Northeast Fisheries Science Center Reference Document 08-12a & b

A Report of the 47th Northeast Regional Stock Assessment Workshop

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

Part A. Assessment Report
Part B. Assessment Report Appendixes

July 2008

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08-10 *Harbor Porpoise Bycatch Rates that Indicate Compliance with Pinger Regulations for the Northeast Gillnet Fishery*, by DL Palka and CD Orphanides. July 2008.

08-11 *47th SAW Assessment Summary Report*, by the 47th Northeast Regional Stock Assessment Workshop (47th SAW). July 2008.

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

July 2008

Northeast Fisheries Science Center Reference Documents

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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
North Charleston, SC 29405
john.carmichael@safmc.net

SARC Panelists (CIE):

Dr. Yan Jiao
Department of Fisheries and Wildlife Science
Virginia Tech
Blacksburg, VA, 24061-0321
Tel: 540-2315749
Email: yjiao@vt.edu

Dr. Kevin Stokes
59 Jubilee Rd, Khandallah, Wellington
Tel: (+64) 04 385 4005 / 04 8021 500 (direct)
E-mail: stokesk@seafood.co.nz

Dr. Mike Armstrong
Centre for Environment, Fisheries, and Aquaculture Sciences (CEFAS)
Pakefield Road, Lowestoft
Suffolk NR33 0HT UK
Tel: +44(0) 1502 524362.
Email: Mike.Armstrong@cefas.co.uk

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 Introduction Agenda Conduct of Meeting	**James Weinberg**, SAW Chairman **John Carmichael**, SARC Chairman	
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
Dvora Hart	NEFSC	deborah.hart@noaa.gov
Toni Kerns	ASCFC	tonikerns@asmfc.org
Paul Nitschke	NEFSC	paul.nitschke@noaa.gov
Andrea Strout	NEFSC	andrea.strout@noaa.gov
Chris Legault	NEFSC	chris.legault@noaa.gov
Jessica Coakley	MAFMC	jcoakley@mafmc.org
MarkTerceiro	NEFSC	mark.terceiro@noaa.gov
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

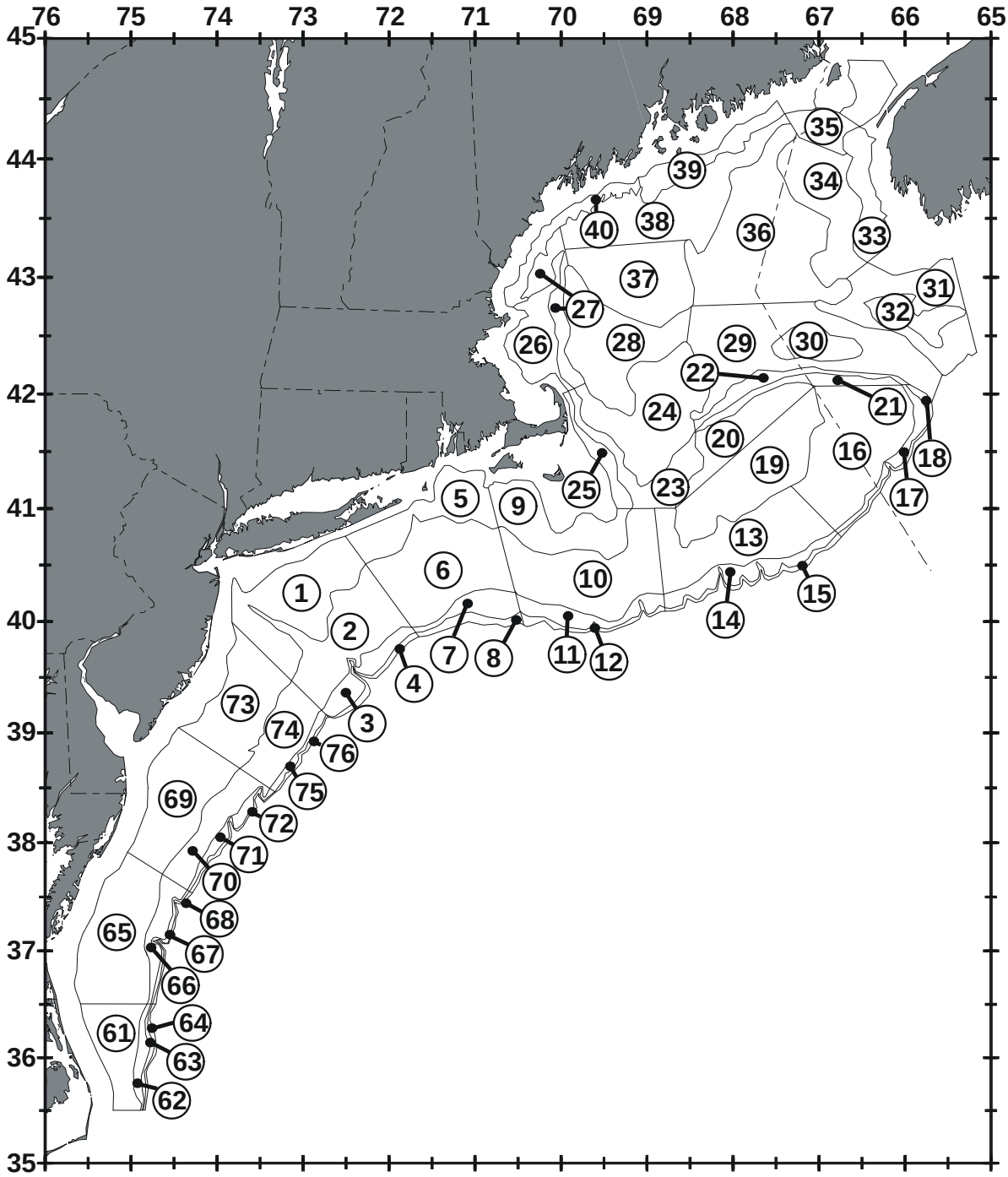

Figure 1. Offshore depth strata sampled during Northeast Fisheries Science Center bottom trawl research surveys.

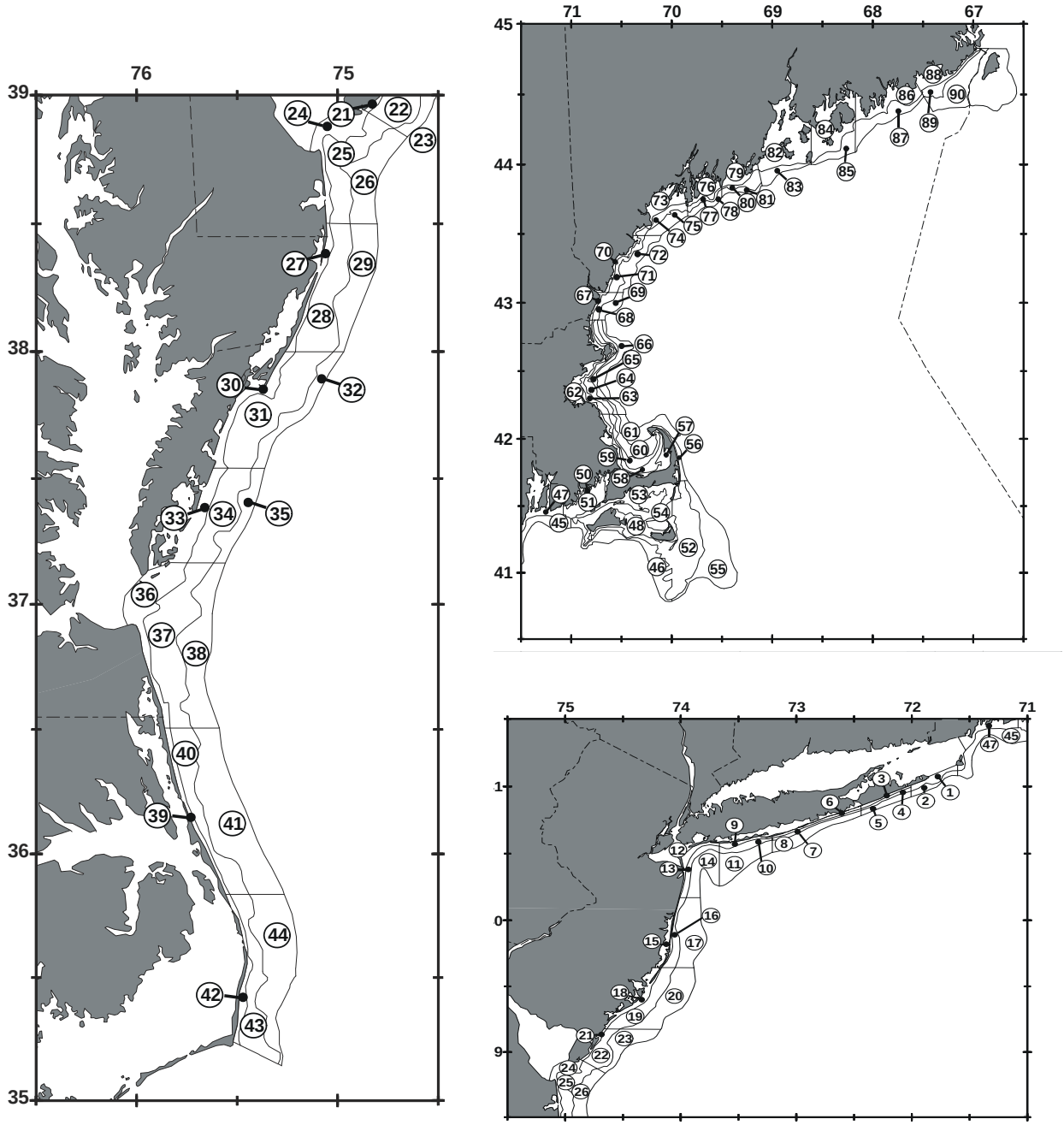

Figure 2. Inshore depth strata sampled during Northeast Fisheries Science Center bottom trawl research surveys.

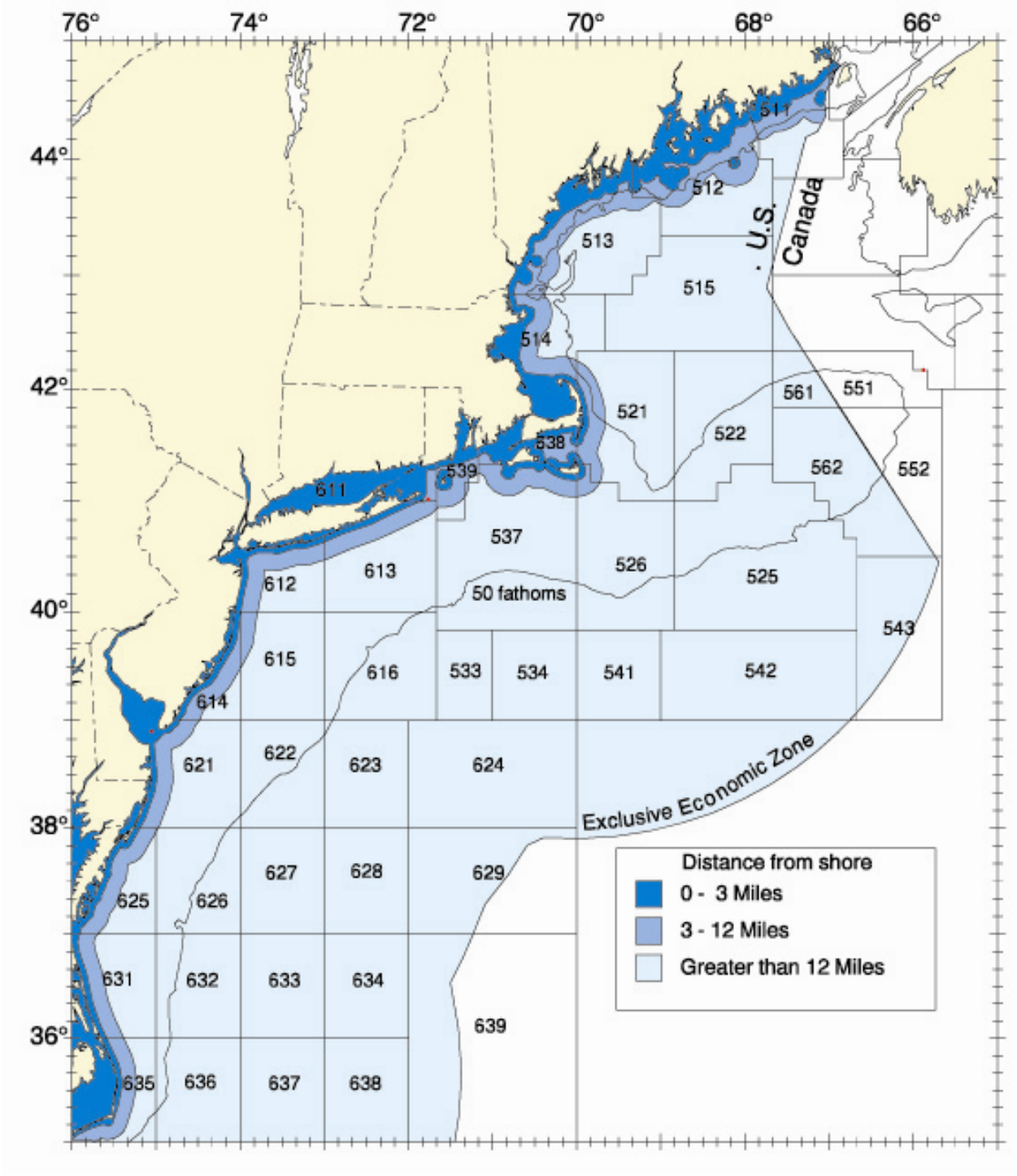

Figure 3. Statistical areas used for reporting commercial catches.

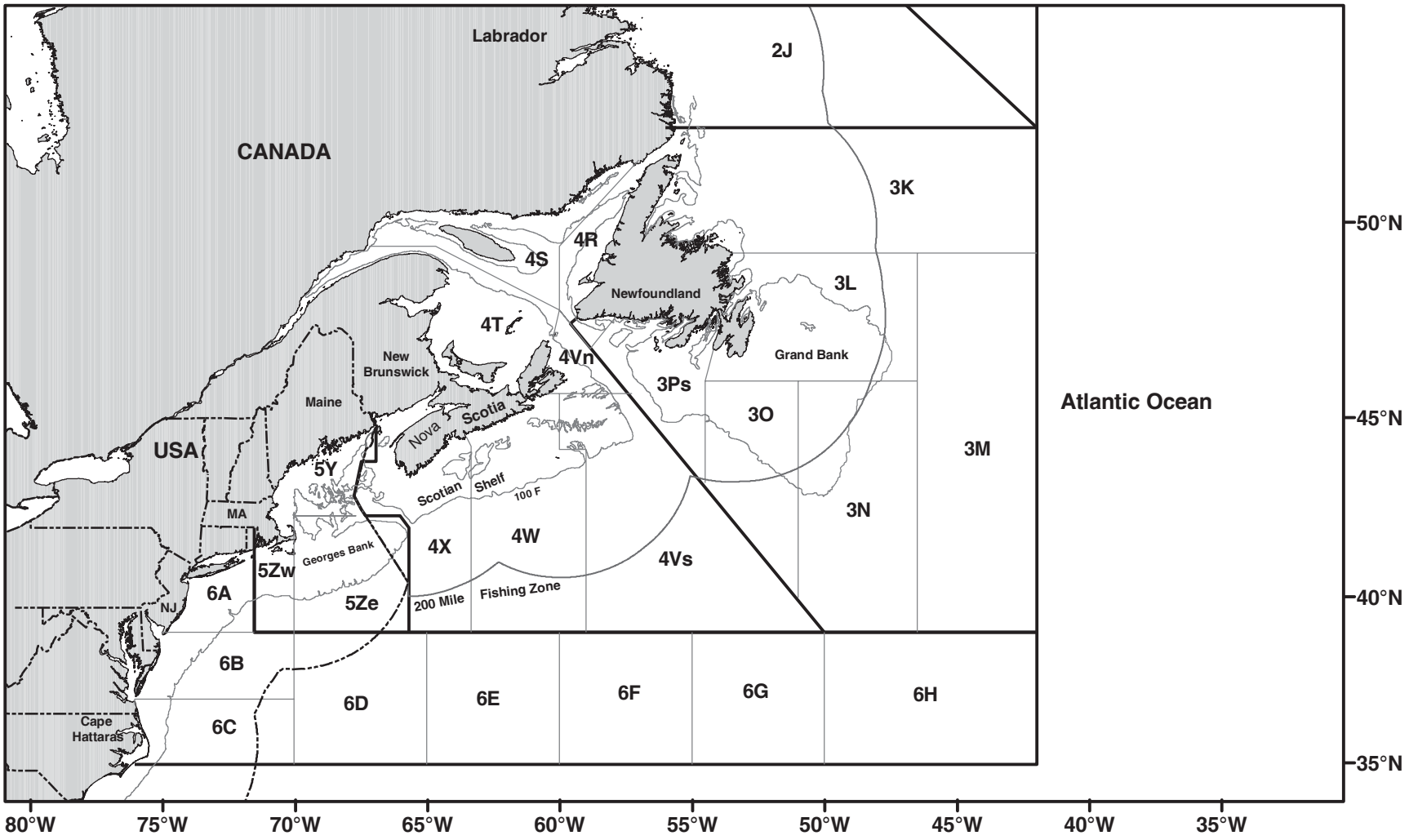

Figure 4. Catch reporting areas of the Northwest Atlantic Fisheries Organization (NAFO) for Subareas 3-6.

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 (50^{th} 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 (50^{th} 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 (50^{th} 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 (50^{th} 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 ($\alpha = 0.10$ 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 ± 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 90th 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

	Quarter				
DIV	1	2	3	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

	Quarter				
DIV	1	2	3	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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

DIV	Quarter 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

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

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 *S-R function lambda set = 0* *Estimate S-R steepness, R0, R1 offset* *Recruit devs to begin in 1982*	59	3026	0.000027	age 2; 0.99 to 0.77	44,430	0.34	**Recruit (YOY) and Age-1 estimates follow indices** **SELEX changes substantially (as expected)** **Recruits in 1982-1983 low relative to other models** **B-H Steepness = 0.92** **B-H Alpha ~45% higher than in ASAP T5 run**
F08_BASE_T1 *Used ESS/OSS ratio* *to tune Fishery age comps* ***Var. adj. = 1.863x***	59	3068	0.000077	age 2; 0.99 to 0.71	39,950	0.40	**Recruit (YOY) and Age-1 estimates follow indices** **SELEX changes substantially (as expected)** **Recruits in 1982-1983 low relative to other models** **B-H Steepness = 0.94** **B-H Alpha ~20% higher than in ASAP T5 run** **Improved ESS/OSS ratio**
F08_BASE_T2 *Increased SV CVs to 0.3, 0.4, 0.6* *(as in ASAP T5 run)* ***Var. Adj. = +0.14, +0.19, +0.20***	59	1050	0.000543	age 2; 0.99 to 0.68	38,820	0.43	**Recruit (YOY) and Age-1 estimates follow indices** **SELEX changes substantially (as expected)** **Recruits in 1982-1983 low relative to other models** **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 *Models each fishery component seperately - 6 fishery CAA* *Landings use flat pattern* *Discards use dome pattern* *"Untuned"*	200	4950.8	0.003016	variable	39,500	0.43	**Comm & Rec Land SELEX "steeper" than BASE_F2** **TRWL Disc SELEX flat** **SCAL Disc and REC disc strongly domed** **B-H Steepness = 0.88** **Slightly Higher historical F than BASE_T2** **Some SELEX bounds hit** **Positive late90s/early00s resids persist in age 3-5 SVs**
F08_SVAgecomp *Single fishery CAA - flat pattern* *Surveys with multiple ages modeled as multinomial* *Stand-alone age 0 inidces modeled as lognormal* *"Untuned"*	79	2882.8	0.000087	age 2	36,500	0.44	**Fishery SELEX "steeper" than BASE_F2** **Surveys SELEX full (S=1) at ages 1 to 3** **B-H Steepness = 0.95** **10% to 40% higher historical F than BASE_T2** **Some SELEX bounds hit** **Positive late90s/early00s resids in all aggregate SVs**
F08_MULTI_SVAGE *Combines MULTI and SVAgecomp configurations* *"Untuned"*	220	4856.1	0.000140	variable	48,300	0.35	**Comm & Rec Land SELEX LESS "steep" than BASE_F2** **TRWL Disc SELEX flat** **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.

	Year								
	1982	1983	1984	1985	1986	1987	1988	1989	1990
Age									
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

	Year								
	1991	1992	1993	1994	1995	1996	1997	1998	1999
Age									
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

	Year							
	2000	2001	2002	2003	2004	2005	2006	2007
Age								
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)

	ADAPT VPA T2007_M20	**ADAPT VPA T2007_M25**	**ADAPT VPA T2007_M33**
NON-PARAMETRIC	(stochastic) mean M=0.20	(stochastic) mean M=0.25	(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)

	ASAP F08_T2007_T2_M20	**ASAP F08_T2007_T2**	**ASAP F08_T2007_T2_M33**
NON-PARAMETRIC	(stochastic) mean M=0.20	(stochastic) mean M=0.25	(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

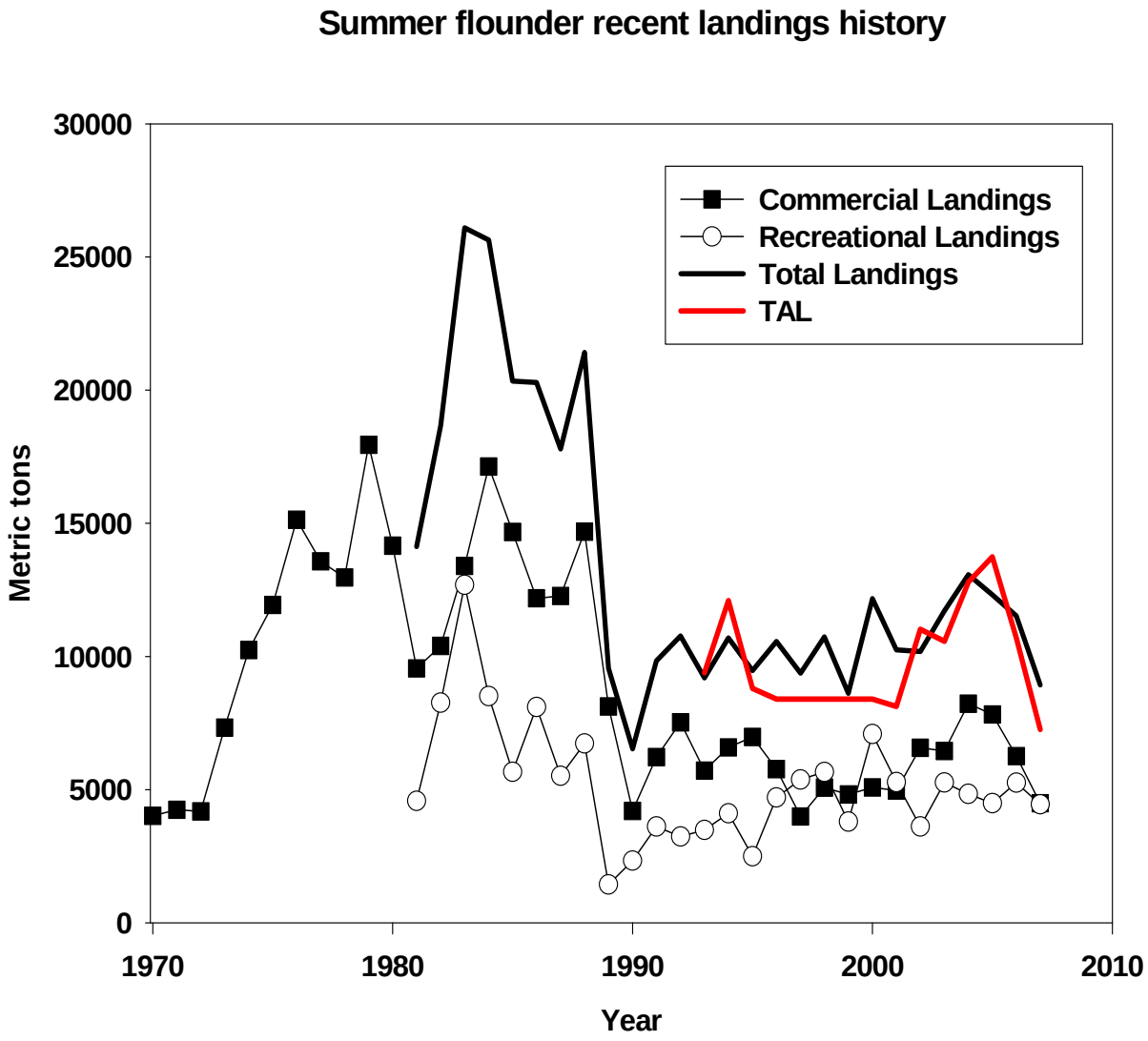


Figure 1. Summer flounder recent commercial (1970-2007), recreational (1981-2007), total fishery (1981-2007) landings, and the corresponding fishery Total Allowable Landings (TAL).

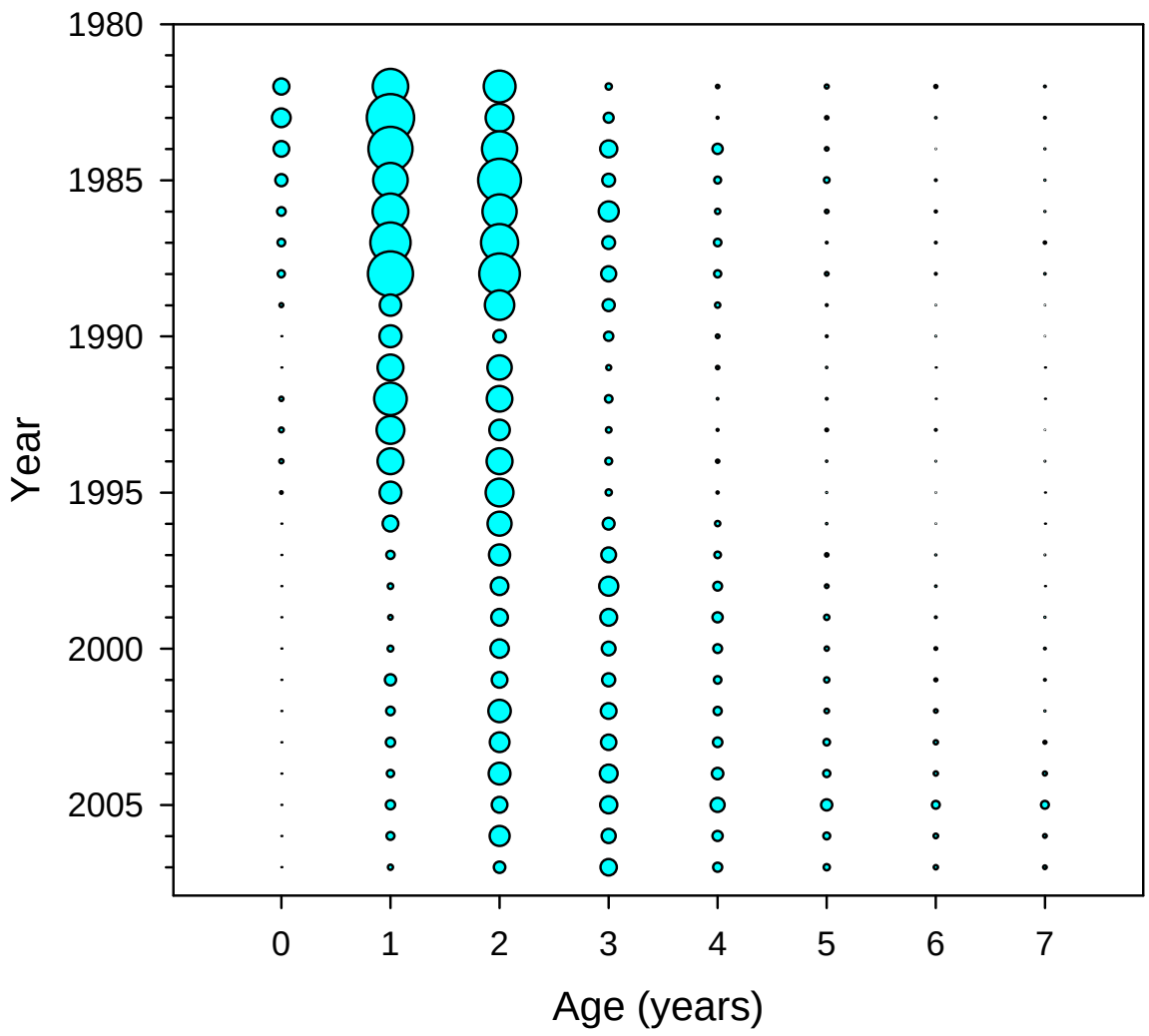


Figure 2. Age composition of NER (ME-VA) commercial landings.

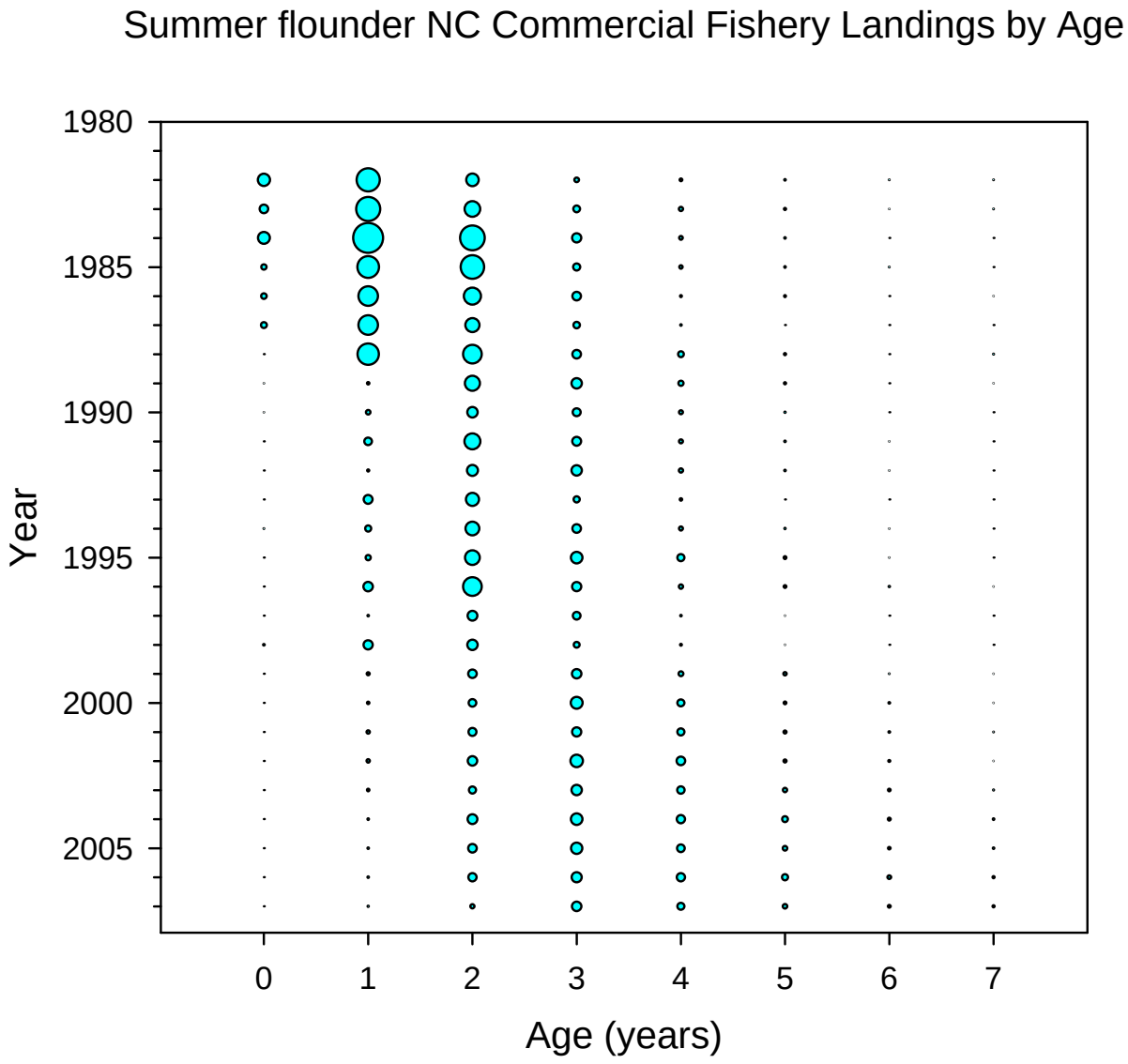


Figure 3. Age composition of North Carolina (NC) commercial landings.

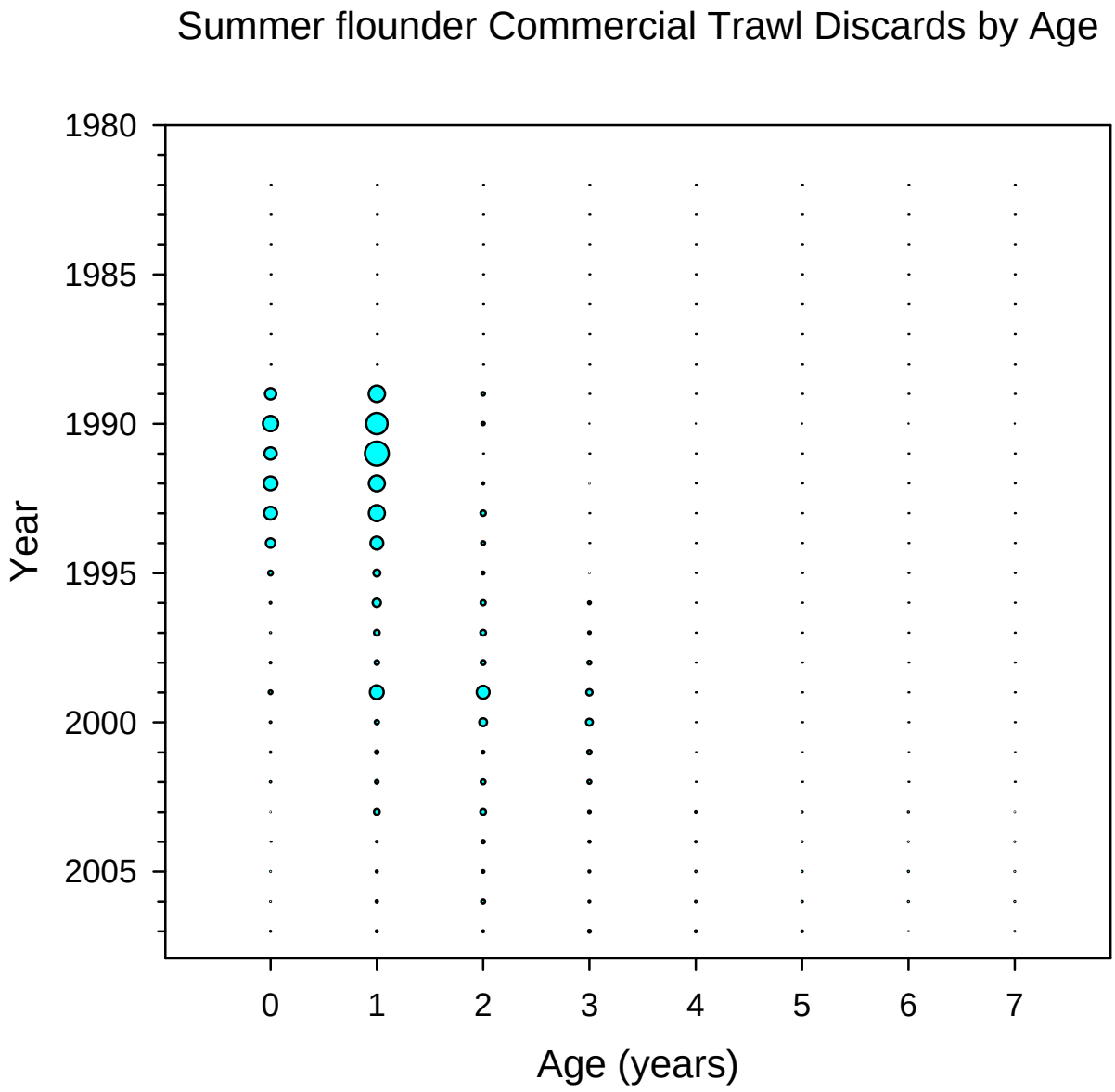


Figure 4. Age composition of commercial trawl discards.

Figure 5. Age composition of commercial scallop dredge discards.

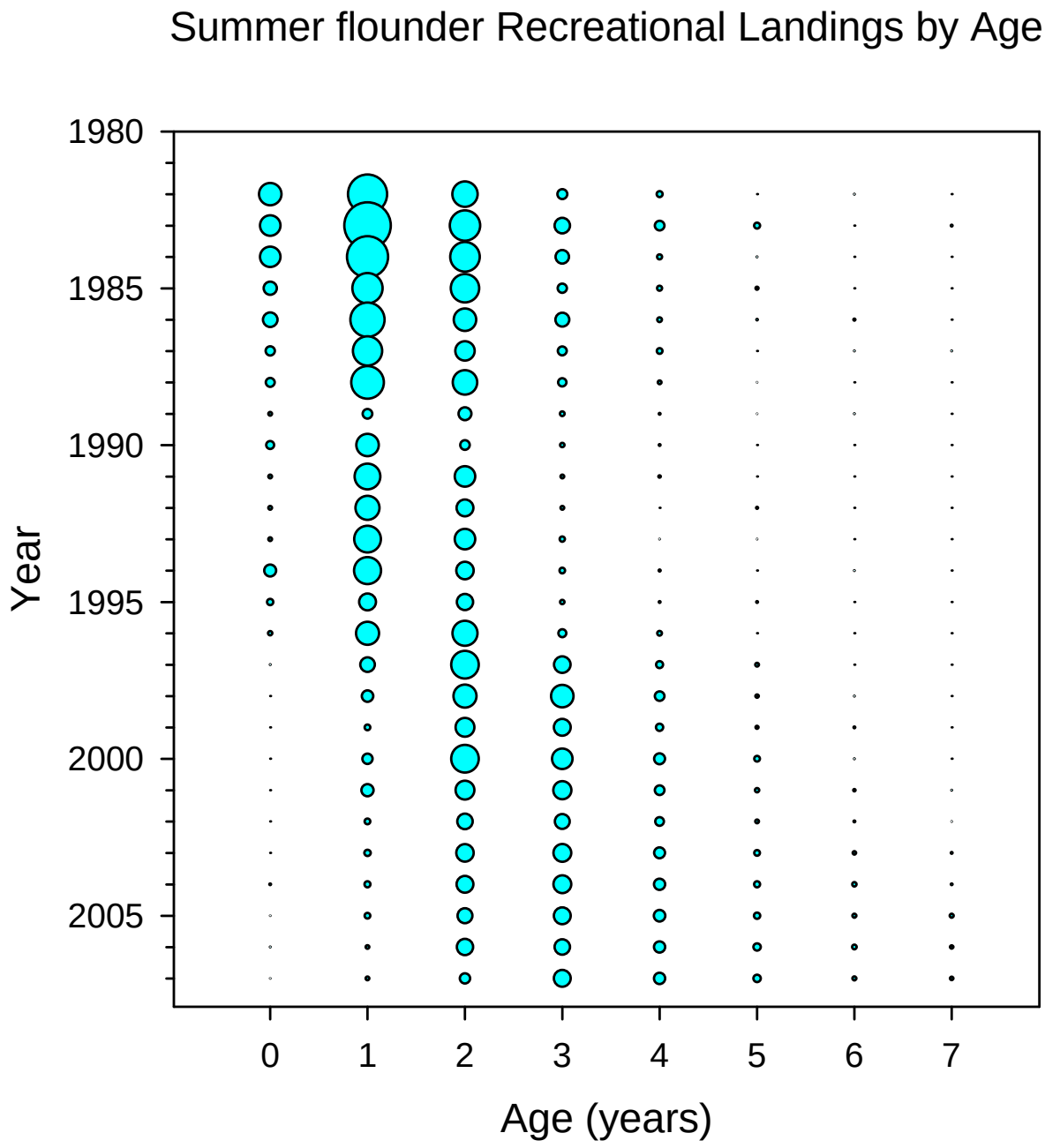


Figure 6. Age composition of recreational landings.

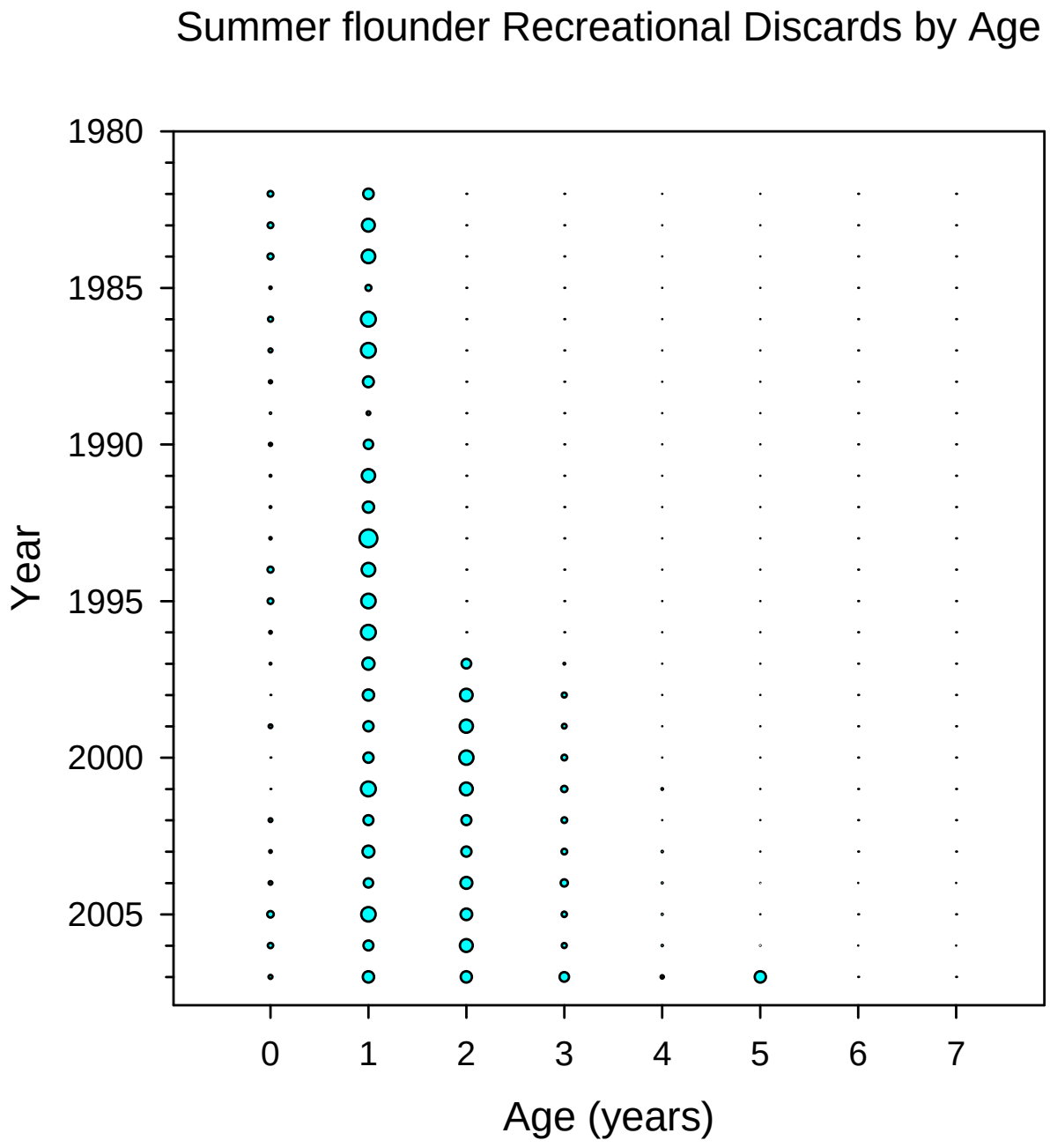


Figure 7. Age composition of recreational discards.

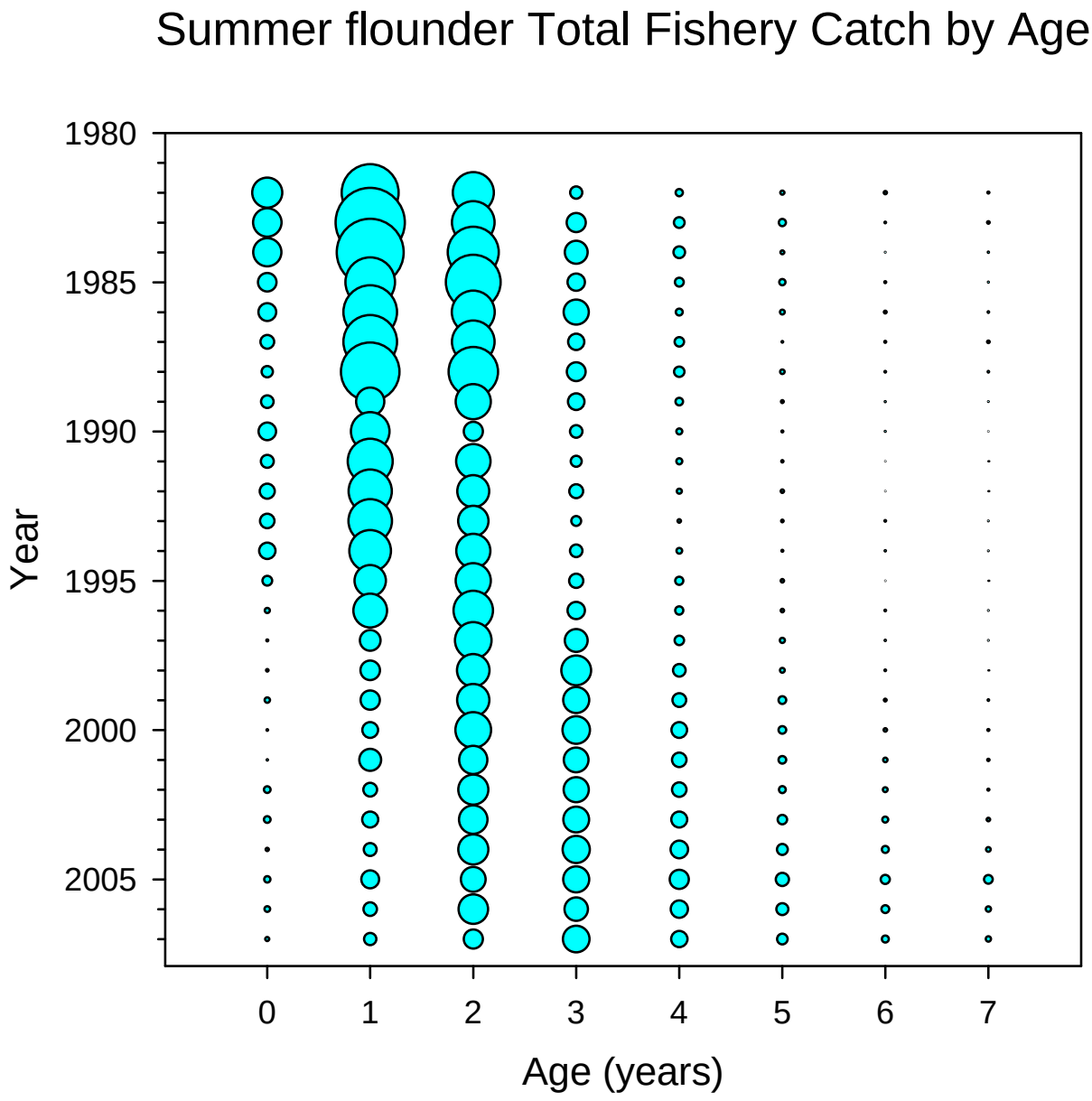


Figure 8. Age composition of total fishery catch.

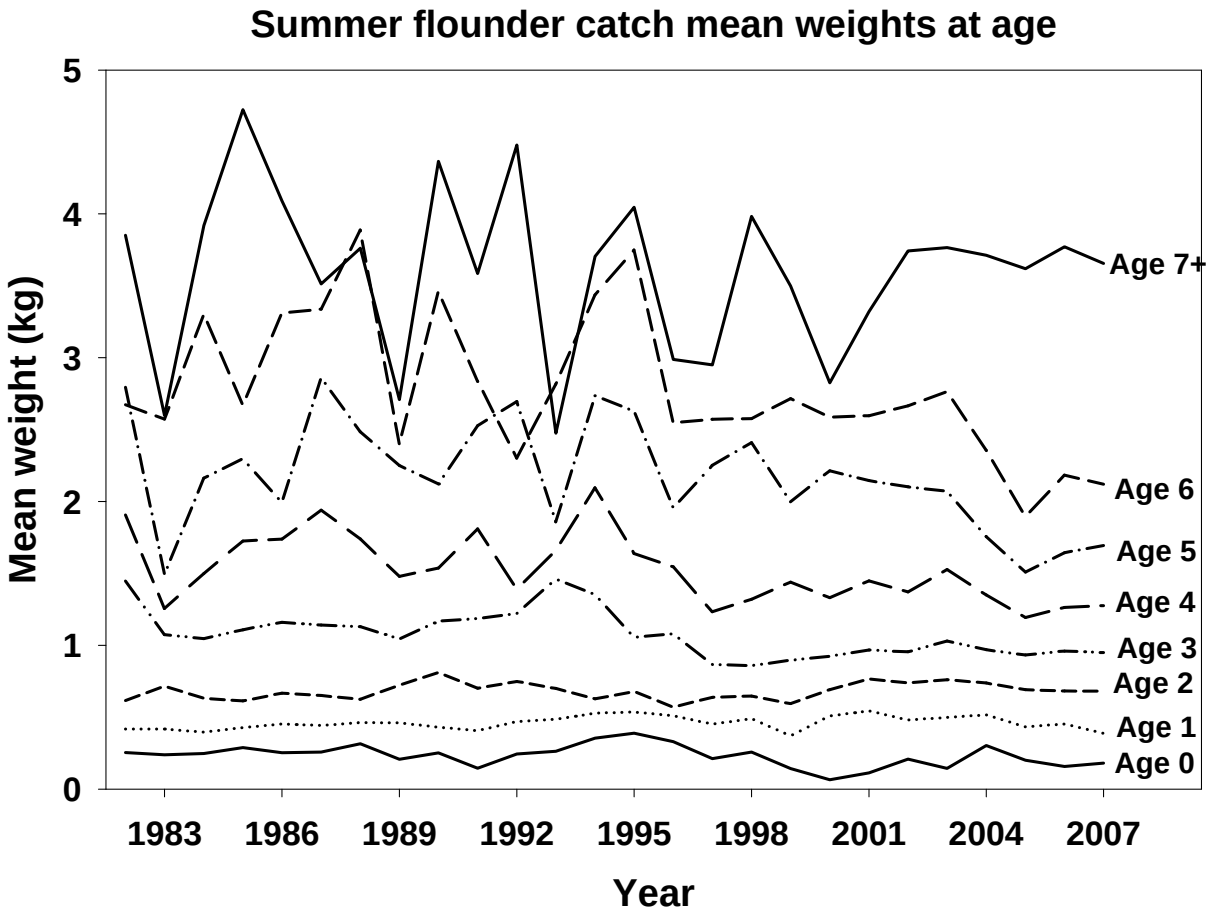


Figure 9. Trends in mean weight at age in the total catch of summer flounder.

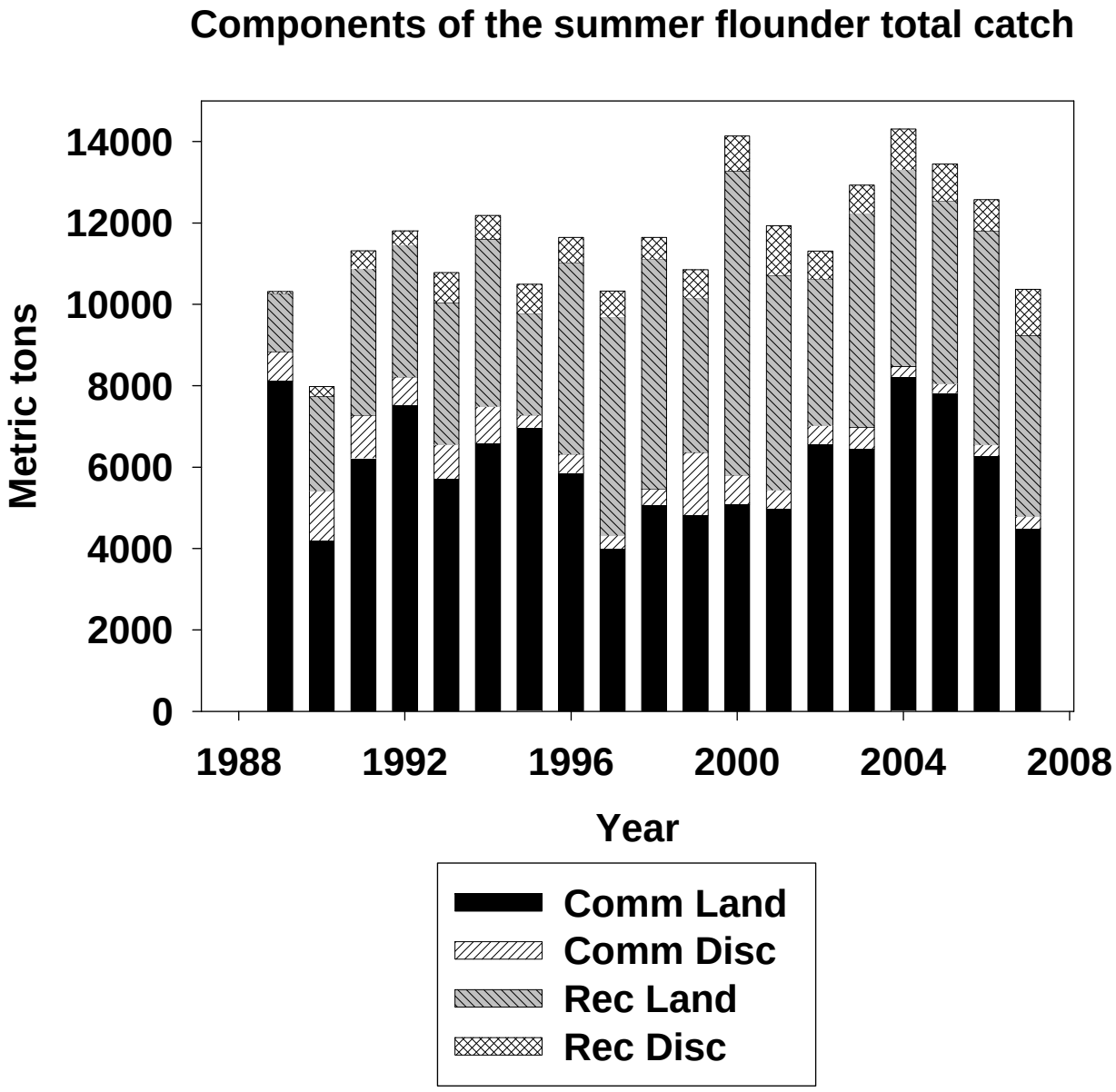


Figure 10. Components of the summer flounder total catch.

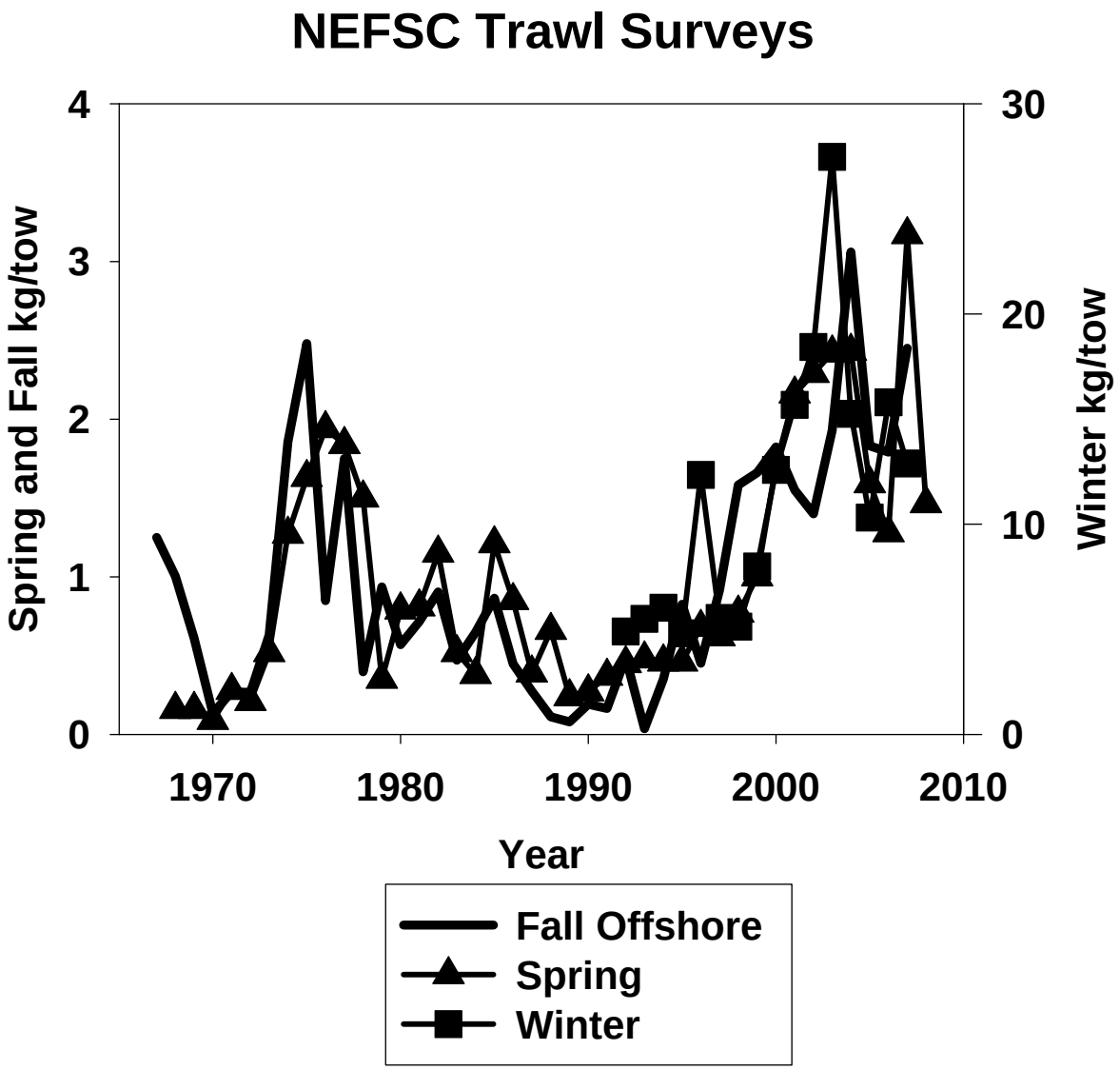


Figure 11. Trends in NEFSC trawl survey biomass indices for summer flounder.

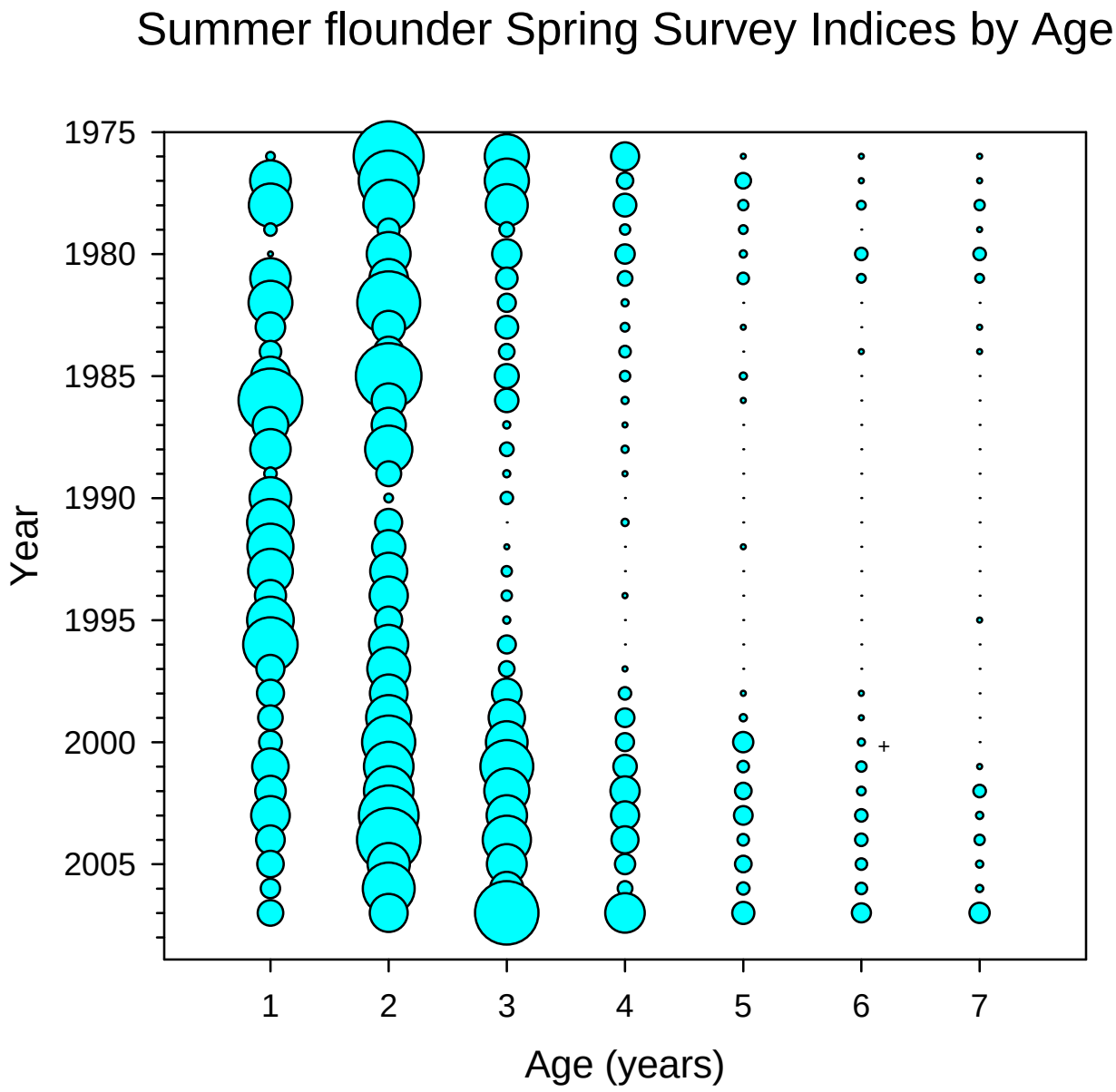


Figure 12. Age composition of the NEFSC spring trawl survey catch.

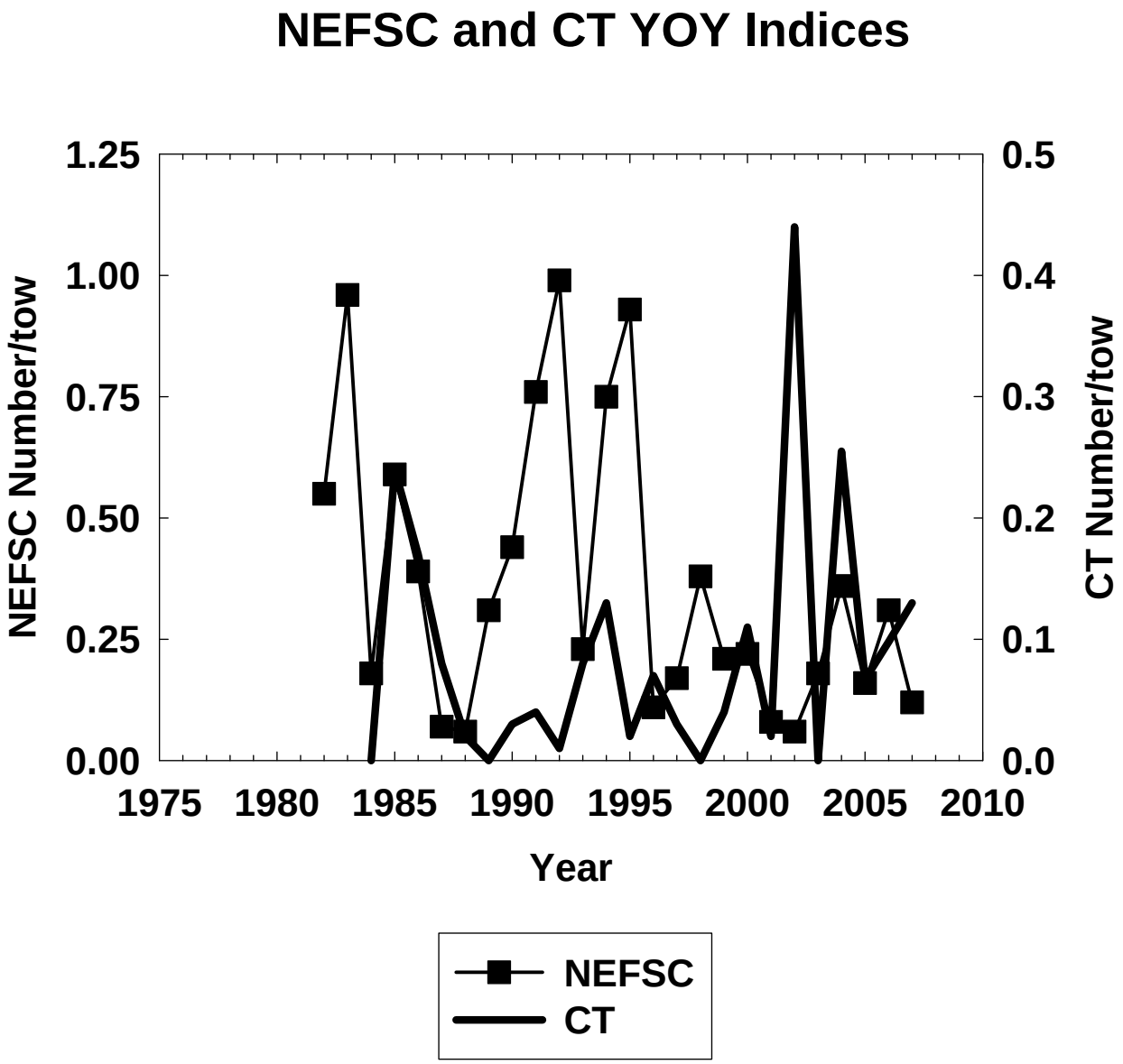


Figure 13. Trends in NEFSC and CT trawl survey recruitment indices for summer flounder.

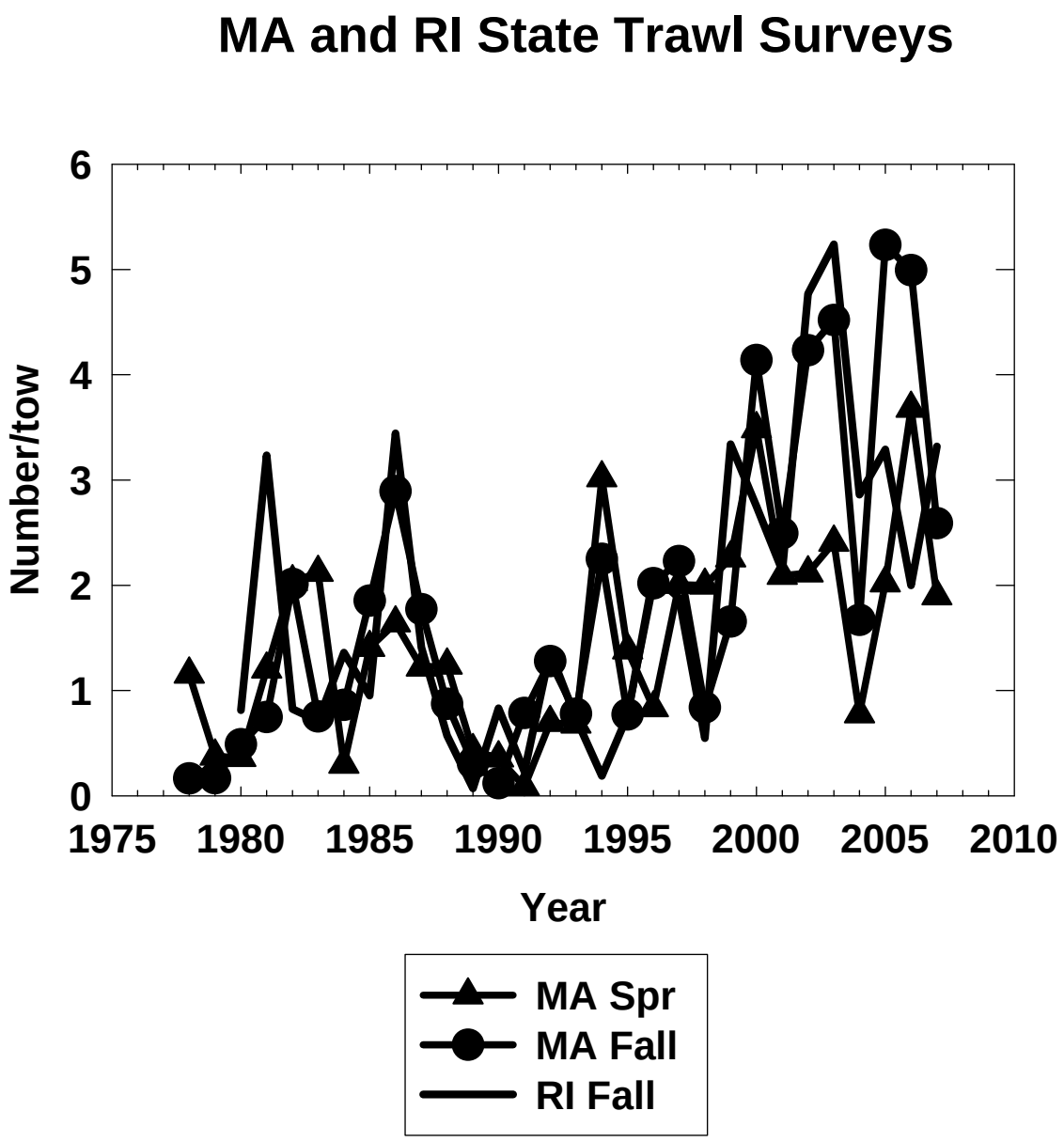


Figure 14. Trends in MA and RI trawl survey abundance indices for summer flounder.

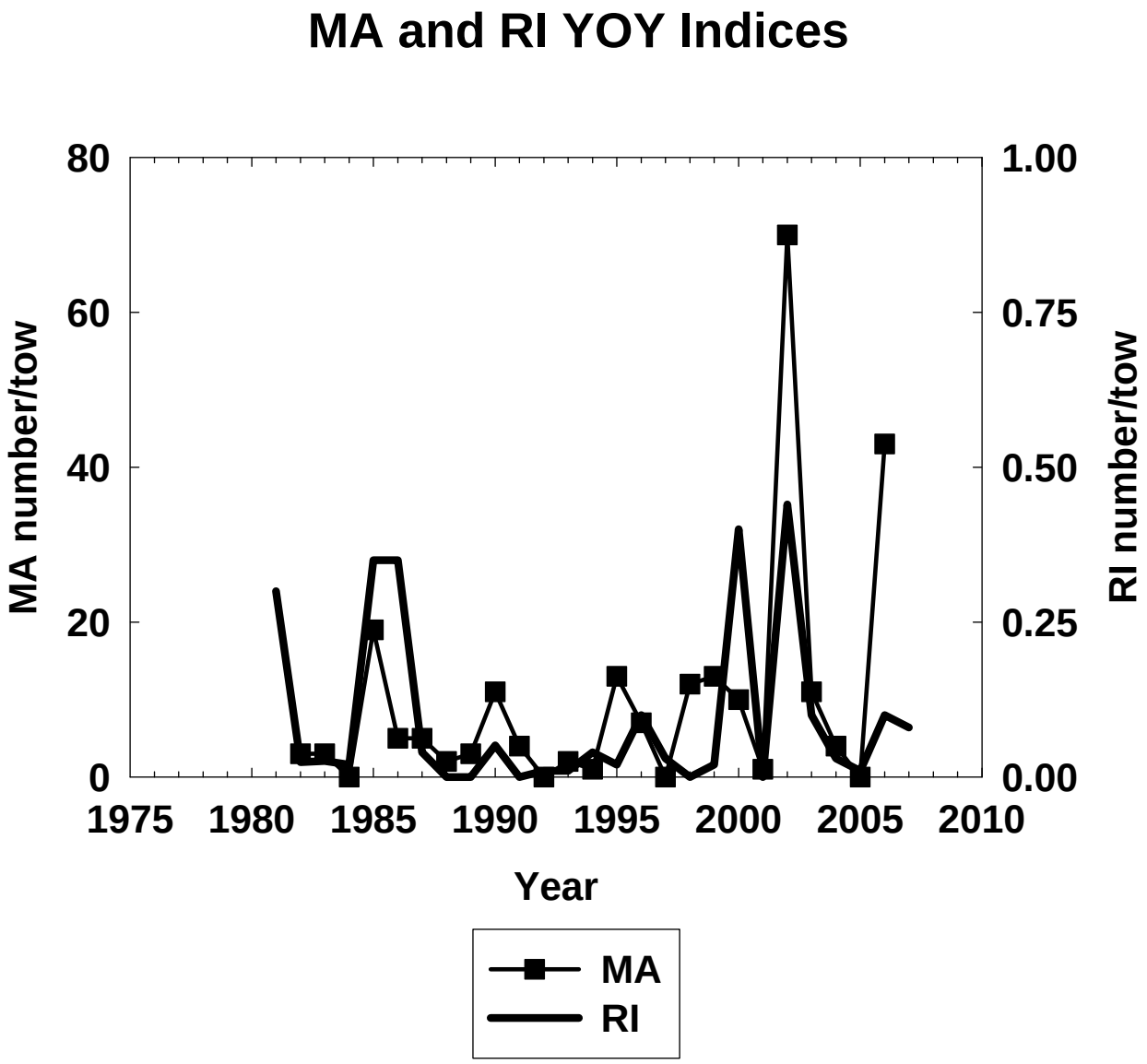


Figure 15. Trends in MA and RI survey recruitment indices for summer flounder.

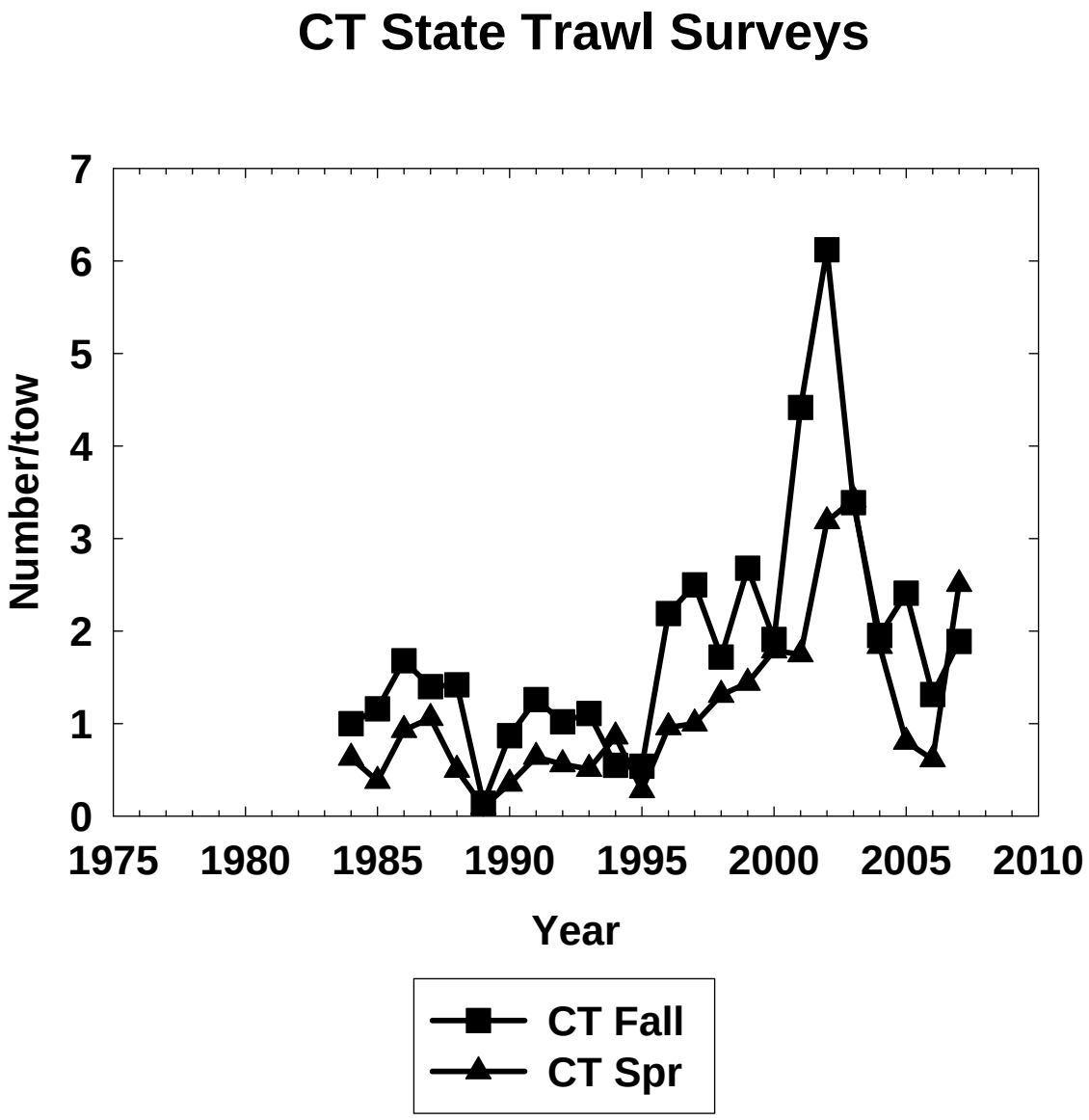


Figure 16. Trends in CT trawl survey abundance indices for summer flounder.

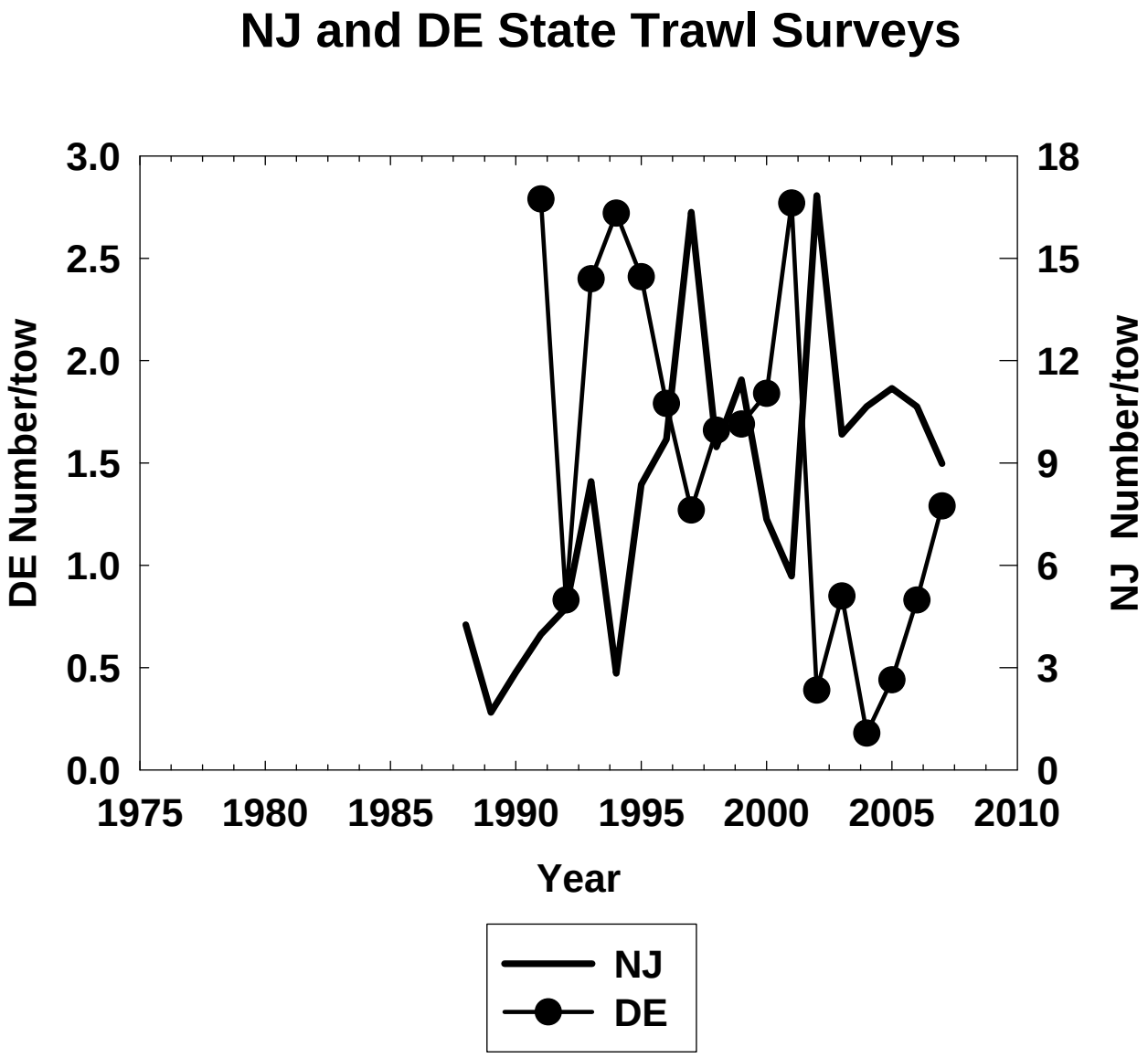


Figure 17. Trends in NJ and DE trawl survey abundance indices for summer flounder.

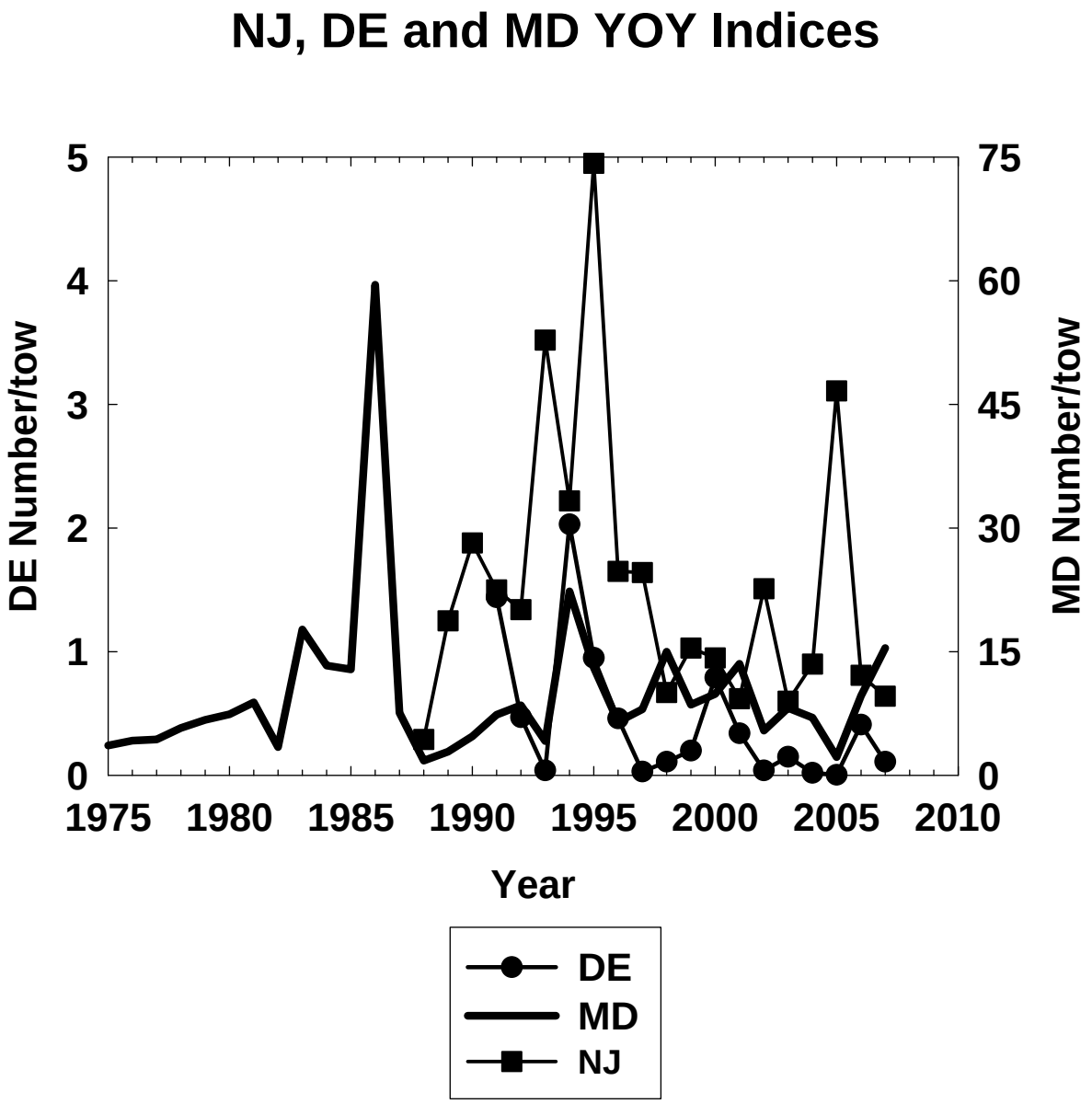


Figure 18. Trends in NJ, DE and MD survey recruitment indices for summer flounder.

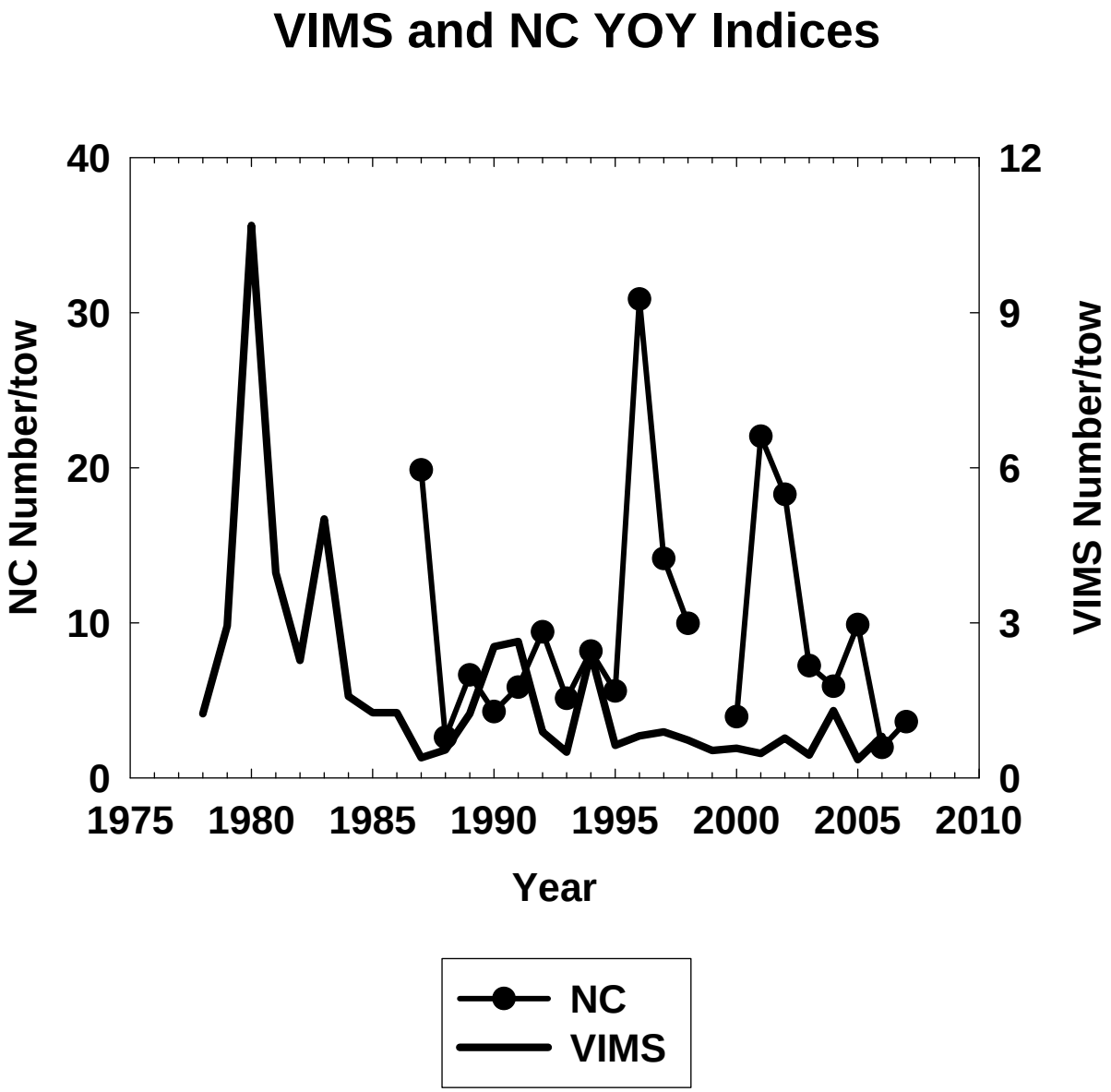
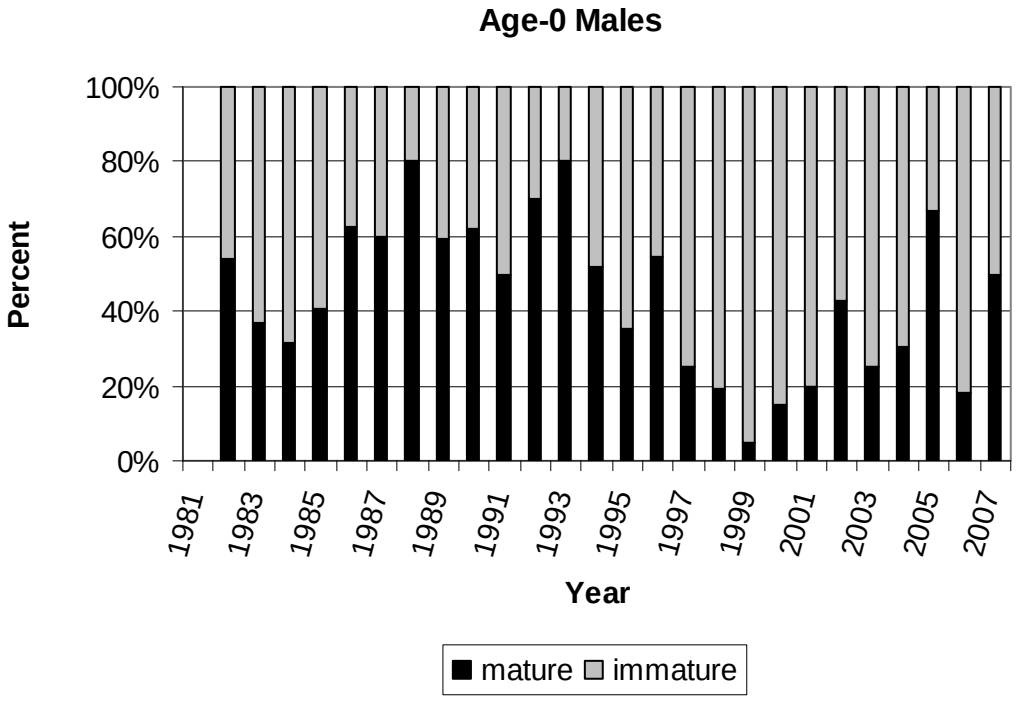


Figure 19. Trends in VIMS and NC trawl survey recruitment indices for summer flounder.



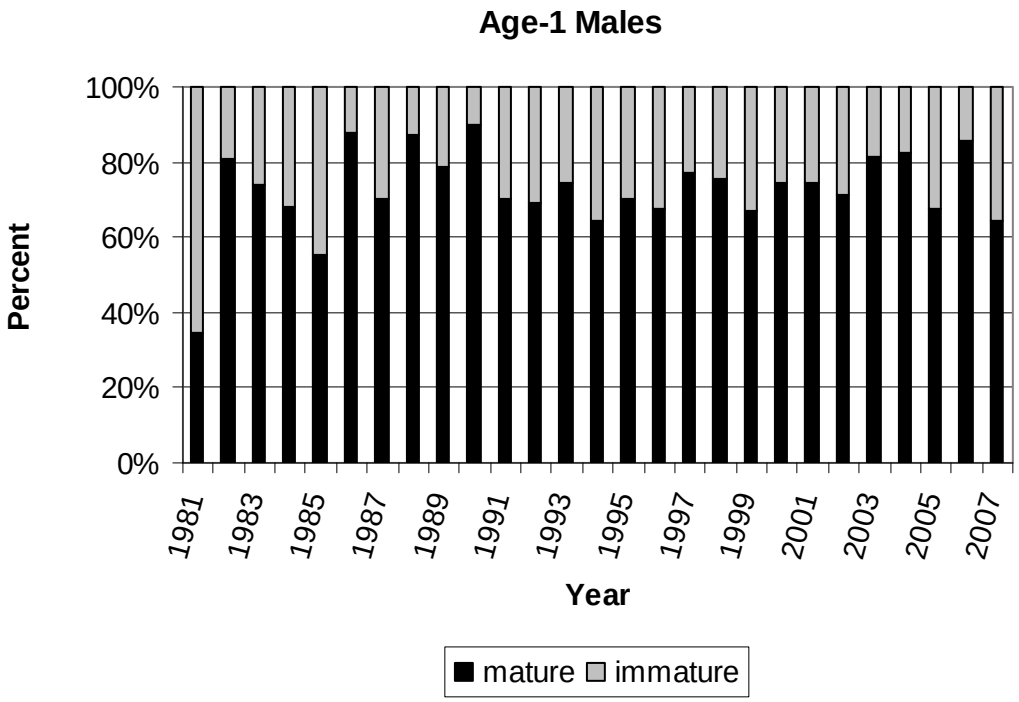
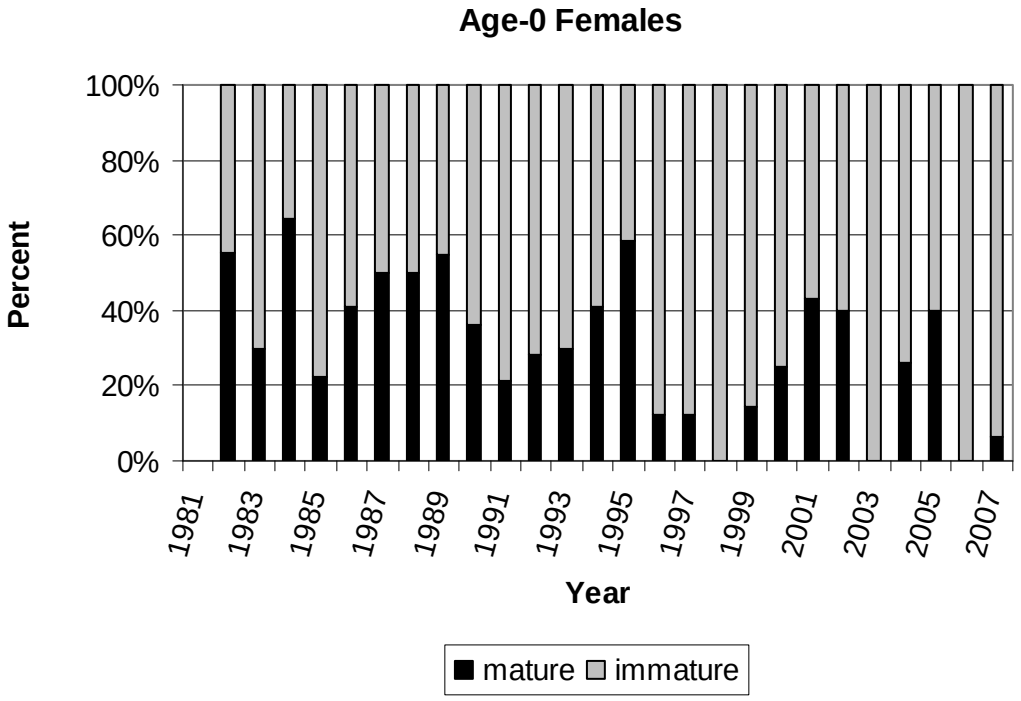


Figure 20. Summer flounder maturity based on the NEFSC spring, fall, and winter trawl survey data; the proportion mature at age-0 and 1, by sex, 1981-2007.



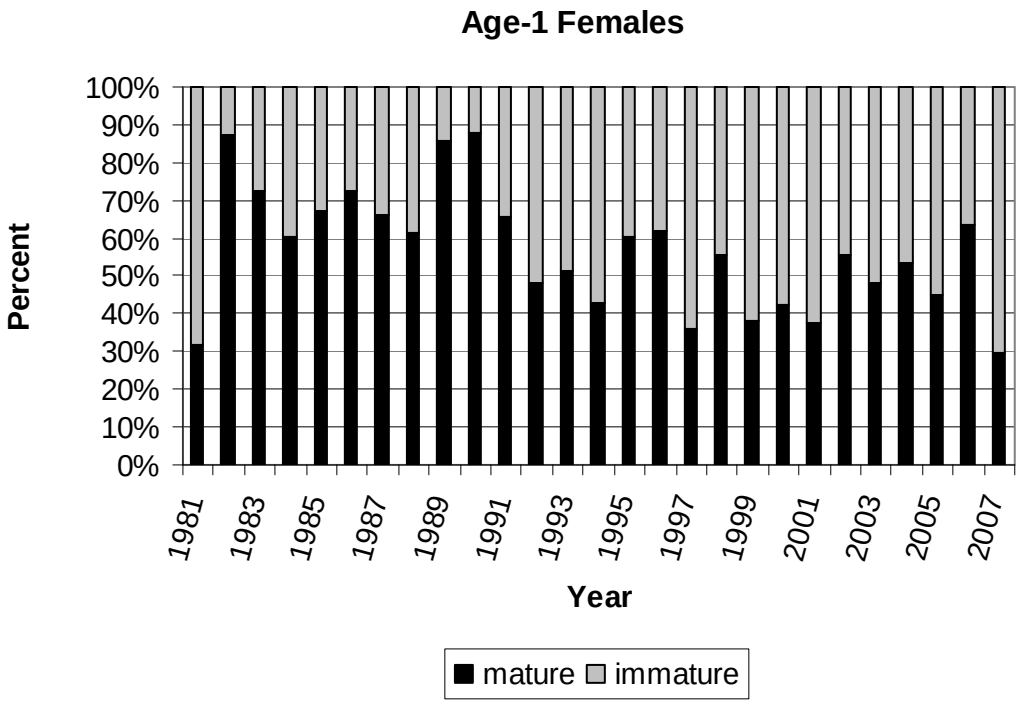


Figure 20. Continued. Summer flounder maturity based on the NEFSC spring, fall, and winter trawl survey data; the proportion mature at age-0 and 1, by sex, 1981-2007.

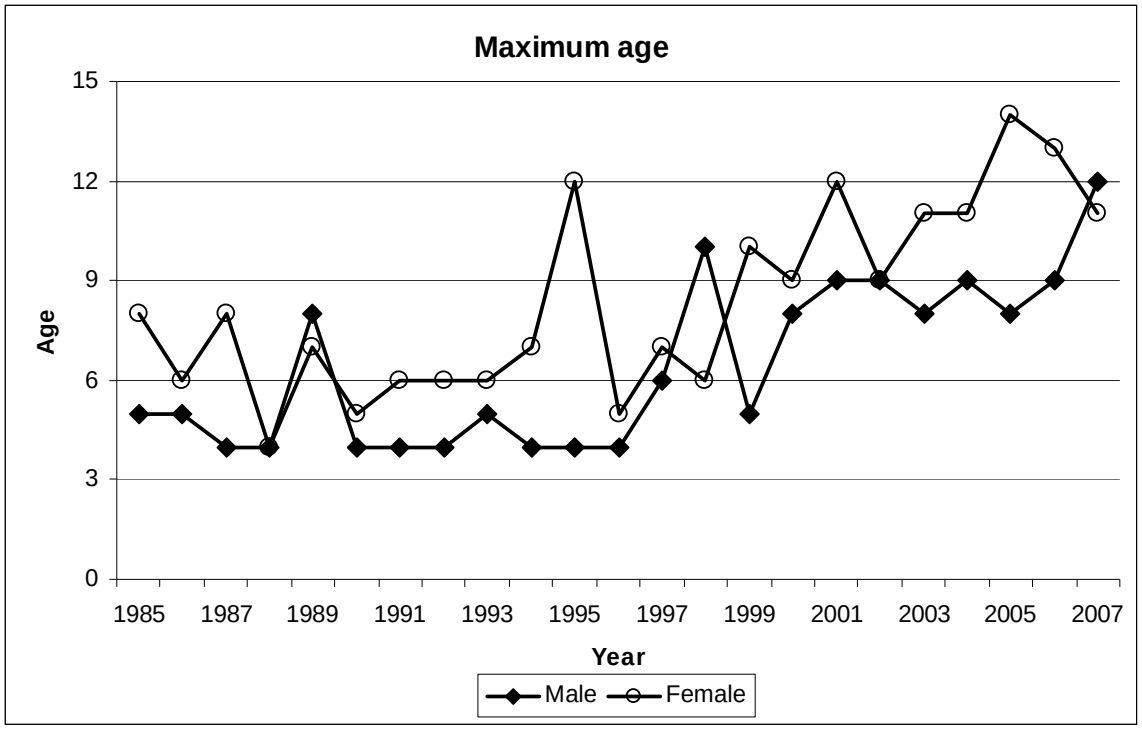


Figure 21. Maximum age by sex from the NEFSC spring, winter, and fall survey data, 1985-1995.

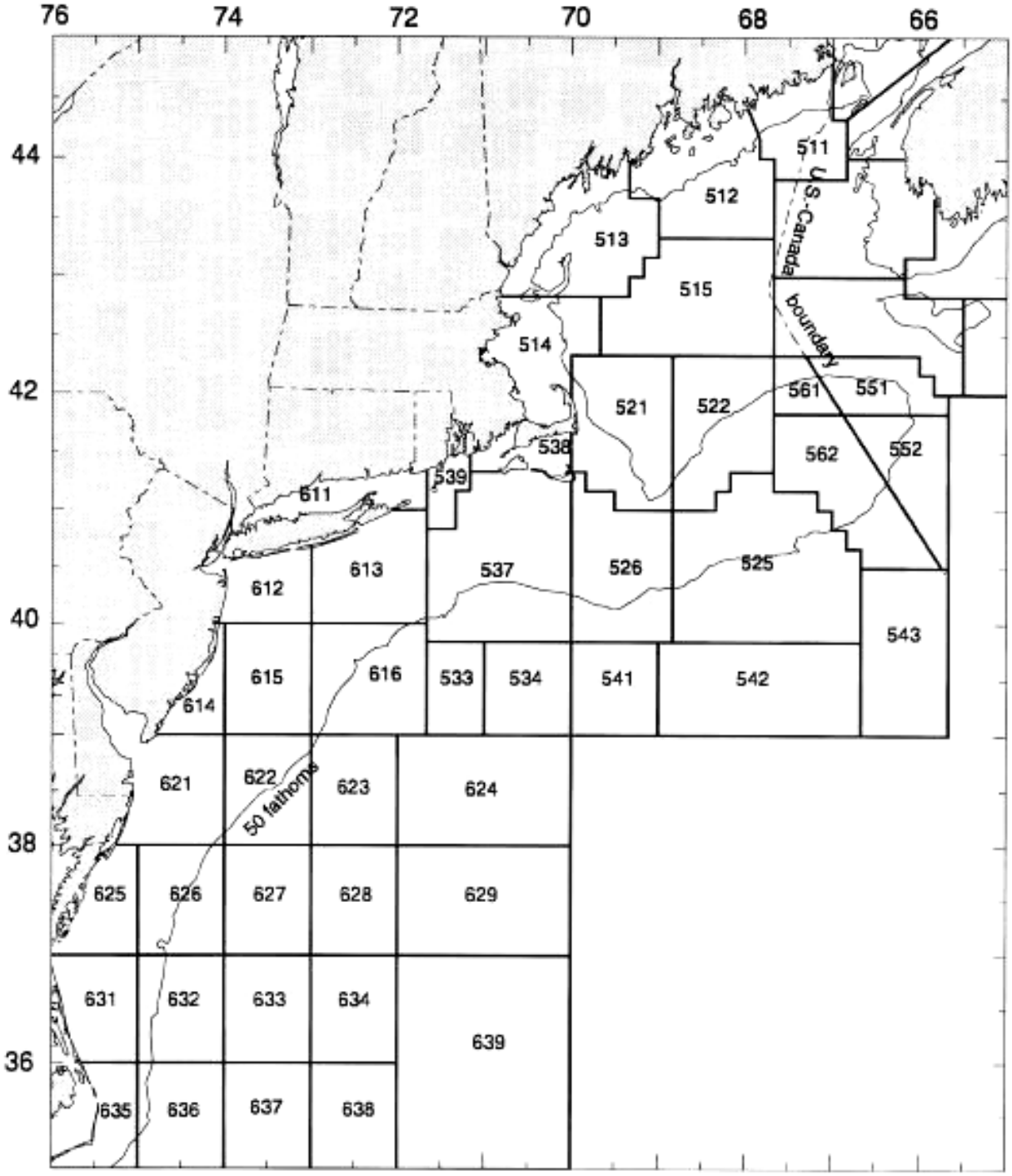
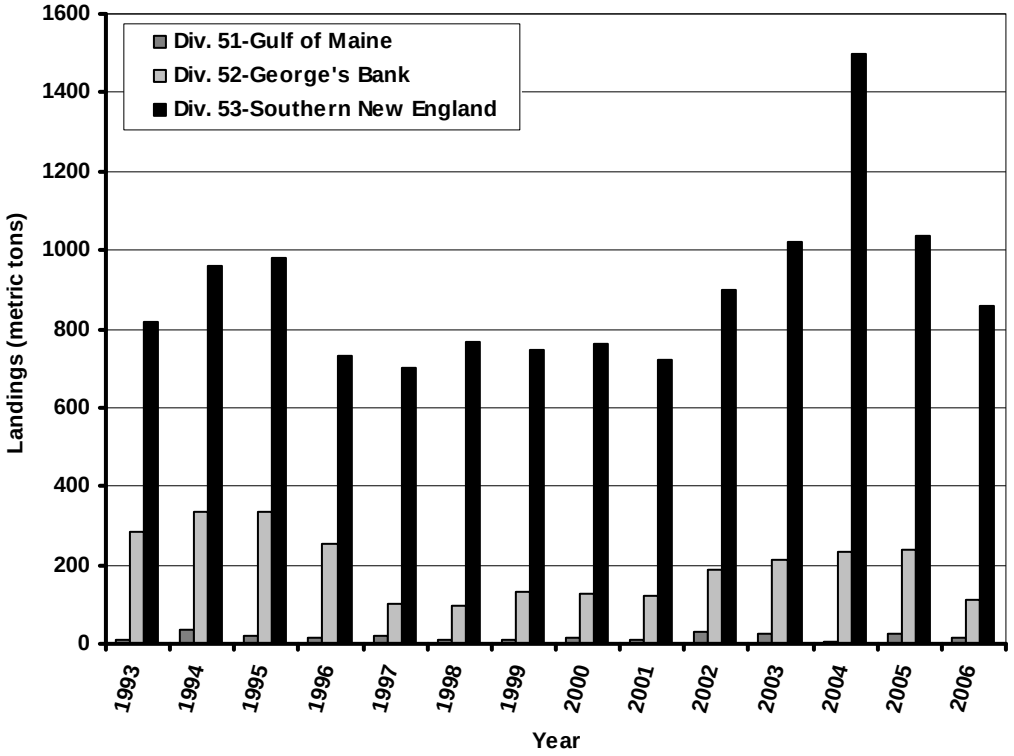


Figure 22. Commercial statistical areas.



