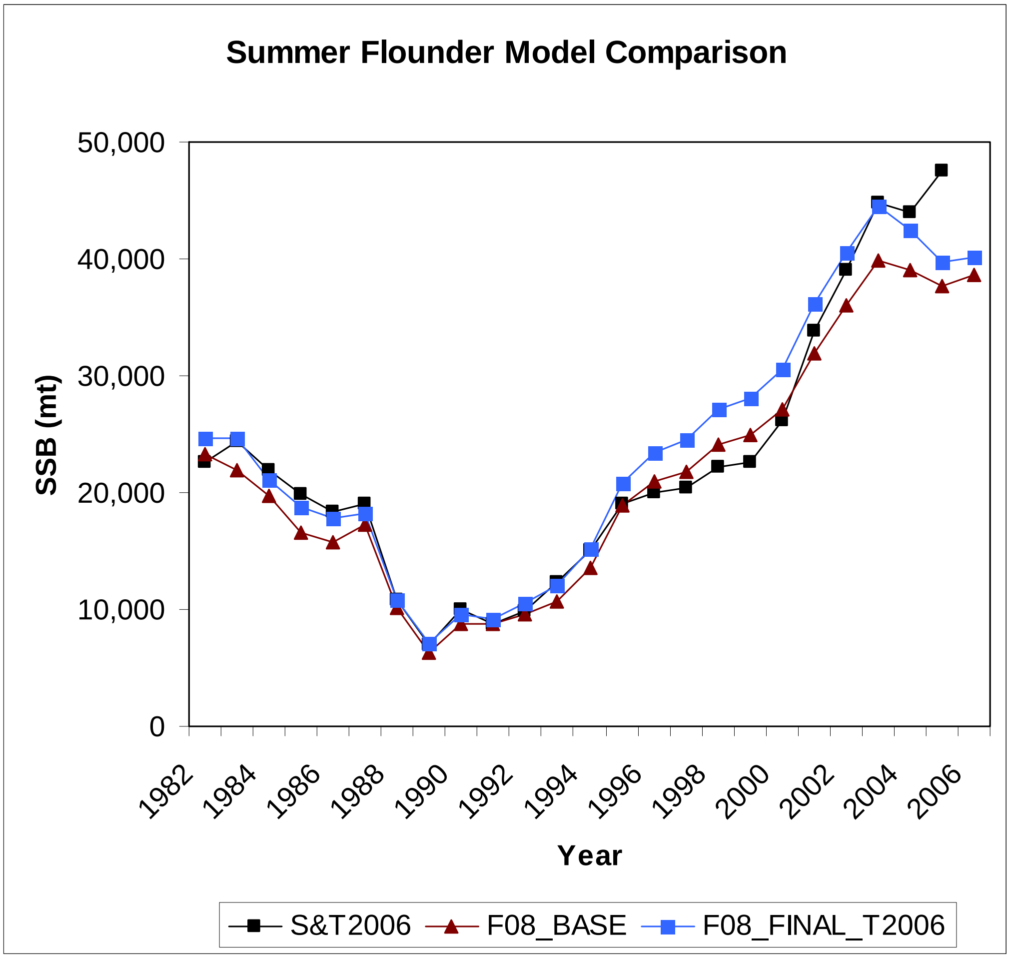


Figure 61. Spawning Stock Biomass (SSB) estimates from the S&T 2006 assessment (ADAPT VPA through 2005), the ASAP F08_BASE run, and the ASAP F08_FINAL_T2006 run.

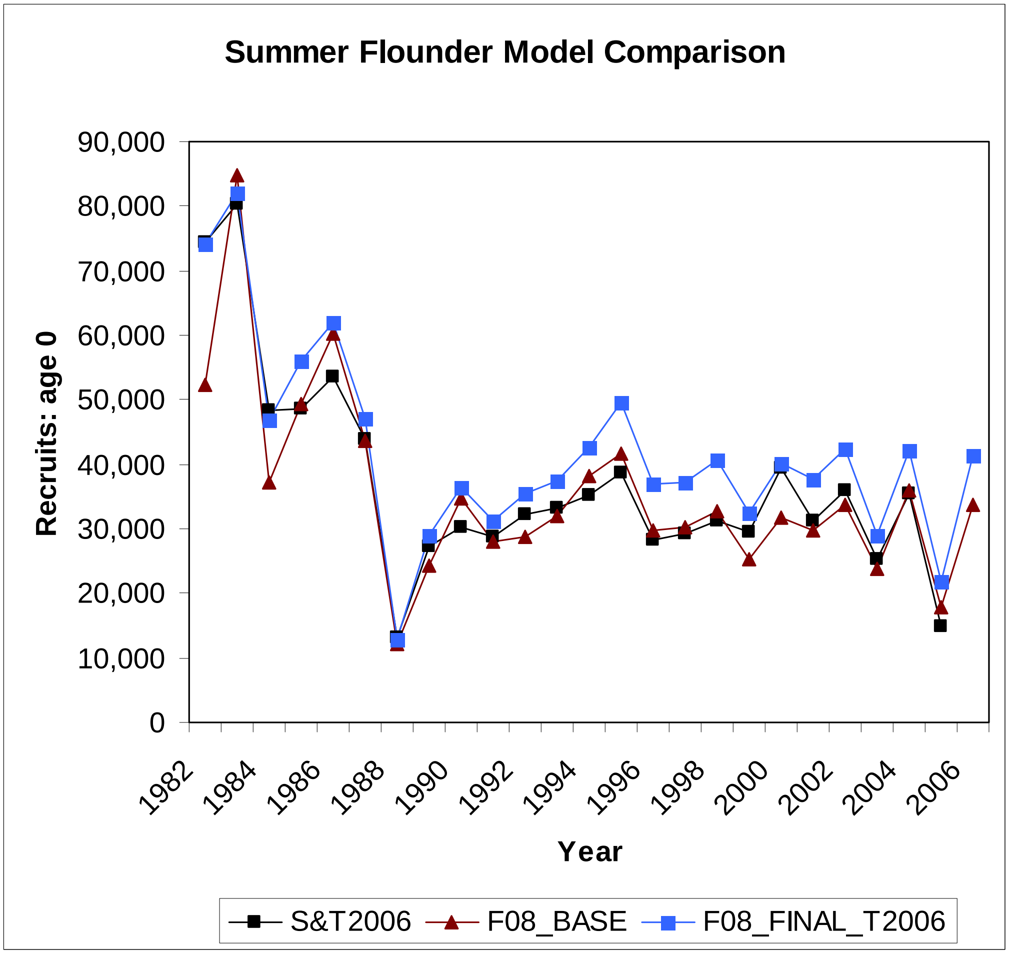


Figure 62. Recruitment (age 0) estimates from the S&T 2006 assessment (ADAPT VPA through 2005), the ASAP F08_BASE run, and the ASAP F08_FINAL_T2006 run.

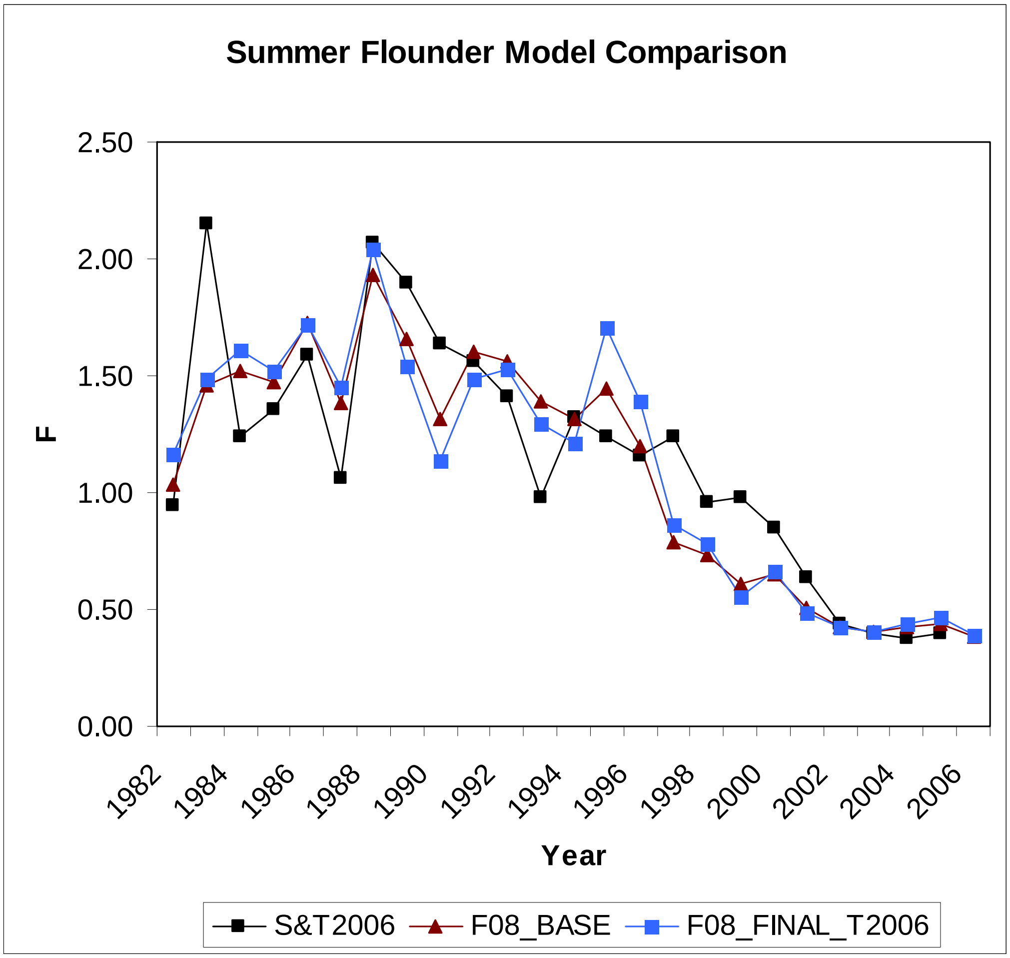


Figure 63. Fishing mortality (F, ages 3+) estimates from the S&T 2006 assessment (ADAPT VPA through 2005), the ASAP F08_BASE run, and the ASAP F08_FINAL_T2006 run.

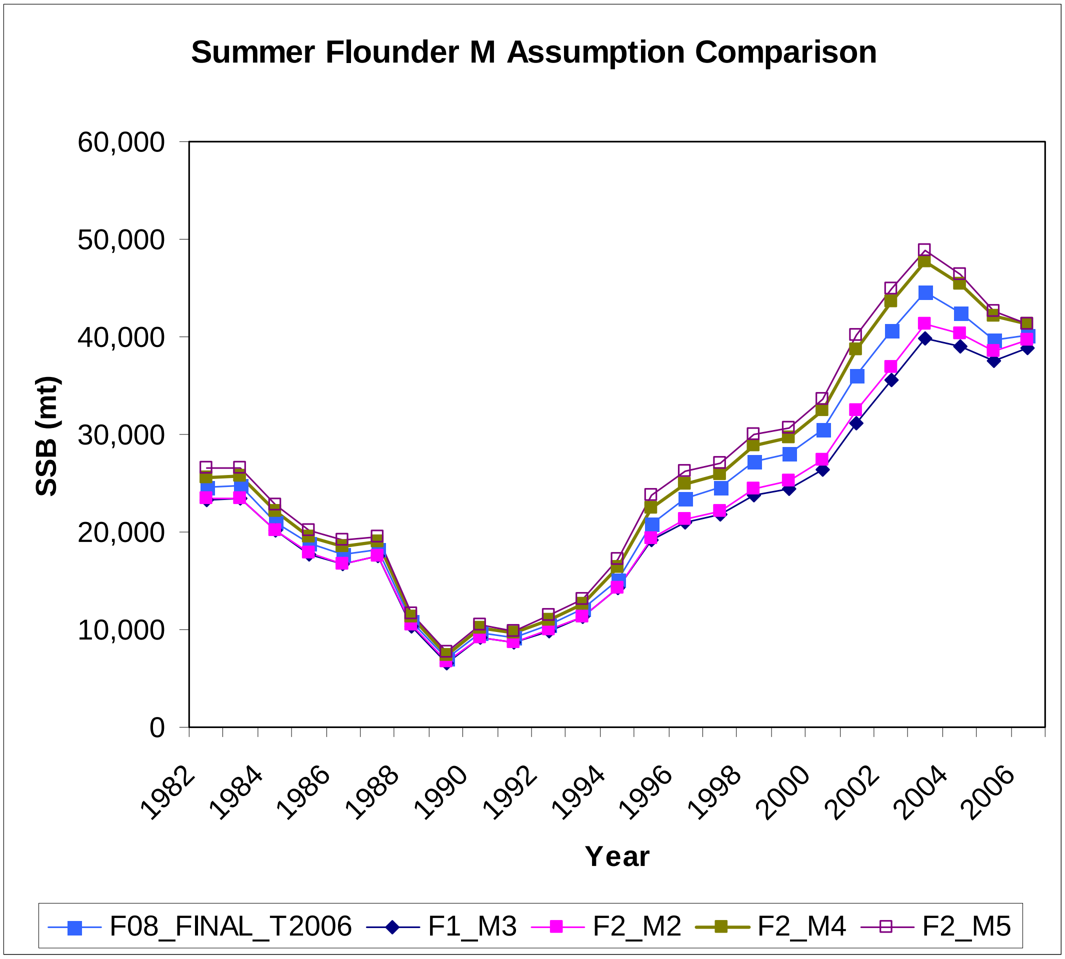


Figure 64. Spawning Stock Biomass (SSB) estimates from the ASAP F08_FINAL_T2006 run and runs with alternative assumptions for natural mortality (M).