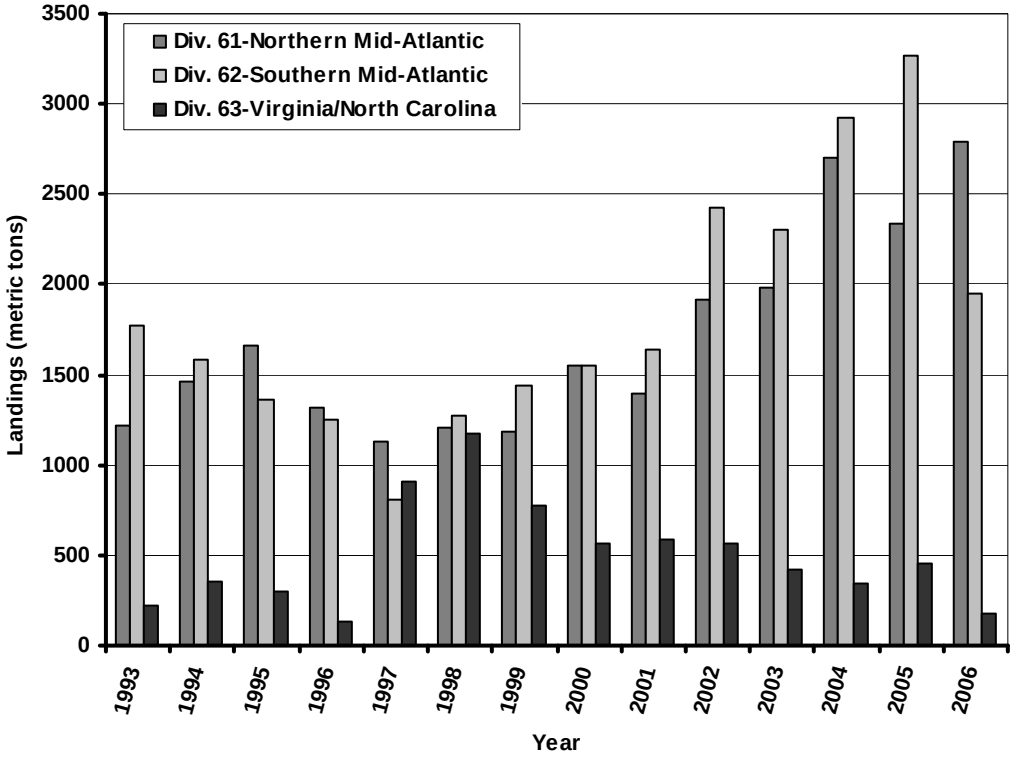


Figure 23. Commercial Landings (mt) for Divisions 51-53 and 61-63, for 1993-2006.

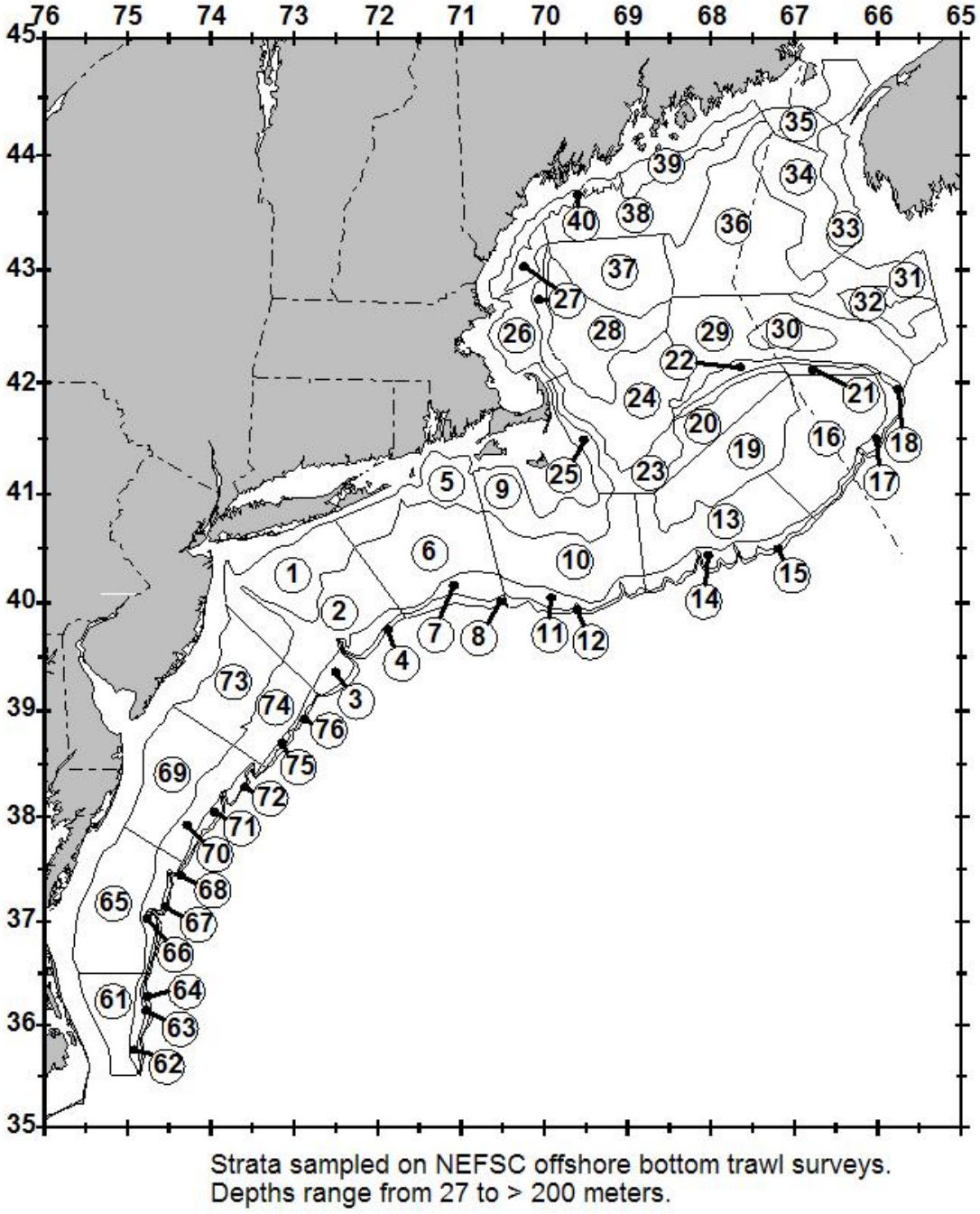
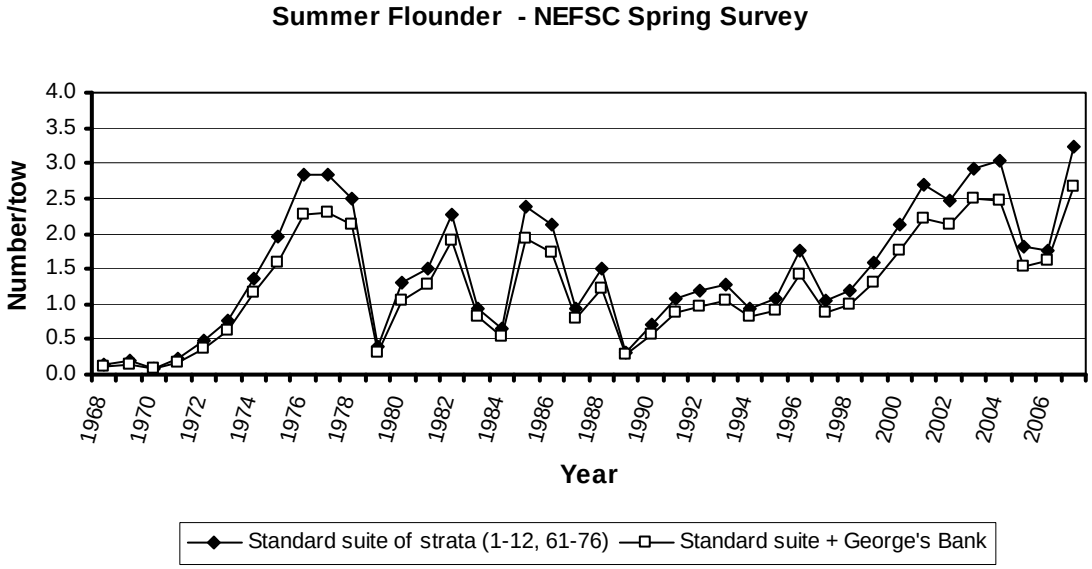


Figure 24. NEFSC survey strata.



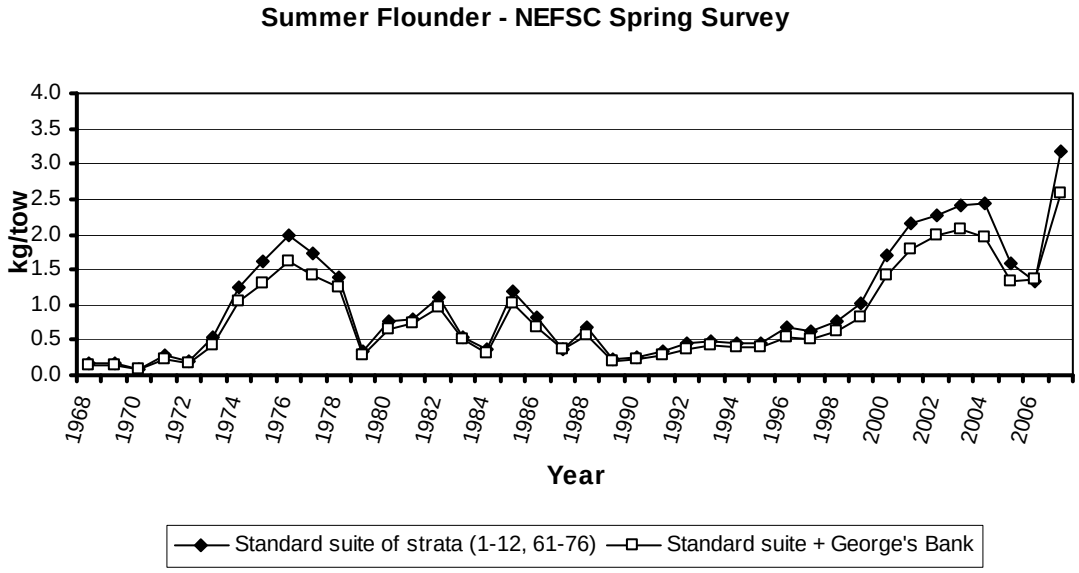
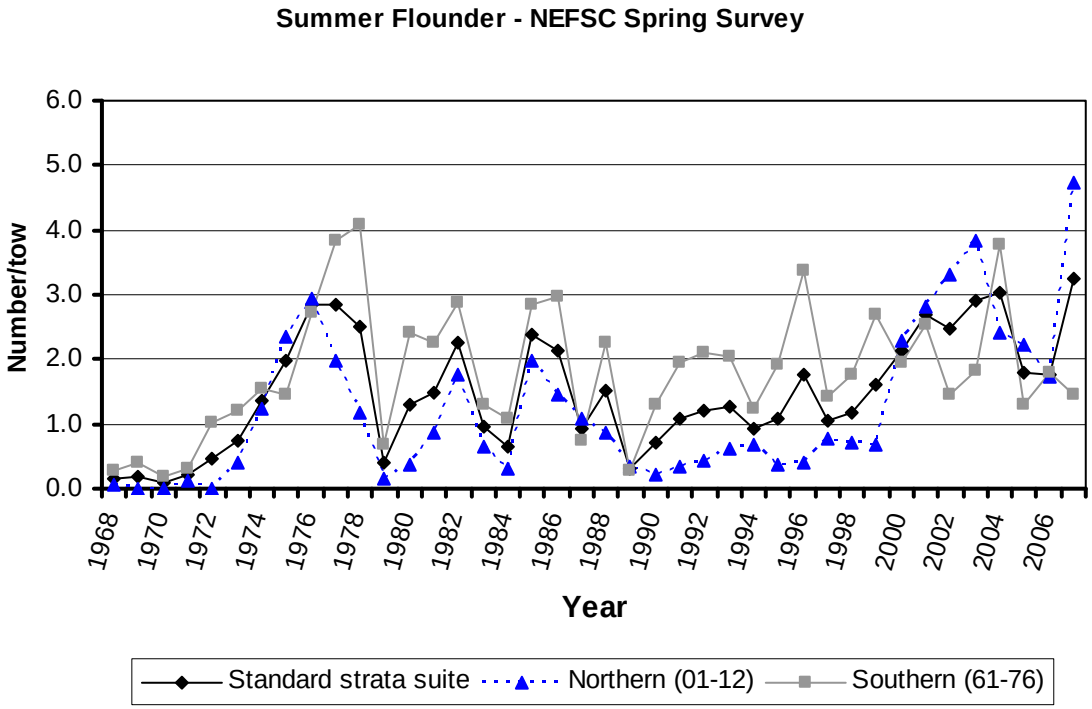


Figure 25. NEFSC Spring survey summer flounder indices (no./tow and kg/tow) with and without the George's Bank survey strata, 1968-2007.



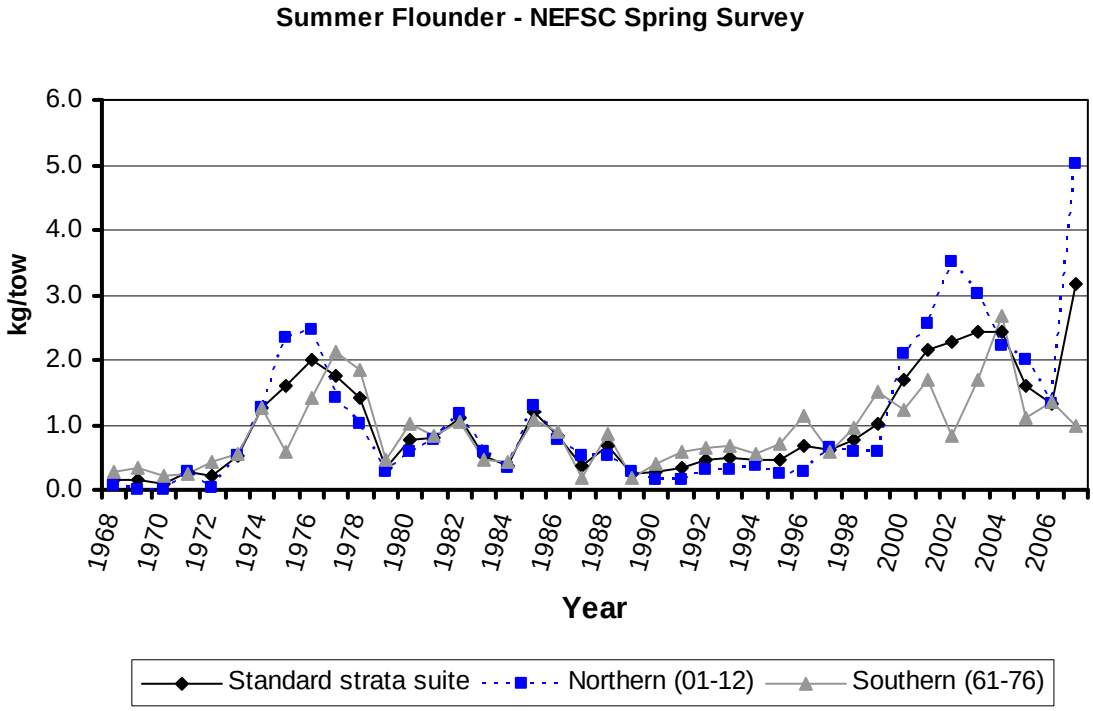
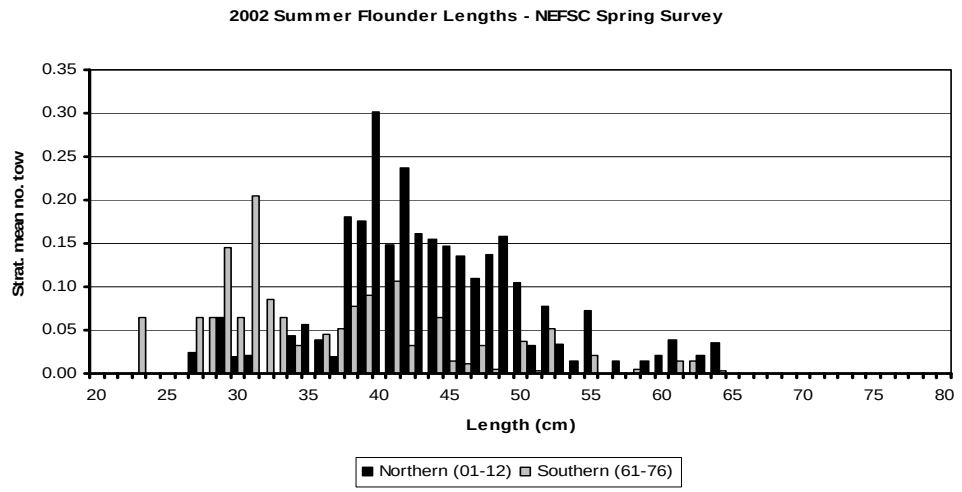
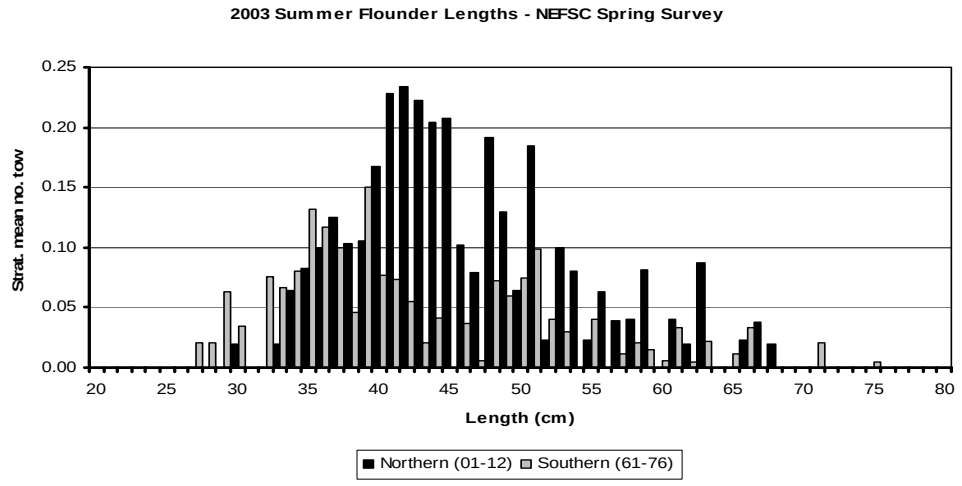


Figure 26. NEFSC Spring survey summer flounder indices (no./tow and kg/tow) with the standard, Northern, and Southern suites of survey strata, 1968-2007.





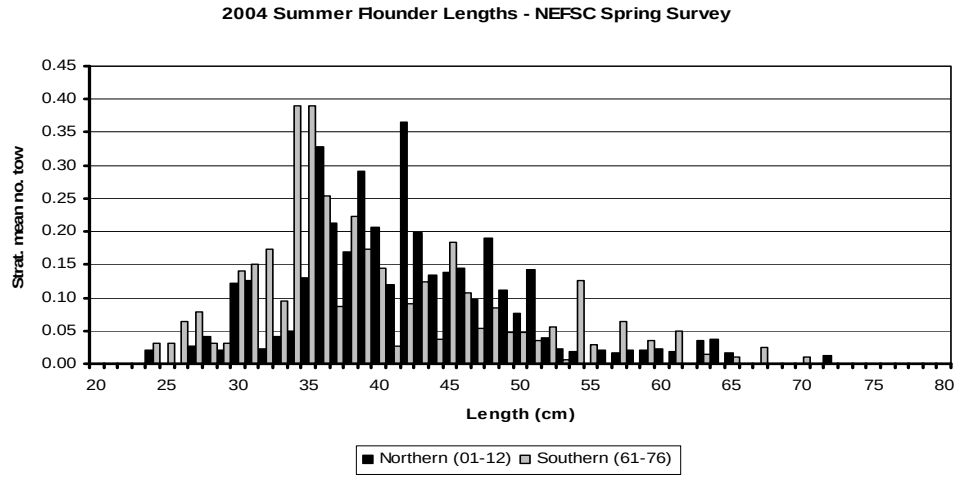


Figure 27. NEFSC Spring survey summer flounder lengths (stratified mean no./tow) for the Northern and Southern suites of survey strata, 2002-2004.

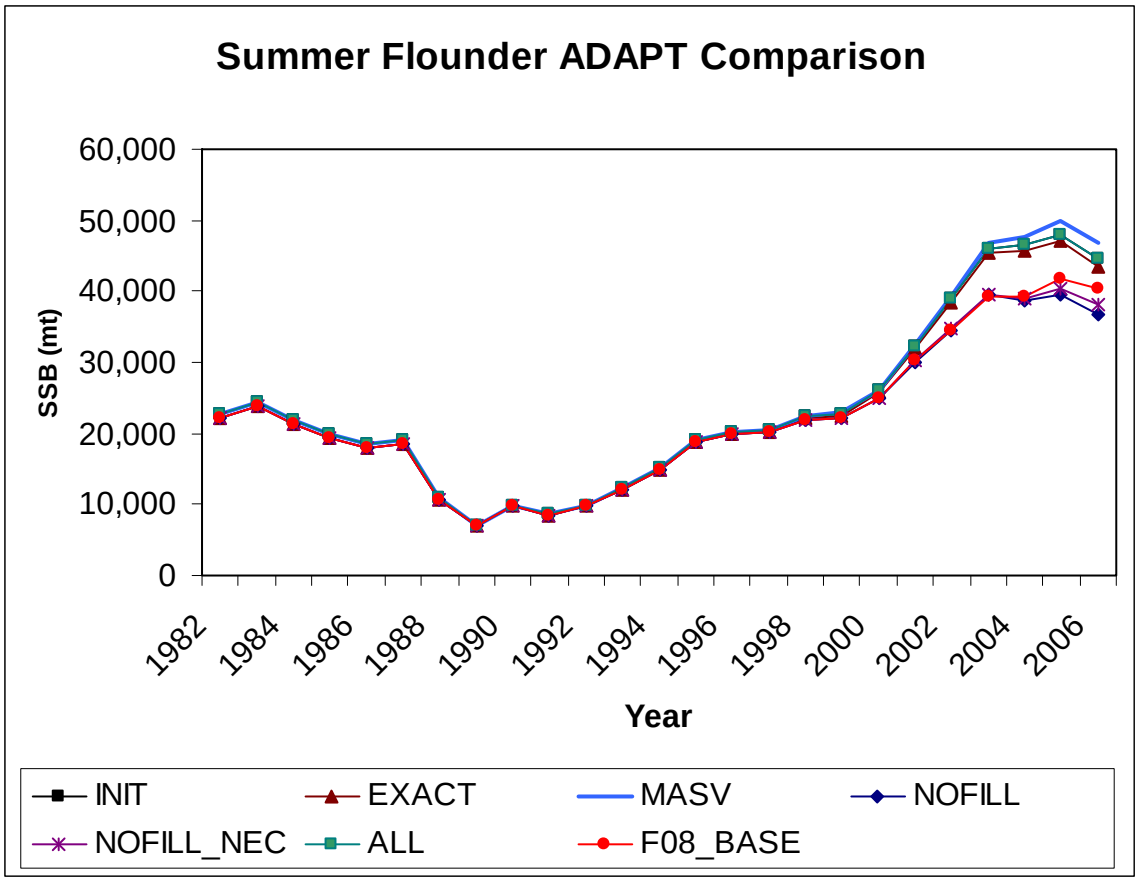


Figure 28. Spawning Stock Biomass (SSB) estimates for alternative ADAPT VPA model configurations. F08_BASE is the final run configuration with catch data through 2006.

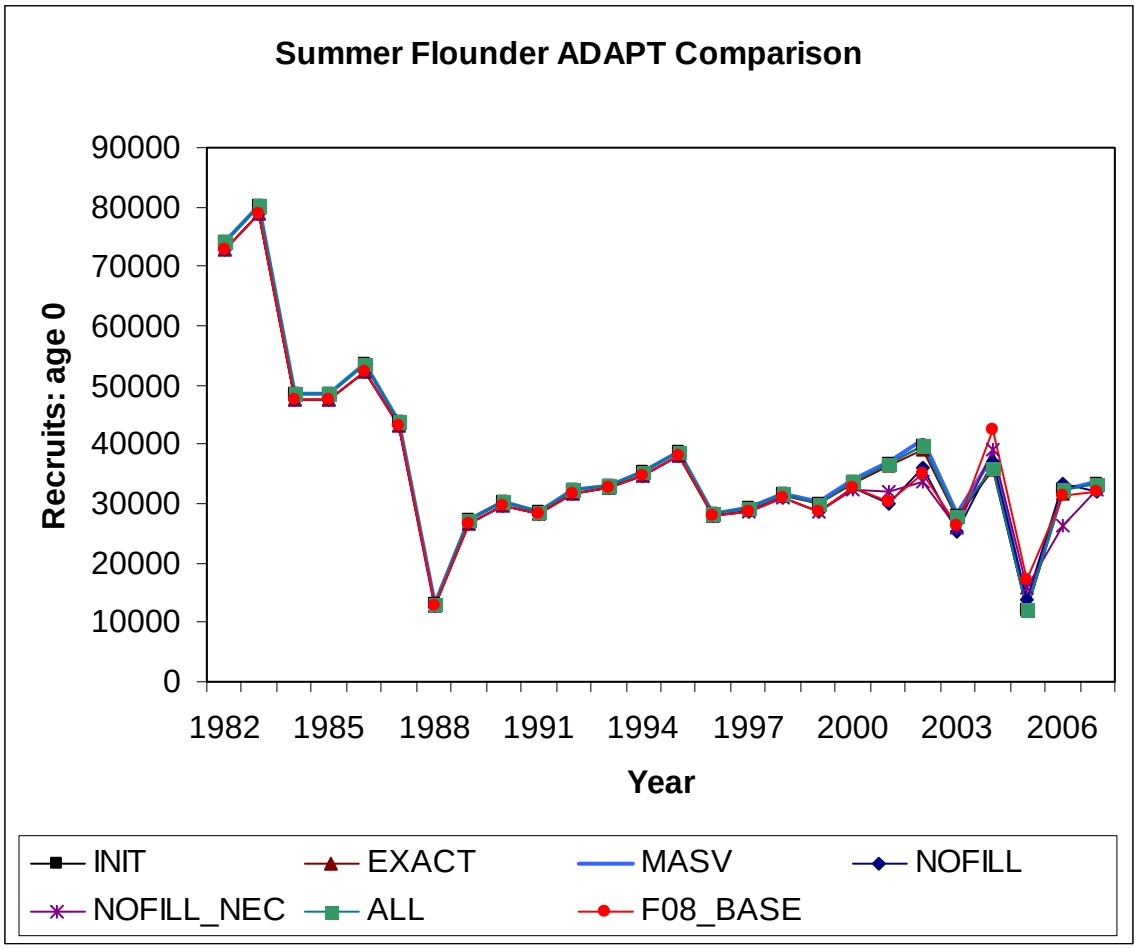


Figure 29. Recruitment at age 0 (R) estimates for alternative ADAPT VPA model configurations. F08_BASE is the final run configuration with catch data through 2006.

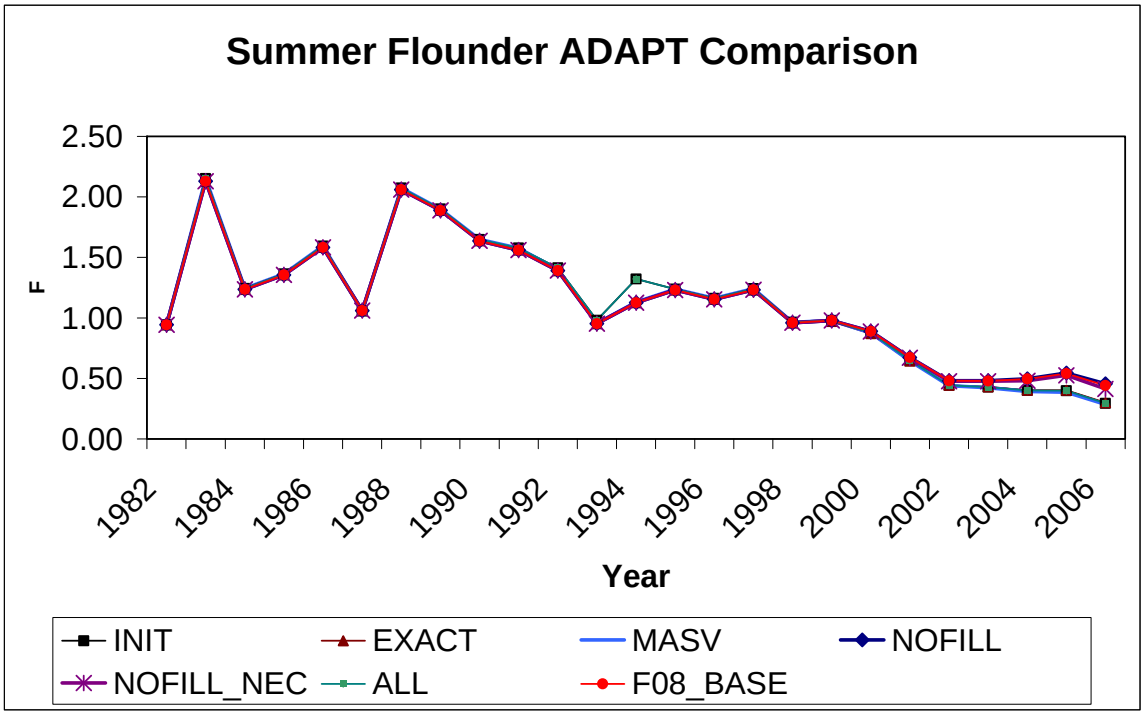


Figure 30. Fishing mortality rate (F, ages 3-5) estimates for alternative ADAPT VPA model configurations. F08_BASE is the final run configuration with catch data through 2006.

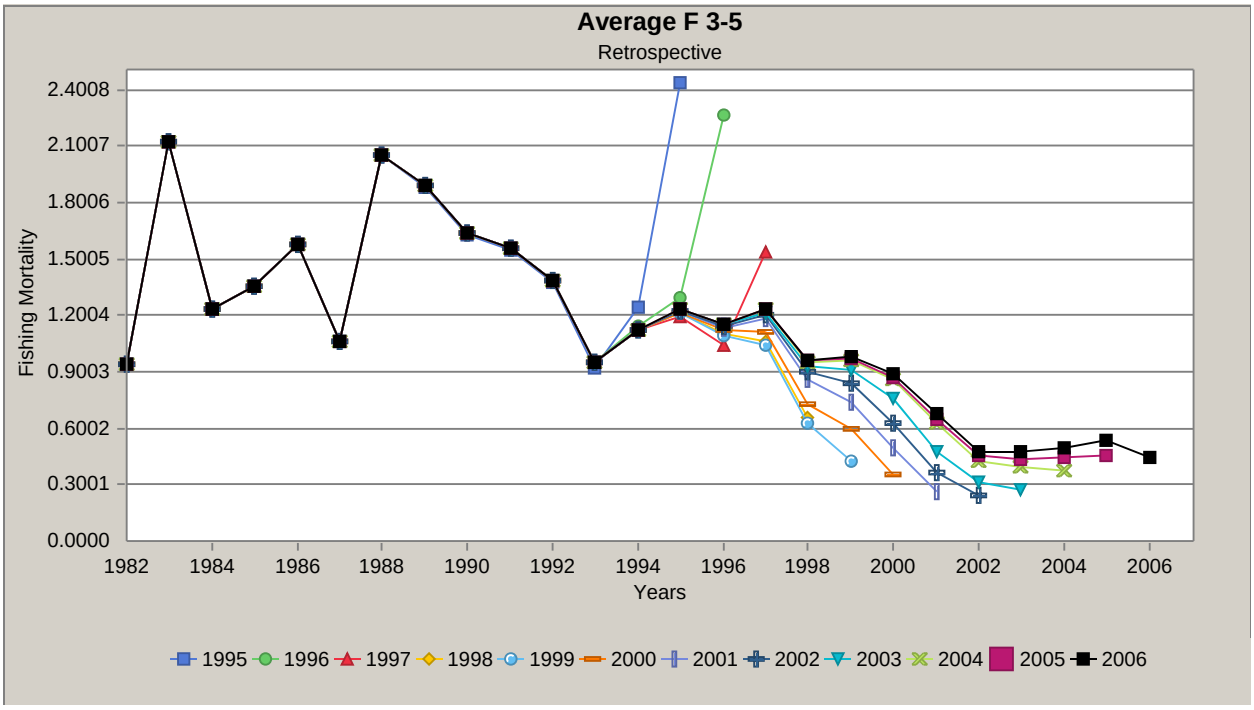


Figure 31. Retrospective analysis of Fishing Mortality (F, ages 3-5) for ADAPT VPA F08_BASE run.

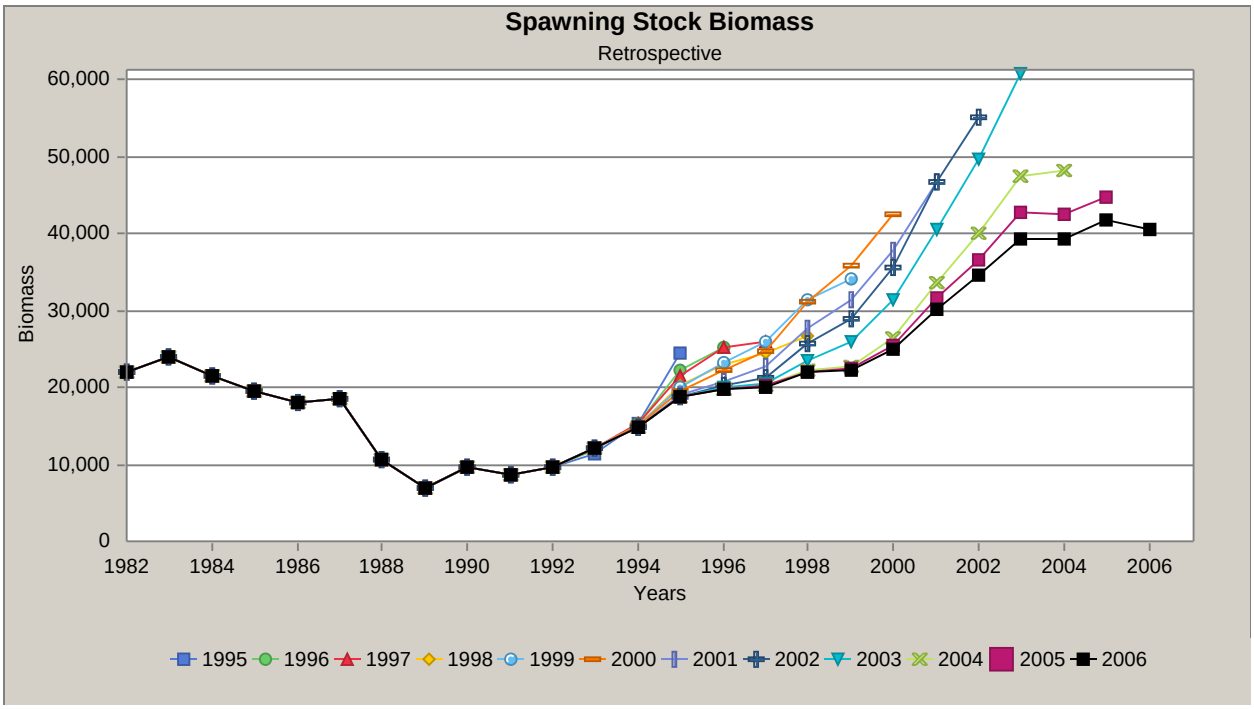


Figure 32. Retrospective analysis of Spawning Stock Biomass (SSB) for ADAPT VPA F08_BASE run.

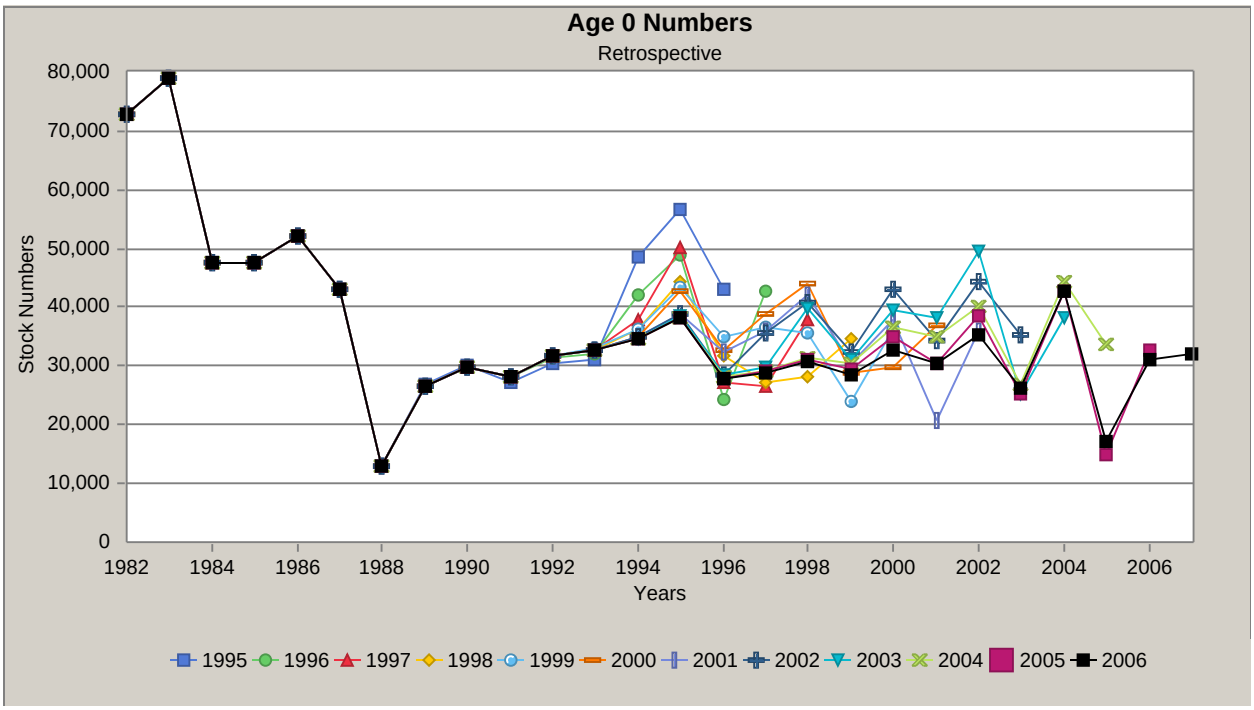


Figure 33. Retrospective analysis of Recruitment at age 0 (R) for ADAPT VPA F08_BASE run.

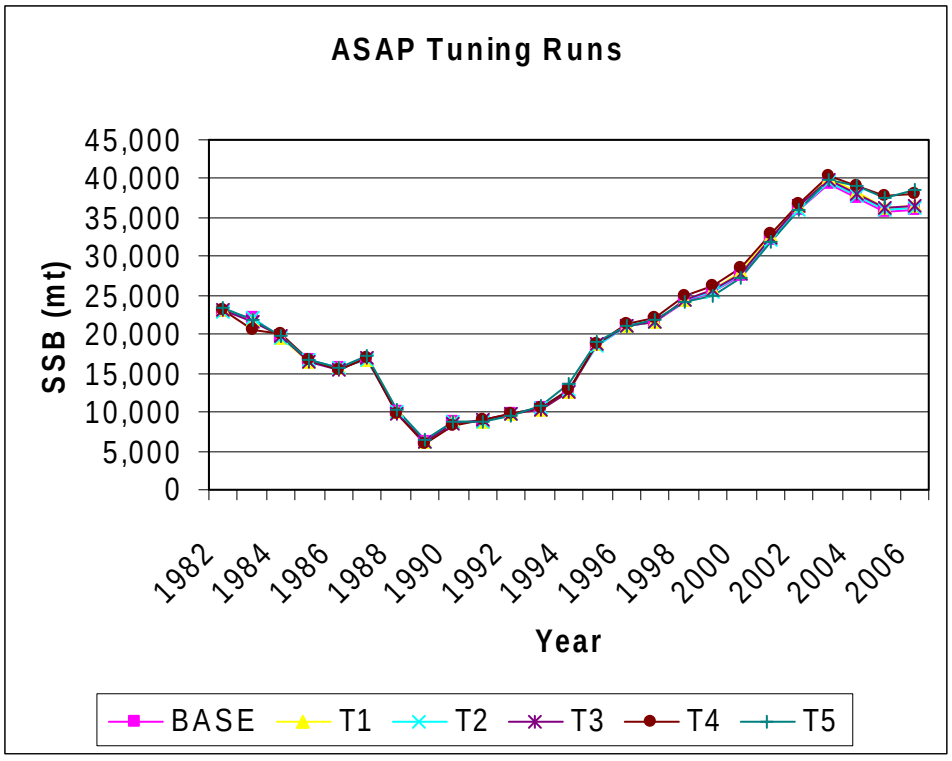


Figure 34. Spawning Stock Biomass (SSB) estimates for ASAP model tuning configurations. F08_BASE_T5 is the final run configuration with catch data through 2006.

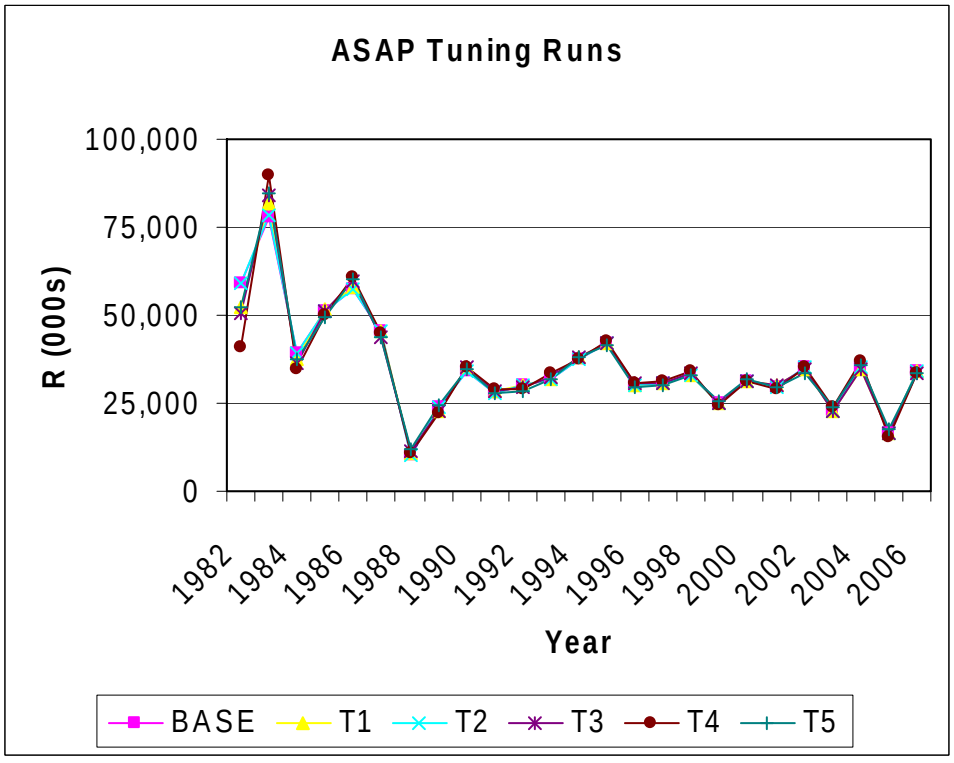


Figure 35. Recruitment at age 0 (R) estimates for alternative ASAP model configurations. F08_BASE_T5 is the final run configuration with catch data through 2006.

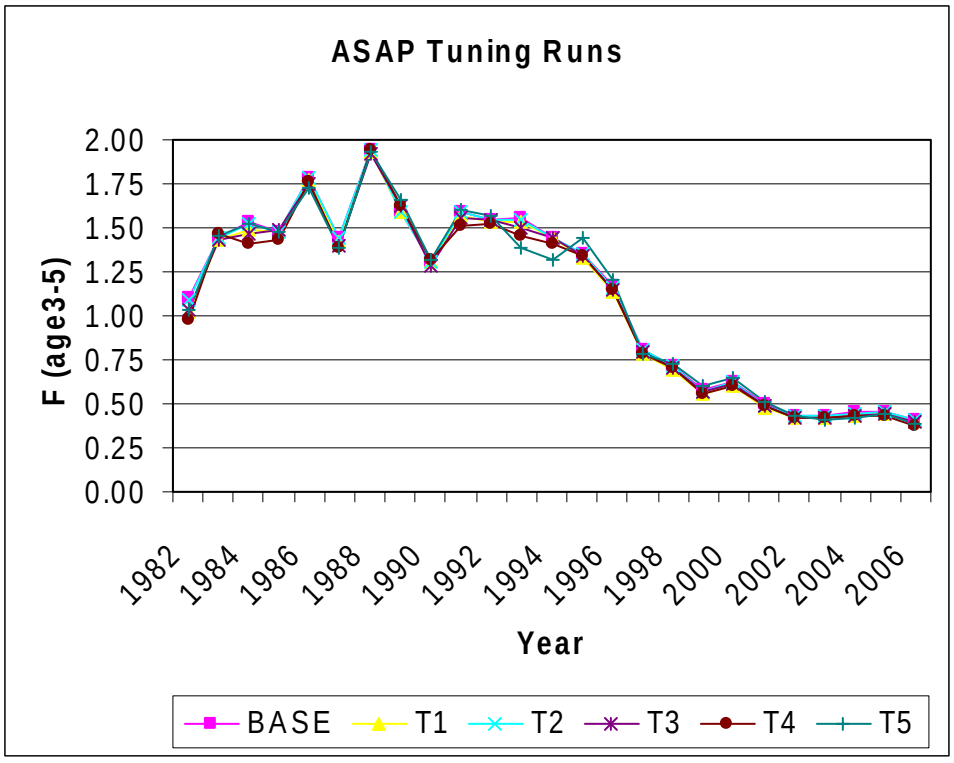


Figure 36. Fishing mortality rate (F, ages 3-5) estimates for alternative ASAP model configurations. F08_BASE_T5 is the final run configuration with catch data through 2006.

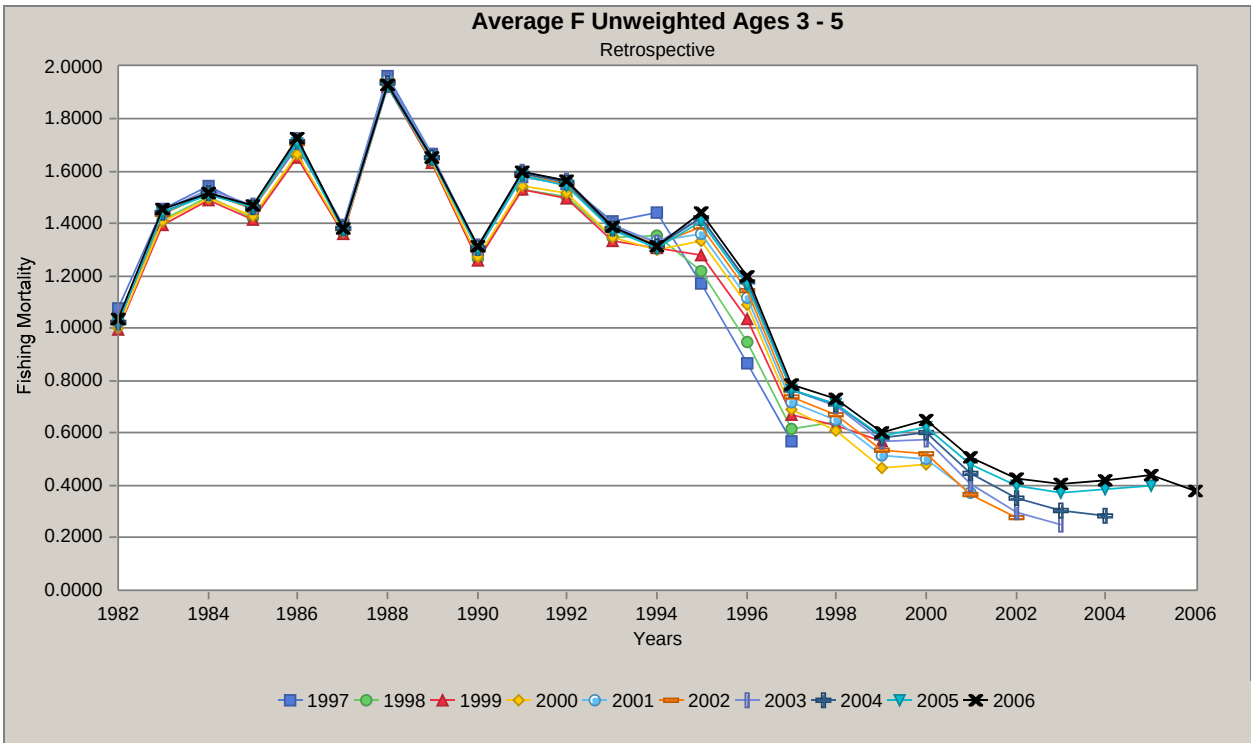


Figure 37. Retrospective analysis of Fishing Mortality (F, ages 3-5) for ASAP F08_BASE_T5 run.

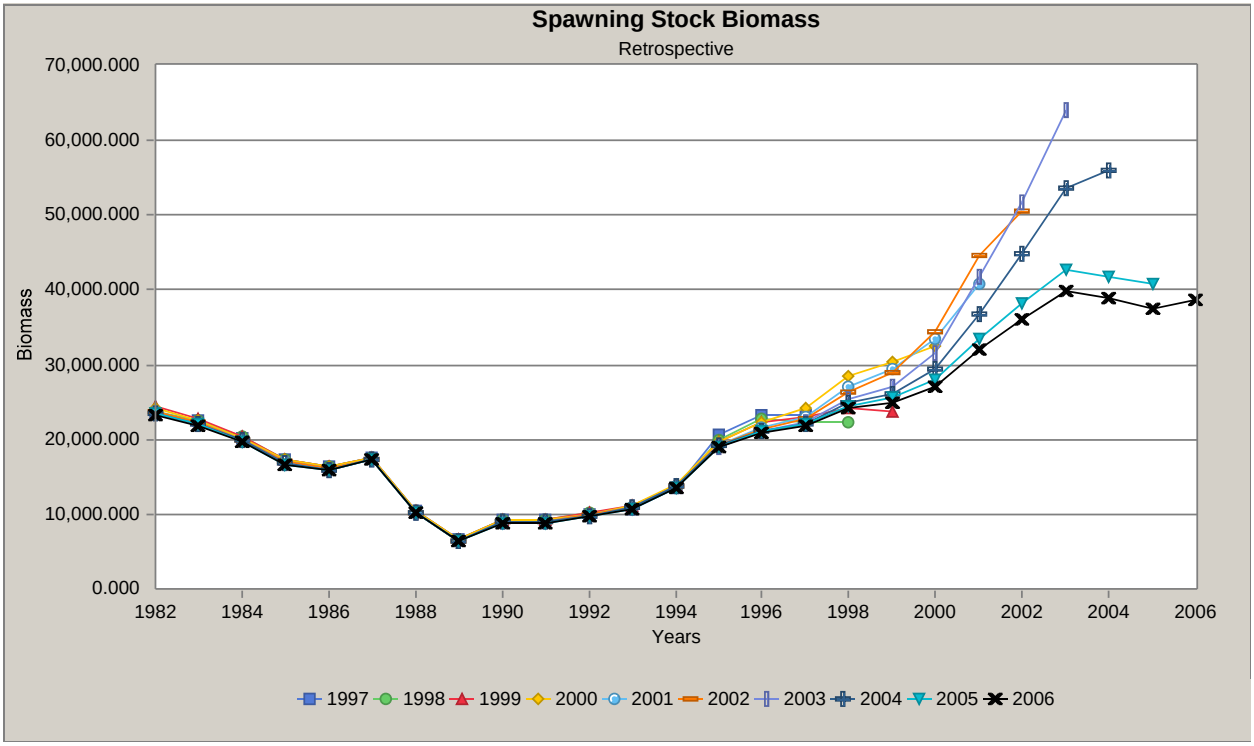


Figure 38. Retrospective analysis of Spawning Stock Biomass (SSB) for ASAP F08_BASE_T5 run.

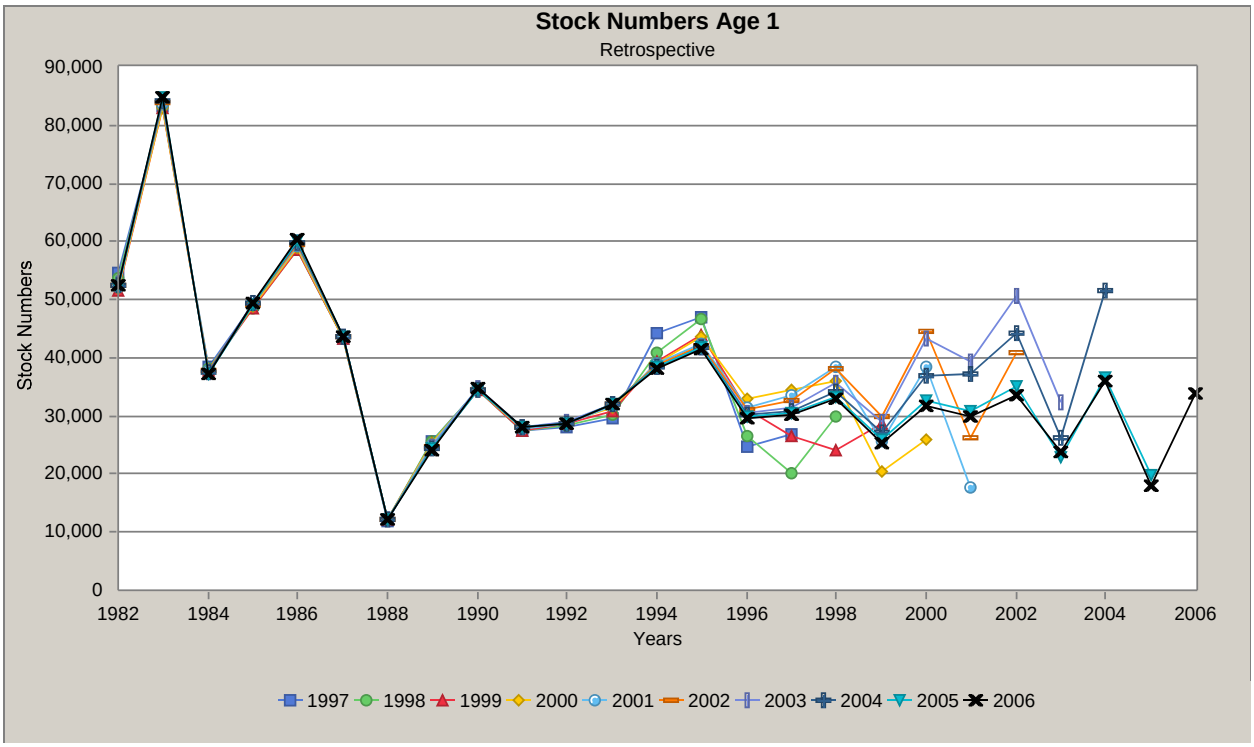


Figure 39. Retrospective analysis of Recruitment at age 0 (R) for ASAP F08_BASE_T5 run. Note that ASAP age 1 is true age 0.

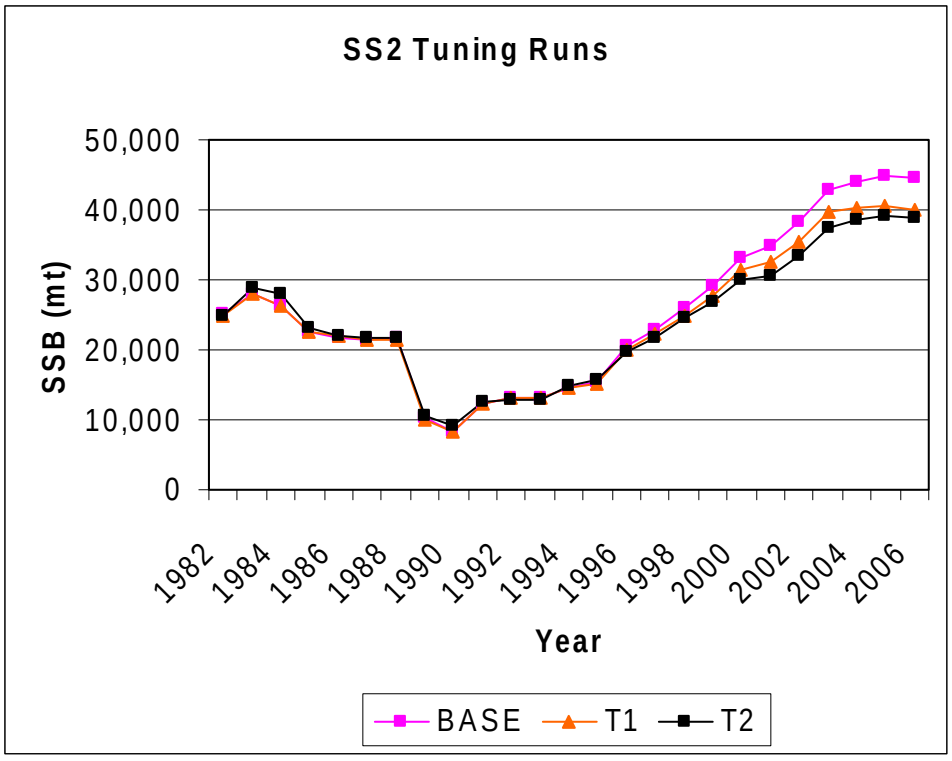


Figure 40. Spawning Stock Biomass (SSB) estimates for SS2 model tuning configurations. F08_BASE_T2 is the final run configuration with catch data through 2006.

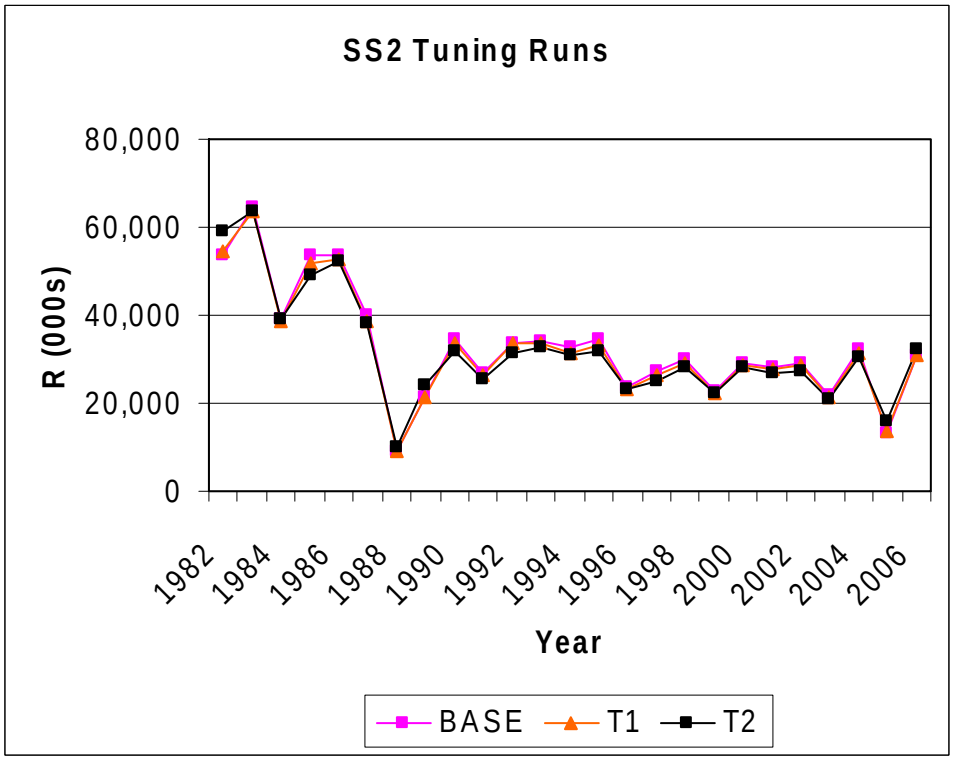


Figure 41. Recruitment at age 0 (R) estimates for alternative SS2 model configurations. F08_BASE_T2 is the final run configuration with catch data through 2006.

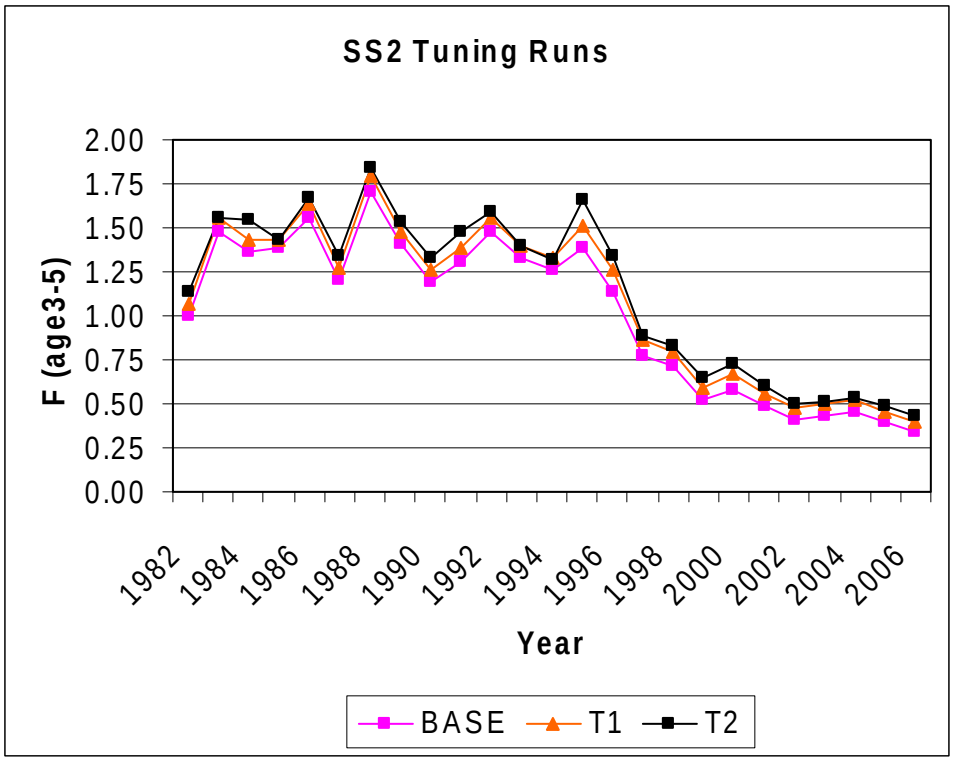


Figure 42. Fishing mortality rate (F, ages 3-5) estimates for alternative SS2 model configurations. F08_BASE_T2 is the final run configuration with catch data through 2006.

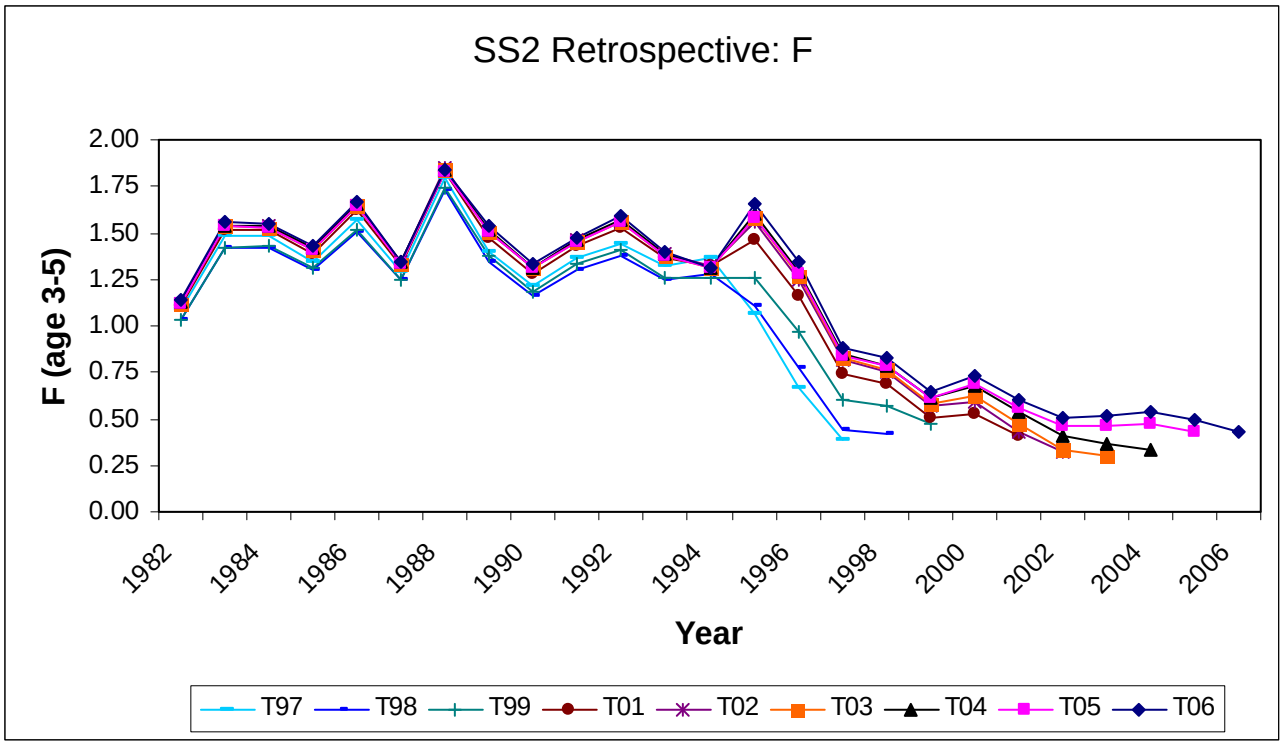


Figure 43. Retrospective analysis of Fishing Mortality (F, ages 3-5) for SS2 F08_BASE_T2 run.

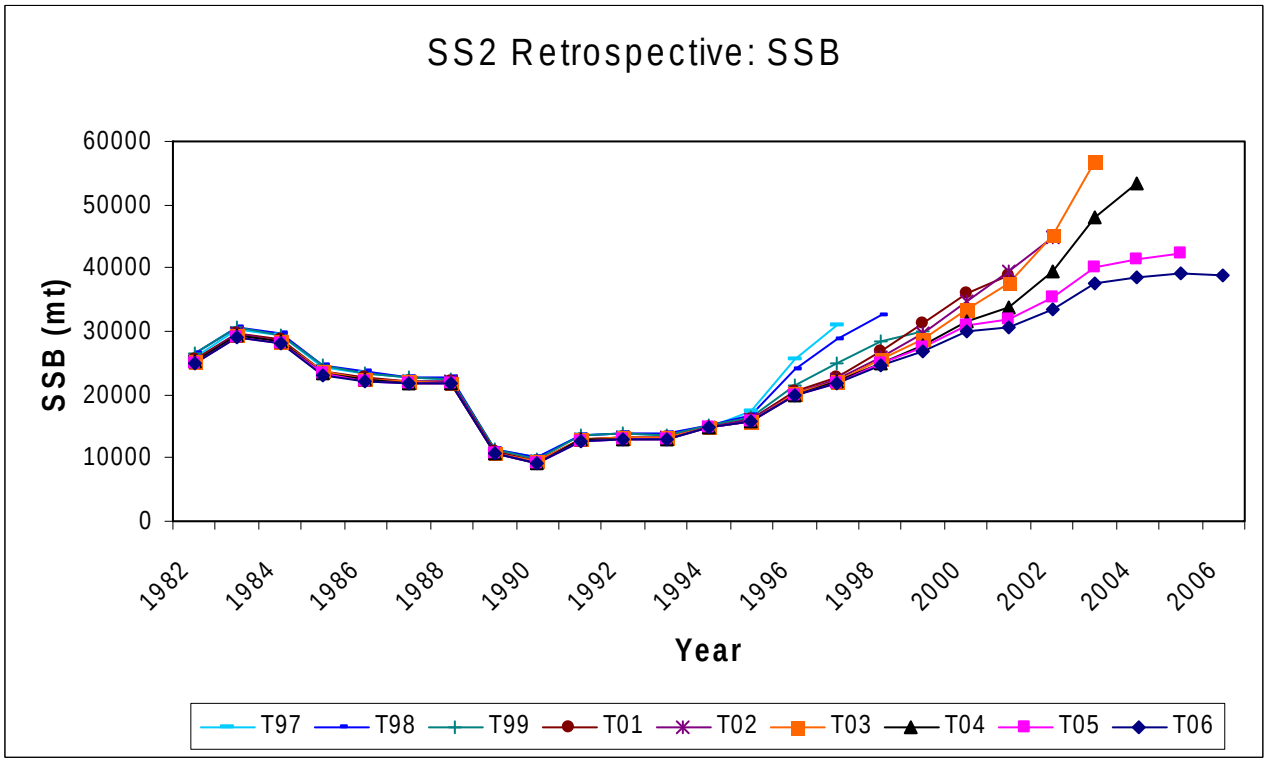


Figure 44. Retrospective analysis of Spawning Stock Biomass (SSB) for SS2 F08_BASE_T2 run.

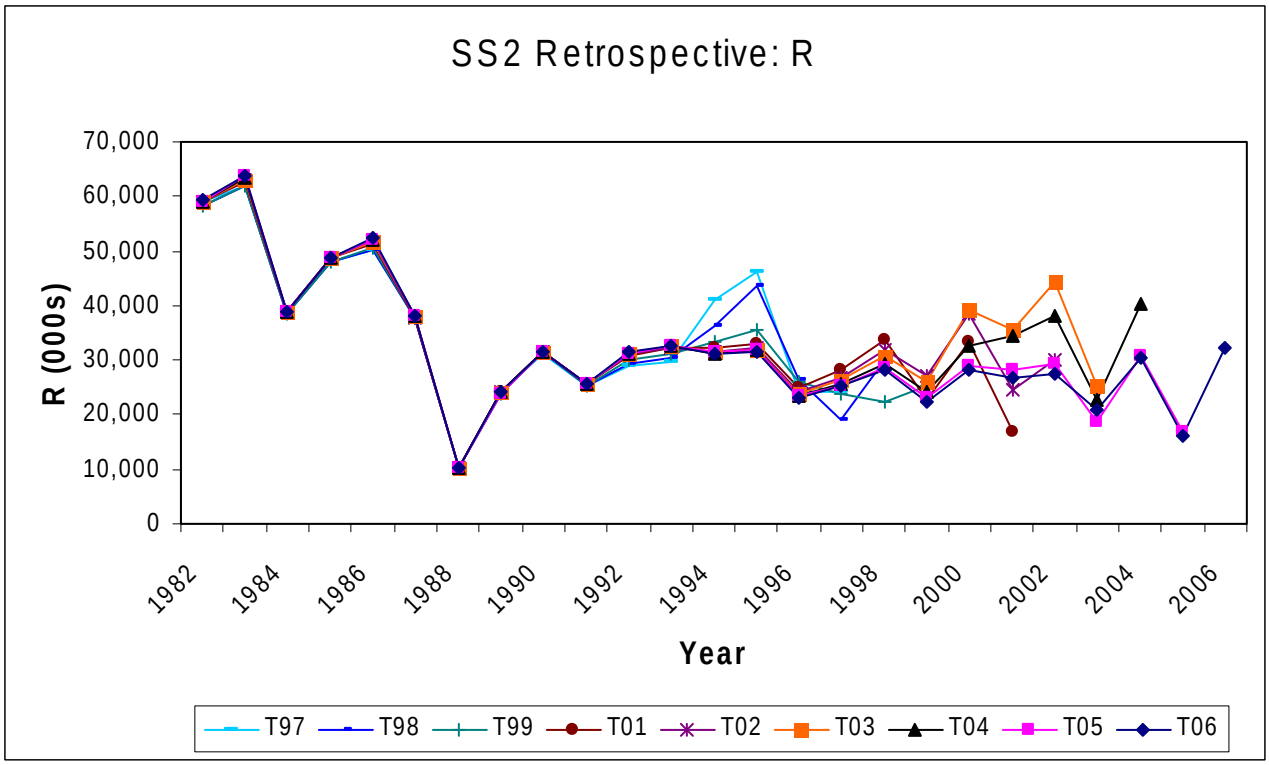


Figure 45. Retrospective analysis of Recruitment at age 0 (R) for SS2 F08_BASE_T2 run.

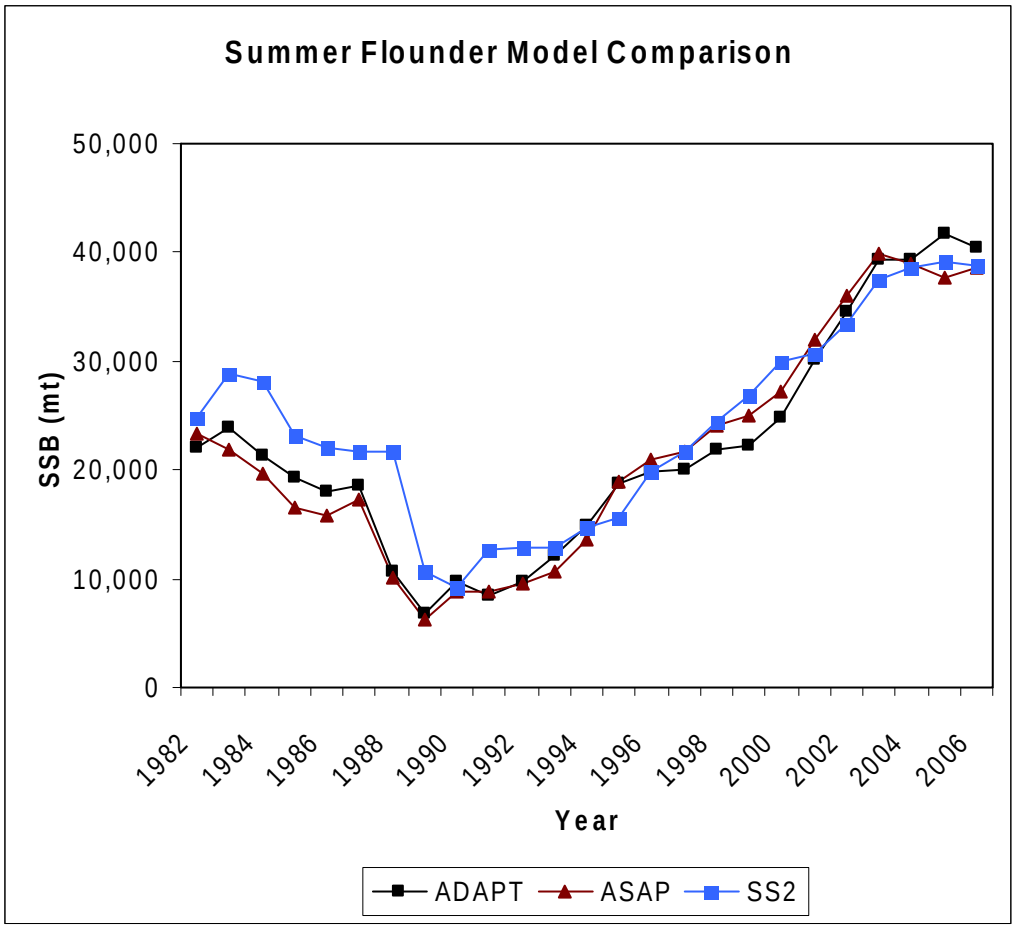


Figure 46. Spawning Stock Biomass (SSB) estimates from ADAPT VPA, ASAP, and SS2 BASE case models.

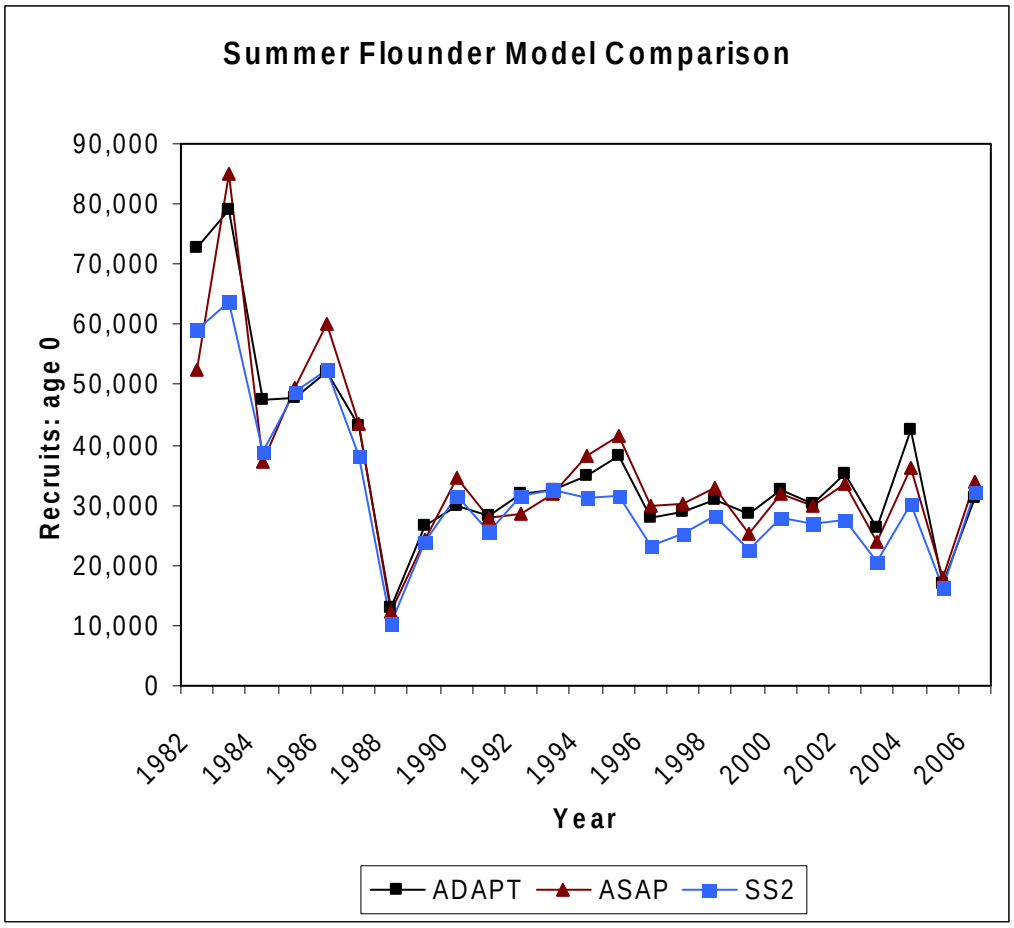


Figure 47. Recruitment at age 0 (R) estimates for ADAPT VPA, ASAP, and SS2 BASE case models.

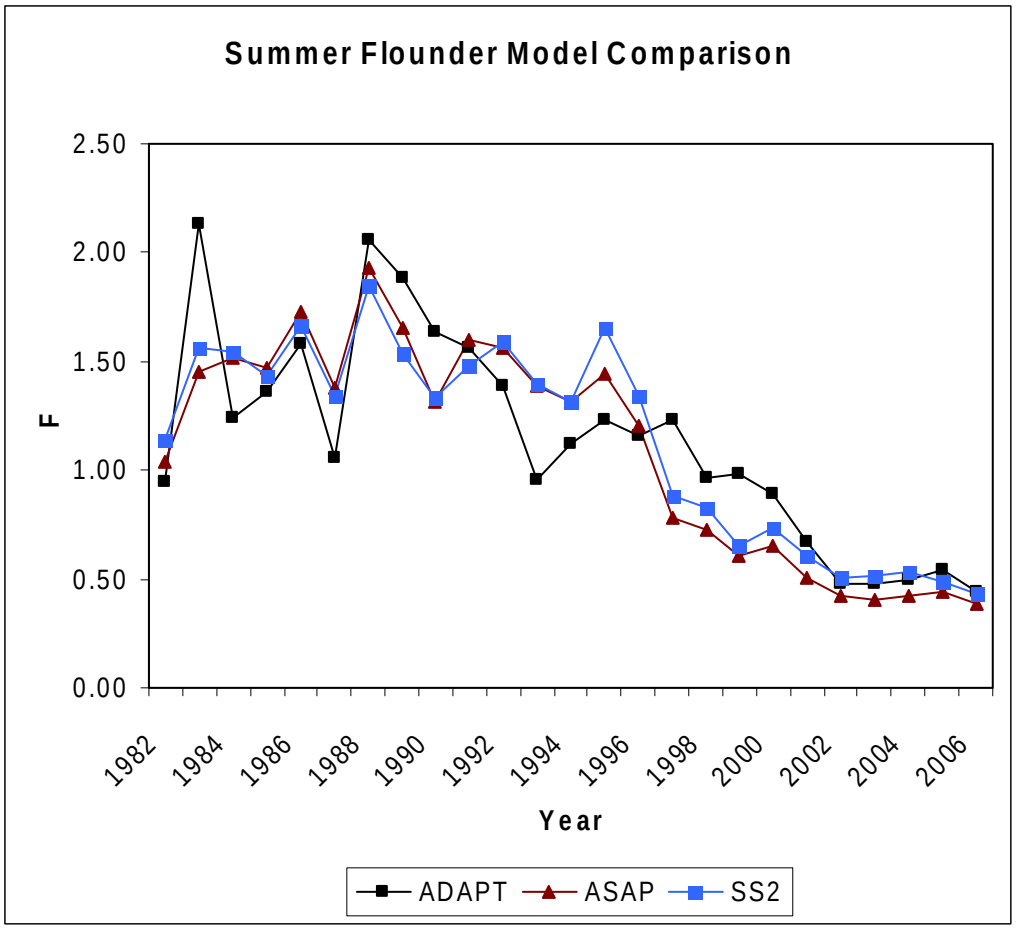


Figure 48. Fishing mortality rate (F, ages 3-5) estimates for ADAPT VPA, ASAP, and SS2 BASE case models.

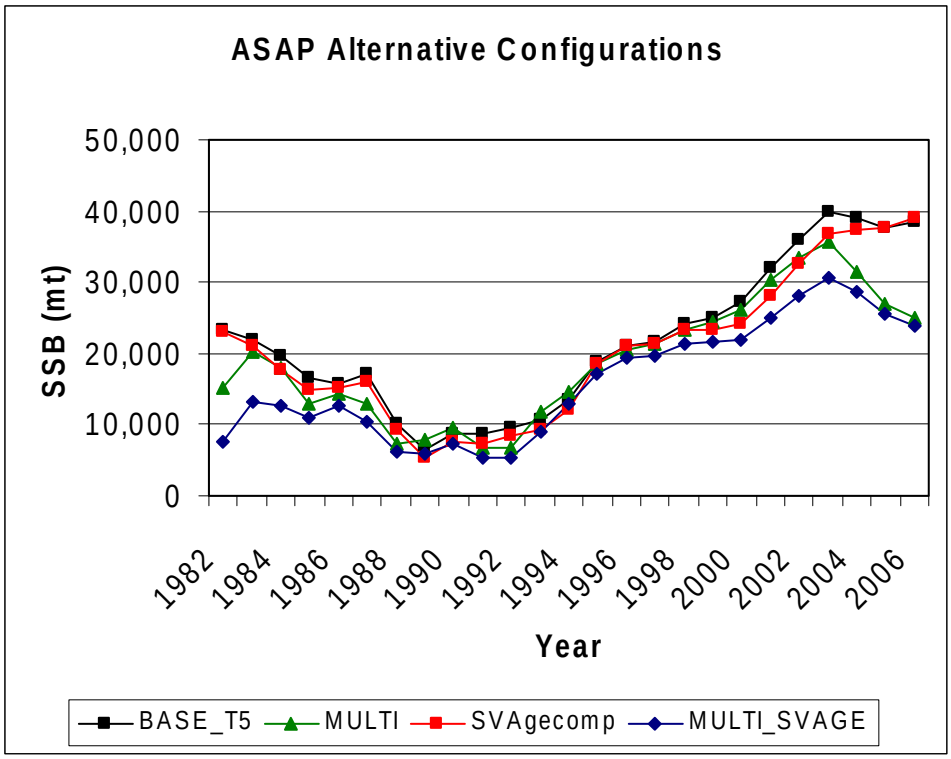


Figure 49. Spawning Stock Biomass (SSB) estimates from the ASAP BASE case and three alternative configuration models.

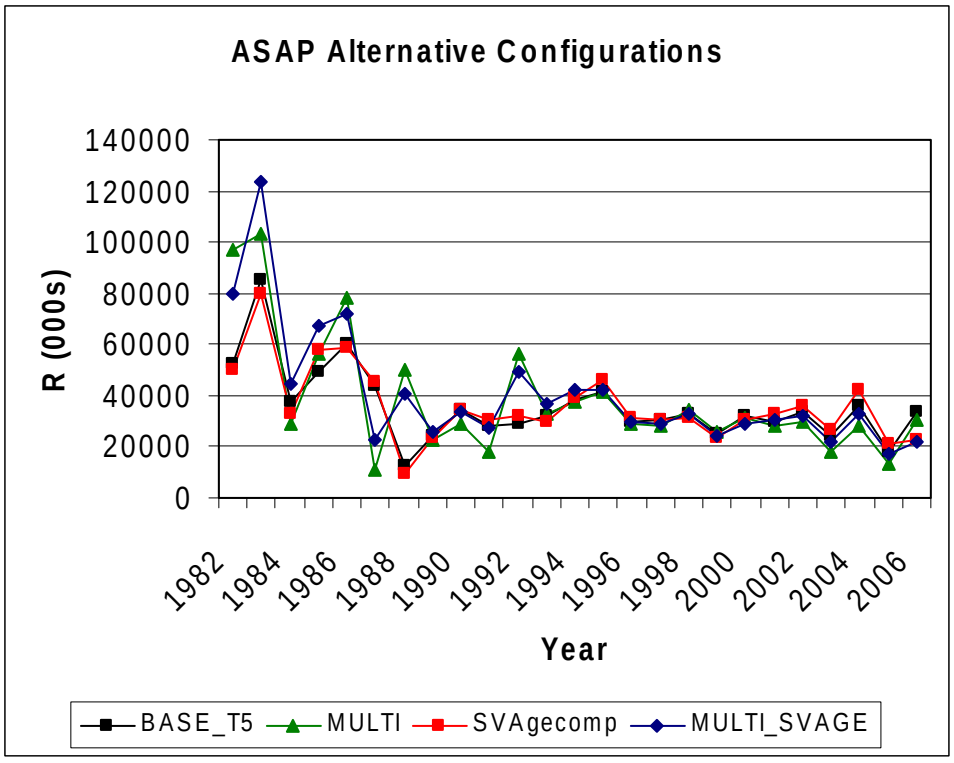


Figure 50. Recruitment at age 0 (R) estimates from the ASAP BASE case and three alternative configuration models.

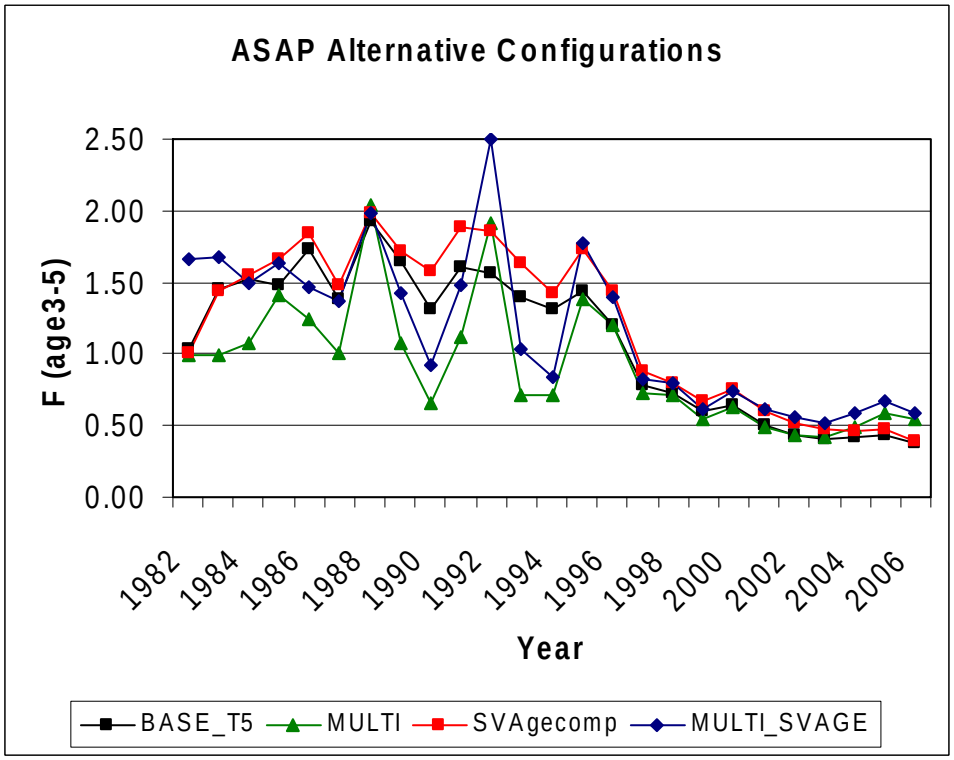


Figure 51. Fishing mortality rate (F, S = 1) estimates from the ASAP BASE case and three alternative configuration models.

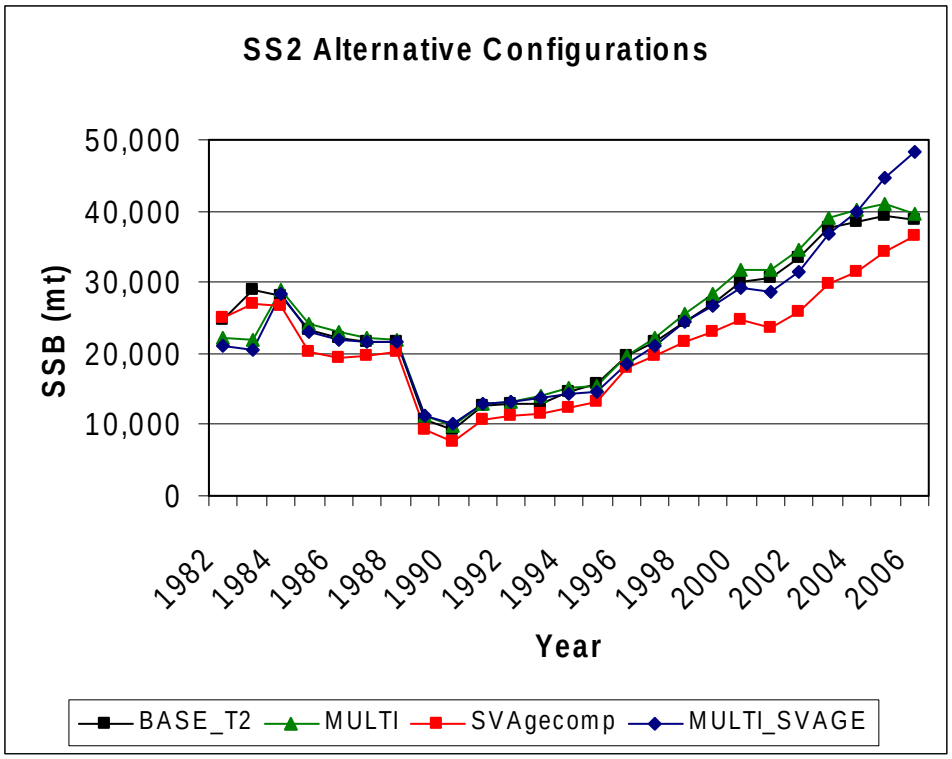


Figure 52. Spawning Stock Biomass (SSB) estimates from the SS2 BASE case and three alternative configuration models.

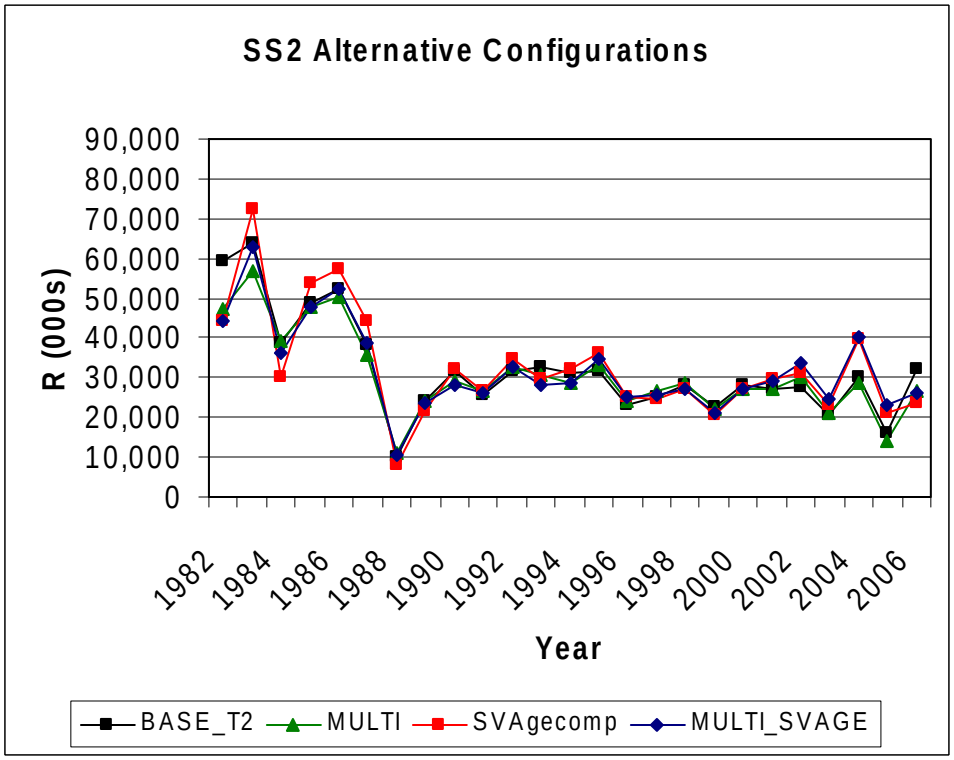


Figure 53. Recruitment at age 0 (R) estimates from the SS2 BASE case and three alternative configuration models.

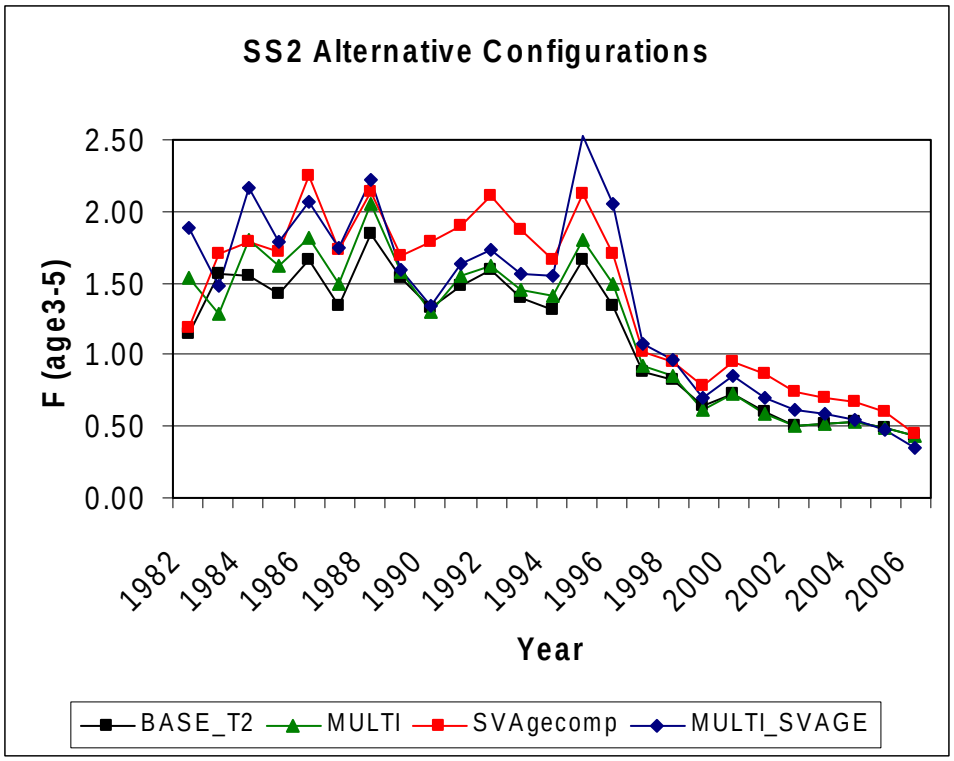


Figure 54. Fishing mortality rate (F, S = 1) estimates from the SS2 BASE case and three alternative configuration models.

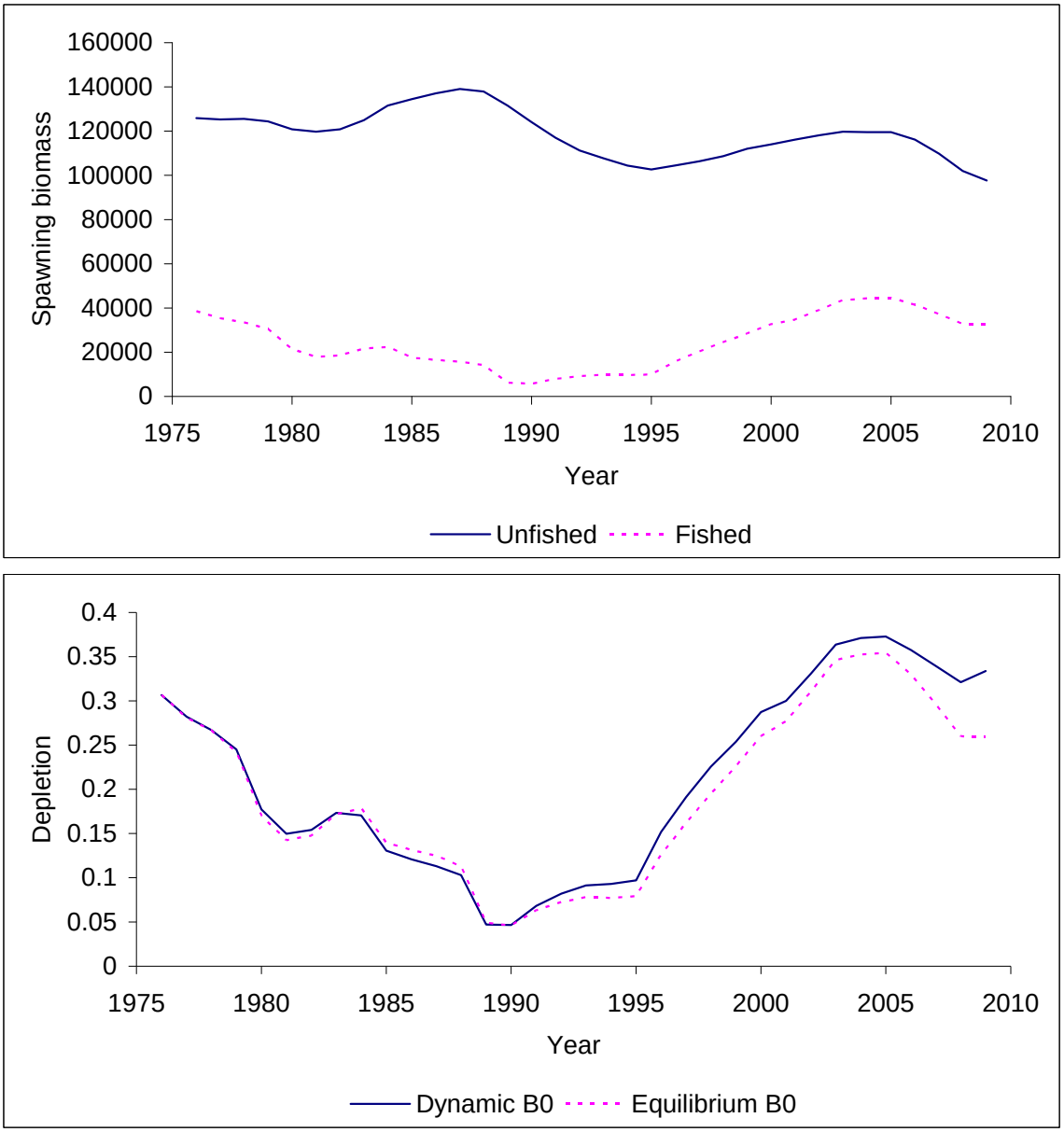


Figure 55. Time series of spawning biomass (top) estimated from the sex-structured stock assessment (fished) compared to the theoretical spawning biomass that would have been present in the absence of fishing (unfished). Time series of depletion levels (bottom) estimated from the sex-structured stock 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).

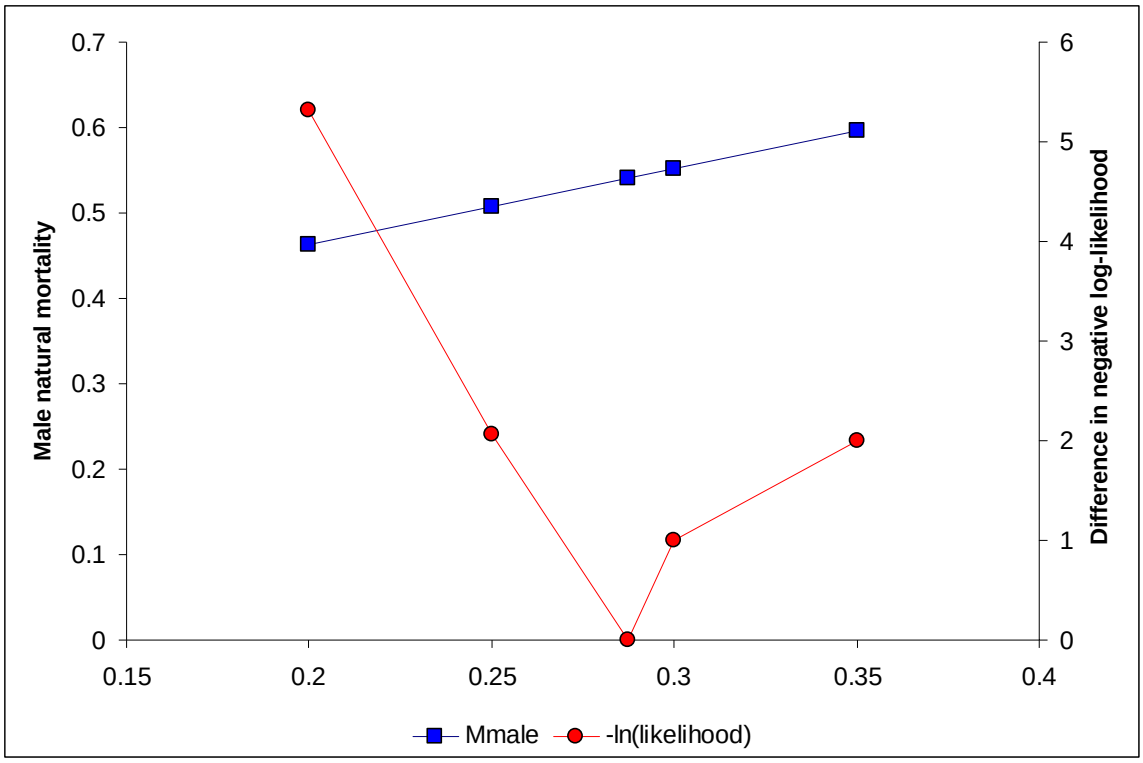


Figure 56. Profile likelihood of female natural mortality (right axis) with the corresponding estimates of male natural mortality (left axis). Female natural mortality is plotted on the x-axis. The SS2 model estimates female natural mortality at 0.28, corresponding to the zero value for the difference in log likelihood.

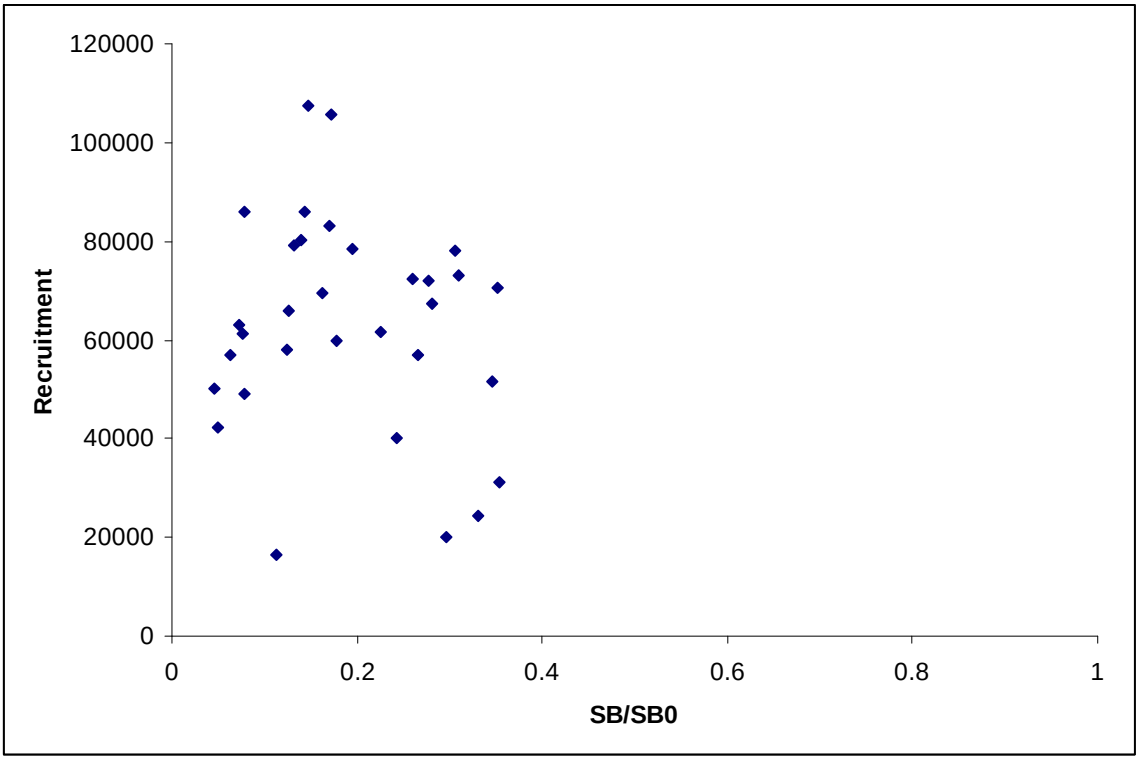


Figure 57. The relationship between recruitment and spawning stock size. Spawning stock size is shown as the spawning stock size relative to the average spawning stock size in the absence of fishing.

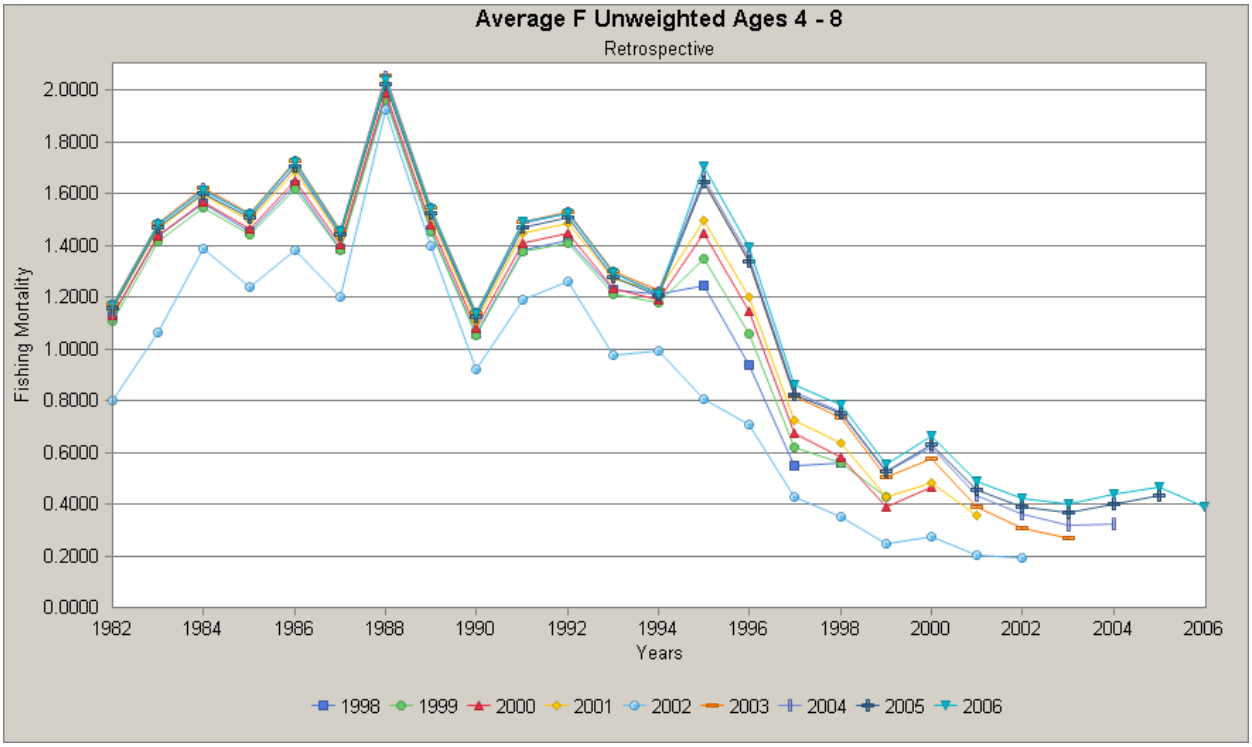


Figure 58. Retrospective analysis of Fishing Mortality (F, ages 3+) for ASAP F08_FINAL_T2006 run. Note that ASAP ages 4-8 are true ages 3-7+.