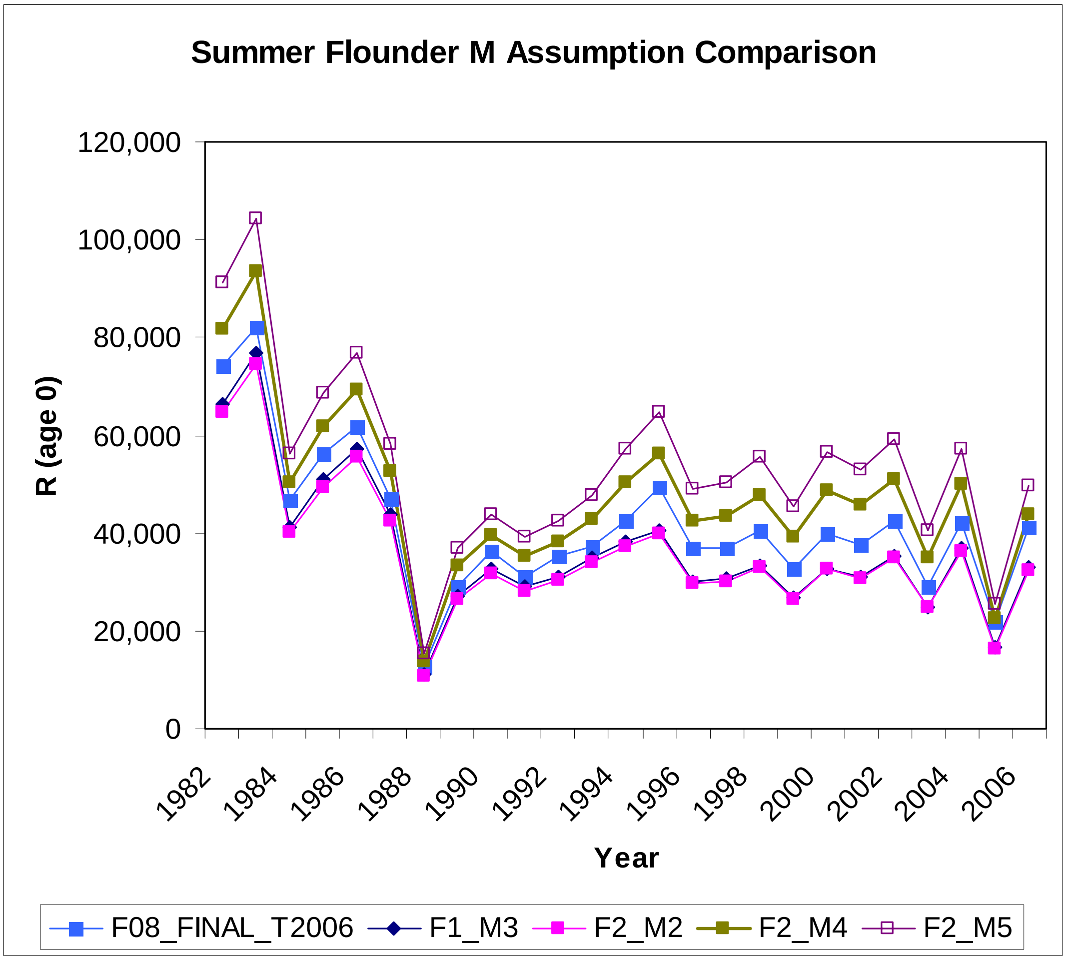


Figure 65. Recruitment (R, age 0) estimates from the ASAP F08_FINAL_T2006 run and runs with alternative assumptions for natural mortality (M).

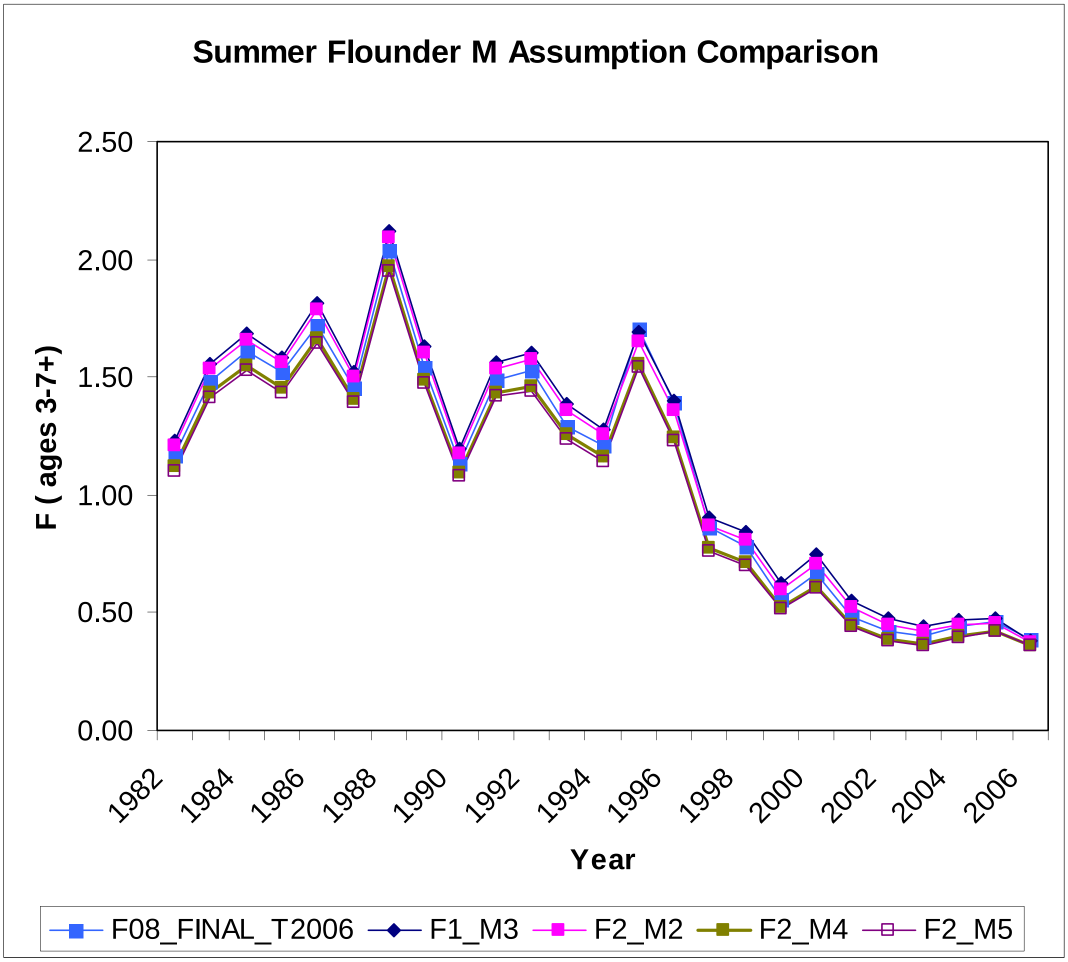


Figure 66. Fishing Mortality (F, ages 3-7+) estimates from the ASAP F08_FINAL_T2006 run and runs with alternative assumptions for natural mortality (M).

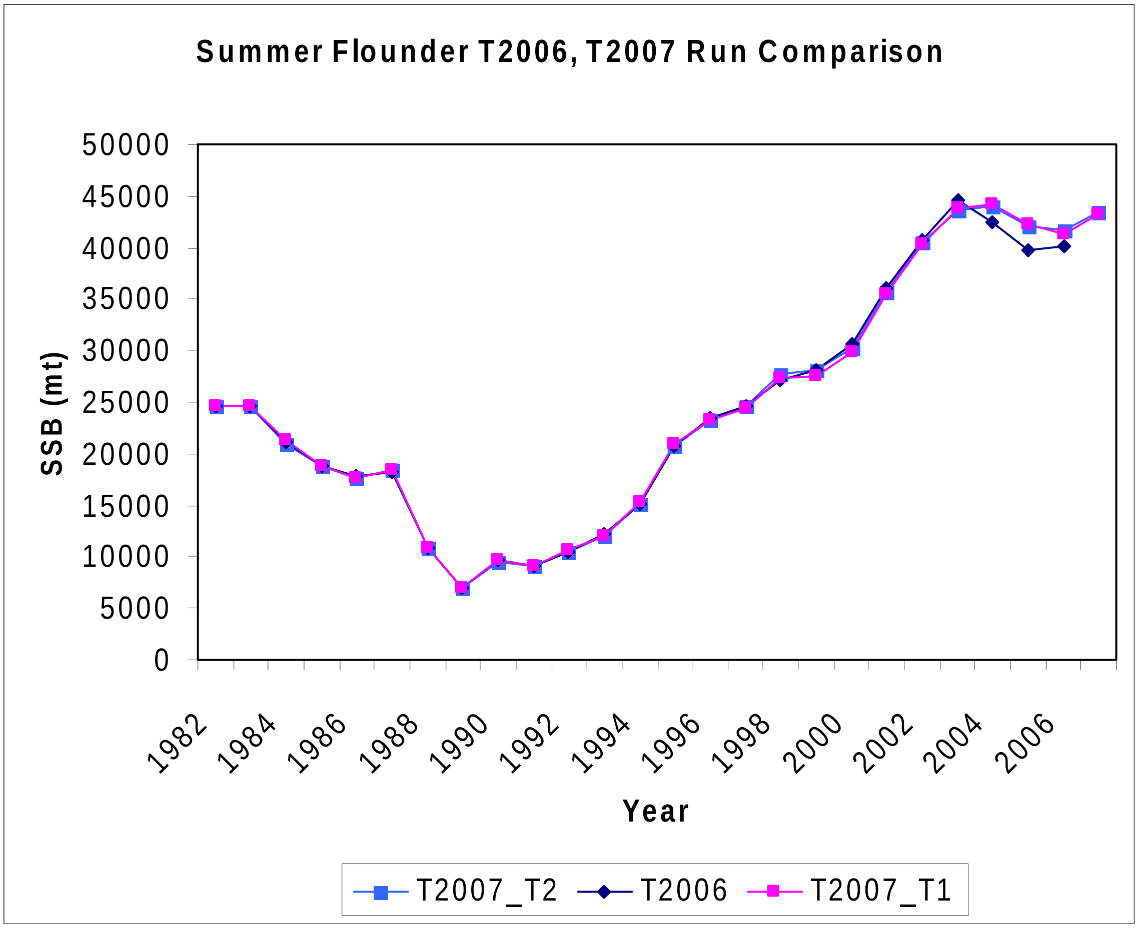


Figure 67. Spawning Stock Biomass (SSB) estimates from the F08_FINAL_T2006, F08_T2007_T1, and F08_T2007_T2 runs.