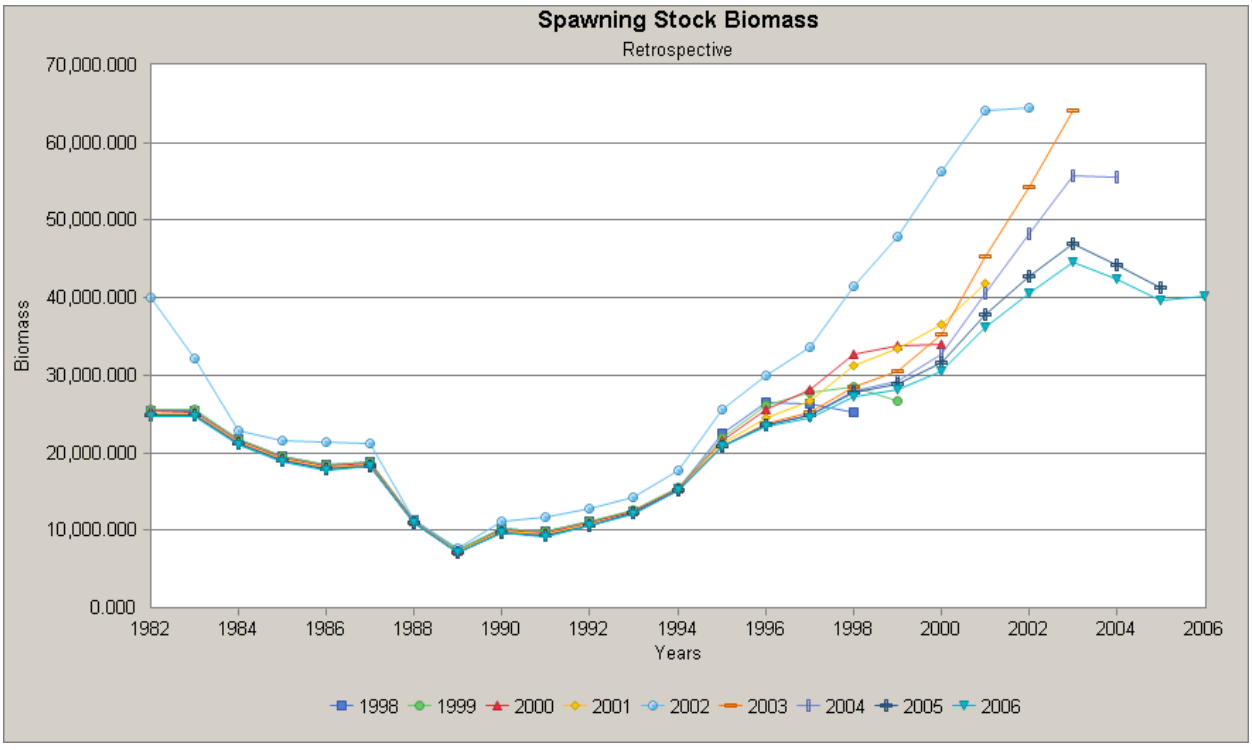


Figure 59. Retrospective analysis of Spawning Stock Biomass (SSB) for ASAP F08_FINAL_T2006 run.

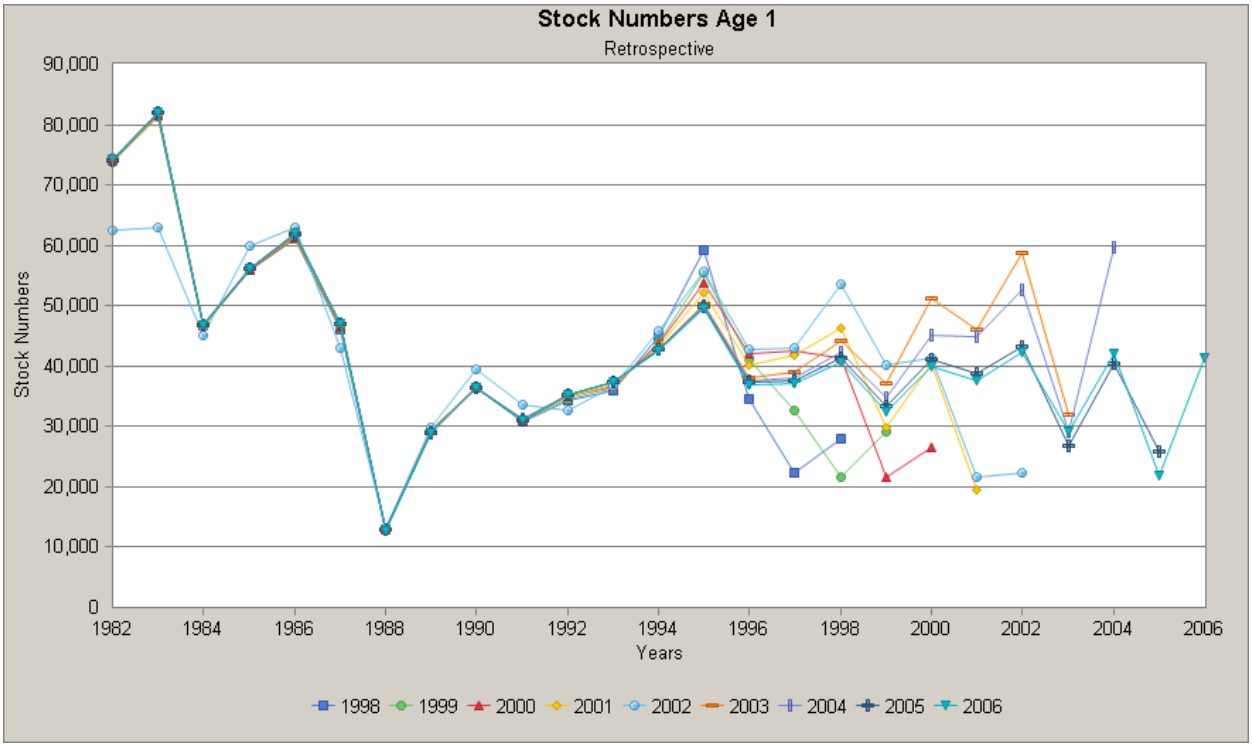


Figure 60. Retrospective analysis of Recruitment (R, age 0) for ASAP F08_FINAL_T2006 run. Note that ASAP age 1 is true age 0.

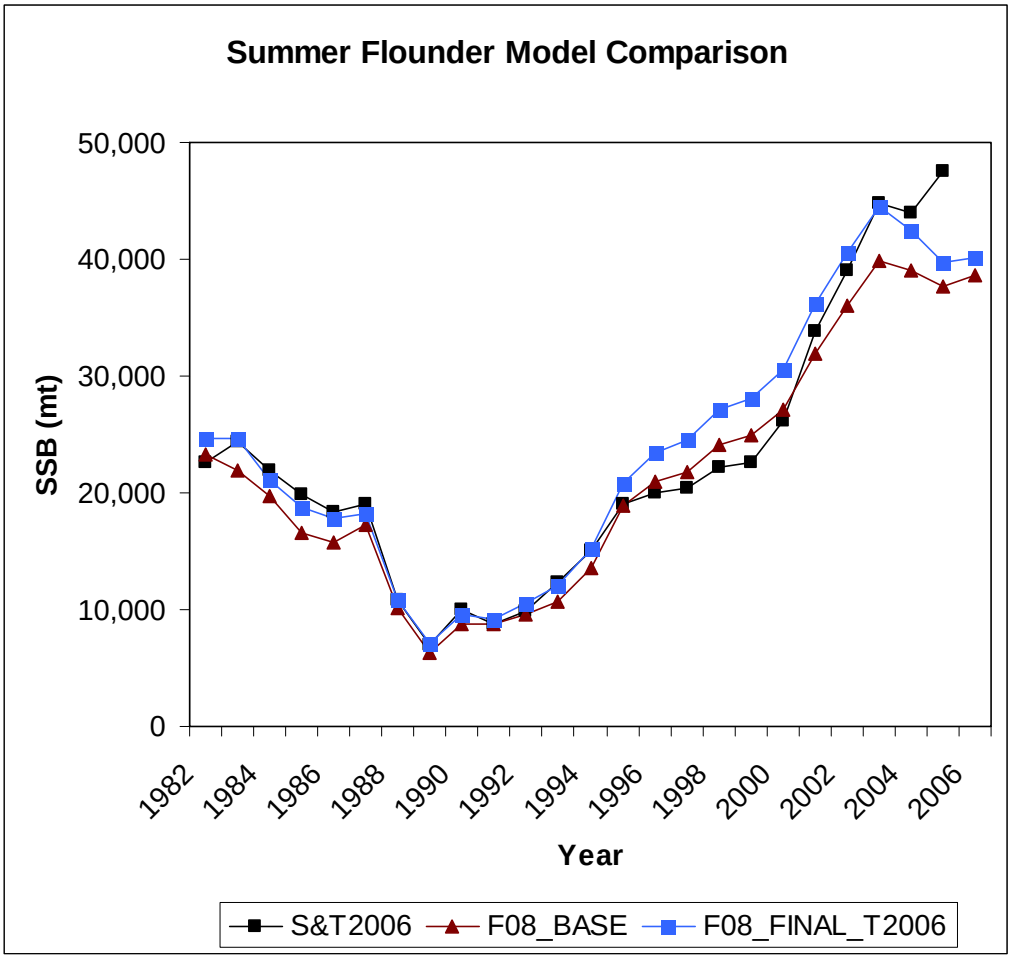


Figure 61. Spawning Stock Biomass (SSB) estimates from the S&T 2006 assessment (ADAPT VPA through 2005), the ASAP F08_BASE run, and the ASAP F08_FINAL_T2006 run.

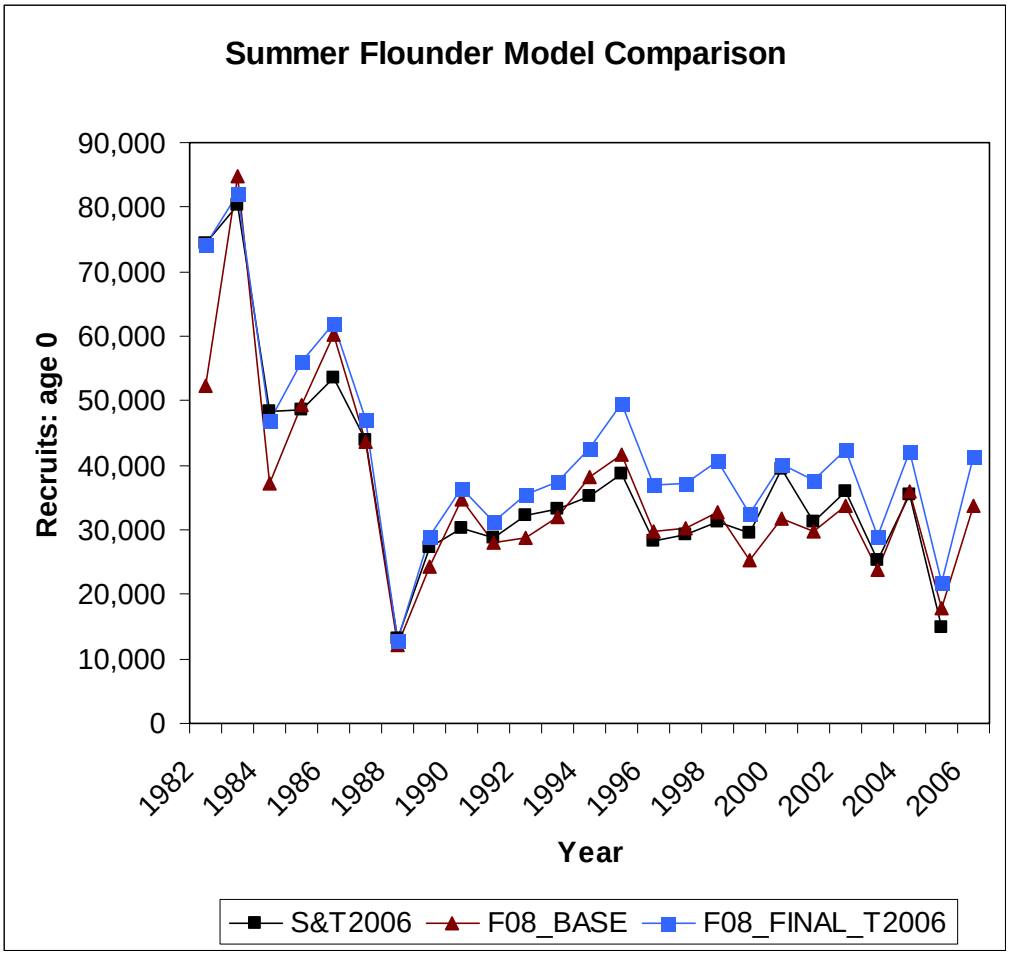


Figure 62. Recruitment (age 0) estimates from the S&T 2006 assessment (ADAPT VPA through 2005), the ASAP F08_BASE run, and the ASAP F08_FINAL_T2006 run.

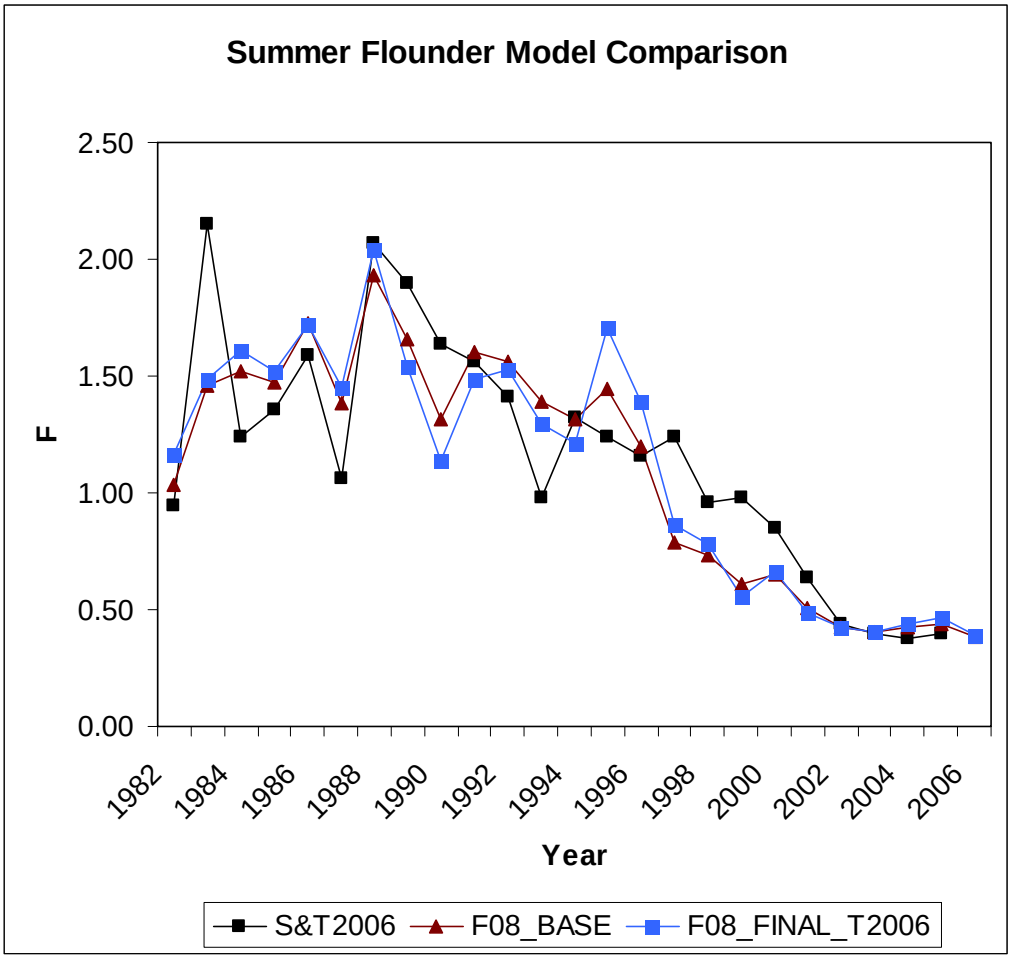


Figure 63. Fishing mortality (F, ages 3+) estimates from the S&T 2006 assessment (ADAPT VPA through 2005), the ASAP F08_BASE run, and the ASAP F08_FINAL_T2006 run.

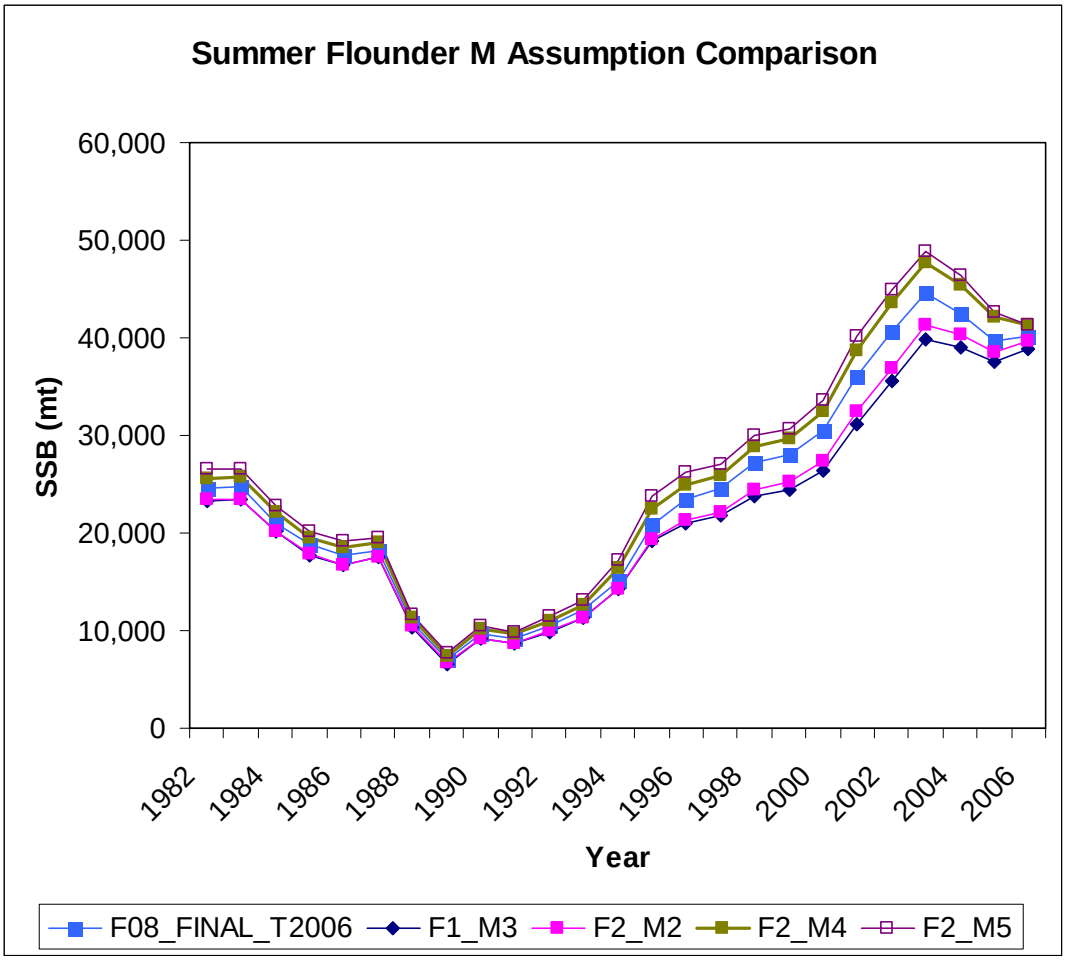
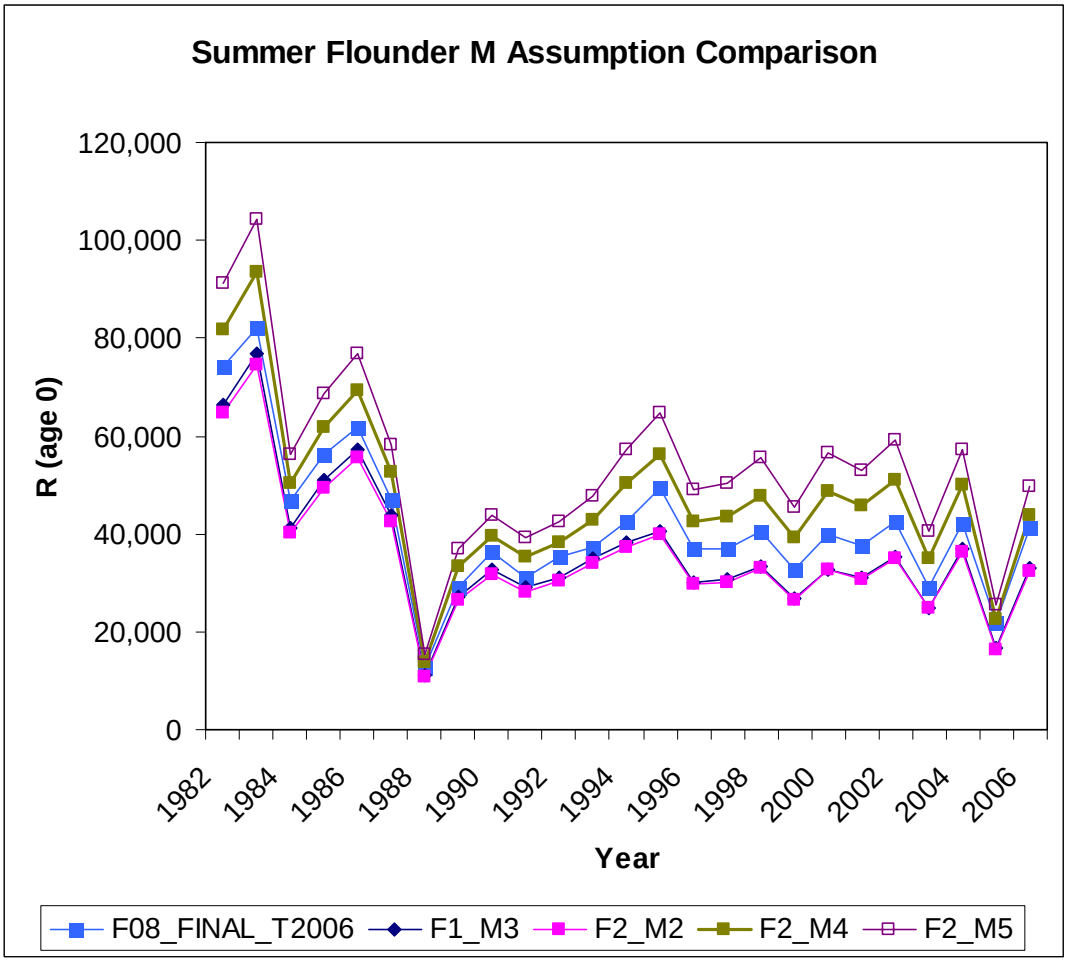


Figure 64. Spawning Stock Biomass (SSB) estimates from the ASAP F08_FINAL_T2006 run and runs with alternative assumptions for natural mortality (M).



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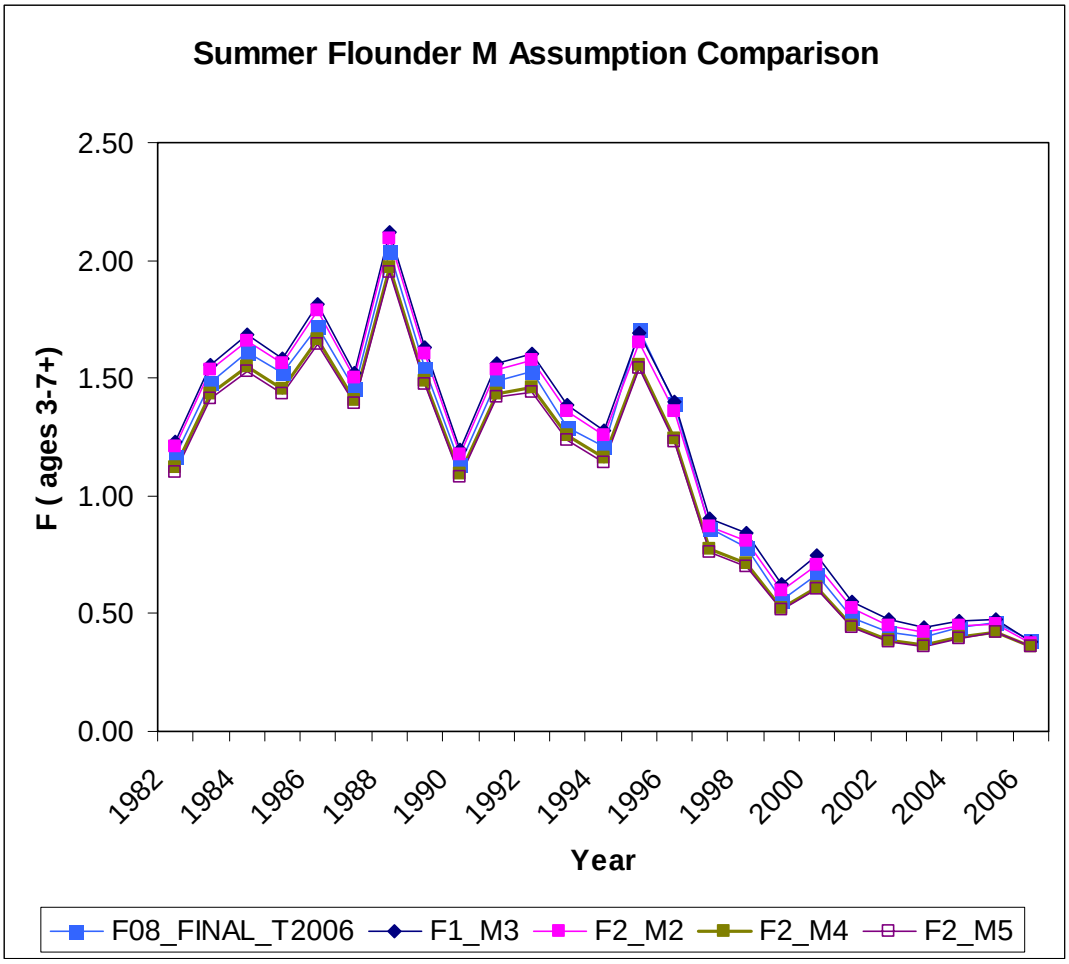


Figure 66. Fishing Mortality (F, ages 3-7+) estimates from the ASAP F08_FINAL_T2006 run and runs with alternative assumptions for natural mortality (M).

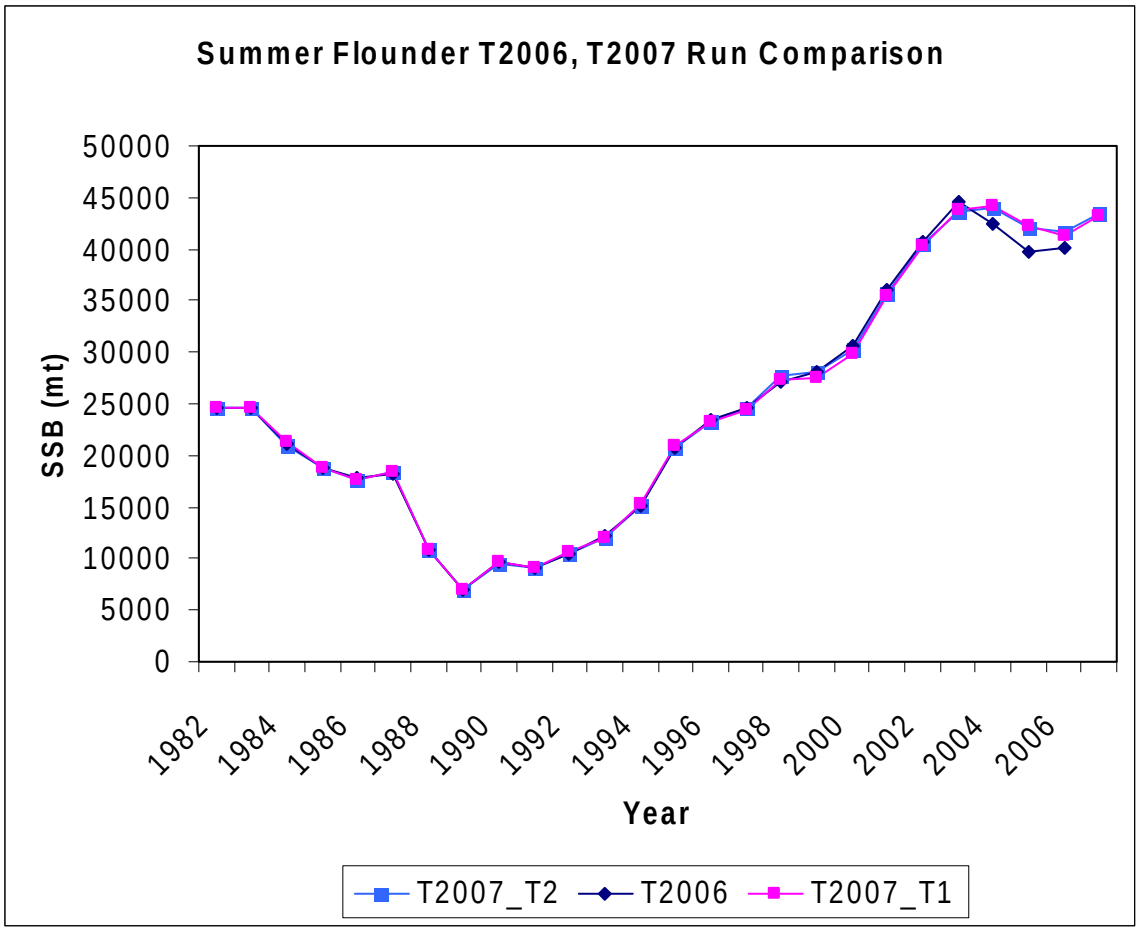


Figure 67. Spawning Stock Biomass (SSB) estimates from the F08_FINAL_T2006, F08_T2007_T1, and F08_T2007_T2 runs.

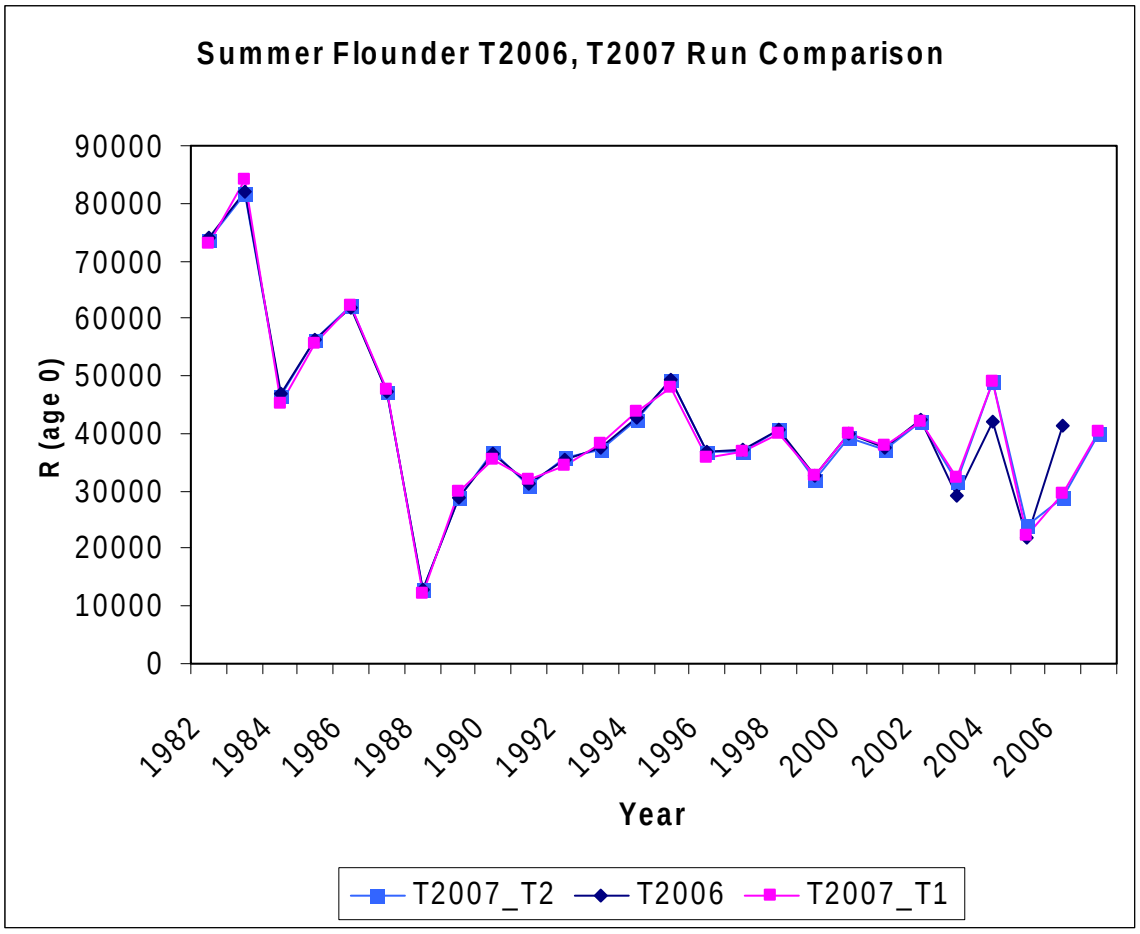
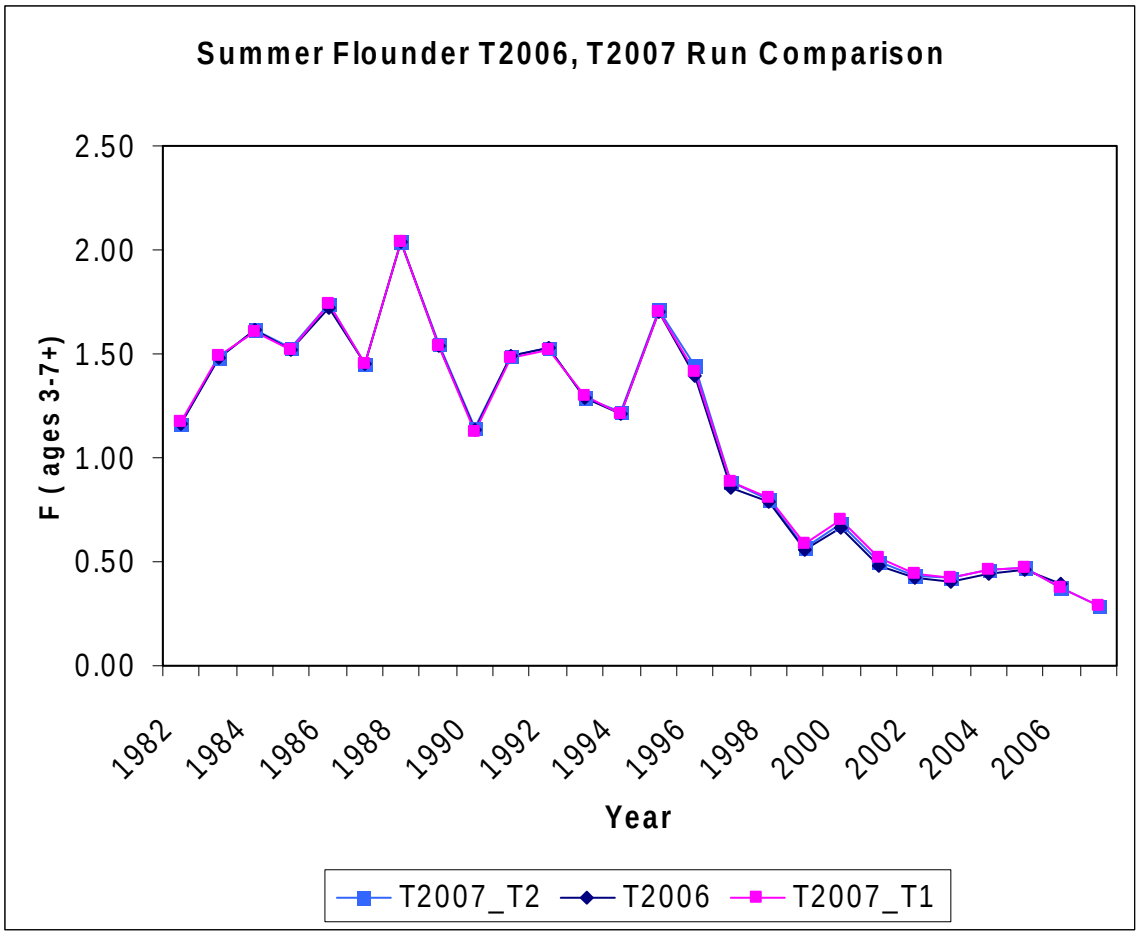


Figure 68. Recruitment (R; age 0) estimates from the F08_FINAL_T2006, F08_T2007_T1, and F08_T2007_T2 runs.



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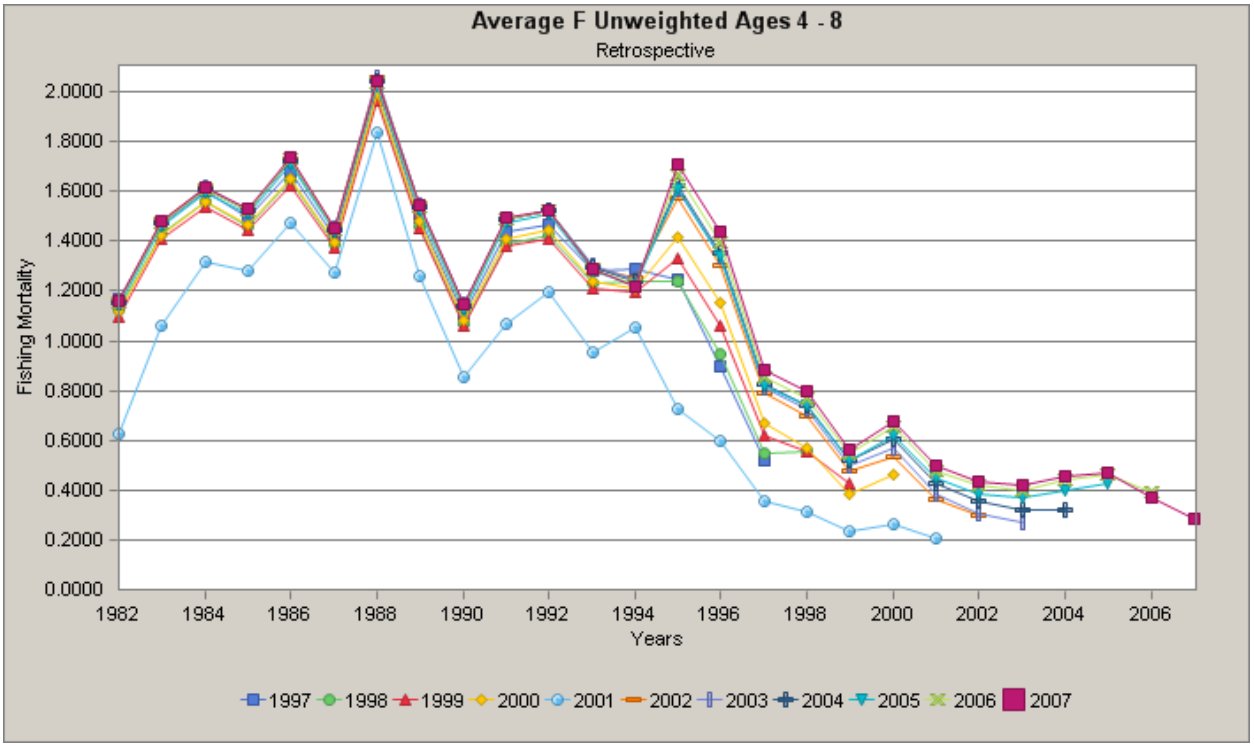

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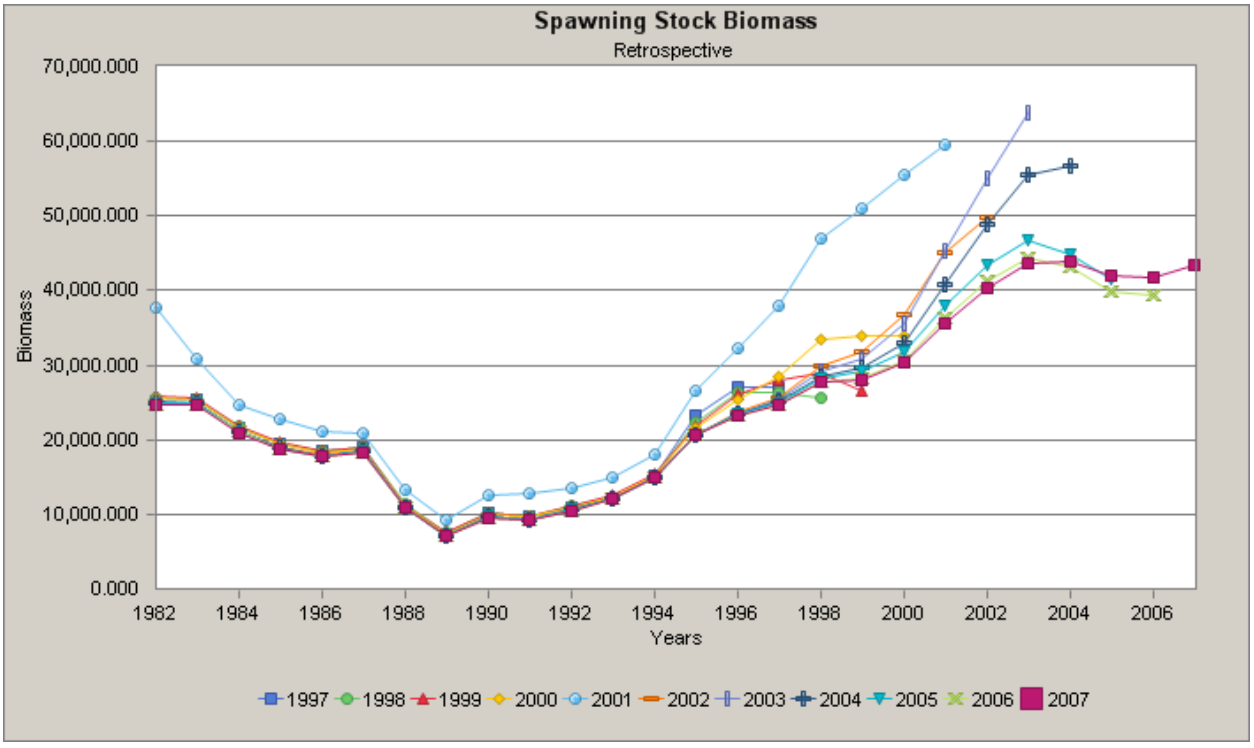

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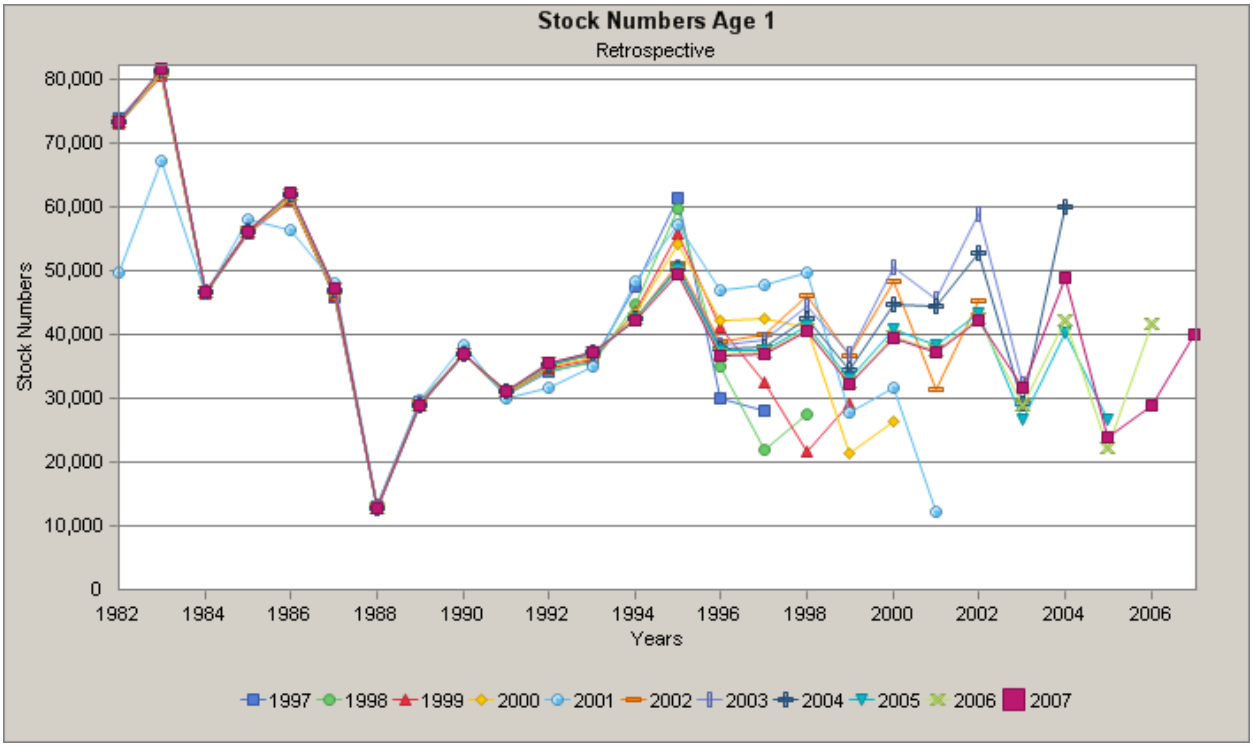
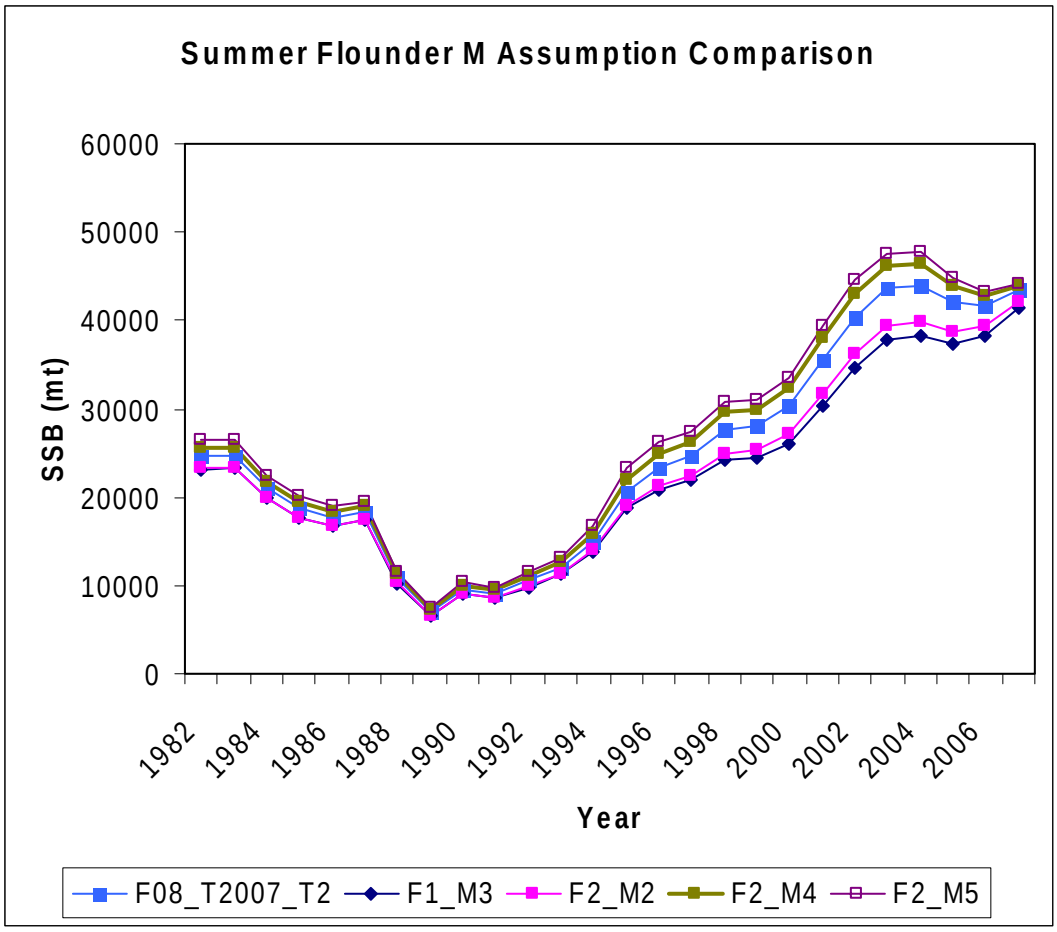


Figure 72. Retrospective analysis of Recruitment (R, age 0) for the ASAP F08_T2007_T2 run. Note that ASAP age 1 is true age 0.



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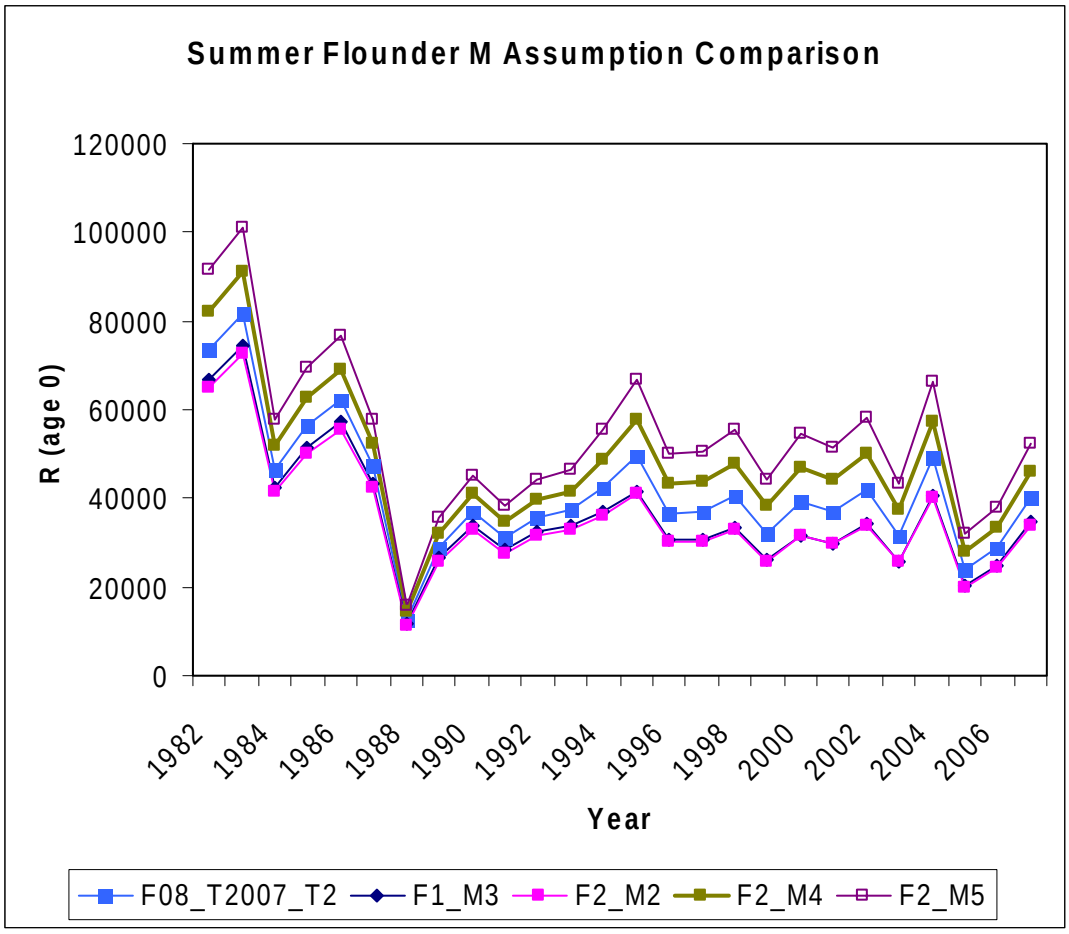

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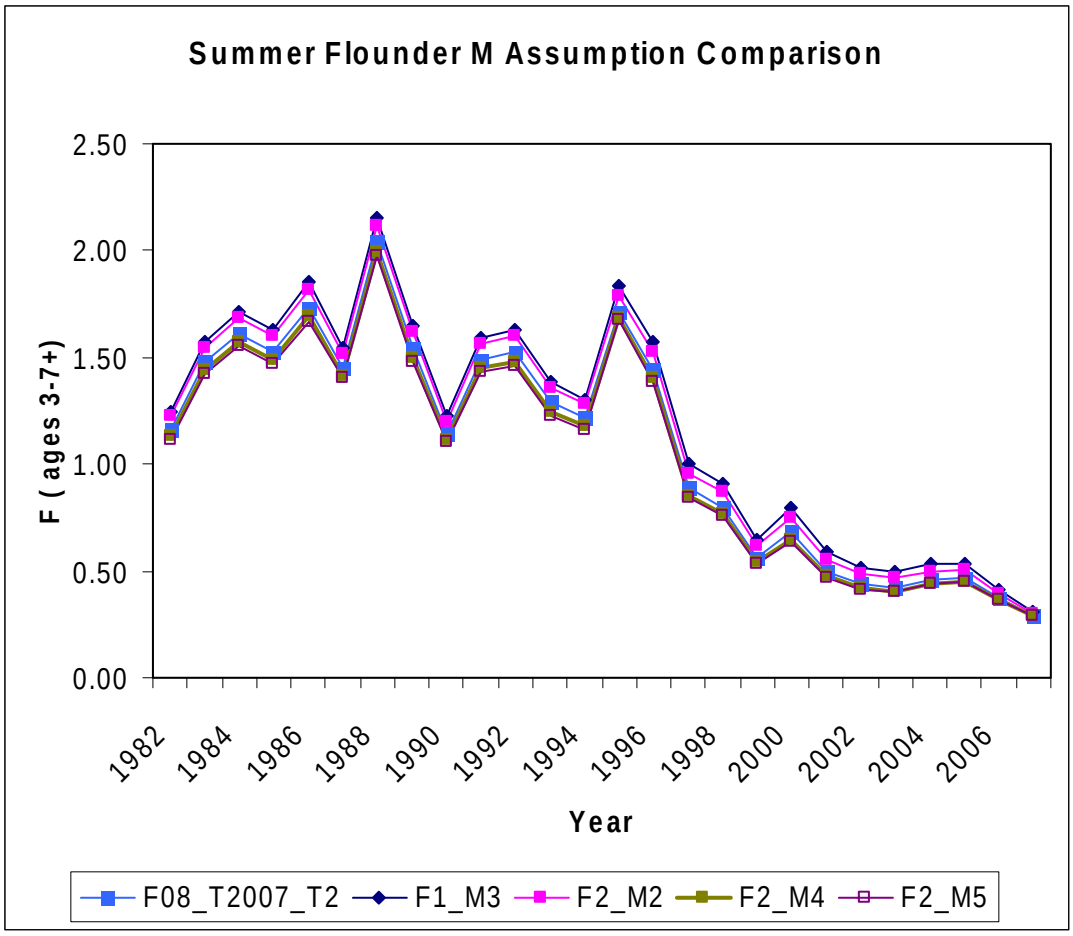
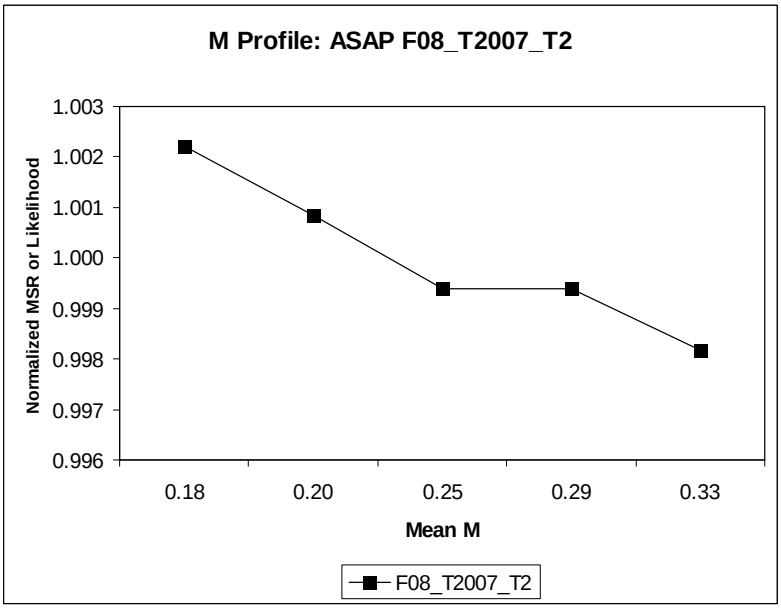
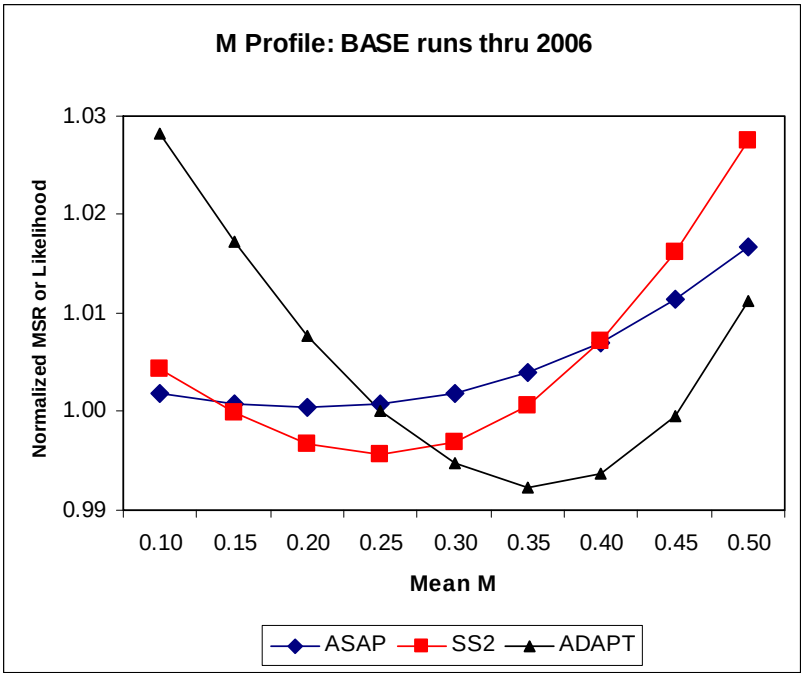


Figure 75. Fishing Mortality (F, ages 3-7+) estimates from the ASAP F08_T2007_T2 run and runs with alternative assumptions for natural mortality (M).

A)



B)



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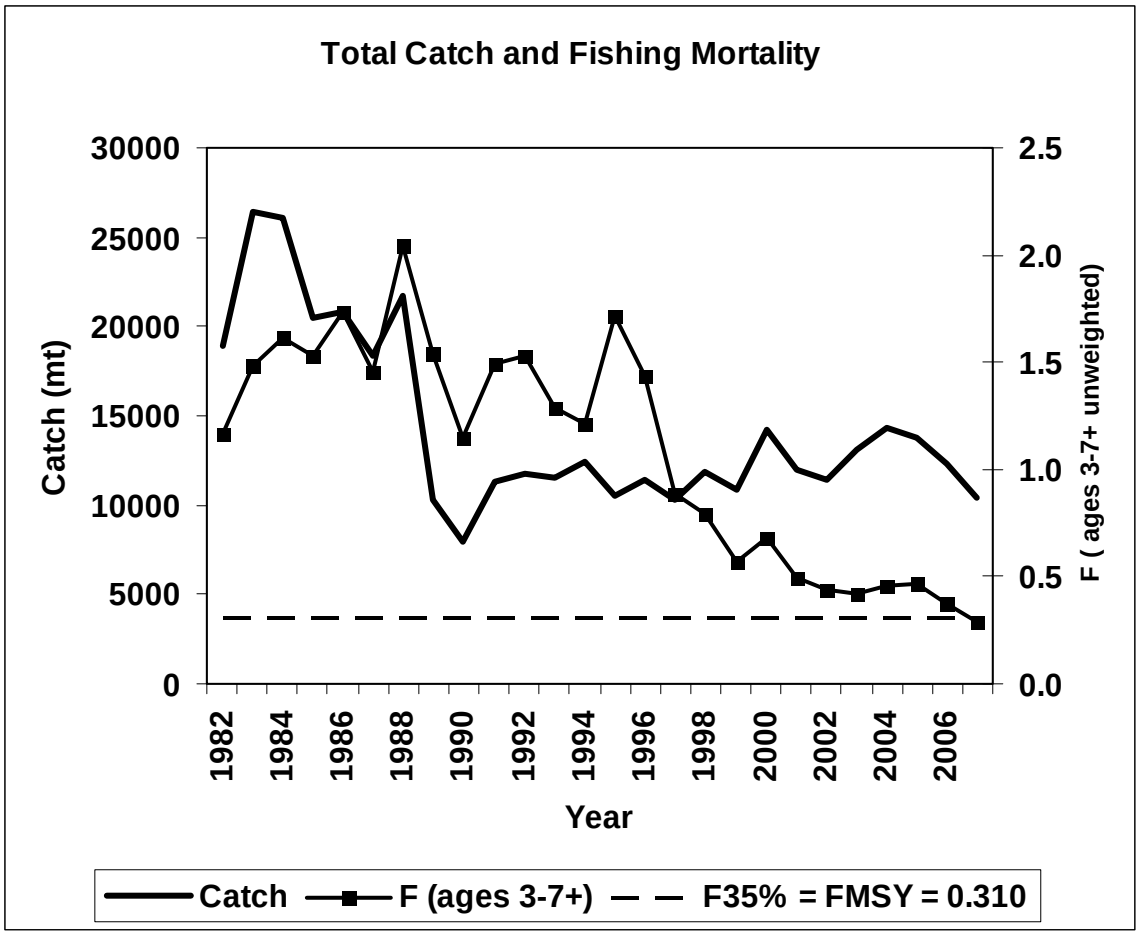

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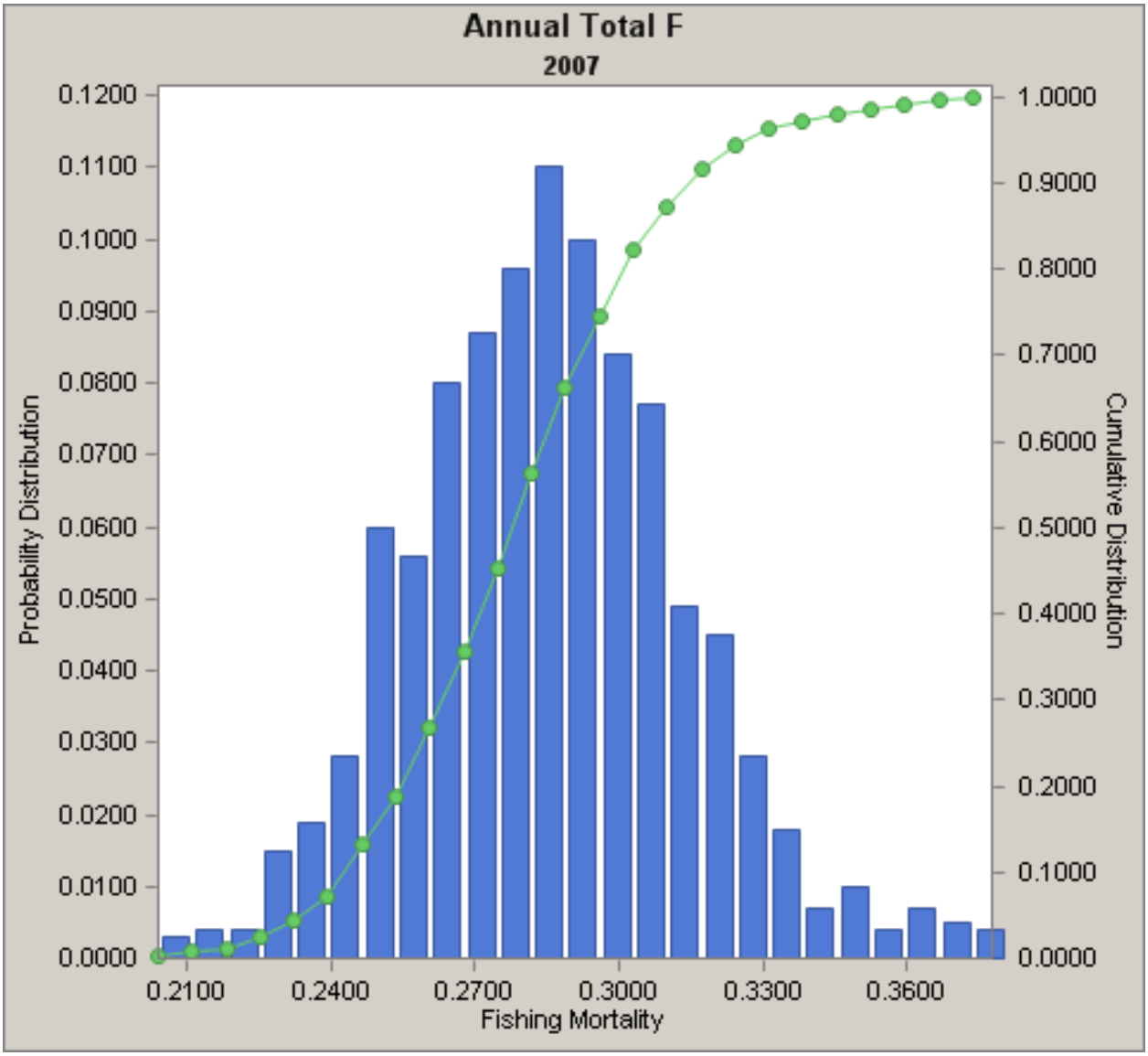
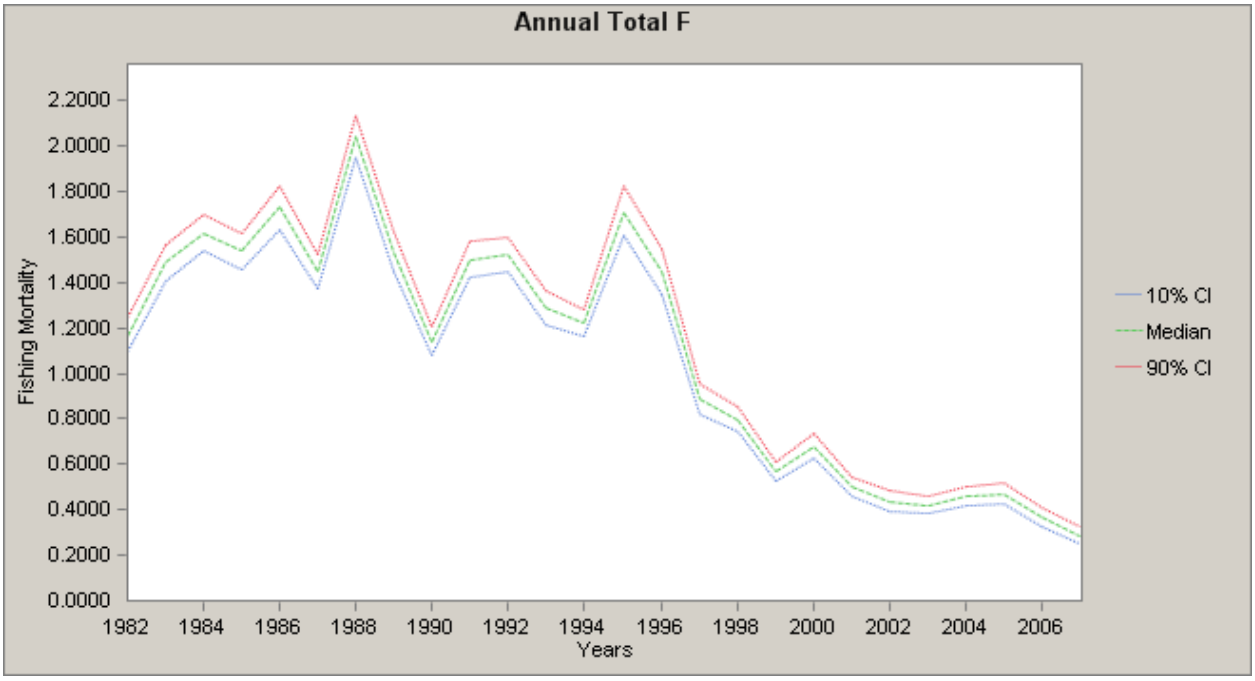


Figure 78. Precision of the 2007 Fishing Mortality estimate from the 2008 assessment final model ASAP F08_T2007_T2 run.



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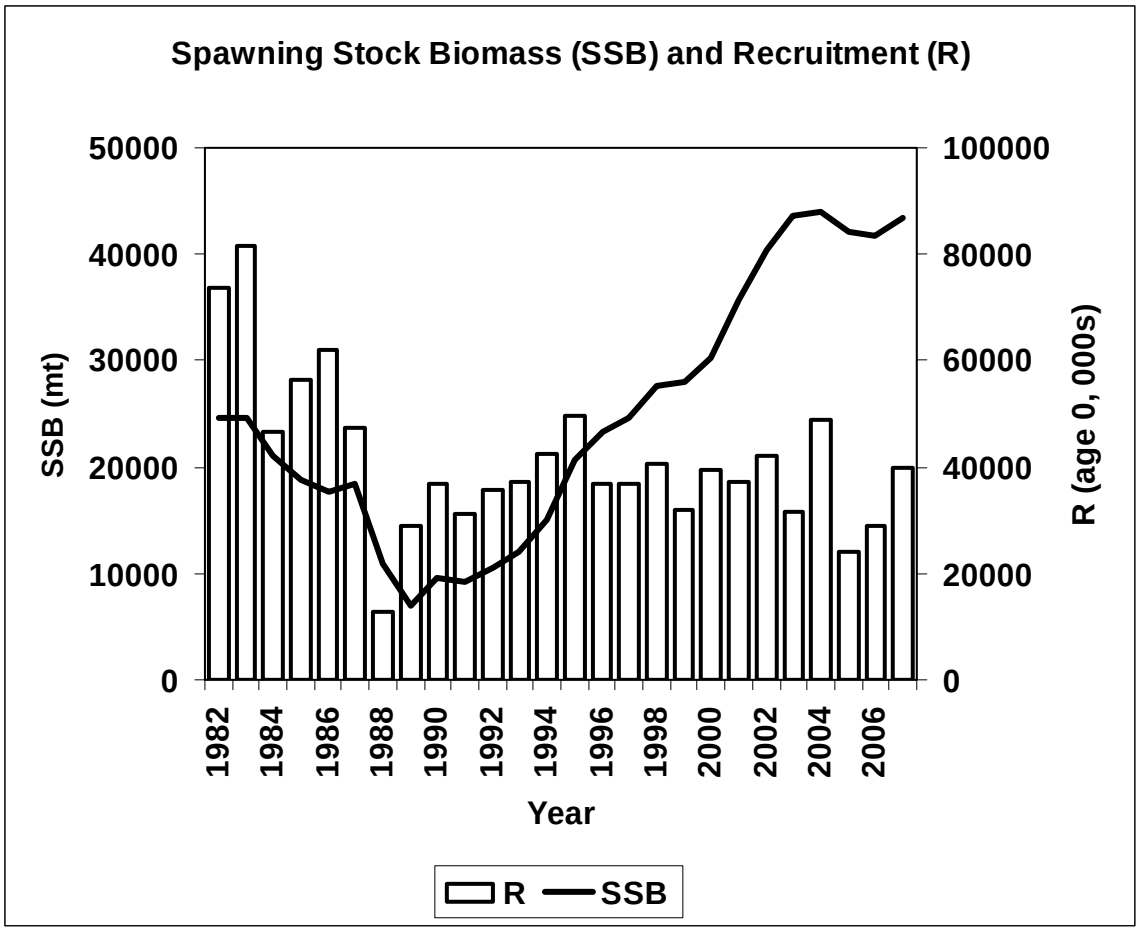

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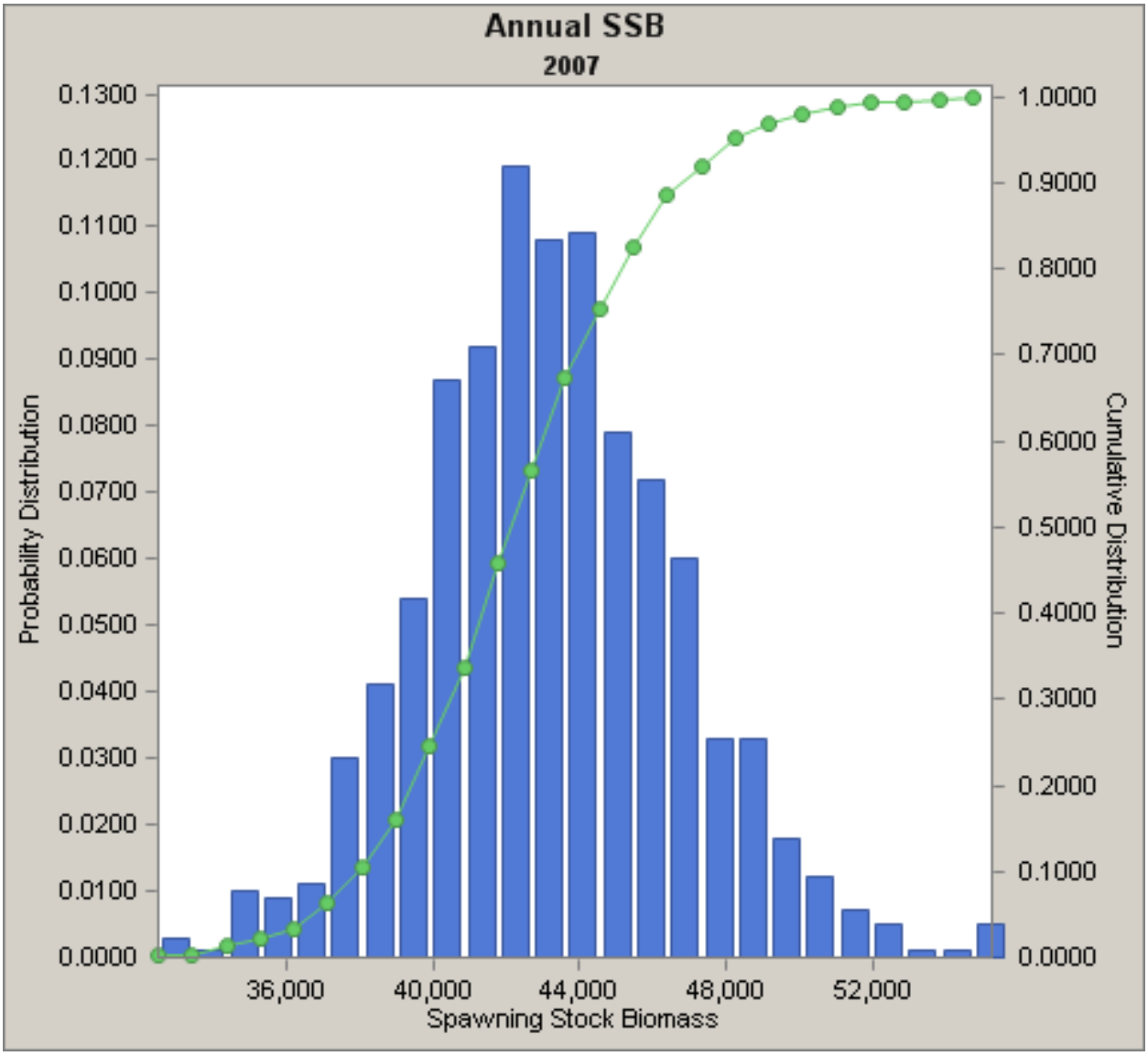

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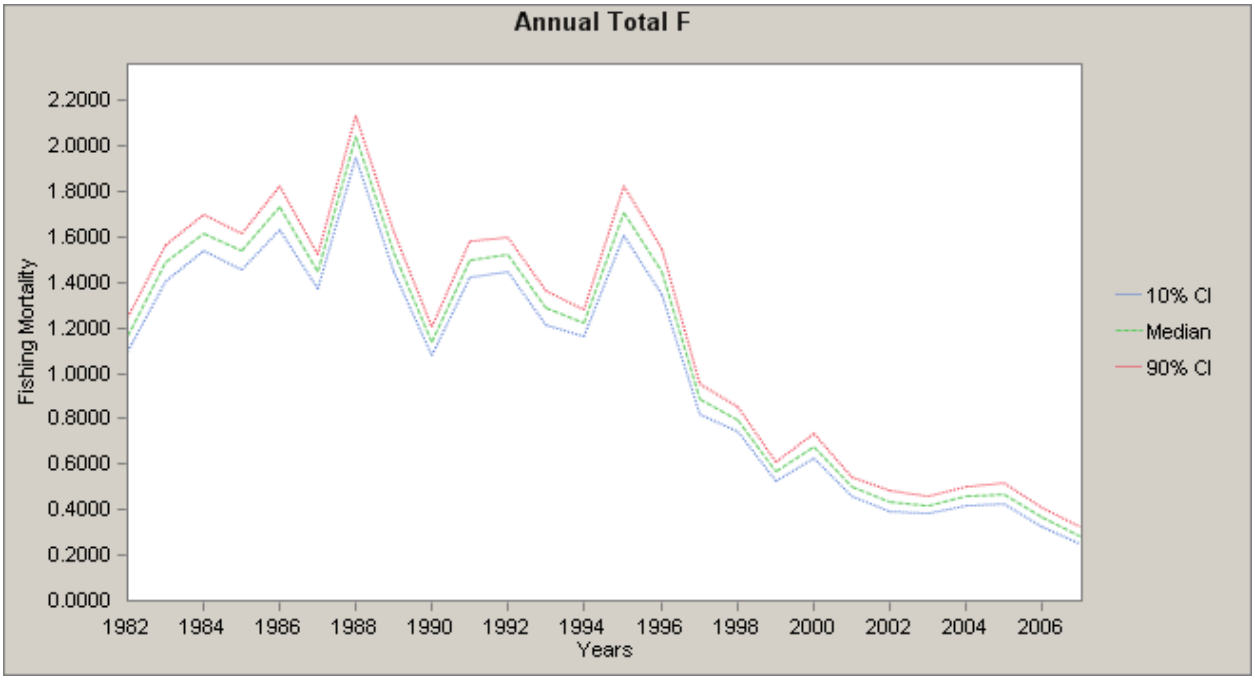

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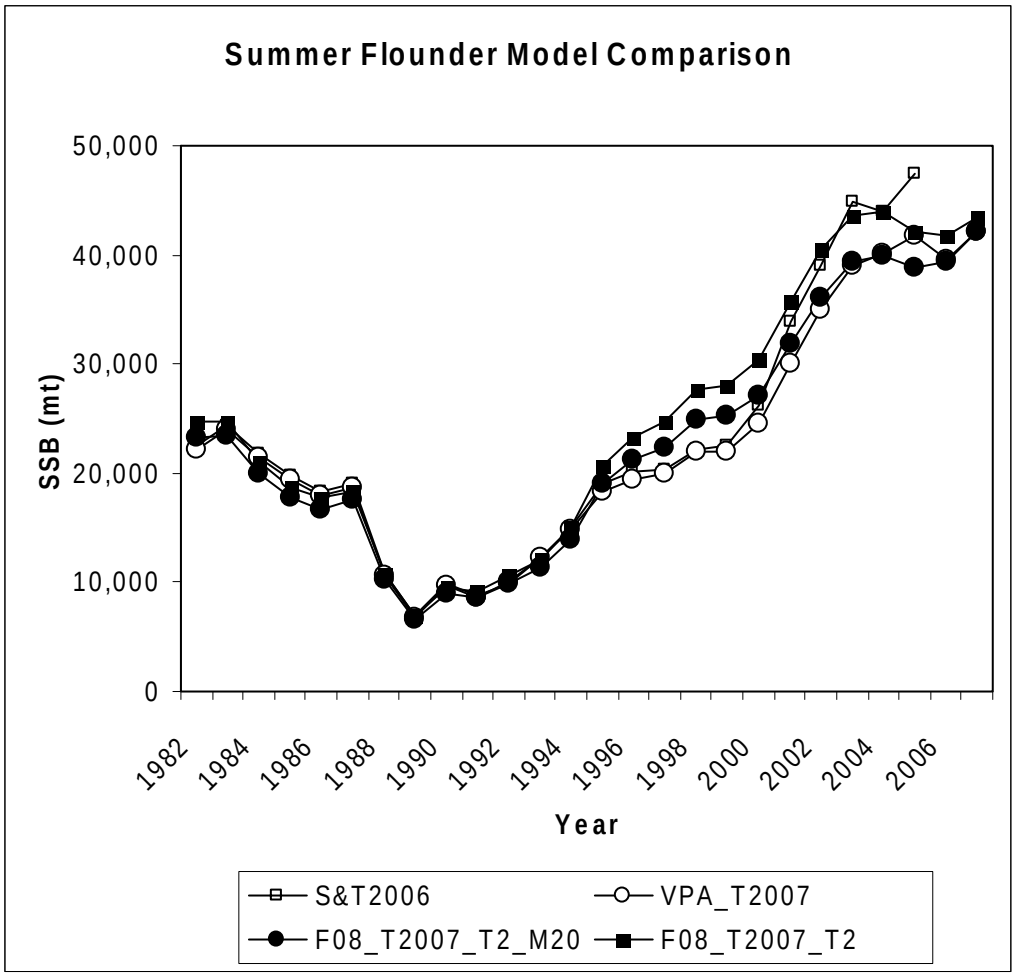

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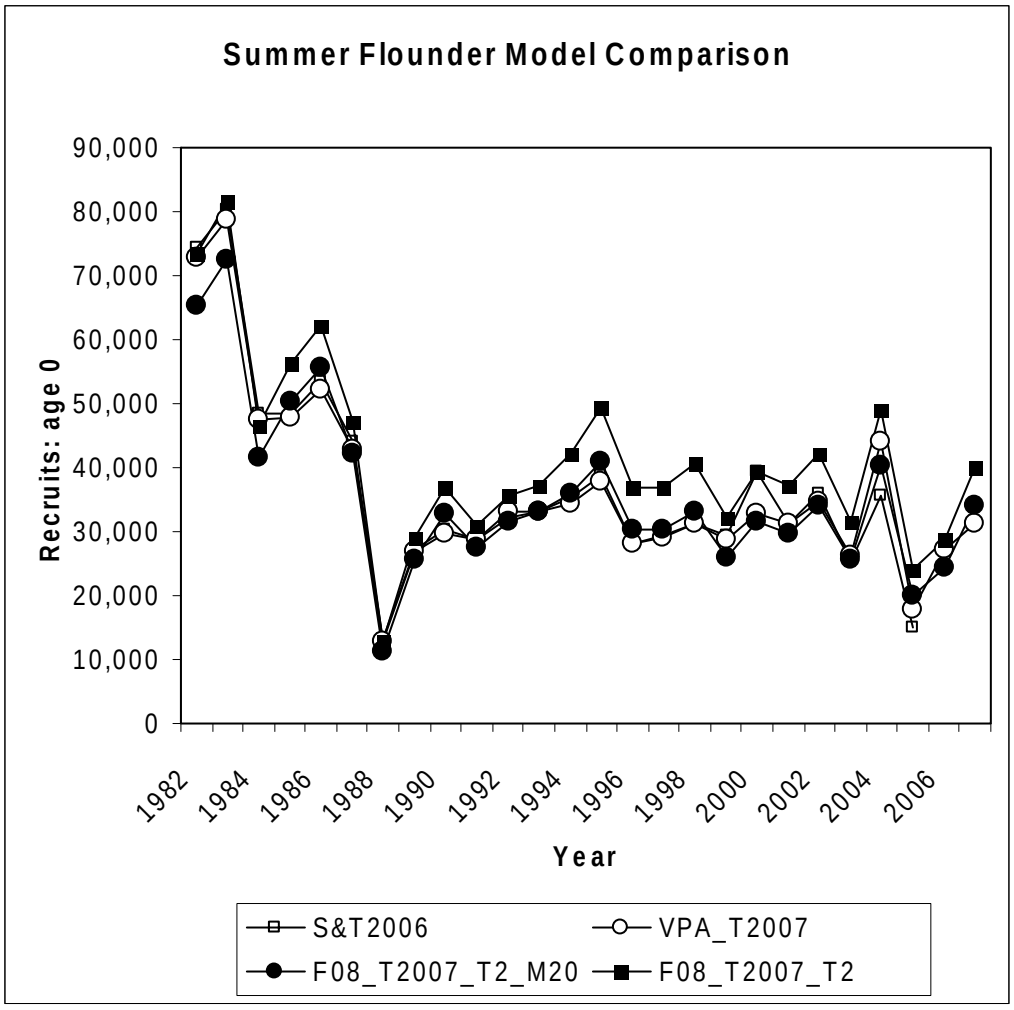

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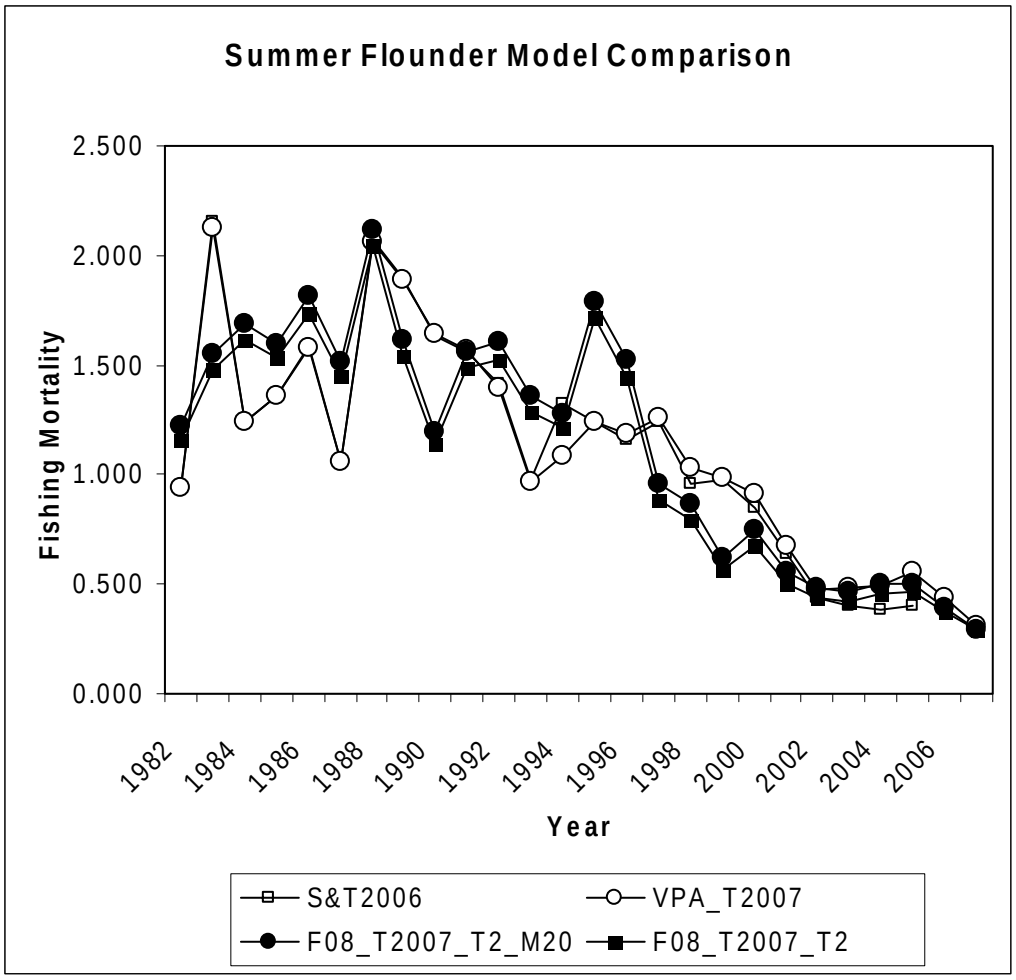

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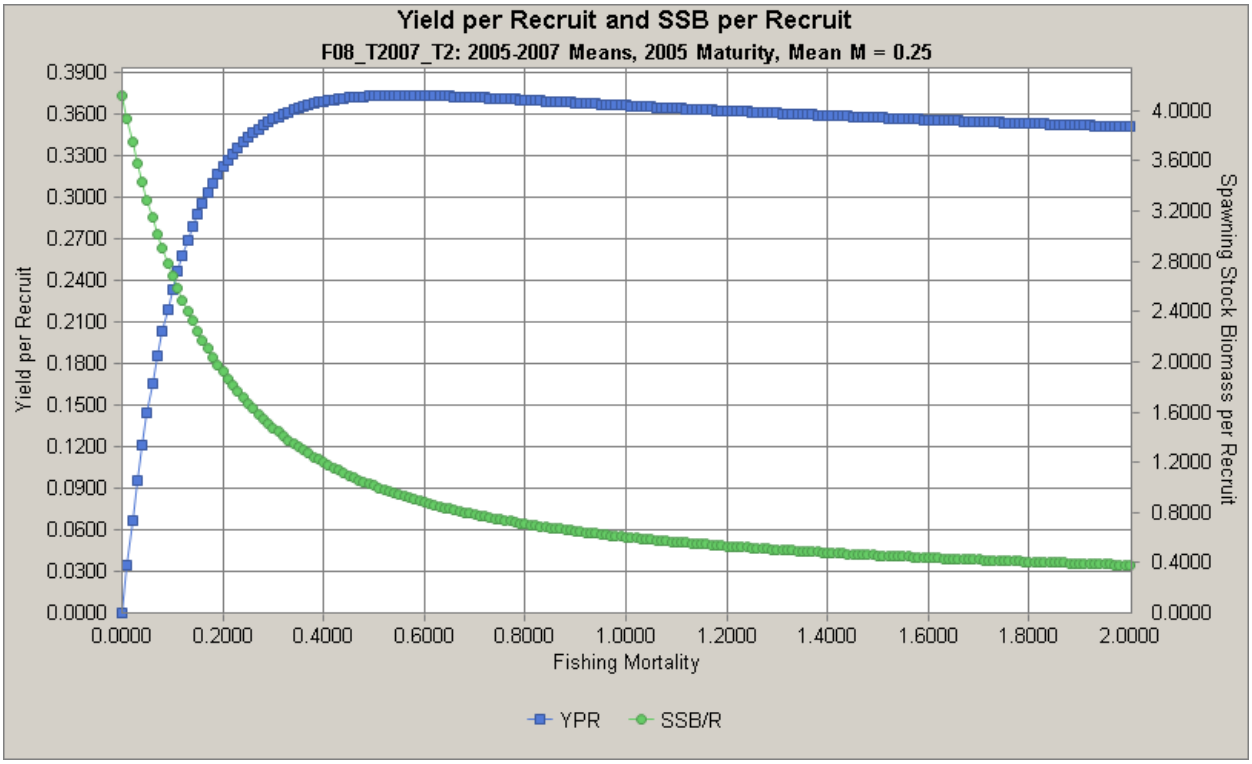

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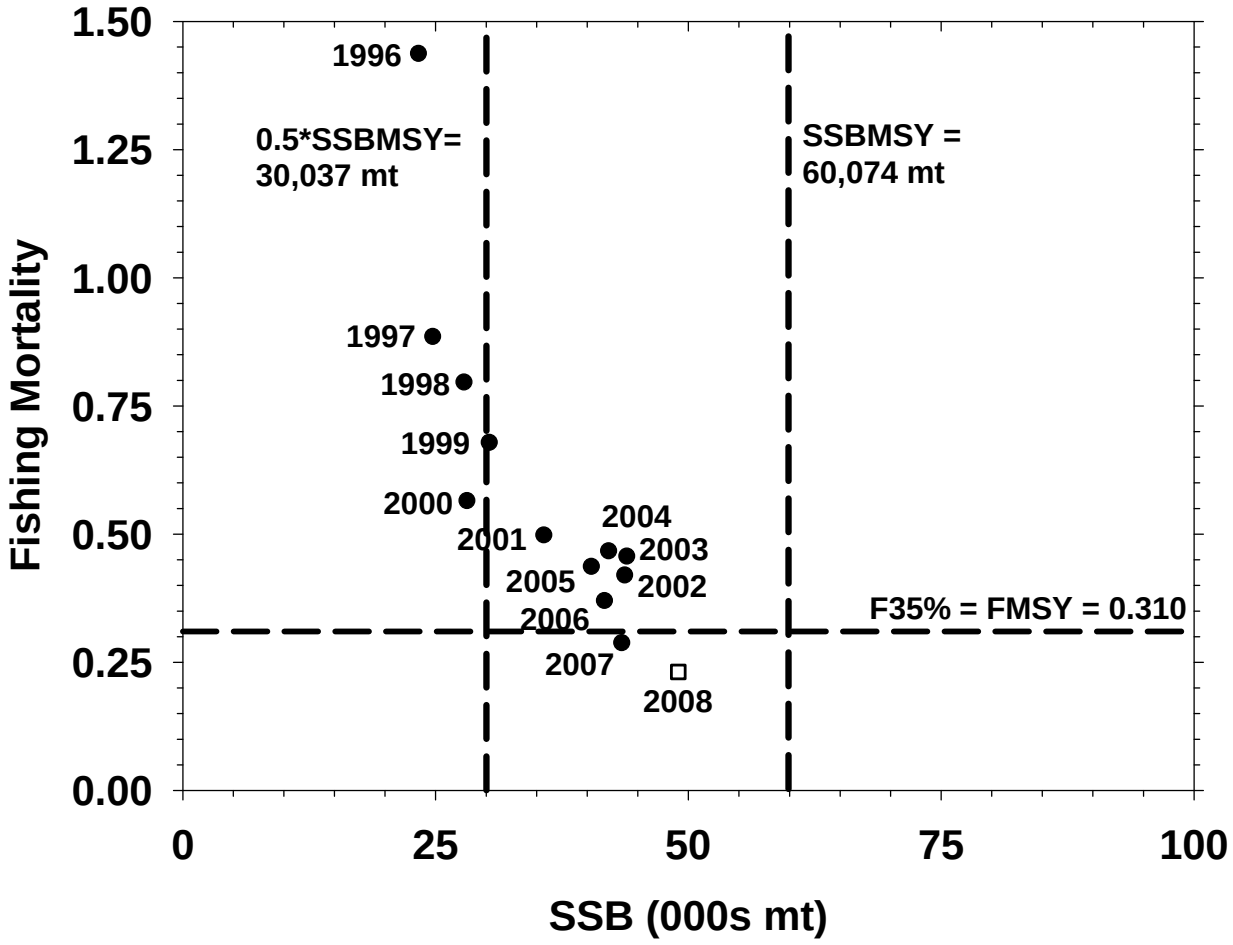

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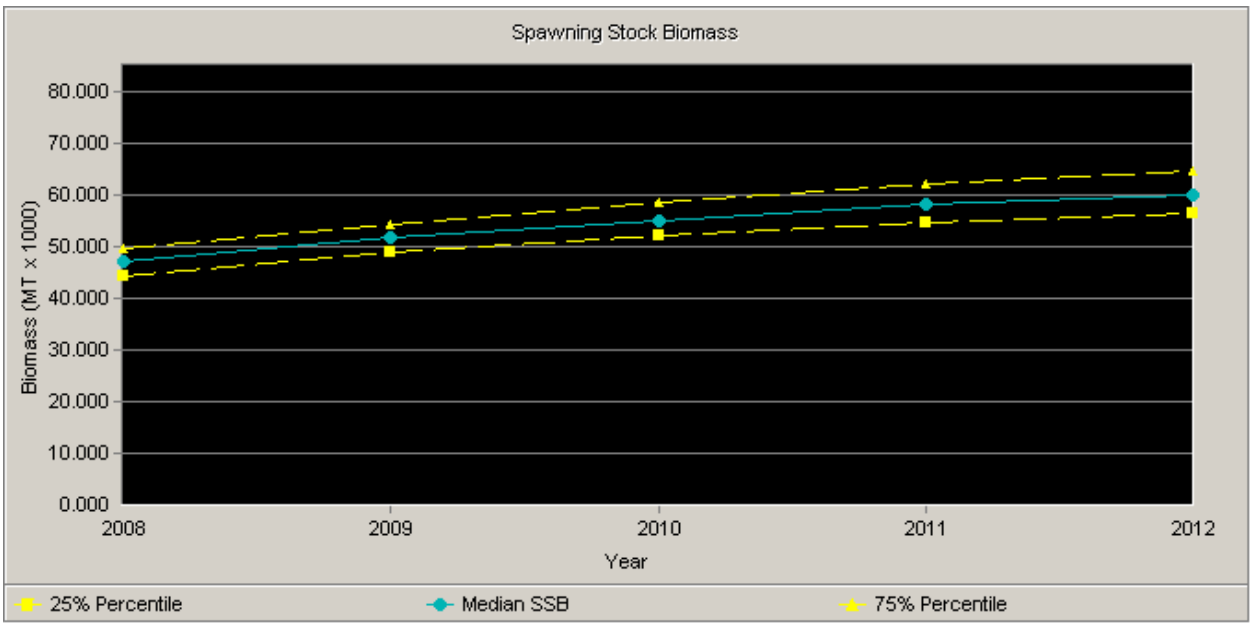

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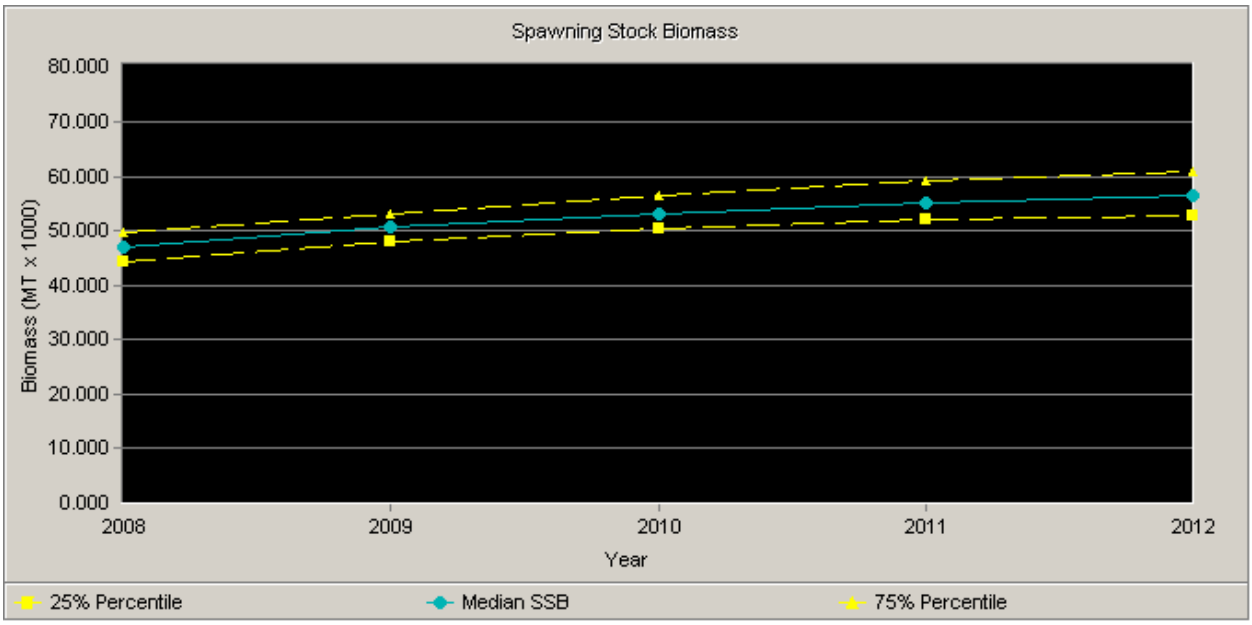

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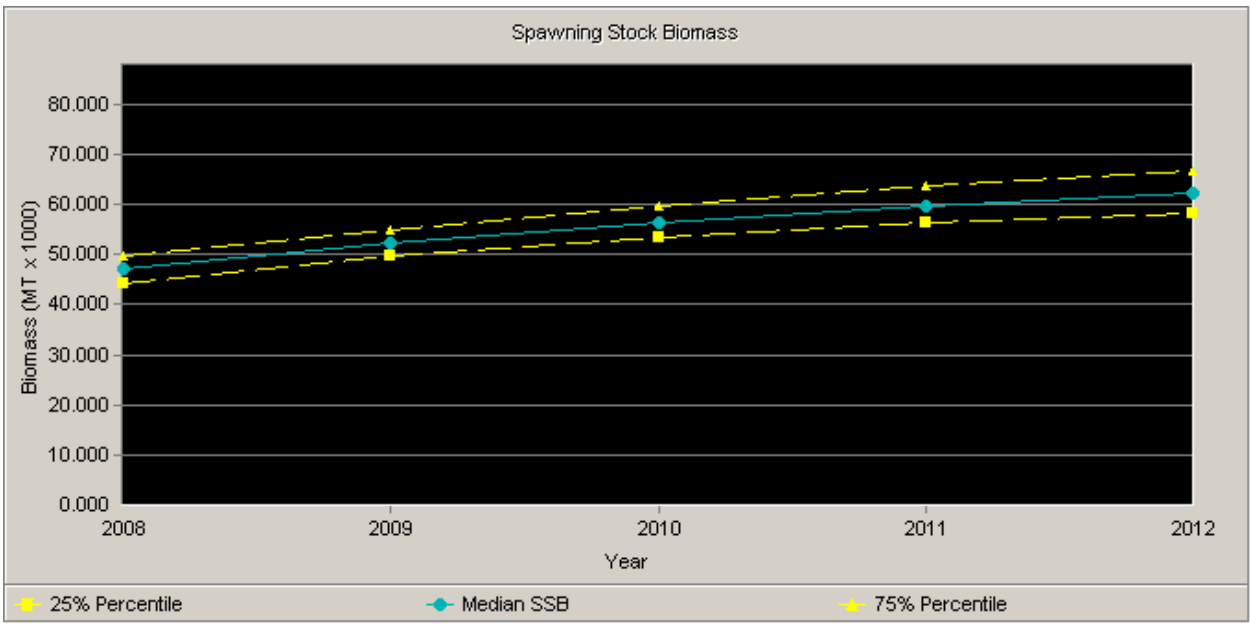

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A Report of the 47th Northeast Regional Stock Assessment Workshop

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

Part B. Assessment Report Appendixes

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

July 2008

Northeast Fisheries Science Center Reference Documents

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APPENDIX 1

SAW 47 Working Paper 1 (TOR 1) – Commercial Fishery Discards

December 10, 2007

Estimation of Commercial Fishery Discards of Summer Flounder: Update 2007 or Revise the 1989-2007 Time Series?

Background

In the 1993 SAW 23 assessment for summer flounder (NEFSC 1993), an 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 effect. The estimation procedure expanded 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 (hereafter called the "mean log ratio with correction" method). The "days fished" effort metric was found to correlate better with the observed summer flounder discards on a per trip basis than other potential expansion factors such as total summer flounder landings or total trip landings of all species. The use of fishery effort as the multiplier (raising factor) also allowed 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 2002-2006, 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.

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 Asample@ 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 1989-1993 period and 1994. Since 1994, total days fished have ranged from 20,700 days in 1999 to 9,300 days in 2004, with a mean of about 12,000 days, a substantial decline relative to the 1989-1993 mean of 22,000 days. 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 1994-2006.

Two adjustments were made to the dealer/VTR matched data subset days fished estimates to fully account for summer flounder fishery effort during 1994-2006. 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. Given the restrictions on the fishery however, there is fishing activity which results in summer flounder discard, 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), 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.

This “mean log ratio with correction” estimation procedure has been used in every assessment since 1993, including the 2006 update (Terceiro 2006). Discard estimates using this method for 1989-2006 are summarized in Table 1 (see ASSESS estimates). Discards as a proportion of the fishery observer data estimated landings were highest in 2001 (53%), and lowest in 1995 and 1996 (5 and 7%). Estimates of landings from observer data ranged from +53% (1999) to -70% (2001) of the reported landings in the fisheries, with discards ranging from 41% (1990) to 6% (1995) of the reported landings (Tables 1-2). Total discards estimated for 2003, 2004, and 2005 were 10%, 4%, and 4% 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 have been estimated to be of the same order of magnitude as in the trawl fishery (see ASSESS estimates, Table 1).

Estimation of discards for groundfish: GARM 2007

Rago et al. (2005) described methods recently adopted by the NEFSC to estimate the discards of trawl, gillnet, longline, scallop, and herring fisheries of the Northeast U.S. The Rago et al. (2005) work focused on the use of stratified discard to kept weight ratios (d/k) as the primary estimator, with the "d" portion for the stocks (or group of stocks) of interest, and the "k" portion most often for the kept of all species, or the species that comprised the dominant portion of the catch.

The method developed by Rago et al. (2005) was subsequently modified and used in an expanded exercise to develop discard estimates for 45 different fishing fleets and 60 fish stocks, encompassing all of the federally managed fisheries in the Northeast. This work is documented in Wigley et al. (2007) – the "SBRM Report." Recently, these general methods were reviewed as part of the Groundfish Assessment Review Meeting (GARM) 2007 Data Methods Workshop. The working paper of Wigley et al. (MS2007) documents revisions to the Rago et al (2005) and Wigely et al. (2007) methods, and provides details on the methodology used to develop the National Bycatch Report for 2005, and proposes this method for use in the GARM 2008 assessments for New England groundfish. That general estimation method is used in this work, and is hereafter called the National Bycatch Report Discard method 2 (NBRD2).

The working paper of Legault (MS2007), also prepared for the GARM 2007 Data Methods Workshop, presented results of simulations designed to rank the utility of different methods to estimate commercial fishery discards. Among the methods compared were the approach currently used in the Terceiro (2006) summer flounder assessment ("mean log ratio with correction" in Legault MS2007) and the Wigley et al. (MS2007) NBRD2 approach ("ratio of sums" in Legault MS2007). Legault (MS2007) concluded that the "mean log ratio with correction" was not a good estimator for total discards, due to the potential for large bias in the estimates; the Wigley et al. (MS2007) "ratio of sums" was recommended as a good estimator, with use of "all species kept" appearing to produce less biased results than kept of only the species of interest. The Wigley et al. (MS2007) "ratio of sums" estimation method (NBRD2) has been used here to estimate discards and landings of summer flounder in the trawl, scallop dredge, and sink gillnet fisheries at different spatial and temporal stratifications, for comparison with estimates made in the Terceiro (2006) stock assessment using the "mean log ratio with correction" (ASSESS) method.

Comparative Results

Trawl Fishery

Discard estimation results for the current method (ASSESS) and the proposed NBRD2 method for trawl gear are compared in Table 1 and Figure 1. Discard estimates in Figure 1 are plotted with +/- one standard error (1 SE) bars. Over the 18 year (1989-2006) time series, the NBRD2 method provides higher discard estimates in 14 years. Of those 14 years, the +/- 1 SE error bars of the NBRD2 estimates overlap those of the ASSESS estimates in 7 years, suggesting that the estimates are comparable in those years – i.e., the two methods produce comparable estimates in 7 of the 18 total years. In 3 of those 7 years, the estimates match very closely (1997, 1999, 2002).

In general, the coefficient of variation (CV) for discard estimates are smaller for NBRD2 discard ratios calculated at a region/quarter stratification than at wider temporal scales (annual or

semi-annual), and at the quarterly time stratification are comparable to, but generally slightly higher than, the ASSESS discard rate CVs (Table 1, Figure 1). The ASSESS discard rate data are from "more directed" observed summer flounder trips (trips must have summer flounder discard and/or landings to be included) and so the discard rates tend to be less variable than the wider universe of trips used in the NBRD2 approach. In addition, the ASSESS method effort expansion factor (days fished) is from VTR trips reporting summer flounder discard and/or landings, which tend to be more "directed" in nature than the "all species landings" (i.e., all trips) expansion factor used in the NBRD2 method. These combined factors generally result in slightly better precision of the ASSESS discard estimates, in spite of the smaller number of observed trips used to calculate the discard rates.

The estimation of landings from the two methods can potentially be used a means to verify the accuracy of the discard estimates. Landings estimation results for the ASSESS and NBRD2 methods and DEALER reported landings for trawl gear are compared in Table 2 and Figure 2. The ASSESS method estimates of trawl landings are closer to the DEALER reported landings in 12 of the 18 years. There are time blocks (ASSESS: 1989-1997, 2001-2003; NBRD2: 1998-2000, 2004-2006) during which one method performs better than the other. Over the 1989-2006 period, DEALER reported landings averaged 4,853 mt, NBRD2 estimates averaged 5,914 mt (+22% above DEALER), and ASSESS estimates averaged 4,602 mt (-5%). The precision of the ASSESS method landings estimates is consistently better than for the NBRD2 method, due to the same factors as for the discards.

Scallop Dredge Fishery

Discard estimation results for the current method (ASSESS) and the proposed NBRD2 method for trawl gear are compared in Table 1 and Figure 3. Discard estimates in the figure are plotted with +/- one standard error (1 SE) bars. Over the 15 year (1992-2006) time series, the NBRD2 method provides higher discard estimates in 12 years. Of those 12 years, the +/- 1 SE error bars of the NBRD2 estimates overlaps those of the ASSESS estimates in 4 years, suggesting that the estimates are comparable in those years – i.e., the two methods produce comparable estimates in 4 of the 15 total years. In 3 of those 4 years, the estimates match closely (1992, 1998, 2001).

In general, as with the trawl fishery estimates, the coefficient of variation (CV) for discard estimates are smaller for NBRD2 discard ratios calculated at the region/quarter stratification than at wider temporal scales (annual or semi-annual), and at the quarterly time stratification are comparable to the ASSESS discard rate CVs (Table 1, Figure 3). The ASSESS discard rate data are from more "directed" observed summer flounder trips (trips must have summer flounder discard and/or landings to be included) and so the discard rates tend to be less variable than the wider universe of trips used in the NBRD2 approach. In addition, the ASSESS method effort expansion factor (days fished) is from VTR trips reporting summer flounder discard and/or landings, which tend to be more "directed" (although still mainly bycatch in nature) than the "all scallop landings" (i.e., all scallop dredge trips) expansion factor used in the NBRD2 method. These combined factors generally result in slightly better precision of the ASSESS discard estimates, especially early in the time series when the total number of scallop dredge trips observed is small (< 50 trips annually).

The estimation of landings from the two methods can potentially be used a means to verify the accuracy of the discard estimates. Landings estimation results for the ASSESS and NBRD2 methods and DEALER reported landings for scallop dredge gear are compared in Table

2 and Figure 4. Summer flounder are generally a small bycatch in the scallop dredge fishery, and the DEALER reported landings have ranged from 25 to 284 mt over the series. The NBRD2 method estimates of summer flounder landings are closer to the DEALER reported landings in 12 of the 15 years. Over the 1992-2006 period, DEALER reported landings averaged 81 mt, NBRD2 estimates averaged 79 mt (-3%), and ASSESS estimates averaged 102 mt (+26%). The precision of the landings estimates are comparable for the two estimation methods over the time series.

Gillnet Fisheries

Discard estimates for the gillnet fishery (sink, drift, and anchor combined) have not previously been estimated in the summer flounder assessment, due to the small magnitude of summer flounder landings in the DEALER reported data and the small absolute magnitude of summer flounder discards in the gillnet observer data. The Wigley et al (2007) report indicated, however, that in 2005 about 25 mt of summer flounder were discarded in the gillnet fisheries (mainly using extra large mesh and targeting monkfish), and so in this exercise discard estimates were made using the NBRD2 method (Table 1, Figure 5). Discard estimates in the Figure 5 are plotted with +/- one standard error (1 SE) bars. Over the 13 year (1994-2006) time series, the NBRD2 method provides discard estimates of 1 to 37 mt annually, with quarterly time strata CVs ranging from 59% (1994) to 18% (2005). The NBRD2 discard estimates for the gillnet fishery are relatively imprecise (CV > 30% in 9 of 13 years) because summer flounder are encountered relatively rarely in the gillnet fishery, and both the observer discard and landings rates are highly variable.

Landings estimation results for the NBRD2 method and DEALER reported landings for gillnet gear are compared in Table 2 and Figure 6. In the gillnet fishery, summer flounder generally are a small bycatch, and the DEALER reported landings have ranged from 8 to 143 mt over the series. NBRD2 method estimates of gillnet landings generally do not match the DEALER reported landings very well over the 13 years; DEALER reported landings averaged 67 mt, while NBRD2 estimates averaged 29 mt (-57%). NBRD2 landings estimates for quarterly time strata have CVs ranging from 78% (1997) to 19% (2004), exceeding 30% in 8 of the 13 years.

Summary

This material was presented and discussed as part of a Post-GARM review session by the NEFSC Population Dynamic Branch (December 6, 2007). The results of that discussion are summarized as follows:

- GARM simulations suggested ASSESS method would prove to be positively biased…
- But, NBRD2 generally produced higher discard estimates for both trawl and scallop fisheries
- For trawl fishery NBRD2 discards average 900 mt; ASSESS discards average 500 mt
- ASSESS method precision was generally slightly better at region/quarter stratification
- ASSESS method estimates of trawl landings more consistently match DEALER over the 18 years (12 of 18 years); DEALER landings average 4,853 mt, NBRD2 estimates average 5,914 mt (+22%); ASSESS estimates average 4,602 mt (-5%)
- But, there are time blocks (ASSESS: 1989-1997, 2001-2003; NBRD2: 1998-2000, 2004-2006) during which one method performs better for the trawl fishery

- For scallop fishery NBRD2 discard estimates average 470 mt; ASSESS discards average 225 mt
- NBRD2 method estimates of scallop dredge landings more consistently match DEALER over the 15 years (12 of 15 years); DEALER landings average 81 mt, NBRD2 estimates average 79 mt (-3%); ASSESS estimates average 102 mt (+26%)
- For gillnet fishery NBRD2 discard estimates average 14 mt
- NBRD2 method estimates of gillnet landings generally don't match DEALER very well over the 13 years; DEALER averages 67 mt, NBRD2 averages 29 mt (-57%)
- The statistical diagnostics (i.e., CV indicating the precision of the discards and landings estimates) do not indicate that the NBRD2 approach represents an improvement over the current ASSESS method
- The verification method (i.e., matching the DEALER reported landings) do not indicate that the NBRD2 approach represents an improvement over the current method for trawl gear; the NBRD2 approach does seem to perform better than the current ASSESS approach for scallop dredge gear
- Given the lack of discard length frequency samples for summer flounder for gillnet gear, those discards may accounted for in the trawl fishery estimate by "raising" of the expansion factor
- Significantly more research into the sensitivity of the NBRD2 method to alternative stratification schemes is needed before the NBRD2 estimates are adopted in the assessment, and therefore…
- For now, make no changes to the discard estimation approach used in the assessment - update for 2008 benchmark assessment using the current ASSESS method
- For future work, focus on trawl and scallop dredge gear; try other approaches using sums of ratio (NBRD2) estimator, possibly with d/df for "directed" fluke trips (ASSESS) or for a "characteristic" group of landed species trips in the trawl fishery (e.g., fluke, scup, BSB, loligo, ilex, yellowtail flounder, winter flounder, cod, haddock, silver hake, etc.)

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Table 1: Comparison of summer flounder estimated discards using the NBRD2 method for alternative stratification of the discard rate. For trawl gear (negear = 050-059), d/k =d_fluke/k_allspecies; for scallop dredge gear (negear = 132), d/k = d_fluke/k_scallop; for gillnet (negear = 100,110,500), d/k = d_fluke/k_allspecies. N (number) of OB trips is the same for stratification levels within years. ASSESS row provides the discard estimates (based on geometric means of trip discard/days_fished ratios) used in the current assessment; N OB trips are based on different criteria (required fluke catch) than current (NBRD2) method; no gillnet gear estimates made.

1989		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	176	881	36	0			0		
Semi		844	39						
Quarter		827	38						
ASSESS	57	642	33	n/a	n/a			n/a	
1990		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	138	1538	38	0			0		
Semi		1455	39						
Quarter		1603	38						
ASSESS	61	1121	32	n/a	n/a			n/a	
1991		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	256	308	47	0			0		
Semi		291	50						
Quarter		419	33						
ASSESS	82	993	31	n/a	n/a			n/a	

Table 1 continued.

1992		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	186	1747	34	18	156	272	0		
Semi		1766	35		159	239			
Quarter		1780	35		306	150			
ASSESS	66	517	33	8	237	62		n/a	

1993		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	66	1337	40	22	147	61	0		
Semi		1535	35		141	60			
Quarter		1604	34		141	59			
ASSESS	37	477	21	15	340	31		n/a	

1994		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	63	270	249	23	112	57	262	5	51
Semi		686	79		104	39		5	58
Quarter		756	72		107	38		5	59
ASSESS	51	429	36	14	591	30		n/a	

1995		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	225	534	21	27	445	42	552	11	63
Semi		514	22		437	43		17	40*
Quarter		500	23		800	14*		15	44*
ASSESS	134	130	17	19	212	27		n/a	

Table 1 continued.

1996		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	194	330	72	40	401	34	450	1	33
Semi		411	57		433	31		1	34
Quarter		630	35		442	26		1	34
ASSESS	111	319	18	24	135	12		n/a	

1997		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	112	126	89	29	654	25	403	2	23
Semi		153	73		556	28		2	23
Quarter		276	29		433	12		2	25
ASSESS	59	299	24	23	108	24		n/a	

1998		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	70	293	70	26	223	33	447	5	40
Semi		437	36		207	33		5	42
Quarter		638	27		191	13		5	43
ASSESS	53	318	18	22	169	27		n/a	

1999		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	108	872	70	31	194	106	222	7	45
Semi		672	89		224	88		7	42
Quarter		1462	34		205	95		7	42
ASSESS	56	1476	33	10	459	39		n/a	

Table 1 continued.

2000		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	187	304	32	261	745	51	255	5	33
Semi		342	29		745	52		5	34
Quarter		459	21		780	38		4	36
ASSESS	115	740	21	23	167	19		n/a	

2001		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	282	1016	42	106	360	13	197	8	35
Semi		911	46		357	13		13	28
Quarter		971	44		358	12		14	27
ASSESS	137	287	35	68	297	12		n/a	

2002		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	325	379	25	94	536	20	150	29	72
Semi		407	20		550	19		33	63
Quarter		418	19		547	16		37	56
ASSESS	175	384	21	55	178	25		n/a	

2003		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	533	364	37	122	650	25	516	22	30
Semi		709	26		608	25		22	30
Quarter		697	21		619	22		20	32
ASSESS	212	556	19	79	194	14		n/a	

Table 1 continued.

2004		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	952	801	17	249	814	15	1058	31	26
Semi		841	16		844	14		33	22
Quarter		867	15		824	12		30	24
ASSESS	546	213	18	132	92	11		n/a	

2005		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	1736	996	9	290	515	13	940	25	18
Semi		1061	9		554	12		27	17
Quarter		1080	8		551	12		24	18
ASSESS	906	191	16	136	96	13		n/a	

2006		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	873	937	15	207	753	15	234	20	52
Semi		982	14		752	15		19	53
Quarter		1154	12		713	15		22	43*
ASSESS	578	268	3	117	93	3		n/a	

*NOTE THAT USE OF IMPUTED CELLS OFTEN REDUCES VARIANCE

Table 2. Comparison of summer flounder estimated landings using the NBRD2 method for alternative stratification of the landings rate. For trawl gear (negear = 050-059), k/k =k_fluke/k_allspecies; for scallop dredge gear (negear = 132), k/k = k_fluke/k_scallop; for gillnet (negear = 100,110,500), k/k =k_fluke/k_allspecies. N (number) of OB trips is the same for stratification levels within years. ASSESS row provides the landings estimates (based on geometric means of trip landings/days_fished ratios) used in the current assessment; no comprehensive CVs available; N OB trips are based on different criteria (required fluke catch) than current (NBRD2) method; no gillnet gear estimates made. DEALER row provides the reported dealer landings by gear.

1989		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	176	9494	33	0			0		
Semi		7913	40						
Quarter		7992	36						
ASSESS	57	7255	22	n/a			n/a		
DEALER		6003			108			8	
1990		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	138	4768	38	0			0		
Semi		5573	37						
Quarter		4454	42						
ASSESS	61	2959	21	n/a			n/a		
DEALER		2798			89			5	
1991		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	256	1638	30	0			0		
Semi		1541	33						
Quarter		1887	24						
ASSESS	82	4133	13	n/a			n/a		
DEALER		4344			176			16	

Table 2 continued.

1992		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	186	10364	33	18	196	168	0		
Semi		10317	34		203	152			
Quarter		11532	34		364	65			
ASSESS	66	4532	12	8	811	28		n/a	
DEALER		5943			284			18	

1993		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	66	10494	37	22	117	68	0		
Semi		10028	38		114	70			
Quarter		10946	33		129	64			
ASSESS	37	3823	20	15	209	38			
DEALER		4176			140			8	

1994		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	63	5750	56	23	16	141	262	9	78
Semi		6839	45		19	221		11	62
Quarter		5971	48		23	86		11	62
ASSESS	51	5858	15	14	145	61		n/a	
DEALER		4240			178			16	

1995		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	225	15253	16	27	97	65	552	5	37
Semi		14413	17		92	70		5	37
Quarter		13000	19		126	45*		5	37
ASSESS	134	5855	10	19	36	59		n/a	
DEALER		4507			92			13	

Table 2 continued.

1996		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	194	2831	141	40	48	57	450	2	25
Semi		3932	94		54	54		2	24
Quarter		7851	41		48	59		2	24
ASSESS	111	4982	32	24	42	55		n/a	
DEALER		3718			42			12	

1997		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	112	274	128	29	21	59	403	72	95
Semi		511	71		29	33		77	92
Quarter		950	41		29	33		95	78
ASSESS	59	2646	34	23	17	35		n/a	
DEALER		3657			25			63	

1998		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	70	1704	78	26	82	43	447	4	32
Semi		3209	49		87	45		4	30
Quarter		4810	28		88	42		4	30
ASSESS	53	3602	23	22	75	32		n/a	
DEALER		4585			52			89	

1999		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	108	1693	97	31	42	96	222	23	68
Semi		1143	114		47	76		27	58
Quarter		4307	38		67	33		27	58
ASSESS	56	7214	24	10	182	52		n/a	
DEALER		4429			71			50	

Table 2 continued.

2000		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	187	1589	116	261	34	118	255	42	63
Semi		1682	115		26	109		42	63
Quarter		7558	16		34	86		57	57
ASSESS	115	6668	18	23	34	50		n/a	
DEALER		4625			25			52	

2001		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	282	580	38	106	10	38	197	25	39
Semi		840	31		10	39		24	40
Quarter		912	30		10	37		21	47
ASSESS	137	1509	28	68	3	123		n/a	
DEALER		4512			44			79	

2002		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	325	5115	30	94	14	36	150	16	43
Semi		5997	25		15	34		14	51
Quarter		5201	29		14	33		14	49
ASSESS	175	6609	18	55	4	58		n/a	
DEALER		6054			36			102	

2003		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	533	1318	132	122	33	36	516	69	25
Semi		5500	40		35	35		61	26
Quarter		6223	41		39	28		58	26
ASSESS	212	5990	17	79	8	35		n/a	
DEALER		5935			44			116	

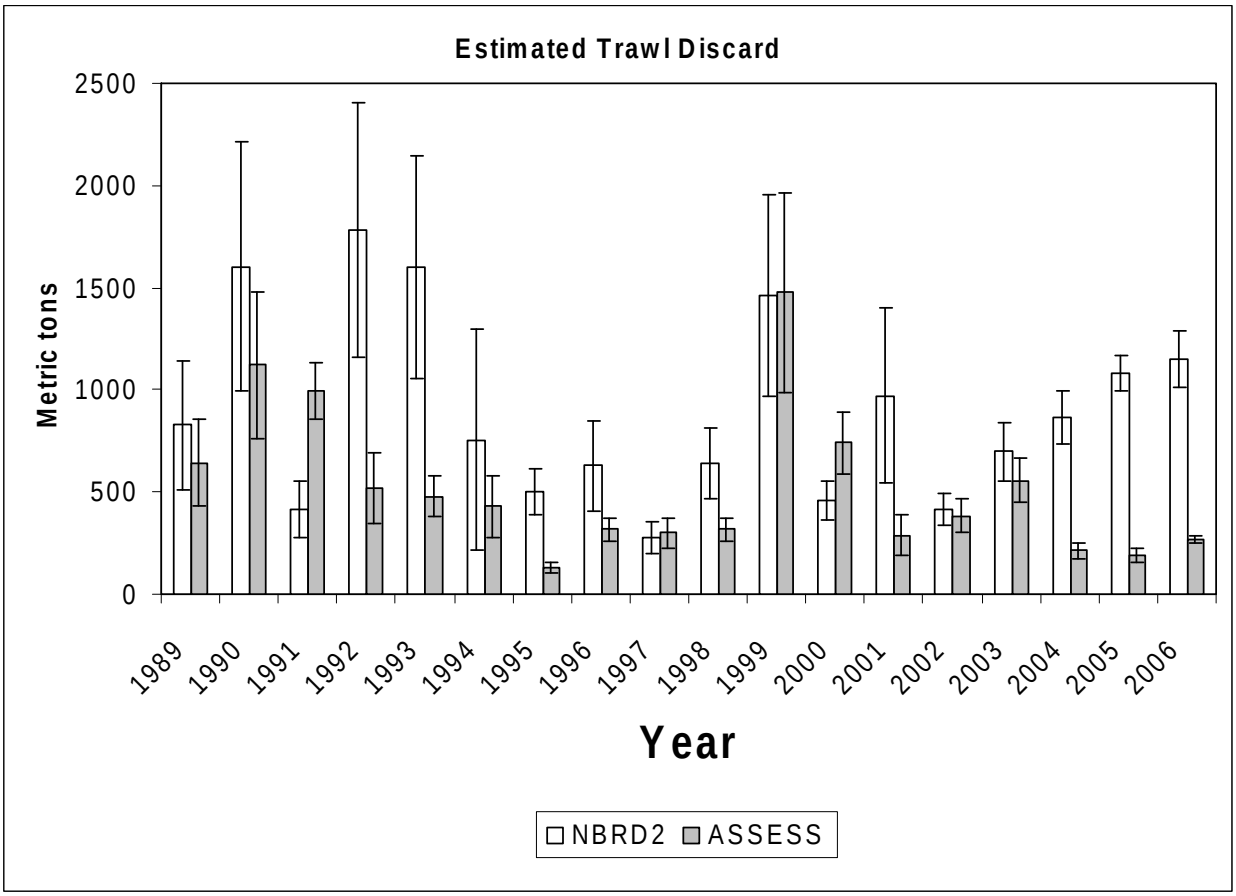
Table 2 continued.

2004		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	952	4202	17	249	66	29	1058	36	20
Semi		5243	18		75	26		39	18
Quarter		5270	16		65	28		38	19
ASSESS	546	4992	10	132	5	47		n/a	
DEALER		6950			42			109	

2005		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	1736	4213	16	290	51	29	940	20	34
Semi		4178	17		49	30		21	32
Quarter		4530	14		45	30		22	30
ASSESS	906	3425	9	136	9	29		n/a	
DEALER		5793			55			143	

2006		Trawl			Scallop			Gillnet	
d/k strata	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)	N OB trips	MT	CV(%)
Annual	873	1363	40	207	131	25	234	16	53
Semi		1383	40		107	25		14	57
Quarter		3057	23		102	25		17	43
ASSESS	578	1787	2	117	9	16		n/a	
DEALER		5066			86			41	

*NOTE THAT USE OF IMPUTED CELLS OFTEN REDUCES VARIANCE


Estimated Trawl Discard
Metric tons
2500
2000
1500
1000
500
0
1989
1990
1991
1992
1993
1994
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1996
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2001
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2004
2005
2006
Year
NBRD2
ASSESS

Figure 1.

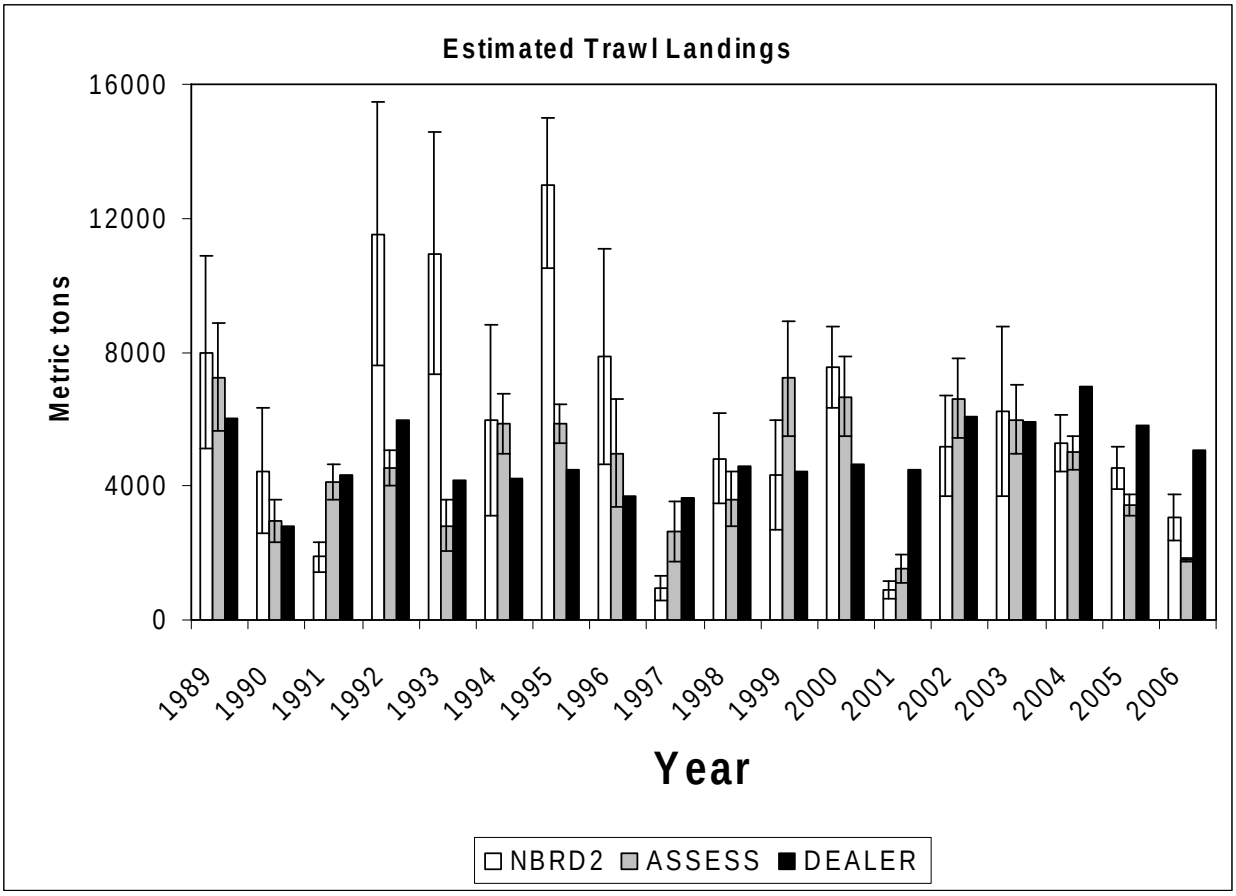
Estimated Trawl Landings
16000
12000
8000
4000
0
Metric tons
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
NBRD2
ASSESS
DEALER

Figure 2.

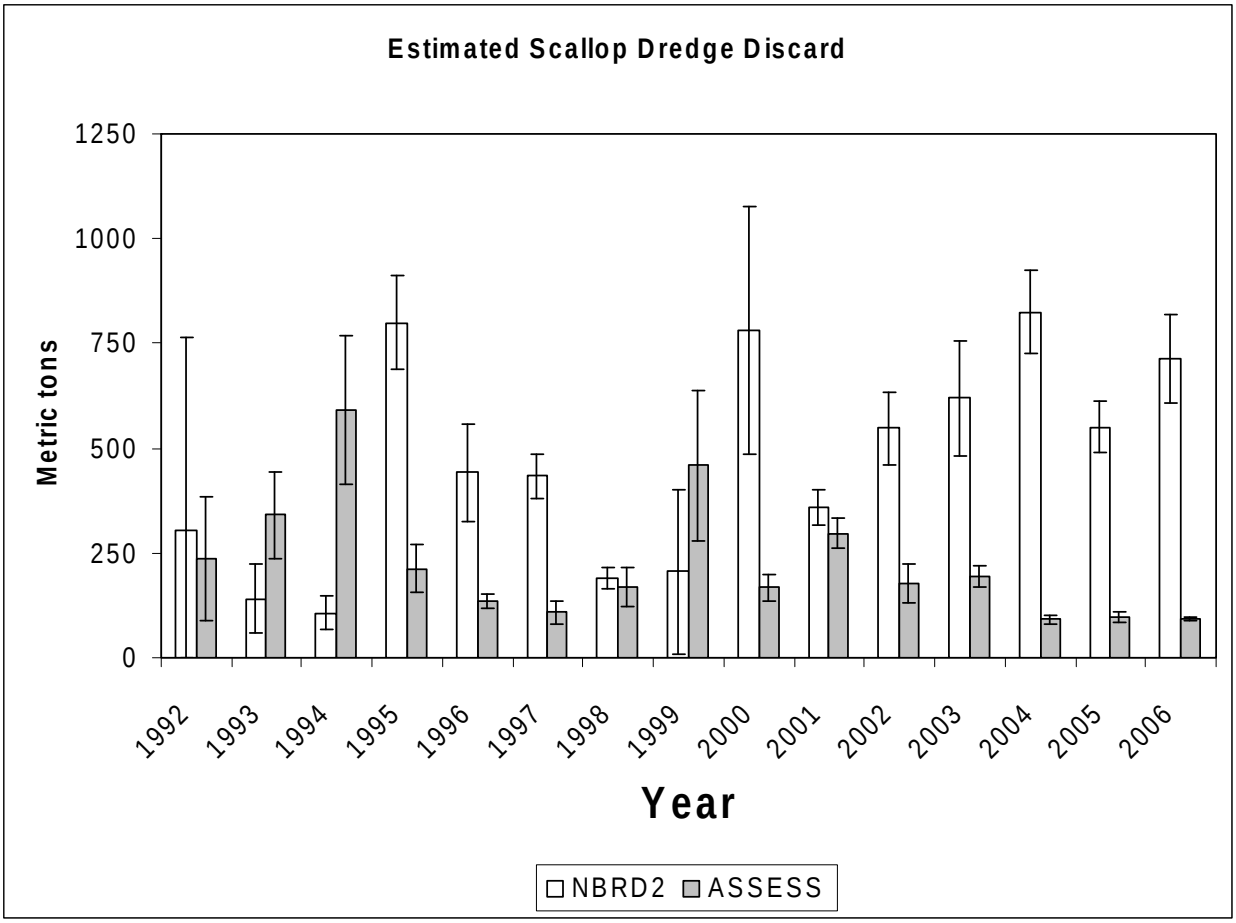
Estimated Scallop Dredge Discard
Metric tons
1250
1000
750
500
250
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
NBRD2
ASSESS

Figure 3.

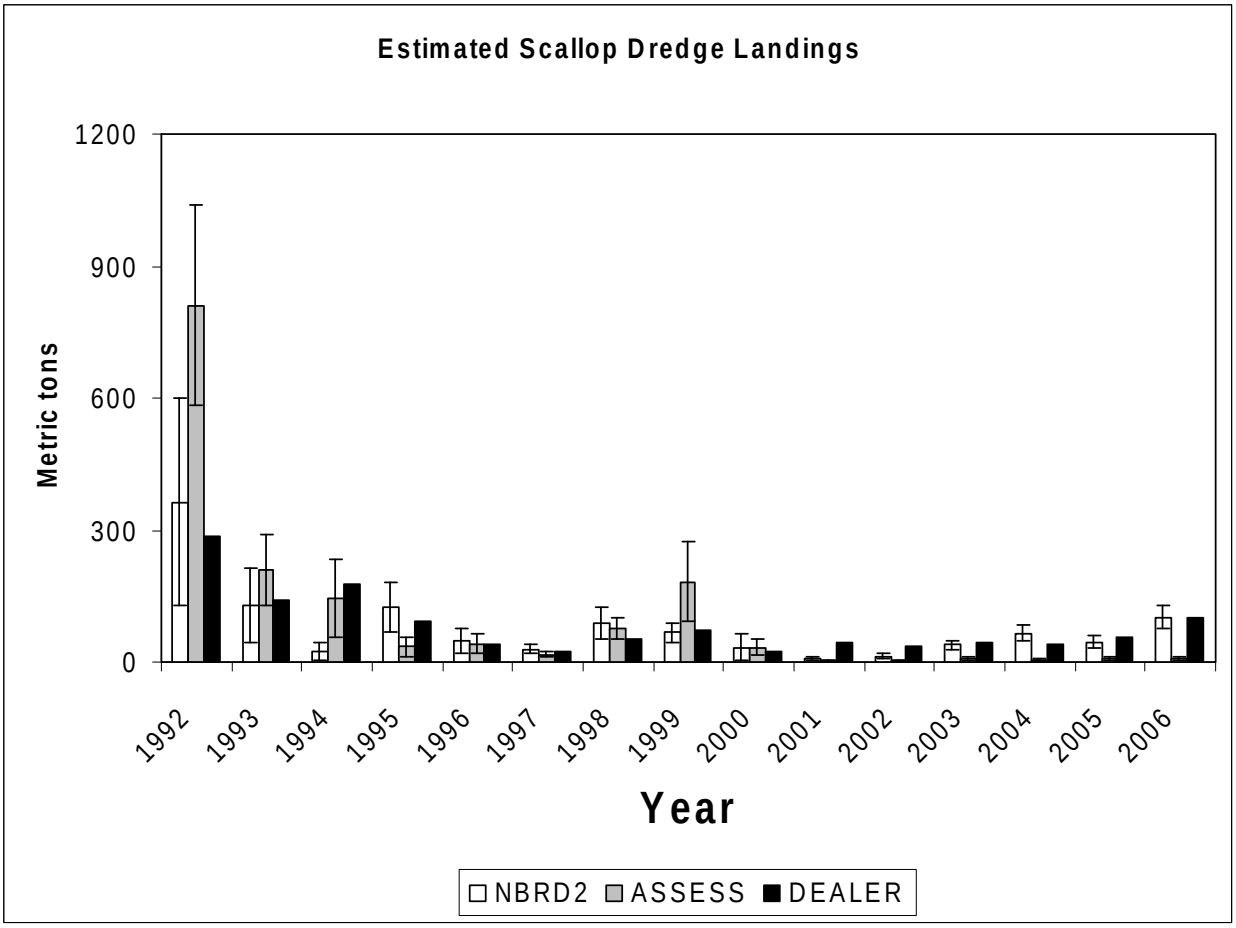
Estimated Scallop Dredge Landings
1200
900
600
300
0
Metric tons
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
NBRD2
ASSESS
DEALER

Figure 4.

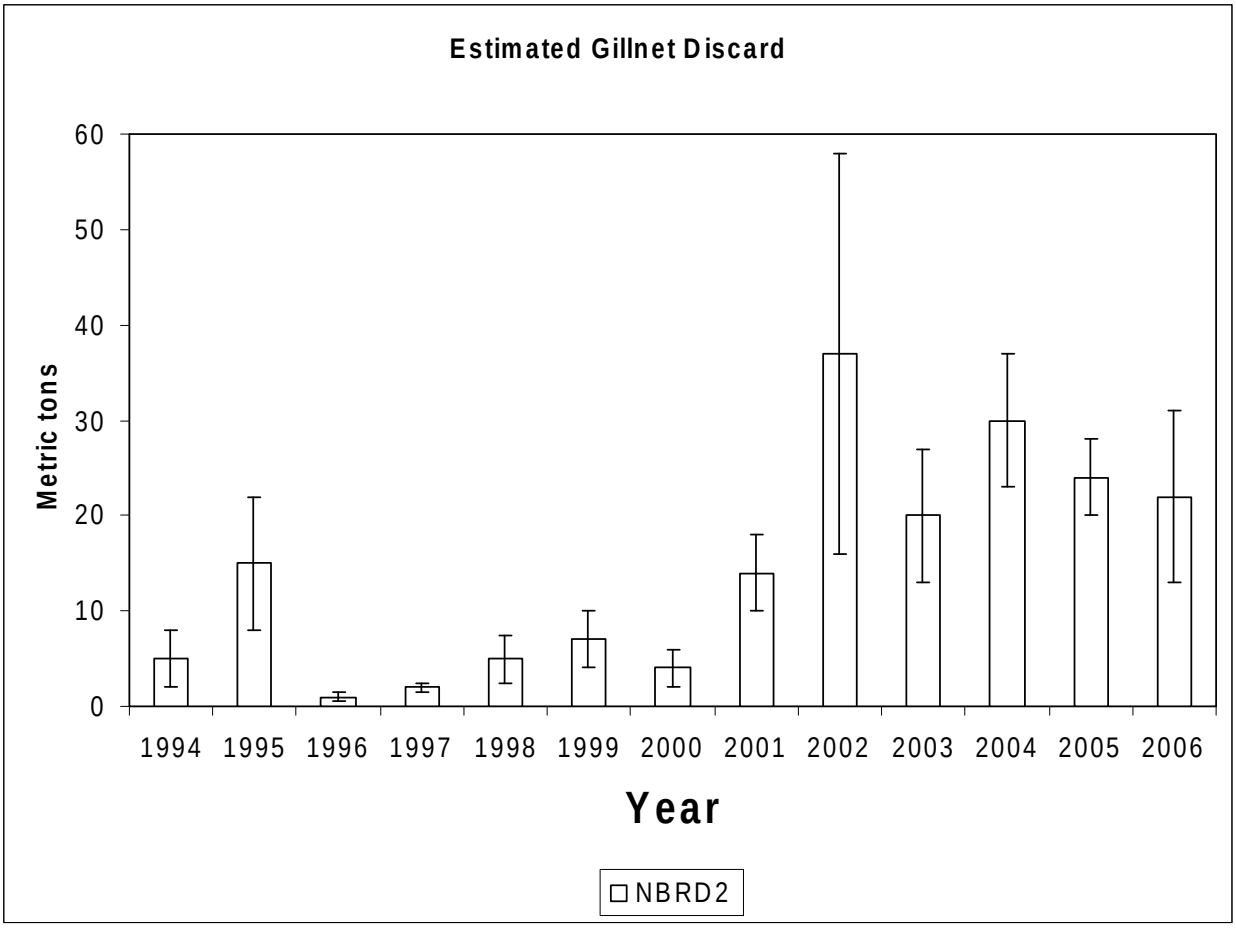
Estimated Gillnet Discard
Metric tons
60
50
40
30
20
10
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
NBRD2

Figure 5

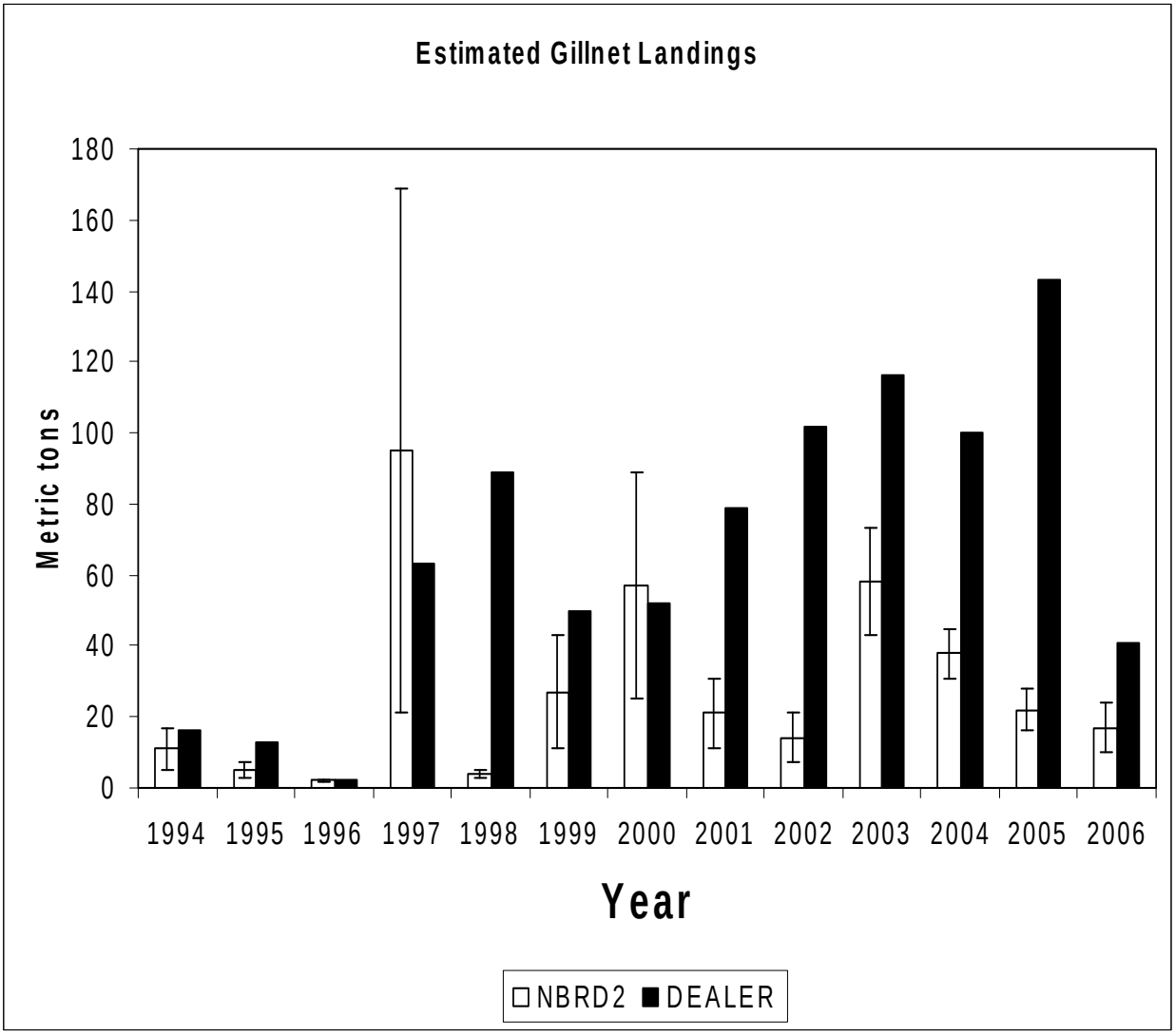
Estimated Gillnet Landings
Metric tons
180
160
140
120
100
80
60
40
20
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
NBRD2
DEALER

Figure 6.

SAW 47 Working Paper 2 (TOR 1) – Commercial Discard Mortality

WORKING PAPER:

DISCARD MORTALITY OF SUMMER FLOUNDER IN THE INSHORE TRAWL FISHERY

Emerson Hasbrouck
Tara Froehlich
Kristin Gerbino
John Scotti
Marine Program
Cornell University Cooperative Extension

Eric N. Powell
Eleanor Bochenek
Jason Morson

Haskin Shellfish Research Laboratory
Rutgers University

SUMMARY

In 2007, Cornell University Cooperative Extension received a RSA grant to determine the discard mortality in the inshore summer flounder trawl fishery. Fieldwork was carried out successfully from May through October 2007 off Long Island, New York. Ten scientific trips were made on commercial draggers working the traditional mixed trawl fishery. A goal of the project was to determine discard mortality relative to tow duration, fish size, and the amount of time fish were on the deck of the vessel. Tows of 1, 2 and 3 hours in duration were conducted. Fish were culled both immediately (from 0-10 minutes on deck) and after being held on deck for a delayed period of time (25-35 minutes on deck). Approximately 20 live fish were removed from the immediate and delayed culls upon haul-back of each tow. These live fish were weighed, tagged, and graded by condition before being transferred to a flow through seawater holding system where they were held on deck for the duration of the trip. The total catch of fluke was weighed and sorted between live and dead at consistent intervals of time to determine the effect of culling for a long as it took to clear the deck. Other variables were examined including total catch weight, species composition of total catch, fish condition factors, gear size, water temperature and air temperature. Upon arrival at the dock, live fish were transferred to a dockside net pen holding system and monitored for mortality over a 14-day period. Discard mortality rates were calculated based on the live/dead fraction of fish sorted on deck as well as the mortality rate of the live fish held in the monitoring net pen system over a 14 day period. Mortality rates were calculated by tow duration, cull time and overall. Mortality rates for the one and two hour tows were less than for the three hour tow. Mortality rates for the immediate cull

and delayed cull were similar. Overall median mortality was similar to the value assumed in recent summer flounder assessments.

METHODS

The research design of this study was dictated by the specific proposal requirements, i.e. to conduct ten one-day fishing trips incorporating different gear types, and areas fished, reflective of the inshore mixed trawl fishery. The selection of gear, fishing area, target species was left to the participating commercial fisherman to determine in consultation with CCE. This was done with the hope of not skewing the results in any one given direction, by letting the natural conditions dictate the project activity to reflect a more realistic picture of the existing inshore trawl fishery including summer flounder. Ten research trips were completed and have met the design criteria outlined in the proposal. Each trip consisted of a one, two and three hour tow, with an immediate and delayed cull for each specific tow. A specific culling procedure was adopted, so as to maintain random sampling protocol. The following time line was used after haul back:

- 0-10 minutes (immediate cull) – collection of 20 live fish for cages plus sorting of live and dead fish from one half of the pile.
- 10-25 minutes – sorting of live and dead fish only.
- 25-35 minutes (delayed cull) – collection of 20 live fish for cages plus sorting of live and dead fish from second half of the pile.
- 35-50 minutes – sorting of live and dead fish only.

Processing the catch continued until all summer flounder were sorted by live or dead in 15 minute increments of time until all fish were sorted. In addition, all other species in each tow were recorded. For each of the three tows conducted, forty live fish randomly selected were tagged, weighed, measured and rated as to condition utilizing a scale of excellent, good, poor with specific trawl damage noted.

The live fish selected for the mortality monitoring component of the project were held during the trip in an on board holding system. Twenty live fish were selected from each cull time for each tow duration. 120 total live fish were held for each trip. The on board holding system and plan adopted was similar to that used in the commercial fishery for holding and transport of live fish. Two 35 cubic foot, 268 gallon capacity Bonar insulated holding containers were used in addition to 22 holding cages constructed of plastic coated wire. The live fish were placed in the cages, and the cages were stacked in the Bonar containers filled with seawater. Each Bonar container held up to eight cages, with each cage typically holding ten fish. This system allowed for optimum holding and transport of the fish. The cages kept the fish from sloshing in the containers, kept the weight of fish off of each other and allowed for maximum water flow around each individual fish.

Two (2) twelve volt battery operated aerator compressor systems utilizing four large capacity air stones per container were used to aerate the holding system. This method has proven to be very effective in terms of maintaining fish condition and was very practical for fish handling purposes. The on board holding system was continually monitored for water temperature and dissolved oxygen levels during each trip. Surface and bottom temperatures and dissolved oxygen were also monitored in the targeted fishing areas and correlated with the temperatures and oxygen levels in the on board holding system.

The ability to safely hold and monitor all study fish was necessary to fully measure summer flounder trawl discard mortality. Through consultation with aquaculture specialists, commercial fishermen and gear specialist we were able to design, construct and install a 15' diameter by 15' deep pentagon shaped net pen attached to a stake system incorporating a pulley rope system which allowed the raising and lowering of the net pen similar to a pound net installation. This design allowed easy access to stock and the ability to monitor and finally release study fish with minimum impact. The net pen was installed next to the Inlet Seafood Dock at Montauk. The location was adjacent to the Montauk Harbor Inlet and provided excellent water quality and good flushing and exchange with Block Island Sound.

At the end of each of the scheduled discard mortality harvest trips all fish held live in the on-board live holding system from each tow and cull, were transferred to the dockside net pen holding system. They were held in the net pen system for 14 days to monitor mortality. Scuba certified staff conducted net pen monitoring on days 1, 2, 3 and then every other day during the 14 day holding period. Information collected included dead fish vitals, fish tag numbers, surface and bottom water temperature/ DO levels. Scales and otoliths were also collected from dead fish.

On day 14 the net pen was lifted and all remaining fish including live fish, dead fish and control fish, were removed from the net pen. Tag information and fish condition index were recorded for all fish. All live control and experimental fish were released in adjacent waters. The net pen was then re-set and prepared to receive a new set of control fish as well as the new set of experimental fish being harvested on board the mortality harvest trip. We utilized two CCE crews on each day that we had a scheduled harvest trip (every 14 days). One crew went out on the trawler and performed all scientific components associated with the collection and harvest of fish. The other crew was the net pen shore side crew and took care of all scientific components related to: collecting and releasing fish from the net pen after their 14 day study; accepting and processing new control fish; transferring the new set of experimental fish into the net pen when the harvest vessel and crew returned to the dock at the end of the day. This two crew procedure provided for efficiency of the overall process and allowed us to stick to a schedule of a new harvest trip every 14 days in order to accomplish the number of trips needed before the end of October. Also, local baymen were hired to lift and re-set the net pen on each release day.

RESULTS

We calculated the cumulative mortality for each tow on trips 3-10 using the mortality on board and estimating the number of live fish culled that would have died using the 14-day survivorship observed in the dockside holding/monitoring pen. First, for each trip, tow, and cull time we calculated a weight for dead fish in the pen that was corrected for the mortality rate of control fish in the pen, $\hat{w}t_d$:

$$\hat{w}t_d = w_d - [(1 - surv_c)(w_d + w_l)] \qquad (1)$$

where w_d is the weight of dead fish in the pen, $surv_c$ is the fraction of control fish living after 14 days in the pen, and w_l is the weight of live fish released from the pen after 14 days.

The survivorship of live fish in the pen, SP, was determined as:

$$SP = wt_l / (wt_l + \hat{w} t_d) \quad (2)$$

The survivorships from equation (2) were used to calculate the ratio of survivorship between the immediate and delayed cull times, ΔS:

$$\Delta S = SP_{\tau=D} / SP_{\tau=I} \quad (3)$$

where $SP_{\tau=D}$ is the survivorship of fish in the pen at the delayed cull time and $SP_{\tau=I}$ is the survivorship of fish in the pen at immediate cull time.

We calculated the elapsed time between the immediate and delayed cull times, t as:

$$t = [(t_e - t_s)/2 + t_s]_{\tau=D} - [(t_e - t_s)/2 + t_s]_{\tau=I} \quad (4)$$

where t_e is the end of the time interval in question, from the time the net was brought onboard, and t_s is the start of the time interval in question, both in cumulative minutes.

The change in the survival fraction, ΔS, between the two cull times is converted to a rate, fm, that can be used to estimate the change from any other cull time, under the assumption that the rate is linear with time:

$$fm = (-\ln(\Delta S)) / t \quad (5)$$

Thus, to calculate the amount of surviving summer flounder, we apply this rate to each 10-15 minute cull period, using equation (4) to determine the elapsed time. Then, the estimated fish surviving, EL, is:

$$EL = \sum_{i=1}^{n} (L_{up} + L_p) e^{-fm \times t} \quad (6)$$

where L_{up} is the weight of live fish that were not placed into the pen and L_p is the weight of the live fish that were placed into the pen.

The estimated weight of dead fish for each tow, ED, is then:

$$ED = wt_c - EL \quad (7)$$

where wt_c is the total catch weight for all summer flounder.

Finally, the % mortality for the tow can be calculated as:

$$\%Mortality = ED/(ED + EL) \quad (8)$$

The discard mortality for each tow length duration, as well as for all tow durations combined, is shown in Table 1. These mortality rates are for the entire summer flounder catch for each tow duration and reflect the total mortality for each tow from the time the fish were dumped on deck until the deck is cleared. The median mortality for all tows combined at 78.7% is 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. Also the mean and median mortality rates for the one hour and two hour tows are considerably less than the currently estimated 80% mortality. In order to use a mortality rate representative of the overall inshore fishery for summer flounder, tow length parameters of the fishery should be evaluated. Observer data and VTR data should be analyzed for average tow time across the fishery. Our calculated mortality rate for the tow duration that is most representative of the Observer/VTR data could then be used in the assessment.

An *a posteriori* least squares means test on tow time shows that mortality was greater in 3-hour tows than 2-hour tows and greater in 2-hour tows than 1-hour tows. Additionally, 1-hour tows and 3-hour tows were significantly different from each other ($p = .0044$).

The calculated mortality by tow duration and cull time is shown in Table 2. All of these values are considerably different, for both the mean and median, from the currently used 80% rate and exhibit a considerable range. Interestingly there is not much difference between the overall mortality rate for all tows combined at the immediate cull and at the delayed cull.

Table 1. Mean, standard deviation in parentheses, median, 25th to 75th percentiles for the percent mortality by tow time and overall.

% MORTALITY	MEAN	MEDIAN	25TH-75TH PERCENTILE
TOW 1	**57.8(35.5)**	**63.9**	**27.7-96.0**
TOW 2	**61.4(31.4)**	**63.3**	**32.7-89.1**
TOW 3	**76.6(29.5)**	**86.9**	**60.0-98.0**
ALL	**64.6(32.2)**	**78.7**	**31.0-96.0**

Table 2. Mean, standard deviation in parentheses, median, 25th to 75th percentiles for the percent mortality by tow time, cull time, and overall. I=initial cull. D=delayed cull.

% MORTALITY	MEAN	MEDIAN	25TH-75TH PERCENTILE
TOW 1 I	**44.9(39.2)**	**34.6**	**9.0-96.0**
TOW 1 D	**44.3(41.7)**	**31.8**	**1.6-87.3**
TOW 2 I	**47.8(36.1)**	**48.5**	**11.2-78.4**
TOW 2 D	**68.4(28.9)**	**68.5**	**43.2-97.8**
TOW 3 I	**62.7(36.7)**	**68.8**	**32.1-97.0**
TOW 3 D	**68.5(27.7)**	**63.8**	**45.6-97.4**
ALL I	**51.3(36.8)**	**50.1**	**12.5-96.0**
ALL D	**59.2(34.9)**	**59.4**	**32.6-95.6**

APPENDIX 2

SAW 47 Working Paper 3 (TOR 2a) – Integrating Indices

May 9, 2007

Some approaches to the integration of survey abundance indices used in VPA calibration

by

Mark Terceiro
NOAA Fisheries NEFSC
166 Water Street
Woods Hole, MA 02563
1-508-495-2203 (Phone)
1-508-495-2393 (Fax)
Mark.Terceiro@noaa.gov

Keywords: abundance indices, virtual population analysis, general linear models, summer flounder

ABSTRACT

Northeast United States fish stock assessments typically incorporate multiple abundance indices at age from several state and federal research survey programs. Peer reviews of these assessments have recommended investigation of methods to better integrate trends in abundance provided by survey indices, prior to their use in population model calibration. Exercises were performed to explore different approaches to the integration of survey indices for use in virtual population analysis calibration. General linear modeling of integrated indices of abundance provides a useful summarization of mean survey trends. However, an 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. The greatest potential utility for the integrated index approach is in simple index-based assessments.

INTRODUCTION

Many of the Northeast United States fish stock assessments conducted by Northeast Regional (NER) Stock Assessment Workshop (SAW) Working Groups and Atlantic States Marine Fisheries Commission (ASMFC) Technical Committees incorporate abundance indices from several state and federal agency research survey programs. Typically, these indices of abundance are provided to the assessment process as annual or seasonal indices at age. Use of

these indices ranges from: a) isolated consideration in single-index based assessments (i.e., as measures of stock abundance in relation to an index based reference point; e.g., for scup, black sea bass, and the skate stocks); b) use of single indices in calibrated analyses (e.g., lobster in a Collie-Sissenwine model); and c) use of many indices from many surveys for a range of age classes in complex age-structured calibrated analyses (e.g., striped bass, bluefish, summer flounder, and winter flounder assessments).

Evaluation of the utility of indices for inclusion in complex models using many survey indcies has typically been accomplished by looking for common trends in abundance (i.e., signal) through: a) examination of time series plots; b) analysis of correlation (of lack thereof) between survey indices and between survey indices and population dynamics model results; c) outlier analysis; and d) consideration of the trend and magnitude of residuals (i.e., noise) when indices are included in population dynamics models. Multiple analyses with different sets of indices are often conducted to examine the sensitivity of results to inclusion of a given index series to determine the best analysis configuration to characterize stock status. Alternatively, all available abundance indices may be included in an analysis with the results most strongly influenced by those indices that statistically fit best within the analytical framework. Even given these approaches, with 50 or more indices of abundance at age to consider for inclusion in a complex age structured assessment, it can be difficult to discern general trends in abundance from the battery of available indices. The decision to include a given index time series at age can therefore often be subjective, based on a loose set of decision rules that may vary from one assessment to another.

Recent NER SAW peer reviews have recommended the investigation of methods to better integrate trends in stock abundance inferred from survey indices of abundance, prior to the inclusion of such indices in a population model calibration. For example, in the development of the NER index-based assessments for monkfish (NEFSC 1997), scup (NEFSC 1998) and skates (NEFSC 2000), extensive discussions occurred about which survey time series (i.e., NEFSC Spring or Fall) would best serve as the basis for biological reference points and the evaluation of stock status. A recent review of the NER summer flounder assessment (NEFSC 2002) included the following discussion:

- The SARC discussed the procedure for selecting survey indices used in the summer flounder VPA. The use of state surveys, which cover only a small component of the stock, was questioned. It was noted that YOY surveys may be variable due to the low numbers of fish caught per tow. The SARC requested that the standard error also be shown with the survey indices in the future. Whether differences in state surveys truly measure different trends in different components of the stock or whether differences are simply due to variation among survey was questioned.

and research recommendations:

- Explore the possibility of weighting survey indices used in VPA calibration by the areal coverage (i.e., in square kilometers) of the respective seasonal surveys.
- Evaluate trends in the regional components of the NEFSC surveys and contrast with the state surveys that potentially index components of the stock.@

A recent review of the NER black sea bass stock assessment (NEFSC 2004) also called for improved integration of survey indices to aid in the interpretation of stock abundance trends. That review recommended:

- More comprehensive evaluation of regional survey data is required to give more integrated indices of recruitment. For example, catch rates of recruits can be modeled as a function of location, time of year, and gear type in the surveys, to provide standardized indices, and
- Attempts should be made to extract as much information as possible from all time series considered using, for example, a GLM or GAM approach to combine the various surveys and gear types into a standardized index.

In a recent review of the NER bluefish stock assessment, the review panel (NEFSC 2004) recommended:

- There is a need for an integrated analysis of the many different research surveys for juvenile bluefish. The surveys cover different regions using different gear types and provide data on 0- and 1- group bluefish. It is recommended that serious consideration be given to... methods for standardizing and combining data from small scale intensive surveys with large scale less spatially intensive surveys, to give improved indices of recruitment.

Finally, another review of the NER summer flounder assessment (NEFSC 2005) recommended:

- Develop integrated survey indices by: combining the three NEFSC research trawl indices into a single annual abundance index, and combining state-run survey indices into a single annual abundance index.

In assessments like those for NER stocks of striped bass, bluefish, summer flounder, and winter flounder, the recommendations for development of integrated indices stem, in part, from the realization that the state agency survey data 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 suggest that a method to statistically summarize and/or appropriately weight indices which are considered *a priori* to not 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 integration of survey indices collected by different research sampling programs can be viewed as analogous to the standardization analysis of commercial fishing vessel rates in developing fishery-dependent indices of abundance. Viewed in that light, a General Linear Model framework (GLM; SAS Institute 1999) can be used in which deviations from the mean trend are modeled by defining various classification variables which are thought to account for the deviations. This general approach has been used in several NAFO groundfish stock assessments to integrate multiple fishery-independent survey indices of recruitment (e.g., Healey et al. 2001 and subsequent Greenland halibut assessments, and Stansbury et al. 2001 and subsequent Grand Banks cod assessments). In the current study, four exercises were constructed

to explore and illustrate different approaches to the integration of indices of abundance in VPA calibrations of NER assessments.

MATERIALS AND METHODS

Exercise 1: simple, simulated survey data

As GLM modeling results can be strongly influenced by the assumed nature of the underlying error structure of the data (Terceiro 2003), the first step was to determine the appropriate error assumption to apply to research survey data. The statistical characteristics of *positive* catch data for summer flounder (*Paralichthys dentatus*) from the NEFSC Winter Trawl Survey for 1992, 1998, and 2004 were examined. Compiled on a total catch (numbers per tow) basis, the summer flounder data appear to resemble a Poisson or negative binomial distribution, although the majority of the catches (closest to the origin of the plots) reasonably approximate a lognormal distribution (Figure 1). A K-S test indicated that any of these distributions might be appropriate, with slightly better fit indicated for the Poisson (slightly smaller deviations from the expected). Terceiro (2003) indicated that inclusion of zero catch events (trips or tows) in such distributions increases the likelihood that the Negative binomial distribution will fit best. Most of the analytical models currently used in Northeast U.S. stock assessments, however, assume a normal or lognormal error structure, due mainly to variance estimation considerations.

The next step was to illustrate how Acombining indices into an integrated index@ should workgiven simulated survey data with known statistical characteristics and patterns. To this end, survey catch per tow data were simulated for 15 years and 2 seasons, with means ranging from 8 to 100 fish per tow and corresponding Coefficients of Variation (CVs) of 150% (standard errors ranging from 12 to 150), under a Poisson error distribution assumption. One hundred catch per tow values were randomly simulated for each year/season combination, for a total of 15 years * 2 seasons * 100 tows = 3,000 total tows. The annual sequence of the seasonal abundance indices was ordered to provide a time series pattern of a period of high abundance followed by a steady decline, followed by a relatively rapid increase, and then a short term decline. This exercise provided two realistic seasonal time series of survey abundance indices with: a) known statistical properties; b) slightly different annual rank orders; and c) generated a significant correlation (r = 0.7) between the series comparable to that between the actual NEFSC Winter and Spring survey 1992-2005 time series for summer flounder (r = 0.66; NEFSC 2005).

The 3,000 simulated individual tows were used an input to a GLM model with year of sampling and survey season as the main effects classification variables. The goal was to derive an Aintegrated abundance index@ from the two independent survey series - i.e., the GLM reproduction of the simple mean of two independent series with known characteristics. Models were run under lognormal, Poisson (true), and Negative binomial error assumptions. Normalized, retransformed year effect model coefficients served as the annual indices of abundance. This exercise was intended to demonstrate that if the assumption about the error distribution is correct, the GLM model should exactly extract the simple mean of two known series - i.e., a simple form of an Aintegrated@ survey index.

Exercise 2: Simulation of integrated indices at age

This simulation extended Exercise 1 to create integrated age-based indices, as might be used in an age-structured population model calibration (e.g., a VPA). Exercise 2 also explored the issue of weighting indices by the geographical coverage of individual surveys, as recommended by peer reviews of the NER stock assessments (see the Introduction). The intent was to simulate the averaging of multiple, individual survey indices at age into single, integrated indices of abundance, and compare the performance of four different index treatments in VPA calibration.

Three substock populations were simulated using NFT Popsim (NFT 2005a). The substocks were simulated with common biological and fishery characteristics (e.g., partial recruitment to the fishery and magnitude and time series patterns of fishing and natural mortality), but with different initial proportions of the additive, total stock numbers in Year 1 at ages 0 (recruits) through age 6. The magnitude of the correlation between the three simulated indices (ranging from 0.3 to 0.4, or borderline significance at the alpha = 10% level for degrees of freedom of about 20 observations; Rohlf 1981) and between the three simulated indices and the true substock sizes (ranging from 0.5 to 0.7) was made comparable to that observed in recent summer flounder assessments (NEFSC 2005, Terceiro 2006) so as to lend realism to the simulation. In actual assessments, indices with a poorer correlation than these are generally excluded from the VPA calibrations in preliminary screening work (NEFSC 2005, Terceiro 2006). Error was incorporated into the catchability coefficient (q) of each of the three simulated substock abundance indices at recruiting age 0 for the 21 years (random error with CV = 100%, 100%, and 150%) to ensure a realistic degree of deviation from the True Total Stock (TTS) sizes. The catch from each substock was simulated without error, to isolate the effects in the VPA calibration caused solely by the treatment of the age 0 indices. The percentages that each substock accounted for of the TTS numbers was set at 50%, 40%, and 10%. The simulated catch and population numbers were summed to provide the TTS catch and population numbers.

To create an integrated index for use in the four VPA calibration treatments, the three 21 year time series of simulated age 0 indices were averaged to single integrated age 0 index series within GLM models. Both simple (unweighted) and stratified (area-weighted) integrated indices were compiled. This step was intended to reconfirm the conclusion of exercise 1, but on a index-at-age basis: to establish that the GLM can exactly extract the means, simple or stratified, of multiple input time series of indices of abundance to create an integrated index of age 0 abundance. The areal coverages of the respective surveys were set at (63%, 31%, and 6%) [different from the TTS percentages in numbers (50%, 40%, and 10%)] to explore the impact of such differences (i.e., what if the assumption that survey area coverage = percentage of total stock is wrong?) on integrated index modeling and VPA calibration.

In the final step of Exercise 2, the use of the four index treatments was explored in an ADAPT VPA (NFT 2005b) calibration for the TTS catch at age and the differences summarized. The normalized versions of all indices (each value divided by its= time series mean) were used to remove scale effects prior to calibration. Only the age 0 index treatments were used as VPA calibration indices. Stock sizes for ages 1-6 were calculated using the known, input fishing mortality rates and a partial recruitment vector. Both deterministic (one-time run) and stochastic (1000 bootstrap iterations of the age 0 index calibration residuals) VPA calibrations were explored.

The four age 0 index treatments were:

1) three age 0 substock indices, simple (unweighted)
2) three age 0 substock indices, stratified (area weighted in the VPA calibration)
3) one GLM integrated age 0 index, simple (unweighted)
4) one GLM integrated age 0 index, stratified (area weighted in the GLM)

Exercise 3: Real data GLM integrated indices of abundance at age

In Exercise 3, the GLM approach was used with actual research survey data to calculate integrated indices of abundance at age for use in 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. As previously noted in the Introduction, the analytical approach is analogous to a GLM standardization analysis of commercial fishing vessel catch per unit effort data: 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. 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 provides average, or integrated, annual indices of abundance at age.

Examination of the observed distribution of the normalized summer flounder age 0 survey indices suggested that the indices were best characterized by either a lognormal or Poisson/Negative binomial distribution. The standard error of the indices is slightly less than the mean (mean = 1.0, standard error = 0.8, skew = 2.8), with a single data point accounting for the high skewness. K-S tests indicated that the Poisson and negative binomial expected distributions were the same, and slightly better than the expected lognormal distribution in fitting the observed mean and variance. Visual differences (observed minus expected) were similar for the three expected distributions. Since the indices were to be lognormal-transformed in the ADAPT VPA calibration (NFT 2005b), and the age 0 indices represent the largest group of indices with the greatest absolute value range (and hence provide the best age for which to reliably examine statistical properties), it was concluded that GLM modeling under a lognormal error distribution would be reasonable for all ages in this exercise.

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 0 input to the VPA calibration in place of the twelve original survey series. The input GLM age 0 vector was called GLM_YOY. The corresponding VPA run using this vector was called VPA_GLM0. In VPA_GLM0, for example, all of the original indices for all the other ages (1, 2, 3, 4, and 5-7+) were retained so that the effect of using the GLM_YOY vector could be isolated. The pattern was repeated as GLM vectors (GLM_1, GLM_2...GLM_5:7) for the other ages tested. A run using only the GLM vectors at age

(VPA_GLM) was also constructed. Results from these seven GLM integrated index run configurations were compared to the trends in stock size at age provided by the VPA calibration run (F04_ALL) using the original, full suite of indices at age.

Exercise 4: Real data GLM integrated indices at age, NEFSC vs. State

The 2005 SARC 41 Panel review of the NER summer flounder assessment (NEFSC 2005) recommended the development of integrated survey indices by combining the various seasonal NEFSC research trawl survey series indices at age into single annual abundance indices at age (e.g., NEFSC age 0 index, age 1 index, etc.), and likewise combining the state survey indices into a single annual abundance indices at age. In Exercise 4, the GLM approach was used with the same data as in Exercise 3 to construct integrated indices at age from the three seasonal NEFSC surveys (winter, spring and fall) and from the state surveys (MA, RI, CT, NJ, MD, VA, NC), for a total of twelve GLM integrated indices at age (NEFSC ages 0-5:7+; State ages 0-5:7+). Considering the series in this manner resulted in more inconsistent data in terms of the length of the series, and more frequent occurrence of >zero@ observations. Therefore, the resulting GLM integrated ANEFSC@ and AState@ indices exhibit a greater number of missing observations for some year and age combinations than did the six GLM integrated indices at age for all surveys combined constructed in Exercise 3. Given the extent of Exercise 3, comparisons in Exercise 4 were limited to a VPA calibration using the 12 GLM integrated indices (VPA_NEC_ST) and the VPA calibration (F04_ALL) using the original suite of indices at age.

RESULTS

Exercise 1: simple, simulated survey data

Table 1 shows the time series of annual means of the two simulated seasonal survey indices, the combined annual means of the two simulated series, and retransformed GLM year effect coefficients (annual indices of abundance) under lognormal, Poisson, and negative binomial error assumptions. As the two seasonal series were simulated with Poisson error, the expected result was that the retransformed Poisson coefficients would exactly match the combined mean of the two input series, while the lognormal and negative binomial results would differ slightly. For ease of comparison, all results were rescaled to the means of the respective series in the bottom of Table 1. The results demonstrate that if the error distribution is correctly specified, the GLM model can exactly reproduce the combined mean of averaged survey series.

Exercise 2: Simulation of integrated indices at age

The Year 1 numbers at age of the three substock populations (SS1, SS2, SS3) simulated using NFT Popsim (NFT 2005a) are presented in Table 2. The catch and population numbers were summed to provide the true total stock (TTS) catch and population numbers. The panels in Figure 2 show the relationship between the simulated age 0 population sizes in the three substocks and the respective simulated age 0 survey indices over the 21 year time series. Figure 3 presents the trends in age 0 stock size, age 1-6+ stock size, and age 0-6+ catch in the simulated VPA used to explore the sensitivity of the VPA calibration to different treatments of the age 0 indices.

The simulated integrated indices of age 0 abundance using simple arithmetic averaging and GLM modeling are presented in the upper section of Table 3. As noted earlier, Astratified@ equates to area weighted; rescaled indices (divided by the time series means) are presented in the lower section of Table 3. The results re-confirm those of Exercise 1, that given the correctly specified error distribution, the GLM model can exactly reproduce the combined mean of averaged survey series.

VPA calibration results for the four treatments of the age 0 indices (VPA1 = simple mean, VPA2 = stratified mean, VPA3 = simple GLM, and VPA4 = stratified GLM) differ from the True Total Stock (TTS) and also from each other mainly in the Auncoverged@ part of the VPA in Years 14-21 (Table 4). Because the area weights intentionally did not match the true substock percentages, the stratified mean (VPA2) and stratified GLM (VPA4) treatments generated calibration results that deviated more (both on an aggregated deviation and mean deviation basis), and correlated less well (Pearson r) than the simple mean (VPA1) and simple GLM (VPA3) treatments. Since the area weight was highest for SV1 (63%), the weighted index treatments (VPA2 and VPA4) correlated best with the SV1 index, and poorest with SV2 and SV3, than the simple mean (VPA1) and simple GLM (VPA3) treatments. In this exercise, the smoothing effect of the simple GLM model of the indices produced VPA calibrated stock sizes that deviated from the TTS sizes slightly less, on both aggregate and mean bases, than the simple mean treatment (Table 4, Figure 4).

VPA bootstrap results were qualitatively similar to the one-time runs, and with the focus on the Year 21 age 0 stock size estimates, show how the incorrect assumption of survey area coverage as a proxy for stock size percentages can provide inaccurate results. As in the one-time runs, the simple (unweighted) VPA1 and VPA3 bootstrap estimates more closely match the TTS size for age 0 in Year 21 than the stratified (area weighted) VPA2 and VPA4 estimates (Table 5). The smoothing effect of the GLM on the integrated age 0 index in the VPA3 calibration produces a larger deviation from the TTS size than the simple three index VPA1 calibration. Finally, while the VPA2 estimate (54,107) is most precise (CV = 0.11; due to the good correlation of estimated stock sizes and the SV1 index), it deviates most from the TTS size (92,000).

Exercise 3: GLM using real indices of abundance at age

The results for the age 0 indices in exercise 3 are first provided in the upper left panel of Figure 5, where the pattern of age 0 stock sizes indicated by the GLM model estimated year effect vector (the integrated index at age 0, GLM_YOY) is compared with the estimates from the VPA (VPA0_GLM0) when this single, integrated age 0 index is used in place of the 12 original indices to calibrate age 0 stock size. The overall patterns are similar, with highest recruitment at the start of the series and a poor year class in 1988. The major difference is in the rank order of the 1982/1983 and 1985/1986 year classes. The upper left panel of Figure 6 compares estimates of age 0 stock size from VPA_GLM0 (using the integrated index for age 0, and the original indices for ages 1 and older) with the VPA using the original survey series for all ages (F04_ALL). In the two VPAs, the estimates of age 0 abundance are nearly identical. Exercise 3 results for ages 1, 2, 3, 4 and 5-7+ are provided in the successive panels of Figures 5-6. A VPA calibration was also conducted using only the GLM integrated indices (i.e., 6 index series at ages 0-5:7+), and these results are presented in Figure 7.

In general, the GLM integrated indices at age diverged somewhat from the VPA_GLM estimates, due to the smoothing effect of the GLM and possibly due to process error caused by mis-specification of the true error structure. However, the VPA_GLM and F04_ALL estimates are nearly the same for all ages, diverging only in the most recent 2-3 years in the unconverged part of the VPA. This last finding reflects the substantial influence on stock size estimates of the input catch at age data and the convergence properties of the VPA model. The F04_ALL VPA calibration is characterized by a substantial retrospective pattern, with F underestimated and stock size overestimated over the unconverged part of the analysis. The retrospective patterns for F, SSB, and recruitment at age 0 (R) are nearly identical for the VPA_GLM calibration, indicating no improvement in this characteristic of the analysis by using integrated indices of abundance (Figure 8).

Exercise 3 results suggest that using GLM integrated indices may increase the difficulty of interpreting the uncertainty of the VPA estimates. VPA calibrations based on a limited number of externally derived GLM integrated indices are likely to have less total absolute variance than calibrations with multiple sets of indices; an example is the difference in the Residual Sums of Squares (RSS) and Mean Squared Residual (MSR) between the F04_ALL and VPA_GLM runs. The VPA_GLM MSR is about one-third of the F04_ALL MSR, indicating an overall Abetter fitting@ model (Table 6). However, the number of potential calibration residuals in the VPA_GLM run is also much lower (130 versus 937 in the F04_ALL run), and so estimates of individual stock sizes, and subsequently derived quantities such as Average F and Biomass, are less precise (a Adegrees of freedom@ phenomenon). This is evident in both the deterministic Nonlinear Least Squares (NLLS) and Bootstrap (1000 iterations; BOOT) results for the F04_ALL and VPA_GLM runs (Table 6).

Exercise 4: GLM Integrated Indices, NEFSC vs. State

Figure 9 compares the GLM integrated indices at age derived from the NEFSC survey indices at age are compared with those derived from state survey indices at age. Consistency in trend and rank order between the NEC and ST indices at age is poorest for ages 0 and 1, and best for ages 3 and 4, but overall is very similar across all ages. The use of the twelve GLM integrated indices at age in a VPA calibration, the VPA_NEC_ST run, produced estimates of stock size at age that were generally slightly lower than the F04_ALL run in the unconverged (most recent) years of the analysis. As a result, the estimated total stock size is slightly lower for the VPA_NEC_ST run compared to the F04_ALL estimate, and correspondingly the average fishing mortality rate (F) is slightly higher (Figure 10). Finally, as with the Exercise 3 comparison, the total variance (RSS) for the integrated index VPA_NEC_ST run is smaller than for the F04_ALL run. However, the VPA_NEC_ST run Mean Squared Residual (MSR) is higher than the F04_ALL run, indicating a slightly poorer fit. As well, the VPA_NEC_ST run provided larger CVs on the estimated parameters, in both the deterministic (NLLS) and bootstrap (BOOT) runs (Table 7). The overall fit of the NEC integrated indices was similar to the ST integrated indices, with the NEC integrated indices accounting for 51.5% of the total variance in the fit and the ST integrated indices 48.5%. NEC integrated indices at age fit better (i.e., smaller partial variance) for ages 2, 4, and 5-7+; the ST indices fit better for ages 0, 1, and 3 (Figure 11).

CONCLUSIONS

The results of Exercises 1 and 2 suggest that use of a lognormal error distribution in constructing integrated indices in a GLM framework can introduce some degree of process (model) error to these indices because of mis-specification of the true error distribution of survey catch data. Future developments should consider alternative error distribution assumptions. Such alternative assumptions, or use of non-parametric approaches such as General Additive Modeling (GAM), would also permit the use of Azero@ observations in the calibration which are generally treated as missing observations in lognormal models.

The inclusion of auxiliary information (e.g., environmental data) in the GLM modeling could theoretically improve the accuracy and utility of integrated indices. If fine-scale auxiliary data are available and have predictive utility, integration of indices at the tow or stratum level could be easily accomplished. Further research should consider alternative modeling frameworks such as GAM or ordination approaches such as Principal Components Analysis (PCA) which could incorporate non-parametric assumptions and smoothing. Results of exercises using real summer flounder data 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.

A number of stock assessments in the Northeast United States rely on a single, seasonal time series of survey indices, selected from among several candidate series, as the sole means of evaluating the status of the stock with respect to an index-based reference point. For those situations, the construction of an integrated index of abundance from several different time series could provide a more robust approach to the evaluation of the status of a stock. Therefore, the greatest potential utility for the integrated index approach may be for simple index-based assessments.

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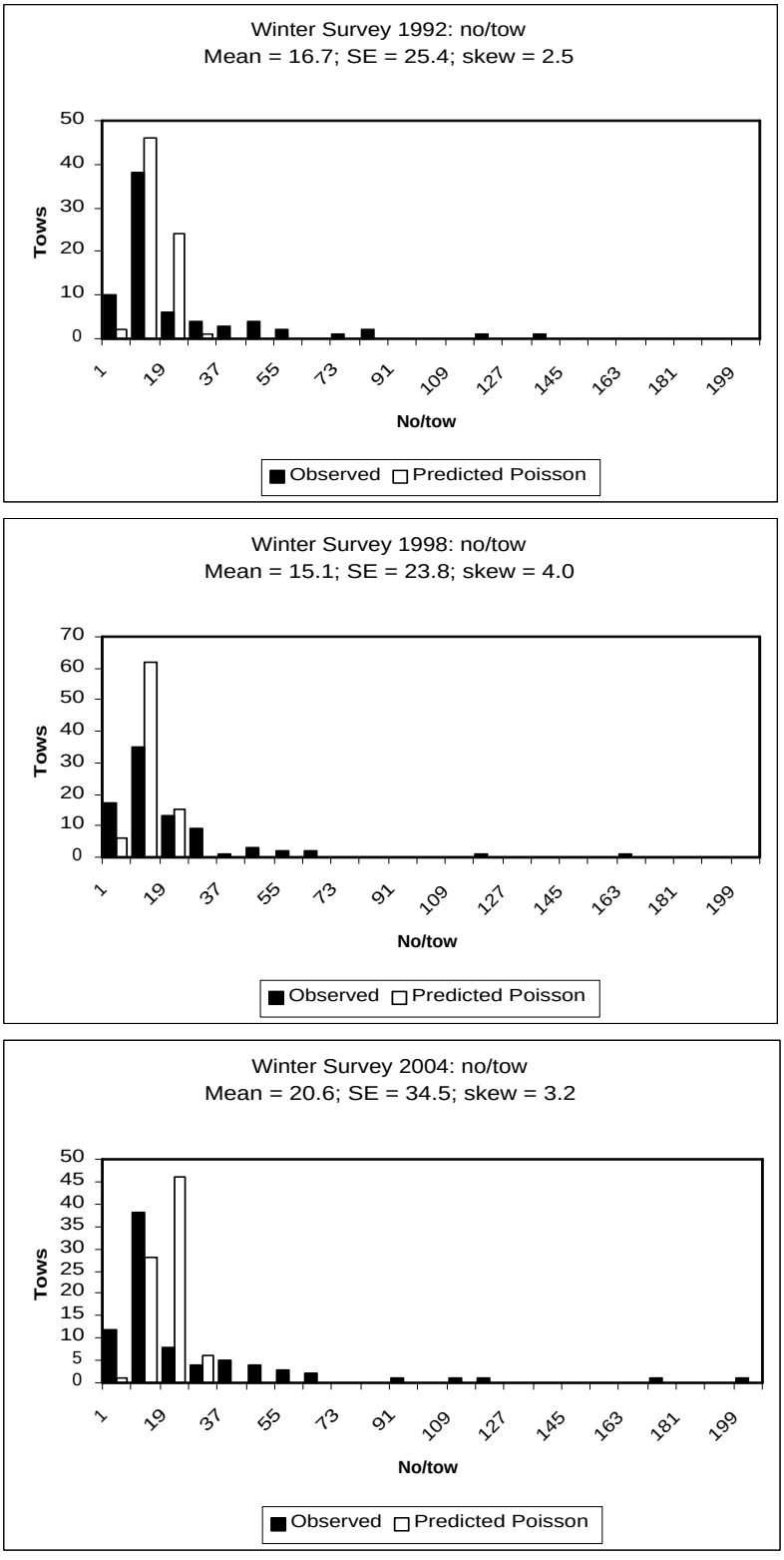
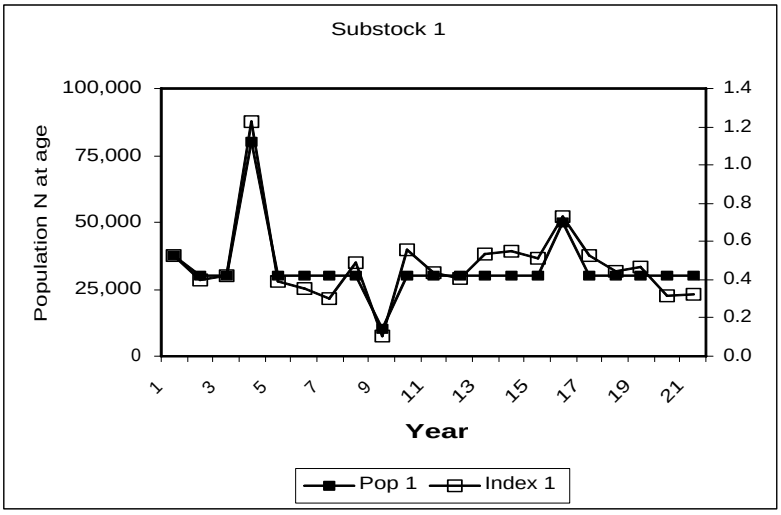
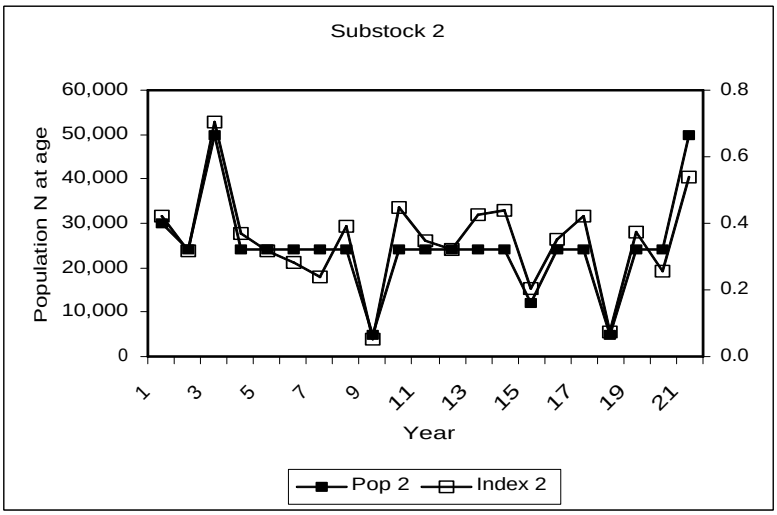

Winter Survey 1992: no/tow
Mean = 16.7; SE = 25.4; skew = 2.5
Tows
No/tow
Observed
Predicted Poisson
Winter Survey 1998: no/tow
Mean = 15.1; SE = 23.8; skew = 4.0
Tows
No/tow
Observed
Predicted Poisson
Winter Survey 2004: no/tow
Mean = 20.6; SE = 34.5; skew = 3.2
Tows
No/tow
Observed
Predicted Poisson

Figure 1


Substock 1
Population N at age
100,000
75,000
50,000
25,000
0
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1
3
5
7
9
11
13
15
17
19
21
Year
Pop 1
Index 1


Substock 2
Population N at age
60,000
50,000
40,000
30,000
20,000
10,000
0
0.8
0.6
0.4
0.2
0.0
1
3
5
7
9
11
13
15
17
19
21
Year
Pop 2
Index 2

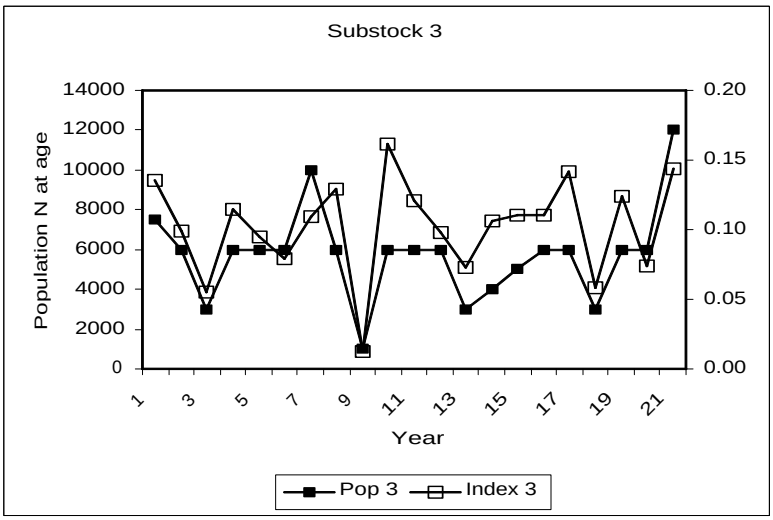
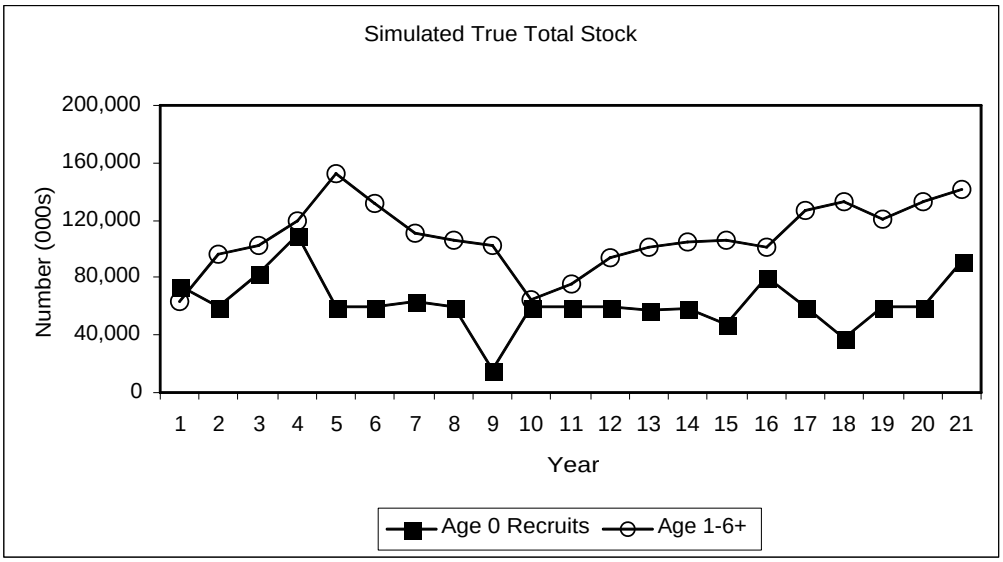

Substock 3
Population N at age
14000
12000
10000
8000
6000
4000
2000
0
0.20
0.15
0.10
0.05
0.00
1
3
5
7
9
11
13
15
17
19
21
Year
Pop 3
Index 3

Figure 2.


Simulated True Total Stock
200,000
160,000
120,000
80,000
40,000
0
Number (000s)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Year
Age 0 Recruits
Age 1-6+

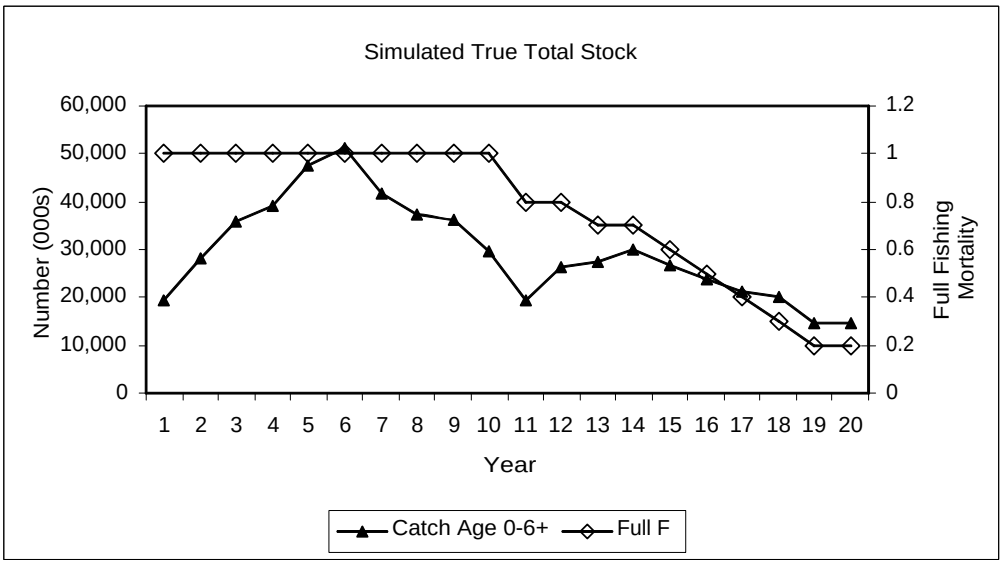

Simulated True Total Stock
60,000
50,000
40,000
30,000
20,000
10,000
0
Number (000s)
1.2
1
0.8
0.6
0.4
0.2
0
Full Fishing Mortality
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Year
Catch Age 0-6+
Full F

Figure 3.

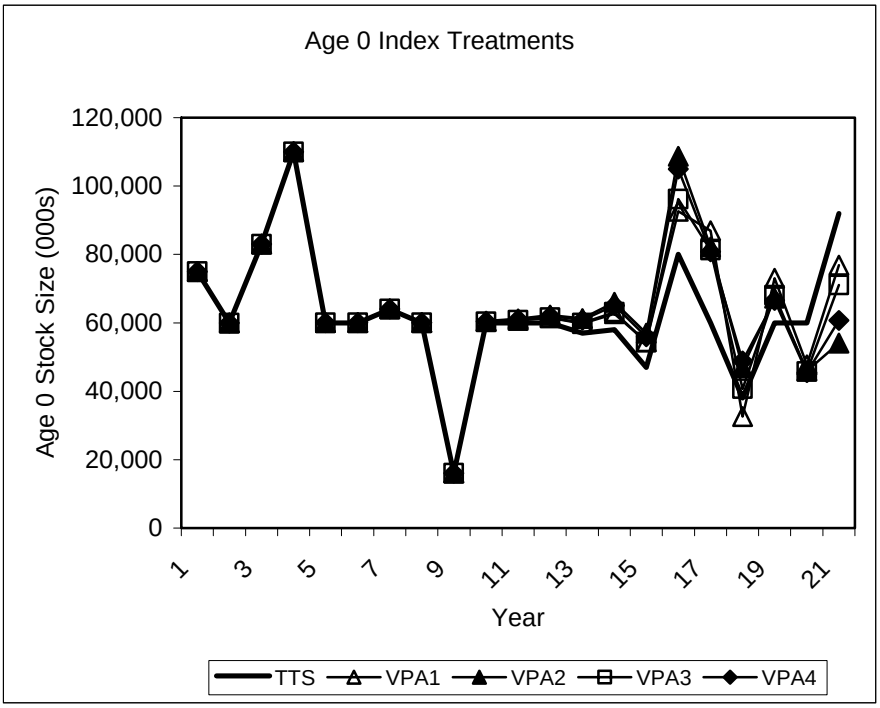

Age 0 Index Treatments
Age 0 Stock Size (000s)
120,000
100,000
80,000
60,000
40,000
20,000
0
1
3
5
7
9
11
13
15
17
19
21
Year
TTS
VPA1
VPA2
VPA3
VPA4

Figure 4.

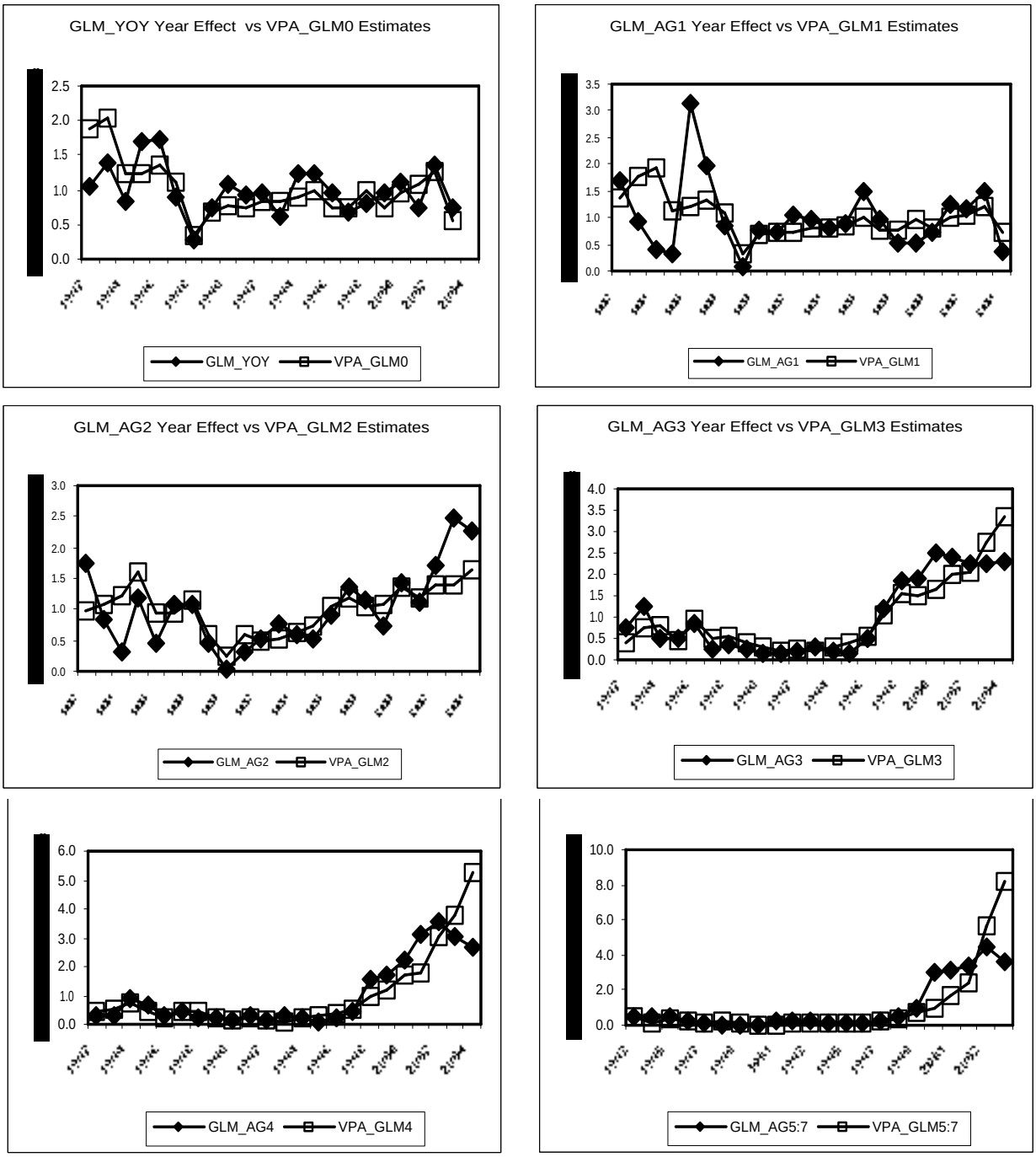

GLM_YOY Year Effect vs VPA_GLM0 Estimates
GLM_YOY
VPA_GLM0
GLM_AG1 Year Effect vs VPA_GLM1 Estimates
GLM_AG1
VPA_GLM1
GLM_AG2 Year Effect vs VPA_GLM2 Estimates
GLM_AG2
VPA_GLM2
GLM_AG3 Year Effect vs VPA_GLM3 Estimates
GLM_AG3
VPA_GLM3
GLM_AG4
VPA_GLM4
GLM_AG5:7
VPA_GLM5:7

Figure 5.

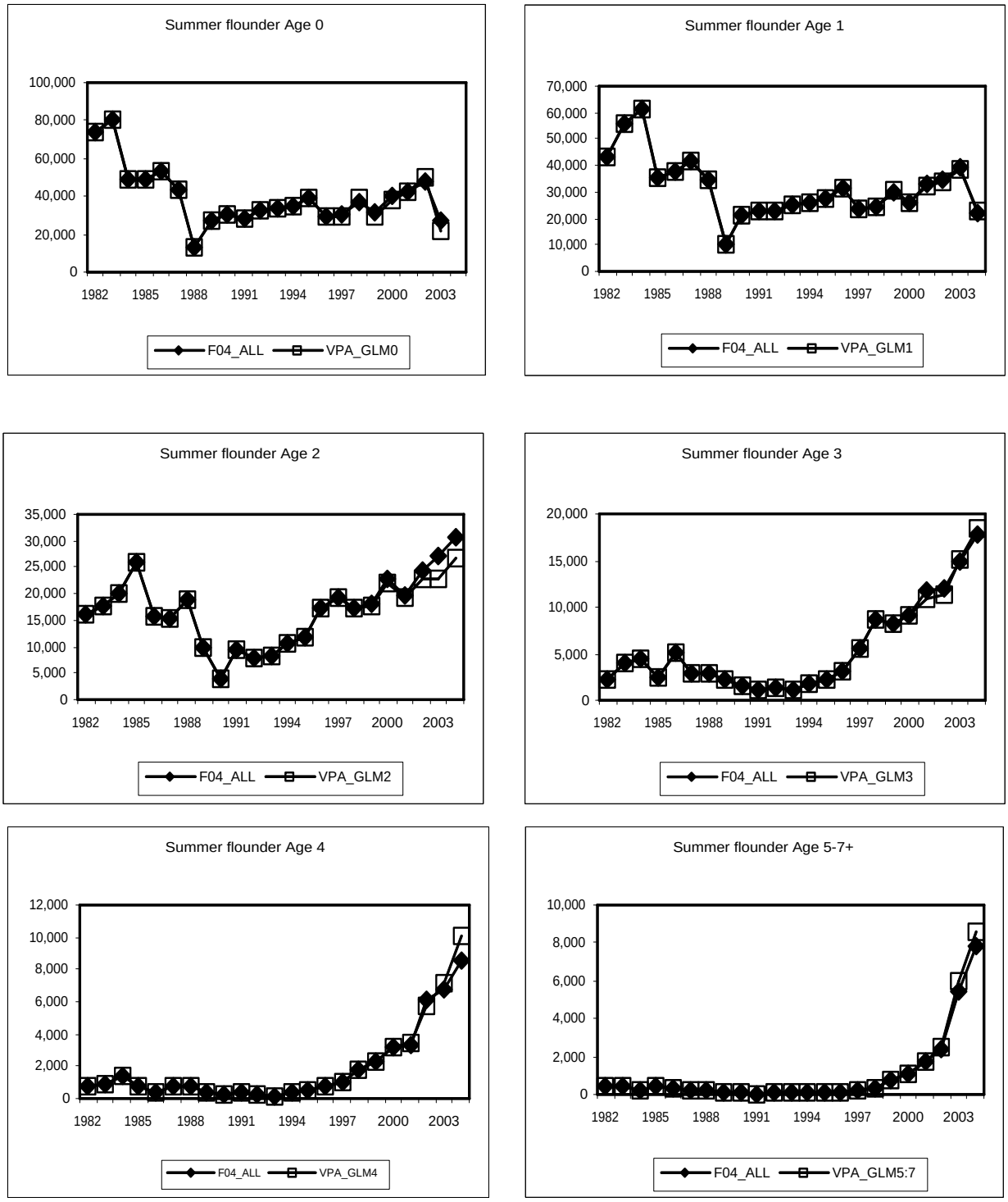
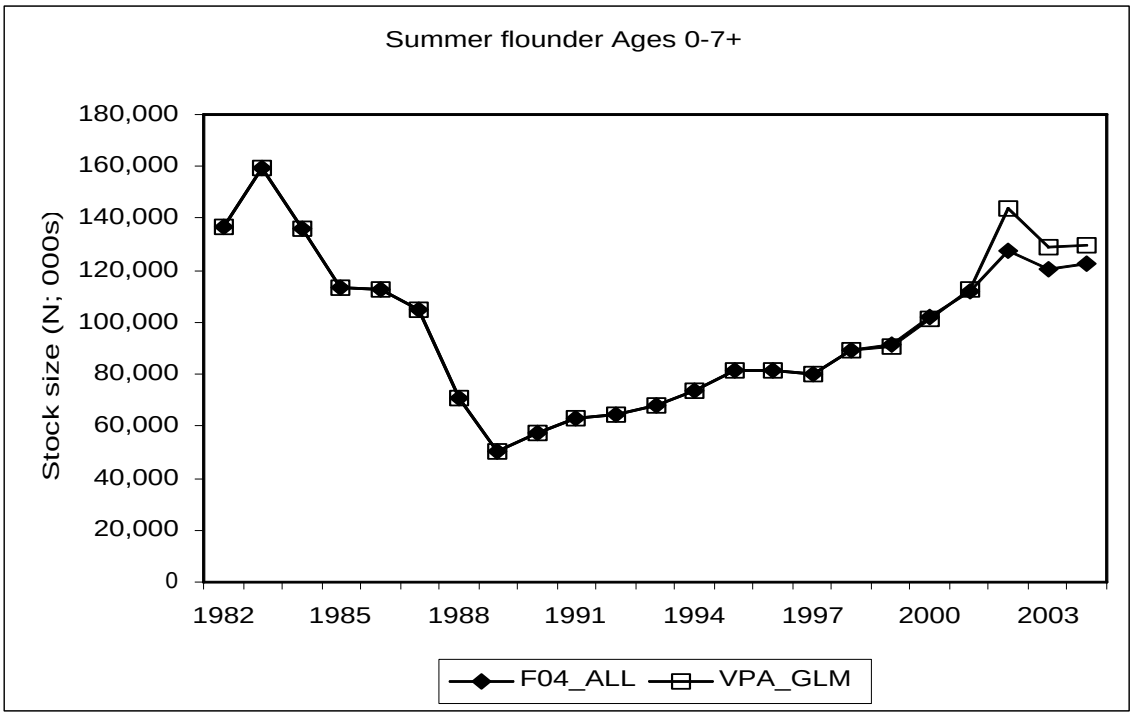

Summer flounder Age 0
100,000
80,000
60,000
40,000
20,000
0
1982 1985 1988 1991 1994 1997 2000 2003
F04_ALL VPA_GLM0
Summer flounder Age 1
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
1982 1985 1988 1991 1994 1997 2000 2003
F04_ALL VPA_GLM1
Summer flounder Age 2
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1982 1985 1988 1991 1994 1997 2000 2003
F04_ALL VPA_GLM2
Summer flounder Age 3
20,000
15,000
10,000
5,000
0
1982 1985 1988 1991 1994 1997 2000 2003
F04_ALL VPA_GLM3
Summer flounder Age 4
12,000
10,000
8,000
6,000
4,000
2,000
0
1982 1985 1988 1991 1994 1997 2000 2003
F04_ALL VPA_GLM4
Summer flounder Age 5-7+
10,000
8,000
6,000
4,000
2,000
0
1982 1985 1988 1991 1994 1997 2000 2003
F04_ALL VPA_GLM5:7

Figure 6.


Summer flounder Ages 0-7+
Stock size (N; 000s)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1982
1985
1988
1991
1994
1997
2000
2003
F04_ALL
VPA_GLM

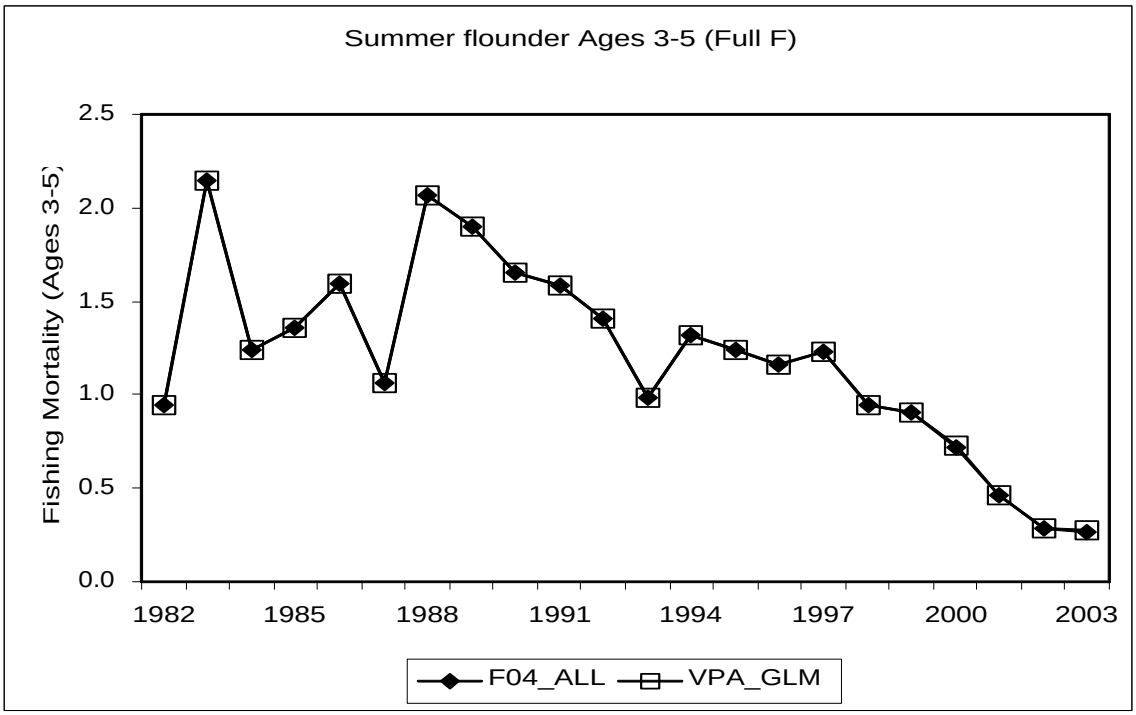
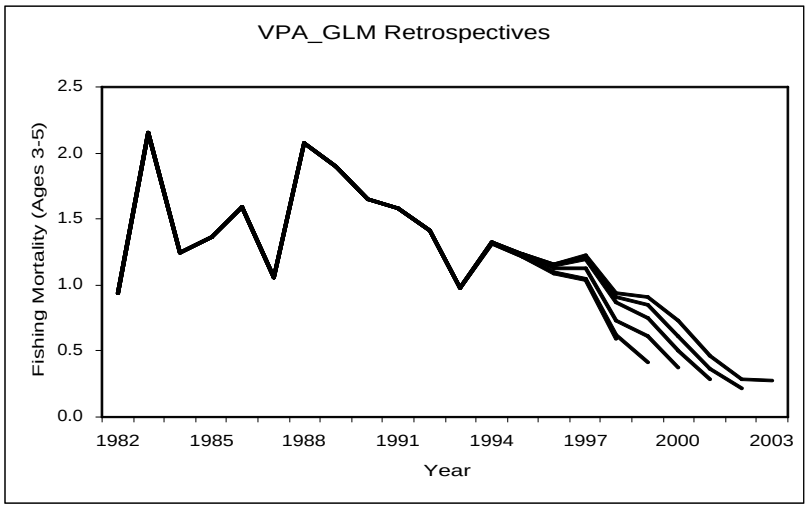
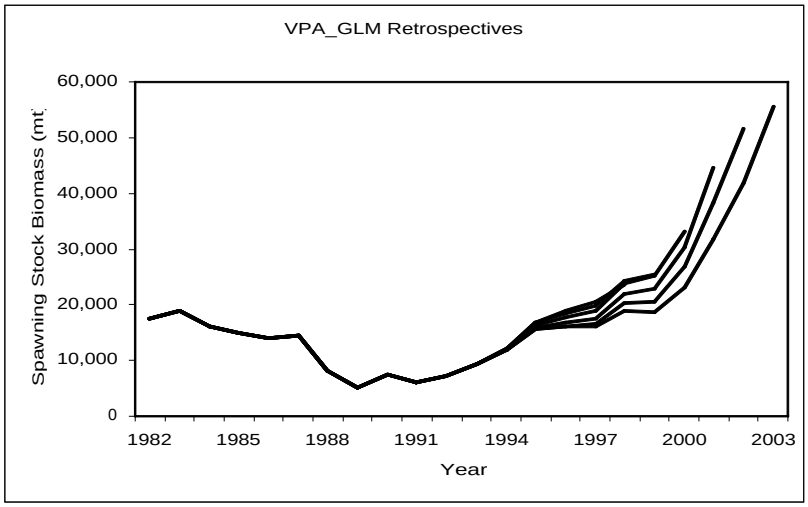

Summer flounder Ages 3-5 (Full F)
Fishing Mortality (Ages 3-5)
2.5
2.0
1.5
1.0
0.5
0.0
1982
1985
1988
1991
1994
1997
2000
2003
F04_ALL
VPA_GLM

Figure 7.


VPA_GLM Retrospectives
Fishing Mortality (Ages 3-5)
2.5
2.0
1.5
1.0
0.5
0.0
1982
1985
1988
1991
1994
1997
2000
2003
Year


VPA_GLM Retrospectives
Spawning Stock Biomass (mt
60,000
50,000
40,000
30,000
20,000
10,000
0
1982
1985
1988
1991
1994
1997
2000
2003
Year

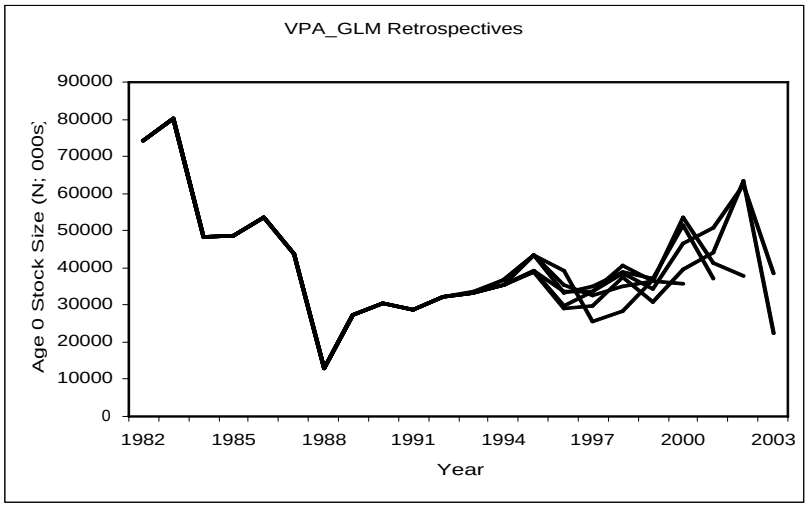

VPA_GLM Retrospectives
Age 0 Stock Size (N; 000s)
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1982
1985
1988
1991
1994
1997
2000
2003
Year

Figure 8.