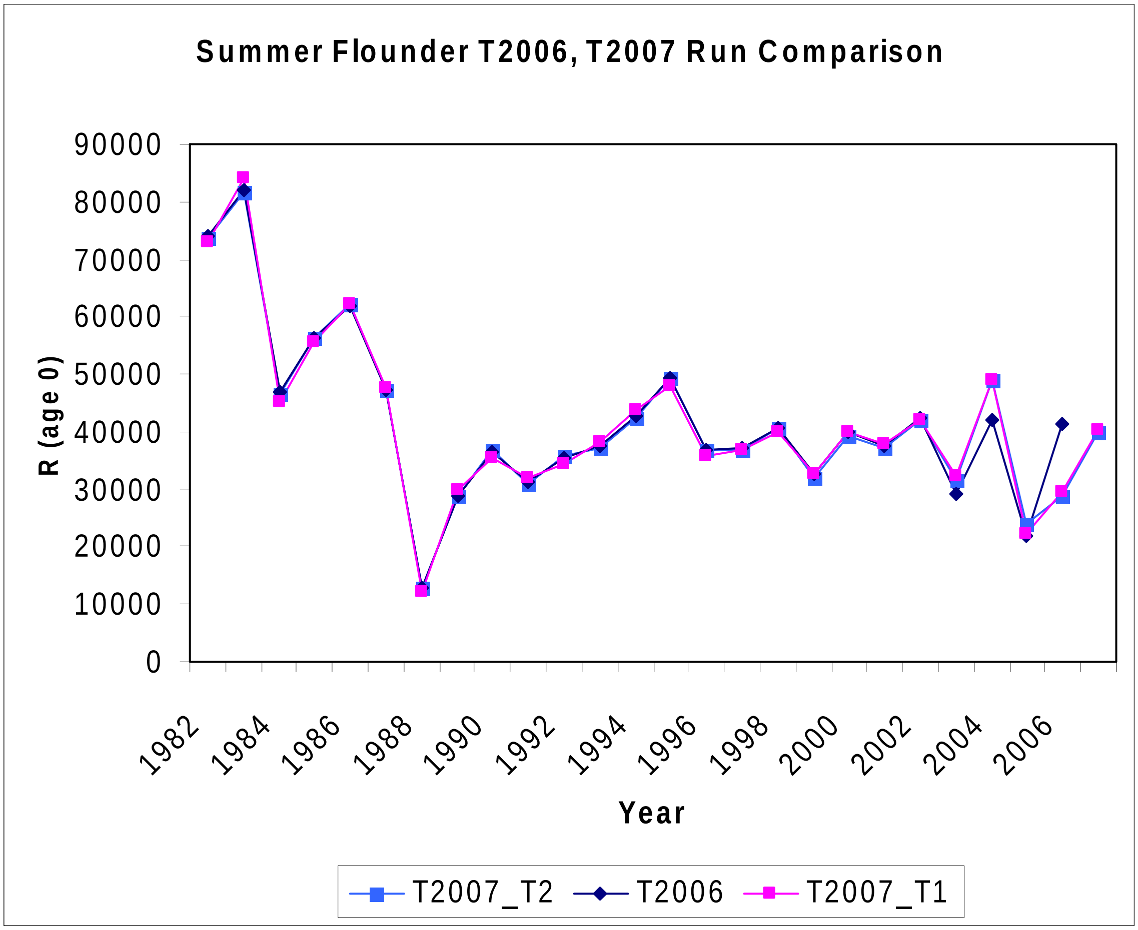


Figure 68. Recruitment (R; age 0) estimates from the F08_FINAL_T2006, F08_T2007_T1, and F08_T2007_T2 runs.

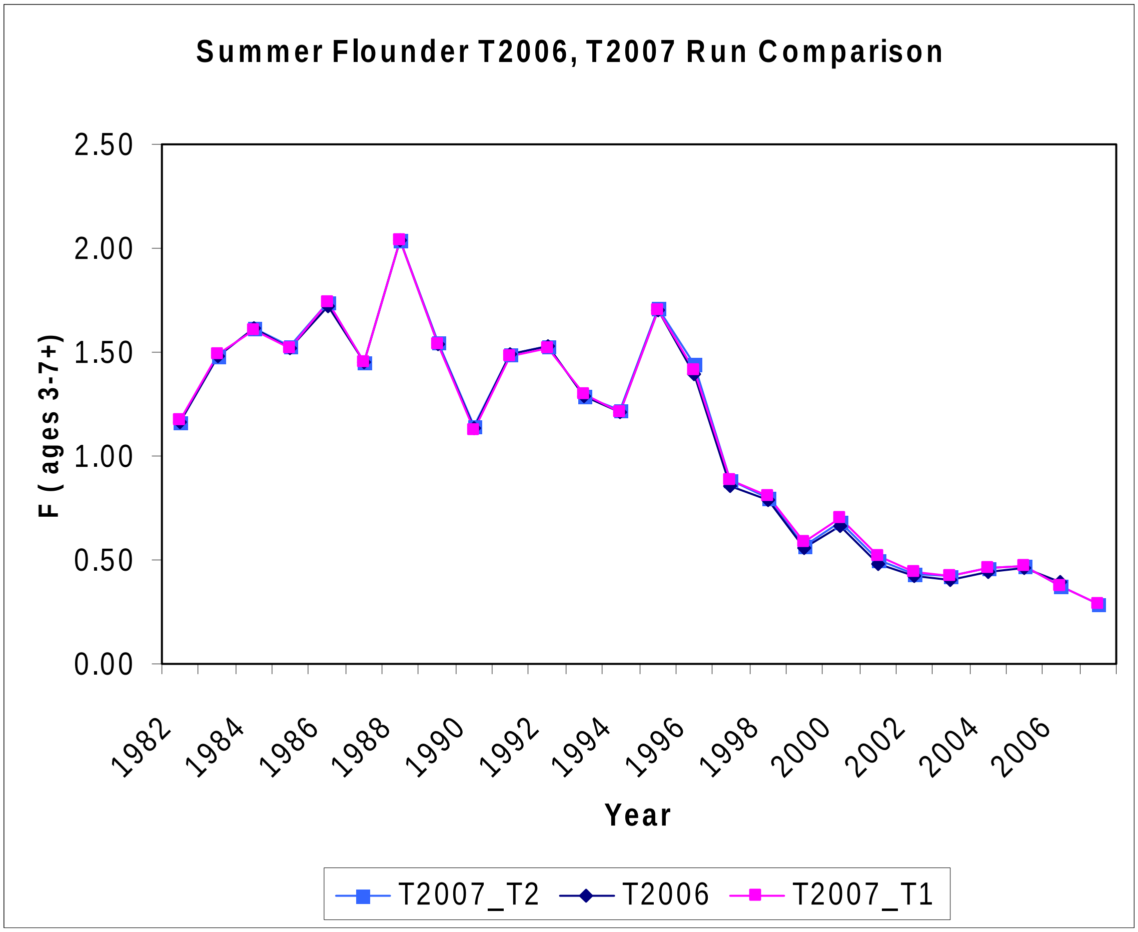


Figure 69. Fishing mortality (F, ages 3-7+) estimates from the F08_FINAL_T2006, F08_T2007_T1, and F08_T2007_T2 runs.

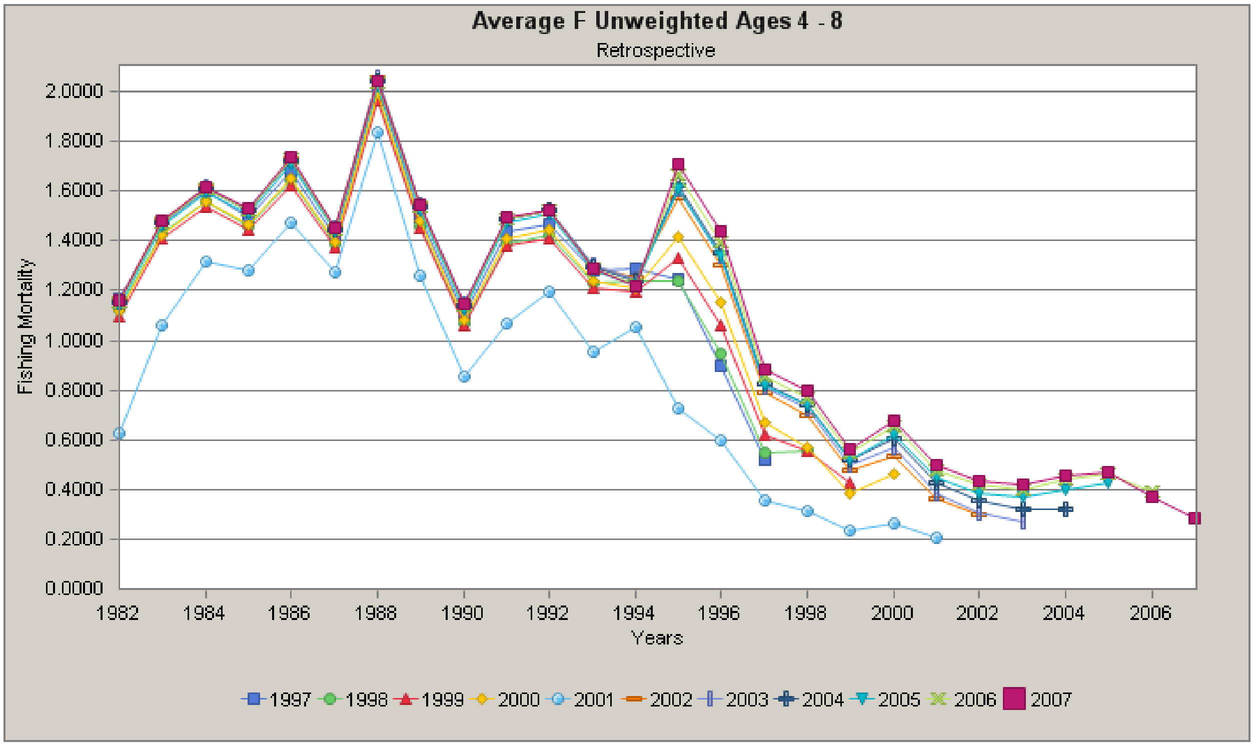


Figure 70. Retrospective analysis of Fishing Mortality (F, ages 3+) for the ASAP F08_T2007_T2 run. Note that ASAP ages 4-8 are true ages 3-7+.

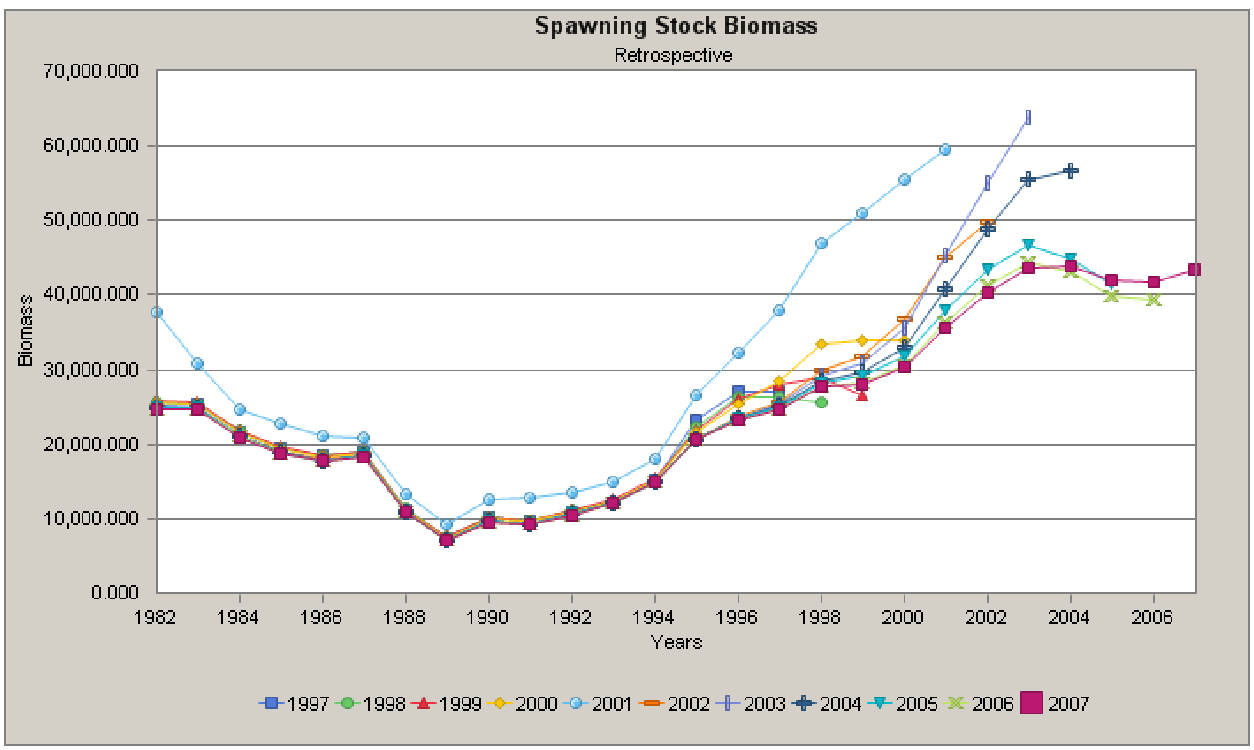


Figure 71. Retrospective analysis of Spawning Stock Biomass (SSB) for the ASAP F08_T2007_T2 run.