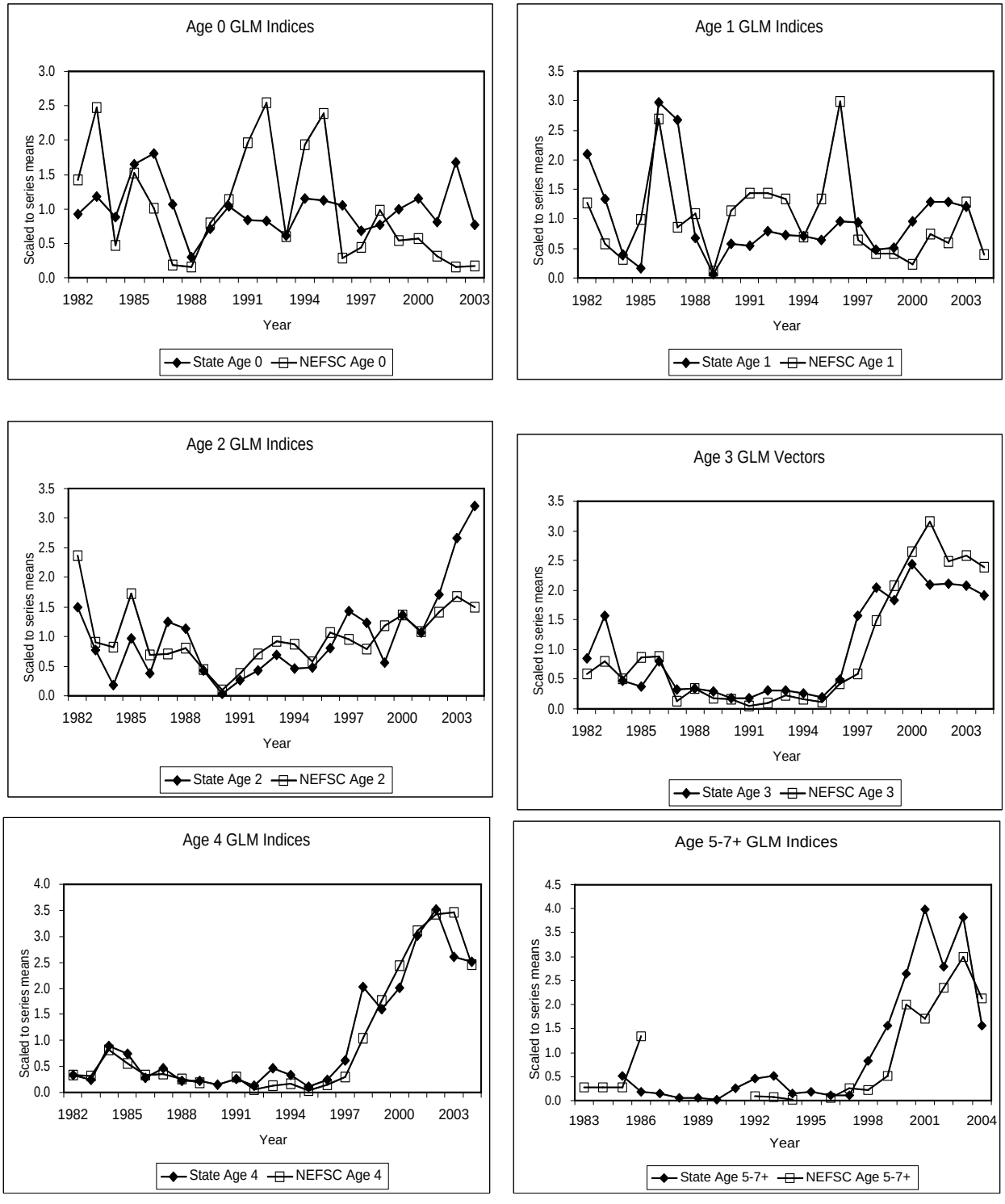
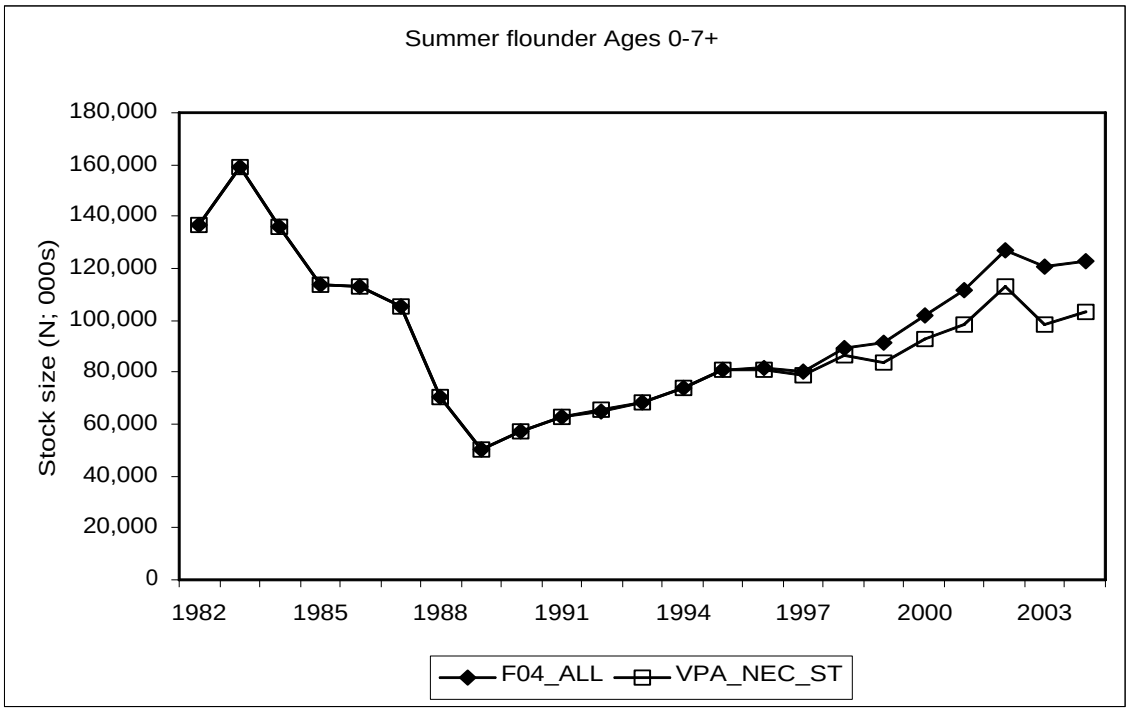

Age 0 GLM Indices
Scaled to series means
Year
State Age 0
NEFSC Age 0
Age 1 GLM Indices
State Age 1
NEFSC Age 1
Age 2 GLM Indices
State Age 2
NEFSC Age 2
Age 3 GLM Vectors
State Age 3
NEFSC Age 3
Age 4 GLM Indices
State Age 4
NEFSC Age 4
Age 5-7+ GLM Indices
State Age 5-7+
NEFSC Age 5-7+

Figure 9.


Summer flounder Ages 0-7+
Stock size (N; 000s)
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1982
1985
1988
1991
1994
1997
2000
2003
F04_ALL
VPA_NEC_ST

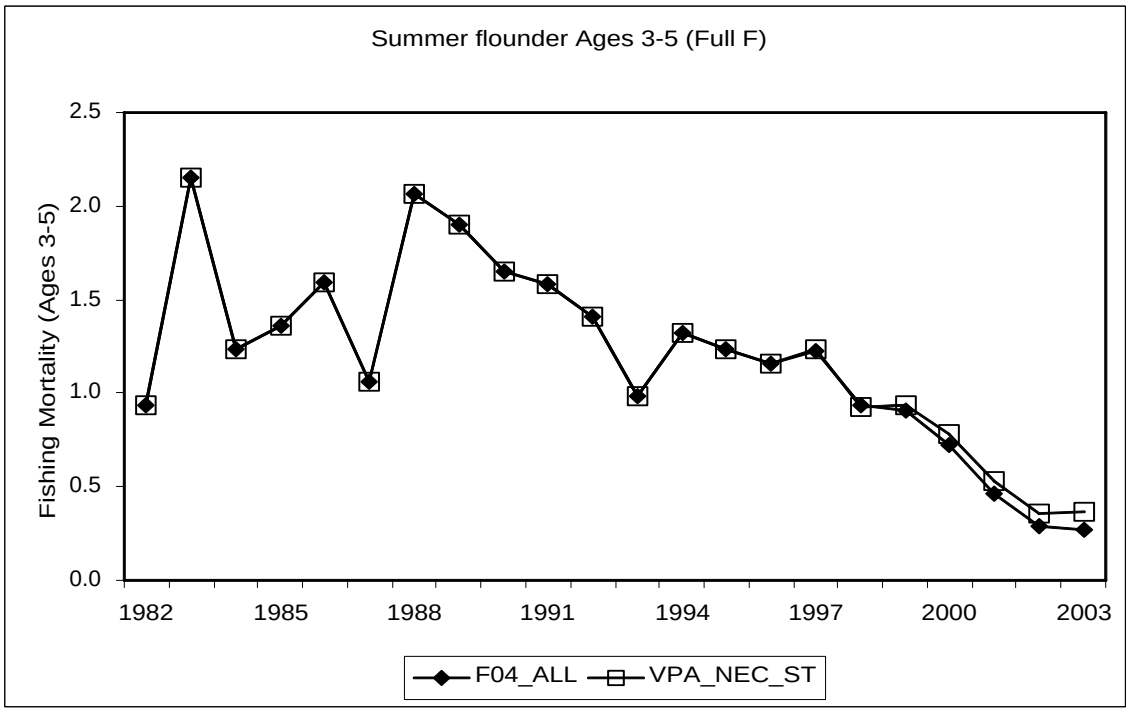

Summer flounder Ages 3-5 (Full F)
Fishing Mortality (Ages 3-5)
2.5
2.0
1.5
1.0
0.5
0.0
1982
1985
1988
1991
1994
1997
2000
2003
F04_ALL
VPA_NEC_ST

Figure 10.

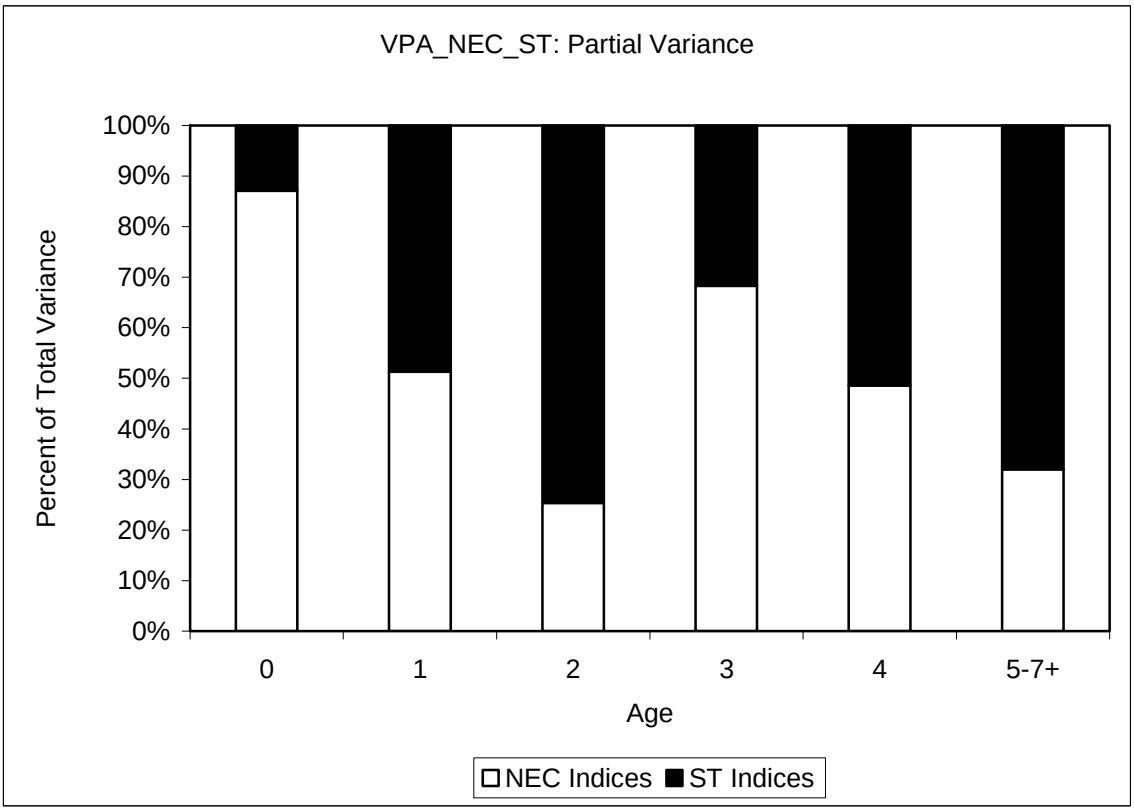

VPA_NEC_ST: Partial Variance
Percent of Total Variance
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
1
2
3
4
5-7+
Age
NEC Indices
ST Indices

Figure 11.

SAW 47 Working Paper 4 (TOR 2b) – Zero Filling

8 November 2006

Simulation Studies of Issues Associated with Filling Zeros in VPA Tuning Indices

by

Chris Legault and Al Seaver

Introduction

Recently, the 2006 assessment of summer flounder (Terceiro 2006) 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.

This recommendation departs from the standard practice in NEFSC assessments of treating zero values in tuning indices as missing values. To more fully understand the implications of this suggested change, two types of simulation analyses were conducted. The first is a simple spreadsheet example of how a single time series is impacted by different levels of fish detection and the implications for a full VPA. The second is a full simulation that generates many random sets of data for VPA from a known case, creates zeros for some of the indices in some years, and compares different methods for dealing with these zeros, including treating them as missing values, replacing the zeros with a fixed small value, and the one sixth of the smallest observation rule.

First Study: Impact of Zeros on One Time Series

A population that declined and then increased was created artificially. A catchability coefficient was applied to generate a survey time series exactly from the data. The values in the time series were rounded to two, one, and zero decimal places creating observations of zero for 2, 4, and 7 years, respectively (Table 1). A series of constants was added to the time series ranging from 0.0001 to 10 so that the holes were filled. A new catchability coefficient was calculated that minimized the difference between the true population and the observed survey time series which had been modified to fill the holes. This was done to show how a model would need to change the predicted values to more closely match the observed series. In this study, treating the index values as missing results in an exact match between the observed and predicted values, due to the formulation of the problem and so are not considered further.

The differences between observed and predicted values depend strongly on the constant added to the time series (Figs 1-3). Adding a large value, such as 10, causes the survey time series to flatten relative to the true population. A model would try to reduce the change in the population in this case. Conversely, adding a very small value, such as 0.0001, causes the survey time series to exhibit a stronger decline and recovery than the true population. In this case, a model would try to increase the changes in the population. Adding one sixth of the minimum observed value appears to be an objective way to determine a value that is not too big or too small for the round 2 case where only two zeros are replaced.

However, the more disturbing result seen in these simulations is that the addition of a constant value to replace the zeros in a survey time series artificially imposes 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.

Second Study: Simulation Analysis of Different Methods of Treating Zeros

A comparative study was performed using the POPCOMP length based population simulator tool and VPA version 2.3.3. The objective was to examine the effects of using indices of abundance with some portion of the index data treated as missing or alternatively replaced with an imputed value. Four scenarios were examined. In each case the simulated data were sampled to create 100 realizations of VPA input data and the results of the multiple realizations were compared in their ability to recover the true stock numbers and fishing mortality at age. The test was performed in such a manner as the VPA files created for each realization would be the same for each scenario except in the specified removal and alternative replacement of index data based on an input cut point.

The simulated population was loosely based on the summer flounder assessment with the population initially declining due to high F (>2) and then rebuilding as F was lowered to <0.5). The simulated population spans 24 years starting in 1982 and consisting of 8 age classes with the last age class acting as a plus group. Natural mortality was 0.2 for all ages and years. Both recruitment and fishing mortality vary widely over the time series. The growth projection matrix was created using von Bertalanffy growth coefficients and length bins ranging from 10 to 84 cm. A logistic equation was used for fishery selectivity at length. Catch was removed from the population based on the true F but samples were collected from four market categories based on size (sample sizes 65-133 per 100 metric tons) to introduce variability in the catch at length. Age-length keys were created based on sampling 25% of the observed lengths and an ageing error matrix was included to introduce variability in the catch at age (mis-aged proportions

ranged from 4% to 17%). The length-weight equation coefficients supplied to allow expansion of sampled catch to total landings, which had a small amount of variability relative to the true landings (CV = 0.01). Discards were not included in this simulation. This level of uncertainty in the catch at age is thought to be representative of the level associated with the summer flounder assessment. However, there is not a retrospective pattern observed when the simulated data are analyzed with VPA, so not all sources of uncertainty have been captured.

There was only one index generated for each age. The catchability for each index was chosen so that catchability increased with age (Table 2). The uncertainty was higher for the indices at younger ages than older ages (Table 2). The coefficients of variation were used to generate lognormally distributed error in the observed indices. The population trends, catchability coefficients, and coefficients of variation combined to produce different probabilities that a given index value would fall below 1.0 (Table 3). Index values below 1.0 were treated in four different ways:

- 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 VPA input files generated for each realization were identical excepting that indices of abundance were altered by case.

The median values of F and N at age from the 100 realizations of the VPA model under the four cases of treating index values below 1.0 were compared with the true values from the simulated population (Tables 4-5 and Figs 4-5). Due to the convergence properties of VPA, the medians from the 4 cases are essentially identical for years 1982-1994, as seen in Figures 4-5, and so are not shown in Tables 4-5. The most striking feature seen in the tables and figures is the poor performance of Case 3 (replacing zeros with the arbitrary constant 0.01). The fishing mortality rates in Case 3 were well below the true values while the estimated population abundances were well above the true values. Case 3 clearly demonstrates 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.

Discussion

An alternative method to determining the constant to use in place of zeros that was not considered in this exercise is provided by Berry (1987). The Berry approach consists of finding the constant that minimizes a function of the skewness plus kurtosis of the raw data. This

approach is not 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. The main problem remains however. Filling zeros with a constant value, no matter how that constant is selected, creates a pattern that may not match reality. These simulations show that this approach can produce results further from the truth than treating zeros as missing values.

Of course, in reality the zeros do have information. Results should be checked to ensure that predicted values are not high when index is zero. If an assessment model predicts high abundance for a year-age combination that had a zero index, the model results should be questioned. However, adding incorrect information arbitrarily has the potential to bias the results, as demonstrated in these simulations.

Conclusions

The two simulation studies have 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, we recommend the NEFSC standard approach of treating zero values in tuning indices for VPA as missing values.

References Cited

Berry DA. 1987. Logarithmic transformations in ANOVA. Biometrics 43:439-456.

Methot R. 2006. Review of the 2006 Summer Flounder Assessment Update. Chair's Report. NMFS Office of Science and Technology. 6 p.

Terceiro M. 2006. Stock assessment of summer flounder for 2006. NEFSC Ref Doc. 06-17. 119 p.

Table 1. Artificial time series for a population and the associated time series of indices given a catchability of 0.000002 when the values are rounded to two, one, and zero decimal places. Highlighted cells are years when the tuning index has an observed zero.

		Index		
Year	Population	Round 2	Round 1	Round 0
1980	2000000	4.00	4.0	4
1981	1500000	3.00	3.0	3
1982	1300000	2.60	2.6	3
1983	1000000	2.00	2.0	2
1984	500000	1.00	1.0	1
1985	300000	0.60	0.6	1
1986	200000	0.40	0.4	0
1987	10000	0.02	0.0	0
1988	5000	0.01	0.0	0
1989	1000	0.00	0.0	0
1990	2000	0.00	0.0	0
1991	50000	0.10	0.1	0
1992	100000	0.20	0.2	0
1993	300000	0.60	0.6	1
1994	400000	0.80	0.8	1
1995	700000	1.40	1.4	1
1996	1200000	2.40	2.4	2
1997	1500000	3.00	3.0	3
1998	1100000	2.20	2.2	2
1999	1200000	2.40	2.4	2
2000	1700000	3.40	3.4	3

Table 2. Catchability coefficients (q) and coefficients of variation (CV) by age for the tuning indices used in the second study. The q values multiplied the true populations at age to generate the expected values for the indices by year. The CV values describe the amount of lognormally distributed error used to create the random VPA input data.

Param	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8
	0.0000003	0.000001	0.000001	0.0000	0.0000	0.0000	0.0000	0.0000
q								
CV	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.3

Table 3. Probability that an index value will be below 1.0 and thus set to zero given the true population, catchability coefficient, and uncertainty associated with each index and year.

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8
1982	6.9	<1.0	16.4	<1.0	<1.0	6.4	9.5	94.6
1983	4.9	<1.0	2.1	<1.0	<1.0	<1.0	98.5	89.6
1984	28.0	<1.0	4.4	<1.0	<1.0	46.6	>99.0	>99.0
1985	27.8	<1.0	1.2	<1.0	<1.0	<1.0	>99.0	>99.0
1986	21.6	<1.0	10.9	<1.0	<1.0	<1.0	85.8	>99.0
1987	35.5	<1.0	14.0	<1.0	<1.0	<1.0	63.4	>99.0
1988	98.6	1.0	5.8	<1.0	<1.0	<1.0	6.6	>99.0
1989	73.8	64.1	26.5	<1.0	<1.0	<1.0	58.5	>99.0
1990	65.9	11.2	97.6	<1.0	<1.0	1.5	>99.0	>99.0
1991	70.0	6.9	59.9	<1.0	<1.0	0.8	>99.0	>99.0
1992	60.7	8.5	47.8	<1.0	<1.0	1.5	>99.0	>99.0
1993	58.4	4.9	48.1	<1.0	<1.0	84.2	>99.0	>99.0
1994	53.2	3.8	27.8	<1.0	<1.0	<1.0	>99.0	>99.0
1995	45.3	3.2	31.0	<1.0	<1.0	<1.0	92.5	>99.0
1996	70.8	1.9	26.3	<1.0	<1.0	<1.0	64.5	>99.0
1997	68.8	7.9	18.7	<1.0	<1.0	<1.0	51.2	>99.0
1998	64.2	7.3	42.7	<1.0	<1.0	<1.0	36.4	>99.0
1999	69.5	5.3	34.4	<1.0	<1.0	<1.0	10.8	>99.0
2000	53.7	7.0	29.1	<1.0	<1.0	<1.0	1.7	96.7
2001	69.0	2.8	31.7	<1.0	<1.0	<1.0	<1.0	71.5
2002	56.2	6.3	15.0	<1.0	<1.0	<1.0	<1.0	8.4
2003	80.3	2.9	21.5	<1.0	<1.0	<1.0	<1.0	<1.0
2004	55.1	11.4	12.2	<1.0	<1.0	<1.0	<1.0	<1.0
2005	97.5	2.7	31.9	<1.0	<1.0	<1.0	<1.0	<1.0
2006	97.5	46.6	12.4	<1.0	<1.0	<1.0	<1.0	<1.0

Table 4. Comparison of true fishing mortality at age with medians from 100 realizations under the four cases of treating index values less than 1.0.

		F at Age					Percent bias in Medians vs Truth			
Age	Year	True	Case 1	Case 2	Case 3	Case 4	Case 1	Case 2	Case 3	Case 4
1	1995	0.084	0.084	0.084	0.082	0.084	0	0	-3	0
1	1996	0.079	0.078	0.078	0.073	0.078	-1	-1	-7	-1
1	1997	0.085	0.082	0.082	0.073	0.082	-3	-3	-14	-3
1	1998	0.066	0.065	0.066	0.049	0.064	-1	0	-25	-3
1	1999	0.067	0.064	0.065	0.039	0.061	-5	-3	-42	-9
1	2000	0.060	0.058	0.060	0.031	0.055	-3	0	-49	-8
1	2001	0.046	0.044	0.045	0.038	0.044	-3	-1	-17	-3
1	2002	0.033	0.031	0.032	0.026	0.032	-4	-3	-20	-3
1	2003	0.032	0.031	0.031	0.029	0.032	-1	-2	-10	0
1	2004	0.032	0.031	0.033	0.025	0.029	-3	3	-21	-10
1	2005	0.036	0.030	0.024	0.057	0.034	-16	-34	59	-5
2	1995	0.378	0.380	0.381	0.377	0.380	1	1	0	1
2	1996	0.356	0.370	0.370	0.361	0.369	4	4	1	4
2	1997	0.380	0.385	0.385	0.358	0.382	1	1	-6	1
2	1998	0.299	0.299	0.301	0.256	0.297	0	1	-14	-1
2	1999	0.306	0.305	0.308	0.223	0.298	0	1	-27	-3
2	2000	0.272	0.266	0.270	0.155	0.253	-2	-1	-43	-7
2	2001	0.210	0.208	0.213	0.104	0.196	-1	1	-51	-7
2	2002	0.151	0.150	0.151	0.129	0.150	-1	0	-15	-1
2	2003	0.147	0.144	0.146	0.119	0.142	-2	0	-19	-3
2	2004	0.147	0.152	0.151	0.137	0.154	3	3	-6	5
2	2005	0.167	0.170	0.173	0.135	0.156	2	4	-19	-6
3	1995	0.730	0.709	0.710	0.705	0.709	-3	-3	-3	-3
3	1996	0.688	0.669	0.669	0.657	0.668	-3	-3	-4	-3
3	1997	0.737	0.732	0.733	0.700	0.729	-1	-1	-5	-1
3	1998	0.578	0.562	0.564	0.502	0.558	-3	-2	-13	-3
3	1999	0.597	0.573	0.577	0.457	0.563	-4	-3	-23	-6
3	2000	0.529	0.506	0.509	0.329	0.486	-4	-4	-38	-8
3	2001	0.410	0.378	0.388	0.188	0.357	-8	-5	-54	-13
3	2002	0.297	0.281	0.295	0.124	0.261	-5	-1	-58	-12
3	2003	0.289	0.275	0.278	0.227	0.275	-5	-4	-22	-5
3	2004	0.290	0.287	0.284	0.226	0.277	-1	-2	-22	-4
3	2005	0.329	0.336	0.335	0.291	0.338	2	2	-11	3
4	1995	0.973	0.913	0.913	0.909	0.913	-6	-6	-7	-6
4	1996	0.913	0.848	0.849	0.836	0.848	-7	-7	-8	-7
4	1997	0.980	0.910	0.911	0.877	0.908	-7	-7	-11	-7
4	1998	0.765	0.726	0.727	0.662	0.721	-5	-5	-13	-6
4	1999	0.790	0.725	0.729	0.595	0.714	-8	-8	-25	-10
4	2000	0.701	0.637	0.643	0.431	0.617	-9	-8	-39	-12
4	2001	0.542	0.488	0.499	0.262	0.465	-10	-8	-52	-14
4	2002	0.390	0.337	0.351	0.138	0.310	-14	-10	-65	-21
4	2003	0.381	0.340	0.361	0.125	0.308	-11	-5	-67	-19
4	2004	0.383	0.349	0.355	0.271	0.351	-9	-7	-29	-8

4	2005	0.435	0.410	0.408	0.303	0.392	-6	-6	-30	-10
5	1995	1.110	1.051	1.051	1.046	1.051	-5	-5	-6	-5
5	1996	1.041	0.974	0.975	0.960	0.973	-6	-6	-8	-7
5	1997	1.115	1.041	1.042	1.004	1.038	-7	-7	-10	-7
5	1998	0.870	0.820	0.822	0.750	0.814	-6	-5	-14	-6
5	1999	0.894	0.849	0.855	0.710	0.838	-5	-4	-21	-6
5	2000	0.793	0.730	0.737	0.502	0.706	-8	-7	-37	-11
5	2001	0.611	0.548	0.564	0.292	0.522	-10	-8	-52	-15
5	2002	0.438	0.390	0.407	0.166	0.361	-11	-7	-62	-18
5	2003	0.427	0.374	0.396	0.122	0.333	-12	-7	-71	-22
5	2004	0.429	0.375	0.405	0.108	0.328	-13	-6	-75	-23
5	2005	0.488	0.449	0.453	0.312	0.442	-8	-7	-36	-9
6	1995	1.177	1.133	1.133	1.128	1.133	-4	-4	-4	-4
6	1996	1.106	1.028	1.028	1.017	1.027	-7	-7	-8	-7
6	1997	1.185	1.107	1.107	1.069	1.102	-7	-7	-10	-7
6	1998	0.923	0.848	0.851	0.777	0.844	-8	-8	-16	-8
6	1999	0.947	0.867	0.875	0.727	0.856	-8	-8	-23	-10
6	2000	0.838	0.778	0.788	0.535	0.742	-7	-6	-36	-11
6	2001	0.644	0.573	0.591	0.308	0.542	-11	-8	-52	-16
6	2002	0.461	0.400	0.415	0.169	0.370	-13	-10	-63	-20
6	2003	0.447	0.385	0.403	0.126	0.341	-14	-10	-72	-24
6	2004	0.449	0.374	0.413	0.093	0.319	-17	-8	-79	-29
6	2005	0.511	0.424	0.474	0.090	0.350	-17	-7	-82	-32
7	1995	1.209	1.133	1.133	1.128	1.133	-6	-6	-7	-6
7	1996	1.136	1.028	1.028	1.017	1.027	-10	-10	-10	-10
7	1997	1.218	1.107	1.107	1.069	1.102	-9	-9	-12	-10
7	1998	0.948	0.848	0.851	0.777	0.844	-11	-10	-18	-11
7	1999	0.971	0.867	0.875	0.727	0.856	-11	-10	-25	-12
7	2000	0.859	0.778	0.788	0.535	0.742	-9	-8	-38	-14
7	2001	0.660	0.573	0.591	0.308	0.542	-13	-10	-53	-18
7	2002	0.471	0.400	0.415	0.169	0.370	-15	-12	-64	-21
7	2003	0.456	0.385	0.403	0.126	0.341	-16	-12	-72	-25
7	2004	0.458	0.374	0.413	0.093	0.319	-18	-10	-80	-30
7	2005	0.520	0.490	0.503	0.369	0.474	-6	-3	-29	-9
8	1995	1.227	1.133	1.133	1.128	1.133	-8	-8	-8	-8
8	1996	1.150	1.028	1.028	1.017	1.027	-11	-11	-12	-11
8	1997	1.234	1.107	1.107	1.069	1.102	-10	-10	-13	-11
8	1998	0.961	0.848	0.851	0.777	0.844	-12	-11	-19	-12
8	1999	0.984	0.867	0.875	0.727	0.856	-12	-11	-26	-13
8	2000	0.870	0.778	0.788	0.535	0.742	-11	-9	-38	-15
8	2001	0.667	0.573	0.591	0.308	0.542	-14	-11	-54	-19
8	2002	0.476	0.400	0.415	0.169	0.370	-16	-13	-64	-22
8	2003	0.461	0.385	0.403	0.126	0.341	-17	-12	-73	-26
8	2004	0.462	0.374	0.413	0.093	0.319	-19	-11	-80	-31
8	2005	0.525	0.490	0.503	0.369	0.474	-7	-4	-30	-10

Table 5. Comparison of true population numbers at age (thousands) with medians from 100 realizations under the four cases of treating index values less than 1.0.

		F at Age					Percent bias in Medians vs Truth			
Age	Year	True	Case 1	Case 2	Case 3	Case 4	Case 1	Case 2	Case 3	Case 4
1	1995	35236	35204	35180	35943	35249	0	0	2	0
1	1996	25724	26354	26310	27872	26458	2	2	8	3
1	1997	26449	26916	26811	30592	27112	2	1	16	3
1	1998	28054	28554	28367	36913	29142	2	1	32	4
1	1999	26207	27566	27102	44094	28562	5	3	68	9
1	2000	31907	32711	31866	61032	34452	3	0	91	8
1	2001	26383	27216	27231	31739	27606	3	3	20	5
1	2002	30976	31174	31460	37429	31911	1	2	21	3
1	2003	22272	21688	22217	24795	21886	-3	0	11	-2
1	2004	31379	31477	30866	38880	33836	0	-2	24	8
1	2005	13176	14426	20116	8650	13929	9	53	-34	6
1	2006	13176	13461	27312	3659	11610	2	107	-72	-12
2	1995	24025	24166	24162	24367	24182	1	1	1	1
2	1996	26523	26475	26454	27088	26520	0	0	2	0
2	1997	19463	19941	19918	21154	20006	2	2	9	3
2	1998	19900	20228	20157	23206	20440	2	1	17	3
2	1999	21504	21908	21761	28759	22399	2	1	34	4
2	2000	20057	21123	20803	34764	22028	5	4	73	10
2	2001	24611	25247	24559	48407	26662	3	0	97	8
2	2002	20634	21314	21398	24997	21670	3	4	21	5
2	2003	24546	24731	24986	29795	25386	1	2	21	3
2	2004	17667	17198	17604	19741	17318	-3	0	12	-2
2	2005	24890	24958	24448	31007	26906	0	-2	25	8
2	2006	10407	11427	16081	6674	11061	10	55	-36	6
3	1995	12645	12600	12599	12651	12604	0	0	0	0
3	1996	13490	13521	13517	13659	13529	0	0	1	0
3	1997	15224	14967	14959	15492	15024	-2	-2	2	-1
3	1998	10904	11082	11050	12111	11133	2	1	11	2
3	1999	12087	12282	12214	14715	12447	2	1	22	3
3	2000	12966	13234	13057	18672	13585	2	1	44	5
3	2001	12517	13289	12992	24479	13977	6	4	96	12
3	2002	16330	16799	16227	35675	17965	3	-1	118	10
3	2003	14523	15014	15026	17976	15280	3	3	24	5
3	2004	17356	17479	17544	21764	18001	1	1	25	4
3	2005	12489	12140	12403	14081	12114	-3	-1	13	-3
3	2006	17254	17285	16870	22139	18867	0	-2	28	9
4	1995	4938	4959	4959	4970	4960	0	0	1	0
4	1996	5000	5099	5100	5141	5102	2	2	3	2
4	1997	5559	5670	5668	5796	5677	2	2	4	2
4	1998	5974	5904	5899	6279	5933	-1	-1	5	-1
4	1999	5015	5191	5169	5967	5241	4	3	19	5
4	2000	5454	5672	5621	7670	5803	4	3	41	6
4	2001	6259	6555	6417	11078	6850	5	3	77	9
4	2002	6802	7408	7157	16538	7980	9	5	143	17
4	2003	9941	10365	9909	25846	11260	4	0	160	13
4	2004	8905	9327	9348	11763	9506	5	5	32	7

4	2005	10635	10737	10873	14259	11289	1	2	34	6
4	2006	7361	7048	7273	8649	7071	-4	-1	17	-4
5	1995	1354	1488	1488	1490	1488	10	10	10	10
5	1996	1529	1639	1639	1649	1640	7	7	8	7
5	1997	1645	1772	1771	1809	1775	8	8	10	8
5	1998	1710	1867	1865	1977	1875	9	9	16	10
5	1999	2277	2343	2335	2659	2368	3	3	17	4
5	2000	1865	2047	2037	2688	2098	10	9	44	12
5	2001	2216	2451	2418	4064	2576	11	9	83	16
5	2002	2982	3290	3203	6966	3519	10	7	134	18
5	2003	3770	4345	4133	11817	4791	15	10	213	27
5	2004	5560	6003	5660	18664	6770	8	2	236	22
5	2005	4971	5379	5373	7295	5482	8	8	47	10
5	2006	5636	5852	5934	8603	6258	4	5	53	11
6	1995	355	394	394	395	394	11	11	11	11
6	1996	366	427	427	429	427	17	17	17	17
6	1997	442	505	505	515	506	14	14	16	14
6	1998	442	510	509	542	512	15	15	23	16
6	1999	587	679	676	760	684	16	15	30	16
6	2000	762	815	808	1076	833	7	6	41	9
6	2001	691	812	798	1342	852	17	16	94	23
6	2002	985	1157	1136	2464	1258	18	15	150	28
6	2003	1575	1825	1750	4824	2010	16	11	206	28
6	2004	2014	2445	2271	8516	2823	21	13	323	40
6	2005	2964	3397	3073	13723	3991	15	4	363	35
6	2006	2498	2812	2784	4372	2903	13	11	75	16
7	1995	66	83	83	83	83	27	27	27	27
7	1996	90	106	106	106	106	18	18	19	18
7	1997	99	122	122	125	122	23	23	26	24
7	1998	111	135	135	145	136	22	22	31	23
7	1999	144	180	179	201	181	25	25	40	26
7	2000	186	232	230	305	237	24	23	64	27
7	2001	270	307	303	514	322	14	12	90	19
7	2002	297	369	358	804	405	24	20	171	36
7	2003	509	633	609	1692	703	24	20	233	38
7	2004	825	1010	963	3467	1175	23	17	320	42
7	2005	1053	1376	1234	6359	1679	31	17	504	60
7	2006	1456	1809	1562	10263	2309	24	7	605	59
8	1995	9	13	13	13	13	48	48	48	48
8	1996	18	24	24	24	24	34	33	34	34
8	1997	28	36	36	36	36	27	27	29	27
8	1998	31	41	41	44	41	34	34	42	35
8	1999	45	60	59	68	60	33	32	52	34
8	2000	58	73	73	95	75	26	25	64	29
8	2001	85	110	108	182	113	30	28	115	34
8	2002	150	184	180	388	198	23	20	159	32
8	2003	228	287	277	803	321	26	22	252	41
8	2004	382	487	456	1705	559	28	19	347	46
8	2005	624	690	666	845	710	11	7	35	14
8	2006	814	1057	937	14806	997	30	15	1718	22

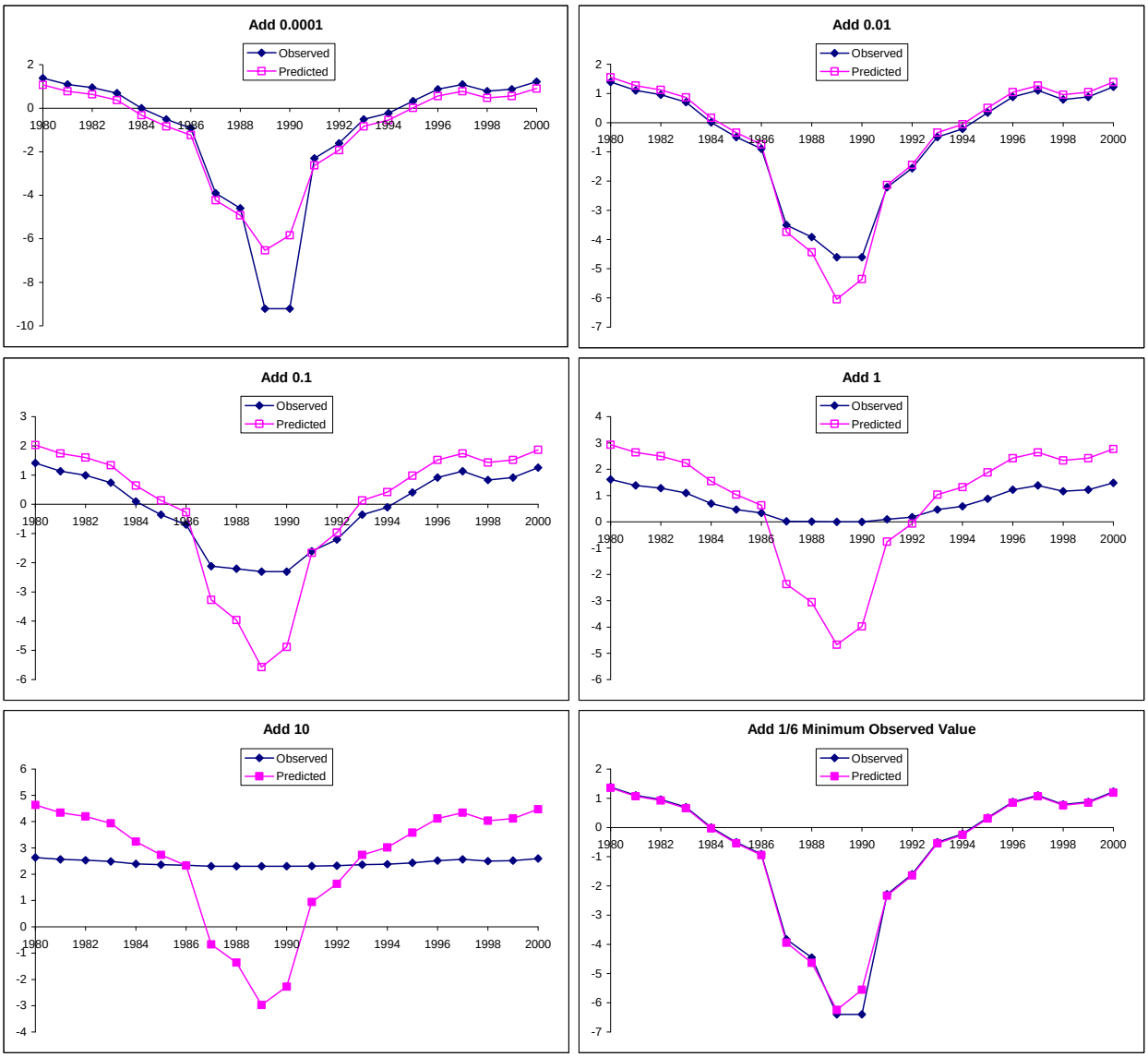


Figure 1. Comparison of observed and predicted indices when observed values are rounded to two decimal places and resulting zeros are replaced by different constants. The predicted indices follow the true population pattern and are scaled by a catchability coefficient to minimize the natural logarithm of the squared residuals. Note the y-axes are log scale.

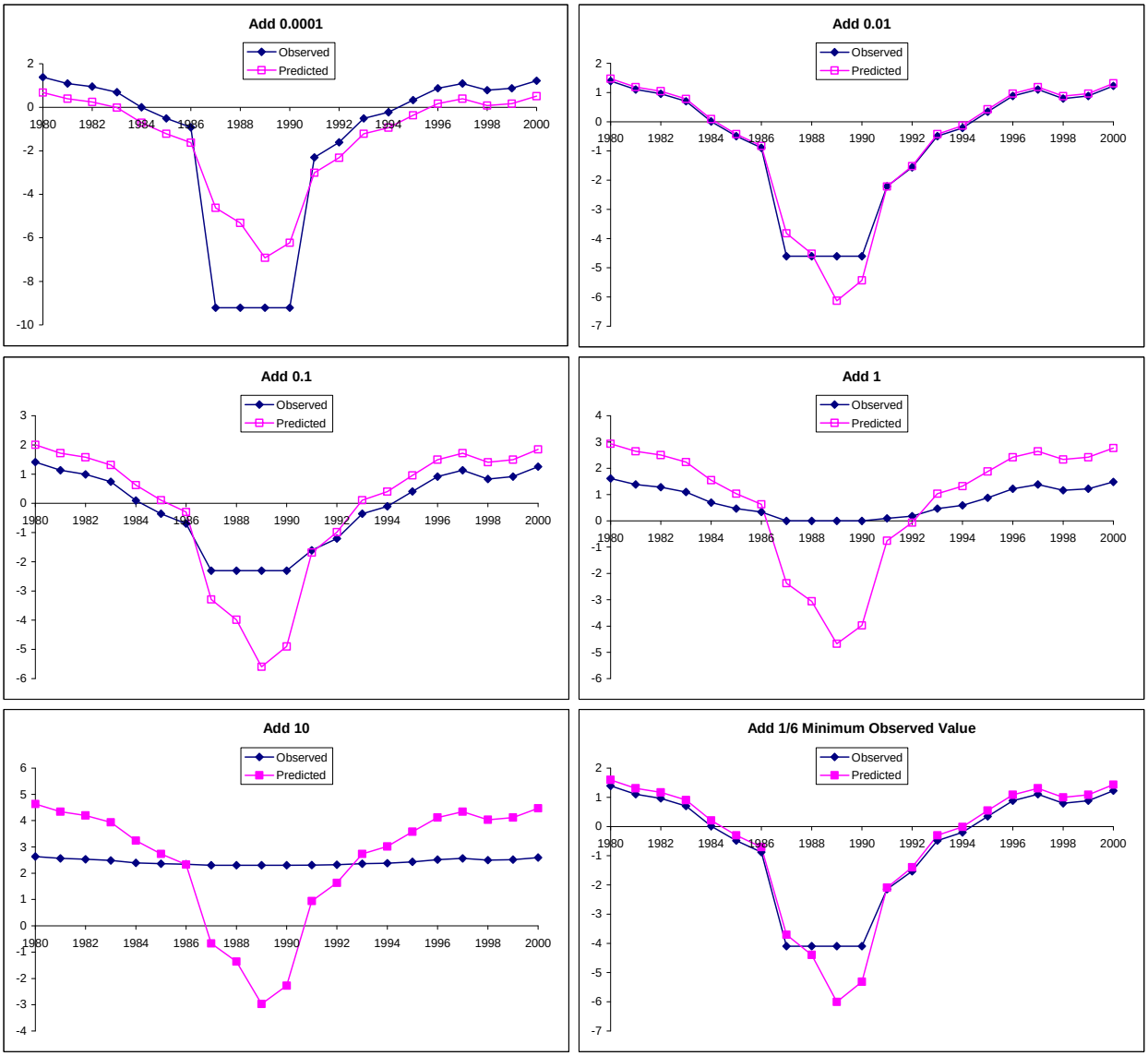


Figure 2. Comparison of observed and predicted indices when observed values are rounded to one decimal place and resulting zeros are replaced by different constants. The predicted indices follow the true population pattern and are scaled by a catchability coefficient to minimize the natural logarithm of the squared residuals. Note the y-axes are log scale.

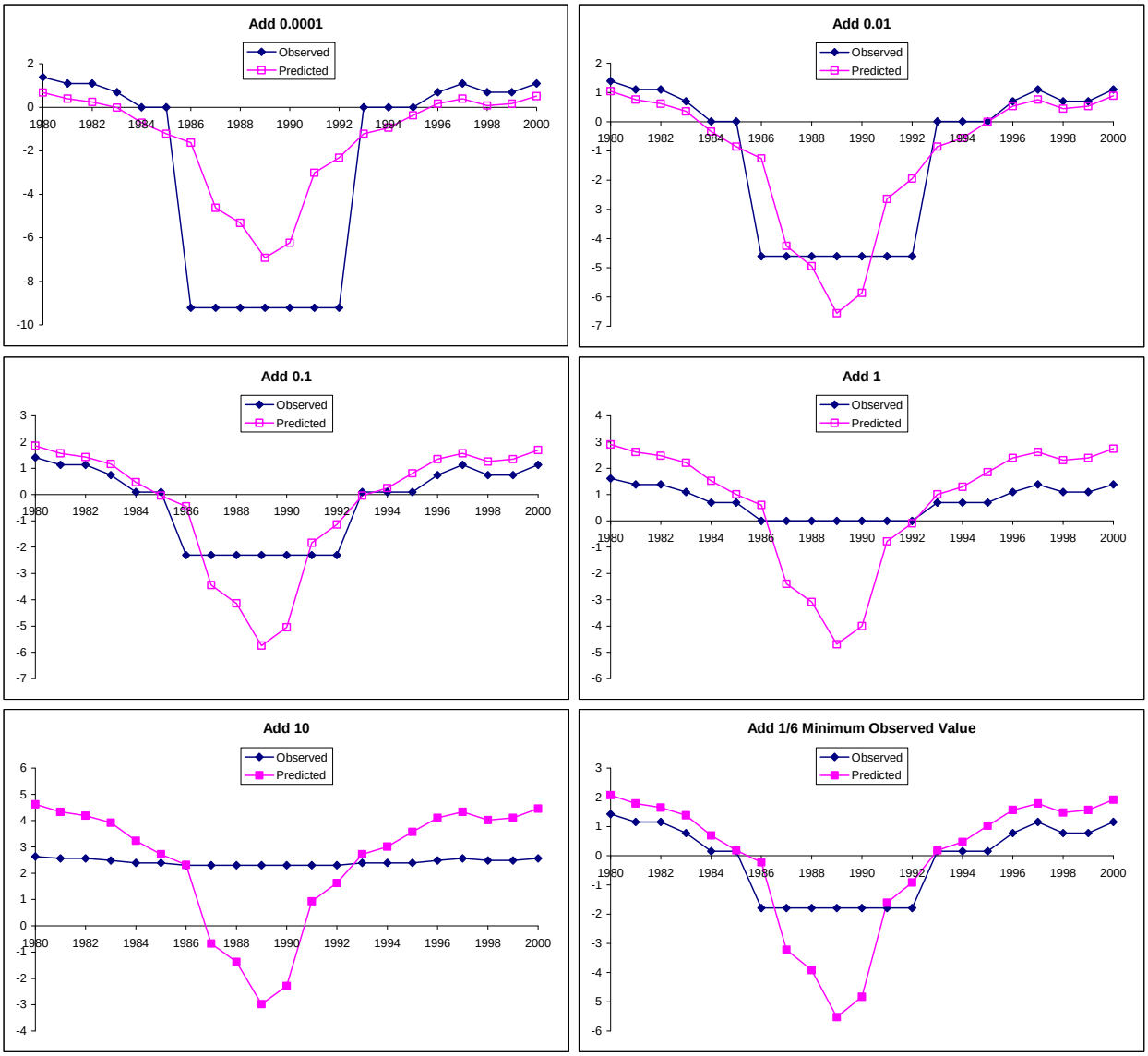


Figure 3. Comparison of observed and predicted indices when observed values are rounded to zero decimal places and resulting zeros are replaced by different constants. The predicted indices follow the true population pattern and are scaled by a catchability coefficient to minimize the natural logarithm of the squared residuals. Note the y-axes are log scale

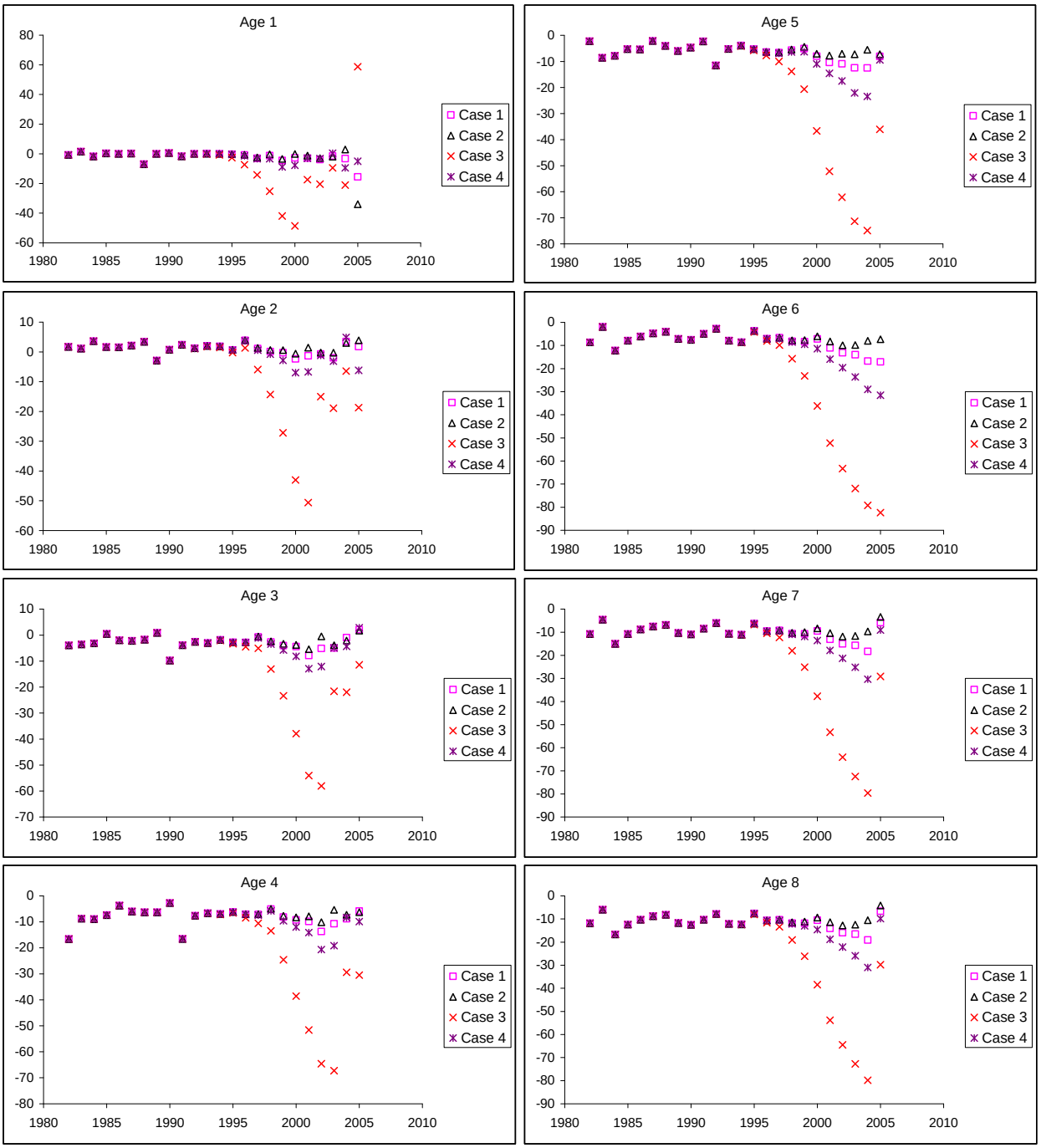


Figure 4. Percent bias in the medians of fishing mortality by age and year for the four cases of how index values less than one are treated

Figure 5. Percent bias in the medians of population numbers by age and year for the four cases of how index values less than one are treated. Note a number of case 3 values are too large to be shown on the plots, values are given in Table 5.

SAW 47 Working Paper 5 (TOR 2b) – Zero-fill Regression Example

15 November 2006

Some More Thoughts on Filling Zeros in Tuning Indices: A Simple Regression Example

by
Chris Legault

Introduction

The problem of zeros in tuning indices is that a lognormal error distribution is assumed. 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. One objective method to do this is to add 1/6 of the smallest non-zero value in the series to all values. The consequences of these two approaches are considered in a simple regression example.

Methods

A 26 year population time series was simulated with each value varying uniformly between zero and 50,000 fish. A catchability coefficient of 0.0001 was applied to generate the predicted index value. Lognormal noise with exp(std dev) of 0.2 was applied to the predicted values to generate the observed indices. If an observed index was below 0.5, then it was set to zero to mimic the problem of low abundance not being detected. The constant c was determined for each realization as 1/6 of the smallest non-zero value in the observed time series. Four time series of values were created, 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.

Results

When zero observations were treated as missing, the slope was slightly negatively biased with mean 0.983 and 90% confidence interval (0.864, 1.109). 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 with mean 1.261 and 90% confidence interval (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.

Discussion

The reason for this large disparity between the "missing" and "add c" results can be seen by examining an extreme example of the data used in the regressions (Figure 1). There were five observations that were replaced with c=0.094 causing the five ln(obs+c) values to all be -2.364 even though the associated ln(pred+c) values ranged from -1.265 to -0.307. These points do not fall on the line that would have been fit to the remaining data and are the source of the bias in the results. More typical results followed the same pattern but with less difference between the two slopes.

The constant was added to both observed and predicted data because to ensure an appropriate comparison. In a separate simulation I did not replace values less than 0.5 with zero and found nearly identical distributions for the "missing" and "add c" slopes. This demonstrates 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.

Conclusion

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.

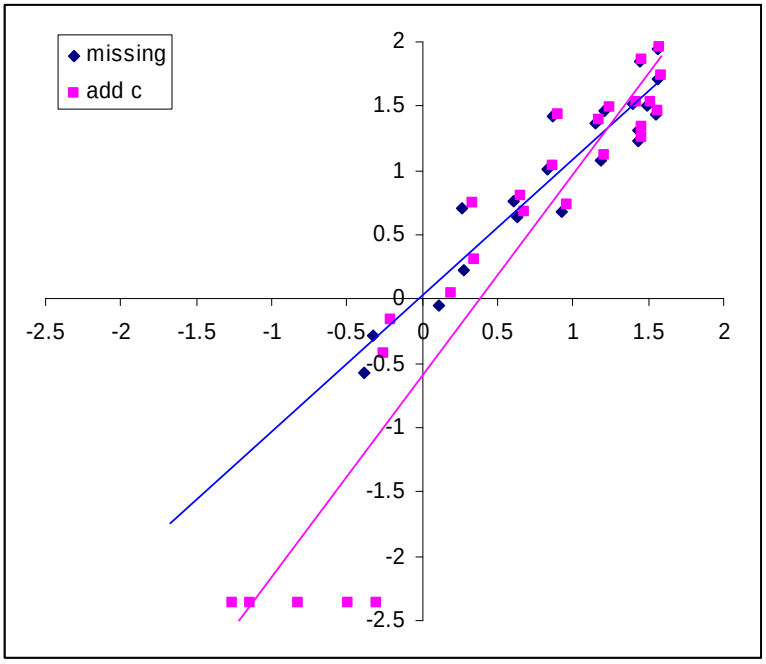


Figure 1. One realization of the "missing" and "add c" regressions. This example is extreme with "add c" slope slightly larger than the upper 90% confidence interval. The x-axis is either ln(pred) or ln(pred+c) and the y-axis is either ln(obs) or ln(obs+c).

SAW 47 Working Paper 6 (TOR 2b) – Treatment of Zeros

October 30, 2006

The treatment of "zero" observations in the Summer Flounder ADAPT VPA calibration

by
Mark Terceiro

Introduction

The issue of how to treat "zero" observations in ADAPT VPA calibrations was 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."* This recommendation stemmed from the nature of the ADAPT VPA calibration (tuning) algorithm, which includes natural logarithm (ln) transformation (i.e., assumption of a lognormal error distribution) of the input survey abundance indices prior to calibration. Some of the tuning series in the assessment include several "true zero" observations (as contrasted with years for which no sampling was performed) in their time series. Since "zeros" are treated as missing values in the ADAPT computations, a possible solution would be to add a constant to every value in these series to enable use of these "true zeros" as observations.

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. Briefly, the method 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. 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.

Recently, the 2006 assessment of summer flounder (Terceiro 2006a) 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, a revised 2006 ADAPT VPA for summer flounder was developed for which 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). For ages 1-7+ survey series with "zero" observations, a value equal to one-sixth of the minimum value in each series was used in place of the "zero" observations. Typically, the minimum non-zero value in these series was 0.01, and so the additive constant was 0.001667 (Terceiro 2006b).

Summer flounder 2006 ADAPT VPA

In this work, the Berry (1987) approach is applied 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. Table 1 summarizes the statistical properties of the 24 survey series that were examined. The distributions of the surveys 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).

Table 2 summarizes the results of the exercise for each group of age-specific indices. Values of *g* were minimized for constants between 0.001 and 100 (minimum values in ***bold italics***), for the age 0, 1, 2, 3, 4, and 5-7+ (aggregate) survey indices (number per tow or haul). There is no statistically significant correlation (Table 3) between the value of the additive constant that minimizes g and the statistical parameters listed in Table 1.

Age 0 Indices

For the five age 0 series, the *g* statistic was minimized by values of the additive constant ranging from 0.001667 to 1. The constant equated to one-sixth of the minimum non-zero observed value for 2 of the 5 series . The relationships between the additive constants and calculated values of *g* for the age 0 indices are shown in Figure 1.

Age 1 Indices

For the three age 1 series, the additive constant of 0.01 minimized the absolute value of *g*. The relationships between the additive constants and calculated values of *g* for the age 1 indices are shown in Figure 2.

Age 2 Indices

For the single age 2 series, the additive constant of 0.1 minimized the absolute value of *g*. The relationships between the additive constants and calculated values of *g* for the age 2 indices are shown in Figure 3.

Age 3 Indices

For the six age 3 series, the absolute value of the *g* statistic was minimized by values of the additive constant ranging from 0.001 to 100. The constant equated to one-sixth of the minimum non-zero observed value for 1 of the 6 series . The relationships between the additive constants and calculated values of *g* for the age 3 indices are shown in Figure 4.

Age 4 Indices

For the six age 4 series, the absolute value of the *g* statistic was minimized by values of the additive constant ranging from 0.001 to 1. The constant equated to one-sixth of the minimum non-zero observed value for 1 of the 6 series . The relationships between the additive constants and calculated values of *g* for the age 4 indices are shown in Figure 5.

Age 4/5-7+ Indices

For the three age 4/5-7+ series, the absolute value of the *g* statistic was minimized by values of the additive constant ranging from 0.001667 to 100. The constant equated to one-sixth of the minimum non-zero observed value for 1 of the 3 series . The relationships between the additive constants and calculated values of *g* for the age 4/5-7+ indices are shown in Figure 6.

Conclusion

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."

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Table 1 . Statistical properties of summer flounder ADAPT VPA survey calibration series with "zero" observations.

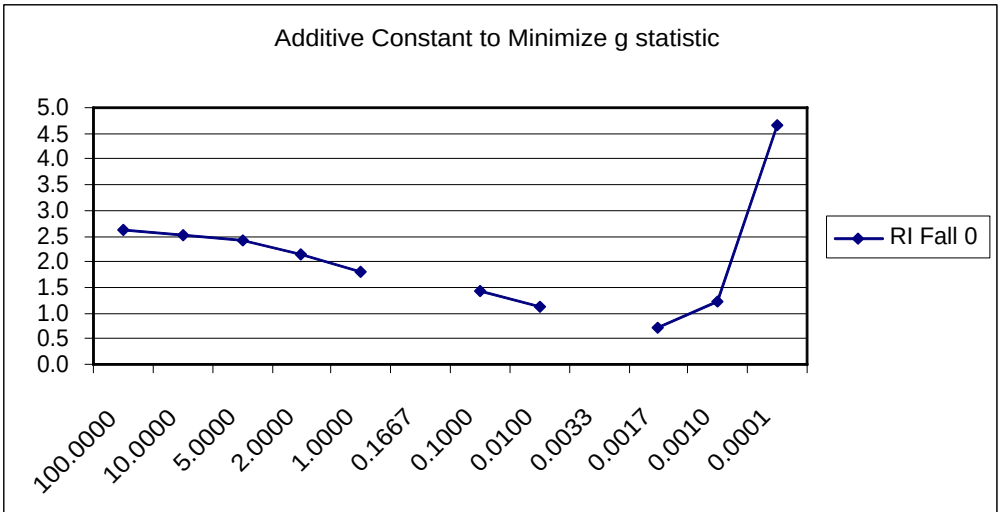
Survey Name	N Obs	N "Zeros"	Mean	Max	Non-zero Min	CV (%)	Skew	Kurt
Age 0 Indices								
RI Fall 0	26	2	0.130	0.550	0.01	118	1.422	1.212
RI Monthly 0	16	3	0.037	0.110	0.01	95	1.044	0.152
CT Fall 0	22	4	0.085	0.442	0.013	128	2.078	4.733
MA Seine 0	24	3	8.292	70.000	1	170	3.904	17.141
DE 30 0	15	1	0.487	2.280	0.02	133	1.874	3.463
Age 1 Indices								
MA Spring 1	28	2	0.260	1.770	0.025	140	3.105	11.161
MA Fall 1	28	2	0.761	2.907	0.011	109	1.280	0.686
RI Fall 1	26	1	0.535	2.470	0.05	120	2.197	4.724
Age 2 Indices								
MA Fall 2	28	2	0.759	2.235	0.047	85	0.884	-0.224
Age 3 Indices								
NEC Spring 3	31	1	0.302	1.020	0.01	99	0.865	-0.536
NEC Fall 3	24	2	0.168	0.660	0.01	111	1.076	0.334
MA Fall 3	28	2	0.132	0.756	0.010	132	2.086	5.191
RI Monthly 3	16	2	0.199	0.530	0.01	95	0.786	-0.916
NJ Trawl 3	18	3	0.340	1.280	0.01	112	1.141	0.828
DE 30 3	15	2	0.155	0.470	0.01	105	0.991	-0.137
Age 4 Indices								
NEC Spring 4	31	5	0.092	0.310	0.01	111	0.985	-0.404
NEC Fall 4	24	8	0.043	0.190	0.01	144	1.444	0.762
MA Spring 4	28	5	0.086	0.317	0.010	116	1.187	0.242
MA Fall 4	28	13	0.019	0.186	0.01	196	3.484	14.026
RI Fall 4	26	5	0.035	0.280	0.01	179	2.961	9.516
RI Monthly 4	16	4	0.060	0.240	0.01	122	1.257	0.856
Age 5-7+ Indices								
NEFSC Spring 5-7+	31	10	0.060	0.210	0.01	121	0.892	-0.793
NEFSC Winter 5-7+	15	1	0.803	2.600	0.01	106	0.698	-0.636
NJ Trawl 4-7+	18	4	0.172	0.810	0.01	129	1.715	2.946

Table 2. Values of the additive constants that minimize the statistic *g*. Values that are one-sixth the minimum observed in the series are in bold.

Survey Name	Constant
Age 0 Indices	
RI Fall 0	**0.001667**
RI Monthly 0	0.01
CT Fall 0	0.01
MA Seine 0	1
DE 30 0	**0.003333**
Age 1 Indices	
MA Spring 1	0.01
MA Fall 1	0.01
RI Fall 1	0.01
Age 2 Indices	
MA Fall 2	0.1
Age 3 Indices	
NEC Spring 3	0.01
NEC Fall 3	**0.001667**
MA Fall 3	0.001
RI Monthly 3	0.01
NJ Trawl 3	2
DE 30 3	100
Age 4 Indices	
NEC Spring 4	0.001
NEC Fall 4	0.1
MA Spring 4	1
MA Fall 4	0.001
RI Fall 4	**0.001667**
RI Monthly 4	0.1
Age 5-7+ Indices	
NEFSC Spring 5-7+	100
NEFSC Winter 5-7+	**0.001667**
NJ Trawl 4-7+	0.1

Table 3. Correlation analysis (value of *r*) of various statistical properties of the 24 summer flounder index series with "zero" observations. For n = 24, the critical value of *r* at the 0.05 significance level is about 0.4.

	N	Nzero	Mean	Max	Min	CV	Skew	Kurt	*g*
N	1.00								
Nzero	0.32	1.00							
Mean	0.01	-0.12	1.00						
Max	0.02	-0.08	1.00	1.00					
Min	0.18	-0.28	-0.01	-0.05	1.00				
CV	0.20	0.57	0.31	0.35	-0.19	1.00			
Skew	0.21	0.26	0.50	0.53	0.08	0.88	1.00		
Kurt	0.20	0.26	0.57	0.60	0.05	0.86	0.99	1.00	
g	-0.02	0.25	-0.08	-0.07	-0.12	-0.13	-0.24	-0.22	1.00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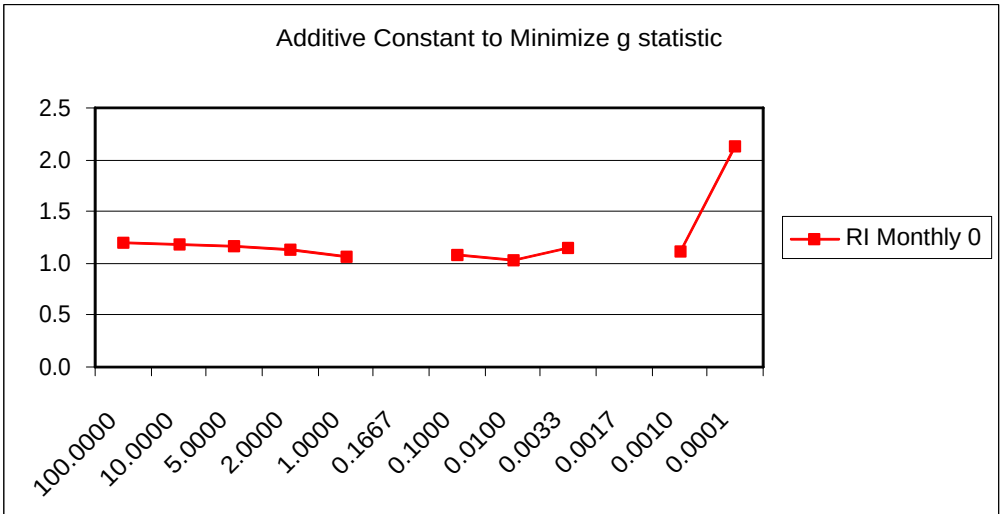
RI Fall 0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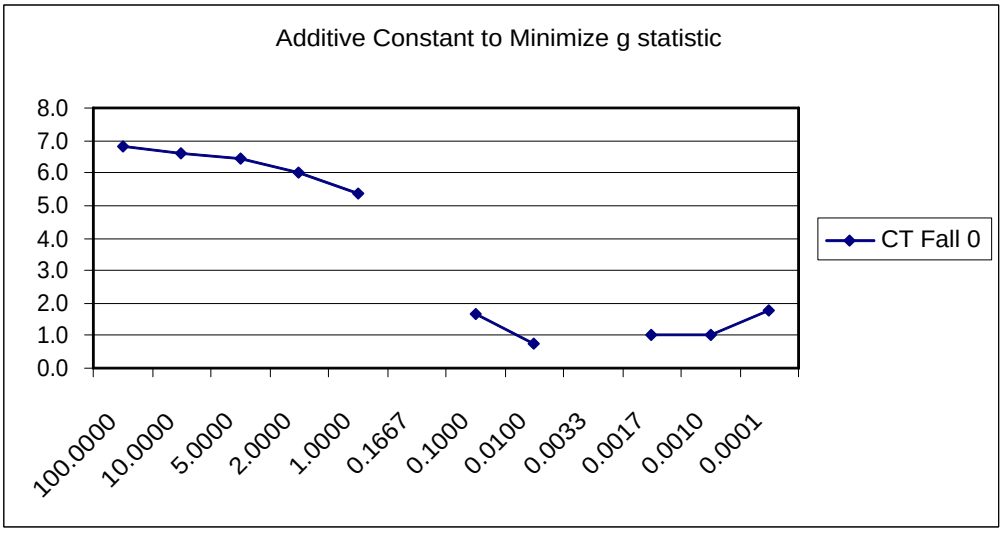
RI Monthly 0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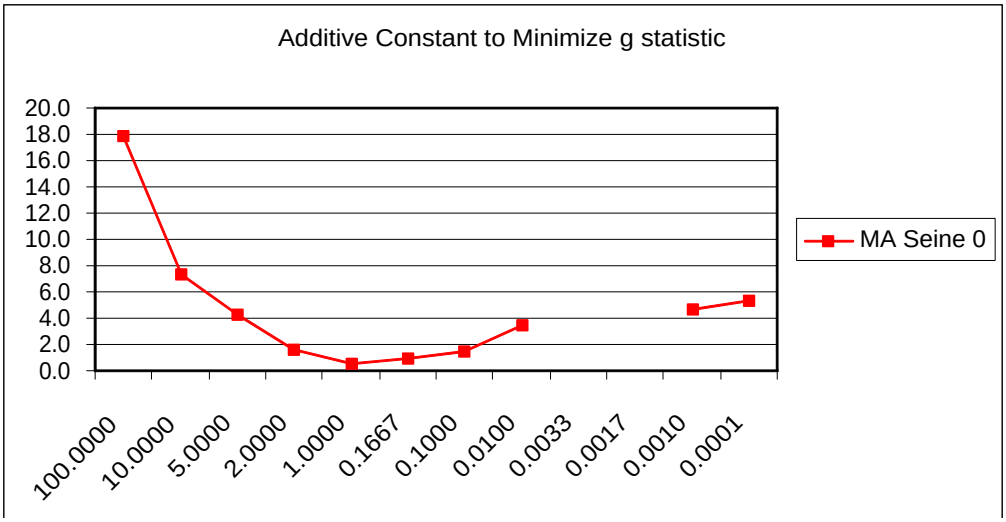
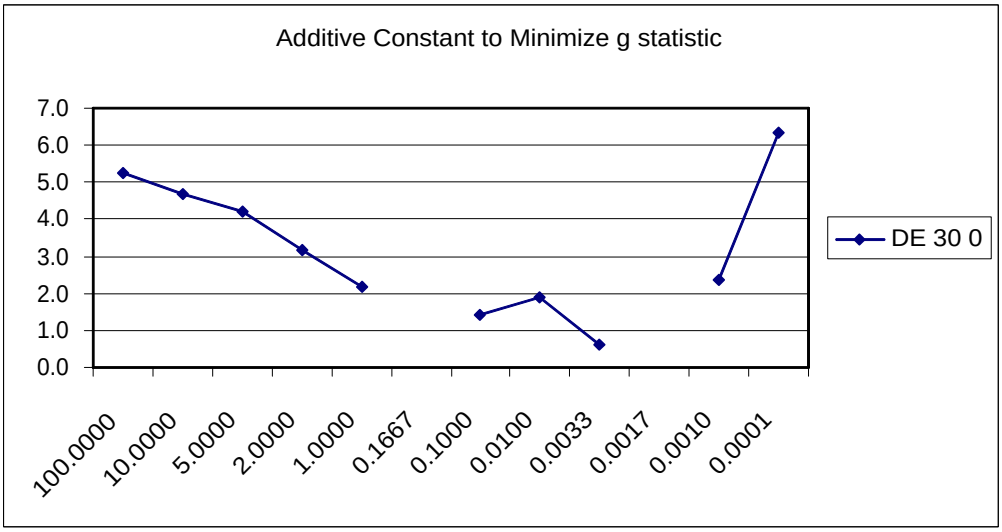
CT Fall 0

Figure 1.





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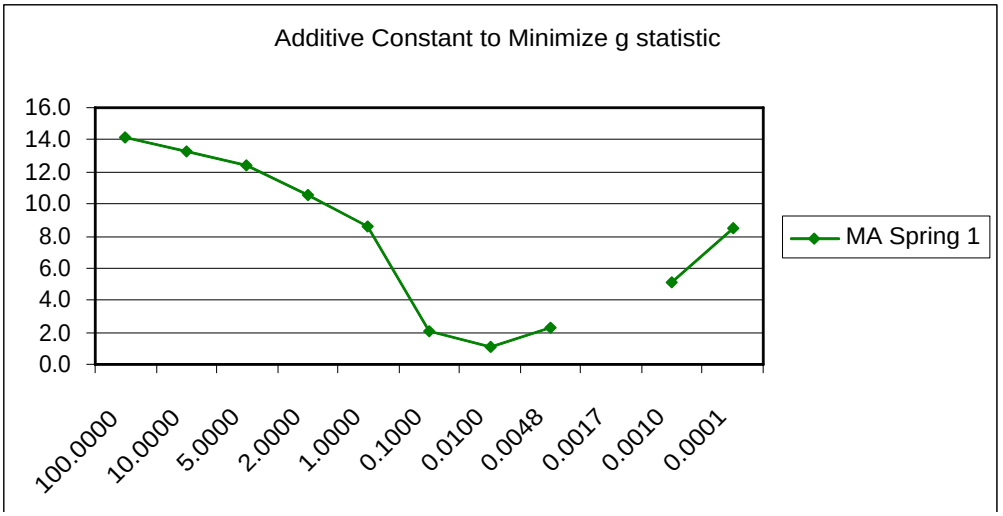
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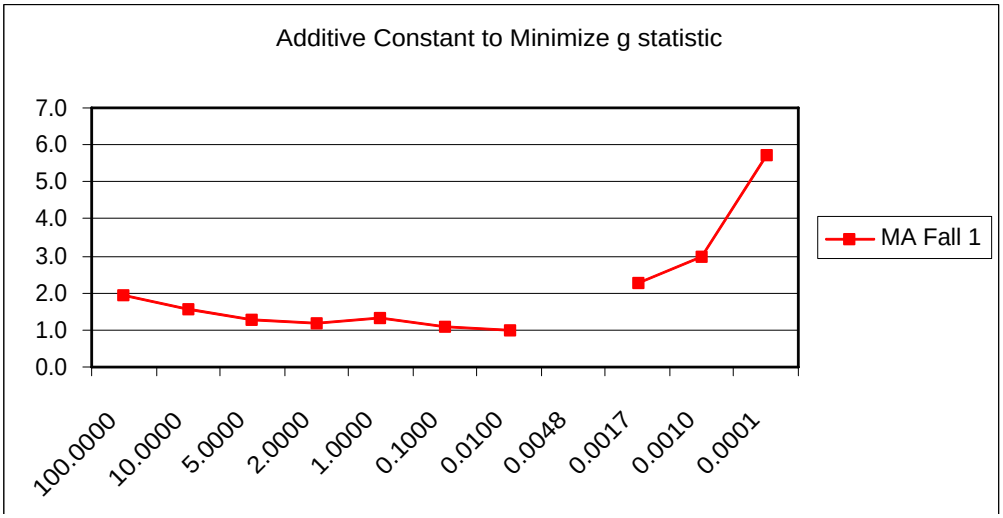
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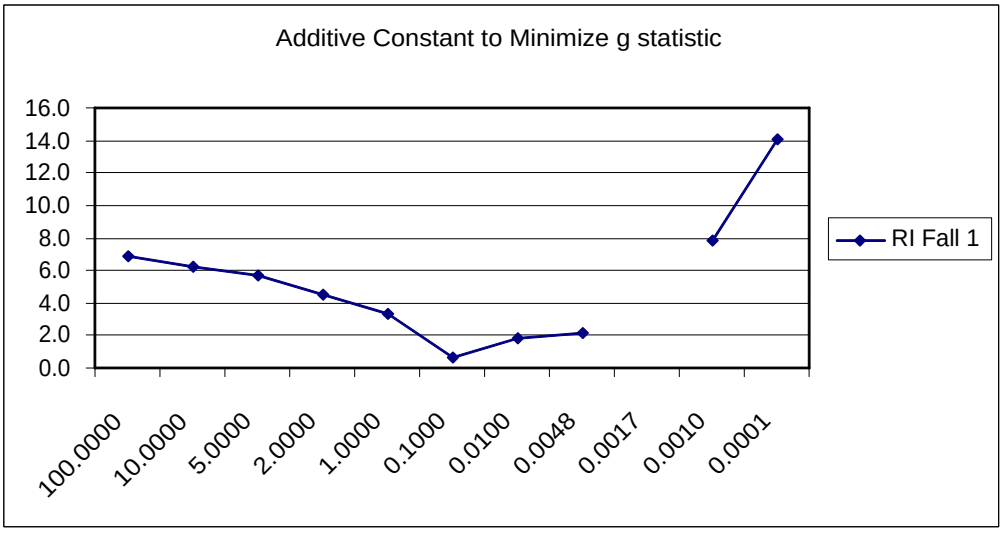
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RI Fall 1

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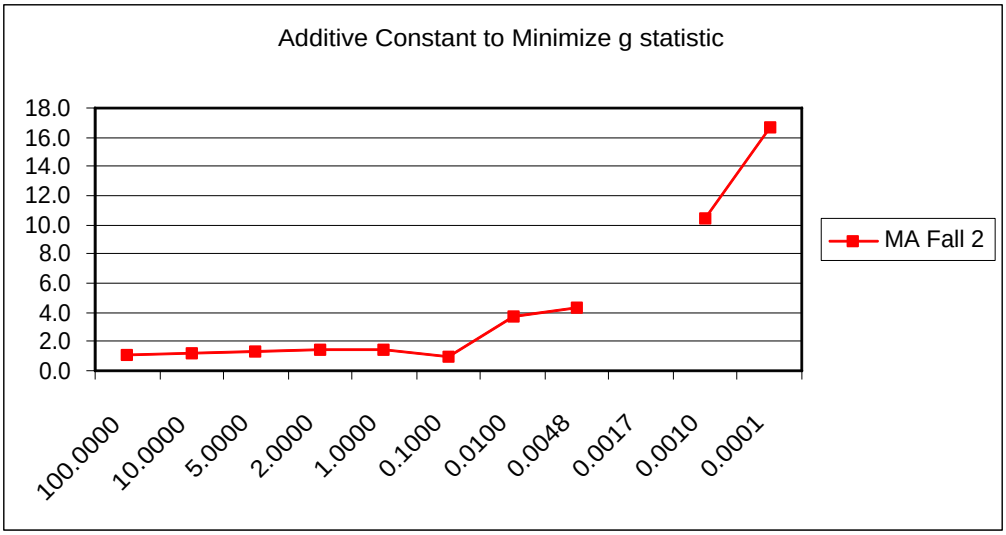
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MA Fall 2

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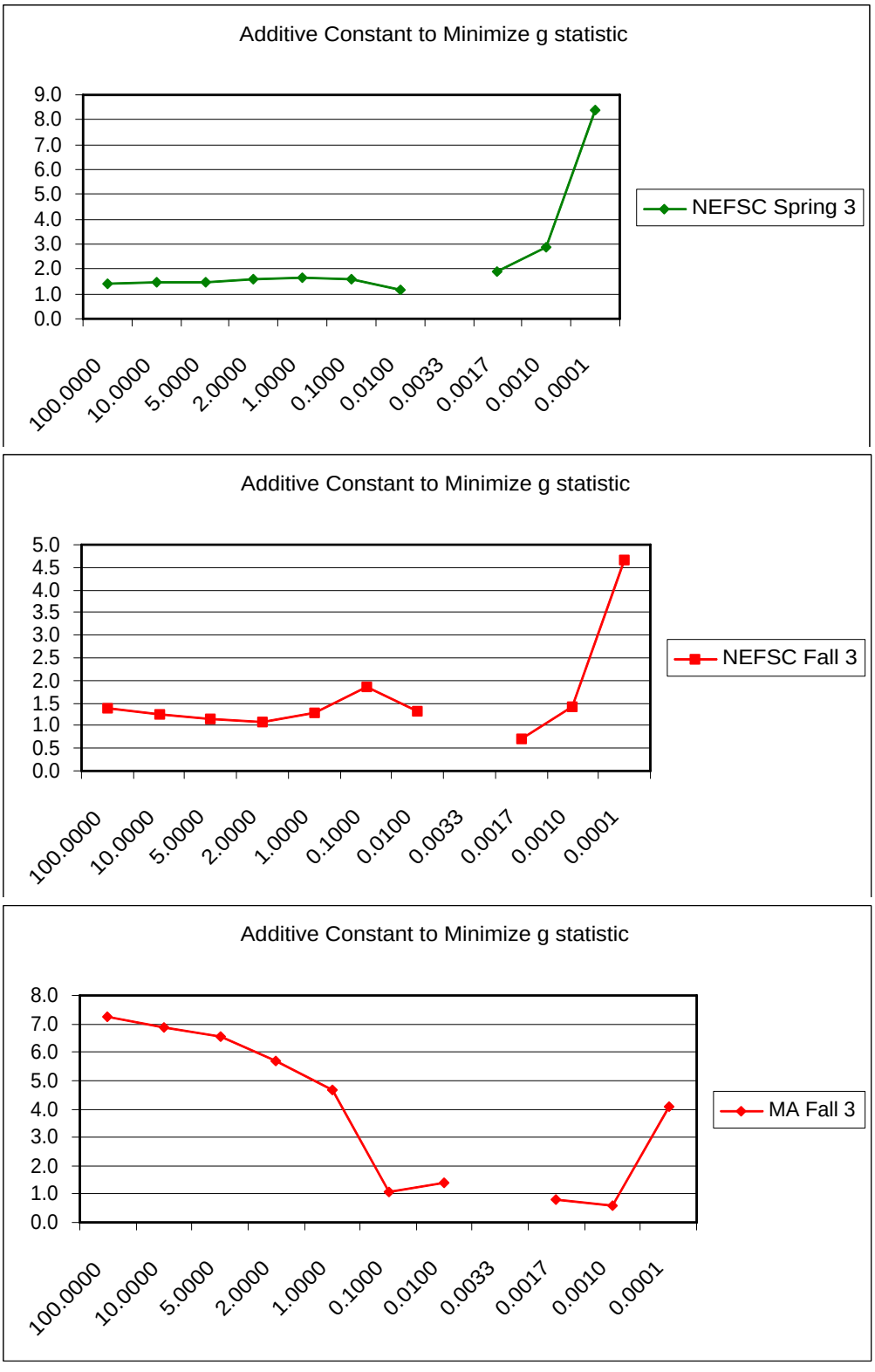
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3.0
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2.0
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10.0000
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1.0000
0.1000
0.0100
0.0033
0.0017
0.0010
0.0001
NEFSC Fall 3
Additive Constant to Minimize g statistic
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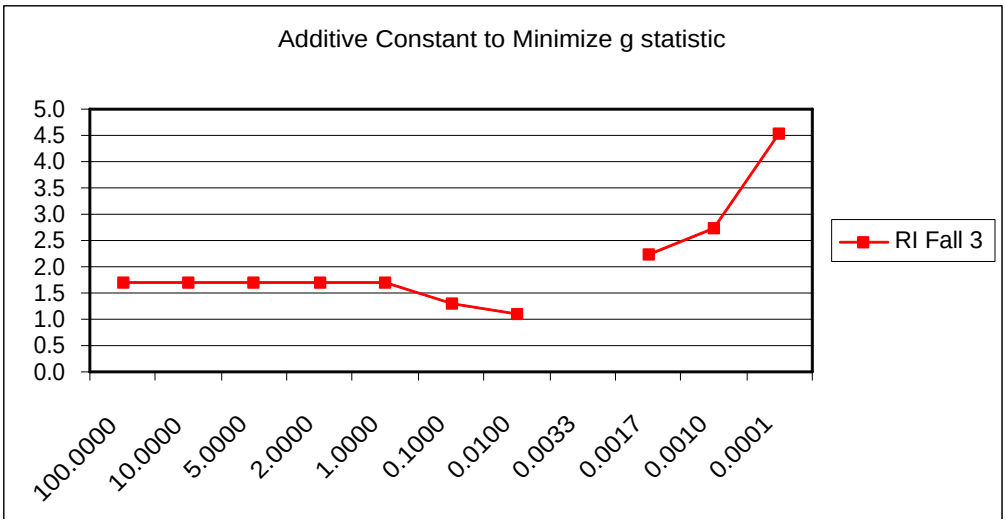
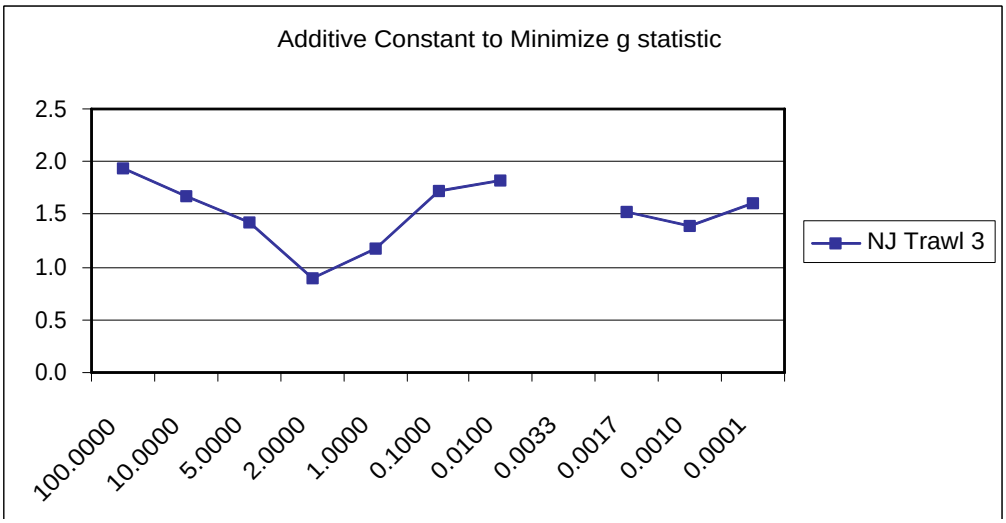
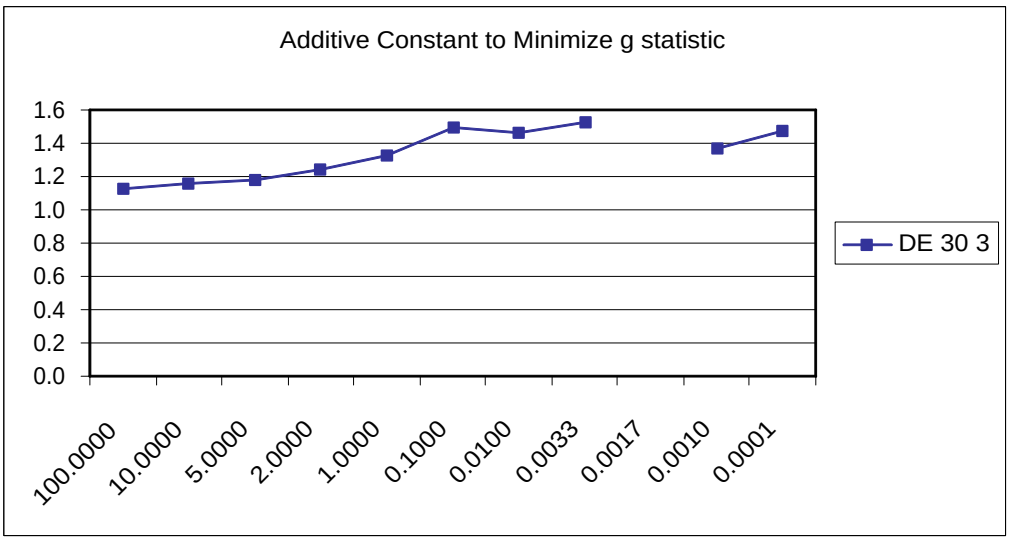
MA Fall 3

Figure 4.







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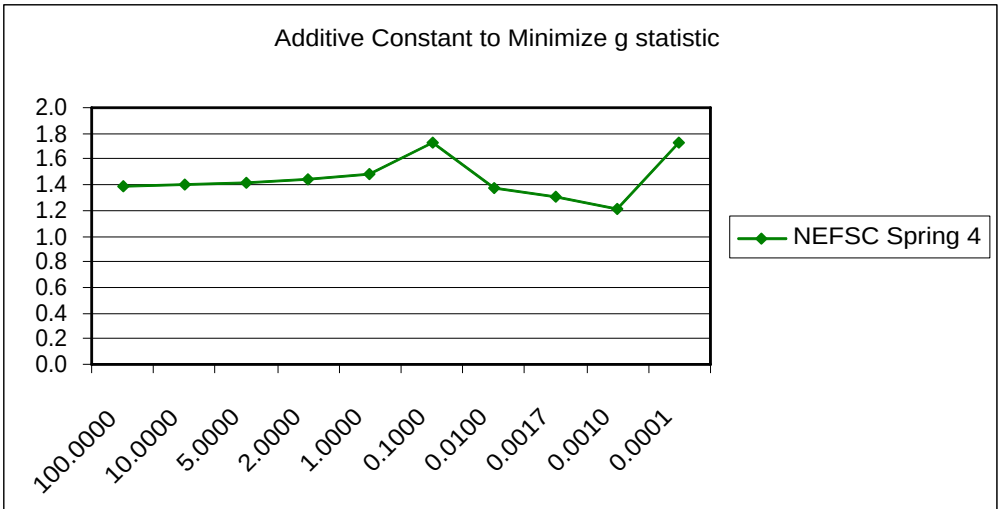
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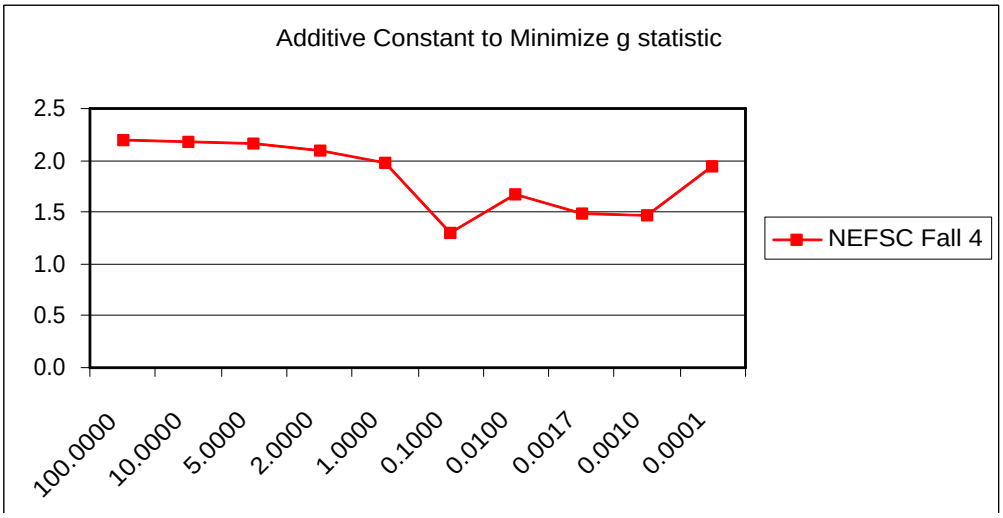
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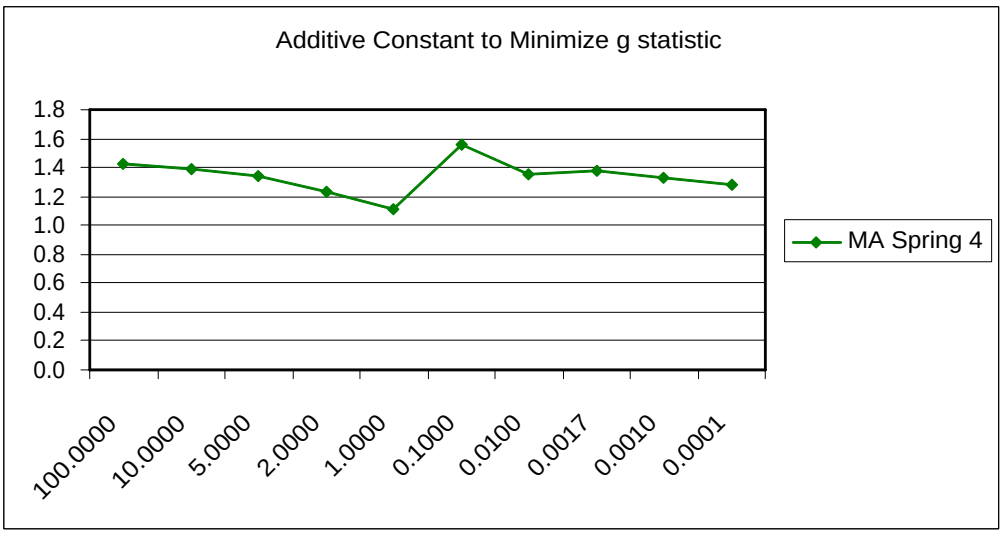
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MA Spring 4

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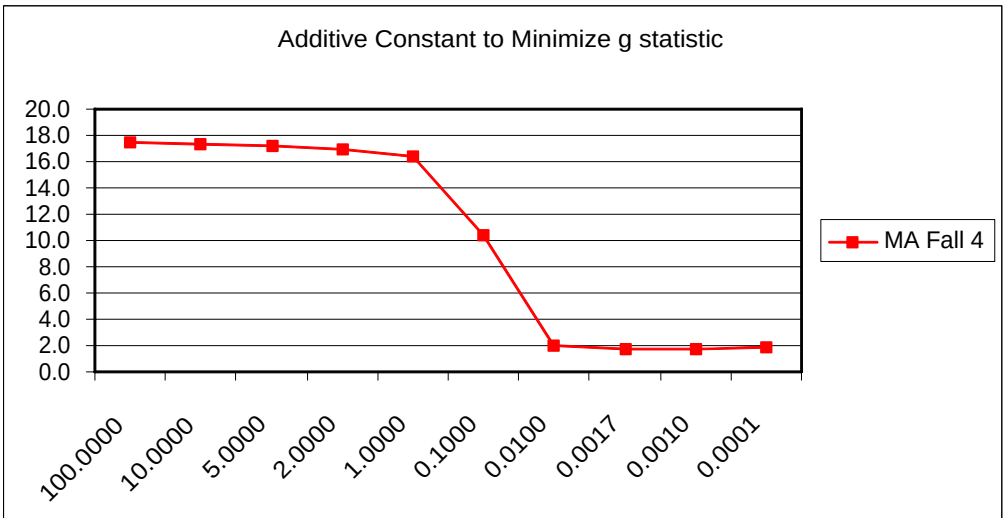

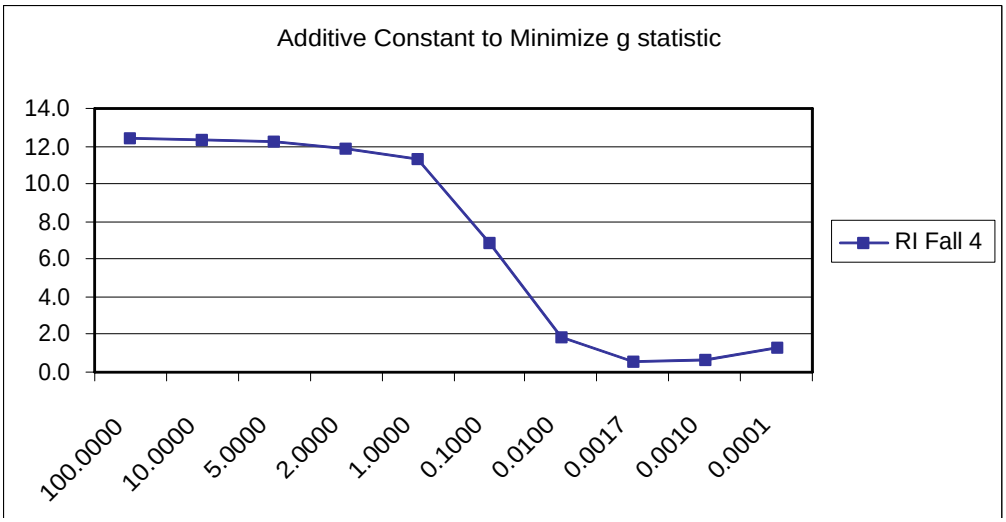

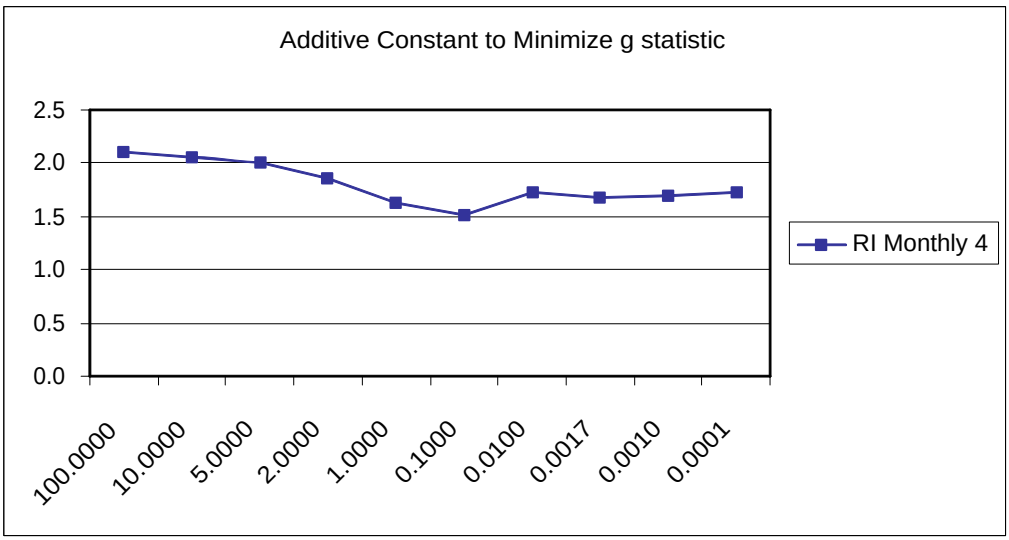

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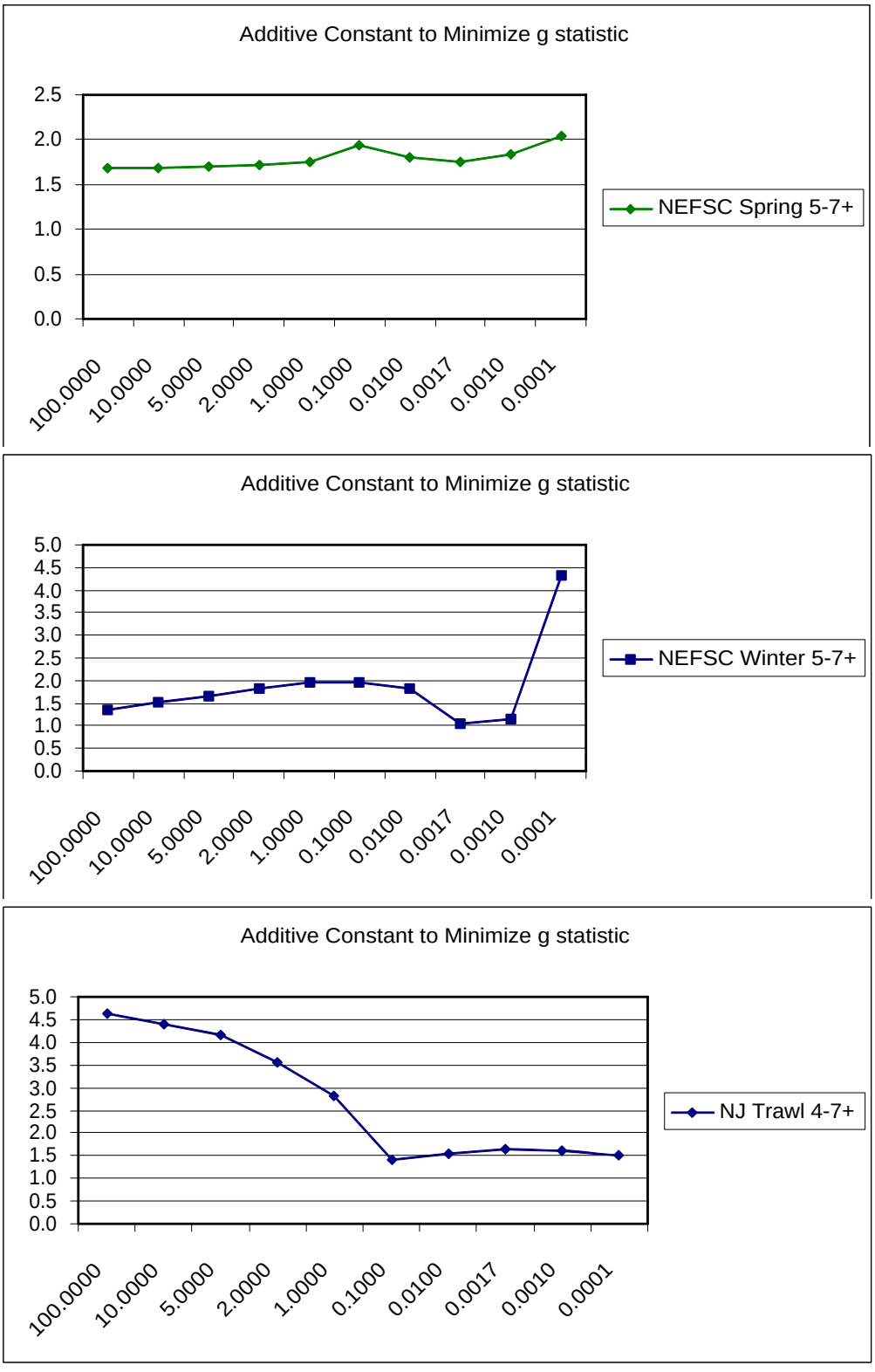
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NEFSC Spring 5-7+
Additive Constant to Minimize g statistic
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4.0
3.5
3.0
2.5
2.0
1.5
1.0
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0.0
100.0000
10.0000
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NEFSC Winter 5-7+
Additive Constant to Minimize g statistic
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0.0001
NJ Trawl 4-7+

Figure 6.

APPENDIX 3

SAW 47 Working Paper 7 (TOR 3) – Life History Parameters

Evaluation of summer flounder life history parameters from NEFSC trawl survey data, 1992 – 2006.

Jeffrey C. Brust
New Jersey Division of Fish and Wildlife

April 2008

Background

In 2000, summer flounder stocks were determined to be overfished. Management of the species entered a ten year rebuilding period in order to increase abundance to sufficient levels. Recent stock assessments indicate that, although fishing mortality has decreased substantially and biomass is at the highest level ever recorded, the stock is still only about 50% of the target biomass. As the end of the rebuilding period nears and quotas continue to drop despite the high biomass, there has been growing concern that the stock assessment and/or biological reference points for the species are flawed.

During the 2007 stock assessment update, it was noted that there have been changes in certain biological parameters of the stock over the last few years. Among these are size at age and sex ratio. Changes in these and other parameters could affect population dynamics and rebuilding rates. The purpose of this paper is to review data collected during National Marine Fisheries Service, Northeast Fishery Science Center seasonal trawl surveys in order to investigate key biological parameters and evaluate potential implications on stock rebuilding and management of the species.

Methods

Data were obtained from the NEFSC trawl survey database. Since 1992, NEFSC finfish trawl surveys have occurred three to four times per year, and have recorded lengths, weights, ages, and sex from at least a subsample of summer flounder captured in the survey.

Length and weight at age

Evaluation of sample size at age revealed that sample size at older ages was very low, particularly during early years of the analysis. Data were therefore subset to years and ages that had a sufficient sample size.

Trends of size at age over time were evaluated in two ways. First, sex specific mean size at age was calculated for each year with sufficient sample size. SAS Proc REG (SAS 1990) was used to conduct regressions of size at age over time.

Second, observed data were fit to a von Bertalanffy growth function

$$L_t = L_\infty * (1 - e^{-(k*(t-t_0))})$$

to develop annual sex specific predicted length at age estimates using SAS Proc NLIN (SAS 1989a). For each year, residuals were resampled with replacement to develop 500 bootstrap datasets (Barker 2005), each of which was also fit using the von Bertalanffy growth function. Summary statistics were calculated for the parameter estimates, as well as predicted size at age. SAS Proc REG was used to perform regression analysis of mean predicted length at age over time.

For both methods, slope parameters of length at age over time were evaluated at the $\alpha = 0.10$ level.

Length-weight analysis was also conducted with SAS Proc NLIN using an allometric growth function.

$$W = \alpha L^\beta$$

For each year, residuals between observed and predicted weight at length were calculated and resampled to develop 500 bootstrap datasets which were also fit to the growth function. Summary statistics were calculated for the parameter estimates, as well as predicted weight at length. SAS Proc REG was used to evaluate trends in mean weight at length over time.

Maximum age, sex ratio, and natural mortality

Maximum age by sex was found by analytical review of the raw data, as were overall sex ratios and sex ratios by age. 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).

Natural mortality for each sex was estimated using the approximation of 3 / T_{MAX} (Hoenig 1983). Annual estimates of natural mortality for the stock were determined using a weighted average of sex-specific natural mortality and annual sex ratio.

Fecundity

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

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

Number of mature females by age and year were determined by multiplying the VPA estimated abundance at age by sex ratios at age and the VPA input maturity schedule. These were multiplied by fecundity at age and summed across ages to estimate total theoretical fecundity of the stock.

Results

Length and weight at age

The number of fish observed on trawl surveys was low for some ages and years, particularly during early years of the analysis. Data were therefore subset to years and ages where sample size was generally greater than 50 fish per year (all surveys combined). Prorating ages to the season fish were captured (assuming a January 1 birthdate) as done in earlier drafts resulted in low sample size for some seasons, but fitting equations using ages pooled across surveys in a year resulted in poor or unconverged fits for some years. As a result, length at age calculations (mean and von Bertalanffy) were conducted using samples from the winter survey only. The subset data include years from 1999 to 2006 and 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 (Table 1).

Mean lengths for males age 1 to 4 show no long term trends between 1999 and 2006 (Table 2, Figure 1), and regression results indicate no significant changes over time (Table 3). 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 (Table 4). Bootstrap average maximum length for these years was approximately 100,000 cm. Although the mean estimated parameter values produce unrealistic estimates of length at age, specific bootstrap replicates with large maximum size estimates had correspondingly lower estimates of the growth parameter *k*, such that mean predicted length at age was not erratic for fish less than 8 years old. Regression results for length

at ages 0 to 10 (the approximate age range observed in survey data) showed no significant trends (Table 5, Figure 2).

Estimated von Bertalanffy parameters for females were also unrealistic in 2000, though much less so than for males (Table 6). Regression results indicate no significant trend in predicted length at age for ages 0 to 4; however, predicted length at ages five and older decreased significantly between 1999 and 2006 (Table 7, Figure 3). For both males and females, regression results using von Bertalanffy predicted length at age were consistent with results of mean length at age.

Length:weight analysis was conducted on the same subset of years and ages as age:length analysis. As before, sample size was generally above 40 fish (Table 8). No significant trends were observed for weight at length for males (Tables 9 and 10, Figure 4) or females (Tables 11 and 12, Figure 5).

Maximum age, sex ratio, and natural mortality

Between 1985 and 1995, maximum age for males generally varied between age 4 and 5, while female maximum age ranged from age 6 to 8 (Figure 6). By 2000, maximum age of males had 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.

From 1992 to 1997 overall sex ratio averaged approximately 54% female (Figure 7). From 1997 to 2000, females increased from 53 to 58% of the stock, where it remained stable for 3 years. In 2003, the ratio dropped to 51% female and has varied widely from 47 to 57% since then.

Natural mortality was estimated as a weighted average of sex ratio and sex-specific natural mortality. Using maximum ages of 12 and 15 for males and females, respectively, sex-specific natural mortality is estimated at 0.25 for males and 0.20 for females. Applying these to overall sex ratios, M has remained relatively stable around 0.223, with a range of 0.221 in 2000 to 0.226 in 2005 (Figure 7).

Sex ratios by age (Figure 8) show a general decrease in percent female at age since the mid 1990s for all ages, although the declines are more evident for ages 2 and above. For example, 3 year old fish have dropped from an average of 75% female during 1992 to 1994 to 56% female in 2004 to 2006. Four year old fish have dropped from 85% female to 62% female over the same time period.