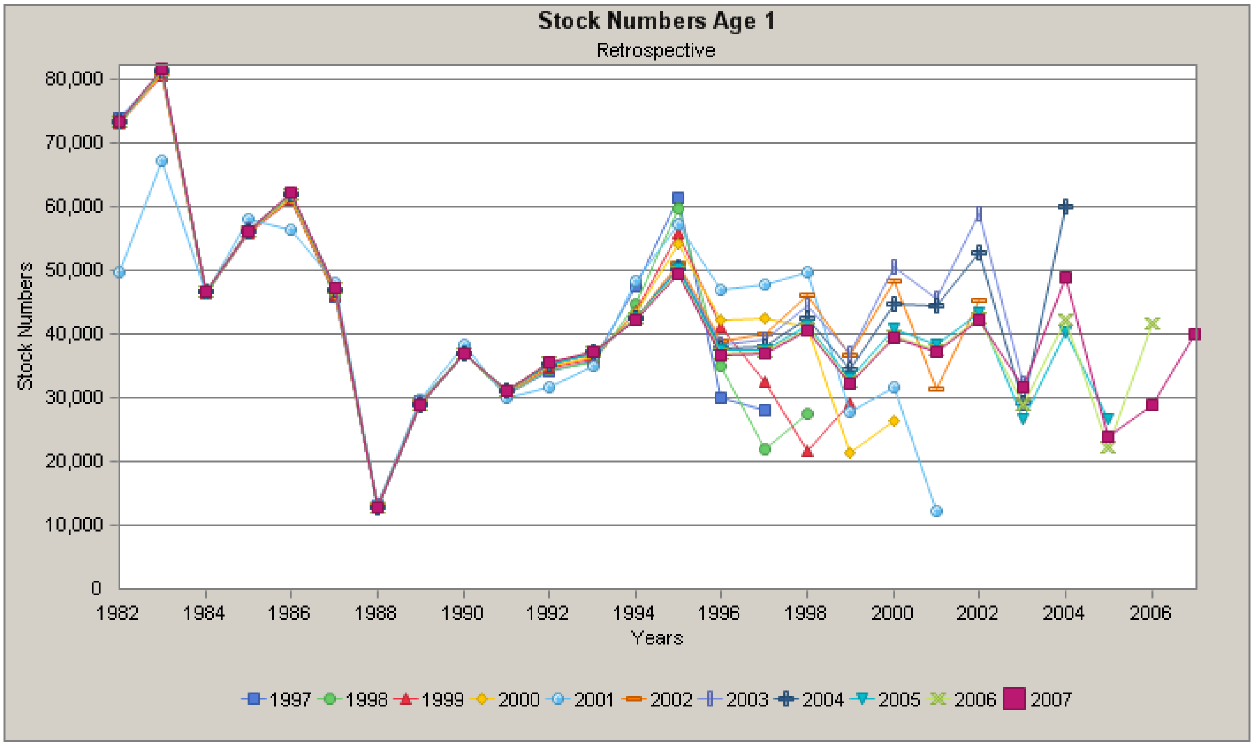


Figure 72. Retrospective analysis of Recruitment (R, age 0) for the ASAP F08_T2007_T2 run. Note that ASAP age 1 is true age 0.

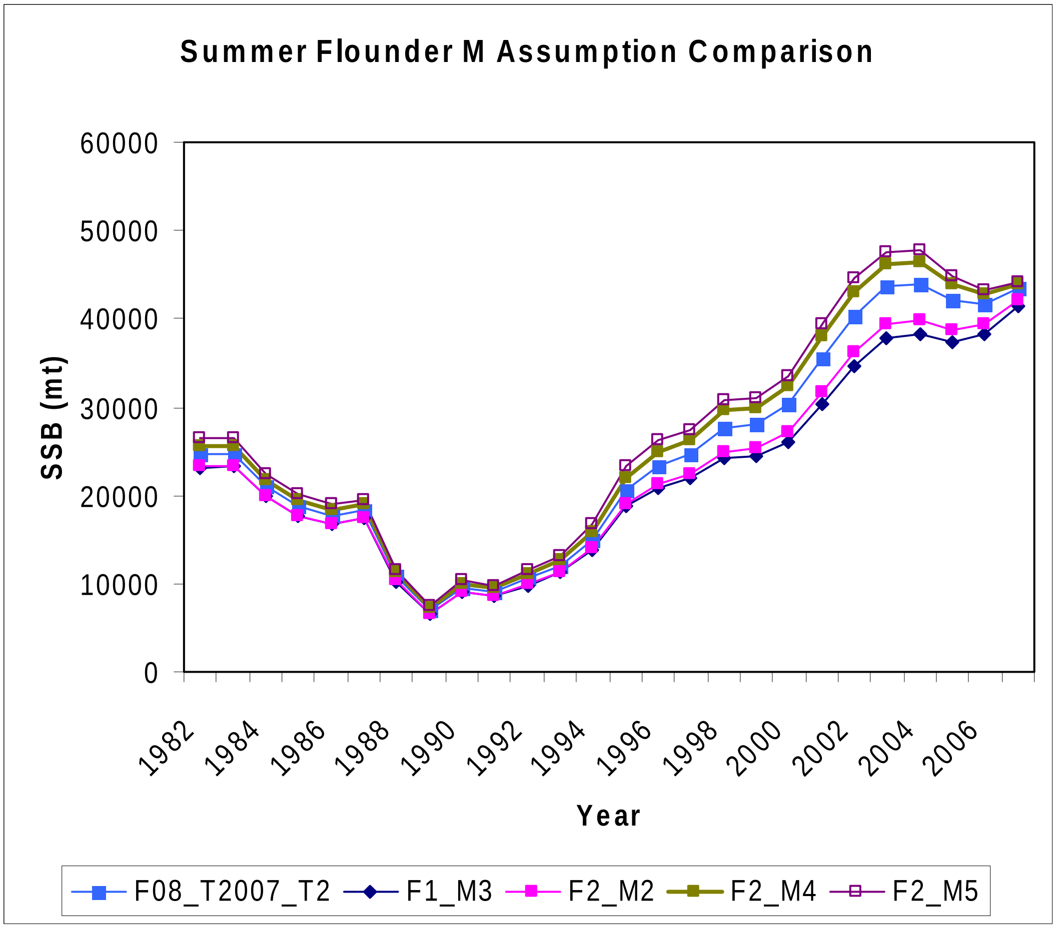


Figure 73. Spawning Stock Biomass (SSB) estimates from the ASAP F08_T2007_T2 run and runs with alternative assumptions for natural mortality (M).

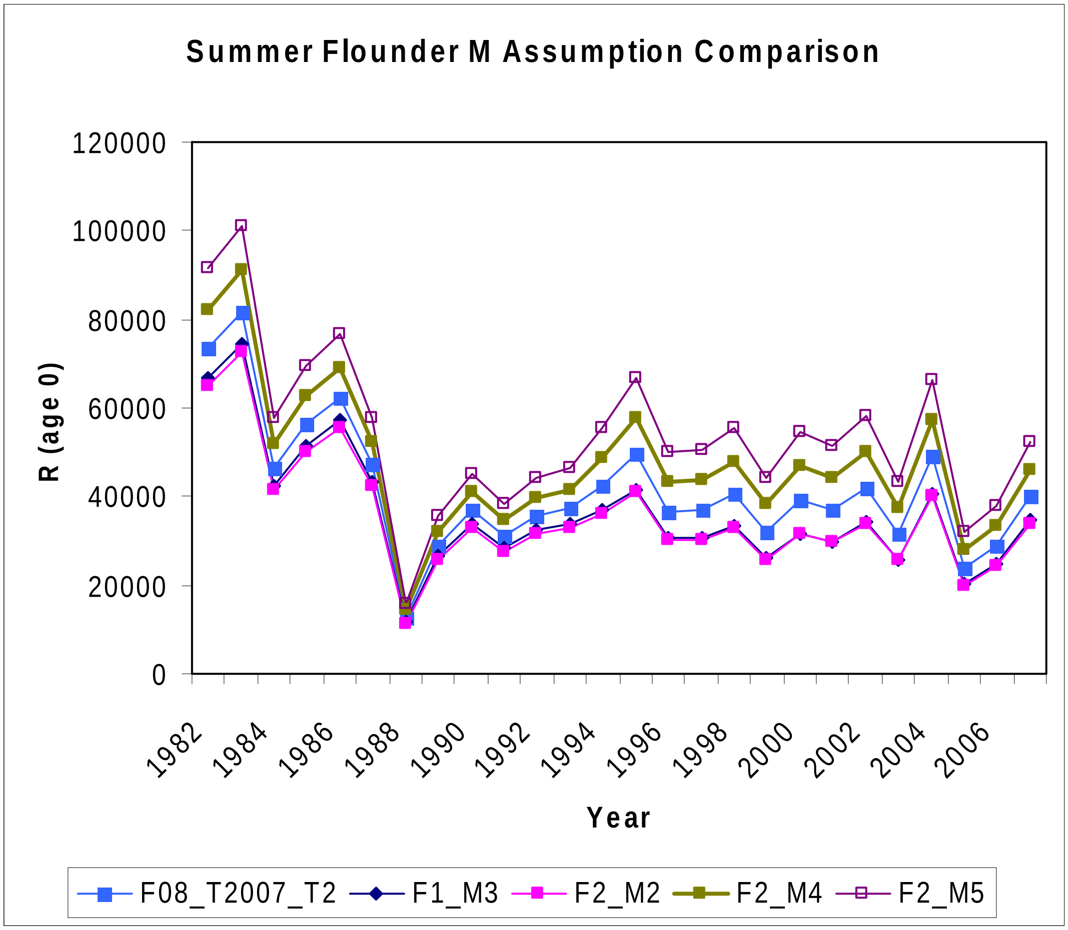


Figure 74. Recruitment (R, age 0) estimates from the ASAP F08_T2007_T2 run and runs with alternative assumptions for natural mortality (M).

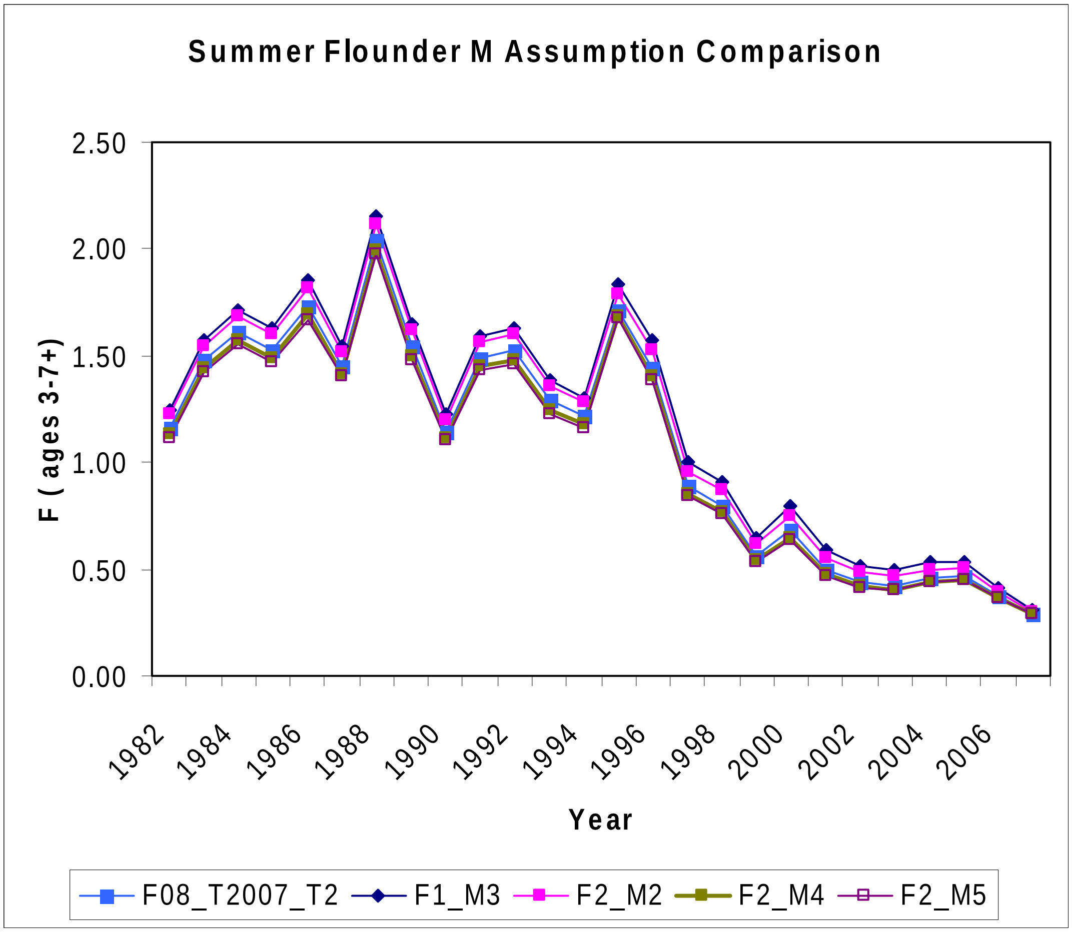
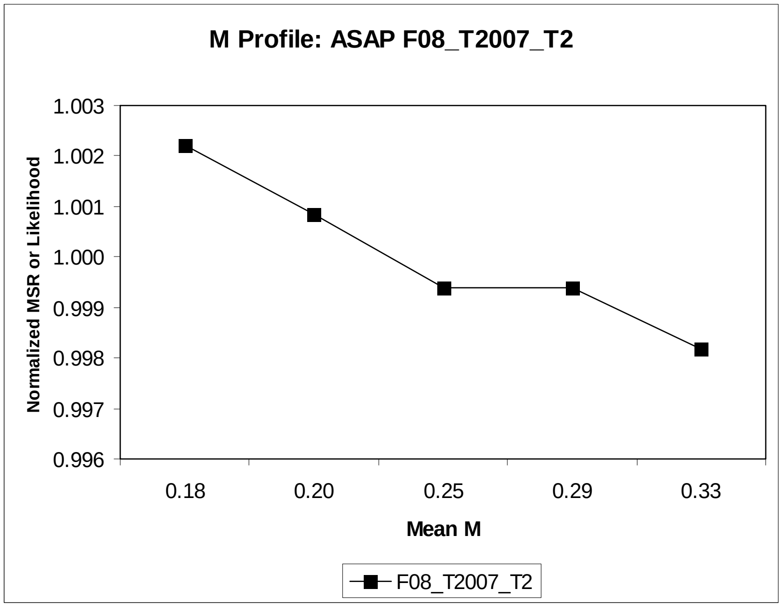


Figure 75. Fishing Mortality (F, ages 3-7+) estimates from the ASAP F08_T2007_T2 run and runs with alternative assumptions for natural mortality (M).

A)



B)

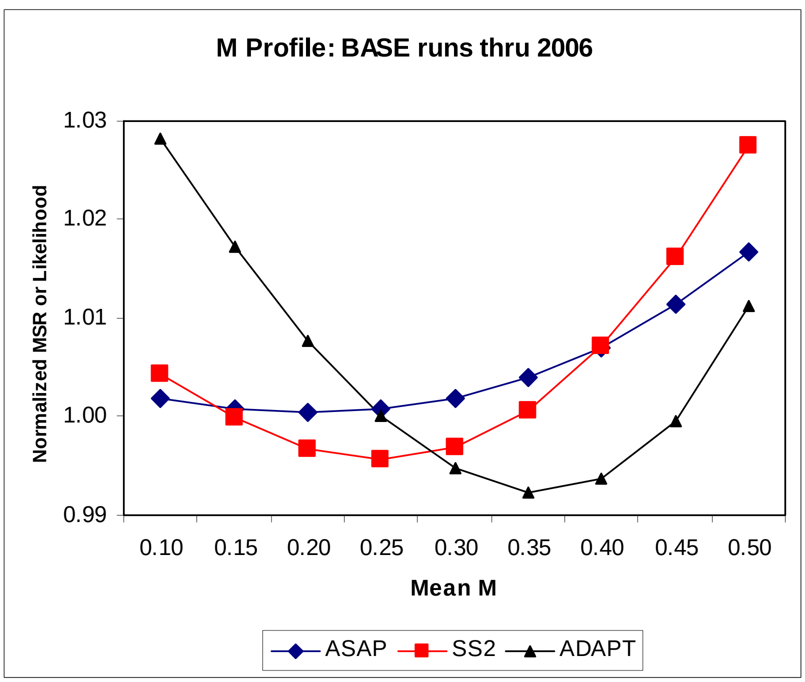


Figure 76. A) Likelihood profile of M for the ASAP F08_T2007_T2 run. B) Likelihood profile of M for the ADAPT, ASAP, and SS2 BASE runs (T 2006).

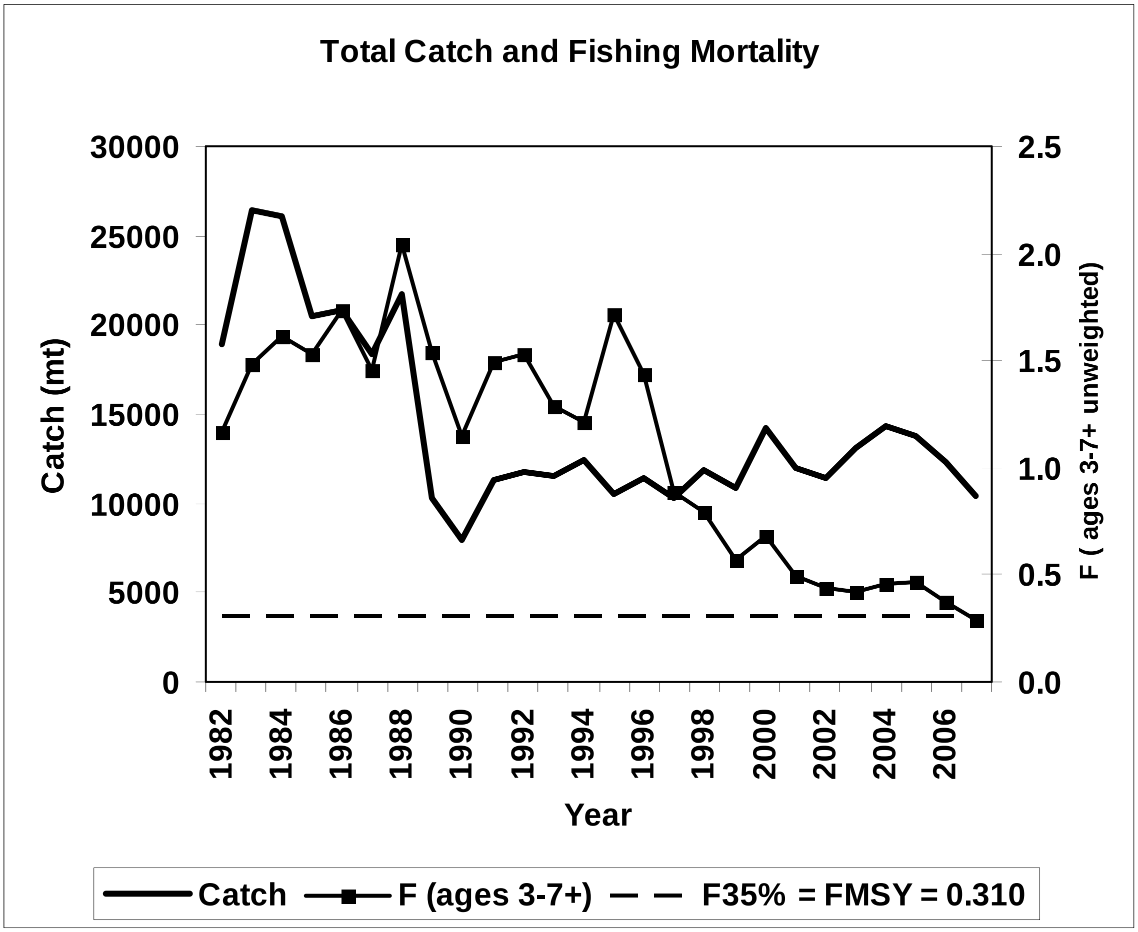


Figure 77. Total catch (landings and discards, metric tons) and fishing mortality rate (F, ages 3-7+) for summer flounder.

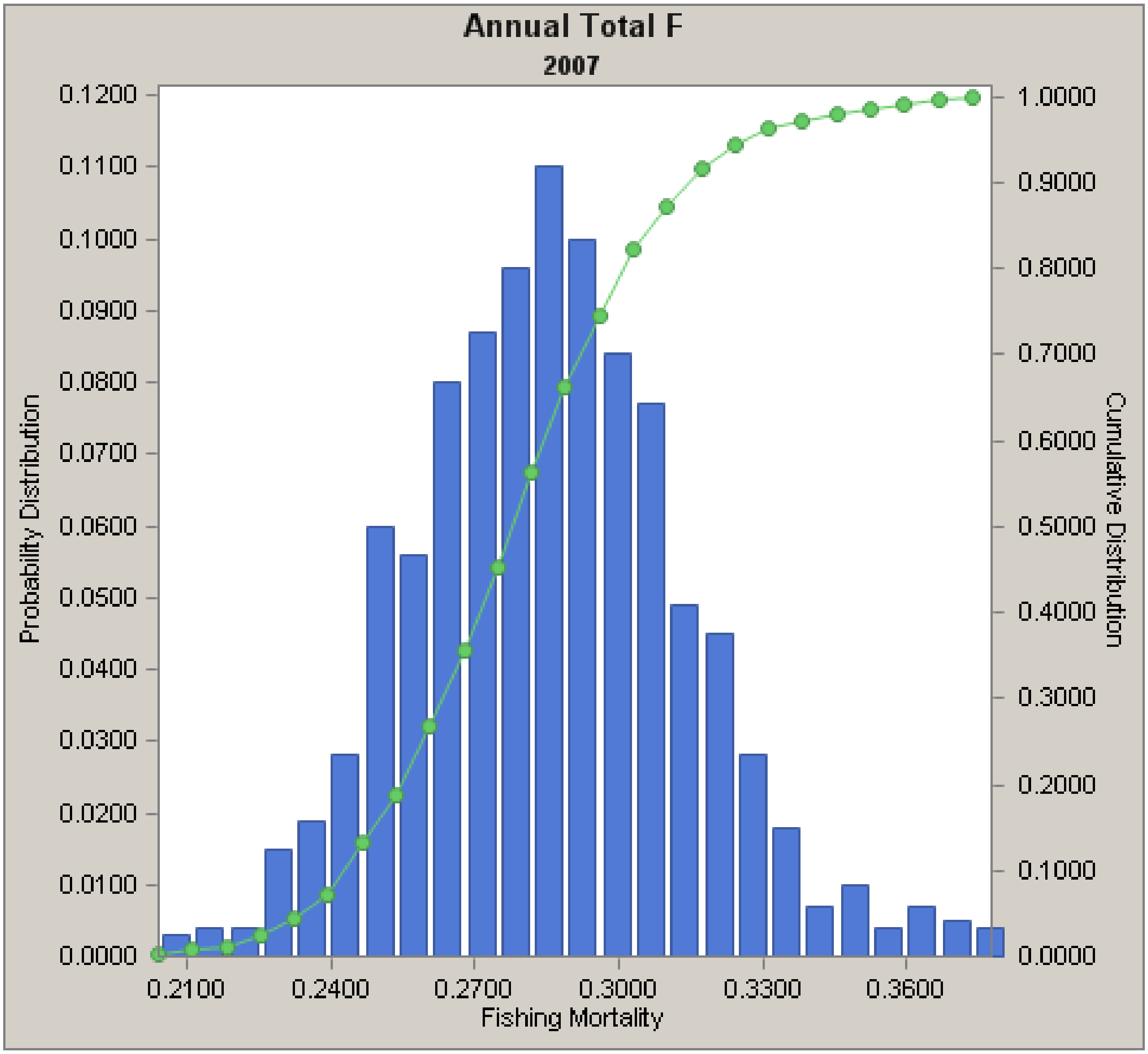


Figure 78. Precision of the 2007 Fishing Mortality estimate from the 2008 assessment final model ASAP F08_T2007_T2 run.