Sex ratio at size data (discussed below) indicate that greater than 90% of fluke can be sexed by 25 cm. Von Bertalanffy estimates indicate that both males and females attain this size by age 1. By age 2 both males and females have recruited to the commercial fishery (36 cm, 14”), so age 1 is the only age where they are large enough to be sexed and experience no harvest pressure. Natural mortality for age 1 fish is generally stable between 0.225 and 0.23 from 1992 to 2002, but has increased to approximately 0.235 in recent years (Figure 9). Even though age 2 fish are exploited, the sex ratio averages approximately 50:50 up to 43 cm (17”, age 3), and both sexes are likely harvested in equal proportions. Natural mortality of age 2 fish shows a gradual increase from 0.216 to 0.23 from 1992 to 2005, before dropping sharply back to 0.224 in 2006. Average M for age 1 and 2 also shows a gradual increase over all years from 0.222 to approximately 0.23.

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 (Figure 10). Using annual data, the 50% inflection ranges from 33 cm in 1992 and 1995 to 43 cm in 2003 and 2005 (Figure 11).

Combined data show that greater than 90% of all animals 25 cm and larger can be sexed. Sex ratio for fish 25-35 cm (*i.e.* able to be sexed but less than minimum size) has decreased from an average of 34.5% females for 1992-94 to 29.4% for 2004-06 (Figure 12). Natural mortality for fish in this size range has increased from an average of 0.233 for 1992-94 to 0.235 for 2004-06 (Figure 13). From 35 cm to 43 cm, the sex ratio is approximately 50:50, and fish in this size range are likely exploited in similar proportions. The sex ratio for fish 25 to 43 cm shows a decline from 48.4% female in 1992-1994 to 37.2% in 2004-2006. *M* for this size range has increased from 0.226 to 0.231 over the same time period.

Fecundity

Because of the concerns with sample size for age:length data, fecundity could only be evaluated for the years 1999 to 2006. Theoretical fecundity of the stock increased steadily from approximately 22.3 x 10^{12} eggs in 1999 to a maximum of over 36.5 x 10^{12} eggs in 2004 (Figure 14). Fecundity has decreased in each of the last two years, to approximately 31.0 x 10^{12} eggs in 2006. During this time period, recruitment (VPA output) has remained relatively stable between 28 million and 38 million individuals, except for 2004 where recruitment was estimated at only 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.

Discussion

Summer flounder biomass has increased substantially during the rebuilding period, yet managers continue to cut annual quotas in an attempt to reach established biomass reference points. This has led many managers and industry stakeholders to question the accuracy of the reference point targets. In recent months, evidence has been presented that summer flounder stocks may be experiencing changes in life history parameters, such as size at age and sex ratios. In addition, there have been implications that management measures themselves are impeding stock rebuilding by selectively harvesting larger individuals which are primarily female. This paper was undertaken to evaluate certain life history parameters and the implications they have on stock rebuilding.

Dery 1988 found males reached a maximum age of 7 years and females 12 years. This is generally consistent with maximum ages observed in NEFSC trawl surveys from 1992 to 2000. Since then, maximum ages of both males and females captured in the NEFSC trawl surveys have approximately doubled, likely as a result of reduced fishing mortality allowing fish to survive to older ages. Trawl data indicate that maximum ages of 12 for males and 15 for females may be more appropriate. As maximum ages for both sexes were observed in recent years, additional years of reduced fishing pressure may result in even older maximum ages. In addition, maximum ages may be confounded with survey catchability at size.

As identified by Terceiro (pers. comm.) length and weight at age do appear to have decreased in recent years. For males, decreases in length at age are not yet statistically significant, but may become so if the trend continues. For females, significant decreases in length at age have been observed for ages 5 and older. Although length:weight relationships

have not changed, decreased length at age results in lower weight at age, which may result in slower than anticipated rebuilding rates.

In recent months, many fishermen have expressed concern regarding the finding of the NEAMAP trawl survey that most fluke greater than 41 cm (16") are female. These findings are not new (*e.g.* Murawski and Figley 1977, Morse 1981), but this sexual dimorphism has greater implications for management and stock rebuilding as minimum size limits increase in an effort to reduce harvest. There does appear to be a general decline in the ratio of females to males observed in the trawl survey. However, for many ages this decline has been observed over 15 years, much longer than states have required large minimum sizes.

Natural mortality for summer flounder is generally approximated as $M = 0.2$ based on longevity information. Because summer flounder males and females appear to have different maximum ages, the sex ratio of the population could affect the overall stock natural mortality rate. The shift in sex ratio towards more males in recent years has led to a slight increase in natural mortality for the stock, but the increase does not appear substantial enough to affect rebuilding. However, estimates based on current data indicate that $M = 0.22$ might be a more appropriate estimate of overall natural mortality. A higher natural mortality rate would result in a higher F_{Target} and lower SSB_{Target} than currently estimated. Although this analysis provides evidence for a higher M, additional analyses should be conducted. The Hoenig (1983) approximation used in this paper is often criticized as being inadequate (*e.g.* Pascual and Iribarne 1993, Hewitt and Hoenig 2005). In addition, maximum ages captured by trawl in a stock that is undergoing rebuilding may be underestimated.

Morse (1981) found that length was the best indicator of fecundity in fluke. Changes in female length at age and management strategies directing effort to large females could affect fecundity of the stock. In general, however, increases in total abundance have outpaced any decreases in fecundity, resulting in theoretical stock fecundity increasing more than 50% from 1999 to 2004. Fecundity declined in 2005 and 2006, coincident with slower stock growth. However, additional years of data are necessary to determine if there is a causal relationship.

Conclusions

Review of NEFSC trawl survey data do indicate that certain life history parameters have changed since 1992. Length at age has decreased significantly for older females. Maximum ages have approximately doubled since 2000. Sex ratios have shifted towards higher proportions of males. Natural mortality based on longevity and sex ratio has increased slightly. Despite decreases in fecundity at age, overall theoretical stock fecundity was higher in 2006 than in 1999. The implications of these patterns in biological parameters should be reviewed and considered when evaluating potential management strategies for stock rebuilding.

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Table 1. Sample size by age and year from the winter survey. Cells in bold italics indicate the years and ages used in the age:length analysis. A) Males, B) Females

A)	Age							
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8+**
1992	150	75	14	1				
1993	113	144	5		1			
1994	102	185	19	6				
1995	92	155	3	1				
1996	229	145	18	2				
1997	106	152	27	22	4			
1998	67	92	71	7	2			1
1999	***46***	***161***	***101***	***15***	6			
2000	***18***	***164***	***122***	***72***	13	5	1	2
2001	***70***	***186***	***160***	***81***	23	10		2
2002	***75***	***239***	***172***	***75***	17	6	1	1
2003	***127***	***161***	***117***	***45***	12	3	1	1
2004	***51***	***221***	***112***	***46***	17	7	3	3
2005	***76***	***127***	***77***	***38***	19	8	2	2
2006	***72***	***148***	***78***	***50***	22	9	5	5

B)	Age							
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8+**
1992	138	175	17	3	1	3		
1993	88	242	30	5	1	2		
1994	67	285	63	22			1	
1995	145	195	28	3				
1996	221	263	51	10	2			
1997	140	247	69	23	12	4		
1998	46	133	140	62	16	2		
1999	***48***	***135***	***151***	***92***	***35***	9	5	3
2000	***24***	***155***	***176***	***169***	***86***	18	10	3
2001	***113***	***149***	***279***	***146***	***74***	43	12	10
2002	***101***	***273***	***201***	***148***	***94***	43	14	4
2003	***83***	***145***	***134***	***99***	***59***	28	24	15
2004	***55***	***201***	***166***	***110***	***51***	45	24	31
2005	***45***	***89***	***103***	***54***	***37***	21	13	25
2006	***46***	***179***	***102***	***89***	***72***	36	18	43

Table 2. Results of mean length (cm) at age.

Sex	Age		Year 1999	2000	2001	2002	2003	2004	2005	2006
Males	1	**Mean**	27.15	27.67	28.20	28.91	29.83	28.53	27.66	29.75
Males	1	**Std Dev**	3.47	2.22	2.39	2.96	3.39	2.79	2.91	3.54
Males	2	**Mean**	36.36	34.37	36.18	36.85	37.64	36.62	36.42	34.99
Males	2	**Std Dev**	3.30	2.56	2.91	2.79	3.05	3.09	3.16	2.91
Males	3	**Mean**	42.27	39.98	41.11	42.94	44.01	42.59	42.14	39.86
Males	3	**Std Dev**	2.98	2.95	3.00	2.93	3.39	2.90	2.90	3.52
Males	4	**Mean**	47.47	45.74	46.99	48.19	48.51	47.72	45.82	44.36
Males	4	**Std Dev**	3.64	3.18	3.21	3.36	3.45	2.79	3.14	3.08
Females	1	**Mean**	28.98	28.29	28.27	30.00	31.27	28.84	28.09	29.83
Females	1	**Std Dev**	3.18	2.93	2.83	3.33	3.16	3.30	2.98	3.97
Females	2	**Mean**	38.78	37.51	38.79	40.24	41.12	40.32	39.02	38.94
Females	2	**Std Dev**	3.58	4.18	3.76	3.35	3.48	3.52	3.50	3.40
Females	3	**Mean**	46.97	44.23	46.19	48.10	48.94	47.49	46.27	43.34
Females	3	**Std Dev**	2.87	4.11	3.79	3.94	3.66	3.08	3.28	4.13
Females	4	**Mean**	53.10	52.41	54.47	54.61	55.58	53.75	52.09	49.52
Females	4	**Std Dev**	3.03	3.70	4.29	3.65	3.63	3.38	3.12	3.76
Females	5	**Mean**	60.49	57.98	59.49	60.30	58.59	57.65	56.95	53.32
Females	5	**Std Dev**	3.74	3.25	4.16	3.57	4.60	3.51	3.12	3.01

Table 3. Regression results for the slope of mean length at age over time.
Rows in bold italics are significant at 0.05 level.

Sex	Age	RMSE	Estimate	Std Err	T value	P Value	Lo 95 CI	Up 95 CI
Male	1	0.8577	0.2388	0.1324	1.8041	0.1213	-0.0851	0.5626
Male	2	1.1190	0.0334	0.1727	0.1936	0.8529	-0.3891	0.4559
Male	3	1.5629	-0.0065	0.2412	-0.0270	0.9794	-0.5966	0.5836
Male	4	1.4199	-0.2242	0.2191	-1.0234	0.3456	-0.7603	0.3119
Female	1	1.1565	0.0936	0.1785	0.5247	0.6186	-0.3430	0.5303
Female	2	1.1513	0.1691	0.1776	0.9521	0.3778	-0.2656	0.6038
Female	3	2.0131	-0.1241	0.3106	-0.3995	0.7034	-0.8842	0.6360
Female	4	1.8421	-0.3315	0.2842	-1.1663	0.2878	-1.0270	0.3640
Female	***5***	***1.5172***	***-0.7445***	***0.2341***	***-3.1803***	***0.0191***	***-1.3174***	***-0.1717***

Table 4. Results of von Bertalanffy growth analysis using bootstrap data for males. A) Parameter estimates, B) Predicted length at age. Lengths are in cm.

A)

Param		Year 1999	2000	2001	2002	2003	2004	2005	2006
L_inf	Mean	57.69	105879.36	73.02	69.65	66.93	66.29	52.88	99089.26
L_inf	Std Err	0.24	15286.72	0.79	0.31	0.33	0.32	0.10	13789.90
k	Mean	0.37	0.07	0.19	0.22	0.25	0.25	0.43	0.08
k	Std Err	3.69E-03	2.59E-03	2.42E-03	2.02E-03	2.44E-03	2.51E-03	2.71E-03	2.87E-03
t0	Mean	-0.82	-2.87	-1.77	-1.51	-1.45	-1.40	-0.73	-3.67
t0	Std Err	1.15E-02	3.30E-02	1.67E-02	1.14E-02	1.22E-02	1.34E-02	7.46E-03	4.30E-02

B)

Age		Year 1999	2000	2001	2002	2003	2004	2005	2006
0	Mean	14.17	21.13	19.74	19.15	19.62	18.49	14.06	23.98
0	Std Err	0.10	0.06	0.05	0.05	0.05	0.06	0.07	0.04
1	Mean	27.26	27.95	28.53	28.95	29.80	28.66	27.67	29.75
1	Std Err	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02
2	Mean	36.26	34.27	35.74	36.79	37.70	36.56	36.45	35.03
2	Std Err	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3	Mean	42.49	40.14	41.67	43.06	43.84	42.73	42.13	39.88
3	Std Err	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4	Mean	46.83	45.61	46.56	48.09	48.64	47.56	45.82	44.35
4	Std Err	0.03	0.01	0.01	0.01	0.02	0.02	0.02	0.02
5	Mean	49.88	50.73	50.61	52.13	52.39	51.35	48.23	48.50
5	Std Err	0.06	0.04	0.03	0.03	0.04	0.04	0.03	0.04
6	Mean	52.04	55.53	53.97	55.39	55.34	54.34	49.80	52.35
6	Std Err	0.08	0.07	0.06	0.05	0.06	0.06	0.05	0.07
7	Mean	53.57	60.05	56.77	58.01	57.66	56.70	50.84	55.95
7	Std Err	0.11	0.11	0.09	0.07	0.09	0.08	0.06	0.11
8	Mean	54.66	64.31	59.10	60.14	59.49	58.57	51.52	59.32
8	Std Err	0.13	0.16	0.11	0.09	0.11	0.11	0.07	0.16
9	Mean	55.45	68.35	61.06	61.86	60.94	60.06	51.97	62.49
9	Std Err	0.15	0.21	0.14	0.12	0.13	0.13	0.08	0.21
10	Mean	56.03	72.18	62.70	63.26	62.09	61.24	52.27	65.48
10	Std Err	0.16	0.27	0.17	0.14	0.15	0.15	0.08	0.27

Table 5. Regression results for the slope of male predicted length at age over time.

Age	RMSE	Estimate	Std Err	T value	P Value	Lo 95 CI	Up 95 CI
0	3.4782	0.3580	0.5367	0.6671	0.5295	-0.9552	1.6713
1	0.8369	0.2059	0.1291	1.5940	0.1620	-0.1101	0.5219
2	1.1417	0.0678	0.1762	0.3851	0.7135	-0.3632	0.4989
3	1.4866	-0.0515	0.2294	-0.2243	0.8300	-0.6128	0.5099
4	1.4686	-0.1516	0.2266	-0.6691	0.5283	-0.7061	0.4029
5	1.5410	-0.2343	0.2378	-0.9851	0.3626	-0.8161	0.3476
6	2.0495	-0.3016	0.3162	-0.9538	0.3770	-1.0754	0.4722
7	2.9216	-0.3561	0.4508	-0.7900	0.4596	-1.4592	0.7469
8	3.9818	-0.4000	0.6144	-0.6511	0.5391	-1.9034	1.1033
9	5.1309	-0.4353	0.7917	-0.5498	0.6023	-2.3725	1.5020
10	6.3189	-0.4635	0.9750	-0.4753	0.6514	-2.8493	1.9223

Table 6. Results of von Bertalanffy growth analysis using bootstrap data for females. A) Parameter estimates, B) Predicted length at age. Lengths are in cm.

A)

Param		Year 1999	2000	2001	2002	2003	2004	2005	2006
L_inf	Mean	98.94	175.38	95.32	83.70	72.92	68.16	70.01	68.25
L_inf	Std Err	0.55	21.38	0.35	0.19	0.13	0.09	0.15	0.22
k	Mean	0.15	0.09	0.16	0.21	0.28	0.33	0.29	0.24
k	Std Err	1.39E-03	1.60E-03	1.07E-03	9.93E-04	1.31E-03	1.36E-03	1.58E-03	1.90E-03
t0	Mean	-1.40	-1.87	-1.22	-1.17	-0.98	-0.70	-0.82	-1.58
t0	Std Err	9.69E-03	1.71E-02	6.70E-03	5.92E-03	5.94E-03	5.43E-03	6.54E-03	1.37E-02

B)

Age		Year 1999	2000	2001	2002	2003	2004	2005	2006
0	Mean	18.21	19.38	16.81	17.86	17.46	13.87	14.44	20.67
0	Std Err	0.05	0.07	0.04	0.04	0.05	0.06	0.06	0.07
1	Mean	29.22	28.68	28.42	30.13	31.08	29.11	28.31	30.55
1	Std Err	0.02	0.03	0.02	0.01	0.02	0.02	0.02	0.02
2	Mean	38.67	37.15	38.28	40.10	41.33	40.05	38.68	38.32
2	Std Err	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3	Mean	46.79	44.85	46.66	48.19	49.05	47.90	46.44	44.44
3	Std Err	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4	Mean	53.77	51.88	53.79	54.76	54.86	53.55	52.25	49.28
4	Std Err	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5	Mean	59.78	58.29	59.85	60.11	59.25	57.61	56.62	53.10
5	Std Err	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02
6	Mean	64.96	64.15	65.01	64.46	62.56	60.54	59.90	56.13
6	Std Err	0.04	0.04	0.03	0.02	0.03	0.03	0.04	0.03
7	Mean	69.42	69.52	69.40	68.00	65.07	62.64	62.36	58.54
7	Std Err	0.06	0.07	0.05	0.04	0.04	0.04	0.05	0.05
8	Mean	73.27	74.43	73.15	70.88	66.96	64.17	64.22	60.45
8	Std Err	0.09	0.10	0.07	0.05	0.05	0.05	0.06	0.06
9	Mean	76.60	78.94	76.34	73.22	68.39	65.26	65.62	61.98
9	Std Err	0.11	0.14	0.09	0.06	0.06	0.06	0.08	0.08
10	Mean	79.48	83.08	79.06	75.14	69.48	66.06	66.68	63.19
10	Std Err	0.14	0.18	0.11	0.08	0.07	0.06	0.09	0.10

Table 7. Regression results for the slope of female predicted length at age over time. Rows in bold italics are significant at the 0.05 level.

Age	RMSE	Estimate	Std Err	T value	P Value	Lo 95 CI	Up 95 CI
0	2.4271	-0.1979	0.3745	-0.5284	0.6162	-1.1143	0.7185
1	1.0632	0.1244	0.1641	0.7584	0.4770	-0.2770	0.5258
2	1.3838	0.1393	0.2135	0.6525	0.5383	-0.3832	0.6618
3	1.7126	-0.0470	0.2643	-0.1778	0.8648	-0.6936	0.5997
4	1.7485	-0.3597	0.2698	-1.3330	0.2309	-1.0198	0.3005
5	***1.5973***	***-0.7464***	***0.2465***	***-3.0283***	***0.0232***	***-1.3494***	***-0.1433***
6	***1.4044***	***-1.1709***	***0.2167***	***-5.4032***	***0.0017***	***-1.7012***	***-0.6407***
7	***1.3408***	***-1.6087***	***0.2069***	***-7.7758***	***0.0002***	***-2.1149***	***-1.1025***
8	***1.5285***	***-2.0433***	***0.2359***	***-8.6636***	***0.0001***	***-2.6204***	***-1.4662***
9	***1.9350***	***-2.4642***	***0.2986***	***-8.2531***	***0.0002***	***-3.1948***	***-1.7336***
10	***2.4627***	***-2.8649***	***0.3800***	***-7.5389***	***0.0003***	***-3.7947***	***-1.9350***

Table 8. Sample size of weights by age and year from the winter survey. Cells in bold italics indicate the years and ages used in the age:length analysis. A) Males, B) Females

A)	AGE							
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8+**
1992								
1993	113	144	5		1			0
1994	99	184	19	6				0
1995	92	155	3	1				0
1996	229	144	18	2				0
1997	106	151	26	22	4			0
1998	67	92	71	7	2			1
1999	***46***	***159***	***101***	***15***	6			0
2000	***18***	***164***	***122***	***72***	13	5	1	2
2001	***70***	***186***	***160***	***81***	23	10		2
2002	***75***	***239***	***172***	***75***	17	6	1	1
2003	***127***	***161***	***117***	***45***	12	3	1	1
2004	***51***	***221***	***112***	***46***	17	7	3	3
2005	***76***	***127***	***77***	***38***	19	8	2	2
2006	***72***	***148***	***78***	***50***	22	9	5	5

B)	AGE							
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8+**
1992								
1993	88	242	30	5	1	2		0
1994	67	285	63	22			1	0
1995	141	191	28	3				0
1996	219	263	51	10	2			0
1997	140	246	69	23	12	4		0
1998	46	133	139	62	16	2		0
1999	***48***	***135***	***151***	***92***	***35***	9	5	3
2000	***24***	***155***	***176***	***169***	***86***	18	10	3
2001	***113***	***149***	***279***	***146***	***74***	43	12	10
2002	***101***	***272***	***201***	***148***	***94***	43	14	4
2003	***83***	***145***	***134***	***99***	***59***	28	24	15
2004	***55***	***201***	***166***	***110***	***51***	45	24	31
2005	***45***	***89***	***103***	***54***	***37***	21	13	25
2006	***46***	***179***	***102***	***89***	***72***	36	18	43

Table 9. Results of length:weight analysis using bootstrap data for males. A) Parameter estimates, B) Predicted length at age. Weights are in kg.

A)

Param		Year 1999	2000	2001	2002	2003	2004	2005	2006
a	Mean	5.27E-06	6.73E-06	3.61E-06	5.67E-06	4.10E-06	4.61E-06	3.25E-06	9.14E-06
a	Std Err	2.66E-08	2.98E-08	1.87E-08	2.09E-08	1.88E-08	2.46E-08	1.63E-08	4.81E-08
b	Mean	3.18	3.11	3.28	3.15	3.24	3.21	3.31	3.03
b	Std Err	1.35E-03	1.17E-03	1.38E-03	9.75E-04	1.20E-03	1.43E-03	1.35E-03	1.42E-03

B)

Length (cm)		Year 1999	2000	2001	2002	2003	2004	2005	2006
10	Mean	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
10	Std Err	1.52E-05	1.49E-05	1.38E-05	1.17E-05	1.29E-05	1.55E-05	1.28E-05	1.93E-05
20	Mean	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08
20	Std Err	7.17E-05	6.85E-05	7.12E-05	5.61E-05	6.59E-05	7.65E-05	6.68E-05	8.07E-05
30	Mean	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.27
30	Std Err	1.23E-04	1.20E-04	1.34E-04	1.03E-04	1.27E-04	1.39E-04	1.24E-04	1.26E-04
40	Mean	0.64	0.65	0.64	0.63	0.64	0.64	0.65	0.64
40	Std Err	1.11E-04	1.20E-04	1.37E-04	9.86E-05	1.35E-04	1.33E-04	1.27E-04	1.16E-04
50	Mean	1.30	1.30	1.32	1.27	1.31	1.31	1.35	1.26
50	Std Err	3.68E-04	3.07E-04	3.59E-04	1.95E-04	2.81E-04	3.62E-04	3.87E-04	4.26E-04
60	Mean	2.32	2.29	2.40	2.25	2.37	2.35	2.47	2.18
60	Std Err	1.17E-03	9.56E-04	1.17E-03	6.87E-04	9.26E-04	1.18E-03	1.24E-03	1.25E-03
70	Mean	3.78	3.69	3.98	3.66	3.91	3.85	4.12	3.48
70	Std Err	2.66E-03	2.17E-03	2.75E-03	1.64E-03	2.20E-03	2.75E-03	2.88E-03	2.73E-03
80	Mean	5.78	5.59	6.16	5.57	6.04	5.91	6.40	5.21
80	Std Err	5.09E-03	4.14E-03	5.36E-03	3.21E-03	4.33E-03	5.33E-03	5.60E-03	5.06E-03
90	Mean	8.40	8.07	9.07	8.07	8.84	8.63	9.46	7.44
90	Std Err	8.71E-03	7.06E-03	9.35E-03	5.56E-03	7.56E-03	9.22E-03	9.74E-03	8.46E-03

Table 10. Regression results for the slope of male predicted weight at length over time.

Length (cm)	RMSE	Estimate	Std Err	T value	P Value	Lo 95 CI	Up 95 CI
10	0.0011	4.00E-05	1.70E-04	0.2363	0.8211	-0.0004	0.0005
20	0.0049	1.40E-04	7.60E-04	0.1901	0.8555	-0.0017	0.0020
30	0.0077	2.10E-04	1.18E-03	0.1798	0.8633	-0.0027	0.0031
40	0.0067	1.40E-04	1.03E-03	0.1357	0.8965	-0.0024	0.0027
50	0.0328	-1.50E-04	5.06E-03	-0.0300	0.9771	-0.0125	0.0122
60	0.0985	-7.00E-04	1.52E-02	-0.0459	0.9649	-0.0379	0.0365
70	0.2176	-1.50E-03	3.36E-02	-0.0446	0.9659	-0.0837	0.0807
80	0.4086	-2.50E-03	6.31E-02	-0.0396	0.9697	-0.1568	0.1518
90	0.6919	-3.61E-03	1.07E-01	-0.0338	0.9741	-0.2649	0.2576

Table 11. Results of length:weight analysis using bootstrap data for females. A) Parameter estimates, B) Predicted length at age. Weights are in kg.

A)

Param		Year 1999	2000	2001	2002	2003	2004	2005	2006
a	Mean	2.65E-06	4.60E-06	2.84E-06	4.83E-06	4.00E-06	4.61E-06	3.24E-06	5.12E-06
a	Std Err	1.20E-08	2.20E-08	1.11E-08	1.80E-08	1.92E-08	2.17E-08	2.14E-08	3.85E-08
b	Mean	3.35	3.21	3.33	3.19	3.24	3.21	3.30	3.18
b	Std Err	1.14E-03	1.20E-03	9.68E-04	9.33E-04	1.20E-03	1.18E-03	1.67E-03	1.89E-03

B)

Length (cm)		Year 1999	2000	2001	2002	2003	2004	2005	2006
10	Mean	0.0060	0.0074	0.0061	0.0075	0.0069	0.0074	0.0064	0.0077
10	Std Err	1.14E-05	1.49E-05	1.01E-05	1.19E-05	1.42E-05	1.46E-05	1.77E-05	2.35E-05
20	Mean	0.0611	0.0682	0.0612	0.0680	0.0655	0.0681	0.0633	0.0696
20	Std Err	6.91E-05	8.15E-05	6.11E-05	6.48E-05	8.01E-05	7.91E-05	1.01E-04	1.21E-04
30	Mean	0.2381	0.2504	0.2361	0.2478	0.2437	0.2496	0.2413	0.2525
30	Std Err	1.62E-04	1.80E-04	1.44E-04	1.44E-04	1.81E-04	1.72E-04	2.23E-04	2.49E-04
40	Mean	0.6250	0.6299	0.6156	0.6203	0.6189	0.6278	0.6236	0.6304
40	Std Err	2.30E-04	2.44E-04	2.13E-04	2.01E-04	2.55E-04	2.30E-04	2.90E-04	2.99E-04
50	Mean	1.3212	1.2885	1.2948	1.2639	1.2756	1.2840	1.3027	1.2819
50	Std Err	2.33E-04	2.23E-04	2.19E-04	1.92E-04	2.44E-04	2.14E-04	2.58E-04	3.12E-04
60	Mean	2.4357	2.3124	2.3768	2.2609	2.3031	2.3037	2.3783	2.2896
60	Std Err	4.91E-04	4.46E-04	3.68E-04	3.26E-04	4.24E-04	4.85E-04	7.58E-04	9.96E-04
70	Mean	4.0852	3.7914	3.9723	3.6969	3.7957	3.7765	3.9564	3.7389
70	Std Err	1.39E-03	1.30E-03	1.04E-03	9.35E-04	1.24E-03	1.37E-03	2.17E-03	2.61E-03
80	Mean	6.3940	5.8186	6.1982	5.6602	5.8512	5.7948	6.1487	5.7181
80	Std Err	3.07E-03	2.86E-03	2.34E-03	2.08E-03	2.77E-03	2.95E-03	4.69E-03	5.36E-03
90	Mean	9.4927	8.4900	9.1770	8.2416	8.5711	8.4540	9.0718	8.3180
90	Std Err	5.77E-03	5.33E-03	4.46E-03	3.89E-03	5.22E-03	5.44E-03	8.66E-03	9.61E-03

Table 12. Regression results for the slope of female predicted weight at length over time.

Length (cm)	RMSE	Estimate	Std Err	T value	P Value	Lo 95 CI	Up 95 CI
10	0.0006	1.30E-04	1.00E-04	1.2622	0.2537	-0.0001	0.0004
20	0.0032	6.30E-04	5.00E-04	1.2579	0.2552	-0.0006	0.0019
30	0.0059	1.09E-03	9.00E-04	1.2101	0.2717	-0.0011	0.0033
40	0.0056	5.00E-04	8.70E-04	0.5741	0.5868	-0.0016	0.0026
50	0.0176	-2.67E-03	2.71E-03	-0.9873	0.3616	-0.0093	0.0040
60	0.0567	-1.04E-02	8.74E-03	-1.1845	0.2810	-0.0318	0.0110
70	0.1312	-2.49E-02	2.02E-02	-1.2280	0.2655	-0.0744	0.0247
80	0.2540	-4.88E-02	3.92E-02	-1.2453	0.2594	-0.1447	0.0471
90	0.4399	-8.52E-02	6.79E-02	-1.2546	0.2563	-0.2513	0.0809

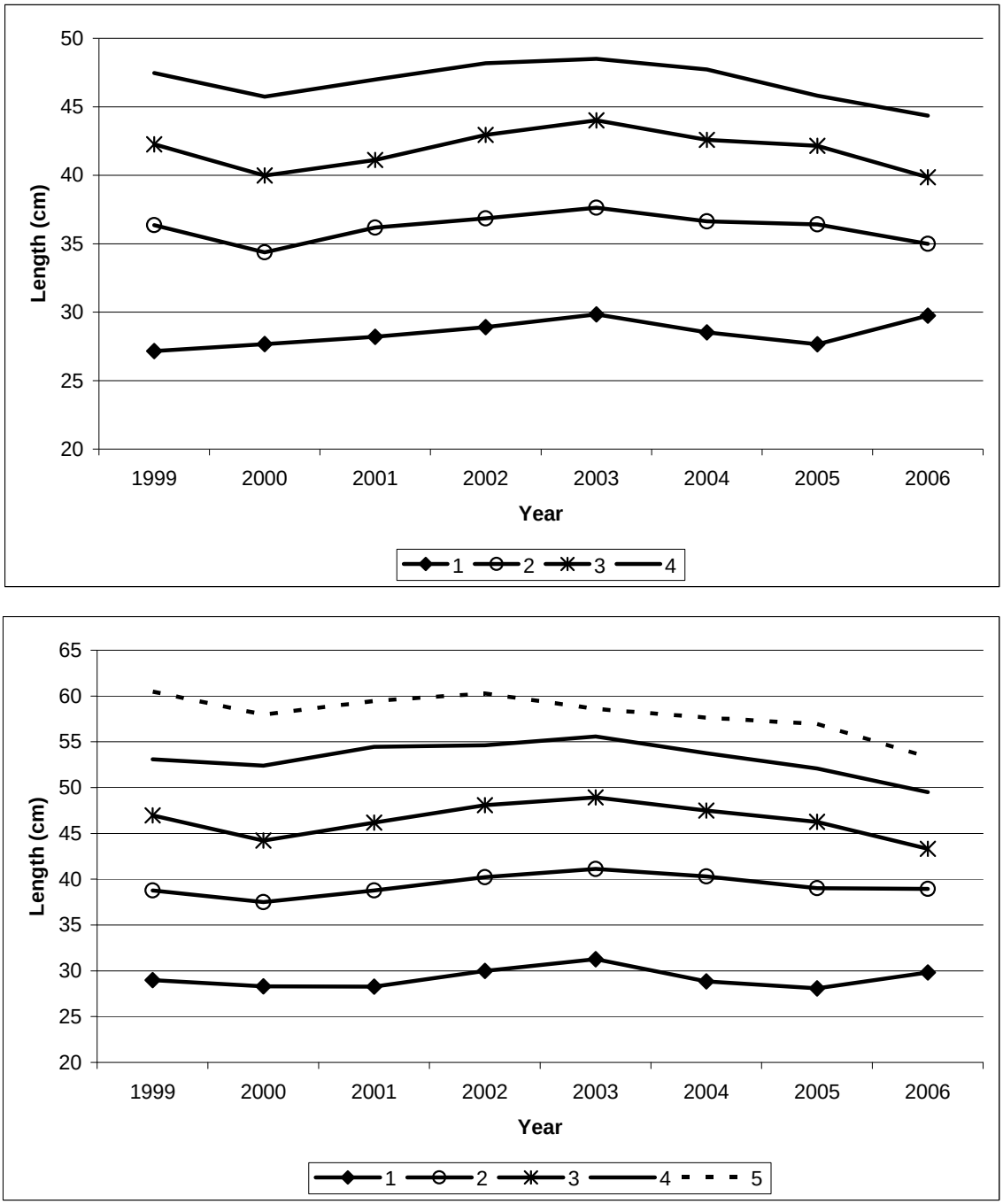

Figure 1. Mean length at age for males age 1 to 4 (top) and females age 1 to 5.

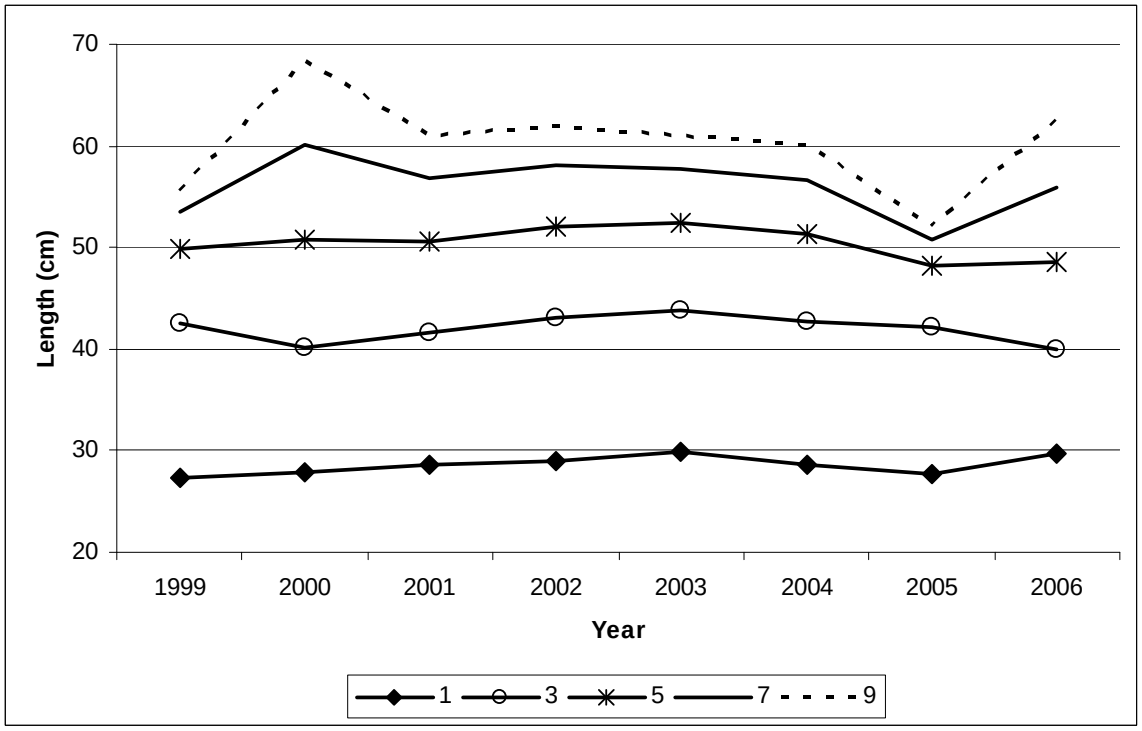

Figure 2. Mean predicted length at age for selected ages of males.

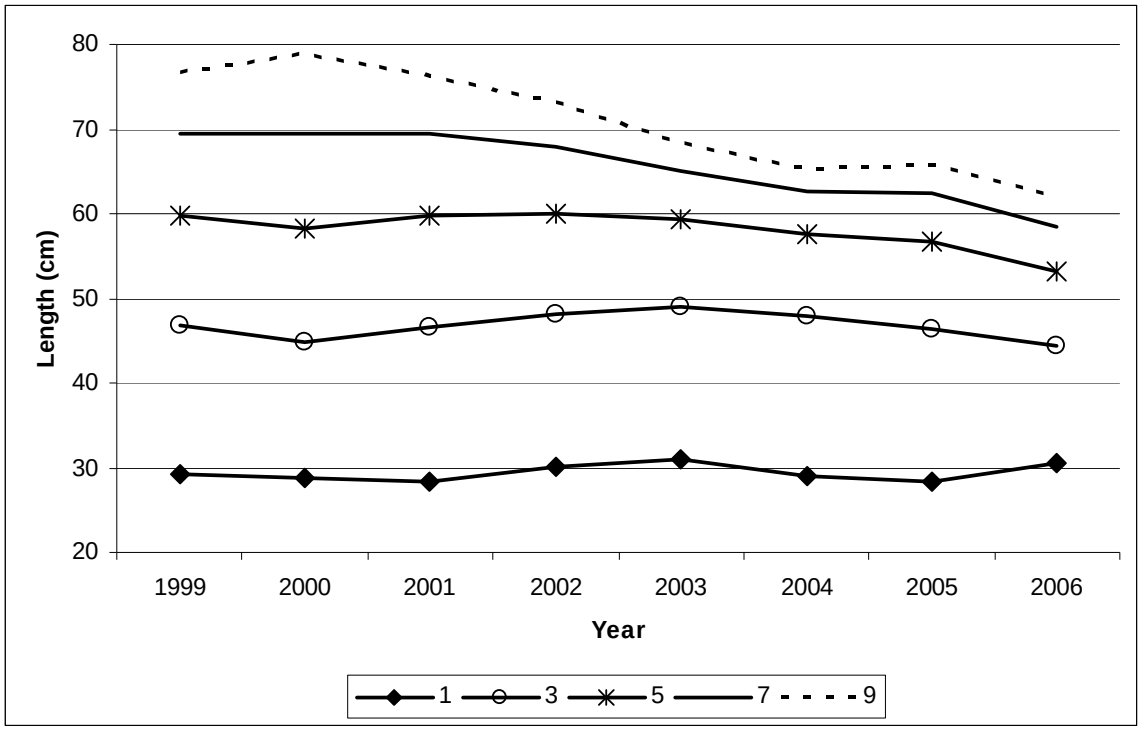

Figure 3. Mean predicted length at age for selected ages of females.

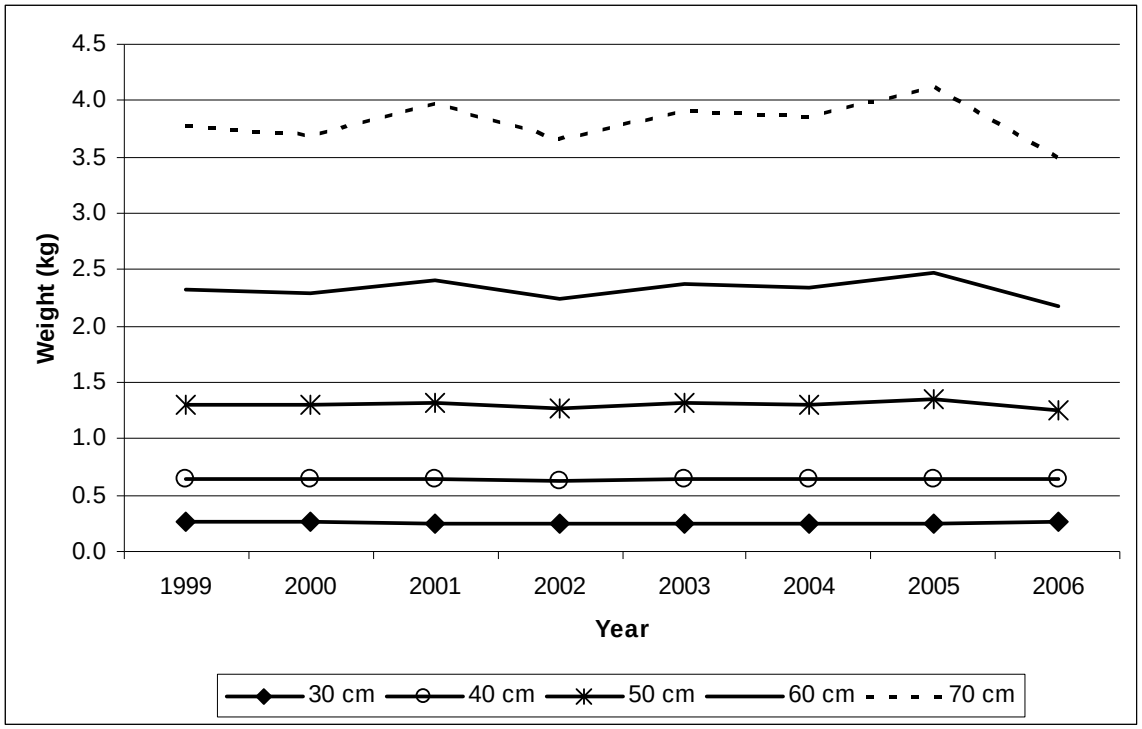

Figure 4. Mean predicted weight at length for selected lengths of males.

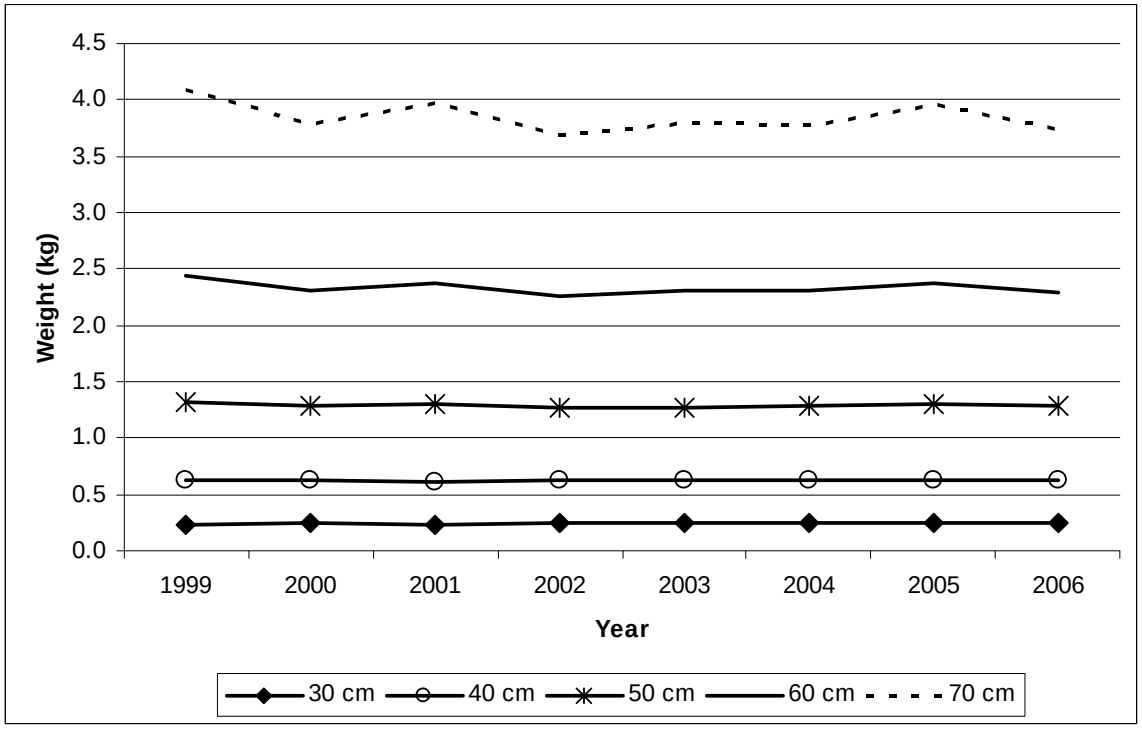

Figure 5. Mean predicted weight at length for selected lengths of females.

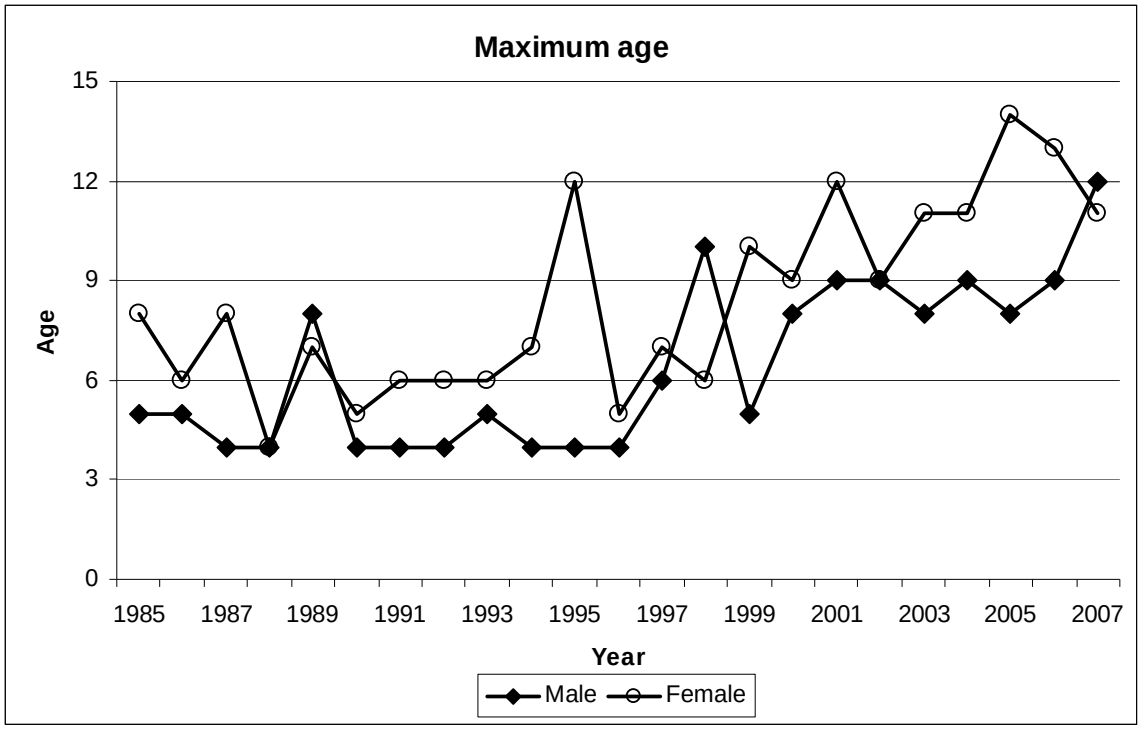

Figure 6. Observed maximum age by sex in NEFSC trawl surveys.

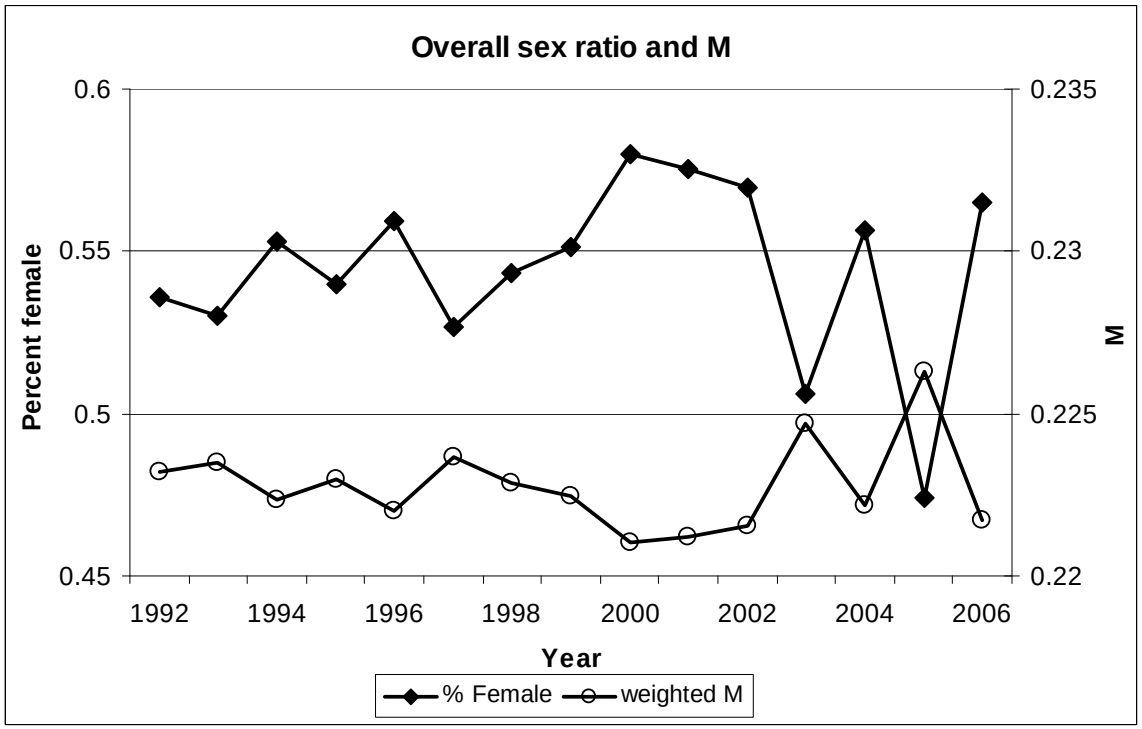

Figure 7. Sex ratio and natural mortality estimate by year across all ages.

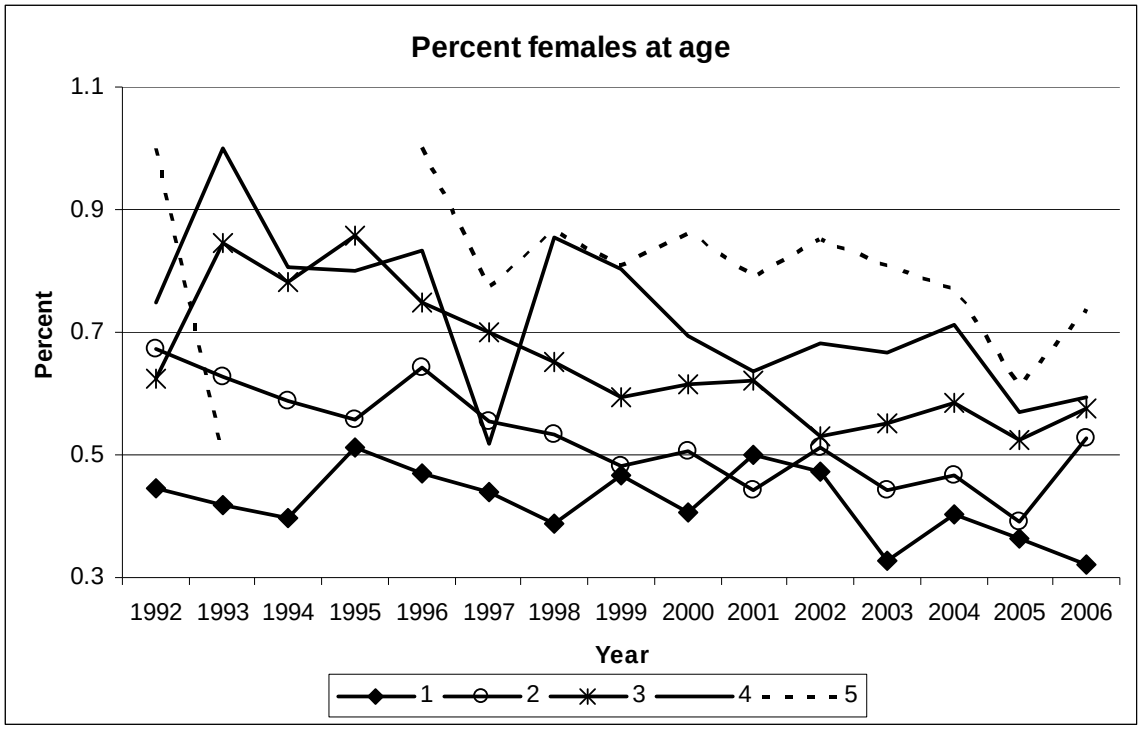

Figure 8. Percent female at age for selected ages.

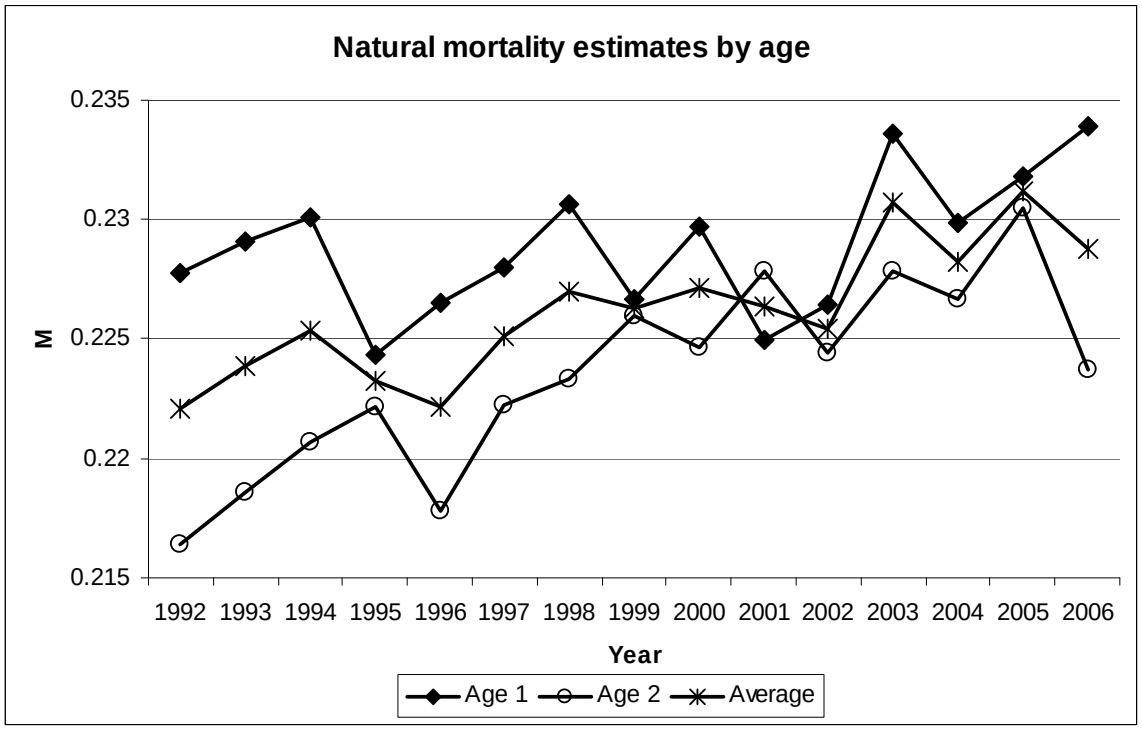

Figure 9. Natural mortality estimates by age for 1 and 2 year old fish

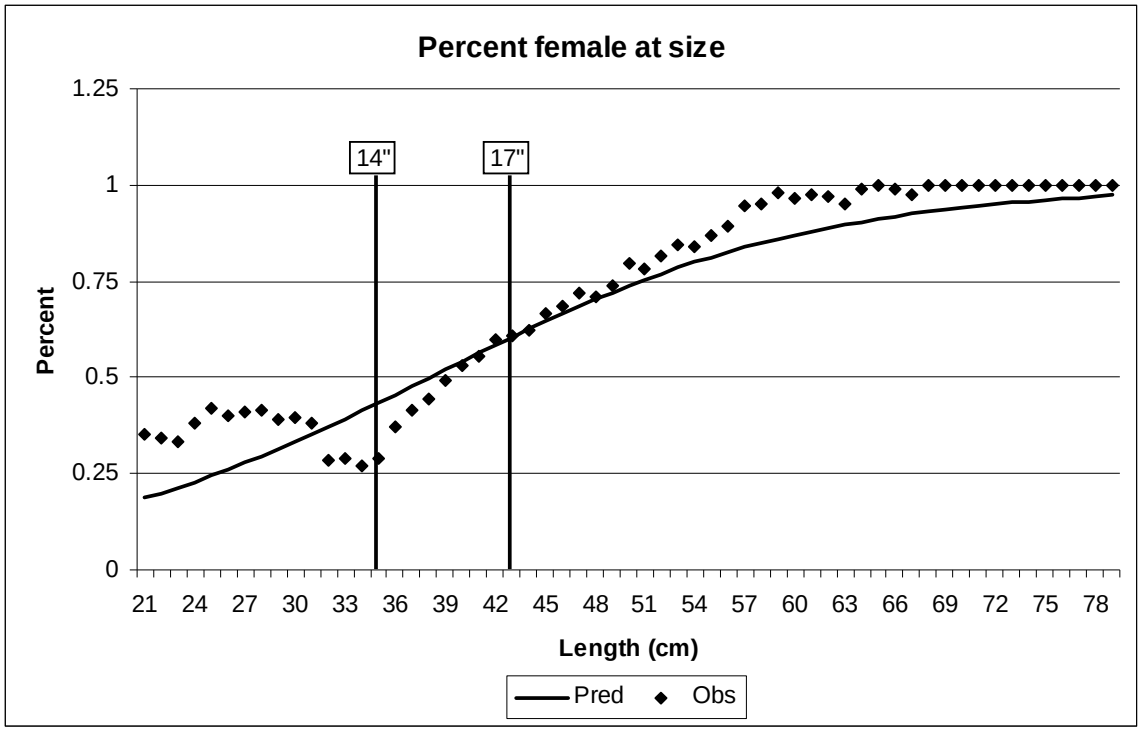

Figure 10. Logistic regression of percent female at size for all years combined.

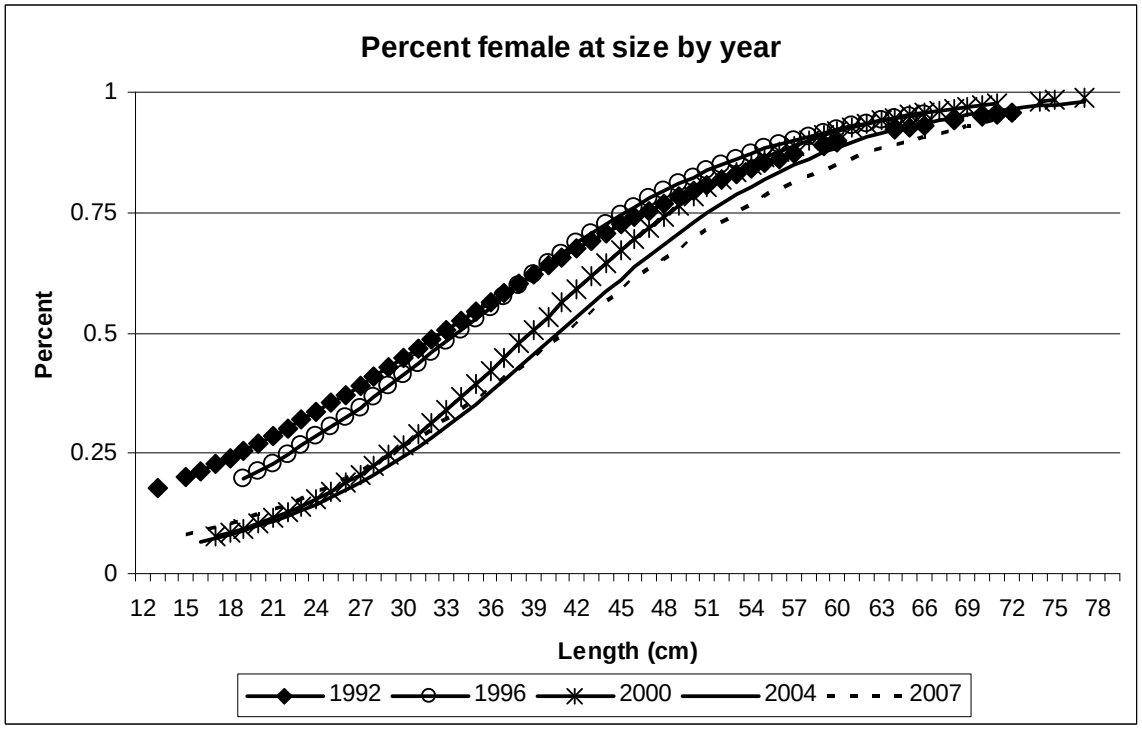

Figure 11. Logistic regression of percent female at size by year for selected years.

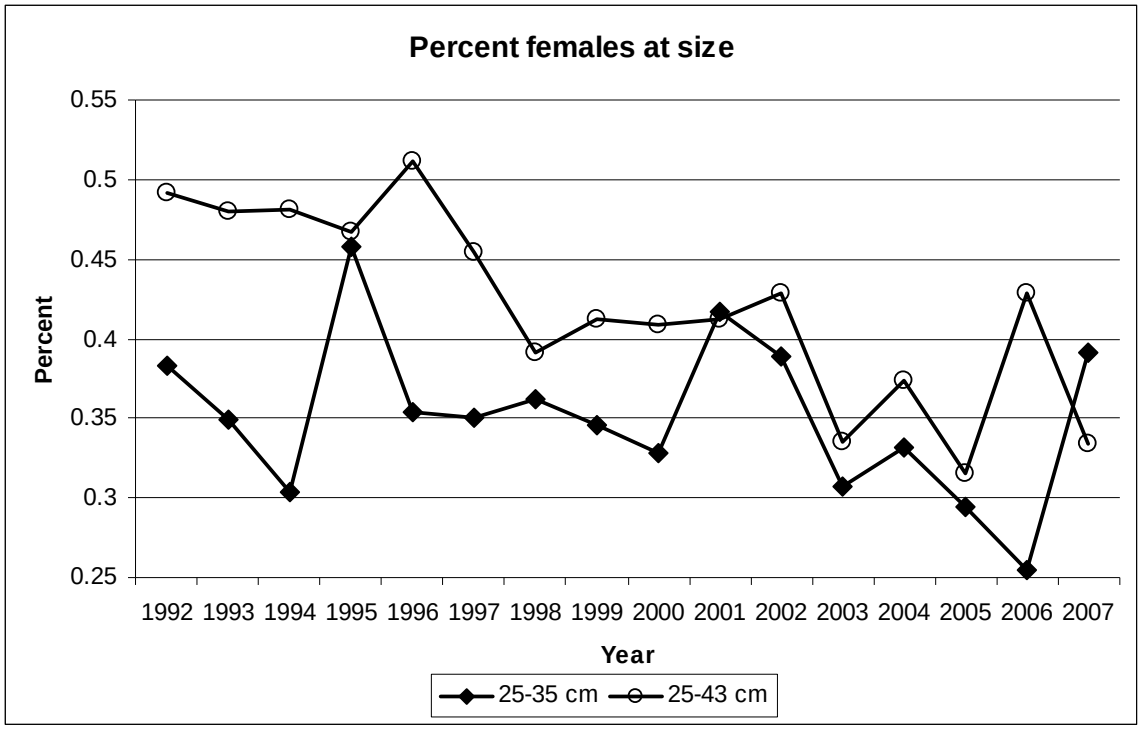

Figure 12. Percent female by year for two different size classes.

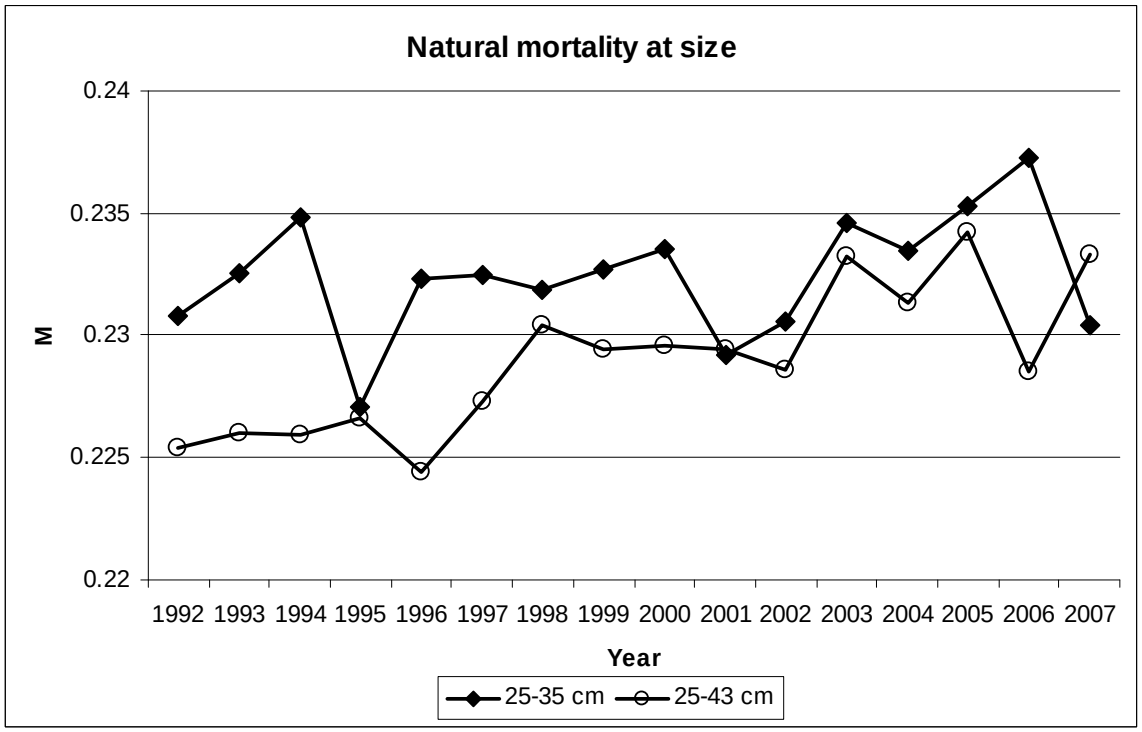

Figure 13. Natural mortality estimates for two different size groups.

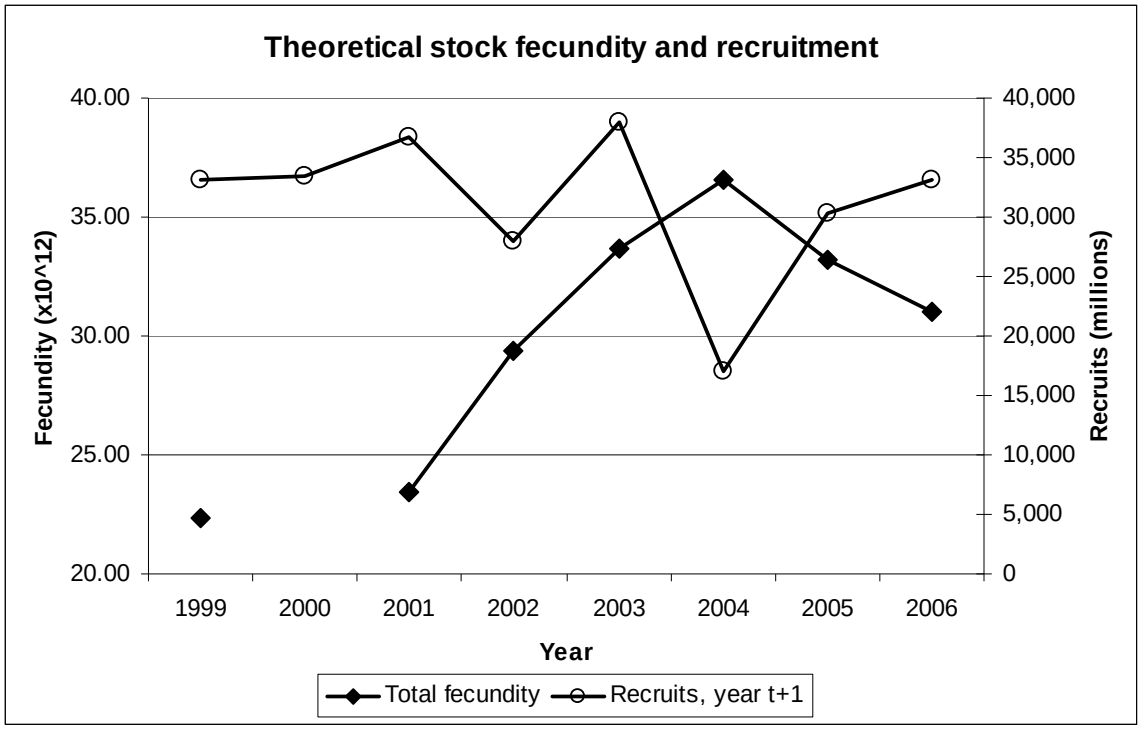

Figure 14. Overall fecundity and recruitment.

SAW 47 Working Paper 8 (TOR 3) – Natural Mortality
A Review of Natural Mortality of Summer Flounder
Rich Wong

This report is a short review of the common models used to estimate natural mortality rates M for use in population dynamics modeling. The natural mortality models were categorized as either longevity- or life-history based estimators of M. Sex and age-specific estimates of M are given in Tables 1-3, calculated from model inputs from current summer flounder age and growth data (1976-2007) from the NMFS trawl survey.

Longevity-Based Estimators of Natural Mortality

Longevity-based estimators of natural mortality are derived from the underlying mathematical function describing population decline, $\frac{N_t}{N_0} = e^{-Zt}$. For unexploited stocks, 1) Z = M, and 2) $\frac{N_t}{N_0}$ approaches zero as t approaches a stock's maximum longevity. This is the basis for the rule of thumb (ROT) equation, $M = \frac{-\ln(P)}{t_{\max}}$. Only two variables, therefore, affect M given this ROT expression, 1) P, which represents some small proportion of the population that survives to a given maximum age, and 2) t_{max}, which should represent the maximum longevity of the stock (Hewitt and Hoenig 2005). The value of P is often set equal to 5% for population modeling purposes (e.g. blue crabs, summer flounder, tautog, bluefish, etc.) resulting in a more simplified expression, $M = \frac{\ln(0.05)}{t_{\max}} \approx \frac{3}{t_{\max}}$. However, aside from its common use in assessments, the value of P = 5% is not well supported by data (Hewitt and Hoenig 2005). Recently, Hewitt and Hoenig (2005) recommended a more empirically supported value of P = 1.5% based on a regression of Z and maximum observed age from 134 unexploited fish, mollusk, and cetacean stocks in earlier work by Hoenig (1983). Hoenig's (1983) regression, $\ln(Z) = 1.44 - 0.982\ln(t_{\max})$,

can be rearranged as $Z = \frac{e^{1.44}}{t_{max}^{0.982}} \approx \frac{4.22}{t_{max}}$. Ergo, P roughly equals 1.5% from the equation, ln(P) = -4.22. Estimates of M using the 5% ROT are 29% lower than the estimates from P = 1.5% (Figure 1). Predictably, outputs from population models are highly sensitive to estimates of M. Lower M inputs typically result in lower abundance estimates from population modeling and lower benchmarks from YPR analysis.

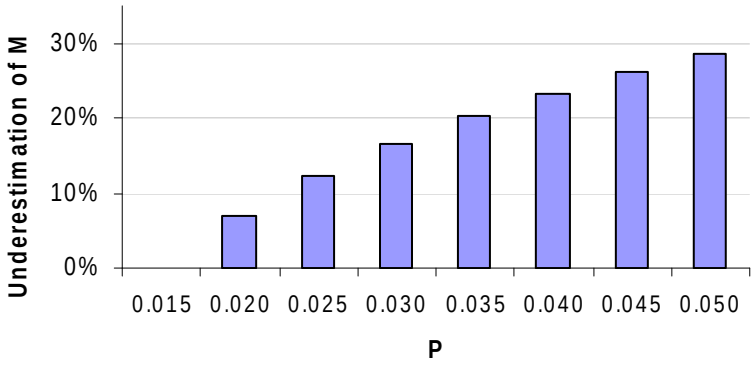

Figure 1. Underestimation of M relative to P = 1.5%.

In addition to the critical importance of P, using a maximum observed age collected from a highly exploited stock produces a biased underestimate of longevity and is in direct violation of the longevity-based M paradigm. As an example of how the maximum observed age can change over a short time period, the maximum observed age of Atlantic croaker increased from 6 to 12 since the early 1990s from age and growth studies in North Carolina, mirroring an increase in stock abundance over this period (pers. comm. R. Gregory, age/growth biologist NC Division of Marine Fisheries). If t_{max} were solely based on these age samples, the resulting estimates of M (using the 1.5% ROT) would have declined from 0.70 to 0.35 in less than 20 years. Despite the recent occurrence of older age classes, no specimen has yet been observed at the maximum age of 15 y recorded from scattered otoliths found in archaeological shell middens from a period of minimal exploitation (Hales and Reitz 1992).

The underestimation of longevity is a legitimate concern for stocks whose t_{max} is observed during a period of heavy exploitation. For example, for summer flounder at the current t_{max} = 15, the effect of potentially underestimating longevity by 1 to 5 years results in an overestimation of M by 6 to 32% (Figure 2). On the other hand, the consequence of using a P value up to 5% is the 29% reduction in M from the 1.5% ROT supported by Hoenig (1983) (Figure 1). The widespread use of P = 5% for stock assessment purposes, whether intentional or not, automatically accounts for an assumed ~4 year underestimation of longevity (assuming that P = 1.5% is the proper P value for the longevity-based ROT).

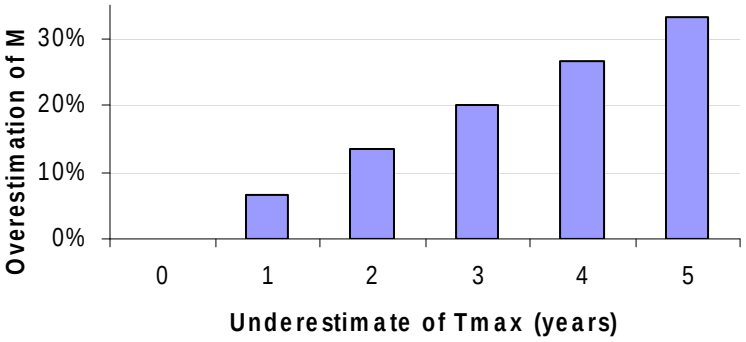

Figure 2. Effect of underestimating longevity by up to 5 years for summer flounder.

Life-History Based Estimators of Natural Mortality

Other methods of estimating M are based on specific life history characteristics from the species in question (Table 1; Figure 3). Pauly (1980) described M using von Bertalanffy growth parameters (L_{inf}, K) and water temperature based on data of 175 fish stocks. Jensen (1996) provides a modification of Pauly's (1980) model based solely on the correlation between M and K, providing the basis for the simplified equation, M = gK. The coefficient g was estimated as 1.598 (r^2 = 0.72) based on Pauly's (1980) data (Jensen 1996). Gunderson (1997) showed that M

could be predicted from reproductive effort from data of 28 fish stocks by the linear regression, M = 1.79*GSI (r^2 = 0.75). Variance of these life-history based estimates of M can be calculated given the known variances of model inputs (Gunderson et al. 2002).

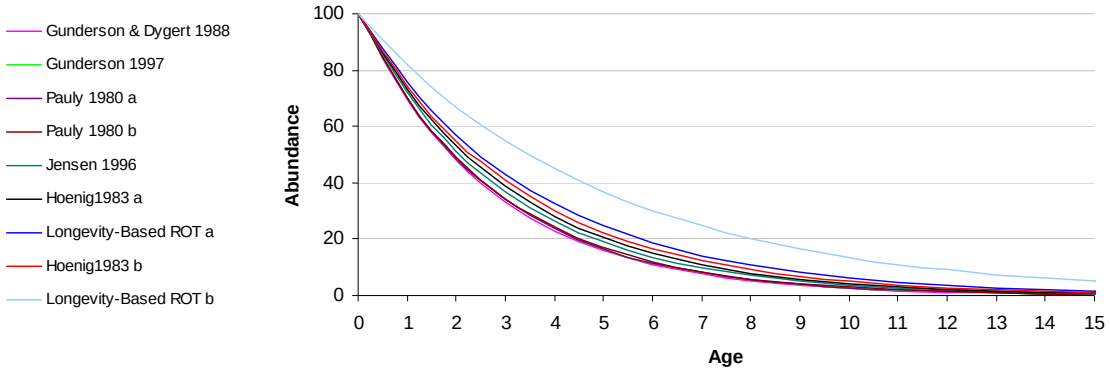

Figure 3. Survival curves from constant M estimates.

Other life-history based estimators of M provide for size-specific or age-based natural mortality rates (Tables 2, 3; Figures 4, 5, 6). Peterson and Wroblewski (1984) describe an inverse relationship between M and dry weight for juvenile and adult fishes. McGurk (1986) complemented this model by describing a steeper inverse M-dry weight relationship specific to fish eggs and larvae based on the linear regression of ln(M) and ln(dry weight) ($r = 0.58$, $P < 0.001$). Lorenzen (1996) describes a similar allometric relationship between body weight and natural mortality in juvenile and adult fish across different ecosystems. All of these size-dependent M rates can also be expressed as age-dependent M rates with necessary age and growth data. Chen and Watanabe (1989) estimate age-specific M rates based on known LVB growth parameters, accounting for higher natural mortality rates at early and senescent life history stages. Use of Lorenzen's (2000) approach, which is based on an allometric relationship between body length and M, combined with an assumption of longevity (ala the aforementioned

longevity-based ROTs) can provide for somewhat of a hybrid age-dependent-longevity-based natural mortality model (pers. comm. L. Brooks, NMFS).

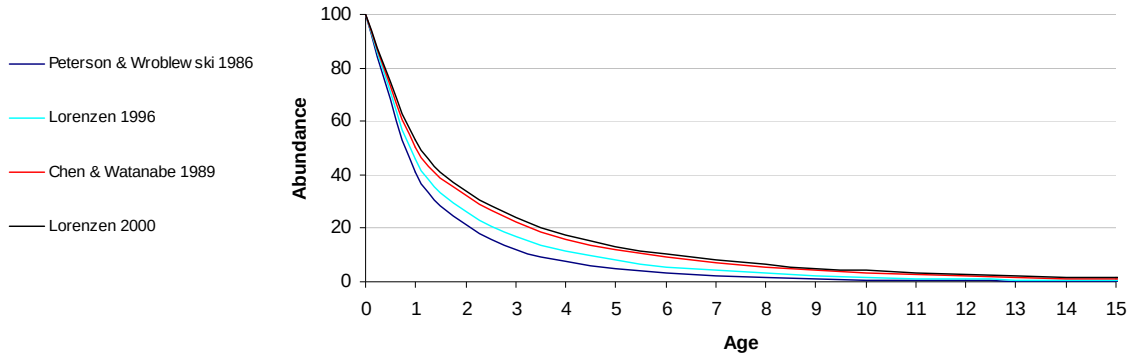

Figure 4. Survival curves from age-specific M estimates.

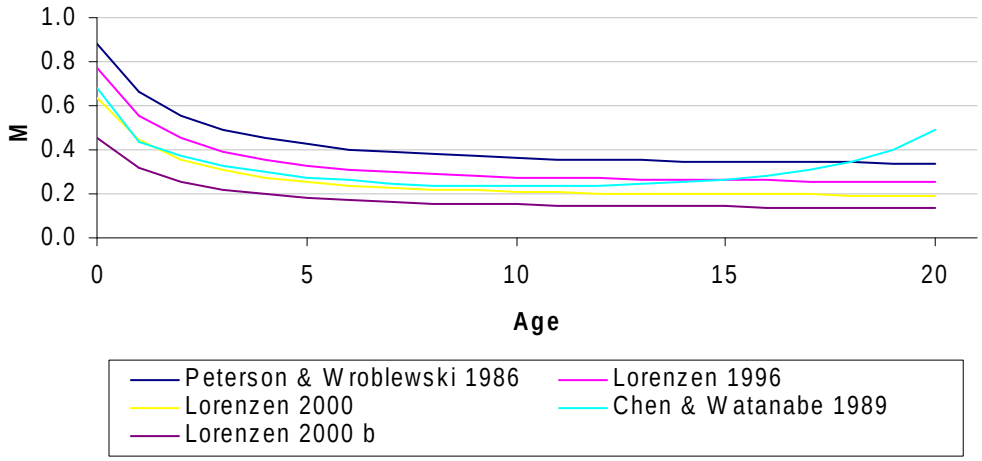

Figure 5. Age-specific M rates. Lorenzen 2000 is based on the 1.5% ROT, Lorenzen 2000 b is based on the 5% ROT.

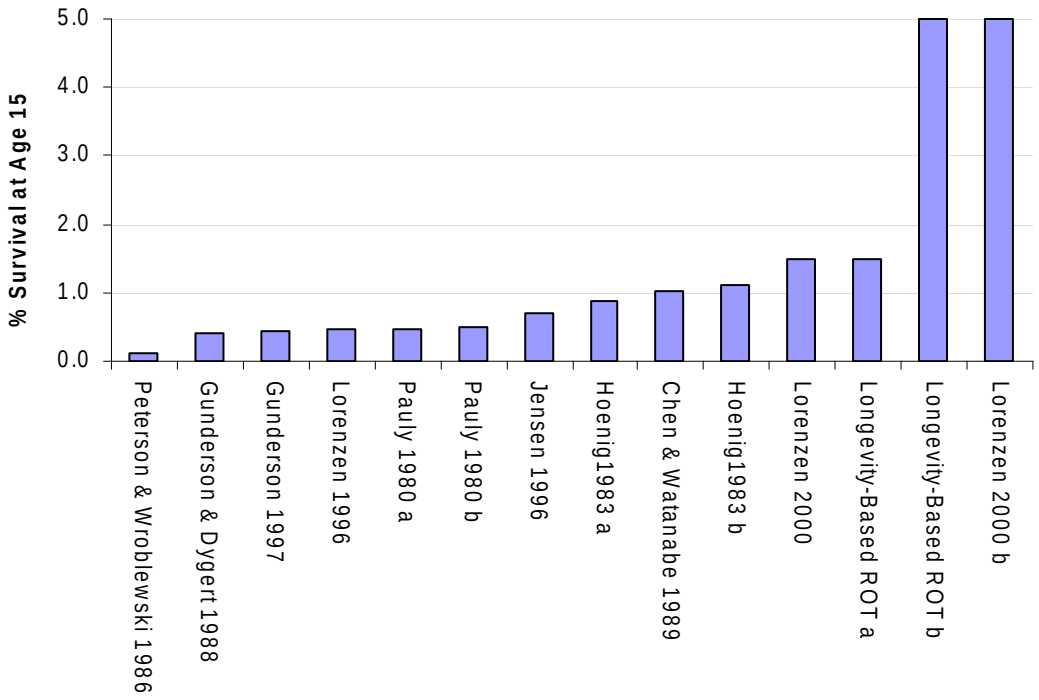

Figure 6. Percent survival at age = 15y.

Male-to-female demographics are very important considerations when combined-sex M rates are calculated. For example, size-at-age inputs for M models will likely differ from a combined-sex LVB growth trajectory versus the sex-weighted mean size-at-age observed in the population (Figure 6), resulting in potentially different M rates. Also, the time step chosen for calculating age-based M estimates can be influential particularly when estimates of natural mortality are much higher at early life stages. For example, survival after one year is 46% using a 1 year time step versus 44% using a 1/4 year step from size-based M rates calculated from the Lorenzen (1996) model (using the size at the mid-point of each time step).

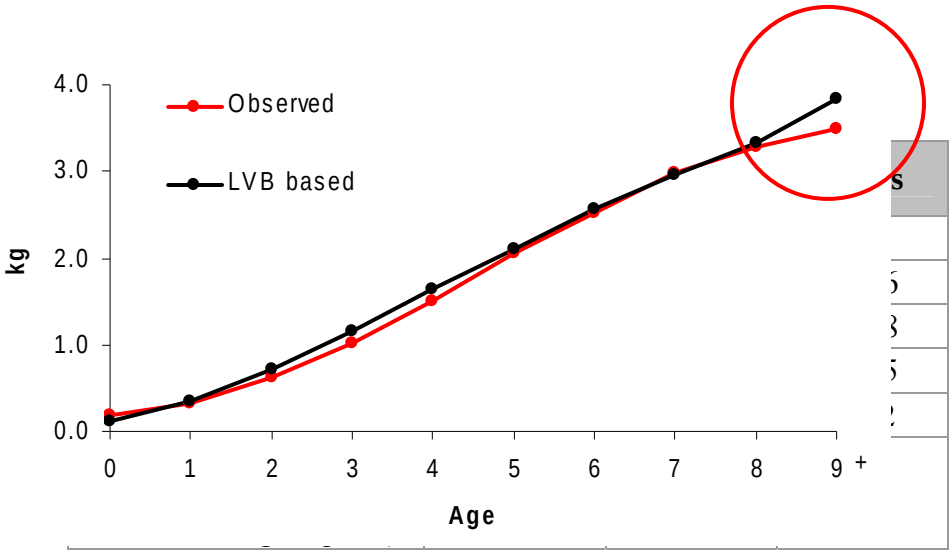

Figure 7. Observed mean weight-at-age from the NMFS trawl survey versus weight-at-age based on LVB length-at-age and L:W relationship.

Table 1. Estimates of constant natural mortality rates for summer flounder.

Model	Formula	M (combined-sex)	M (females)	M (males)
Hoenig (1983)	Z = exp(1.44-0.982*ln(tmax)); 134 mixed stocks	0.295	0.295	0.340
	Z = exp(1.46-1.01*ln(tmax)); 84 fish stocks	0.279	0.279	0.323
Longevity-Based ROTs	Z = ln(1.5%)/tmax or 4.22/tmax	0.280	0.280	0.323
	Z = ln(5%)/tmax or 3/tmax	0.200	0.200	0.230
Pauly (1980)	ln(M) = -0.0066-0.279*ln(Linf)+0.6543*ln(K)+0.4634*ln(T)	0.358	0.419	0.452
	ln(M) = -0.0152-0.279*ln(Linf)+0.6543*ln(K)+0.4634*ln(T)	0.355	0.416	0.448
Jensen (1996)	M = gK; g = 1.598	0.331	0.414	0.428
Gunderson & Dygert (1988)	M = 0.03 + 1.68*GSI		0.368	
Gunderson (1997)	M = 1.79*GSI		0.360	

Table 2. Age or size-based estimates of M.

Inputs	Combined-sex	Females	Males	Model	Formula
Maximum Observed Age	15	15	13	Peterson & Wroblewski 1984	M^{-d} = 5.26 *(10^ -3) * W^-0.25
K	0.207	0.259	0.268	Chen & Watanabe 1989	M1 = K/(1-EXP(-K*(t-t0))); early life stages
L_inf	76.95	73.97	61.15		M2 = K /(a0+a_1*(t-tm)+a_2*(t-tm)^2); senescence
T0	-1.24	-0.92	-1.32	Lorenzen 1996	M = 3.00*W^(-2.88)
L:W Parameter a	4.08E-06	3.68E-06	4.51E-06	Lorenzen 2000	M = Mr * (Lr/Lt), assuming 1.5% survival ROT
L:W Parameter b	3.241	3.266	3.218		
a0	0.773	0.787	0.702		
a1	0.047	0.055	0.080		
a2	-4.87E-03	-7.13E-03	-1.07E-02		
Lr	33.35	34.48	32.43		
Mr	0.443	0.434	0.456		

Table 3. Age-variable M rates for fluke.

	Lorenzen 2000			Lorenzen 1996			Chen & Watanabe 1989			Peterson & Wroblewski 1986		
Age	**Combined-sex**	**Females**	**Males**	**Combined-sex**	**Females**	**Males**	**Combined-sex**	**Females**	**Males**	**Combined-sex**	**Females**	**Males**
0	0.634	0.656	0.627	0.775	0.796	0.759	0.685	0.840	0.694	0.886	0.908	0.871
1	0.443	0.434	0.456	0.554	0.540	0.566	0.441	0.516	0.500	0.663	0.648	0.675
2	0.356	0.344	0.378	0.452	0.434	0.475	0.373	0.432	0.418	0.555	0.536	0.580
3	0.307	0.297	0.334	0.393	0.377	0.423	0.329	0.378	0.369	0.492	0.475	0.525
4	0.276	0.268	0.306	0.356	0.343	0.391	0.298	0.343	0.340	0.452	0.437	0.490
5	0.255	0.250	0.288	0.331	0.321	0.370	0.275	0.320	0.323	0.424	0.412	0.466
6	0.240	0.237	0.276	0.313	0.305	0.355	0.260	0.304	0.316	0.404	0.395	0.450
7	0.229	0.228	0.267	0.300	0.295	0.344	0.248	0.295	0.316	0.389	0.383	0.439
8	0.221	0.222	0.261	0.290	0.287	0.337	0.241	0.290	0.325	0.378	0.374	0.430
9	0.215	0.217	0.256	0.283	0.281	0.331	0.236	0.291	0.343	0.369	0.368	0.424
10	0.210	0.213	0.253	0.277	0.277	0.327	0.234	0.296	0.375	0.363	0.363	0.419
11	0.207	0.211	0.250	0.272	0.274	0.324	0.235	0.306	0.427	0.357	0.359	0.416
12	0.204	0.209	0.248	0.269	0.271	0.322	0.238	0.323	0.516	0.353	0.356	0.413
13	0.202	0.207	0.247	0.266	0.269	0.320	0.244	0.348	0.688	0.350	0.354	0.411
14	0.200	0.206	0.246	0.263	0.268	0.319	0.254	0.386	1.124	0.347	0.353	0.410
15	0.198	0.205	0.245	0.262	0.267	0.318	0.267	0.443	4.066	0.345	0.351	0.409
16	0.197	0.205	0.244	0.260	0.266	0.317	0.286	0.536		0.344	0.350	0.408
17	0.196	0.204	0.244	0.259	0.265	0.316	0.312	0.703		0.342	0.350	0.407
18	0.195	0.204	0.243	0.258	0.265	0.316	0.350	1.085		0.341	0.349	0.407
19	0.195	0.203	0.243	0.257	0.264	0.315	0.404	2.727		0.340	0.349	0.406
20	0.194	0.203	0.243	0.257	0.264	0.315	0.491			0.340	0.348	0.406
21							0.643					
22							0.974					
23							2.222					

SAW 47 Working Paper 9 (TOR 3) – Analysis of Sex Ratios

Analysis of Trends in Sex Ratio, Implications for Natural Mortality, and Variation in Age-Length Keys in Summer Flounder

Eric N. Powell
Jason Morson

Haskin Shellfish Research Laboratory
Rutgers University

Introduction

The analyses described herein use the biological database for summer flounder. The goals of these analyses are to answer the following questions to the extent permitted by this database.

1. Does information exist in the sex-ratio data that would support the need to construct a sex-explicit model for summer flounder?
2. Does information exist in the sex-ratio data that would support the need to utilize regionally-specific sex-at-age keys?
3. Does information exist in the sex-ratio data that would support a differential natural mortality rate for male and female summer flounder or a nonlinear whole-stock natural mortality rate?
4. Does variation exist in the relationship of size and age that would support the need to utilize regionally-specific age-length keys?

Sex Ratio as a Function of Age

Methods and Results

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, we exclude data from southern New England north and also from Cape Hatteras south in this set of analyses. We also exclude all age-year combinations where the number of sexed summer flounder is less than 20. For some analyses, we have collected the data into six year groups with the central four being half-decadal. Year group 1 contains data from 1982-1985 and year group six for 2006-2007.

Table 1 shows the sex ratio by year and age for summer flounder. The year-group averages are in Table 2. Perusal of Table 1 elucidates two general trends.

First, the 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, a frequency significantly different than the expected 50:50 split (binomial test, $P < 0.0005$). Furthermore, the fraction male for young-of-the-year fish frequently exceeds 0.6; in fact a sex ratio at least this divergent from 50:50

occurs in 17 of 26 years. The average number of age-0 fish sexed per year is 51.5. Given this average, a 50:50 male:female ratio by chance when measured would return a ratio of 60:40 or greater 7.56% of the time. The occurrence rate observed, 17 in 26, would not be expected to occur by chance (binomial test, $P < 0.0001$). Thus, young-of-the-year summer flounder are consistently over-represented by male fish.

Table 1. The fraction of summer flounder that are male at age for ages and years where the total number of summer flounder sexed was ≥20.

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age8
1982	0.707	0.519	0.369	0.133					
1983	0.583	0.466	0.361	0.296					
1984	0.576	0.589	0.304	0.250					
1985	0.674	0.484	0.378	0.263					
1986	0.645	0.590	0.500	0.056					
1987	0.714	0.622	0.474						
1988	0.714	0.783	0.357						
1989	0.574	0.586	0.227						
1990	0.662	0.548							
1991	0.739	0.617	0.476						
1992	0.614	0.534	0.291	0.200					
1993	0.750	0.578	0.348	0.103					
1994	0.436	0.580	0.412	0.135					
1995	0.622	0.451	0.401	0.115					
1996	0.579	0.528	0.302	0.250					
1997	0.667	0.563	0.440	0.281	0.167				
1998	0.574	0.602	0.477	0.303	0.102	0.083			
1999	0.720	0.524	0.502	0.396	0.171	0.045			
2000	0.543	0.571	0.485	0.381	0.297	0.123	0.083		
2001	0.682	0.484	0.529	0.350	0.291	0.171	0.194		
2002	0.737	0.523	0.492	0.474	0.284	0.128	0.069		
2003	0.633	0.644	0.569	0.422	0.331	0.190	0.040	0.062	
2004	0.655	0.582	0.562	0.440	0.260	0.193	0.103	0.059	
2005	0.808	0.635	0.638	0.454	0.397	0.341	0.190		
2006	0.429	0.683	0.515	0.426	0.305	0.197	0.108	0.125	0.062
2007	0.286	0.581	0.666	0.441	0.250	0.196	0.250	0.067	

The second observation is a consistent change in sex ratio with age (Figure 1), such that male frequencies over 0.5 occur only 8 times in 25 cases in age-2 fish and ratios above 0.3 occur only 6 times in age-4 fish. In fact, of the sex ratios accumulated by year-group in Table 2, only one age and year-group pair was characterized by a sex ratio not significantly different from 50:50 male-to-female. 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.

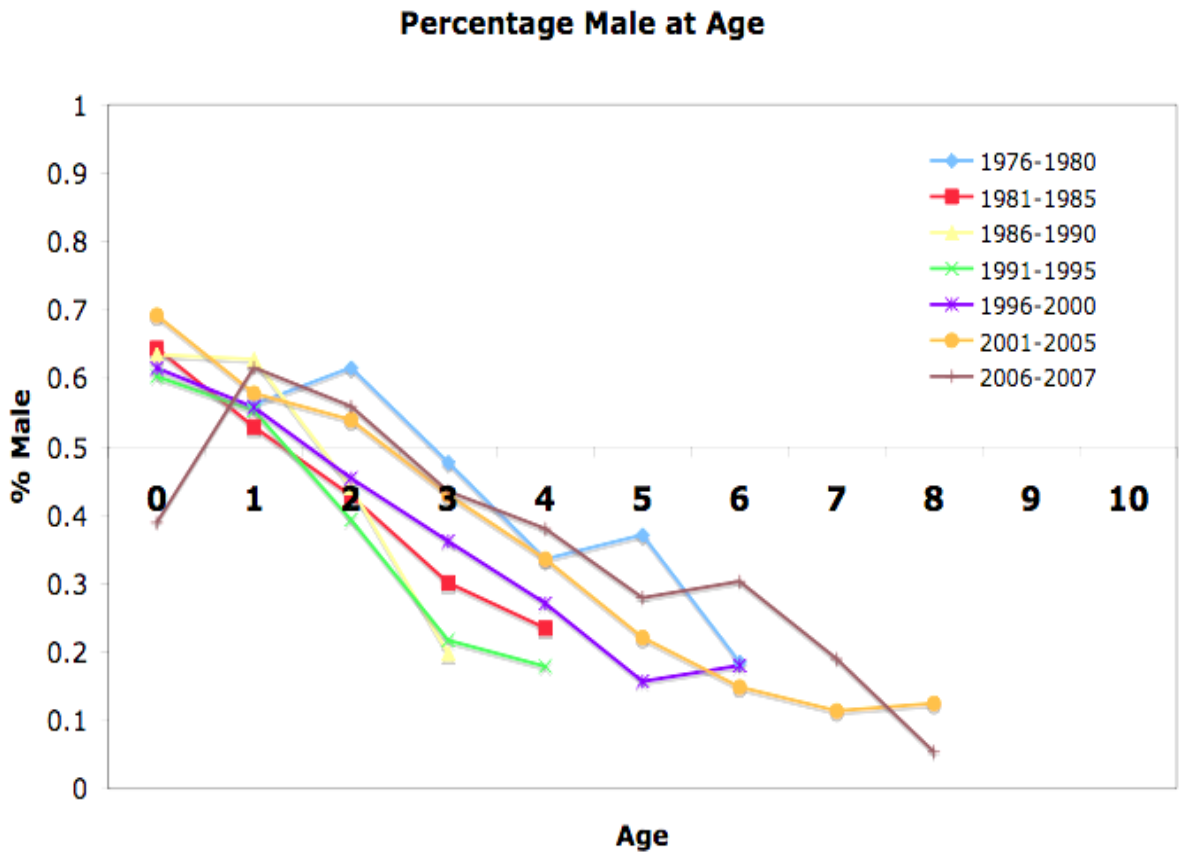

Figure 1. The percentage of the stock that is male by age, summarized by year-group.

Two additional observations are worthy of note. First, 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 typical age-1 sex ratios in being biased in favor of males. Thus, the aberrant 2006 young-of-the-year ratio is likely 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 (Table 2). One explanation is that male fish are moderately more susceptible to the fishery at high fishing mortality rates, but two other explanations should first be considered. The same outcome would be obtained either if a reduction in natural mortality rate had occurred of if the originating sex ratio was biased to a greater degree in favor of males. Evidence in Table 1 does not strongly support the latter alternative. Evidence in a subsequent section does not support the penultimate option. The dispersion of males and females as the cohort ages, discussed in a subsequent section, might be interpreted to support the first alternative.

Table 2. The fraction of summer flounder that are male at age for ages and year groups where the total number of summer flounder sexed was ≥20. Parentheses indicate ratios not significantly different from an expected 50:50 split (binomial test, $\alpha = 0.05$).

Year Group	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8
1982-1985	0.644	(0.518)	0.357	0.222	0.167				
1986-1990	0.641	0.630	0.397	0.140					
1991-1995	0.601	0.543	0.370	0.133	0.074				
1996-2000	0.605	0.544	0.438	0.344	0.227	0.126	0.100		
2001-2005	0.690	0.568	0.550	0.423	0.302	0.192	0.117	0.071	0.158
2006-2007	0.386	0.621	0.588	0.436	0.277	0.197	0.164	0.097	0.042

Interpretation: Age-dependent Bias in Sex Ratio

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 records undifferentiated fish. Assigning all of these fish to the female sex, however, does not markedly change the data summarized in Table 2. Thus, maturity schedule 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.

The most viable explanation for biased sex ratios in young-of-the-year summer flounder is temperature-dependent sex determination. Temperature has been shown to influence sex ratios at the point of sexual differentiation in flatfish, not afterwards, and this influence of temperature seems to be a frequent characteristic of flounder species. For example, when barfin flounder, *Verasper moseri*, were reared at high temperatures (18°C for this species), all fish developed as males, whereas at 14°C, the sex ratio was close to 1:1 (Goto et al. 1999). Marbled sole, *Limanda yokohamae*, also show temperature-dependent sex determination; when the larvae were kept in 25°C water, the sex ratio was again strongly skewed towards males (Goto et al. 2000). Southern flounder, *Paralichthys lethostigma*, likewise develop a sex ratio skewed towards males when raised at higher (28°C) or lower (18°C) than optimal temperature, 23°C, which produces a 1:1 ratio (Luckenbach et al. 2003). Although little is known of the genetic determinants of sex, *Paralichthys olivaceus* uses an *XX* female/*XY* male system of genetic sex determination, yet high water temperatures (25-27.5°C) produce physiological males possessing an *XX* genotype.

Genetically determined males (*XY*) were never observed to develop into physiological females (Yamamoto 1999).

Among the flatfishes have been shown to exhibit temperature-dependent sex determination are two species of the same genus as summer flounder, the Japanese flounder or hirame, *Paralichthys olivaceus*,and the southern flounder, *Paralichthys lethostigma* (Yamamoto 1999; Luckenbach, et al.2003). Furthermore, in both cases, extreme temperatures result in a higher fraction of the young being male. This could potentially explain why a higher fraction of young-of-the-year summer flounder are found at the northern and southern edges of their range, as described subsequently.

Sex Ratio as a Function of Region and Depth

Methods and Results

For this analysis, we allocated strata to three depth zones (<25 fm; 25-50 fm; >50 fm). This division allocated sex-ratio data into approximately equivalent groups by data richness. Insufficient data were present to achieve a finer division of deeper-water strata. Strata were allocated to 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. Finally, data were 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.

Table 3. Results of ANOVAs examining the impact of depth, region, and year-group on sex ratios at age. Blank cells indicate insufficient data. NS, non-significant at $\alpha = 0.05$. ×, an interaction term.

Age	Region	Depth	Year Group	Depth × Region	Depth × Year Group	Year Group × Region	Year Group × Depth × Region
0	NS		≤.001			NS	
1	NS	NS	NS	≤.001	NS	NS	0.01
2	0.05	≤.001	≤.001	≤.001	NS	≤.001	0.005
3	NS	0.002	≤.001	NS	NS	NS	0.005
4	≤.001	NS	0.01	NS	0.03	NS	NS
5	≤.001	NS	0.006	NS	NS	NS	NS
6	NS	NS	NS	NS	NS	NS	NS
7	NS	NS	NS	NS	NS	NS	NS

Depth significantly influenced sex ratio in summer flounder, ages 2 and 3 (Table 3). The catch of age-0 fish was insufficient in the deeper depth zones to analyze. Whereas depth was only significant for ages 2 and 3 in the ANOVA, Tukey's studentized range tests identified depth differences in sex ratios for ages 1 through 4. The presence of significant interaction terms, however, limits the interpretation of this *a posteriori* test. For these younger fish, exclusive of age 1, a tendency exists for the sex ratios to be more nearly 50:50 offshore (Figure 2). Age-1 males are distinctly proportionately more common offshore. At ages 5 and older, depth no longer impacts sex ratios significantly in summer flounder.

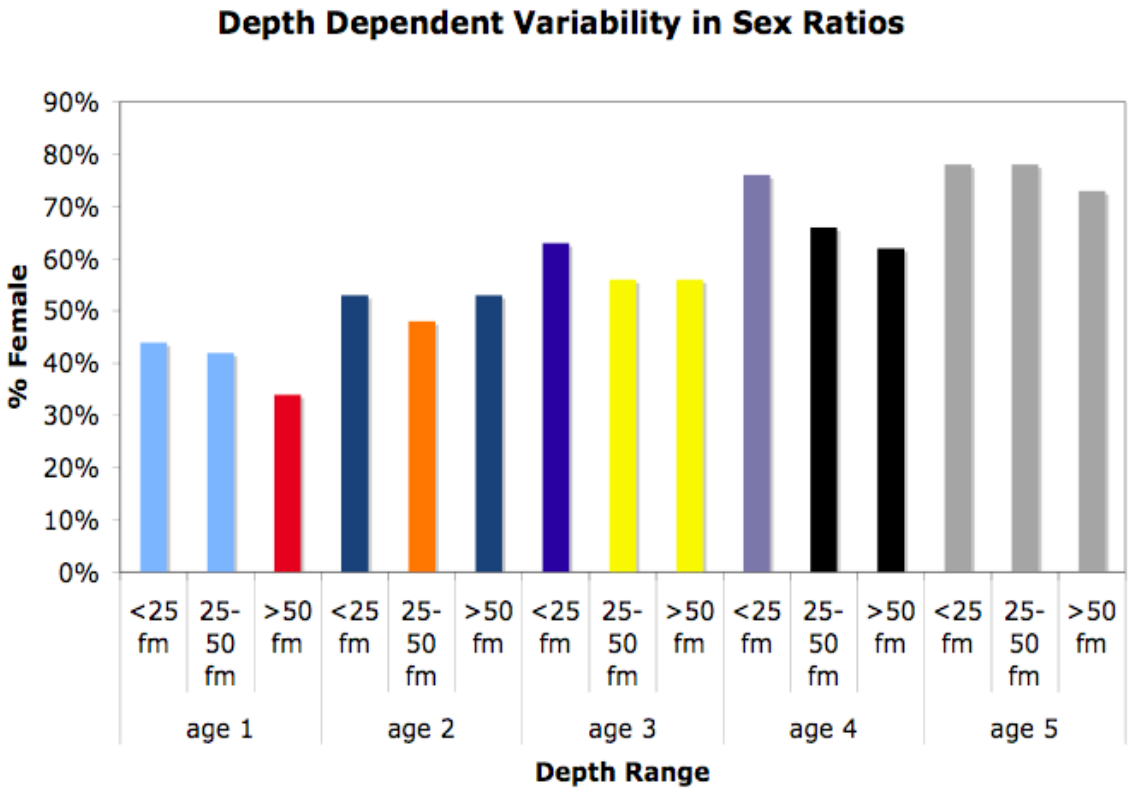

Figure 2. Mean percent female at age by depth. Bars within an age group with the same color were not significantly different in an *a posteriori* Tukey's test. ANOVA results are in Table 3

Sex ratios were significantly affected by region at age 2, but much more so for ages 4 and 5 (Table 3). The switch between depth and region as the dominant main effect between ages 3 and 4 is dramatic and suggests a differential segregation of the stock spatially as the fish age. Interaction terms were routinely significant between main effects for younger ages, but rarely significant after age 3. The change in significant main effect with age and the frequency of significant interaction terms including depth suggests that regionality in summer flounder sex ratios is not facilely explained simply in terms of depth and latitude. Tukey's studentized range tests document the tendency for the northern Mid-Atlantic and Delmarva regions to group together, while one of either the south Atlantic or southern New England regions differed significantly from the central region group (Figure 3). For the cases in which region was a significant main effect, a significantly lower fraction of females occurred in southern New England strata when compared to the Delmarva and northern Mid-Atlantic regions.

Year-group was highly significant for ages 0, 2, 3, 4, and 5. Tukey's studentized range tests clearly indicated a pattern for early years (1976-1980) and later years (2001-2007) to group together and for middle years (1981-1996) to group together (Figure 4). These groupings can be correlated with periods of low and high abundance. Furthermore, periods of lower abundance routinely had higher male ratios than periods of high abundance.

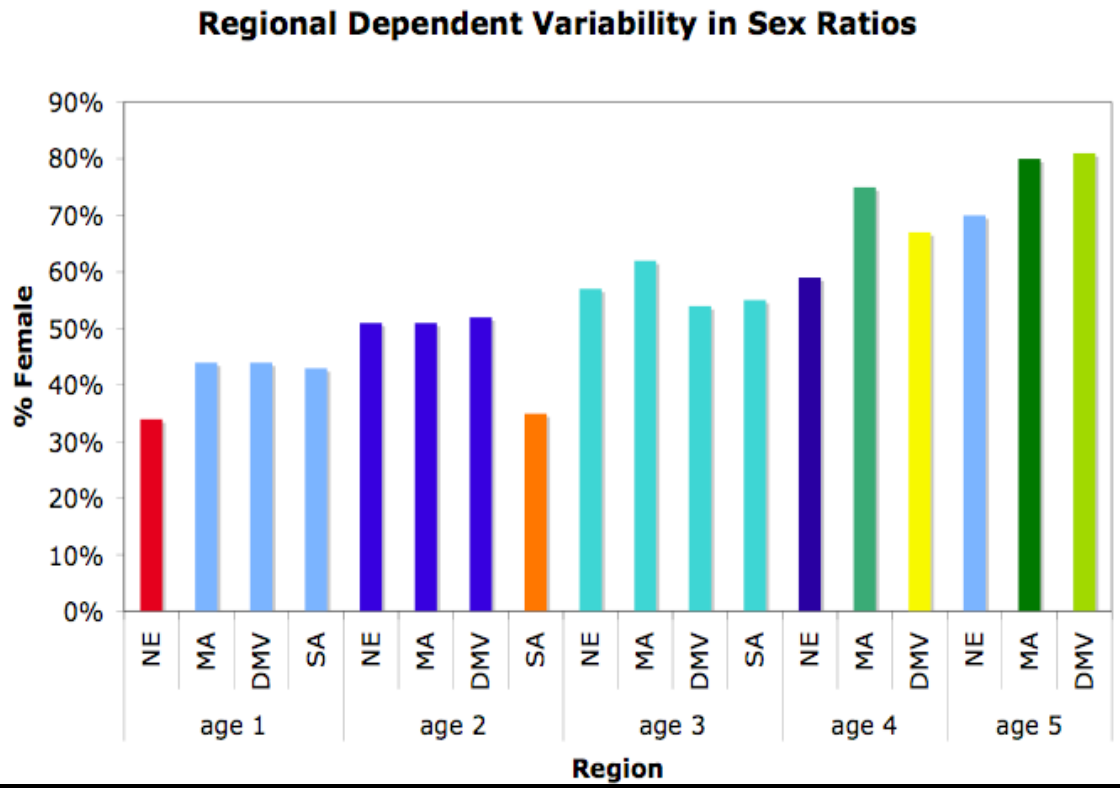

Figure 3. Mean percent female at age by region. Bars within an age group with the same color were not significantly different in an *a posteriori* Tukey's test. ANOVA results are in Table 3. NE, southern New England; MA, northern Mid-Atlantic; DMV, Delmarva; SA, south Atlantic.