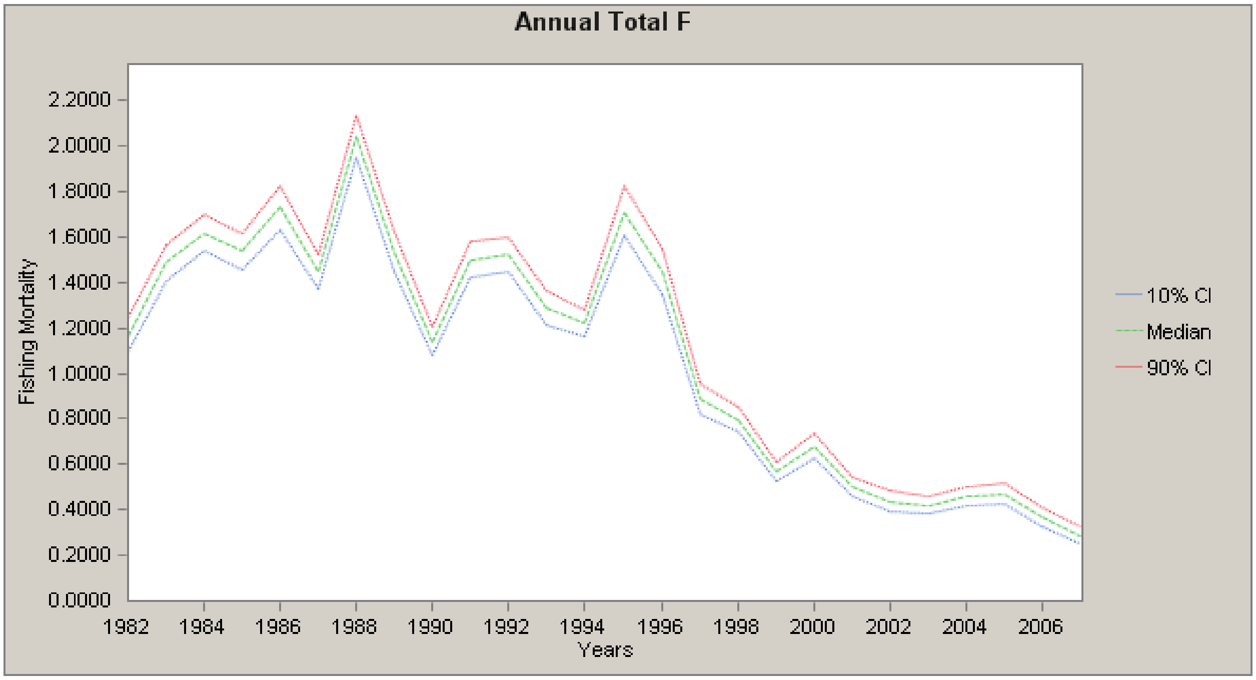


Figure 79. Time series of Fishing Mortality estimates from the 2008 assessment final model ASAP F08_T2007_T2 run with 10% and 90% confidence intervals.

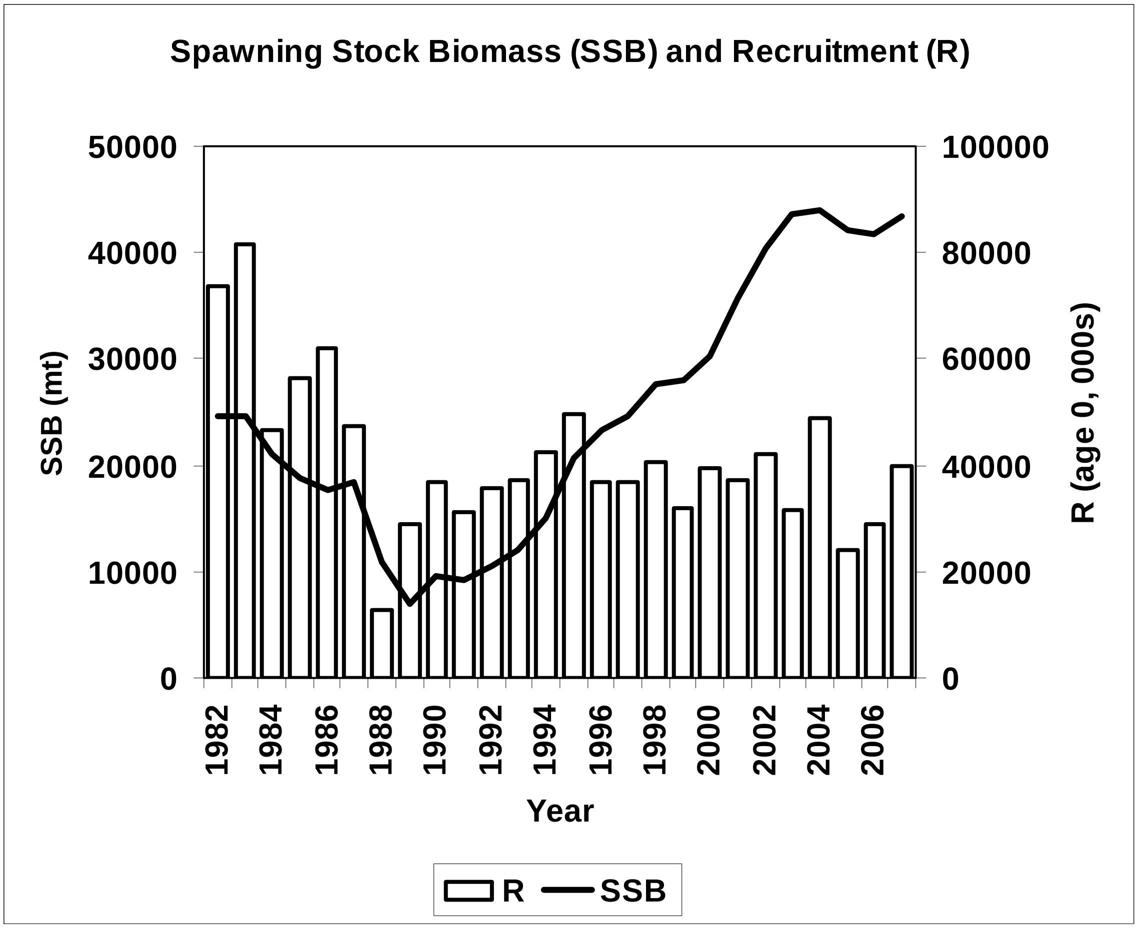


Figure 80. Spawning stock biomass (SSB) and recruitment (age 0) for summer flounder.

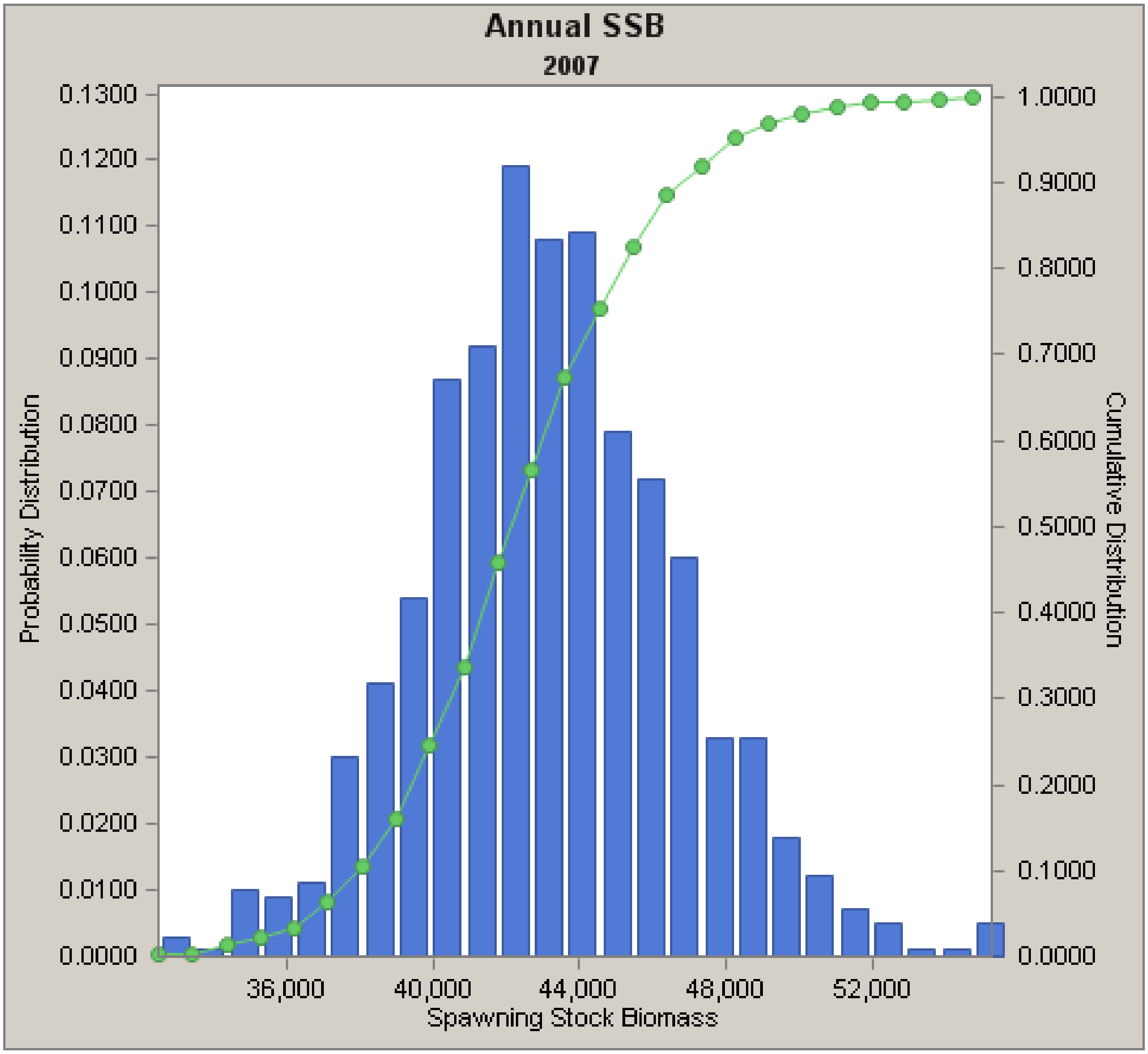


Figure 81. Precision of the 2007 Spawning Stock Biomass (SSB) estimate from the 2008 assessment final model ASAP F08_T2007_T2 run.

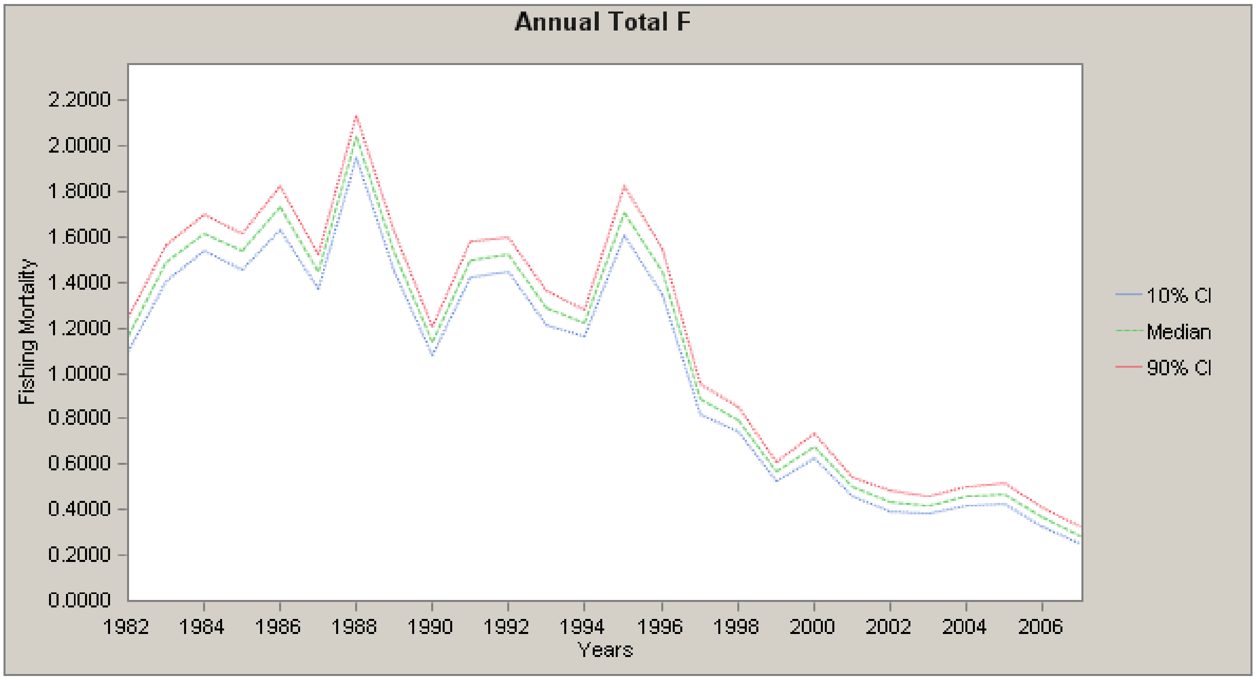


Figure 82. Time series of Spawning Stock Biomass (SSB) estimates from the 2008 assessment final model ASAP F08_T2007_T2 run with 10% and 90% confidence intervals.