Interpretation: Spatial Divergence in Sex Ratio

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 precisely 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.

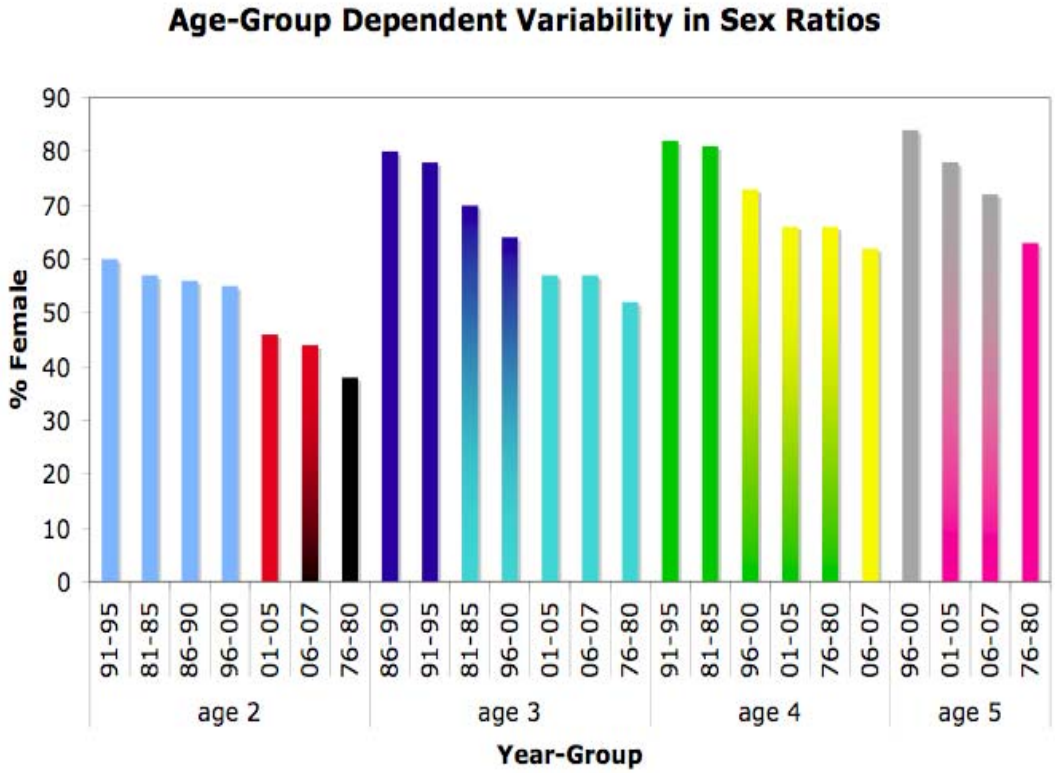

Figure 4. Mean percent female at age by year-group. Bars within an age group with the same color were not significantly different in an *a posteriori* Tukey's test. ANOVA results are in Table 3.

Sex Ratio-imposed Requirement on Relative Mortality Rate

Methods and Results

The gradual shift in sex ratio from male-dominated to female-dominated with increasing age might accrue from differential mortality or differential availability. The latter would seem unlikely, as the trends in sex ratio are consistent across a wide range of age groups.

The differential rate of natural mortality can be directly calculated from the information provided in Table 2. The calculation is based on the following governing equation:

$$N_{1_m} + N_{1_f} = N_{0_m} e^{-Z_m t} + N_{0_f} e^{-Z_f t} \tag{1}$$

where N is abundance of males m or females f, Z is total mortality rate, t is time, and numerals designate consecutive time periods. The equation can be converted to ratio form by dividing through by N_1:

$$1 = \frac{N_{0_m}}{N_1} e^{-Z_m t} + \frac{N_{0_f}}{N_1} e^{-Z_f t} \tag{2}$$

Equation (2) can be solved iteratively under the conditions that the sum of the two terms on the right-hand side closely approximate 1, that $N_{1_m} \le N_{0_m}$, and that $N_{1_f} \le N_{0_f}$.

Table 4. Relative natural mortality rates of male and female summer flounder calculated from the changes in sex ratios with age, by year-group, Delmarva and northern Mid-Atlantic region only, from equation (2).

Year Group	Male (Z_m)	Female (Z_f)
1976-1980	0.46	0.12
1981-1985	0.82	0.42
1986-1990	0.51	0.13
1991-1995	0.53	0.30
1996-2000	0.25	0.22
2001-2005	0.53	0.22
All years	0.62	0.22

Table 4 demonstrates that the change in sex ratio over the lifespan of a cohort requires a differential natural mortality rate, whereby males die at a much faster rate than females. The calculation is robust in measuring the relative mortality rate. The mortality rate for males is often twice that of females. Considering the entire dataset, all years combined, the natural mortality rate for males is about three times the female rate (Table 4). The calculation is less robust in measuring absolute natural mortality rate as any mortality process distributed evenly among the sexes would not impact an estimate based on varying sex ratios. Nevertheless, the female natural mortality rate of 0.22 for all years is remarkably similar to the assumed female natural mortality rate derived from estimates of female lifespan.

Interpretation: Sex-specific Natural Mortality Rate

The change in sex ratio with age requires that male and female summer flounder be modeled separately as far as natural mortality rate. In lieu of a sex-explicit model, a whole stock mortality rate might be employed, although this is less satisfactory. The natural mortality rate, derived thusly, is not linear, however (Table 5). We calculated this age-dependent rate using the equation:

$$Z_{m+f} = -\log\left(\frac{N_{0_m}}{N_{0_{m+f}}}e^{-Z_m t} + \frac{N_{0_f}}{N_{0_{m+f}}}e^{-Z_f t}\right) \quad (3)$$

Equation (3) was employed using age-independent mortality rates for males and females from Table 4, based on the observation of relatively constant mortality with age within sex inferred from Figure 5. Whole-stock natural mortality rates derived thusly vary from 0.45 for young-of-the-year summer flounder to 0.25 for fish age 7 and older (Table 5).

Table 5. Whole-stock mortality rate based on the age-dependency in sex ratio from 1976-2007 and the male and female natural mortality rates reported in Table 4.

Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7
0.447	0.424	0.394	0.362	0.316	0.286	0.262	0.245

A higher natural mortality rate in males could potentially be explained by some type of biological refuge for females. 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.

Comparison of Age-Length Keys: Relationship of Length at Age with Region and Depth

Methods and Results

Tables 6 and 7 show the results of ANOVAs examining the relationship of depth, region, and year-group on length at age. For these analyses, the dependent variable, length, was ranked. Thus, the analysis is nonparametric. 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 (Figure 6).

Length at age varied significantly with region for male and female summer flounder, ages 0-4, but not at older ages. Whereas Tukey's Studentized Range tests identified a tendency for some regions to group together at some ages, overall, fish are smaller in the south and get progressively larger at all ages, 0-4, northward (Figure 7). 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.

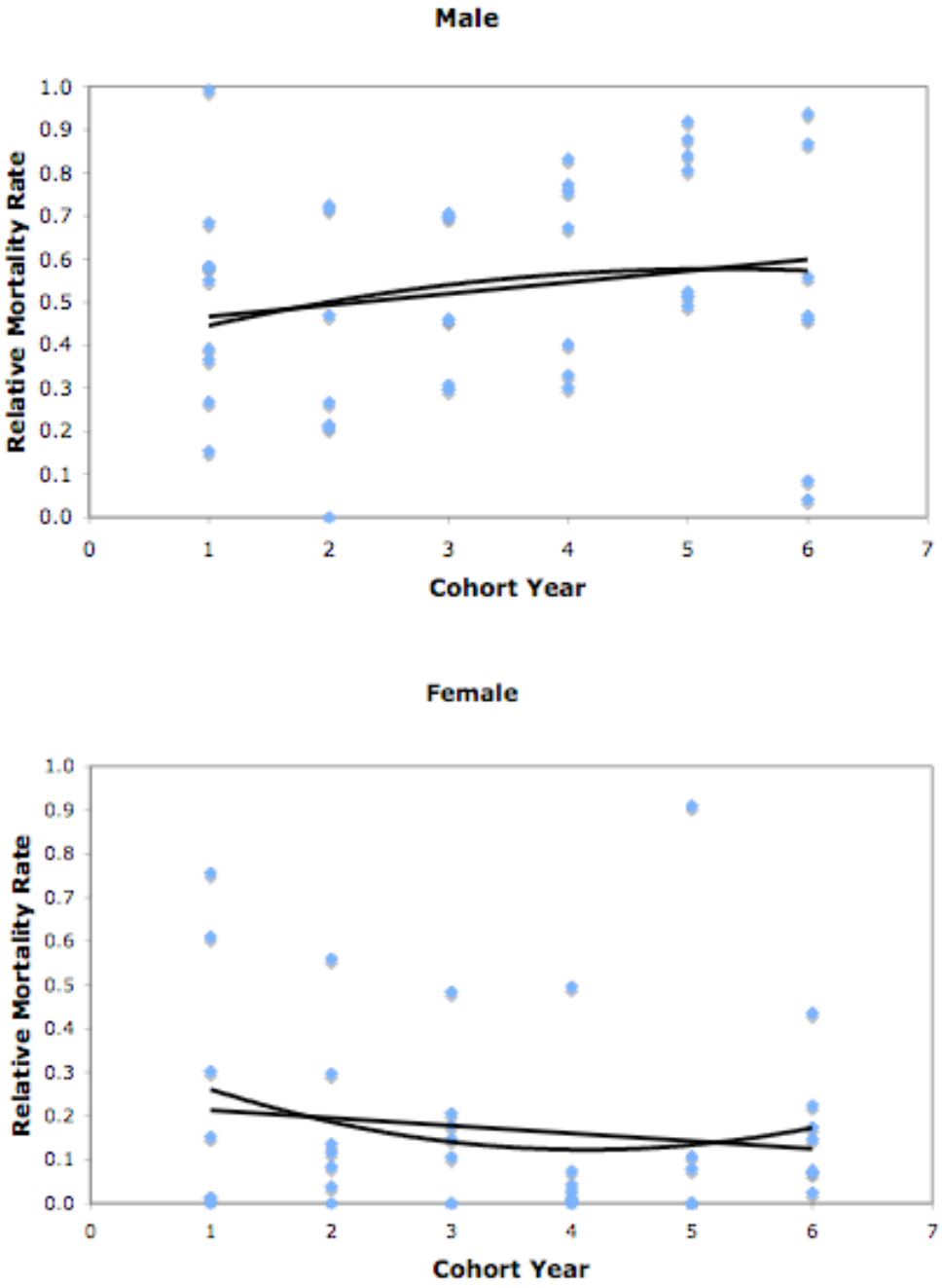

Figure 5. Trends in natural mortality rate by age for male and female summer flounder. Points are values from each of the years from 1976-2006 where sufficient data density permitted the estimate of within-cohort natural mortality rate at age. Neither polynomial nor linear curve fits transit a slope significantly at variance to zero.

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Length at age varied significantly with region for male and female summer flounder, ages 0-4, but not at older ages. Whereas Tukey's Studentized Range tests identified a tendency for some regions to group together at some ages, overall, fish are smaller in the south and get progressively larger at all ages, 0-4, northward (Figure 7). 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.

Disregarding the influence of fishing mortality on age-at-length, these trends indicate 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. These trends are remarkably reminiscent of those observed earlier for sex ratio (Table 3).

Table 6. Results of ANOVAs examining the impact of depth, region, and year-group on male length for summer flounder. All regional data were included. Blank cells indicate insufficient data. NS, non-significant at $\alpha = 0.05$. ×, an interaction term.

Age	Region	Depth	Year Group	Depth × Region	Depth × Year Group	Year Group × Region	Year Group × Depth × Region
0	≤.001		≤.001			NS	
1	≤.001	≤.001	≤.001	≤.001	0.006	≤.001	NS
2	≤.001	≤.001	≤.001	NS	≤.001	≤.001	
3	≤.001	≤.001	≤.001	≤.001	NS	NS	NS
4	0.02	NS	≤.001	≤.001	NS	NS	NS
5	NS	NS	≤.001	NS	NS	NS	NS
6	NS	NS	NS	NS	NS	NS	NS
7	NS	NS	NS	NS	NS	NS	

Table 7. Results of ANOVAs examining the impact of depth, region, and year-group on female length for summer flounder. All regional data were included. Blank cells indicate insufficient data. NS, non-significant at $\alpha = 0.05$. ×, an interaction term.

Age	Region	Depth	Year Group	Depth × Region	Depth × Year Group	Year Group × Region	Year Group × Depth × Region
0	≤.001		≤.001			NS	
1	≤ .001	≤.001	≤.001	≤.001	NS	≤.001	0.003
2	≤.001	≤.001	≤.001	≤.001	≤.001	0.02	NS
3	≤.001	≤.001	≤.001	≤.001	0.03	0.02	NS
4	≤.001	0.008	≤.001	NS	≤.001	NS	0.02
5	NS	NS	≤.001	NS	NS	NS	NS
6	NS	0.01	≤.001	NS	NS	NS	NS
7	NS	NS	0.006	NS	NS	NS	

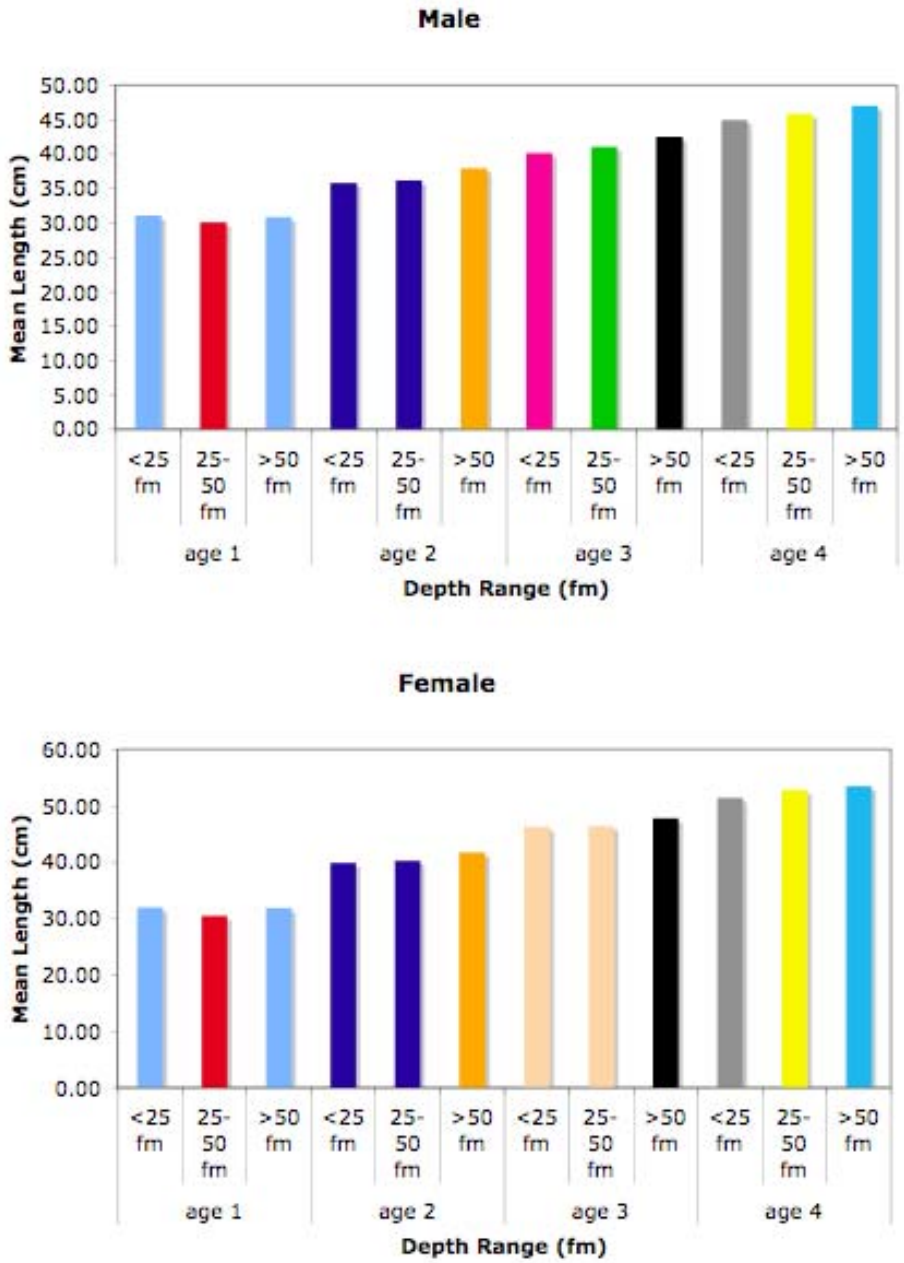

Figure 6. Mean length at age for male and female summer flounder. Bars within an age group with the same color were not significantly different in an *a posteriori* Tukey's test. ANOVA results are in Tables 6 and 7.

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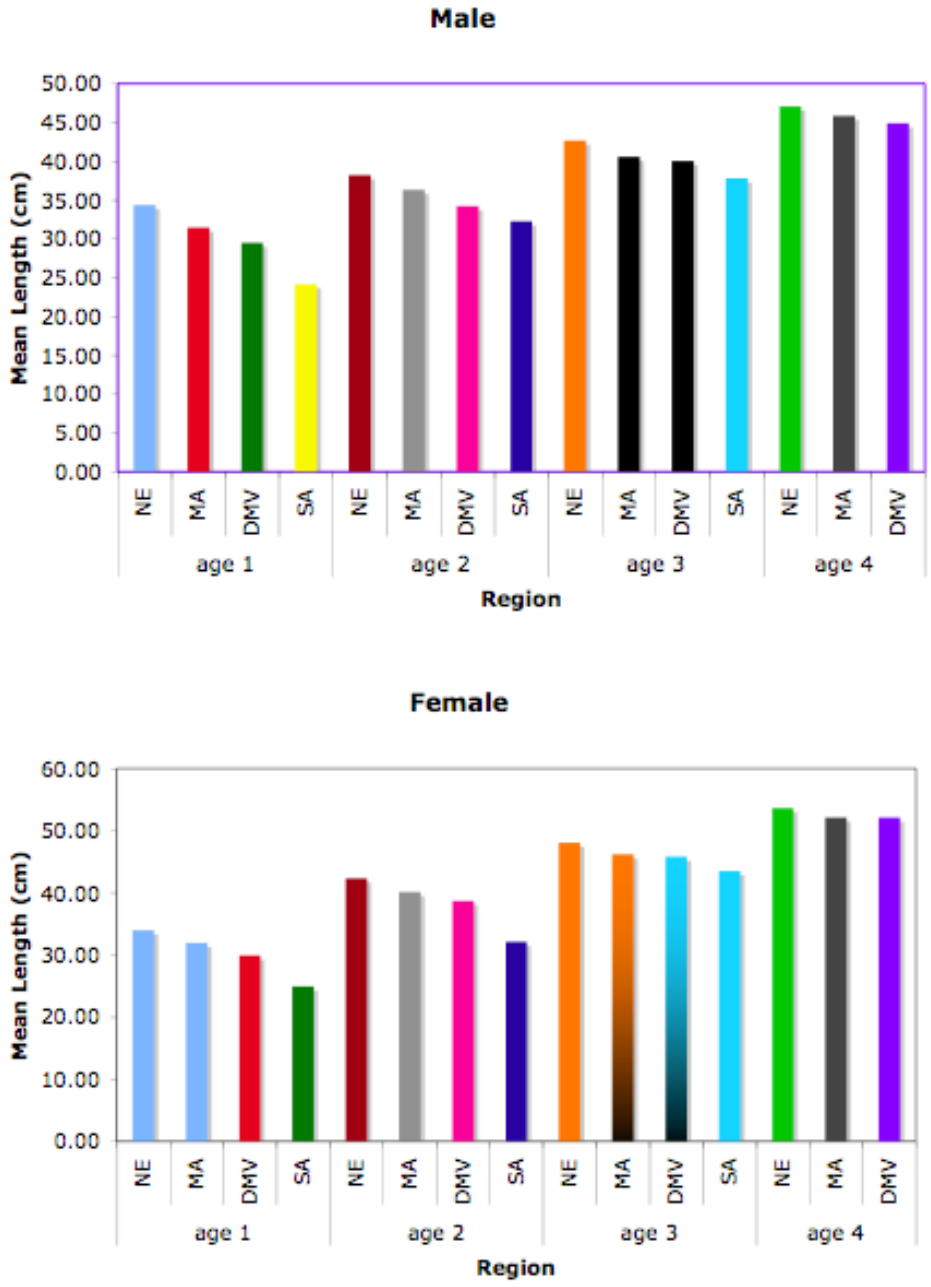

Figure 7. Mean length at age for male and female summer flounder. Bars within an age group with the same color were not significantly different in an *a posteriori* Tukey's test. ANOVA results are in Tables 6 and 7. NE, southern New England; MA, northern Mid-Atlantic; DMV, Delmarva; SA, south Atlantic

Disregarding the influence of fishing mortality on age-at-length, these trends indicate 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. These trends are remarkably reminiscent of those observed earlier for sex ratio (Table 3).

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. A few trends are clear in both males and females. First, summer flounder averaged much smaller at all ages in the period from 1976-1980 than any other year group. Additionally, year groups including years 1981-1985 and 2006-2007, generally group together as periods where size was smaller at age. Other year-groups are not consistently associated with small or large size-at-age groups. The former groupings are interesting because these periods are associated with relatively high abundance in comparison to the intermediate years. Additionally, a similar trend was noted in the sex ratio analyses.

Tables 8 and 9 repeat the ANOVAs of Tables 6 and 7, but restrict regional coverage to the two central regions, Delmarva and northern Mid-Atlantic. The frequency of significant main effects is much reduced in these ANOVAs relative to the earlier ones, although depth effects in particular continue to be present. Even for depth, significant main effects are less common, as are significant interaction terms, indicating that the central component of the stock offers a more spatially coherent picture than those portions near the northern and southern range limits.

Table 8. Results of ANOVAs examining the impact of depth, region, and year-group on male summer flounder length. Only the Mid-Atlantic and Delmarva regions were included. Blank cells indicate insufficient data. NS, non-significant at $\alpha = 0.05$. ×, an interaction term.

Age	Region	Depth	Year Group	Depth × Region	Depth × Year Group	Year Group × Region	Year Group × Depth × Region
0	≤.001		≤.001			NS	
1	NS	≤.001	≤.001	≤.001	≤.001	NS	NS
2	NS	≤.001	≤.001	NS	≤.001	NS	NS
3	NS	NS	≤.001	0.04	NS	NS	NS
4	NS	NS	≤.001	NS	NS	NS	NS
5	NS	NS	0.002	NS	NS	NS	NS
6	NS	NS	NS	NS	NS	NS	
7	NS	NS	NS				

Interpretation: Spatial Variation in Length-at-age

The ANOVAS of Tables 6-9 suggest that a single age-length key is not likely to be representative across all regions and in different depths. Furthermore, the differential with region and depth suggests that differential fishing pressure cannot be excluded as the mechanism generating these differences.

Table 9. Results of ANOVAs examining the impact of depth, region, and year-group on female summer flounder length. Only the Mid-Atlantic and Delmarva regions were included. Blank cells indicate insufficient data. NS, non-significant at $\alpha = 0.05$. ×, an interaction term.

Age	Region	Depth	Year Group	Depth × Region	Depth × Year Group	Year Group × Region	Year Group × Depth × Region
0	≤.001		≤.001			NS	
1	NS	≤.001	≤.001	≤.001	NS	0.005	≤.001
2	NS	≤.001	≤.001	NS	≤.001	NS	NS
3	NS	≤.001	≤.001	NS	0.01	NS	NS
4	NS	NS	≤.001	NS	0.004	NS	NS
5	NS	NS	≤.001	NS	NS	NS	NS
6	NS	NS	≤.001	NS	NS	NS	NS
7	NS	NS	0.04	NS	NS	NS	NS

Comparison of Age-Length Keys: Comparison of Key Structure Across Region and Depth

Methods and Results

These analyses 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 intervals. Size 12 included fish ≥70 cm and size 1 included fish <20 cm. This yielded three age-length 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. Tests were conducted on doubly standardized arrays (columns and rows). These results are anticipated since the ages are not independently distributed with respect to lengths in these keys.

The commonest age at length translates a diagonal from the northwestern to the southeastern corner of the age-length array (age in columns, length in rows). This trend is consistent across keys. A same cell-to-same cell mapping evaluated by a Spearman's rank correlation test on doubly standardized arrays returned a significance level of $P < 0.0005$ or better for each pair-wise comparison (e.g., Delmarva vs northern Mid-Atlantic). This also is expected from the anticipated structure of the keys.

These two standard statistics are described because these approaches, plus the afore-described ANOVAs (Tables 6-9) represent typical statistical treatments of age-length data. None of them answer the query concerning equivalency of the age-length relationship documented by the distribution of ages at length in the two-dimensional array of the key.

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. Each row was standardized, but a column standardization was not performed. Residuals were calculated for each array cell as $expected_{i,j} - observed_{i,j}$ where the expected values were obtained from the first of two paired arrays. The null hypothesis is that the residuals will be randomly distributed in x-y space. A statistical test revealing a non-random pattern in the residuals indicates that some portion of the two arrays under examination differ in the distribution of values among cells; that is, that the age-length relationship differs.

The test statistics were calculated following Cliff and Ord (1973) where:

$$Moran's\ I = \left(\frac{n}{W}\right)\frac{\sum_{i=1}^{n}\sum_{\substack{j=1 \\ i\neq j}}^{n} w_{ij} z_i z_j}{\sum_{i=1}^{n} z_i^2}\ ; \tag{4}$$

$$Geary's\ C = \left(\frac{n-1}{2W}\right)\frac{\sum_{i=1}^{n}\sum_{\substack{j=1 \\ i\neq j}}^{n} w_{ij}(x_i - x_j)^2}{\sum_{i=1}^{n} z_i^2} \tag{5}$$

and

$$W = \sum_{i=1}^{n}\sum_{\substack{j=1 \\ i\neq j}}^{n} w_{ij}\ ; \tag{6}$$

$$z_i = x_i - \bar{x}; \quad (7)$$

$n =$ number of samples; $x_i =$ datum of each sample i; and $w_{ij} =$ a weighting measure as described subsequently. Significance levels were calculated under the assumption of randomization (Jumars et al., 1977).

Calculation of Moran's I or Geary's C is contingent on the mathematical representation of the spatial relationship of the cell values (w_{ij}). We employed a King's moves weighting such that any two cells i and j located in the array at position k,l for i and at positions $k,l+1,\ k,l-1,\ k-1,\ l$, and $k+1,\ l$ for j were given $w_{ij} = 1.0$. For the remainder, $w_{ij} = 0$.

Moran's I is sensitive to the location of extreme departures from the mean ($x_i - \bar{x}$). The expected value of I for spatially randomly distributed samples is $-(n-1)^{-1}$, a number close to zero at high n (Cliff and Ord, 1973). High values of I occur if x_i and x_j are both, much above or much below the mean. Geary's C is sensitive to sample-to-sample variation ($x_i - x_j$). Values above 1.0 indicate negative spatial autocorrelation (i.e., neighboring values less similar than expected by chance), an even distribution. Values below 1.0 indicate positive spatial autocorrelation (i.e., neighboring values more similar than expected by chance), a patchy distribution.

Both statistics are provided; however the question at hand is the relationship of nearest neighbors in the array and thus a strong preference is given to Geary's C as the statistic best evaluating similarity between two age-length arrays.

An important question concerns the incorporation of zeros. The northeastern and southwestern corners of the arrays routinely contain zeros. These paired zeros increase the number of cells and thus bias the statistic in proportion to their importance, as they are a guaranteed characteristic of the array if formulated correctly. An additional concern is singleton zeros, as the residual obtained is less constrained than for cases with paired non-zero values. In our opinion, the most valid approach is to discount paired-zeros only. Results of comparison of three age-length keys for the three depths and two geographic regions are provided in Tables 10 and 11. These comparisons are based on the exclusion of paired-zero cells.

Table 10. Values of Geary's C and Moran's I and significance for the cases in which array cells characterized by paired zeros were excluded. Age-length keys compared were for males only. The first array in each array pair as listed is the parent array used to generate the expected values for the second array. Residuals were calculated for the second array. Significance values are Moran's I over Geary's C $\left(\frac{Moran's\ I}{Geary's\ C}\right)$. NS, not significant. For region, Delmarva was used as the parent array.

Array Pair	Moran's I	Geary's C	Significance
Depth 1 vs. 2	0.182	2.175	$\frac{P < 0.05}{P < 0.005}$
Depth 1 vs. 3	-0.005	2.281	$\frac{NS}{P < 0.005}$
Depth 2 vs. 3	0.164	0.932	$\frac{P < 0.005}{NS}$
Region	-0.090	2.353	$\frac{NS}{P < 0.005}$

Table 11. Values of Geary's C and Moran's I and significance for the cases in which array cells characterized by paired zeros were excluded. Age-length keys compared were for females only. The first array in each array pair as listed is the parent array used to generate the expected values for the second array. Residuals were calculated for the second array. Significance values are Moran's I over Geary's C $\left(\frac{Moran's\ I}{Geary's\ C}\right)$.

NS, not significant. For region, Delmarva was used as the parent array.

Array Pair	Moran's I	Geary's C	Significance
Depth 1 vs. 2	0.056	1.645	$\frac{NS}{P<0.01}$
Depth 1 vs. 3	0.174	1.392	$\frac{P<0.05}{P<0.10}$
Depth 2 vs. 3	0.026	0.890	$\frac{NS}{NS}$
Region	-0.013	1.573	$\frac{NS}{P<0.05}$

The trend with depth is exemplified by Table 12 in which is compared via residuals the arrays for depths 1 (<25 fm) and 3 (>50 fm). A negative residual indicates a higher value in the second array (>50 fm). Consistently, across size groups, the negative residuals occur at older ages indicating that male fish of a given size tend to be older at deeper depths. This is consistent with ANOVA results described earlier in Tables 6-9. Table 13 compares the male arrays for the two regions. In this case, the residual pattern is more complex; however, negative values tend to occur at younger ages for a given size, indicating that males tend to be older at size in the southern portion of the Mid-Atlantic Bight. This is also consistent with ANOVA results.

Table 12. Residual pattern for the comparison of and example age-length relationship in summer flounder males between arrays representing depths 1 and 3.

Length (cm)	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
<20	54.43	-60.76	6.33				
20-<25	30.01	-40.91	10.90				
25-<30	23.04	-35.13	12.62	-0.60	0.07		
30-<35	6.92	14.68	-15.40	-5.69	-0.51		
35-<40	0.33	42.35	-31.37	-10.17	-0.69	-0.46	
40-<45		10.06	30.03	-28.95	-9.65	-1.49	
45-<50		1.00	18.93	12.20	-22.38	-7.77	-1.99
50-<55			4.42	18.67	-9.67	-2.05	-11.37
55-<60			1.91	-4.88	3.29	11.77	-12.09

Table 13. Residual pattern for the comparison of and example age-length relationship in summer flounder males between arrays representing Delmarva and the northern Mid-Atlantic Bight.

Length (cm)	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
<20	17.5540	-24.7482	7.1942				
20-<25	20.0380	-25.6052	5.5672				
25-<30	9.2232	-16.8604	7.6844	-0.2277	0.1805		
30-<35	0.4179	-2.9349	0.8727	1.4069	0.2375		
35-<40	-0.0198	-14.4489	7.3256	5.8648	1.2466	0.0317	
40-<45		-1.8036	-17.6687	12.4069	7.1451	-0.0799	
45-<50		-0.4988	-8.7182	-3.3502	12.3292	0.4147	-0.1767
50-<55		-1.6949	-2.6635	3.8740	6.7192	-6.2349	
55-<60		-4.0000	16.6667	13.3333	-31.3333	5.3333	

Interpretation

The male age-length relationships are more variable over depth and region than the female ones. Probably, this accrues from the higher natural mortality rates for the males which are also probably more variable spatially. The analyses suggest that a single age-length key may not be adequate, particularly for the males. However, comparison of model runs using different age-length keys would be needed to determine whether the observed variations are substantive for stock modeling. Regardless, the analyses again focus on the need to differentiate the two sexes and to investigate a spatially explicit model.

Conclusions and Recommendations

1. 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 is likely the result of temperature-dependent sex determination (TSD).
2. The age-dependency of sex ratio indicates the need to implement a sex-explicit model for summer flounder. Spatial variation in sex ratio suggests that a single sex-at-age key is not likely to be representative across all regions and in different depths.
3. The change in sex ratio with age also requires that separate natural mortality rates be used for male and female summer flounder stock assessment models. In lieu of a sex-explicit model, a whole stock mortality rate might be employed, although this is less satisfactory. The natural mortality rate, derived thusly, is not linear, but varies from 0.45 for age-0 fish to 0.25 for fish age 7 and older.
4. Higher natural mortality rate in male summer flounder is supported by published information on summer flounder and other flatfish.
5. 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.

6. 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.

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APPENDIX 4

SAW 47 Working Paper 10 (TOR 4) – Surplus Production Model

Re-evaluation of Summer Flounder (*Paralichthys dentatus*) Stock Status Following Adjustments for Retrospective Bias and Inclusion of Trophic Effects

Victor Crecco
Connecticut Marine Fisheries Division
333 Ferry Rd..
Old Lyme CT 06371

February 28, 2008

SUMMARY

In this report, a time series (1982-2006) of age aggregated (ages 1+) F and stock size estimates was derived for summer flounder from 1982 to 2006. A subset of tuning indices that significantly ($P < 0.01$) predicted the converged portion of the flounder time series (1982-2000) was used to project stock sizes for the non-converged portion (2001-2006) where the presence of retrospective bias from ADAPT was shown to systematically overestimate stock size. In addition, overfishing thresholds (Fmsy, Bmsy) were estimated for flounder by dynamic surplus production models. Finally, I examined the hypothesis that flounder stock rebuilding has been recently halted due mainly to enhanced predation and shifts in environmental factors. The stepwise regression analyses revealed that the recreational cpue index and the NEFSC spring trawl index were selected as the best predictors of mean ages 1+ numbers, biomass and SSB from 1982 to 2000. These regression models accounted for 62 to 89% of the variation in abundance over three converged periods (1982-1998, 1982-1999, 1982-2000), and were then used to project recent (2001-2006) ages 1+ abundance in an effort to address systematic retrospective bias during those years. The ADAPT model overestimated ages 1+ abundance by 35 to 50% in most years after 2000. Based on these analyses, the most reliable time series (1982-2006) of flounder abundance and SSB consisted of the converged portion (1982-2000) from ADAPT plus the predicted abundance and SSB estimates from 2001 to 2006 based on the predictive equations. This time series of stock size estimates was used in all subsequent analyses.

Biomass weighted fishing mortality (F) on ages 1+ flounder was high and variable before 1995, ranging from a low of 0.74 in 1994 to a high of 1.88 in 1988. After 1994, ages 1+ fishing mortality rates dropped considerably and remained relatively stable between 0.38 and 0.54. Ages 1+flounder biomass (mt) based on ADAPT was relatively high and stable from 1982 to 1987 at around 25 thousand mt, than flounder biomass dropped quickly to below 16 thousand mt from 1988 to 1994. Thereafter stock biomass began to rise and eventually reached about 30 thousand mt by 2001. Ages 1+ stock biomass remained relatively steady at around 30 thousand mt from 2001 to 2005, but the 2006 biomass level fell by 30% to 23 thousand mt. The dynamic Gompertz production model was a good fit to flounder surplus production data, but the model generated an anomalous residual pattern. As a result, several candidate predators (striped bass, bluefish and spiny dogfish) and

environmental variables (mean annual water temperatures and deviations in the winter NAO index) were added to the Gompertz model in a stepwise regression. Striped bass was the only additional variable selected to the Gompertz model at the $P < 0.02$ level. The extended Gompterz model with striped bass predatory effects explained over 83% of the variability in surplus production and, more importantly, removed the serial residual pattern noted from the original Gompertz model. This extended Gompertz production model was then used to estimate flounder overfishing thresholds (Fmsy, Bmsy). The resulting overfishing threshold (Fmsy) for flounder was 0.64 (80% C.I.: 0.51 to 0.77) and the biomass threshold was 32,500 mt (80% C. I: 25,900-39,200 mt). All of the ages 1+ fishing mortality (FW) rates (biomass weighted) on flounder from 1982 to 1994 exceeded the Fmsy threshold of 0.64, indicating that overfishing had occurred on flounder from 1982 to 1994. However, all subsequent FW estimates were below the Fmsy threshold, suggesting that overfishing was corrected by additional management measures imposed during the early to mid 1990's. Recent (2002-2005) biomass (mt) levels have approached my Bmsy threshold, but the 2006 biomass level of 22,900 mt represented a 30% drop and was well below the Bmsy threshold of 32,500 mt. Since fishing mortality rates (FW) have stabilized below Fmsy since 1995, the recent lack of stock rebuilding is likely due to enhanced striped bass predation and not overfishing. When the dome-shaped Ricker S-R model was fitted to the flounder S-R data, the model converged and the parameter estimates (A, Kp) were highly significant ($P < 0.0001$). However, the residual pattern from the Ricker Model looked almost exactly like the atypical residual pattern exhibited by the asymptotic Beverton-Holt S-R model. When striped bass abundance from 1982 to 2006 was added as a second explanatory variable, the extended Ricker model explained 91% of the recruitment variability, all three parameter estimates (A, Kp, c) were highly significant ($P < 0.0001$), and most importantly, the anomalous residual pattern observed in the basic Beverton-Holt and Ricker S-R models virtually disappeared. These finding are consistent with the Predation Hypothesis, indicating that surplus production and the transmission of age 0 recruits to the adult stock has been recently impeded due to a recent rise in striped bass predation. The management implications of successful stock rebuilding of summer flounder in the presence of rising predatory mortality are discussed.

INTRODUCTION

The most recent stock assessment for summer flounder (Terceiro 2006) concluded that overfishing on the coast-wide stock has occurred since at least 1982. Current (2006) spawning stock biomass based on the 2007 ADAPT (Terceiro 2007) run is about 6% below the biomass threshold, and the current fully recruited fishing mortality rate (F) is about 25% above the current Fmax threshold of 0.28. As indicated by Terceiro (2006), all ADAPT model runs conducted thus far have exhibited a pronounced and systematic retrospective bias for the terminal (most recent year) F and stock size estimates. Although the exact origin of retrospective bias is still unclear (ICES 2002), this problem occurs at some level in nearly all catch-at-age models. The ADAPT model for summer flounder almost always underestimated F and overestimated stock size for fully recruited fish in the last three to five years of the time series by a sizeable amount. Such a large systematic bias greatly confounds our ability to establish conservative quotas on the commercial fisheries and, more importantly, over-inflates the true pace of flounder stock rebuilding toward the SSB threshold of 44,760 mt. Given that the most recent (2002-2006)

biomass estimates from ADAPT have been consistently overestimated, the rate of stock rebuilding since 2002 may be much slower than previously suggested based on output from ADAPT.

The current target and overfishing thresholds for summer flounder are both expressed by an Fmax value of 0.28 based on the Thompson-Bell yield-per-recruit (YPR) model (Terceiro 2006). The threshold Fmax is assumed to be a suitable proxy for Fmsy when the shape of the stock-recruitment relationship is indeterminate. The YPR model assumes no density-dependence and constant age-specific somatic growth and natural mortality rates (M). The notion that Fmax closely approximates Fmsy under most conditions was challenged recently during a review of reference points for summer flounder conducted by the Mid Atlantic Fishery Management Council (MAFMC). Three reports (Gibson 2000; Crecco 2000; Armstrong 2000) from this meeting estimated Fmsy for summer flounder based on stock-recruitment and dynamic surplus production models that assume the presence of density-dependent mortality. All of their findings indicated that the range of Fmsy thresholds (Fmsy: 0.58-0.82) for summer flounder always exceeded the Fmax level of 0.28 used in the current assessment as did the range of Fmsy levels (Fmsy range: 0.45-0.69) reported earlier by Chang and Pacheco (1976). These findings strongly suggest that summer flounder are under some density-dependent control and are thus more resilient to fishing pressure than previously thought.

Over the last seven years, the stock-recruitment (S-R) relationship for flounder has been extensively examined (Terceiro 2000, 2006; Gibson 2000; Crecco 2000). Terceiro (2006) has shown that the residuals from all Beverton-Holt S-R model runs have exhibited a pronounced and consistent serial correlation over time. The residuals were all large and positive from 1983 to 1987, after which nearly all residuals switched to a negative direction. Gibson (2000) also noted a similar residual pattern for the dome-shaped form of the Shepherd (1982) S-R model, indicating that this serial correlation in residuals over time is widespread and not related to the shape of the S-R curve. The other potential cause for serial residuals is that the basic S-R model lacks an additional important explanatory variable such as an environmental or trophic factor. Given the uncertainty and controversy surrounding the effects of retrospective bias in ADAPT on current F and stock biomass, as well as the persistent occurrence of serial residuals from all current flounder S-R models, I argue here that a thorough examination of these issues are needed even if it occurs outside the normal Peer Review process. The need for such a review may appear unwarranted since the last eight flounder assessments have been upheld by Peer Review (Terceiro 2006). Nevertheless, the ramifications of persistent retrospective bias from ADAPT and residual anomalies from S-R models require more attention here and in future Peer Reviews.

In this report, a time series (1982-2006) of age aggregated (ages 1+) F and stock size estimates was derived from 1982 to 2006. The F and stock size estimates were expressed annually as ratios of landings and discards to ages 1+ abundance from the converged portion of the 2007 ADAPT run (Terceiro 2007). A subset of tuning indices that significantly ($P< 0.01$) predicted the converged numbers and biomass time series was then used to project stock sizes estimates for the non-converged portion (2001-2006) of the biomass, stock numbers and spawning stock biomass (SSB) time series. In addition, overfishing thresholds (Fmsy, Bmsy) were estimated for flounder by dynamic surplus production models. Finally, I examined the hypothesis that flounder surplus production and recruitment have recently fallen mainly due to enhanced predation and shifts in environmental factors.

METHODS

Method to Adjust Recent Stock Size for Retrospective Bias

Retrospective bias has been persistent in the most recent (> 2001) flounder abundance estimates from the ADAPT model (Terceiro 2006). In an effort to reduce the impact of retrospective bias, I developed a number of linear least squares predictive models based on the tuning indices and the mean ages 1+ biomass, mean ages 1+stock numbers and spawning stock biomass (SSB) values from the converged portion of the 2007 ADAPT run (Terceiro 2007), where retrospective bias was minimal. Annual mean ages 1+ biomass and SSB are direct outputs from ADAPT, but mean ages 1+ stock numbers are not. To estimate mean stock numbers according to the VPA manual (Alan Seaver, NEFSC pers. comm.), ages 1+ stock size estimates at the beginning of each year from ADAPT was multiplied by the quantity (1-exp (-Zt)/Zt), where Zt is the instantaneous total mortality estimate (numbers weighted) from ADAPT.

My approach involved the use of the Pearson correlation and stepwise regression analyses to relate all ages 1+ tuning indices in weight and number against average ages 1+ biomass, spawning stock biomass (SSB) and average ages 1+ numbers from the converged portion (1982-2000) of the VPA (Tables 1-3). Both the Pearson correlation and Stepwise regression methods were conducted in the Statistical Analysis System (SAS 2002). A subset of tuning indices was selected from this analysis that best predicted (maximum rsquare) stock size within the converged portion of the VPA. Before the predictive equation was accepted, residual diagnostics was performed on each model to determine whether or not serial correlations were evident between model residuals and time (1982-2000). The residuals from each predictive model were linearly regressed against time (years) and a significant serial correlation coefficient ($P < 0.05$) would indicate an abnormal residual pattern. This would indicate that the current model configuration was either incorrect or an additional explanatory variable was missing from the model. In addition, the partial correlation coefficients were examined for each explanatory variable from the stepwise model. If the model accurately predicted ($P < 0.01$) abundance trends over the converged portion and passed the residual test, it was then used to estimate ages 1+ abundance in number, biomass (mt) and SSB for the non-converged portion (from 2001 to 2006) of the time series.

Since the degree of retrospective bias declines backwards in time from the terminal stock estimate, the exact cutoff for the most recent value in the converged time series is somewhat subjective. It is clear that the degree of retrospective bias in the abundance time series diminished sharply prior to 2001. Thus, the time series of ages 1+ abundance and SSB from 1982-2000 was defined as the converged portion. This converged portion was therefore considered to be the most reliable time series of flounder abundance. This allowed the converged portion to be used as an unbiased dependent variable in the stepwise model, against which the tuning indices can be regressed in the stepwise model. The stepwise model was designed to screen out tuning indices that were poorly correlated ($P > 0.05$) to ages 1+abundance. The definition of the 1982-2000 time series of ages 1+ abundance as a time frame with which to ground truth the tuning indices is arbitrary. Retrospective bias in ages 1+ F and stock size was still discernible albeit at a low level as far back as 1998 (Terceiro 2007). As a result, to further examine how the 1982-2000 time frame might affect the choice of informative indices, the Pearson correlation and stepwise analyses were repeated for ages 1+ abundance and SSB from ADAPT for an additional two periods 1982-1998 and 1982-1999.

The theoretical foundation of this regression approach could be questioned by the fact that trawl survey indices were used to directly tune the 2007 ADAPT run. The potential influence of the tuning indices on the trend in ages 1+ abundance over the converged portion of ADAPT should be minimal. The overall trend in flounder abundance within the converged portion (1982-2000) is mainly influenced by the catch-at-age matrix, whereas more recent abundance estimates are mainly affected by trends in the tuning indices (Mohn 1999).The candidate abundance indices used in the Pearson correlation and stepwise regression analyses included 10 trawl survey indices and one additional recreational cpue index that has not been previously used to tune ADAPT (Tables 1 and 2). The trawl indices included ages 1+ number/tow from the 1982-2006 Massachusetts (MA) spring trawl survey, ages 1+ number/tow in the1982-2006 Rhode Island fall trawl survey, ages 1+ number/tow in the 1990-2006 Rhode Island fixed station trawl survey, ages 1+ number from the 1984-2006 Connecticut spring and fall trawl surveys, both ages 1+ number and kg/tow from the1982-2006 NEFSC spring and fall indices, both ages 1+ number and kg /tow from the 1992-2006 NEFSC winter trawl survey, ages 1+ number /tow from the 1989-2006 New Jersey trawl survey, ages 1+ number/tow from 1990 to 2006 for the Delaware trawl survey. A shorter (1990-2006) time series of flounder kg/tow data are also available for the Connecticut spring and fall surveys. At this time, there are no reported biomass (kg/tow) time series for trawl surveys in Massachusetts, Rhode Island, New Jersey and Delaware. A more extensive description of these 10 trawl survey indices is found in the 2006 assessment report (Terceiro 2007).

The new coast-wide recreational cpue index was derived based on a coast-wide recreational catch-effort ratio from 1982 to 2006:

$$RelNt = ATLN / Et. \qquad (1)$$

The coast-wide recreational catch (ATLN) (type A, B1 and B2) in numbers and recreational fishing effort (Et, trips) in equation (1) were based on the private boat sector of the MRFSS annual surveys (Table 1). Flounder catch and fishing effort data were confined to the private boat sector for two reasons. First, the flounder total catch and total effort estimates each year were derived with relatively high precision (proportional CV < 5% of the mean). Second, the private boat sector of the fishery is highly mobile and capable of catching flounder of all sizes throughout their range.

A second time series (1982-2006) of relative abundance indices in weight (RelWt) was also derived as a ratio of recreational catches (A, B1, B2) in weight (RelWt) to fishing effort (Et) (Table 2). The MRFSS has monitored weight (kg) data from only the harvest (A, B1) so weight data from released fish (B2) are not available. As a result, average weight for A, B1 and B2 catches was estimated indirectly as the average weight (kg) per flounder taken from the NEFSC spring and fall surveys from 1982-2006. The average weight (avwt) of a flounder was derived annually from the NEFSC spring and fall surveys as the average kg/tow index divided by the average number/tow index. The resulting weight index (RelWt) for the recreational fishery was expressed annually as the product of the relative abundance index in number (RelNt) and the average weight (avwt) from the spring and fall NEFSC trawl surveys.

The proposed recreational indices for flounder (RelNt and RelWt) are fishery dependent and thus not entirely independent of the total (sport, commercial and discards) coast-wide landings. However, the problem of colinearity between recreational indices and total coast wide landings should be relatively minor for two reasons. First, auto-correlation between the relative abundance

indices (RelNt and RelWt) and total harvest is minimized by the fact that private boat recreational catches (type A, B1 and B2) were used here rather than harvest (type A and B1) to derive the RelNt. The recreational catches are usually three to four times higher each year than the harvest after 1993. Second, in order to derive the recreational indices, the private boat catches (A, B1, B2) in the MRFSS were further divided by private boat fishing effort (Et). Note that the trend in Et from 1982 to 2006 was inversely related ($r = -0.53$, $P < 0.01$) to total coast-wide flounder harvest.

RESULTS

Each of the ages 1+ abundance indices for the three converged periods 1982-1998, 1982-1999 and 1982-2000 was correlated to the corresponding ages 1+ abundance in number and weight (mt) based on ADAPT (Tables 4 and 5). Regardless of the converged time frames (1982-1998, 1982-1999, 1982-2000), ages 1+ number/tow from the NEFSC spring and winter surveys, as well as the Massachusetts, Rhode Island and Delaware surveys were poorly ($P > 0.05$) correlated to ages 1+ stock size in number from the three converged portions (Table 4). The Rhode Island fixed station survey and Connecticut fall survey of ages 1+ abundance were significantly correlated ($P < 0.03$) to the 1982-2000 and 1982-1999 abundance estimates but not to ages 1+ abundance from the 1982-1998 period. All of the other surveys (NEFSC fall, Connecticut spring, New Jersey and the coast-wide recreational cpue (RelNt) were significantly ($P < 0.05$) correlated to ages 1+ abundance across the three converged periods. However, recreational cpue in number was consistently the most highly ($P < 0.0001$) correlated index to ages 1+ abundance across the three converged periods.

Results of the correlation analyses for biomass (Table 5) revealed that the NEFSC winter biomass indices were poorly correlated to ages 1+ biomass from the converged portions, whereas the Connecticut spring and fall indices were significantly ($P < 0.05$) correlated to ADAPT biomass from 1982 to 1999 and 1982-2000, but not for the period 1982-1998. The NEFSC spring and fall biomass (kg/tow) indices and the recreational cpue index in kg (RelWt) were highly correlated ($P < 0.05$) to ages 1+ biomass across the three converged periods (Table 4). The recreational index (RelWt) always exhibited the highest correlation ($P < 0.0001$) to ages 1+ abundance across the three converged periods.

Ages1+ biomass (mt) from the converged portion (1982-2000) was highly correlated ($P < 0.0001$) to spawning stock biomass (SSB). The correlation matrix (Table 5) indicated that all biomass indices except the NEFSC winter survey were significantly correlated to SSB levels from 1982 to 2000. As in the other comparisons, the recreational cpue (RelWt) was the most highly correlated ($P < 0.0001$) time series to the SSB for the converged portion (1982-2000).

Results from the stepwise regression that related ages 1+ abundance from the converged portion to the tuning indices revealed that the recreational cpue index was the only index selected as the best predictor of mean ages 1+ numbers, accounting for 62 to 68% of the variation in abundance over the three converged periods (1982-1998, 1982-1999, 1982-2000) (Table 6). None of the ten trawl survey indices were selected as a second predictor variable from the stepwise regression. The predictive equation that explained 68% of the variation in abundance from 1982-2000 (Figure 1) was:

$$\text{PredN} = 5.28 + 26.38 * \text{RelNt} . \quad (2)$$

The resulting residual pattern from equation (2) was random over time (P <0.15) (Figure 2), indicating that this predictive model was unbiased and a reliable predictor of abundance at least from 1982-2000. As a result, this model was used to predict ages 1+ flounder abundance from 2001 to 2006 in an effort to adjust recent ages 1+ abundance for systematic retrospective bias. Severe overestimation of ages 1+ stock size from ADAPT was clearly evident in recent years (2001-2006) (Figure 3). The lowest systematic bias occurred in 2001 (23.7%) and highest took place in 2003 (53.9%). The percentage bias for ages 1+ abundance was 50.5% in the terminal (2006) year. The most reliable time series (1982-2006) of ages 1+ abundance was considered to be the converged portion (1982-2000) of ages 1+ abundance from ADAPT plus the predicted ages 1+ abundance estimates from 2001 to 2006 based on equation (2).

Results from the stepwise regression of ages 1+ biomass (mt) from the converged portion and the tuning indices revealed that the recreational cpue index in weight (RelWt) and the NEFSC spring index (kg/tow) were together the best predictors of ages 1+ biomass for the three converged periods (1982-1998, 1982-1999, 1982-2000), each accounting for 87 to 88% of the variation (Table 6). The partial correlation coefficients were always much higher for the recreational cpue (0.77-0.80) than for the NEFSC spring indices (0.09-0.11). The predictive equation for the converged period 1982-2000 was:

$$\text{PredW} = 4.30 + 4.94^{*}\ \text{NEFSC} + 23.10^{*}\ \text{RelWt}, \quad (3)$$

which explained 88% of the variation in ages 1+ stock biomass from 1982-2000 (Figure 4). A plot of residuals was random (P <0.60) across the time series (Figure 5), indicating that the predictive model (equation 3) was unbiased. As a result, this model was used to predict ages 1+ flounder biomass from 2001 to 2006 in an effort to adjust ages 1+ biomass for retrospective bias (Figure 6). The percentage bias between the ADAPT stock biomass and the predicted (PredW) biomass from equation (3) was relatively low (1.5%) in 2001, but the bias generally increased in magnitude over time to the highest (45.5%) level in 2006, indicating that the terminal stock biomass estimate is severely overestimated by ADAPT. The most reliable time series (1982-2006) of ages 1+ biomass for further analyses was the converged portion (1982-2000) of ages 1+ biomass from ADAPT plus the predicted ages 1+ biomass estimates from 2001 to 2006 based on equation (3). This biomass time series was used in all subsequent surplus production modeling.

Stepwise regression analyses of SSB (mt) relating the converged portion of ADAPT to the tuning indices also revealed that the recreational cpue index in weight (RelWt) and the NEFSC spring index (kg/tow) were the best predictors of flounder SSB for the 1982-2000 period (Table 6), accounting for 79% of the variation in SSB (Figure 7). The partial correlation coefficient was much higher for the recreational cpue (0.67) than for the NEFSC spring indices (0.11). The predictive equation for SSB over the converged period 1982-2000 was:

$$\text{PredSSB} = 4.40 + 5.90^{*}\ \text{NEFSC} + 19.26^{*}\ \text{RelWt}. \quad (4)$$

The residuals based on the difference between observed and predicted SSB (PredSSB) were random (P <0.17) across the time series (Figure 8), indicating that the predictive model (equation 4) was unbiased. As a result, this model was used to predict flounder SSB from 2001 to 2006 in an effort to adjust SSB for retrospective bias (Figure 9). The percentage bias between the ADAPT stock biomass and the predicted (PredW) biomass from equation (4) was relatively low (-5.8%) in 2001, but the bias generally rose in magnitude over time to the highest (47.3%)

level in 2006. Based on this analysis, the most reliable time series (1982-2006) of flounder SSB for further analyses was the converged portion (1982-2000) of SSB from ADAPT plus the predicted SSB estimates from 2001 to 2006 based on equation (4) (Table 3). This SSB time series was used in all subsequent stock-recruitment analyses.

Approach to Estimate ages 1+ F and Surplus Production

In this analysis, age aggregated (ages 1+) fishing mortality (Ft) was derived annually on summer flounder from 1982 to 2006. The theoretical underpinnings of our approach is based on a simple re-arrangement of the Baranov catch equation (Ricker 1975, page 13, equation 1.17) with respect to F:

$$F = \text{Catch} / \text{Mean Stock Size}, \quad (5)$$

where: mean stock size is typically expressed as the average stock size in years t and t+1. The ages 1+ Ft estimates were based on the ratio of ages 1+ coast-wide (commercial and sport plus discards) landings (numbers) of flounder in year t (Catcht) to the corresponding ages 1+ abundance estimates (Nt, Nt+1) in year t and t+1:

$$Ft = Catcht / [(Nt + Nt+1)/2], \quad (6)$$

where: Nt and Nt+1 are the flounder ages 1+ abundance estimates from the converged portion (1982-2000) of ADAPT whereas Nt values from 2001 to 2006 represent the predictive values (equation 2). The landings and discards (Catcht, n*1000) of ages 1+ flounder (Table 2) in the numerator of equation (6) were derived earlier in the 2007 stock assessment (Terceiro 2007). Equation (6) is very similar to the equation introduced earlier by Sinclair (1998) except that he estimated relative exploitation:

$$Relu = Catch/ RelNt \quad (7)$$

instead of F. Because the 2007 abundance estimate (Nt) is not yet available, the Nt+1 value a year later in 2006 was assumed to be the same as the 2006 Nt abundance estimate. Ages 1+ F estimates via equation (6) do not consider temporal and spatial shifts in the age structure, so this approach is designed only to monitor age aggregated F values across time (1982-2006). Thus, the Ft values are uninformative about year-class and age-specific changes in F over the time series. However, since Ft estimates from equation (6) are expressed as a ratio of annual harvest to average abundance, the trend in ages 1+ F is not confounded by the assumption of constant natural mortality (M = 0.2) used explicitly to derive F estimates (F = Z – 0.2) in ADAPT and in other catch-age models.

Another time series (1982-2006) of biomass weighted F estimates for ages 1+ flounder was estimated from 1982 to 2006 as a ratio of ages 1+ landings and discards (mt) to the average ages 1+ biomass estimates in year t (Biot) and t+1 (Biot+1). As with the other analysis, Biot and Biot+1 represent the flounder ages 1+ biomass estimates from the converged portion (1982-2000) of ADAPT whereas the Biot estimates from 2001 to 2006 were derived from the predictive equation (equation 3).

A time series (1982-2006) of surplus production estimates in year t (SURPt) was also derived for flounder. As in Jacobson et al (2002), the SURPt values were expressed each year by subtracting flounder biomass in year t (BIOt) from the biomass in year t+1 (BIOt+1), and then adding the coast-wide harvest and discards (mt) (catcht):

$$SURPt = BIOt+1 - BIOt + Catcht. \quad (8)$$

Overfishing Thresholds (Fmsy, Bmsy)

Surplus production estimates have been used to monitor trends in per capita stock productivity for many exploited finfish populations (Jacobson et al 2002).). Having a time series (1982-2006) of flounder surplus production (SURPt) (Table 7) and stock biomass estimates in year t (Biot) (Table 7), updated Fmsy and Nmsy thresholds were estimated for flounder using the dynamic version of the Gompertz external surplus production model (Quinn and Deriso 1999; Jacobson et al 2002). Like stock-recruitment models, the theoretical foundation of production models assumes the existence of compensatory density-dependent mortality for finfish populations, a position widely held by most fish population ecologists (Wahle 2003). We selected the Gompertz form over the more widely used logistics equation because Yoshimoto and Clarke (1993) reported that under simulation conditions, the Gompertz model produced more realistic (positive) and stable overfishing thresholds than the logistics model. In the asymmetrical Gompertz model, surplus production estimates (SURPt) from 1982-2006 were regressed against biomass (Biot) and the product of the log flounder biomass and biomass (LogBiot*Biot) in a two variable linear regression model without a y-axis intercept:

$$SURPt = a*Biot + b * ((LogBiot)*Biot), \quad (9)$$

where: K – theoretical carrying capacity (mt) = exp (a / b);
MSY- maximum sustainable yield (mt) = (-b * K)/2.72;
Bmsy – stock size (mt) at MSY = K / 2.72;
Fmsy – instantaneous fishing mortality at MSY= MSY / Bmsy;
Fcoll – instantaneous fishing mortality at stock collapse = Fmsy *2.72.

Our ability to estimate precise Fmsy and Bmsy values in surplus production models are often plagued by the presence of outliers caused by moderate to high measurement errors. To minimize the effects of outliers, the Gompertz model (equation 9) was fitted as a linear robust regression model using the least trimmed squares regression (LTS) objective function as recommended by Rousseeuw and Van Driessen (2000). The parameter estimates (a, b) and resulting reference points (Fmsy, Bmsy, Fcoll) from the dynamic production model (equation 9) were derived from the ROBUSTREG procedure contained in the Statistical Analysis System (SAS 2002). The parameter estimates (a, b) and their standard errors based on least squares (LS) are highly prone to the presence of outliers. With robust linear regression like LTS, outlying observations are identified and automatically down-weighted, resulting in higher precision and greater overall stability of the parameter estimates (a, b) over those derived from ordinary least squares.

Before the overfishing thresholds (Fmsy, Bmsy) were estimated via equation (9), the pattern of residuals was examined for the presence of serial correlations over time. The residuals from an unbiased model should be distributed randomly over time. By contrast, a significant ($P < 0.05$) correlation between residuals and time (1982-2006) would indicate model misspecification. A serial correlation occurs when the residuals are all in one direction during say the first half of the time series then they switch abruptly in the opposite direction thereafter. This anomalous residual pattern could be due to an incorrect configuration of the production model (i. e. Logistics versus Gompertz), or perhaps, the model lacks an important explanatory variable. If the parameter estimates (a, b) of the model are statistically significant ($P <0.05$), and if the residual pattern from the model exhibited no serial correlation, the model was considered unbiased and used to estimate overfishing (Fmsy, Bmsy) thresholds.

To examine the hypothesis that flounder surplus production has recently been eroded by trophic and environmental factors, candidate predators such as striped bass, bluefish and spiny dogfish abundance (pred term) were included in the production model as an extra independent variable (Table 3). In addition, environmental variables such as annual mean water temperature and deviations in the winter North Atlantic Oscillation (NAO) index (environ term) from 1981 to 2006 (Table 3) were also added to the external production model:

$$SURPt = a*Biot + b * ((LogBiot)*Biot)+ c*(Pred\ of\ Environ), \qquad (10)$$

in a stepwise regression fashion. Since all female flounder reach sexual maturity by age 2 (Almeida et al 1992), water temperature and winter NAO values were lagged t-1 and t-2 years to coincide with flounder recruitment to the adult stock. Environmental disturbances have been proposed as a major process structuring ecological systems (Hollowed et al 2000), both by causing direct mortality and by changing the carrying capacity of the ecosystem. Bluefish, striped bass and spiny dogfish are major inshore finfish predators that have recently risen sharply in abundance along the Atlantic coast. Moreover, these finfish predators overlap the spatial and temporal distribution of flounder, and all are considered, to some extent, as potential candidate predators on flounder (Roundtree 1999). Striped bass is regarded as a voracious predator from the Mid and North Atlantic on menhaden, gizzard shad and herring (Hartman 1993). Larger (> 70 cm) striped bass, however, have been reported to switch their prey preference from herring and small menhaden to spot, flounder and weakfish in Chesapeake Bay (Hartman and Brandt 1995; Walter and Austin 2003). Bluefish (Pomatomous saltatrix) also prey upon a variety of finfishes including flounder throughout the Atlantic coast (Bowman et al 2000). Dogfish (Squalus acanthias) are found coast-wide and are regarded as a primary finfish predator of juvenile summer flounder (Rountree 1999).

Statistical evidence consistent with the predation hypothesis would be evident if the slope (c) for predation effects in equation (10) was negative and statistically significant ($P <0.05$). This would imply that enhanced predation has eroded flounder surplus production independent of fishery effects. Moreover, if the slope for predation effects is significant, the inclusion of the extra predation term in the model can greatly enhance the precision around the (a) and (b) parameters of equation (10), thus allowing more precise estimates of Fmsy and Bmsy thresholds. To test for potential joint effects of fishing (F) and trophic interactions on flounder productivity, residual plots against time were examined for the presence of serial correlations. Further statistical support for the predation hypothesis would exist, if the pronounced serial correlation

evident in the basic production model (equation 9) should disappear following the addition of predation effects to the model (equation 10).

Annual changes in coast-wide striped bass abundance (ages 7+) in numbers (Table 3) have been monitored annually from 1988 to 2006 by the ratio of ages 7+ harvest to the tag-based F derived from the catch equation approach (Versak 2007). In addition, a time series (1982-2006) of ages 8+ striped bass abundance has been derived recently from the Statistical Catch-at-Age model (Nelson 2007). Annual changes in spiny dogfish and bluefish from 1982 to 2006 were indexed here as cpue based on the coast-wide recreational catches in number (A, B1, B2) and coast-wide effort (trips) from the private boat fishery in the MRFSS surveys (Table 3). These trends in coast-wide recreational cpue of dogfish and bluefish were assumed to be informative about coast-wide changes in these stocks from 1982 to 2006. A time series (1982-2006) of average annual surface water temperatures was taken from a continuous temperature recorder in Long Island Sound located at the Millstone Nuclear Power Station, Waterford CT. Annual deviations in the winter NAO indices from 1982 to 2006 were taken from the NOAA web site.

Stock-Recruitment Effects

Over the last seven years, the stock-recruitment (S-R) relationship for flounder has been extensively examined (Terceiro 2000, 2006; Gibson 2000; Crecco 2000). Terceiro (2006) has argued that the asymptotic Beverton-Holt S-R model should be chosen over the parabolic Ricker S-R model based on theoretical grounds, despite the fact that the parabolic model was a better fit to stock-recruitment data (Gibson 2000). Terceiro (2006, 2007) has repeatedly shown that the residuals from all Beverton-Holt S-R model runs have exhibited a persistent serial correlation over time. The residuals were all high and positive from 1983 to 1987, then nearly all subsequent residuals switched to a negative direction. Since Gibson (2000) noted a similar anomalous residual pattern when flounder S-R data were fitted to the dome-shaped form of the Shepherd (1982) S-R model, this serial residual pattern is widespread and not related directly to the shape of the S-R curve. The other potential cause for the serial correlation in residuals is that the basic S-R model may lack an additional important explanatory variable such as environmental or predatory effects.

In this report, the shape and residual pattern of the flounder stock-recruitment relationship was further explored with the flexible Shepherd (1982) S-R model:

$$Rec = A * SSB / (1 + (SSB/ Kp)^{**}b), \quad (11)$$

where: A = the magnitude of compensatory reserve;

Kp = the flounder spawning stock biomass (mt) at which compensatory effects dominate;

b = the degree of compensatory density-dependent mortality;

Rec = estimated age 0 recruits from the most recent ADAPT run (Terceiro 2007) (Table 3);

SSB = estimated SSB from the converged portion (1982-2000) of ADAPT plus predicted SSB from the stepwise model from 2001-2006 (Table 3).

If the b parameter estimate in equation (11) is less than 1.0, the curve approximates a power function. If (b) is equal to 1.0, the S-R curve is consistent with the asymptotic Beverton-Holt model, whereas a (b) estimate greater than 1.0 is consistent with the parabolic Ricker type S-R curve. The entire time series (1982-2006) of flounder recruitment (Rec) based on the 2007

ADAPT run (Terceiro 2007) was fitted to equation (11) because Terceiro (2006) has shown that the degree of retrospective bias on recent recruitment estimates from ADAPT was relatively small. In order to explore the residual patterns from the Beverton-Holt and Ricker type S-R models, the S-R data were fitted to equation 11 holding the (b) parameter constant at 1.0 and 2.0, respectively. The remaining parameter estimates (A, Kp) from the S-R model (equation 11) were derived from the NLIN procedure (marquardt algorithm) contained in the Statistical Analysis System (SAS 2002).

Given the likely presence of outliers in the S-R data, the Shepherd S-R model was fitted as a nonlinear robust regression using the iterative reweighted least squares method outlined by Holland and Welsch (1978). The algorithm and rationale for this approach is described in SAS (2002). This re-weighting scheme is designed to detect outliers, thereby allowing the down weighting of S-R data from certain years in the model where model residuals, regardless of direction, exceeded a previously defined threshold level. As indicated by Holland and Welsch (1978), the choice of a threshold is subjective and always represents a trade-off between minimizing the variances around the parameters (A, Kp) and at the same time generating globally converged parameter estimates. As suggested by Holland and Welsch (1978), a range of threshold estimates was used initially and the final threshold value was selected that satisfied the trade-off between global convergence of all parameter estimates and parameter estimates with maximum precision and minimum variance. The two-step re-weighting approach always produced converged estimates (global estimates) that were within 10% of the parameter estimates (A, Kp) derived by the nonlinear least squares approach. However, the standard errors about the estimates based on iterative re-weighting were always 30 to 45% lower than the standard errors from the least squares method.

To examine for potential predatory and environmental effects on flounder recruitment and on the residuals from the S-R model, the Shepherd S-R model (equation 11) included an extra exponent (c) reflecting potential predation (pred) and environmental (environ) effects:

$$Rec = A * SSB / (1 + (SSB/ Kp)^{**}b) * \exp(c*pred, environ). \quad (12)$$

As in the surplus production analyses, candidate predators (pred) included striped bass, bluefish and spiny dogfish abundance (Table 3) were added separately to the model. Potential environmental variables (environ) included annual water temperature and deviations in the winter North Atlantic Oscillation (NAO) index. Statistical evidence consistent with the predation and environmental hypotheses would exist if the additional exponent (c) for predation and environmental effects in equation (12) was negative and statistically significant ($P < 0.05$). This would imply that biotic and abiotic factors external to the fishery have reduced recent age 0 recruitment over time. Further statistical support for the predation and environmental hypotheses would be evident, if the serial correlation in residuals evident in the basic Shepherd S-R model (equation 11) disappeared following the addition of predation or environmental effects to the S-R model (equation 12).

RESULTS

Ages 1+ Fishing Mortality (F) and Surplus Production (SURPt)

Ages 1+ fishing mortality estimates (FN) (catch weighted) were derived from 1982 to 2006 as the ratio of total annual landings (including discards) to average (t, t+1) ages 1+ abundance (Table 7). These FN estimates on ages 1+ flounder were high and variable before 1995, ranging from a low of 0.74 in 1982 to a high of 2.22 in 1988 (Figure10). After 1994, ages 1+ fishing mortality rates dropped considerably and remained relatively stable at around 0.50 thereafter.

Ages 1+ abundance in number from ADAPT was relatively high from 1982 to 1984, than flounder abundance fell quickly to the lowest level in the time series at 9.5 million fish in 1989 (Table 7, Figure 10). Ages 1+ abundance rose steadily after 1988 to a peak abundance of 33 million fish in 2000. Note that ages 1+ flounder stock sizes from 2001 to 2006 were predicted from equation 2 in order to adjust for retrospective bias from ADAPT. These predicted biomass levels fell slightly after 2000 and remained relatively stable thereafter at around 25 million fish.

Ages 1+ fishing mortality (FW) (biomass weighted) on flounder were again high and variable before 1995 (Table 7), ranging from a low of 0.74 in 1994 to a high of 1.88 in 1988 (Figure 11). Biomass weighted FW levels on ages 1+ flounder dropped steadily from 1994 through 2002 to below 0.38, but FW levels rose slightly thereafter to a peak of 0.54 in 2006.

Ages 1+flounder biomass (mt) based on ADAPT was relatively high and stable from 1982 to 1987 at around 25 thousand mt, than flounder biomass dropped quickly to below 16 thousand mt from 1988 to 1994 (Table 7, Figure 11). Thereafter stock biomass began to rise and eventually reached about 30 thousand mt by 2001. Ages 1+ stock biomass remained relatively steady at around 30 thousand mt from 2001 to 2005, but the 2006 biomass level fell by 30% to 23 thousand mt. Note that stock biomass from 2001 to 2006 was predicted by equation 3 in order to adjust for severe retrospective bias from ADAPT.

Surplus production (SURPt) estimates (mt) for flounder were derived via equation 8 from 1982-2006 (Table 7, Figure 12). Surplus production was highest during the early to mid-1980's despite the presence of high fishing mortality (F) rates (Figures 10 and 11). SURPt levels did fall steadily after 1986, presumably due to high fishing mortality, to the lowest level in the time series in 1990. SURPt levels for flounder increased by 20 to 30% after 1991 but never recovered to the pre 1987 levels despite the presence of relatively low and steady fishing mortality from 1997 to 2006 (Figures 10 and 11).

Overfishing Thresholds (Fmsy, Bmsy)

To estimate overfishing thresholds (Fmsy, Bmsy), flounder surplus production estimates from 1982 to 2006 (Figure 12) were fitted to flounder biomass via the Gompertz dynamic production model (equation 9). The Gompertz model accounted for 80% of the variation in surplus production and the parameter estimates (a, b) were determined with high precision (Table 8). However, the plot of model residuals indicated a severe ($P < 0.01$) serial correlation over time (Figure 13), indicating model misspecification. The residuals were large and positive from 1982 to 1986, then the residuals for most years shifted in the opposite direction. Even when the Logistics form of the surplus production model was used instead of Gompertz , the same serial residual pattern persisted over time, indicating that the residual problem was not due to the

configuration of the production model. Due to the clear residual problem with the basic Gompertz and Logistics models, they were not used to estimate overfishing thresholds for flounder.

Since a serial residual pattern persisted in the basic (equation 9) production model, the environmental-dependent form of the Gompertz model (equation 10) was used in the linear stepwise regression model with potential explanatory variables such as striped bass, bluefish and spiny dogfish, mean annual water temperature and winter NAO. The stepwise model selected striped bass abundance (either tag-based or SCAM estimates) as the only negative and significant ($P < 0.01$) explanatory variable (Table 9). No other variables were chosen at the $P < 0.05$ level.

When this extended production model was fitted to the robust regression procedure, all parameters (a, b, c) estimates were highly significant ($P < 0.0001$) (Table 8). This production model with striped bass effects explained 83% of the variation in flounder surplus production from 1982-2006. Moreover, the serial residual pattern present in the basic production model virtually disappeared (Figure 14) ($P < 0.49$) when striped bass abundance was added as a second variable to the production model. These findings are consistent with the Predation Hypothesis, indicating that flounder productivity has recently been eroded by enhanced striped bass predation.

This extended production model with striped bass predatory effects was then used to estimate flounder overfishing thresholds (Fmsy, Bmsy). The resulting overfishing threshold (Fmsy) for flounder was 0.64 (80% C.I.: 0.51 to 0.77) and the biomass threshold was 32,500 mt (80% C. I: 25,900-39,200 mt) (Table 8). All of the ages 1+ fishing mortality (FW) rates (biomass weighted) on flounder from 1982 to 1994 exceeded the Fmsy threshold of 0.64 (Figure 16), indicating that overfishing had occurred on flounder from 1982 to 1994. However, all subsequent FW estimates were below the Fmsy threshold, suggesting that overfishing was corrected by additional management measures imposed during the early to mid 1990's. By contrast, although ages 1+ biomass (mt) has risen steadily since 1989 (Figure 15), except for the 2001 ages 1+ stock biomass of 33,900 mt, all other ages 1+ biomass estimates have remained below the estimated Bmsy threshold of 32, 500 mt (Figure 16). Recent (2002-2005) biomass levels have approached the Bmsy threshold, but the 2006 biomass level of 22,900 mt represented a 30% drop and is well below the Bmsy threshold of 32,500 mt. Since fishing mortality rates (FW) have stabilized below the Fmsy threshold since 1995, the recent lack of stock biomass growth is likely due largely to enhanced striped bass predation and not overfishing.

Stock –Recruitment Effects

The Beverton-Holt version ($b = 1.0$) of the Shepherd S-R (equation 11) model was fitted to age 0 recruitment and spawning stock biomass (mt) estimates (Table 3) from 1982-2006 using iterative reweighted least squares regression. The S-R model converged but the parameter estimates (A, Kp) did not differ significantly ($P < 0.05$) from zero (Table 10, Figure 17). Moreover, the residual plot over time indicated the presence of significant ($P < 0.0005$) serial correlation in the residuals (Figure 18). The residuals were large and positive from 1982 to 1987 then the residuals became smaller and mostly negative (Figure 17), indicating model misspecification.

When the Ricker version ($b = 2.0$) of the S-R model was fitted to the S-R data (Table 3), the model converged and the parameter estimates (A, Kp) were highly significant ($P < 0.0001$)

(Table 10, Figure 19). However, the residual pattern from the Ricker Model (Figure 20) looked almost exactly like the atypical residual pattern from the Beverton-Holt S-R model. When bluefish and dogfish abundance, as well as lagged (t-1, t-2) mean annual temperature and lagged winter NAO were added separately to the extended Ricker model (equation 12), the resulting exponent (c) for each of these variables did not differ significantly ($P < 0.05$) from zero. However, when striped bass abundance was added as a second explanatory variable, the model explained 91% of the recruitment variation, all three parameter estimates (A, Kp, c) were highly significant ($P < 0.0001$) (Table 10, Figure 21) and, most importantly, the anomalous residual pattern seen in the basic Beverton-Holt and Ricker S-R models virtually disappeared (Figure 22). These finding are consistent with the Predation Hypothesis, indicating that the transmission of age 0 recruits to the adult stock has been recently impeded due to enhanced striped bass predation.

Management Implications and Scientific Advice

My results indicate that density-dependent processes play a much greater role in stabilizing flounder abundance than is assumed in the current stock assessment (Terceiro 2006). The main conclusion from the last stock assessment (Terceiro 2006) is that flounder have been overfished since at least 1982 despite the implementation of catch quotas on commercial fisheries beginning in 1990 and a steady decline in fishing mortality (F) since 1995. The current assessment results show that flounder stock biomass has not yet reached the biomass threshold of 44,760 mt because F has remained too high. The important conclusion from the last assessment that summer flounder have remained overfished for at least 25 years largely depends on the degree of compensatory density-dependent mortality inherent to the flounder stock. It is widely recognized that the magnitude of Fmsy and the level of resilience to exploitation depends on the degree of density-dependent compensation (Quinn and Deriso 1999). The current assessment has assumed that little if any compensation occurs for flounder and therefore used an Fmax of 0.28 from the YPR model as a proxy for Fmsy. In this report, Fmsy was estimated directly to be 0.64 based on the extended Gompterz model that assumes moderate to high density-dependent compensation. My findings indicate that the flounder were overfished before 1995 when ages 1+ F estimates exceeded my Fmsy, but that extensive management measures imposed during the early to mid 1990's enabled F to drop below the overfishing threshold. The very strong fit of both the production and dome-shaped Ricker models suggests that moderate to strong density-dependent mortality is evident in the summer flounder stock, allowing the flounder stock to absorb the effects of relatively high ($F < 0.64$) fishing mortality. My findings of moderate to high density-dependent compensation for summer flounder is consistent with their suite of life history traits that include early female maturation (age 2) (Almeida et al 1992), relatively rapid somatic growth and a relatively short lifespan (12 years) (Dery 1988). My Fmsy threshold of 0.64 is well within the range of Fmsy levels reported from four earlier studies (Chang and Pacheco 1976; Gibson 2000; Crecco 2000; Armstrong 2000). They reported Fmsy thresholds (Fmsy: 0.45-0.82) for summer flounder that always exceeded the Fmax level of 0.28 used in the current assessment, and were clearly closer to my Fmsy estimate of 0.64 based on the Gompertz production model. These earlier findings are consistent with my results, suggesting that summer flounder are under at least partial density-dependent control and are thus more resilient to fishing pressure than previously thought.

The possibility for further rebuilding of summer flounder biomass beyond the Bmsy level of 32,500 mt over the next five years is more uncertain due to the recent rise in predatory mortality. My findings indicate that the rapid build-up in stock biomass inferred from 2001 to 2006 based on ADAPT is overstated due to persistent retrospective bias. When the recent (2001-2006) abundance estimates from ADAPT were adjusted downward by 20 to 50% to account for retrospective bias, the rate of stock rebuilding after 2000 was minimal. My results suggest that enhanced predation by striped bass on young flounder provides the most plausible explanation for the recent stagnation of flounder population growth and age 0 recruitment to the adult stock. Moreover, the inclusion of striped bass effects in both the extended Ricker S-R and Gompertz models was the only variable examined thus far that removed the recurring residual problem that constantly plagued the Beverton-Holt S-R model in previous assessments (Terceiro 2006). The fact that the exponent for striped bass predation was negative and highly significant ($P < 0.0001$) in both the extended Ricker S- R and Gompertz surplus production models is not surprising, given that annual changes in age 0 recruitment largely govern the net changes in fish surplus production (Walters and Martell 2004).

It is widely recognized that statistical evidence (regression and production models) alone does not demonstrate causality, but recent empirical evidence is wholly consistent with the Predation Hypothesis involving striped bass. Due to the success of striped bass management, striped bass abundance has risen steadily to record levels in mid and north Atlantic coastal waters from 1993 to 2006 (Crecco 1994; Nelson 2007). The results of coast-wide tagging of striped bass since 1987 indicate that abundance of ages 7+ stripers has risen nearly four-fold coast-wide from 1998 to 2006 (Versak 2007). Moreover, coast-wide tag returns from Maine to North Carolina indicate that striped bass are found mostly in state waters (Versak 2007) that clearly overlap the temporal and spatial distribution of summer flounder. Since striped bass are known to consume finfish prey up to 60% of their own body length (Manooch 1973), it is reasonable to hypothesize that striped bass abundance has reached such high abundance that flounder population growth would be severely impeded by enhanced striped bass predation. Larger (> 70 cm) striped bass have been reported to switch their prey preference from herring and small menhaden to spot, flounder and weakfish in Chesapeake Bay (Hartman and Brandt 1995; Walter and Austin 2003). Striped bass grow rapidly to a large size (>90 cm) that can easily prey on smaller adult flounder, are highly piscivorous (Hartman 1993), and are efficient diurnal and nocturnal predators along inshore waters (Nelson et al 2006). Recent studies on river herring and American shad in the Connecticut River (Savoy and Crecco 2004), as well as the coast-wide weakfish stock assessment (Kahn et al 2005; Uphoff 2005) concluded that enhanced striped bass predation was the most reasonable hypothesis to explain the unexpected declines of these finfishes under low exploitation. Nelson et al (2006) reported that the average consumption level (mt) of Altantic menhaden by striped bass along the Massachusetts coast from 1997 to 2000 was 12 times greater than the total menhaden commercial landings (mt) from Massachusetts. Finally, Bax (1998), in a comprehensive review of finfish predatory effects, noted that finfish predation accounts for between 2 and 35 times the finfish losses (mt) reported annually to commercial fisheries throughout the world.

The management implications and long-term prognosis for flounder in the presence of enhanced striped bass predation are challenging and somewhat ambiguous. In the current assessment (Terceiro 2006), natural mortality (M) in both the ADAPT and YPR models was assumed constant at 0.20 for all ages and years. It is widely recognized from recent multispecies models (Hollowed et al 2000; Walters et al 2005) that the scientific foundation supporting the

constant M assumption in single species assessments is highly questionable, particularly for younger fish. Moreover, unless long-term tagging studies are conducted, there is no other way to scientifically verify the assumption of a fixed M estimate. Despite the lack of scientific foundation around the fixed M assumption, the constant M approach is used in nearly all single species assessments conducted along the Atlantic coast. The wide acceptance of constant M occurs because time varying M is often difficult to estimate with confidence, and because a constant M assumption greatly reduces the number of parameters to be estimated in age structured VPA models. The constant M assumption implies that no systematic shifts in finfish mortality and productivity associated with predation, inter-specific competition and environmental effects are possible. Thus, the constant M assumption greatly limits our ability to explore for enhanced predation effects that may result in a systematic rise in M particularly among younger and smaller prey, as well as temporal shifts in environmental factors that can adversely affect recruitment, somatic growth and maturation. Since the choice of a fixed M value can greatly affect the magnitude of the Fmax reference point, more detailed analyses are therefore required to determine whether or not M has change systematically over time due to enhanced predation and shifts in environmental variables. In future flounder stock assessments, the assumption that trophic and environmental effects are constant over time should be critically examined. The potential impacts of trophic and environmental effects on summer flounder should also be integrated into fisheries models and rigorously tested as a potential alternative hypothesis to the Overfishing Hypothesis.

The highly significant exponent (c) for striped bass predation from the extended Ricker S-R and Gompertz models is consistent with the presence of enhanced density-independent mortality although, under certain conditions, enhanced finfish predation can give rise to compensatory or even depensatory density-dependent mortality (Tsou and Collie 2001). In any event, increased predation should result in a systematic rise in M, particularly for smaller flounder. This phenomenon plus the apparent emergence of a flounder recruitment bottleneck between ages 0 and 1 makes stock rebuilding of flounder via further management measures an exceedingly difficult task. As indicated by Spencer and Collie (1997), fish stocks that are subject to moderate to severe predatory mortality, often undergo a sudden and persistent drop or prolonged stagnation in recruitment and surplus production over time even when fishing mortality rates have remained low for several years. Note that biomass weighted fishing mortality (FW) on ages 1+ flounder reported here have been below my estimated Fmsy threshold of 0.64 since 1995. If density-independent predation remains high, flounder recruitment and biomass may remain unresponsive to favorable climatic events and to further fishery management restrictions. The phenomenon of enhanced predation mortality could lead to a persistent stagnation in future flounder rebuilding unless predation pressure reverts back to pre 1998 levels.

There is a prevailing consensus that overfishing has had an adverse effect on many fish stocks throughout the world (Myers et al 1997; Hutchings and Reynolds 2004; Scheffer et al. 2001). However, the catch-at-age models traditionally used to estimate fishing mortality over time have almost always assumed a low and constant (M = 0.20) natural mortality rate. Under the assumption of low and constant M, a rise in total mortality (Z) over time is always construed as a rise in fishing mortality (F). Thus in nearly all single species assessments, projection models always predict rapid stock rebuilding following sizeable reductions in F. But if the wide-spread assumption of constant M is violated and M actually rises systematically over time due to enhanced predatory mortality, the results from projection models of rapid stock rebuilding would

be highly misleading. Clearly there are finfish stocks throughout the world where natural mortality (M) approximates 0.20 for some period of time or can otherwise vary without trend. But as shown here for flounder and elsewhere for American shad (Savoy and Crecco 2004) and weakfish (Kahn et al 2005; Uphoff 2005), a systematic rise in predatory mortality on age 0 flounder coupled with relatively low and stable fishing mortality (F) can either greatly extend the timetable for rebuilding, or can simply eliminate the likelihood of any stock rebuilding even after the imposition of stringent conservation measures. A similar case study linking a rise in natural mortality to the lack of stock rebuilding has been recently addressed for Northern cod stocks (Shelton et al 2006). Several cod stocks on the Grand Banks have been under a landings moratorium since 1996, but stock rebuilding of these depleted stocks has, as of 2006, not been realized. Shelton et al (2006) reported that the lack of stock rebuilding of eight cod stocks was attributed to a recent rise in natural mortality from 0.2 prior to 1990 to 0.4 to 0.8 due mainly to enhanced gray seal (Halichoerus grypus) predation. In the case of summer flounder, the probability of successful stock rebuilding via management intervention is reduced further by the emergence of a recruitment bottleneck at age 0 as indicated by results from the extended Ricker S-R model. Due to recent increases in the minimum size on flounder, age 0 flounder are now only slightly susceptible to direct harvest, so a coast-wide moratorium would have little if any impact on the recently emergent recruitment bottleneck.

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Table 1 Flounder Ages 1+ mean stock size (NAV, millions) from ADAPT and predicted stock size (PREDNAV), ten trawl surveys and the recreational cpue in numbers (RelNt) from 1982-2006. Trawl survey indices include the federal spring (NMFSS), federal fall (NMFSF), federal winter (NMFSW), Massachusetts spring (MA), Connecticut Long Island Sound spring (CTS) and fall (CTF), Rhode Island fall (RIF) and fixed station (RIFIX), New Jersey (NJ) and Delaware (DE).

YEAR	nav	prednav	NMFSS	NMFSF	NMFSW	MA	CTS	CTF	RIF	RIFIX	NJ	DE	RelNt
1982	41.70	25.86	2.27	1.95		2.03			0.81				0.78
1983	42.20	37.20	0.95	1.94		2.12			0.68				1.21
1984	43.40	41.16	0.66	1.91		0.30	0.63	1.00	1.24				1.36
1985	31.80	22.95	2.38	1.33		1.41	0.44	1.19	0.61				0.67
1986	26.80	31.40	2.14	1.05		1.64	0.95	1.72	2.89				0.99
1987	33.90	28.76	0.93	0.83		1.22	1.06	1.40	1.22				0.89
1988	24.70	22.95	1.50	0.83		1.24	0.50	1.42	0.56		4.09		0.67
1989	9.50	8.45	0.32	0.26		0.43	0.10	0.14	0.07		0.69		0.12
1990	14.00	16.62	0.72	0.45		0.36	0.35	0.87	0.78	0.27	1.58	1.40	0.43
1991	18.30	22.69	1.08	0.94		0.09	0.64	1.26	0.23	0.15	2.98	1.35	0.66
1992	13.20	20.84	1.20	1.33	12.29	0.70	0.56	1.02	1.30	0.34	3.65	0.36	0.59
1993	21.20	31.13	1.27	0.84	13.60	0.68	0.51	1.11	0.72	0.25	5.91	2.36	0.98
1994	22.90	24.01	0.93	0.78	12.05	3.02	0.86	0.55	0.18	0.13	1.17	0.44	0.71
1995	24.00	23.22	1.09	1.47	10.93	1.38	0.28	0.54	0.73	0.05	3.42	1.47	0.68
1996	30.30	27.18	1.76	1.85	31.25	0.84	0.96	2.19	2.24	0.94	8.03	1.33	0.83
1997	28.70	25.33	1.06	2.76	10.28	2.01	1.00	2.50	1.80	0.69	14.70	1.24	0.76
1998	28.30	30.60	1.19	4.14	7.76	2.00	1.31	1.72	0.54	0.43	8.80	1.55	0.96
1999	32.50	32.19	1.60	3.58	11.06	2.26	1.44	2.68	3.10	0.87	10.41	1.49	1.02
2000	33.20	27.18	2.14	3.10	15.76	3.49	1.79	1.91	2.55	2.52	6.40	1.05	0.83
2001	38.40	29.29	2.69	2.88	18.59	2.09	1.75	4.42	2.14	0.97	5.06	2.30	0.91
2002	44.80	21.64	2.47	2.57	22.68	2.12	3.19	6.12	4.70	1.92	15.33	0.32	0.62
2003	51.00	23.48	2.91	2.80	35.62	2.41	3.42	3.39	5.47	3.73	9.24	0.58	0.69
2004	49.70	24.01	3.03	3.88	17.77	0.78	1.84	1.95	2.86	2.07	9.76	0.14	0.71
2005	55.30	27.70	1.81	2.59	12.89	2.02	0.80	2.41	3.29	2.46	8.08	0.43	0.85
2006	46.90	23.22	1.77	2.25	21.04	2.00	0.86	2.19	3.00			0.40	0.68

Table 2. Flounder ages 1+ stock biomass (BAV, mt*1000) from ADAPT and predicted biomass (PREDBAV), five trawl surveys and the recreational cpue in kg/effort (RelWt) from 1982-2006 trawl survey indices include the federal spring (NMFSSK), federal fall (NMFSFK), federal winter (NMFSWK) and spring and fall CT (CTSK, CTFK),

YEAR	bav	predbav	nmfssk	nmfsfk	nmfswk	ctsk	ctfk	RelWt
1982	21.20	19.25	1.11	0.90				0.41
1983	25.00	21.93	0.53	0.47				0.65
1984	25.30	25.58	0.38	0.65				0.84
1985	20.80	19.47	1.20	0.87				0.40
1986	19.70	20.13	0.82	0.45				0.51
1987	20.60	21.65	0.38	0.28				0.67
1988	16.30	18.98	0.68	0.11				0.49
1989	7.67	7.10	0.24	0.08				0.07
1990	9.40	10.72	0.27	0.19				0.22
1991	10.00	11.11	0.35	0.17				0.22
1992	10.40	13.04	0.46	0.49	4.90	0.35	0.87	0.28
1993	12.40	14.99	0.48	0.04	5.50	0.27	0.85	0.36
1994	14.90	15.35	0.46	0.35	6.03	0.48	0.47	0.38
1995	18.20	15.58	0.46	0.83	4.81	0.16	0.43	0.39
1996	21.30	17.31	0.67	0.45	12.35	0.53	1.61	0.42
1997	21.00	18.63	0.61	0.92	5.54	0.60	1.84	0.49
1998	23.30	22.61	0.76	1.58	5.13	1.15	1.77	0.63
1999	22.50	24.77	1.01	1.66	7.99	1.09	2.27	0.67
2000	27.80	29.56	1.70	1.82	12.59	1.35	1.77	0.73
2001	33.40	33.91	2.16	1.55	15.68	1.21	3.19	0.82
2002	36.30	29.93	2.29	1.40	18.43	2.38	4.41	0.62
2003	44.80	30.58	2.42	1.93	27.48	2.45	3.27	0.62
2004	44.70	31.32	2.43	3.06	15.25	1.69	1.74	0.65
2005	45.70	32.48	1.59	1.83	10.32	0.67	1.93	0.88
2006	42.00	22.93	1.34		15.93	0.61	1.35	0.52

Table 3.Flounder recruitment (REC) from ADAPT, spawning stock biomass (SSB2, mt) and various environmental predators, note that SSB2 from 1982-2000 from ADAPT and 2001-2006 from predicted model. Ages 7+ striped bass (STRIP) abundance from tagging (STRIP) and ages 8+ striper abundance from VPA.

YRC	REC	SSB2	temp	nao	blue	STRIP	stripvpa	DGFISH
1982	74300	22600.0	11.10	2.00	0.68		463	1.31
1983	80300	24400.0	12.00	0.74	0.69		333	3.33
1984	48400	21900.0	12.00	-0.38	0.48		245	0.92
1985	48600	19900.0	12.00	-0.03	0.52		232	0.35
1986	53400	18400.0	11.90	0.34	0.68		337	10.59
1987	43900	19100.0	11.80	0.10	0.78		412	5.58
1988	13000	10900.0	11.10	2.86	0.43	1770	495	5.74
1989	27300	7000.0	11.30	2.37	0.46	2830	628	10.19
1990	30400	9900.0	12.10	0.21	0.55	1996	1375	6.78
1991	28700	8700.0	12.60	1.68	0.38	1526	1918	14.21
1992	32300	9900.0	11.50	1.43	0.40	1715	2329	11.06
1993	33200	12300.0	11.70	1.80	0.27	2177	2621	8.94
1994	35300	15100.0	11.60	2.44	0.28	3728	3052	10.22
1995	38700	19000.0	12.50	-2.32	0.28	3308	3496	5.91
1996	28200	20000.0	10.60	0.18	0.26	4869	3865	3.40
1997	28900	20300.0	10.90	0.80	0.30	4397	4498	6.68
1998	31000	22000.0	12.10	0.98	0.24	3739	4372	6.72
1999	29200	22300.0	12.90	1.85	0.26	3921	4421	6.61
2000	33200	25400.0	12.20	-0.50	0.33	7454	4982	2.49
2001	33400	32945.4	12.50	0.79	0.38	9339	6934	18.14
2002	36600	29858.4	12.70	0.40	0.35	11371	7133	16.34
2003	27900	30625.4	11.50	-0.20	0.38	12168	7669	20.80
2004	38000	31262.5	11.70	-0.11	0.48	14727	8028	27.28
2005	17000	30738.6	11.80	-0.82	0.42	11865	6927	26.07
2006	30300	22326.4	13.00	1.83	0.39	12852	5915	33.76

Table 4. Pearson Correlation (r) Analyses between relative abundance (catch/tow) of each of the 11 candidate tuning indices and ages 1+ flounder abundance over the converged portion from ADAPT. This analysis was conducted on ages 1+ abundance over three converged time periods (1982-1998, 1982-1999, 1982-2000). An asterisk (*) indicates a statistically significant ($P < 0.05$) correlation between the ages 1+ tuning index and ages 1+ abundance.

Index	**Time Periods (Years)**					
	82-98		**82-99**		**82-00**	
	r	P	r	P	r	P
NMFSS	0.34	0.18	0.35	0.15	0.38	0.11
NMFSF	0.48	0.05*	0.48	0.04*	0.50	0.03*
NMFSW	0.31	0.49	0.20	0.63	0.23	0.56
MA	0.39	0.13	0.41	0.09	0.42	0.08
CTS	0.51	0.05*	0.54	0.03*	0.56	0.02*
CTF	0.46	0.09	0.50	0.05*	0.52	0.03*
RIF	0.24	0.35	0.27	0.27	0.31	0.20
RIFIX	0.58	0.10	0.68	0.03*	0.65	0.03*
NJ	0.72	0.01*	0.76	0.004*	0.72	0.005*
DE	0.25	0.52	0.28	0.44	0.19	0.58
RelNt	0.79	0.0001*	0.79	0.0001	0.79	0.0001*

Table 5. Pearson Correlation (r) Analyses between relative abundance (kg/effort) of each of the 6 candidate tuning indices and ages 1+ flounder biomass (mt) and SSB over the converged portion from ADAPT. This analysis was conducted on ages 1+ biomass and SSB over three converged time periods (1982-1998, 1982-1999, 1982-2000). An asterisk (*) indicates a statistically significant ($P < 0.05$) correlation between the ages 1+ tuning index and ages 1+ biomass and SSB.

Index	**Time Periods (Years)**							
	82-00		**82-98**		**82-99**		**82-00**	
	SSB		**Biomass**					
	R	**P**	**r**	**P**	**r**	**P**	**r**	**P**
NMFSSk	0.66	0.002*	0.51	0.04*	0.54	0.02	0.63	0.004*
NMFSFk	0.66	0.002*	0.63	0.007*	0.62	0.006*	0.69	0.001*
NMFSWk	0.57	0.11	0.34	0.45	0.40	0.33	0.62	0.07
CTSk	0.85	0.004*	0.66	0.10	0.72	0.04*	0.82	0.007*
CTFk	0.82	0.007*	0.70	0.08	0.75	0.03*	0.73	0.02*
RelWt	0.82	0.0001*	0.88	0.0001*	0.88	0.0001*	0.89	0.0001*

Table 6. STEPWISE REGRESSION MODEL relating the 11 tuning indices to ages 1+ numbers, ages 1+ biomass and SSB for the three converged time periods (1982-1998, 1982-1999, 1982-2000). Flounder ages 1+ abundance, biomass and SSB from ADAPT were used as dependent variables. Independent variables selected by the stepwise model at the P < 0.05 level were the recreational cpue in number (RelNt) and weight (RelWt) and the NEFSC spring index in kg/tow (NMFSSk). The parameter estimates (Est) and their standard error (SE) are give as well as the coefficient of determination (r**2).

Parameter	**Time Periods (Years)**							
	82-00		**82-00**		**82-99**		**82-98**	
	SSB		**Ages +Biomass**					
	Est	**SE**	**Est**	**SE**	**Est**	**SE**	**Est**	**SE**
Intercept	4.40	1.76	4.30	1.40	3.46	1.58	2.68	1.57
NMFSSk	5.90	1.93	4.94	1.54	6.32	1.96	7.28	1.96
RelWt	19.26	3.63	23.10	2.89	23.32	2.87	24.25	2.79
r**2	0.79		0.88		0.88		0.88	
			Ages 1+ numbers					
Intercept			5.28	3.80	5.15	4.46	5.08	4.63
RelNt			26.28	4.66	27.58	5.30	27.72	5.58
r**2			0.68		0.63		0.62	

Table 7. Combination of estimated and predicted ages 1+ abundance, coast-wide landings (#), catch weighted F ages 1+ biomass, landings biomass and biomass weighted F and surplus production, 1982-2006.

YEAR	nav2	nav2l	catchn	FN2	bav2	bav2l	catchw	Fw2	surpbb
1982	41741.99	42186.33	31100	0.7411	21200.0	25000.0	18960	0.8208	22760.0
1983	42186.33	43434.67	42600	0.9951	25000.0	25300.0	26500	1.0537	26800.0
1984	43434.67	31760.21	46200	1.2288	25300.0	20800.0	26100	1.1323	21600.0
1985	31760.21	26774.55	35300	1.2061	20800.0	19700.0	20400	1.0074	19300.0
1986	26774.55	33900.41	32500	1.0713	19700.0	20600.0	20900	1.0372	21800.0
1987	33900.41	24732.20	30200	1.0301	20600.0	16300.0	18300	0.9919	14000.0
1988	24732.20	9517.85	38000	2.2190	16300.0	7600.0	21800	1.8243	13100.0
1989	9517.85	14033.94	14300	1.2144	7600.0	9400.0	10300	1.2118	12100.0
1990	14033.94	18316.34	12200	0.7542	9400.0	10000.0	8000	0.8247	8600.0
1991	18316.34	13185.28	20100	1.2761	10000.0	10400.0	11300	1.1078	11700.0
1992	13185.28	21166.18	18600	1.0829	10400.0	12400.0	11800	1.0351	13800.0
1993	21166.18	22903.52	17600	0.7987	12400.0	14900.0	10800	0.7912	13300.0
1994	22903.52	23991.90	18700	0.7975	14900.0	18200.0	12200	0.7372	15500.0
1995	23991.90	30334.12	14800	0.5449	18200.0	21300.0	10500	0.5317	13600.0
1996	30334.12	28649.71	18500	0.6273	21300.0	21000.0	11600	0.5485	11300.0
1997	28649.71	28259.64	14500	0.5096	21000.0	23300.0	10300	0.4650	12600.0
1998	28259.64	32531.04	15000	0.4935	23300.0	22500.0	11600	0.5066	10800.0
1999	32531.04	33174.50	14100	0.4292	22500.0	27800.0	10900	0.4334	16200.0
2000	33174.50	29285.80	15700	0.5027	27800.0	33912.4	13800	0.4472	19912.4
2001	29285.80	21635.60	13200	0.5185	33912.4	29934.6	11900	0.3728	7922.2
2002	21635.60	23482.20	12200	0.5408	29934.6	30576.8	11300	0.3735	11942.2
2003	23482.20	24009.80	13000	0.5475	30576.8	31319.2	12900	0.4168	13642.4
2004	24009.80	27703.00	14300	0.5531	31319.2	32482.6	13800	0.4326	14963.4
2005	27703.00	23218.40	13900	0.5459	32482.6	22931.6	13400	0.4836	3849.0
2006	23218.40	23218.00	12635	0.5442	22931.6	22932.0	12300	0.5364	12300.4

Table 8. Parameter estimates (a, b, c) for summer flounder derived from the Gompertz external production model with and without striped bass predation. The overfishing thresholds (F_{msy}, B_{msy}) were derived from the Gompertz model with striped bass effects. The models were fitted to the LTS Robust regression model. The standard error (SE) is given for each parameter estimate (a, b, Strip), as well as the coefficient of determination (r^2). Overfishing thresholds (F_{msy}, B_{msy}) are presented with 80% CI.

LTS Robust Regression Model Without Striped Bass

Parameter	Mean	SE	P
a	8.05	1.08	< 0.0001
b	-0.74	0.11	< 0.0001
r^2	0.80		

LTS Robust Regression With Striped Bass Effects

Parameter	Mean	SE	P
a	7.29	1.01	< 0.0001
b	-0.64	0.10	< 0.0001
c**	-1.36	0.34	<0.0001
r^2	0.83		

Threshold	Mean	80% Confidence Limit
F_{msy}	0.64	0.51 – 0.77
Fcoll	1.74	1.39 – 2.09
Bmsy	32,500 mt	29,900 – 39,200 mt

** c is the slope estimate for striped bass effects

TABLE 9. Stepwise model relating the abundance of three candidate predators (bluefish, striped bass and spiny dogfish) and two environmental variables (t and t-1 lagged mean annual water temperature and deviations in the winter NAO) to surplus production from the Gompertz Production model. The stepwise model selected striped bass abundance (SCAM based) as the only significant (P <0.02) explanatory variable. The standard error (SE) is given for each parameter estimate (a, b, c), as well as the coefficient of determination (r^2).

Least Squares Fit

Parameter	**Mean**	**SE**	**P**
a	7.84	1.20	< 0.0001
b	-0.70	0.12	< 0.0001
c**	-1.04	0.42	< 0.02
r^2	0.85		

** c is the slope estimate for striped bass effects

Table 10. Shepherd S-R Parameter estimates (A, Kp, c) for summer flounder with and without striped bass predation. The S-R models were fitted by nonlinear iterative re-weighted least squares regression. The shape parameter (b) was fixed at 1.0 for the Beverton-Holt model and at 2.0 for the dome-shaped Ricker model. The approximate standard error (SE) is given for each parameter estimate (a, Kp, Strip), as well as the coefficient of determination (r^2).

	Beverton-Holt			**Ricker**		
Parameter	**Mean**	**SE**	**P**	**Mean**	**SE**	**P**
A	23.65	15.45	<0.34	4.16	0.51	<0.0001
Kp	1488.3	1056.5	< 0.47	17532.0	1903.3	< 0.0001
r^2	0.85			0.81		

Ricker S-R With Striped Bass Effects

Parameter	**Mean**	**SE**	**P**
a	4.46	0.31	< 0.0001
Kp	22171.6	1948.5	< 0.0001
c **	-0.000092	0.000012	<0.0001
r^2	0.91		

** c is the exponent for striped bass effects

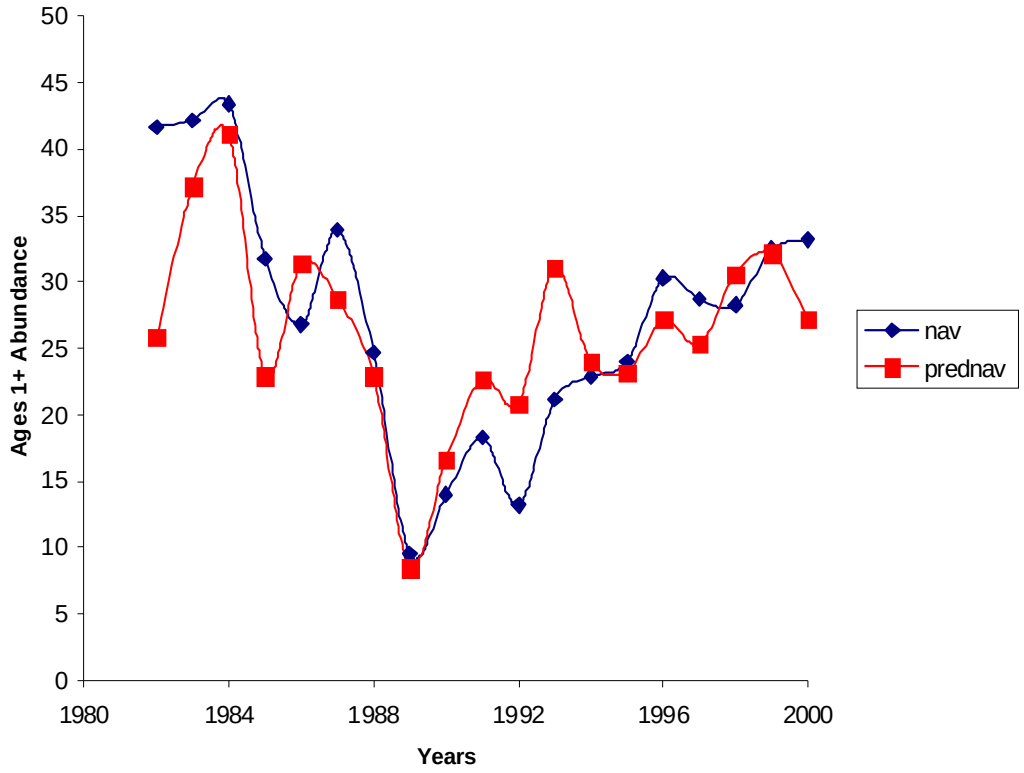

Figure 1. Plot of estimated and predicted ages 1+ flounder numbers over the converged portion (1982-2000) of ADAPT.