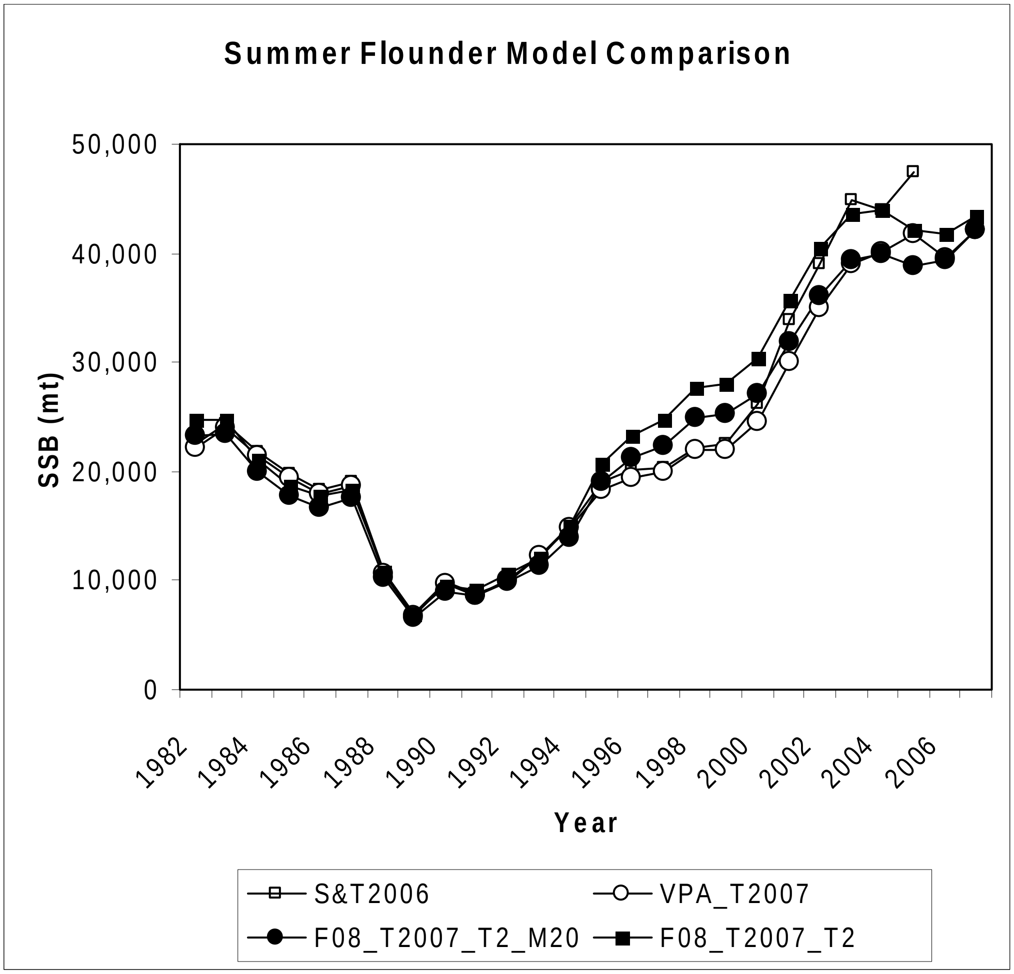


Figure 83. Spawning Stock Biomass (SSB; mt) estimates from the S&T 2006 ADAPT VPA (M = 0.20), VPA_T2007 (M = 0.20), F08_T2007_T2_M20 (M = 0.20) and F08_T2007_T2 runs (Mean M = 0.25).

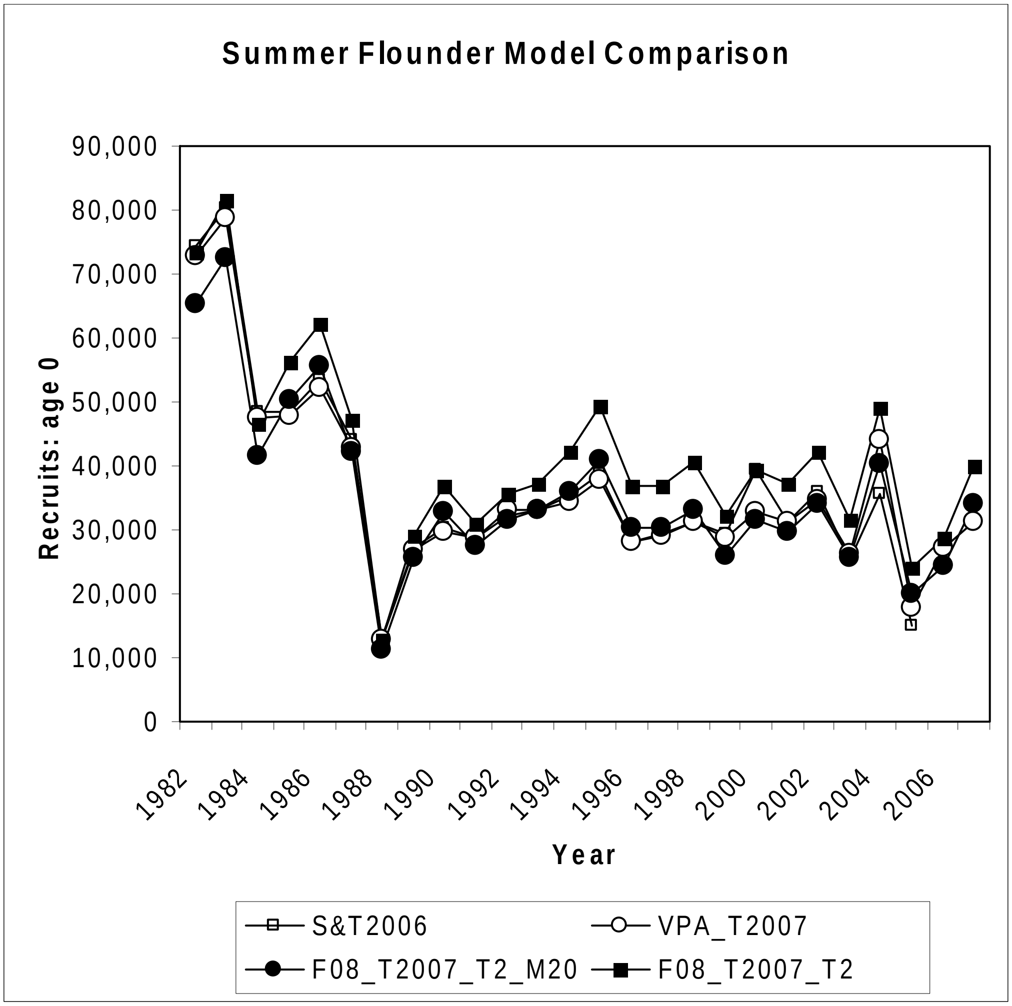


Figure 84. Recruitment (Recruits: age 0) estimates from the S&T 2006 ADAPT VPA (M = 0.20), VPA_T2007 (M = 0.20), F08_T2007_T2_M20 (M = 0.20) and F08_T2007_T2 runs (Mean M = 0.25).

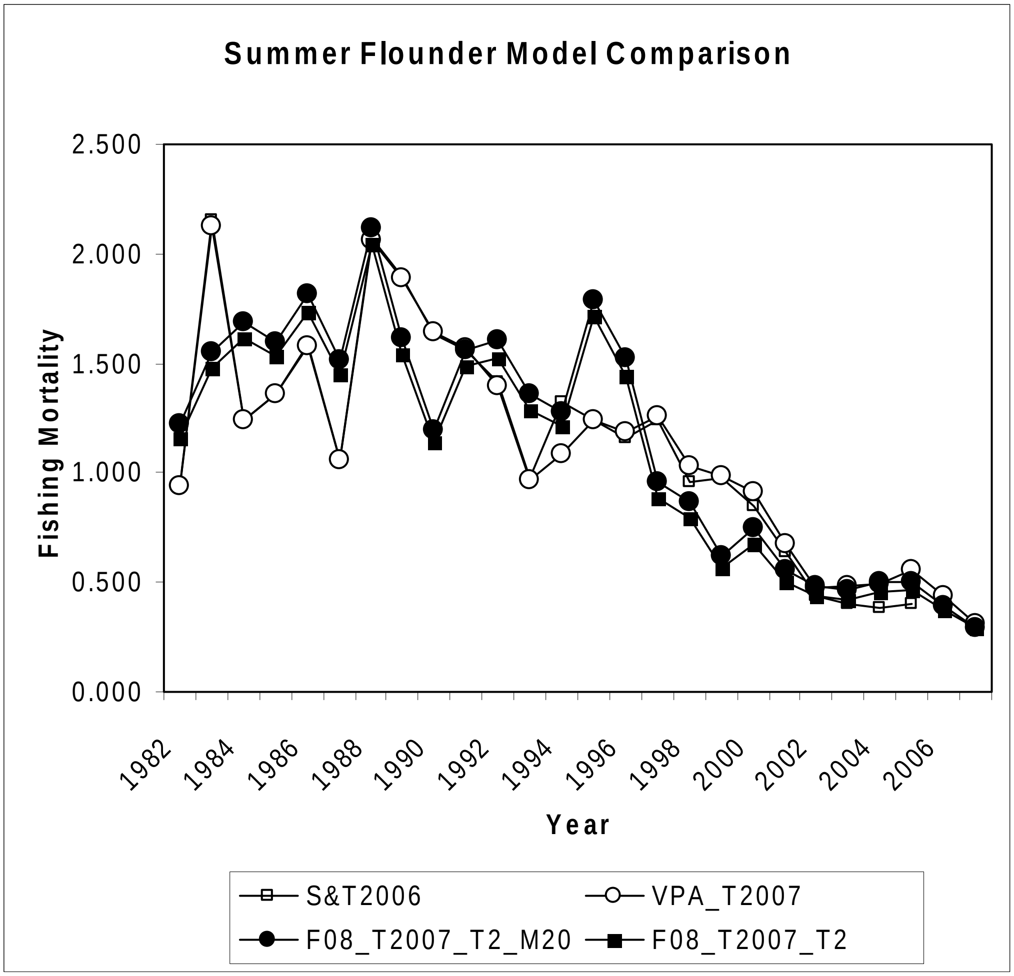


Figure 85. Fishing Mortality estimates from from the S&T 2006 ADAPT VPA (M = 0.20), VPA_T2007 (M = 0.20), F08_T2007_T2_M20 (M = 0.20) and F08_T2007_T2 runs (Mean M = 0.25).

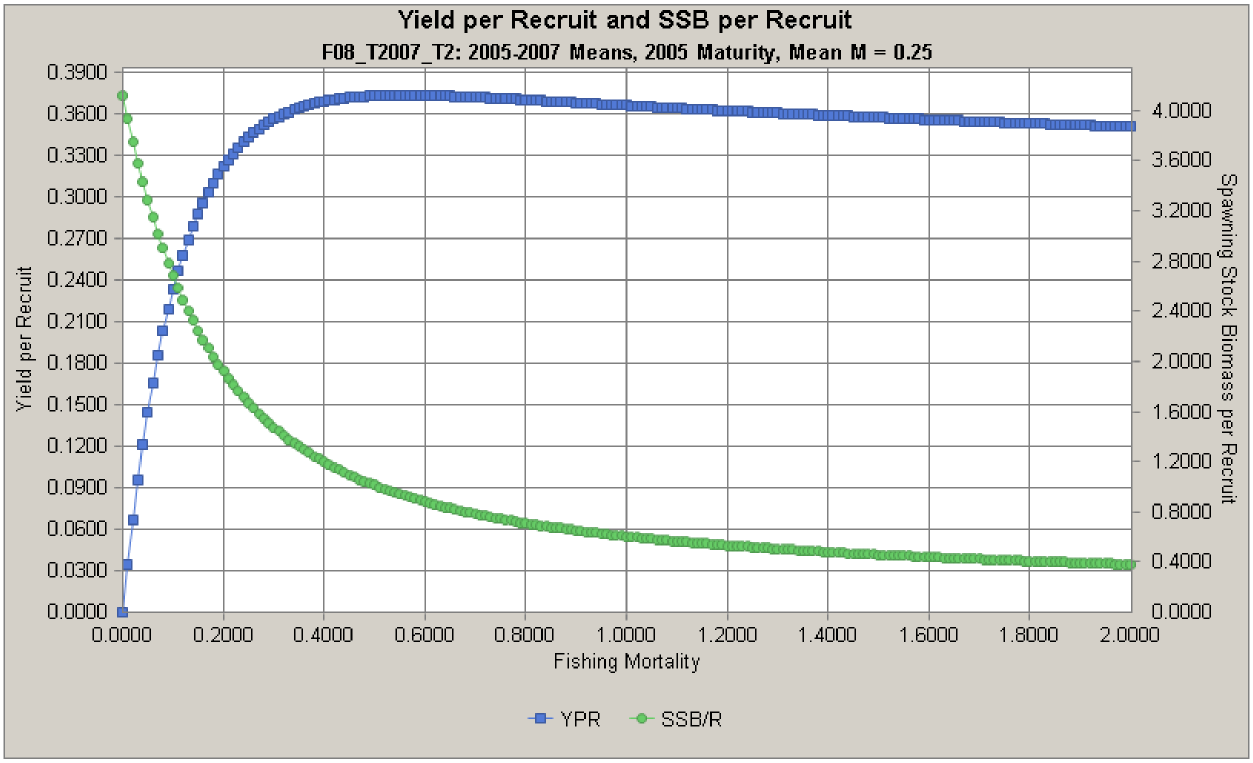


Figure 86. 2008 assessment yield per recruit and SSB per recruit plot.

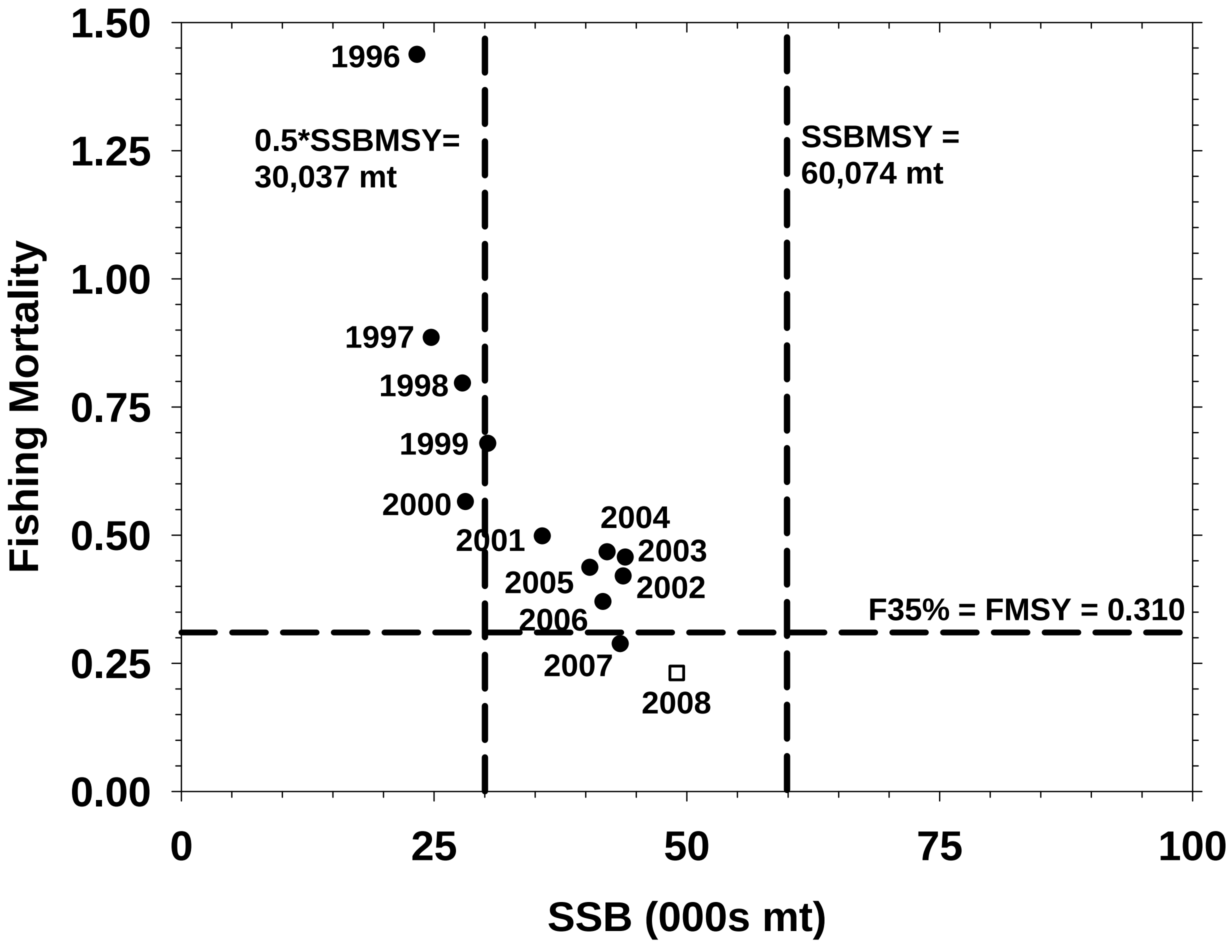


Figure 87. Spawning stock biomass (000s metric tons), fishing mortality, and proposed biological reference points for summer flounder. Forecast SSB and F in 2008 indicated by the open box.

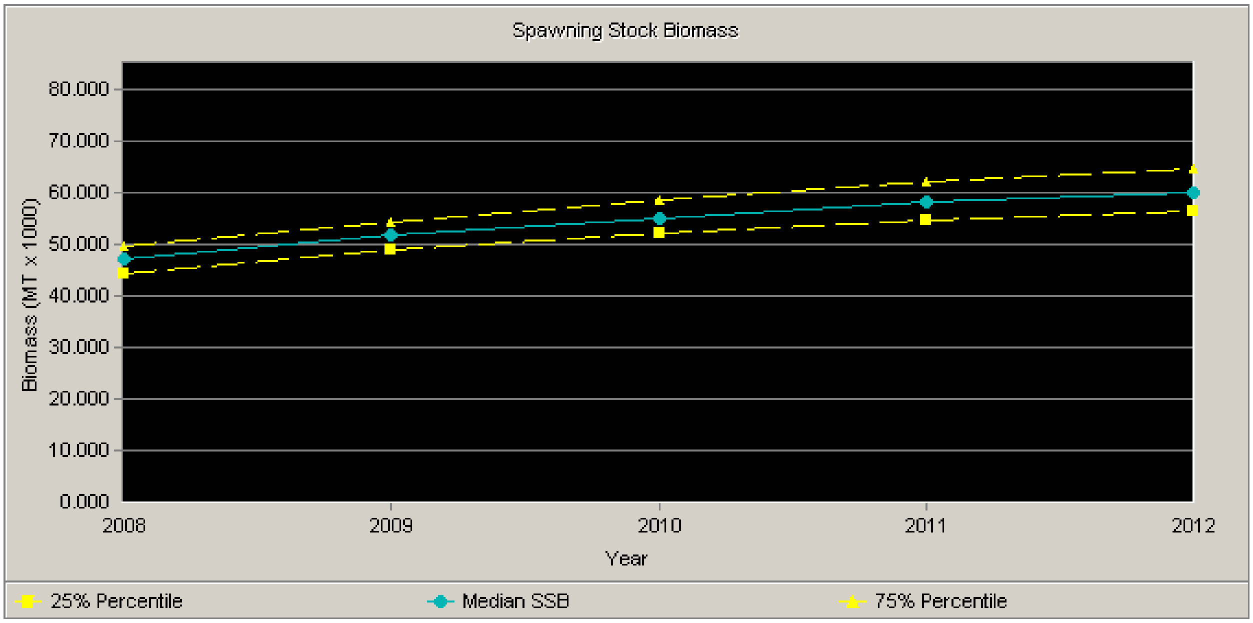


Figure 88. Projection of summer flounder SSB at the proposed Frebuild = 0.274 during 2010-2012.

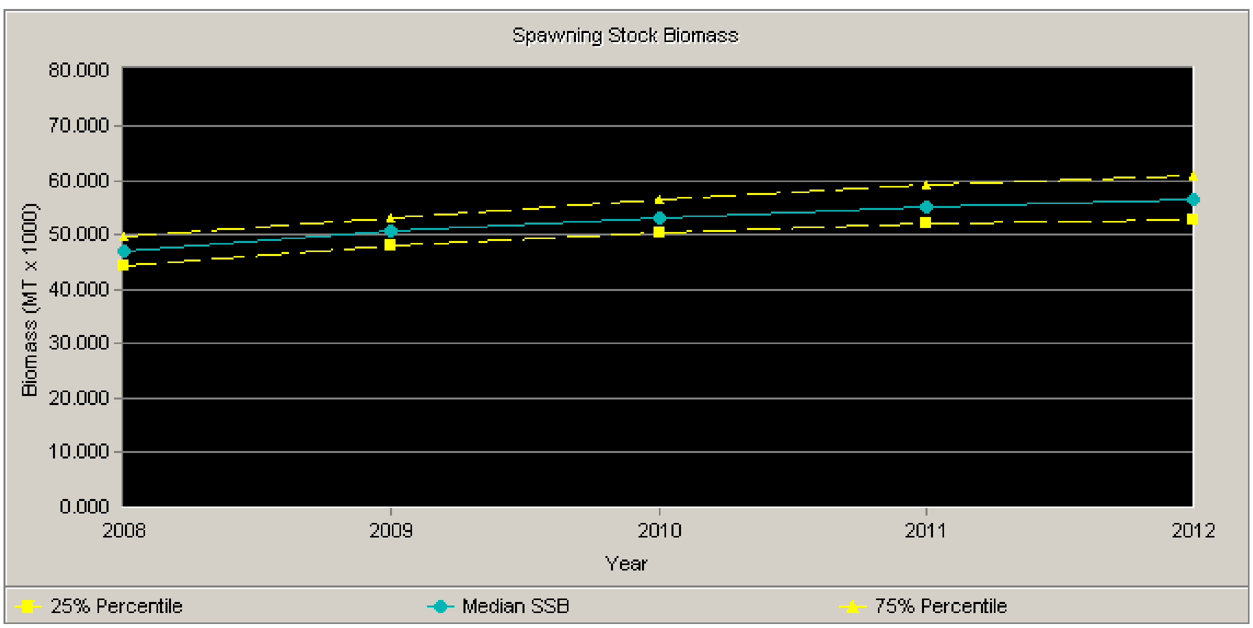


Figure 89. Projection of summer flounder SSB at the proposed FMSY = F35% = 0.310 during 2010-2012.

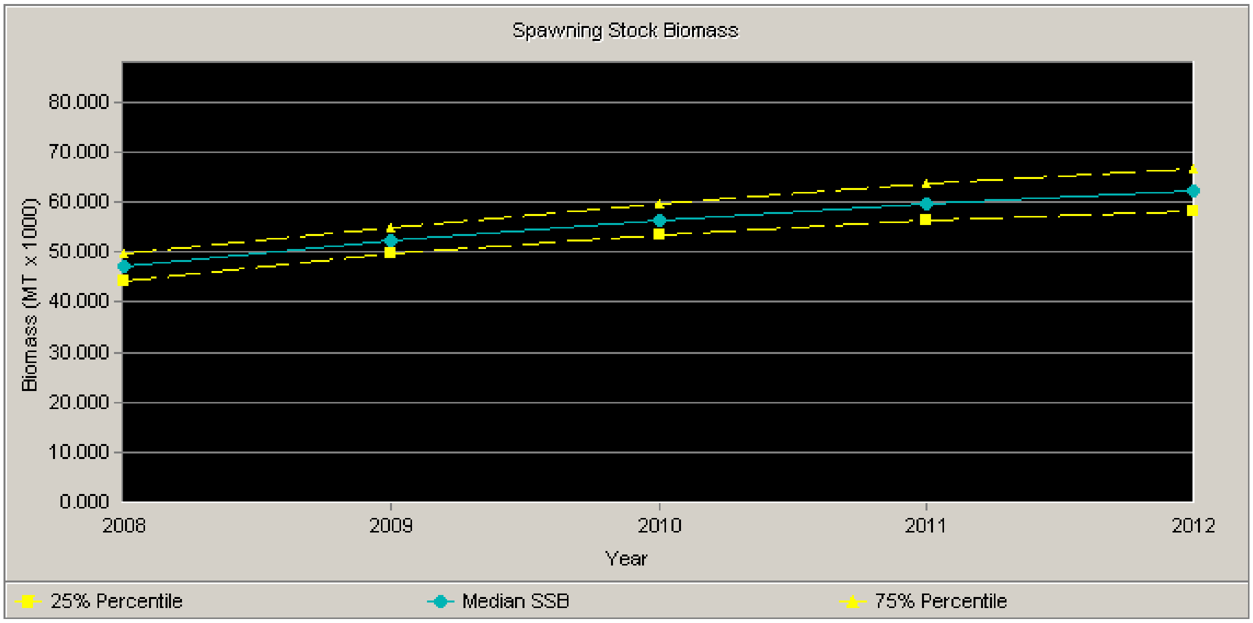


Figure 90. Projection of summer flounder SSB at the proposed Ftarget = F40% = 0.255 during 2010-2012.