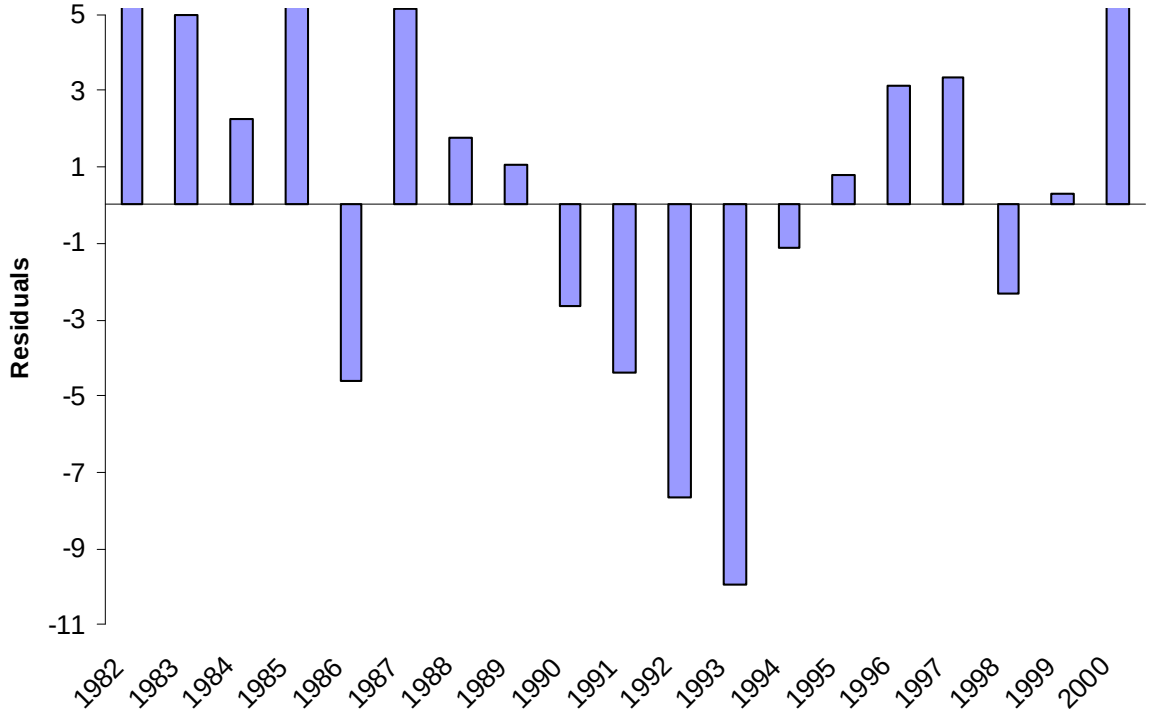

Figure 2. Residual plot for estimated and predicted ages 1+ numbers over time 1982-2000.

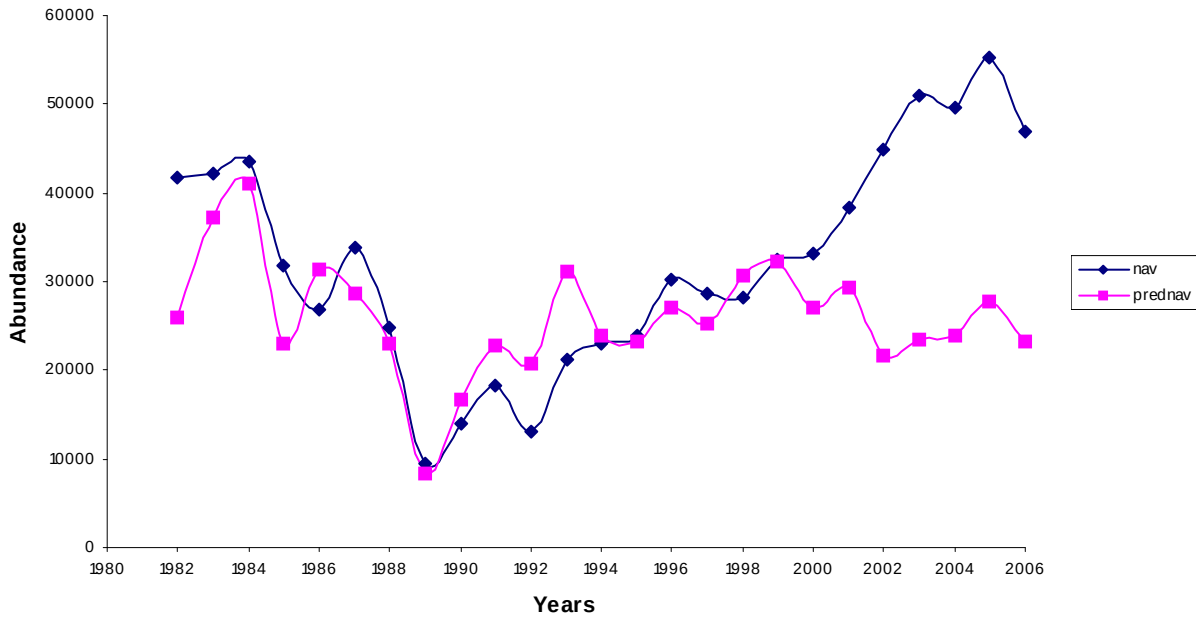

Figure 3. Estimated and predicted ages 1+ flounder abundance, 1982-2006.

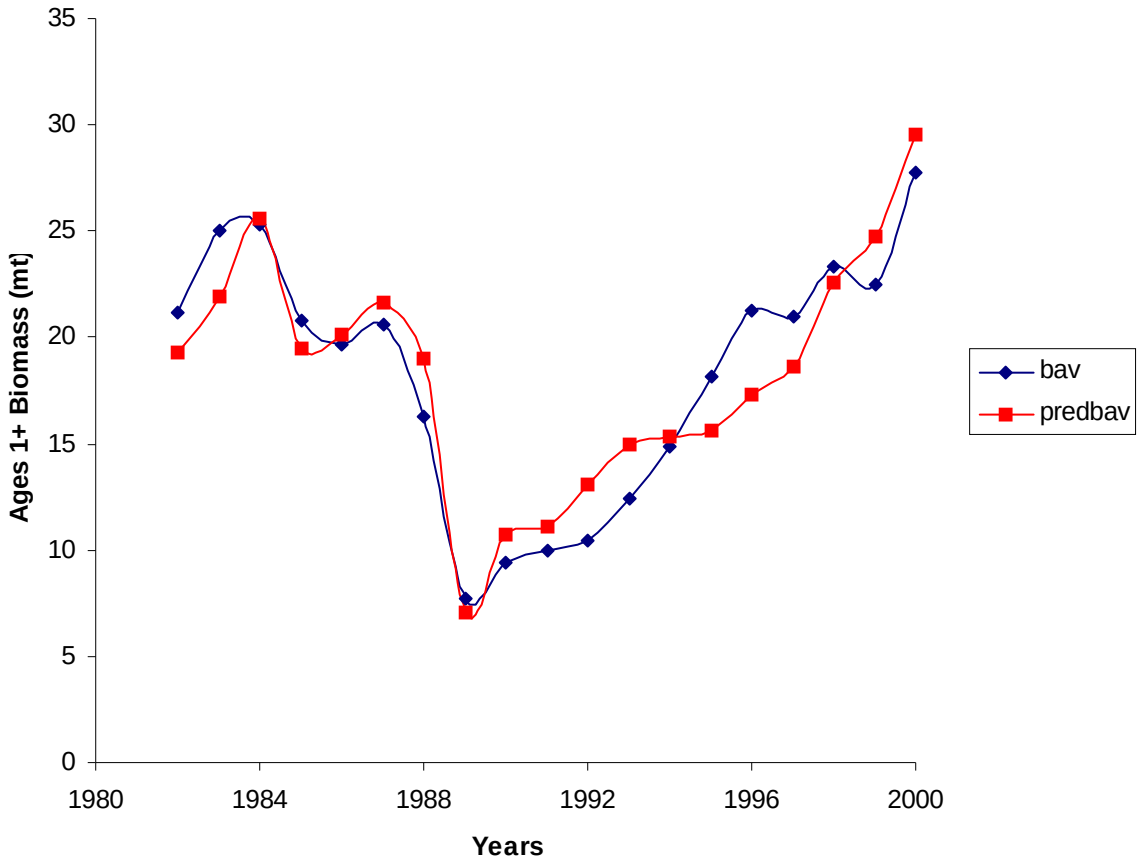

Figure 4. Plot of Estimate and predicted ages 1+ flounder biomass over the converged portion (1982-2000) of ADAPT.

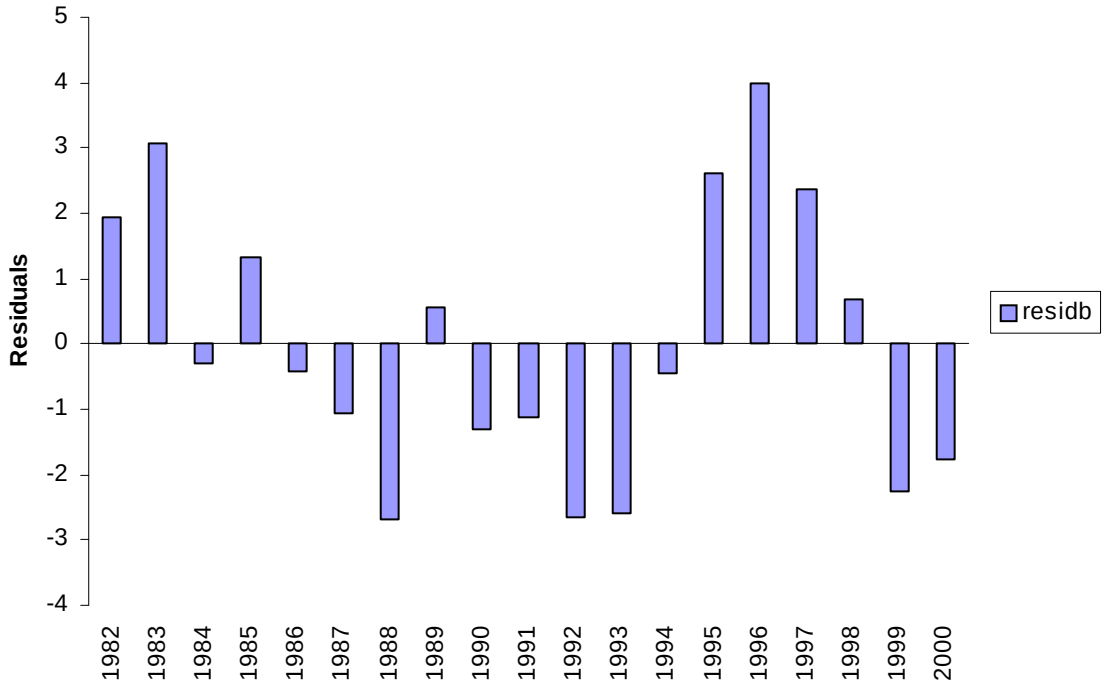

Figure 5. Residual plot for estimated and predicted ages 1+ biomass over time 1982-2000.

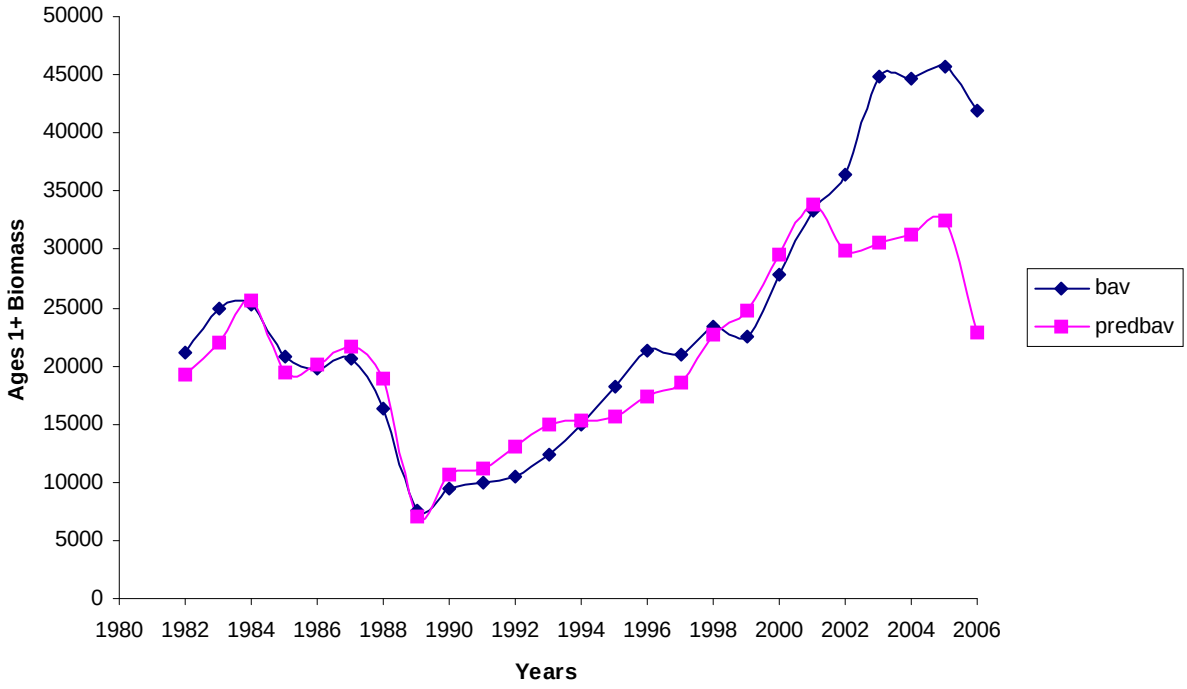

Figure 6. Estimated and predicted ages 1+ flounder biomass, 1982-2006.

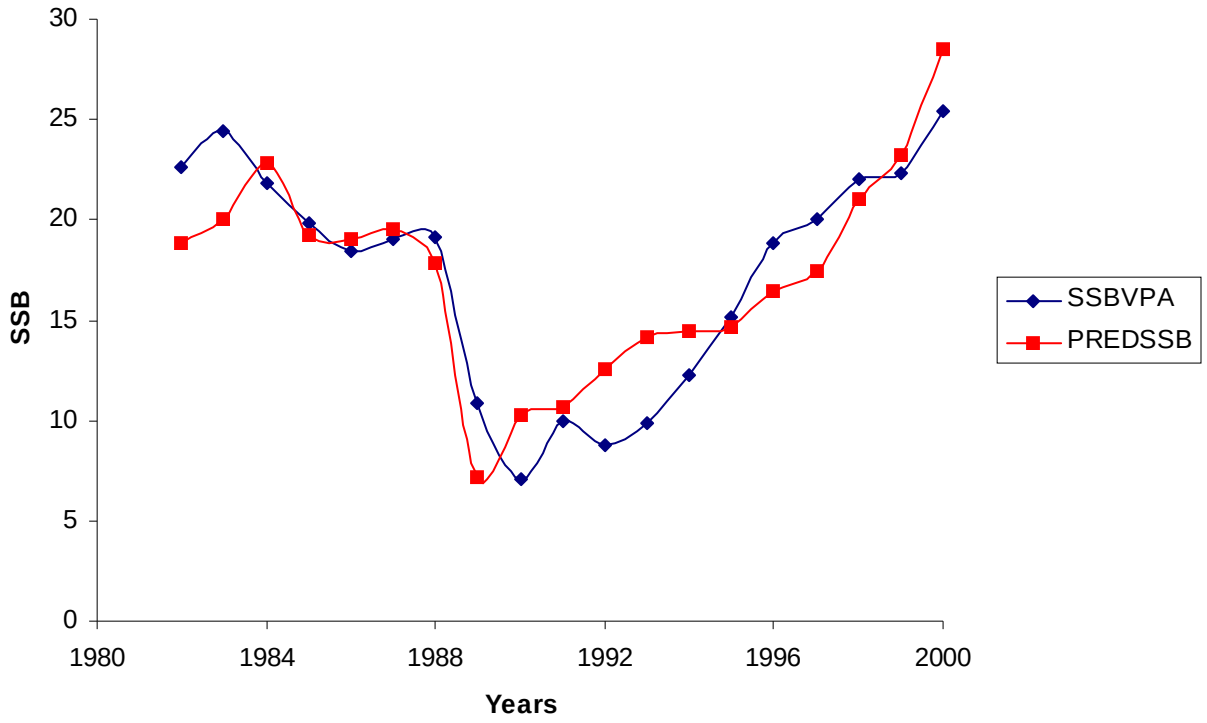

Figure 7. Plot of estimated and predicted ages 1+ flounder ssb over the converged portion (1982-2000) of ADAPT

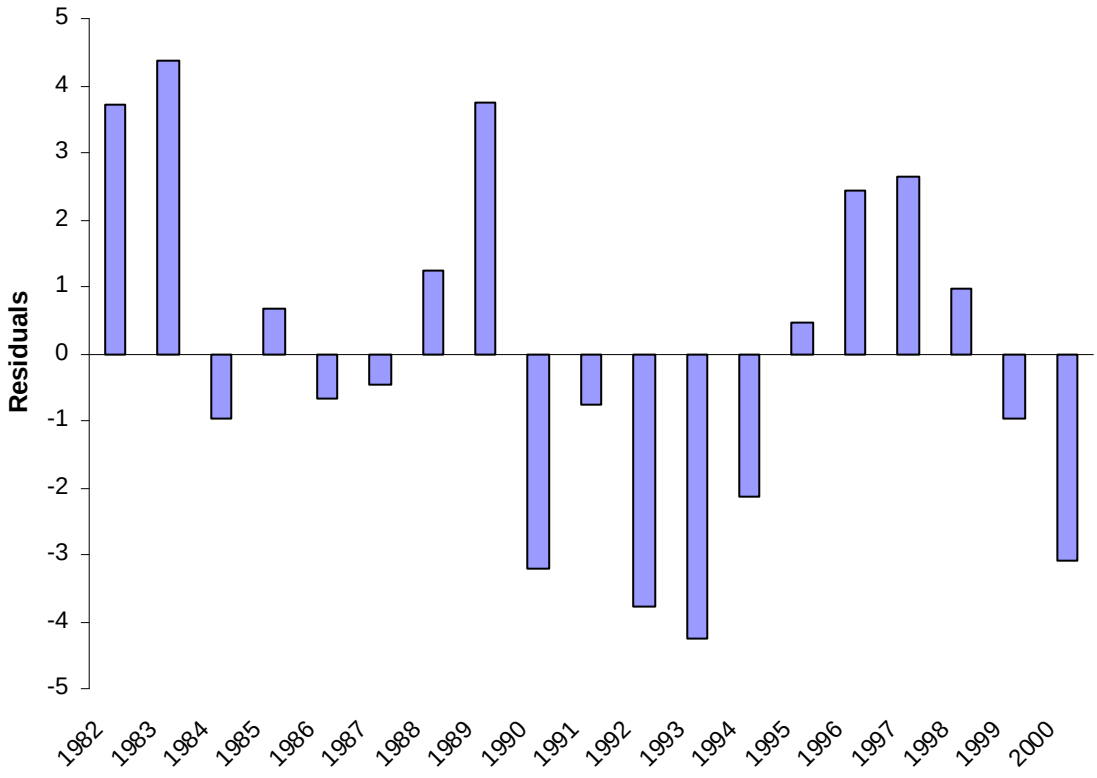

Figure 8. Residual plot for estimated and predicted SSB over time 1982-2000.

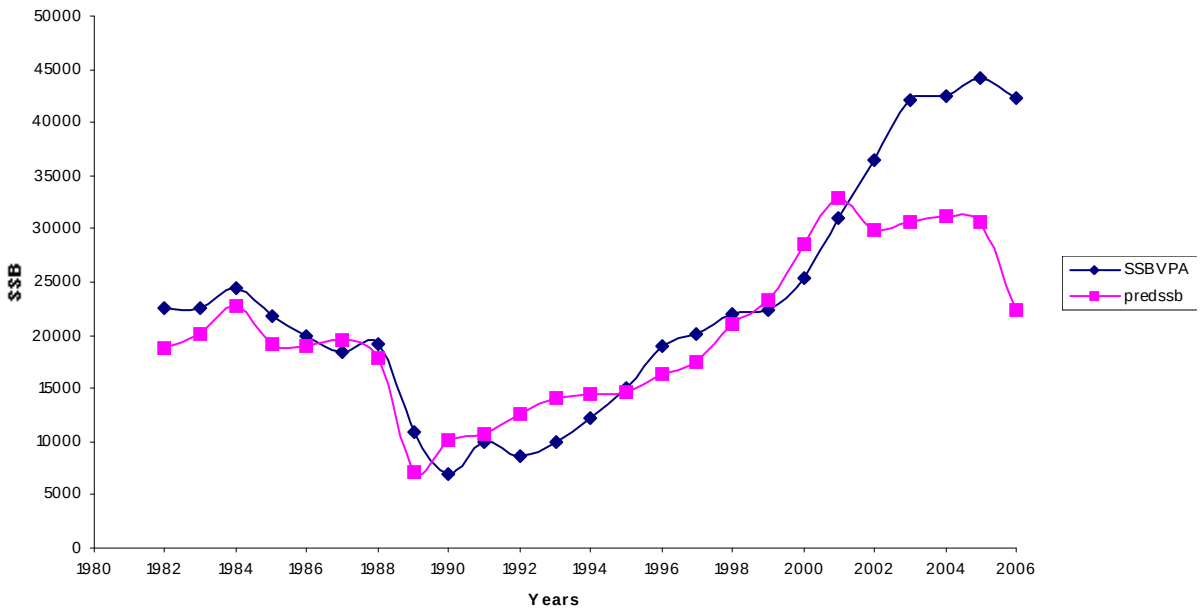

Figure 9. Estimated and predicted flounder SSB, 1982-2006.

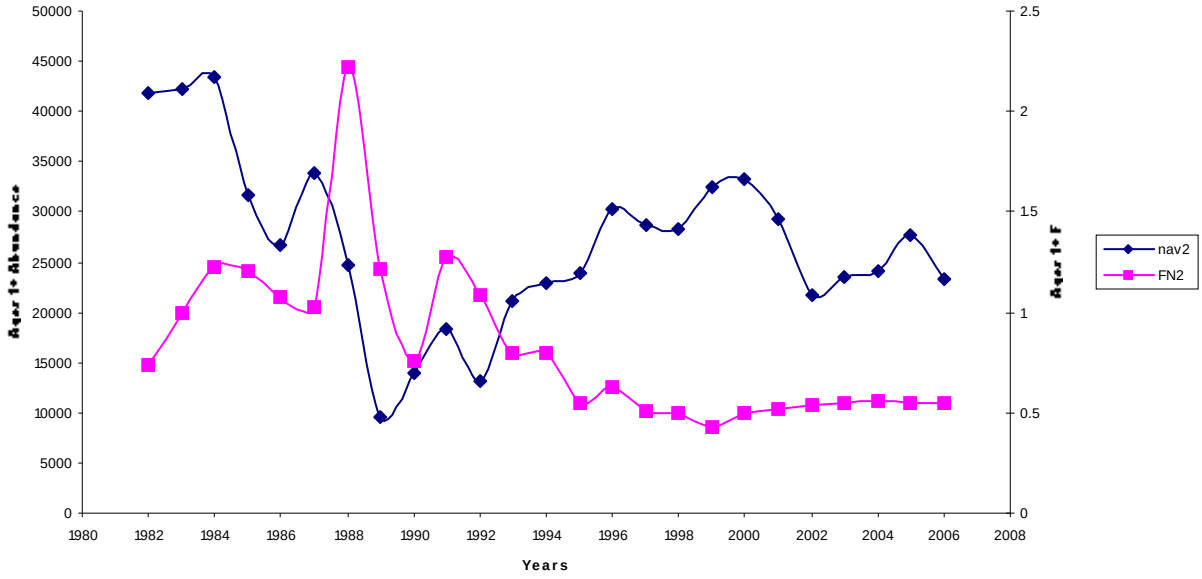

Figure 10. Relationship between ages 1+ fishing mortality and ages 1+ abundance, 1982-2006.

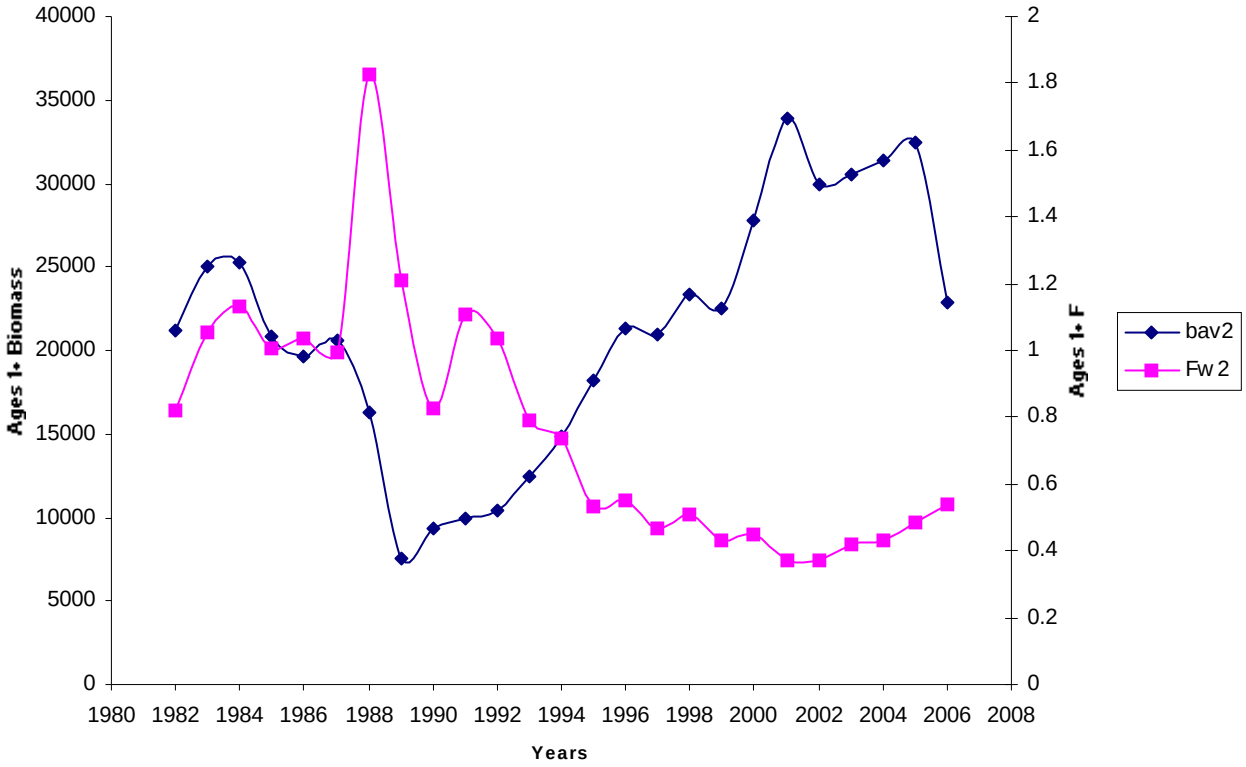

Figure 11. Relationship between biomass weighted F and ages 1+ flounder biomass 1982-2006.

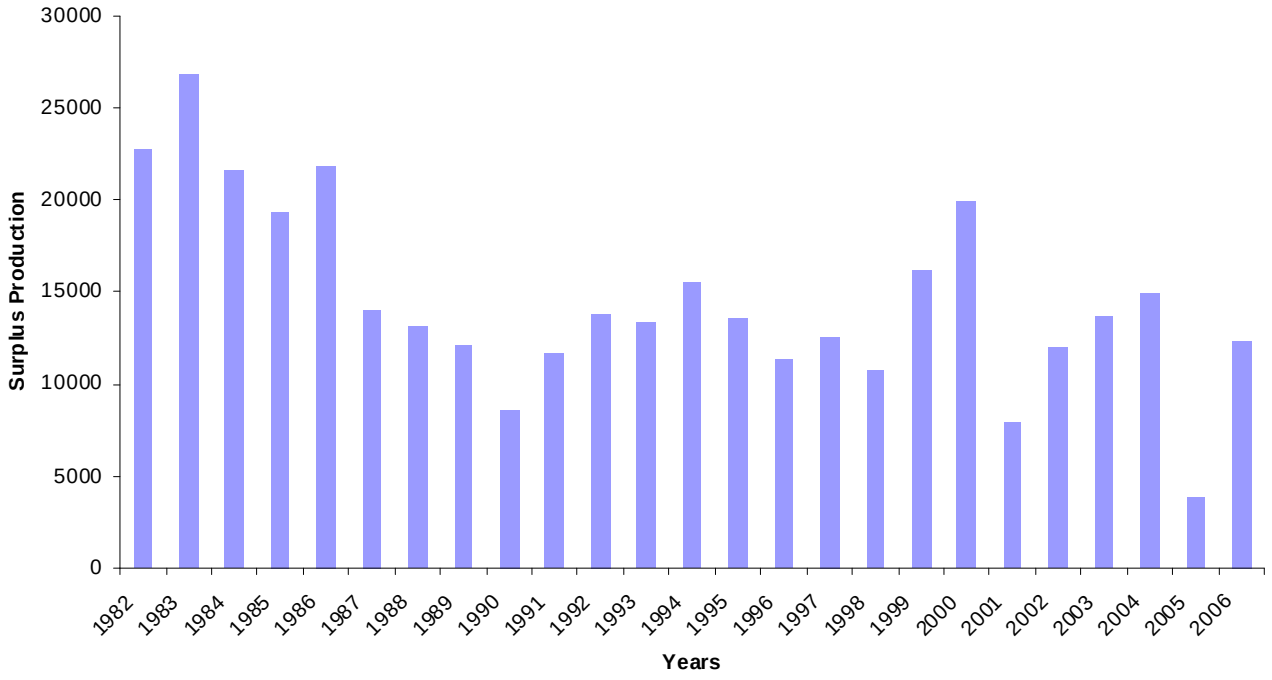

Figure 12. Plot of flounder surplus production, 1982-2006.

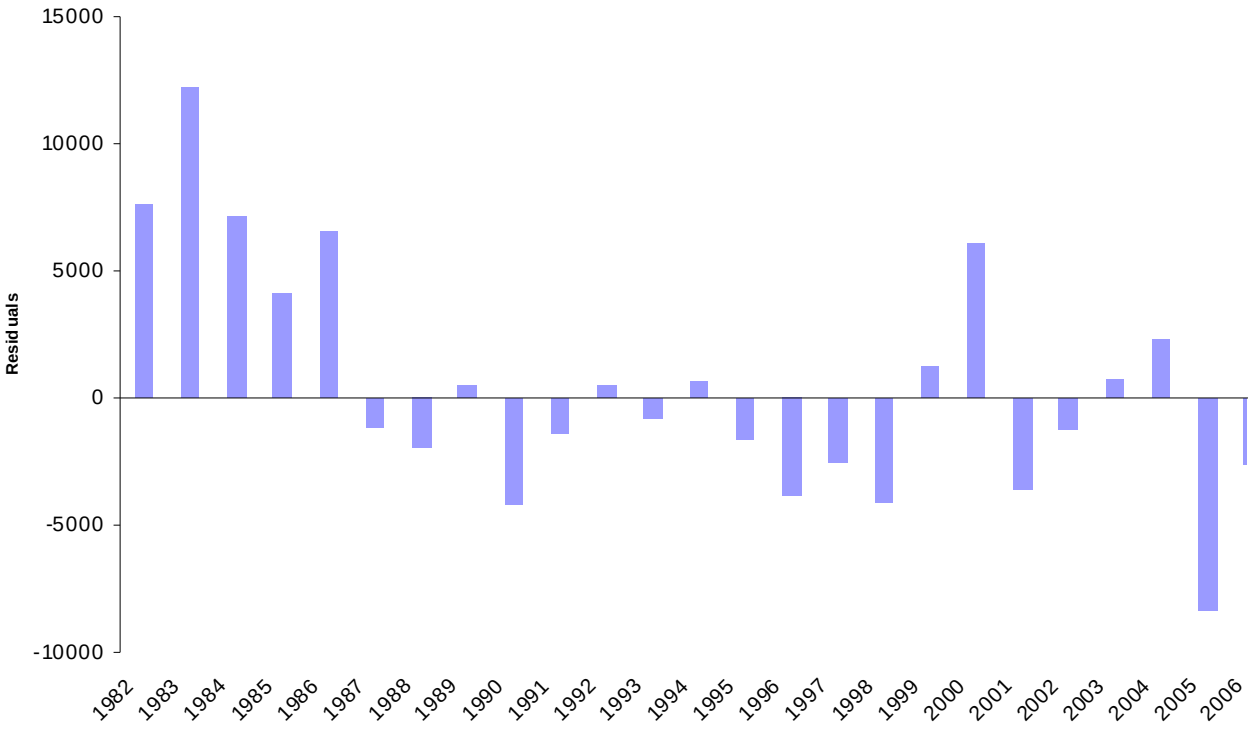

Figure 13. Residual plot for Gompertz Surplus Production Model for flounder without predation, 1982-2006.

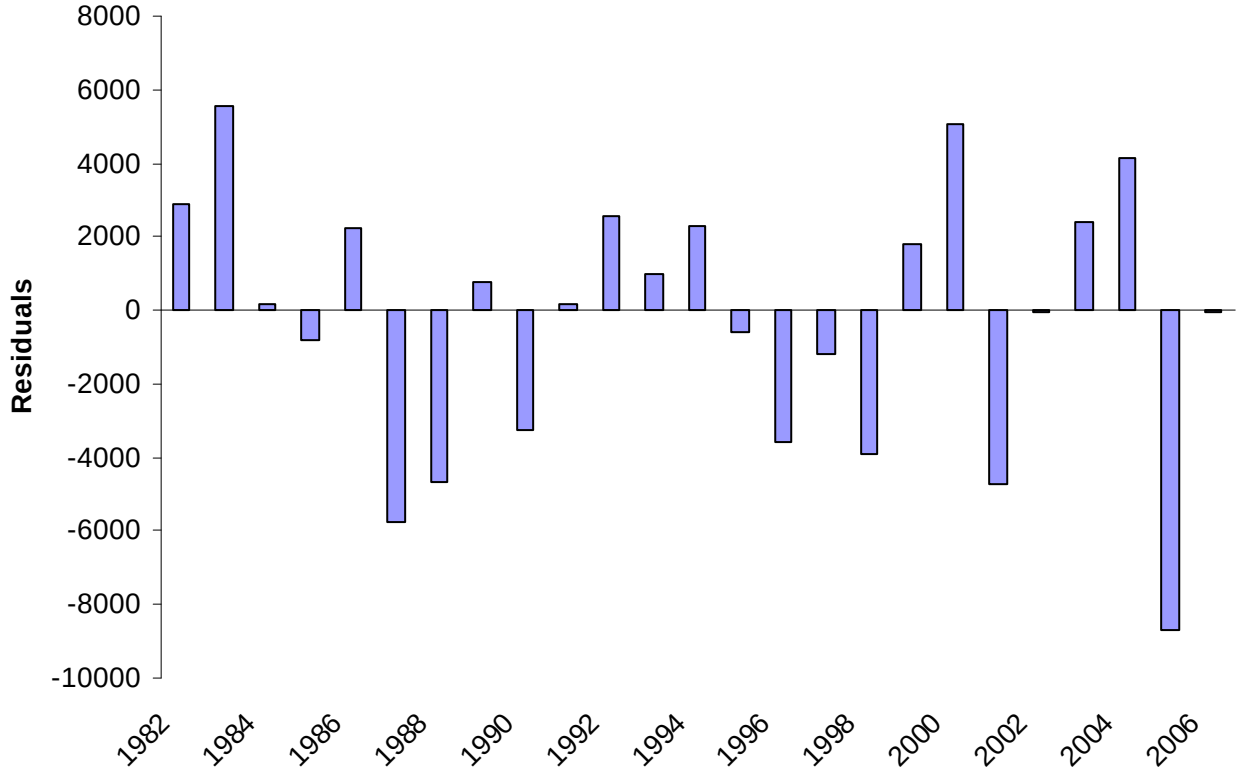

Figure 14. Residual plot from Gompertz model for flounder with striper predation effects, 1982-2006

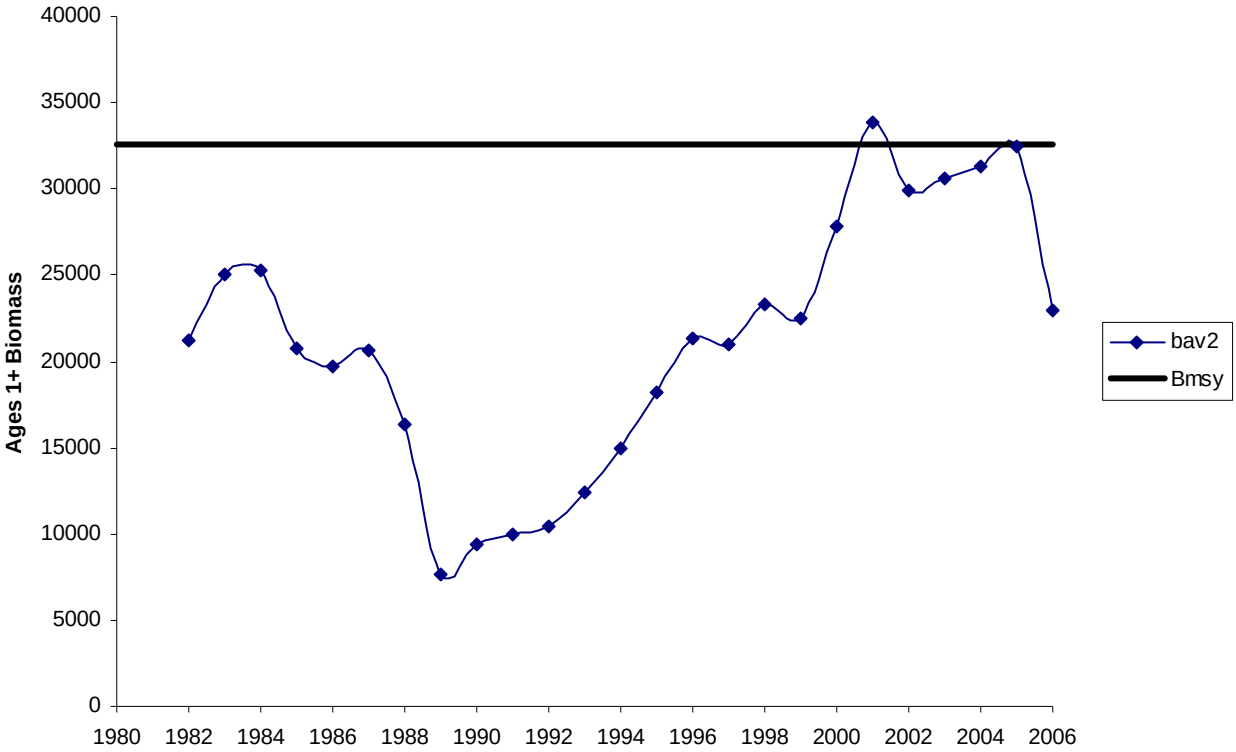

Figure 15. Plot of ages 1+ biomass and Bmsy from Gompertz model with predation 1982-2006.

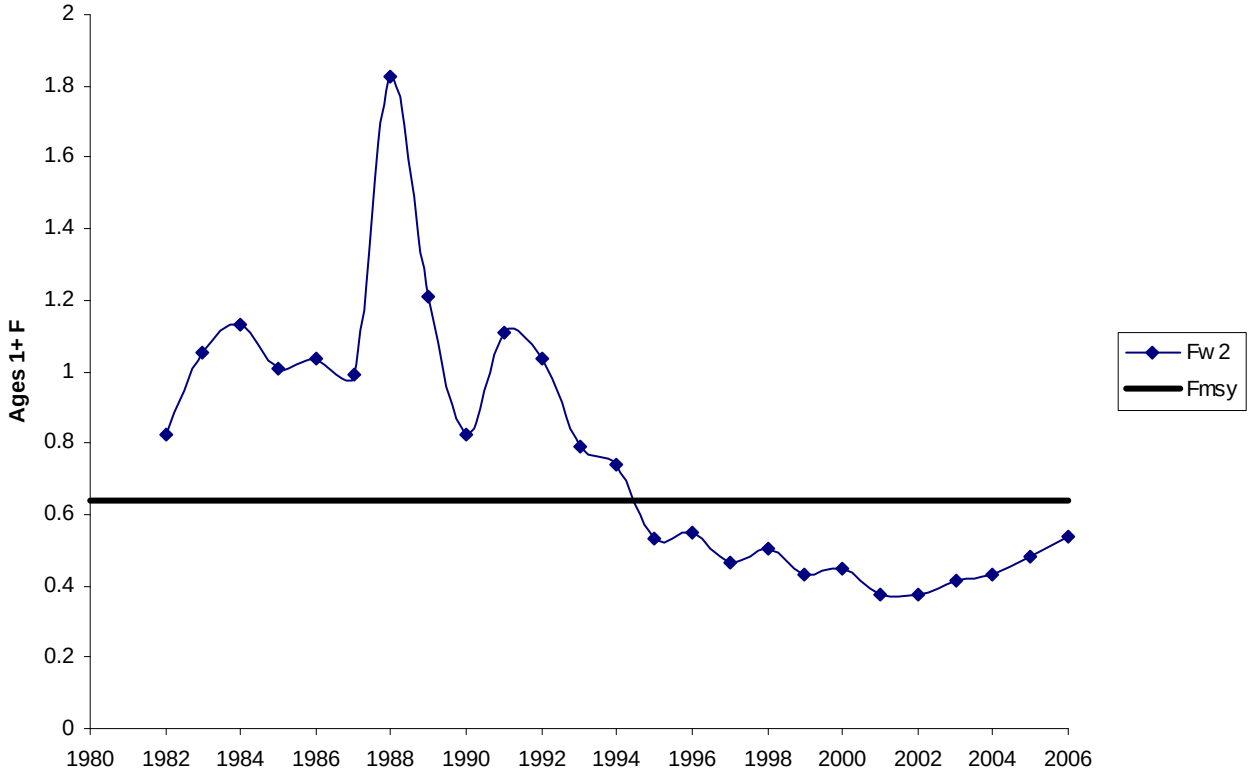

Figure 16. Plot of ages 1+ biomass weighted F and Fmsy from Gompertz model with predation, 1982-2006.

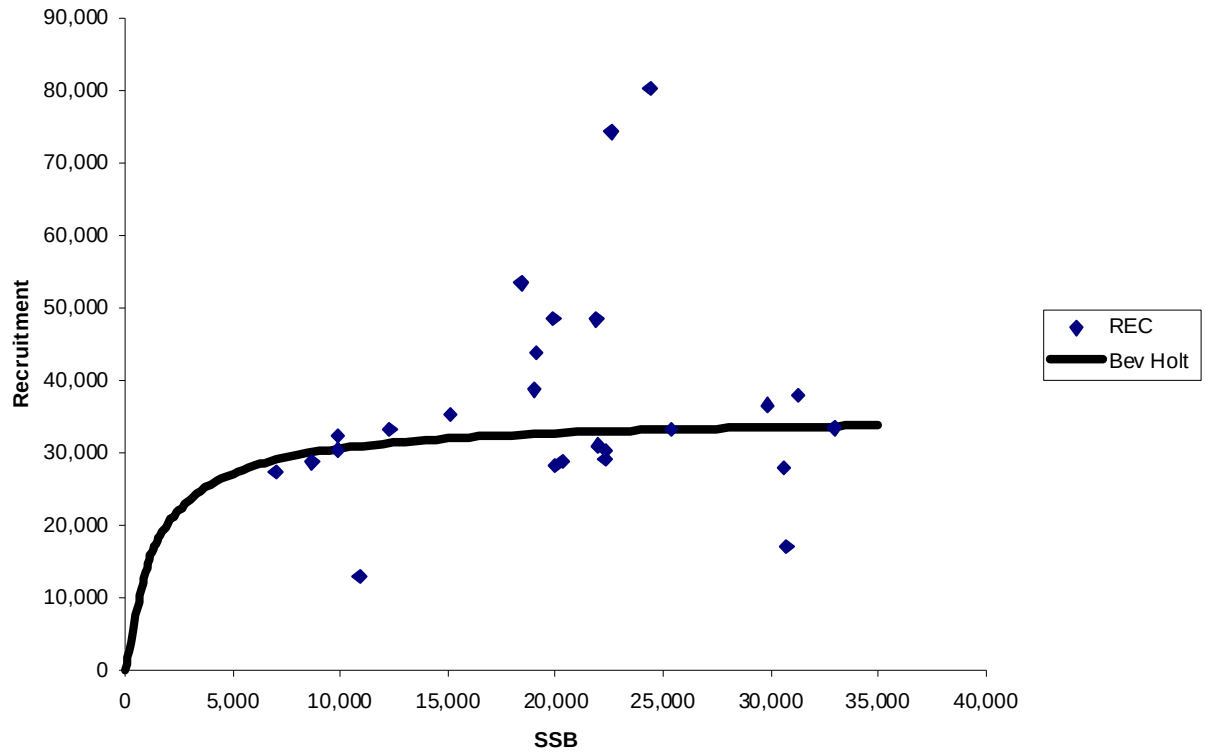

Figure 17. Stock-Recruitment fit to the Beverton-Holt model, 1982-2006.

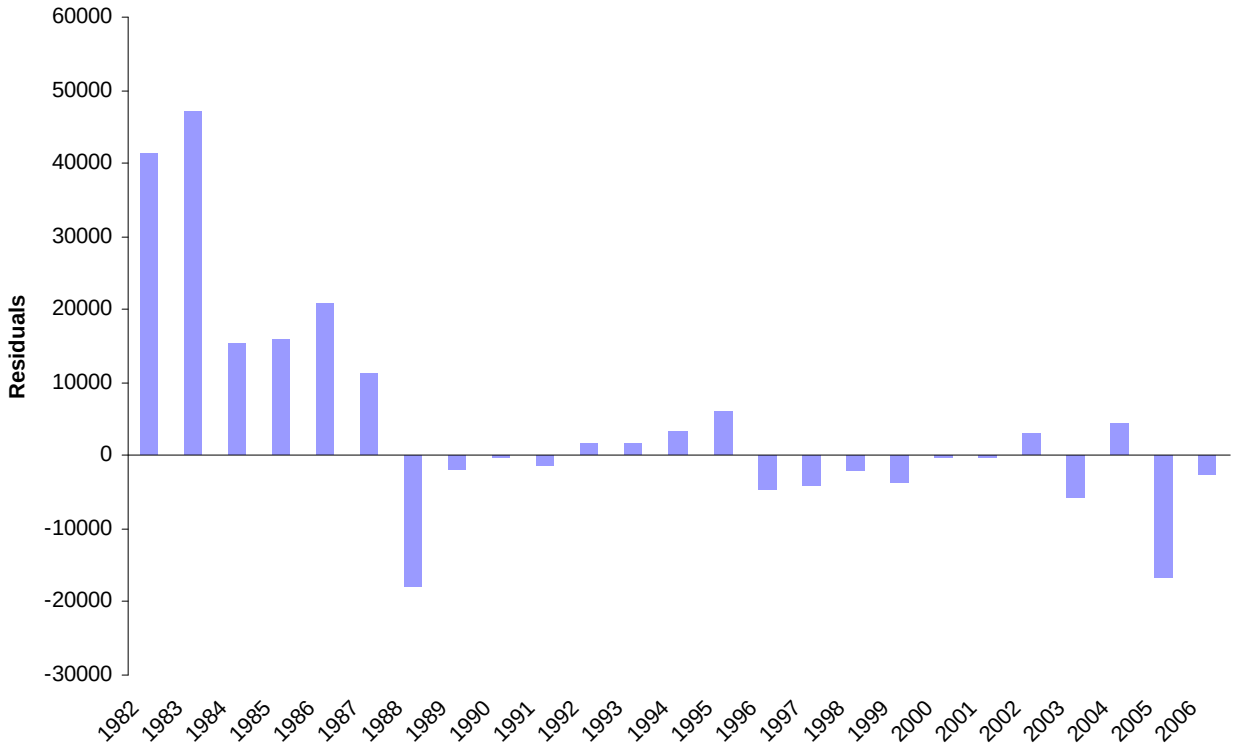

Figure 18. Plot of residuals for Beverton-Holt Model, 1982-2006

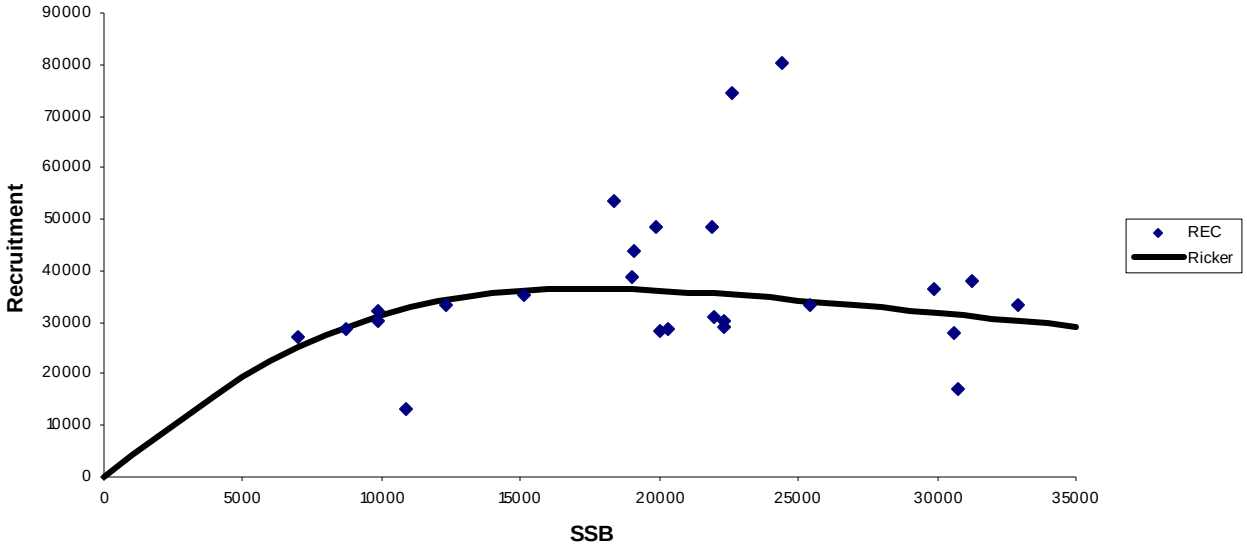

Figure 19. Stock-recruitment fit to the Ricker S-R model, 1982-2006.

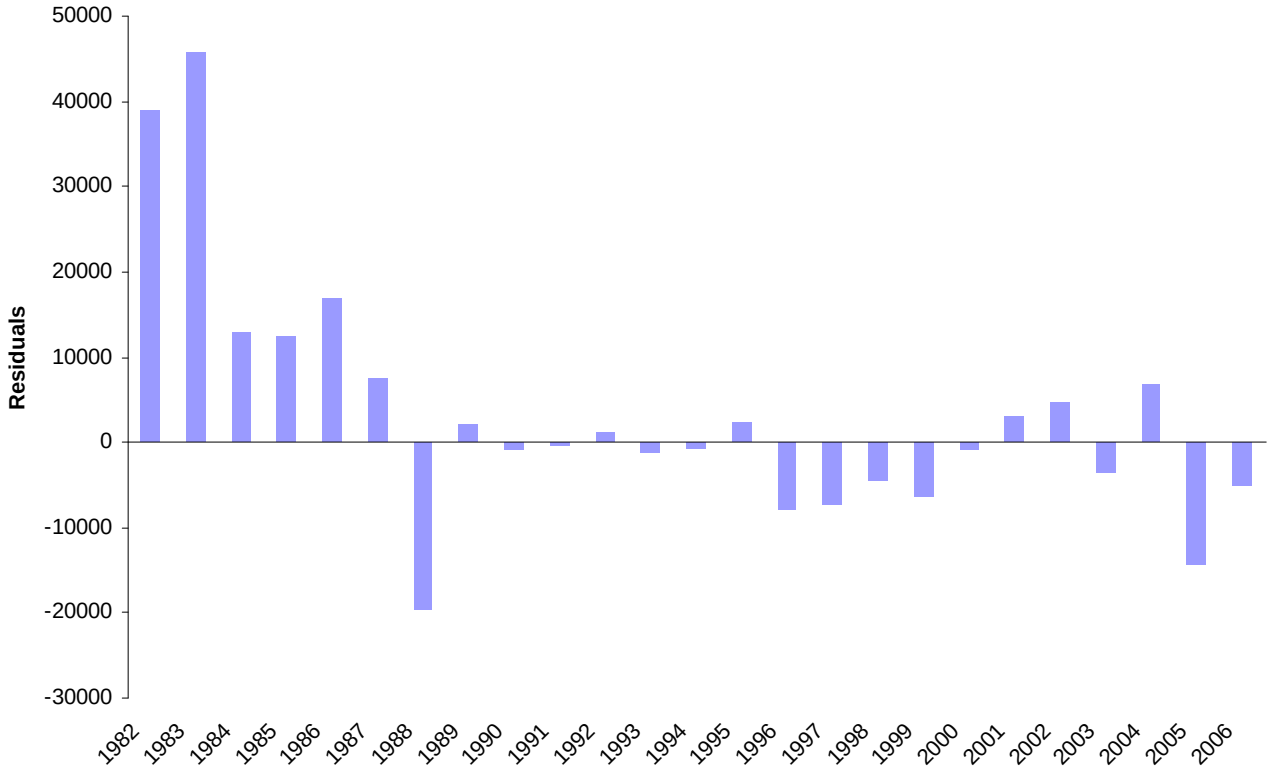

Figure 20. Plot of residuals for the Ricker Type Model, 1982-2006.

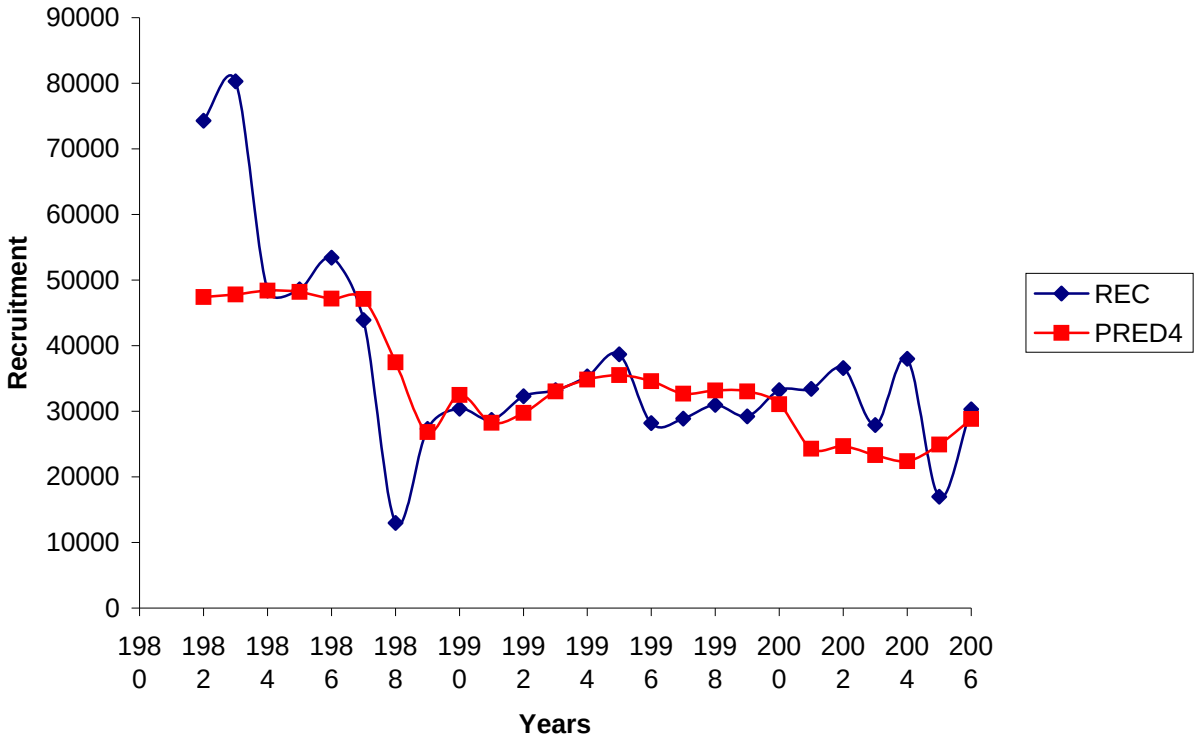

Figure 21. Observed and predicted recruitment from the Ricker Type Model with striped bass predation, 1982-2006.

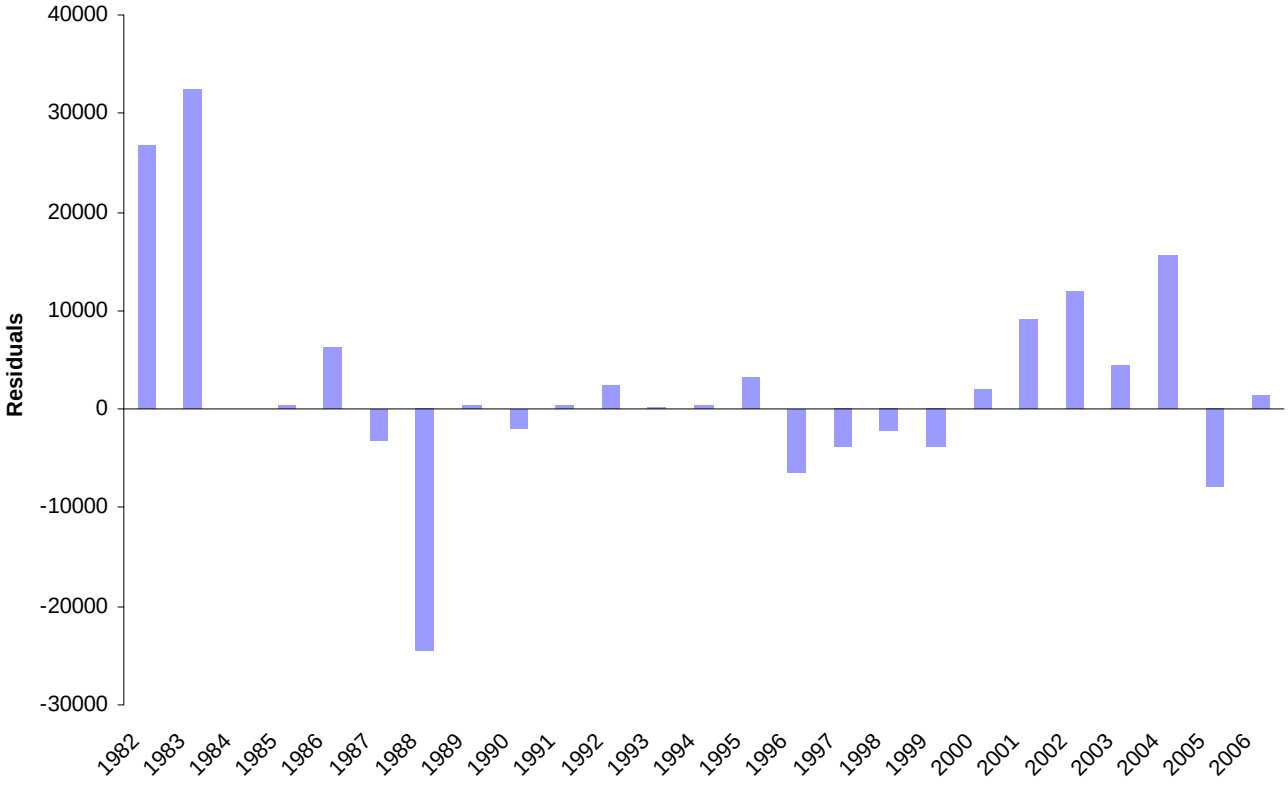

Figure 22. Plot of residuals from the Ricker Type Model with striped bass predation, 1982-2006.

ADAPT VPA BASE RUN (F08_BASE_.OUT)

```
VPA Version 2.7.1

 Model ID: Summer flounder: agreed BASE configuration


 Input File: C:\F2008\ADAPT\F08_BASE_00.DAT
 Date of Run: 19-FEB-2008                          Time of Run: 08:54


 Levenburg-Marquardt Algorithm Completed     5 Iterations
 Residual Sum of Squares =     422.904

 Number of Residuals     =    823
 Number of Parameters    =      6
 Degrees of Freedom      =    817
 Mean Squared Residual   =     0.517630
 Standard Deviation      =     0.719465


 Number of Years =    25
 Number of Ages  =     8
 First Year      =  1982
 Youngest Age    =     0
 Oldest True Age =     6

 Number of Survey Indices Available        =    51
 Number of Survey Indices Used in Estimate =    39


 VPA Classic Method - Auto Estimated Q's


 Stock Numbers Predicted in Terminal Year Plus One (2007)
 Age    Stock Predicted     Std. Error      CV

   1          25416.986   0.629488E+04   0.247664E+00
   2          10309.217   0.211378E+04   0.205038E+00
   3          17336.856   0.313950E+04   0.181088E+00
   4           5396.882   0.107440E+04   0.199078E+00
   5           4052.447   0.975869E+03   0.240810E+00
   6           1050.270   0.596189E+03   0.567654E+00

 Catchability Values for Each Survey Used in Estimate
 INDEX     Catchability    Std. Error      CV

   1       0.141956E-03   0.269635E-04   0.189943E+00
   2       0.416467E-03   0.456733E-04   0.109668E+00
   3       0.341157E-03   0.456260E-04   0.133739E+00
   4       0.337567E-03   0.675095E-04   0.199988E+00
   5       0.447993E-03   0.742654E-04   0.165774E+00
   6       0.138176E-04   0.196560E-05   0.142253E+00
   7       0.379163E-04   0.379567E-05   0.100107E+00
   8       0.344239E-04   0.555454E-05   0.161357E+00
   9       0.383975E-04   0.476407E-05   0.124072E+00
```

10	0.652723E-04	0.813949E-05	0.124700E+00
11	0.676126E-04	0.443512E-05	0.655960E-01
12	0.811036E-04	0.103929E-04	0.128143E+00
13	0.756270E-04	0.106850E-04	0.141286E+00
15	0.406577E-04	0.766483E-05	0.188521E+00
16	0.432367E-04	0.710121E-05	0.164240E+00
18	0.168215E-03	0.178525E-04	0.106129E+00
19	0.657295E-04	0.129519E-04	0.197048E+00
21	0.173459E-04	0.278618E-05	0.160625E+00
22	0.184656E-04	0.284132E-05	0.153871E+00
23	0.295921E-04	0.560622E-05	0.189450E+00
24	0.425758E-04	0.678960E-05	0.159471E+00
25	0.107830E-03	0.138240E-04	0.128201E+00
26	0.882136E-04	0.121995E-04	0.138295E+00
27	0.606059E-04	0.105664E-04	0.174347E+00
29	0.111458E-03	0.169981E-04	0.152506E+00
30	0.854502E-04	0.180487E-04	0.211218E+00
31	0.104477E-04	0.217262E-05	0.207952E+00
32	0.209505E-04	0.353428E-05	0.168696E+00
33	0.158198E-03	0.236253E-04	0.149340E+00
34	0.688016E-04	0.153953E-04	0.223764E+00
35	0.436851E-04	0.803555E-05	0.183943E+00
36	0.588380E-04	0.101782E-04	0.172986E+00
40	0.184557E-05	0.398576E-06	0.215963E+00
41	0.281985E-04	0.321951E-05	0.114173E+00
43	0.238811E-03	0.304404E-04	0.127466E+00
44	0.392777E-04	0.583899E-05	0.148659E+00
45	0.818325E-05	0.123329E-05	0.150710E+00
50	0.548734E-05	0.107239E-05	0.195430E+00
51	0.105736E-05	0.214457E-06	0.202823E+00

```
 -- Non-Linear Least Squares Fit --

 Default Tolerances Used

 Scaled Gradient Tolerance      =    6.055454E-06
 Scaled Step Tolerance          =    3.666853E-11
 Relative Function Tolerance    =    3.666853E-11
 Absolute Function Tolerance    =    4.930381E-32


 VPA Method Options

 - Catchability Values Estimated as an Analytic Function of N
 - Catch Equation Used in Cohort Solution
 - Plus Group Backward Calculation Method Used
 - Rivard Weights Used for JAN-1 Biomass
 - Rivard Weights Calculation Used  3 Years for Terminal Year Plus One

 - Heincke Rule Used in F-Oldest Calculation
 - F-Oldest Calculation in Years Prior to Terminal Year
   Uses Stock Sizes in Ages  3 to  6
 - Calculation of Population of Age 0 In Year 2007
   =  CDF Using First Age Populations
      Year Range Applied =  1982 to  2005

 Stock Estimates

 Age   1
 Age   2
 Age   3
 Age   4
 Age   5
 Age   6

 Full F in Terminal Year               =   0.4413

 F in Oldest True Age in Terminal Year =   0.4413

 Full F Calculated Using Classic Method

 Age  Input Partial  Calc Partial   Fishing     Used In
      Recruitment    Recruitment    Mortality   Full F    Comments

   0      0.020          0.012       0.0068      NO      Stock Estimate in
T+1
   1      0.130          0.162       0.0897      NO      Stock Estimate in
T+1
   2      0.670          0.421       0.2336      NO      Stock Estimate in
T+1
   3      1.000          0.784       0.4346      YES     Stock Estimate in
T+1
   4      1.000          0.605       0.3351      YES     Stock Estimate in
T+1
   5      1.000          1.000       0.5542      YES     Stock Estimate in
T+1
   6      1.000          0.796       0.4413              Input PR * Full F
```

Catch At Age - Input Data

AGE	1982	1983	1984	1985	1986
0	5344.0	4925.0	4802.0	2078.0	1942.0
1	19423.0	28441.0	26582.0	14623.0	17140.0
2	10149.0	10911.0	15454.0	17979.0	11055.0
3	935.0	2181.0	3180.0	1767.0	3782.0
4	328.0	693.0	829.0	496.0	316.0
5	116.0	323.0	95.0	252.0	140.0
6	67.0	16.0	4.0	30.0	58.0
7	30.0	43.0	10.0	8.0	15.0

AGE	1987	1988	1989	1990	1991
0	1137.0	795.0	960.0	1856.0	1001.0
1	17212.0	20557.0	4790.0	8808.0	12149.0
2	10838.0	14562.0	7306.0	2187.0	7148.0
3	1648.0	2137.0	1692.0	995.0	742.0
4	544.0	644.0	353.0	221.0	217.0
5	25.0	121.0	55.0	30.0	32.0
6	29.0	19.0	9.0	8.0	3.0
7	44.0	21.0	4.0	3.0	1.0

AGE	1992	1993	1994	1995	1996
0	1368.0	1285.0	1638.0	592.0	162.0
1	11197.0	11235.0	10362.0	5828.0	6925.0
2	6026.0	5601.0	6996.0	7303.0	9278.0
3	1125.0	566.0	982.0	1239.0	1785.0
4	151.0	73.0	205.0	397.0	417.0
5	70.0	45.0	26.0	77.0	71.0
6	2.0	20.0	14.0	4.0	16.0
7	1.0	3.0	5.0	1.0	3.0

AGE	1997	1998	1999	2000	2001
0	30.0	45.0	181.0	22.0	11.0
1	2545.0	2233.0	2185.0	1538.0	2888.0
2	8046.0	6380.0	6260.0	7967.0	4760.0
3	3149.0	5243.0	4018.0	4670.0	3737.0
4	553.0	980.0	1161.0	1529.0	1293.0
5	160.0	138.0	358.0	370.0	363.0
6	11.0	19.0	55.0	74.0	123.0
7	4.0	1.0	14.0	29.0	33.0

Catch At Age - Input Data

AGE	2002	2003	2004	2005	2006
0	272.0	259.0	107.0	245.0	191.0
1	1135.0	1583.0	1053.0	1936.0	1072.0
2	5411.0	4937.0	5668.0	3717.0	5070.0
3	3839.0	4002.0	4688.0	4045.0	3276.0
4	1302.0	1579.0	1907.0	2206.0	1796.0
5	319.0	563.0	769.0	1049.0	869.0
6	135.0	233.0	304.0	510.0	372.0
7	25.0	86.0	156.0	470.0	180.0

Weight At Age - Input Data

AGE	1982	1983	1984	1985	1986
0	0.2540	0.2400	0.2480	0.2890	0.2530
1	0.4180	0.4170	0.3960	0.4280	0.4530
2	0.6160	0.7160	0.6320	0.6130	0.6680
3	1.4470	1.0750	1.0460	1.1090	1.1600
4	1.9070	1.2570	1.5000	1.7260	1.7390
5	2.7950	1.4950	2.1630	2.2970	1.9940
6	2.6730	2.5720	3.3020	2.6710	3.3110
7	3.8510	2.5990	3.9200	4.7260	4.0910

AGE	1987	1988	1989	1990	1991
0	0.2590	0.3160	0.2080	0.2520	0.1450
1	0.4420	0.4630	0.4600	0.4310	0.4070
2	0.6510	0.6240	0.7230	0.8100	0.7020
3	1.1400	1.1300	1.0440	1.1690	1.1860
4	1.9410	1.7390	1.4790	1.5380	1.8110
5	2.8620	2.4850	2.2490	2.1210	2.5270
6	3.3370	3.8880	2.3990	3.4610	2.8370
7	3.5140	3.7610	2.7090	4.3660	3.5860

AGE	1992	1993	1994	1995	1996
0	0.2450	0.2640	0.3550	0.3900	0.3300
1	0.4700	0.4860	0.5280	0.5370	0.5100
2	0.7490	0.6990	0.6280	0.6780	0.5700
3	1.2220	1.4610	1.3530	1.0560	1.0800
4	1.3900	1.6590	2.0960	1.6390	1.5450
5	2.6960	1.8590	2.7360	2.6280	1.9570
6	2.3020	2.8160	3.4370	3.7500	2.5460
7	4.4790	2.4760	3.7050	4.0470	2.9890

AGE	1997	1998	1999	2000	2001
0	0.2120	0.2590	0.1430	0.0660	0.1140
1	0.4520	0.4900	0.3710	0.5080	0.5440
2	0.6390	0.6480	0.5940	0.6920	0.7660
3	0.8660	0.8590	0.8960	0.9250	0.9680
4	1.2330	1.3210	1.4390	1.3300	1.4490
5	2.2520	2.4100	1.9980	2.2190	2.1450
6	2.5720	2.5770	2.7160	2.5990	2.5970
7	2.9500	3.9830	3.4990	2.8260	3.3220

Weight At Age - Input Data

AGE	2002	2003	2004	2005	2006
0	0.1470	0.1490	0.3060	0.2020	0.1490
1	0.4930	0.5070	0.5170	0.4290	0.4430
2	0.7360	0.7590	0.7390	0.6920	0.6830
3	0.9580	1.0340	0.9680	0.9280	0.9600
4	1.3710	1.5310	1.3480	1.1860	1.2630
5	2.0990	2.0720	1.7520	1.5030	1.6440
6	2.6660	2.7590	2.3540	1.8890	2.1840
7	3.7420	3.9520	3.7360	3.6350	3.7870

JAN-1 Weights at Age - Input Data

AGE	1982	1983	1984	1985	1986
0	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.3194	0.3255	0.3083	0.3258	0.3618
2	0.4663	0.5471	0.5134	0.4927	0.5347
3	1.5525	0.8138	0.8654	0.8372	0.8433
4	2.1538	1.3487	1.2698	1.3437	1.3887
5	2.9136	1.6885	1.6489	1.8562	1.8552
6	2.7333	2.6812	2.2218	2.4036	2.7578
7	3.8510	2.5990	3.9200	4.7260	4.0910

AGE	1987	1988	1989	1990	1991
0	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.3344	0.3463	0.3813	0.2994	0.3203
2	0.5430	0.5252	0.5786	0.6104	0.5501
3	0.8727	0.8577	0.8071	0.9193	0.9801
4	1.5005	1.4080	1.2928	1.2672	1.4550
5	2.2309	2.1962	1.9776	1.7711	1.9714
6	2.5795	3.3358	2.4416	2.7899	2.4530
7	3.5140	3.7610	2.7090	4.3660	3.5860

AGE	1992	1993	1994	1995	1996
0	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.2611	0.3451	0.3734	0.4366	0.4460
2	0.5521	0.5732	0.5525	0.5983	0.5533
3	0.9262	1.0461	0.9725	0.8144	0.8557
4	1.2840	1.4238	1.7499	1.4892	1.2773
5	2.2096	1.6075	2.1305	2.3470	1.7910
6	2.4119	2.7553	2.5277	3.2031	2.5867
7	4.4790	2.4760	3.7050	4.0470	2.9890

AGE	1997	1998	1999	2000	2001
0	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.3862	0.3223	0.3100	0.2695	0.1895
2	0.5709	0.5412	0.5395	0.5067	0.6238
3	0.7026	0.7409	0.7620	0.7412	0.8184
4	1.1540	1.0696	1.1118	1.0916	1.1577
5	1.8653	1.7238	1.6246	1.7869	1.6890
6	2.2435	2.4090	2.5584	2.2788	2.4006
7	2.9500	3.9830	3.4990	2.8260	3.3220

JAN-1 Weights at Age - Input Data

AGE	2002	2003	2004	2005	2006
0	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.2371	0.2730	0.2775	0.3623	0.2991
2	0.6328	0.6117	0.6121	0.5981	0.5413
3	0.8566	0.8724	0.8572	0.8281	0.8151
4	1.1520	1.2111	1.1806	1.0715	1.0826
5	1.7440	1.6854	1.6378	1.4234	1.3963
6	2.3914	2.4065	2.2085	1.8192	1.8118
7	3.7420	3.9520	3.7360	3.6350	3.7870

AGE	2007
0	0.0000
1	0.3130
2	0.5838
3	0.8334
4	1.1116
5	1.4858
6	1.9465
7	3.7193

SSB Weight At Age - Input Data

AGE	1982	1983	1984	1985	1986
0	0.3020	0.2860	0.3000	0.3380	0.3080
1	0.5040	0.4820	0.4610	0.4990	0.5130
2	0.7490	0.8160	0.7690	0.7670	0.8050
3	1.3810	1.2060	1.2450	1.2960	1.3880
4	1.7610	1.5200	1.7390	1.8130	2.0690
5	2.7190	1.9820	2.3240	2.6060	2.3860
6	2.6230	3.4750	4.2560	3.6220	3.4470
7	3.8510	2.5990	3.9200	4.7260	4.0910

AGE	1987	1988	1989	1990	1991
0	0.3170	0.3600	0.2690	0.2980	0.2230
1	0.4980	0.5400	0.5610	0.5110	0.5040
2	0.7890	0.7470	0.8550	0.9240	0.8520
3	1.3200	1.2390	1.1940	1.3610	1.2520
4	2.1120	1.8990	1.6750	1.8280	2.0780
5	3.1790	2.4560	2.6110	2.3430	2.4500
6	3.6210	3.0980	3.7170	3.5450	3.9370
7	3.5140	3.7610	2.7090	4.3660	3.5860

AGE	1992	1993	1994	1995	1996
0	0.3120	0.3370	0.4100	0.4280	0.3680
1	0.5390	0.5310	0.5750	0.5480	0.5510
2	0.9480	0.8820	0.7530	0.7970	0.6590
3	1.3570	1.6550	1.4440	1.2040	1.1300
4	1.5360	1.9750	2.2640	1.7410	1.7600
5	2.7360	2.3070	3.0490	2.6000	2.1490
6	2.4190	3.4120	3.8460	3.2400	2.8170
7	4.4790	2.4760	3.7050	4.0470	2.9890

AGE	1997	1998	1999	2000	2001
0	0.2860	0.2930	0.2280	0.1490	0.1960
1	0.5120	0.5230	0.4620	0.5860	0.6030
2	0.7070	0.7240	0.6920	0.7770	0.8270
3	1.0020	1.0280	1.0270	1.0800	1.0910
4	1.5620	1.5240	1.6710	1.5710	1.6470
5	2.3570	2.5090	2.1820	2.3370	2.3100
6	3.5170	3.1950	2.7900	3.0790	3.3640
7	2.9500	3.9830	3.4990	2.8260	3.3220

SSB Weight At Age - Input Data

AGE	2002	2003	2004	2005	2006
0	0.2310	0.2370	0.2790	0.2670	0.2470
1	0.5730	0.5770	0.5800	0.5050	0.5380
2	0.8270	0.8240	0.7970	0.7740	0.7840
3	1.1280	1.1310	1.0370	1.0310	1.0610
4	1.5820	1.6020	1.3970	1.3270	1.4120
5	2.3050	2.1630	1.7960	1.7100	1.8470
6	3.5280	3.4140	3.2060	3.1600	3.2130
7	3.7420	3.9520	3.7360	3.6350	3.7870

Natural Mortality - Input Data

AGE	1982	1983	1984	1985	1986
0	0.2000	0.2000	0.2000	0.2000	0.2000
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	1987	1988	1989	1990	1991
0	0.2000	0.2000	0.2000	0.2000	0.2000
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	1992	1993	1994	1995	1996
0	0.2000	0.2000	0.2000	0.2000	0.2000
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000

AGE	1997	1998	1999	2000	2001
0	0.2000	0.2000	0.2000	0.2000	0.2000
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	2002	2003	2004	2005	2006
0	0.2000	0.2000	0.2000	0.2000	0.2000
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000

Proportion of Natural Mortality Before Spawning = 0.8300
Proportion of Fishing Mortality Before Spawning = 0.8300

Maturity - Input Data

AGE	1982	1983	1984	1985	1986
0	0.3800	0.3800	0.3800	0.3800	0.3800
1	0.9100	0.9100	0.9100	0.9100	0.9100
2	0.9800	0.9800	0.9800	0.9800	0.9800
3	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000

AGE	1987	1988	1989	1990	1991
0	0.3800	0.3800	0.3800	0.3800	0.3800
1	0.9100	0.9100	0.9100	0.9100	0.9100
2	0.9800	0.9800	0.9800	0.9800	0.9800
3	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000

AGE	1992	1993	1994	1995	1996
0	0.3800	0.3800	0.3800	0.3800	0.3800
1	0.9100	0.9100	0.9100	0.9100	0.9100
2	0.9800	0.9800	0.9800	0.9800	0.9800
3	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000

AGE	1997	1998	1999	2000	2001
0	0.3800	0.3800	0.3800	0.3800	0.3800
1	0.9100	0.9100	0.9100	0.9100	0.9100
2	0.9800	0.9800	0.9800	0.9800	0.9800
3	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	2002	2003	2004	2005	2006
0	0.3800	0.3800	0.3800	0.3800	0.3800
1	0.9100	0.9100	0.9100	0.9100	0.9100
2	0.9800	0.9800	0.9800	0.9800	0.9800
3	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000

Input Partial Recruitment

AGE	
0	0.0200
1	0.1300
2	0.6700
3	1.0000
4	1.0000
5	1.0000
6	1.0000

Input F-Plus Ratio

YEAR	
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000
2005	1.0000
2006	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	NEC_W	NEC_W	NEC_W	NEC_W	NEC_W
AGE	1	2	3	4	5 - 7
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	7.1500	4.7400	0.3300	0.0400	0.0400
1993	6.5000	6.7000	0.3100	0.0500	0.0400
1994	3.7600	7.2000	0.8200	0.2600	0.0100
1995	6.0700	4.5900	0.2500	0.0200	0.0000
1996	22.1700	8.3300	0.6000	0.1200	0.0300
1997	3.8600	4.8000	1.0400	0.4300	0.1500
1998	1.6800	3.2500	2.2900	0.4200	0.1200
1999	2.1100	4.8000	2.9000	0.8400	0.4100
2000	0.7000	6.5200	4.9600	2.5100	1.0800
2001	3.0700	5.3300	6.4200	2.4400	1.3400
2002	2.7700	10.7400	5.5800	2.2600	1.3300
2003	8.1700	14.3600	8.4800	2.6700	1.9600
2004	1.4500	8.6800	4.5600	1.6400	1.4400
2005	2.9600	4.0300	3.0700	1.3400	1.4900
2006	2.6400	9.0600	4.2900	2.4700	2.5800
2007	2.7700	6.1800	5.1500	1.5400	1.1900

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	NEC_S	NEC_S	NEC_S	NEC_S	NEC_S
AGE	1	2	3	4	5 - 7
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1982	0.7000	1.4300	0.1200	0.0200	0.0000
1983	0.3200	0.3900	0.1900	0.0300	0.0200
1984	0.1700	0.3300	0.0900	0.0500	0.0200
1985	0.5500	1.5600	0.2100	0.0400	0.0200
1986	1.4800	0.4300	0.2000	0.0200	0.0100
1987	0.4700	0.4300	0.0200	0.0100	0.0000
1988	0.6000	0.8100	0.0700	0.0200	0.0000
1989	0.0600	0.2300	0.0200	0.0100	0.0000
1990	0.6300	0.0300	0.0600	0.0000	0.0000
1991	0.7900	0.2700	0.0000	0.0200	0.0000
1992	0.7700	0.4100	0.0100	0.0000	0.0100
1993	0.7300	0.5000	0.0400	0.0000	0.0000
1994	0.3500	0.5300	0.0400	0.0100	0.0000
1995	0.7900	0.2700	0.0200	0.0000	0.0100
1996	1.0800	0.5600	0.1200	0.0000	0.0000
1997	0.2900	0.6700	0.0900	0.0100	0.0000
1998	0.2700	0.5200	0.3200	0.0600	0.0200
1999	0.2200	0.7400	0.4800	0.1300	0.0300
2000	0.1900	1.0300	0.6300	0.1200	0.1700
2001	0.4800	0.8900	1.0200	0.2000	0.1000
2002	0.3400	0.8900	0.7400	0.3100	0.1900
2003	0.5400	1.2900	0.5900	0.2900	0.2100
2004	0.3000	1.4500	0.8500	0.2700	0.1500
2005	0.2600	0.6500	0.5800	0.1500	0.1700
2006	0.0400	1.0400	0.2400	0.2500	0.2000
2007	0.2400	0.5200	1.4600	0.5700	0.4600

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	NEC_F	NEC_F	NEC_F	MA_S	MA_S
AGE	2	3	4	1	2
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	0	0
1982	0.0000	0.0000	0.0000	0.3500	1.5840
1983	1.5200	0.4000	0.0300	0.0510	0.5990
1984	1.4600	0.3400	0.1200	0.0440	0.0780
1985	1.3900	0.4300	0.0700	0.1540	1.2600
1986	0.8000	0.4600	0.0500	0.9950	0.5220
1987	0.8300	0.1100	0.1100	0.6560	0.6400
1988	0.5800	0.2000	0.0300	0.2110	1.0050
1989	0.6200	0.1800	0.0300	0.0000	0.3630
1990	0.2100	0.0500	0.0000	0.2570	0.0210
1991	0.3800	0.0300	0.0400	0.0320	0.0500
1992	0.8400	0.0900	0.0000	0.2800	0.3420
1993	1.0400	0.2500	0.0300	0.1260	0.4920
1994	0.8000	0.0300	0.0100	1.8600	1.2170
1995	0.6700	0.0900	0.0100	0.1040	1.3020
1996	1.1600	0.2800	0.0200	0.0760	0.6860
1997	1.2400	0.5700	0.0400	0.5440	1.2790
1998	1.2900	1.1400	0.2900	0.1440	1.2120
1999	2.1300	1.6300	0.3300	0.0780	0.8780
2000	1.7300	1.4900	0.3100	0.2370	1.6590
2001	1.2000	1.2200	0.4000	0.1860	1.0260
2002	1.3600	0.9300	0.3700	0.1510	1.5110
2003	1.1700	0.8600	0.3500	0.2060	1.4400
2004	1.3100	1.0300	0.2500	0.0270	0.2830
2005	1.4900	1.3700	0.6600	0.1360	0.3510
2006	1.1400	0.5400	0.4700	0.0490	2.4400
2007	0.7200	1.2200	0.3500	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	MA_S	MA_F	MA_F	MA_F	CT_S
AGE	3	2	3	4	1
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	1	1	1	0
1982	0.1420	0.4000	0.4050	0.0120	0.0000
1983	0.4500	0.2340	1.6620	0.0200	0.0000
1984	0.0670	0.0330	0.6250	0.1540	0.3140
1985	0.0360	0.4850	0.2670	0.1270	0.0150
1986	0.1850	0.1170	1.8950	0.0400	0.7530
1987	0.0130	2.3160	0.6790	0.2140	0.9510
1988	0.1230	1.2020	0.6630	0.0110	0.2320
1989	0.1020	0.4740	0.4290	0.0060	0.0130
1990	0.0810	0.0000	0.3170	0.0160	0.3040
1991	0.0120	0.1130	0.0000	0.0110	0.3920
1992	0.0900	0.5310	0.2880	0.0060	0.3190
1993	0.0650	1.1810	0.1860	0.0000	0.3200
1994	0.0480	0.3350	0.4780	0.0300	0.4960
1995	0.0530	2.2340	0.0760	0.0000	0.1990
1996	0.1140	0.3420	0.5060	0.0000	0.5780
1997	0.1810	0.7610	1.2820	0.1140	0.3910
1998	0.6590	0.4940	1.5080	0.3510	0.0640
1999	1.1120	0.0120	0.5900	0.2620	0.2450
2000	1.2050	0.3470	0.9400	0.3790	0.3210
2001	0.7300	1.3830	2.3030	0.4940	0.8410
2002	0.3970	1.2440	1.0830	0.3070	1.0570
2003	0.6240	2.6810	1.3020	0.1780	1.6080
2004	0.3230	3.0590	1.2540	0.2560	0.2590
2005	1.0290	0.5890	1.4550	0.1360	0.2530
2006	0.9750	1.5570	2.0490	1.3500	0.0380
2007	0.0000	0.5860	3.7450	0.5590	0.0000

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	CT_S	CT_S	CT_S	CT_F	CT_F
AGE	2	3	4	2	3
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	1	1
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.2710	0.0440	0.0000	0.0000	0.0000
1985	0.3250	0.0400	0.0580	0.5710	0.3310
1986	0.1000	0.0820	0.0080	0.3390	0.5280
1987	0.0860	0.0140	0.0040	1.1700	0.2980
1988	0.2230	0.0350	0.0090	1.0670	0.2230
1989	0.0490	0.0240	0.0160	0.8840	0.4810
1990	0.0220	0.0130	0.0060	0.0290	0.0950
1991	0.1890	0.0290	0.0280	0.6740	0.1100
1992	0.1880	0.0210	0.0040	0.8260	0.3400
1993	0.1510	0.0150	0.0180	0.5700	0.3660
1994	0.3140	0.0250	0.0180	0.8270	0.1520
1995	0.0510	0.0200	0.0050	0.3000	0.0850
1996	0.2660	0.0860	0.0230	0.3840	0.1170
1997	0.5070	0.0570	0.0360	0.8870	1.1880
1998	0.5940	0.5030	0.1160	0.6810	1.3730
1999	0.5930	0.3850	0.1390	0.2690	1.0540
2000	0.7260	0.5240	0.0740	0.6790	1.4840
2001	0.3400	0.3650	0.1200	0.3950	0.8710
2002	1.2640	0.4650	0.2330	2.6890	1.1370
2003	1.0160	0.3950	0.2320	3.0870	1.9300
2004	0.8180	0.4100	0.1940	1.4590	1.3190
2005	0.2640	0.1500	0.0330	0.3850	0.7550
2006	0.3600	0.0680	0.0650	1.0930	0.7440
2007	0.0000	0.0000	0.0000	0.2170	0.5920

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	CT_F	CT_F	RI_F	RI_F	RI_F
AGE	4	5 - 7	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1982	0.0000	0.0000	0.9700	1.7400	0.2000
1983	0.0000	0.0000	0.2100	0.5200	0.0700
1984	0.0000	0.0000	0.1400	0.4200	0.1100
1985	0.0720	0.0250	0.7400	0.4900	0.1000
1986	0.0750	0.0090	0.3100	0.2800	0.0200
1987	0.0720	0.0070	2.4500	0.5100	0.1300
1988	0.0330	0.0030	0.9400	0.3700	0.0200
1989	0.0370	0.0030	0.3400	0.2400	0.0000
1990	0.0150	0.0010	0.0150	0.0700	0.0000
1991	0.0420	0.0120	0.6700	0.1200	0.0000
1992	0.0360	0.0220	0.1200	0.0800	0.0100
1993	0.0460	0.0250	0.7700	0.4100	0.1100
1994	0.0390	0.0070	0.4100	0.2200	0.0700
1995	0.0240	0.0090	0.1200	0.0300	0.0000
1996	0.0120	0.0050	0.5300	0.2000	0.0000
1997	0.0420	0.0050	0.9500	1.0300	0.0100
1998	0.3730	0.0400	0.5600	0.9600	0.0300
1999	0.3210	0.0750	0.0900	0.3600	0.0900
2000	0.3460	0.1270	1.0400	1.9100	0.3500
2001	0.3410	0.1910	0.5000	1.2400	0.4500
2002	0.4360	0.1340	1.0500	0.6300	0.3000
2003	0.4790	0.1830	2.4200	1.3800	0.4000
2004	0.4070	0.2030	2.3500	2.0800	0.4900
2005	0.4400	0.1190	0.4800	1.3000	0.7800
2006	0.3550	0.1510	0.8400	1.3800	0.6900
2007	0.2300	0.1790	0.1400	1.1300	0.4400

SURVEY - INPUT DATA

INDEX	31	32	33	34	35
SURVEY TAG	RI_X	RI_X	NJ	NJ	NJ
AGE	1	2 - 7	1	2	3
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	3.0600	1.0300	0.0000
1989	0.0000	0.0000	0.5100	0.1800	0.0000
1990	0.1700	0.1000	1.4400	0.1100	0.0300
1991	0.0700	0.0800	2.6900	0.2700	0.0200
1992	0.1500	0.1800	3.0000	0.5700	0.0600
1993	0.1100	0.1400	5.6900	0.2000	0.0100
1994	0.0800	0.0500	1.0700	0.0800	0.0000
1995	0.2000	0.2200	2.9300	0.2800	0.0500
1996	0.4100	0.5300	5.1000	2.7000	0.1800
1997	0.1700	0.5200	8.2500	5.2500	1.0200
1998	0.0700	0.3600	5.8000	2.6700	0.2900
1999	0.2600	0.6100	6.1200	3.4600	0.6500
2000	0.6300	1.8900	3.9100	1.8200	0.4500
2001	0.4200	0.5500	3.3200	1.1800	0.4100
2002	0.8100	1.1100	9.1100	4.1300	1.2800
2003	1.4800	2.2500	5.6100	2.5500	0.5700
2004	0.5400	1.5300	6.2700	2.4900	0.5700
2005	0.5500	1.8900	5.9900	1.2400	0.5300
2006	0.1900	1.0900	5.7400	3.2200	0.4800
2007	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	36	37	38	39	40
SURVEY TAG	NJ	DE	DE	DE	CT_Y
AGE	4 - 7	1	2	3	0
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.2400
1986	0.0000	0.0000	0.0000	0.0000	0.1720
1987	0.0000	0.0000	0.0000	0.0000	0.0750
1988	0.0000	0.0000	0.0000	0.0000	0.0150
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0320
1991	0.0000	1.1300	0.1800	0.0400	0.0360
1992	0.0200	0.2800	0.0800	0.0000	0.0130
1993	0.0100	1.5600	0.7300	0.0700	0.0840
1994	0.0200	0.1400	0.2200	0.0800	0.1320
1995	0.1600	1.0000	0.2800	0.1000	0.0230
1996	0.0500	0.7300	0.4800	0.1000	0.0690
1997	0.1800	0.1200	0.4900	0.4700	0.0330
1998	0.0400	0.3100	0.8300	0.2900	0.0000
1999	0.1800	0.0600	0.7700	0.4700	0.0440
2000	0.2200	0.2400	0.3000	0.2800	0.0120
2001	0.1500	1.5500	0.4900	0.2600	0.0210
2002	0.8100	0.2300	0.0900	0.0000	0.4420
2003	0.5100	0.1400	0.2900	0.1500	0.0000
2004	0.4300	0.0700	0.0600	0.0100	0.2550
2005	0.3200	0.3000	0.1100	0.0200	0.0670
2006	0.4000	0.1000	0.2300	0.0700	0.0980
2007	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	41	42	43	44	45
SURVEY TAG	VA_CRY	NC_Y	MD_Y	NJ_Y	NEC_Y
AGE	0	0	0	0	0
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1982	2.2700	0.0000	3.4080	0.0000	0.5500
1983	5.0100	0.0000	17.6990	0.0000	0.9600
1984	1.5800	0.0000	13.3100	0.0000	0.1800
1985	1.2600	0.0000	12.8430	0.0000	0.5900
1986	1.2600	0.0000	59.5260	0.0000	0.3900
1987	0.3900	19.8600	7.5840	0.0000	0.0700
1988	0.5400	2.6100	1.7630	0.1700	0.0600
1989	1.2400	6.6300	2.8550	1.0000	0.3100
1990	2.5400	4.2700	4.7330	1.2800	0.4400
1991	2.6400	5.8500	7.3370	1.0000	0.7600
1992	0.8900	9.1400	8.4870	1.1000	0.9900
1993	0.5000	5.1300	4.1450	2.5500	0.2300
1994	2.4100	8.1700	22.3110	1.6600	0.7500
1995	0.6300	6.6500	13.0670	4.9500	0.9300
1996	0.8100	30.6700	6.4930	1.6600	0.1100
1997	0.8900	14.1400	7.9970	1.6500	0.1700
1998	0.7300	10.4400	14.9830	0.6700	0.3800
1999	0.5300	0.0000	8.5650	1.0300	0.2100
2000	0.5700	3.9400	9.8740	0.9500	0.2200
2001	0.4700	22.0300	13.5430	0.6200	0.1200
2002	0.7700	18.2800	5.4060	1.5100	0.0600
2003	0.4400	7.2300	8.1800	0.6000	0.1800
2004	1.3000	5.9000	6.9930	0.9000	0.3600
2005	0.3500	9.8800	2.1980	3.1100	0.1600
2006	0.8000	1.9600	9.6580	0.8100	0.3100
2007	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	46	47	48	49	50
SURVEY TAG	MA_Y	DE30_Y	RI_Y	DE_EY	DE_IY
AGE	0	0	0	0	0
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0	0	0	0	0
1982	3.0000	0.0000	0.0200	0.1100	0.0000
1983	3.0000	0.0000	0.0300	0.0310	0.0000
1984	1.0000	0.0000	0.0200	0.0760	0.0000
1985	19.0000	0.0000	0.3500	0.0630	0.0000
1986	5.0000	0.0000	0.3500	0.0960	0.3200
1987	4.0000	0.0000	0.0400	0.1360	0.2600
1988	2.0000	0.0000	0.0000	0.0070	0.0100
1989	3.0000	0.0000	0.0000	0.1150	0.1400
1990	11.0000	0.0000	0.0500	0.2290	0.3600
1991	4.0000	1.4400	0.0000	0.0730	0.3800
1992	0.0000	0.4700	0.0100	0.3150	0.3700
1993	2.0000	0.0400	0.0100	0.0290	0.0500
1994	1.0000	2.2800	0.0400	0.2940	0.5700
1995	13.0000	0.9400	0.0200	0.1700	0.3000
1996	7.0000	0.4600	0.1000	0.0330	0.0800
1997	0.0000	0.0300	0.0300	0.0160	0.2200
1998	12.0000	0.1100	0.0000	0.0250	0.3900
1999	13.0000	0.2000	0.0200	0.0480	0.3500
2000	10.0000	0.7900	0.4000	0.1770	0.2100
2001	1.0000	0.3400	0.0000	0.0740	0.1400
2002	70.0000	0.0400	0.4400	0.0670	0.1300
2003	11.0000	0.1500	0.1000	0.0910	0.2100
2004	4.0000	0.0200	0.0300	0.1010	0.2700
2005	0.0000	0.0000	0.0100	0.0040	0.0100
2006	43.0000	0.4100	0.1000	0.0200	0.1700
2007	0.0000	0.0000	0.0000	0.0000	0.0000

INDEX	51				
SURVEY TAG	RI_XY				
AGE	0	NUMBERS	NUMBERS	NUMBERS	NUMBERS
TIME	JAN-1	NUMBERS	NUMBERS	NUMBERS	NUMBERS
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	0				
1982	0.0000				
1983	0.0000				
1984	0.0000				
1985	0.0000				
1986	0.0000				
1987	0.0000				
1988	0.0000				

```
    1989        0.0000
    1990        0.0200
    1991        0.0000
    1992        0.0100
    1993        0.0100
    1994        0.0400
    1995        0.0300
    1996        0.0200
    1997        0.0400
    1998        0.0000
    1999        0.0300
    2000        0.0900
    2001        0.0100
    2002        0.1100
    2003        0.0500
    2004        0.1000
    2005        0.0400
    2006        0.0400
    2007        0.0000

     Additional Output Files

Population File C:\F2008\ADAPT\F08_BASE_00.PP2
Auxilliary File C:\F2008\ADAPT\F08_BASE_00.AUX
Covariance File C:\F2008\ADAPT\F08_BASE_00.CV
Residuals File  C:\F2008\ADAPT\F08_BASE_00.RSD
Log File        C:\F2008\ADAPT\F08_BASE_00.LOG

     Bootstrap Files

Bootstrap Stock Numbers     C:\F2008\ADAPT\F08_BASE_00.BSN
Bootstrap Fishing Mortality C:\F2008\ADAPT\F08_BASE_00.BSF
Bootstrap Biomass           C:\F2008\ADAPT\F08_BASE_00.BSB
Bootstrap Catchability      C:\F2008\ADAPT\F08_BASE_00.BSQ
```

Estimation Results

JAN-1 Population Numbers

AGE	1982	1983	1984	1985	1986
0	72766.	78883.	47542.	47670.	52295.
1	42166.	54755.	60140.	34595.	37153.
2	15890.	17178.	19487.	25486.	15249.
3	2162.	4014.	4392.	2401.	4992.
4	780.	935.	1345.	791.	409.
5	157.	345.	155.	366.	208.
6	151.	27.	6.	42.	77.
7	67.	71.	14.	11.	20.
Total	134140.	156209.	133081.	111363.	110403.

AGE	1987	1988	1989	1990	1991
0	43018.	12833.	26720.	29764.	28185.
1	41062.	34194.	9790.	21010.	22694.
2	15113.	18227.	9742.	3742.	9325.
3	2737.	2812.	2159.	1545.	1120.
4	761.	778.	423.	282.	384.
5	57.	143.	74.	38.	37.
6	47.	24.	11.	12.	5.
7	71.	27.	5.	4.	2.
Total	102865.	69038.	48923.	56398.	61751.

AGE	1992	1993	1994	1995	1996
0	31780.	32665.	34771.	38198.	27954.
1	22172.	24784.	25584.	26990.	30739.
2	7761.	8170.	10256.	11676.	16856.
3	1351.	1062.	1738.	2211.	3083.
4	260.	123.	365.	550.	708.
5	121.	79.	36.	117.	100.
6	3.	37.	25.	7.	27.
7	1.	6.	9.	2.	5.
Total	63450.	66927.	72784.	79750.	79473.

AGE	1997	1998	1999	2000	2001
0	28783.	30888.	28646.	32574.	30385.
1	22741.	23539.	25248.	23290.	26650.
2	18941.	16325.	17259.	18701.	17680.
3	5544.	8314.	7655.	8522.	8188.
4	937.	1738.	2158.	2688.	2821.
5	210.	276.	552.	733.	841.
6	19.	31.	103.	135.	270.
7	7.	2.	26.	53.	73.
Total	77182.	81112.	81646.	86695.	86908.

JAN-1 Population Numbers

AGE	2002	2003	2004	2005	2006
0	35186.	26343.	42627.	17092.	31255.
1	24867.	28562.	21334.	34803.	13773.
2	19216.	19335.	21956.	16516.	26747.
3	10200.	10874.	11395.	12884.	10180.
4	3366.	4914.	5319.	5136.	6920.
5	1155.	1590.	2607.	2646.	2233.
6	364.	659.	798.	1444.	1228.
7	67.	243.	409.	1331.	553.
Total	94421.	92521.	106444.	91853.	92889.

AGE	2007
0	32177.
1	25417.
2	10309.
3	17337.
4	5397.
5	4052.
6	1050.
7	937.
Total	96677.

Fishing Mortality Calculated

AGE	1982	1983	1984	1985	1986
0	0.0844	0.0713	0.1179	0.0492	0.0418
1	0.6980	0.8331	0.6586	0.6192	0.6995
2	1.1758	1.1639	1.8939	1.4302	1.5177
3	0.6388	0.8934	1.5136	1.5702	1.6815
4	0.6148	1.5978	1.1022	1.1359	1.7679
5	1.5776	3.8962	1.0938	1.3612	1.2981
6	0.6639	1.0573	1.3915	1.4349	1.6703
7	0.6639	1.0573	1.3915	1.4349	1.6703

AGE	1987	1988	1989	1990	1991
0	0.0296	0.0707	0.0404	0.0712	0.0399
1	0.6122	1.0556	0.7617	0.6123	0.8729
2	1.4817	1.9333	1.6411	1.0060	1.7318
3	1.0584	1.6949	1.8341	1.1932	1.2589
4	1.4729	2.1550	2.2134	1.8275	0.9528
5	0.6492	2.3292	1.6175	1.8925	2.4672
6	1.1251	1.7945	1.8786	1.2780	1.1892
7	1.1251	1.7945	1.8786	1.2780	1.1892

AGE	1992	1993	1994	1995	1996
0	0.0486	0.0443	0.0533	0.0172	0.0064
1	0.7984	0.6823	0.5844	0.2707	0.2842
2	1.7892	1.3478	1.3342	1.1318	0.9121
3	2.1928	0.8671	0.9514	0.9384	0.9906
4	0.9925	1.0261	0.9410	1.5058	1.0183
5	0.9870	0.9633	1.4841	1.2495	1.4557
6	1.7790	0.8874	0.9566	1.0366	1.0052
7	1.7790	0.8874	0.9566	1.0366	1.0052

AGE	1997	1998	1999	2000	2001
0	0.0012	0.0016	0.0070	0.0007	0.0004
1	0.1315	0.1103	0.1002	0.0756	0.1271
2	0.6234	0.5573	0.5056	0.6259	0.3500
3	0.9597	1.1487	0.8466	0.9056	0.6889
4	1.0223	0.9478	0.8797	0.9620	0.6931
5	1.7155	0.7863	1.2111	0.7978	0.6373
6	0.9851	1.1008	0.8699	0.9110	0.6861
7	0.9851	1.1008	0.8699	0.9110	0.6861

Fishing Mortality Calculated

AGE	2002	2003	2004	2005	2006
0	0.0086	0.0109	0.0028	0.0159	0.0068
1	0.0516	0.0630	0.0559	0.0633	0.0897
2	0.3693	0.3288	0.3330	0.2839	0.2336
3	0.5304	0.5152	0.5969	0.4216	0.4346
4	0.5497	0.4339	0.4982	0.6330	0.3351
5	0.3609	0.4900	0.3906	0.5680	0.5542
6	0.5203	0.4892	0.5391	0.4885	0.4413
7	0.5203	0.4892	0.5391	0.4885	0.4413

Average Fishing Mortality For Ages 3- 5

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1982	0.9438	0.6804	0.7098	0.7121
1983	2.1291	1.2136	1.4097	1.3494
1984	1.2365	1.4087	1.3731	1.4208
1985	1.3558	1.4521	1.4093	1.4636
1986	1.5825	1.6736	1.6624	1.6753
1987	1.0602	1.1406	1.1735	1.1555
1988	2.0597	1.8150	1.8788	1.8234
1989	1.8883	1.8885	1.9063	1.8922
1990	1.6378	1.3034	1.3416	1.3226
1991	1.5597	1.2119	1.2113	1.2309
1992	1.3908	1.9280	1.8020	1.9954
1993	0.9522	0.8886	0.8955	0.8904
1994	1.1255	0.9586	0.9657	0.9610
1995	1.2312	1.0594	1.1283	1.0839
1996	1.1549	1.0076	1.0197	1.0102
1997	1.2325	0.9921	1.0273	1.0000
1998	0.9609	1.1052	1.0845	1.1099
1999	0.9791	0.8729	0.8911	0.8771
2000	0.8884	0.9117	0.9079	0.9127
2001	0.6731	0.6862	0.6837	0.6864
2002	0.4803	0.5215	0.5122	0.5251
2003	0.4797	0.4899	0.4848	0.4920
2004	0.4952	0.5419	0.5230	0.5498
2005	0.5408	0.4928	0.5076	0.5065
2006	0.4413	0.4128	0.4149	0.4221

Back Calculated Partial Recruitment

AGE	1982	1983	1984	1985	1986
0	0.0535	0.0183	0.0623	0.0314	0.0236
1	0.4424	0.2138	0.3477	0.3944	0.3957
2	0.7453	0.2987	1.0000	0.9108	0.8585
3	0.4049	0.2293	0.7992	1.0000	0.9512
4	0.3897	0.4101	0.5820	0.7234	1.0000
5	1.0000	1.0000	0.5775	0.8669	0.7343
6	0.4208	0.2714	0.7347	0.9138	0.9448
7	0.4208	0.2714	0.7347	0.9138	0.9448

AGE	1987	1988	1989	1990	1991
0	0.0200	0.0304	0.0183	0.0376	0.0162
1	0.4132	0.4532	0.3441	0.3235	0.3538
2	1.0000	0.8300	0.7414	0.5316	0.7019
3	0.7144	0.7277	0.8287	0.6305	0.5103
4	0.9941	0.9252	1.0000	0.9657	0.3862
5	0.4382	1.0000	0.7307	1.0000	1.0000
6	0.7593	0.7704	0.8488	0.6753	0.4820
7	0.7593	0.7704	0.8488	0.6753	0.4820

AGE	1992	1993	1994	1995	1996
0	0.0222	0.0329	0.0359	0.0115	0.0044
1	0.3641	0.5063	0.3938	0.1798	0.1952
2	0.8159	1.0000	0.8990	0.7516	0.6265
3	1.0000	0.6433	0.6411	0.6232	0.6805
4	0.4526	0.7613	0.6340	1.0000	0.6995
5	0.4501	0.7148	1.0000	0.8298	1.0000
6	0.8113	0.6584	0.6446	0.6884	0.6905
7	0.8113	0.6584	0.6446	0.6884	0.6905

AGE	1997	1998	1999	2000	2001
0	0.0007	0.0014	0.0058	0.0008	0.0006
1	0.0766	0.0961	0.0827	0.0785	0.1833
2	0.3634	0.4851	0.4175	0.6506	0.5050
3	0.5594	1.0000	0.6991	0.9414	0.9939
4	0.5959	0.8251	0.7264	1.0000	1.0000
5	1.0000	0.6844	1.0000	0.8293	0.9195
6	0.5742	0.9582	0.7183	0.9470	0.9900
7	0.5742	0.9582	0.7183	0.9470	0.9900

Back Calculated Partial Recruitment

AGE	2002	2003	2004	2005	2006
0	0.0156	0.0212	0.0046	0.0252	0.0122
1	0.0939	0.1223	0.0937	0.1000	0.1618
2	0.6718	0.6382	0.5579	0.4485	0.4215
3	0.9648	1.0000	1.0000	0.6660	0.7842
4	1.0000	0.8422	0.8346	1.0000	0.6047
5	0.6565	0.9512	0.6544	0.8973	1.0000
6	0.9465	0.9496	0.9032	0.7718	0.7963
7	0.9465	0.9496	0.9032	0.7718	0.7963

JAN-1 Biomass

AGE	1982	1983	1984	1985	1986
0	0.	0.	0.	0.	0.
1	13468.	17823.	18541.	11271.	13442.
2	7409.	9398.	10005.	12557.	8154.
3	3357.	3267.	3800.	2010.	4210.
4	1680.	1260.	1708.	1063.	568.
5	458.	583.	255.	679.	386.
6	412.	71.	13.	102.	212.
7	260.	186.	56.	54.	81.
Total	27044.	32588.	34379.	27736.	27053.

AGE	1987	1988	1989	1990	1991
0	0.	0.	0.	0.	0.
1	13731.	11841.	3733.	6290.	7269.
2	8206.	9573.	5637.	2284.	5129.
3	2389.	2412.	1742.	1421.	1098.
4	1141.	1095.	547.	358.	558.
5	127.	314.	146.	67.	73.
6	120.	82.	28.	33.	11.
7	248.	102.	14.	20.	6.
Total	25963.	25418.	11846.	10473.	14145.

AGE	1992	1993	1994	1995	1996
0	0.	0.	0.	0.	0.
1	5789.	8553.	9553.	11784.	13710.
2	4285.	4683.	5667.	6986.	9327.
3	1251.	1111.	1690.	1801.	2638.
4	334.	176.	639.	818.	905.
5	268.	127.	77.	274.	179.
6	6.	102.	62.	22.	71.
7	6.	14.	33.	7.	15.
Total	11940.	14765.	17721.	21691.	26844.

AGE	1997	1998	1999	2000	2001
0	0.	0.	0.	0.	0.
1	8782.	7587.	7827.	6277.	5050.
2	10813.	8835.	9311.	9476.	11029.
3	3895.	6160.	5833.	6317.	6701.
4	1082.	1859.	2399.	2934.	3266.
5	391.	476.	896.	1310.	1420.
6	43.	74.	263.	307.	649.
7	20.	6.	92.	149.	241.
Total	25027.	24997.	26622.	26769.	28356.

JAN-1 Biomass

AGE	2002	2003	2004	2005	2006
0	0.	0.	0.	0.	0.
1	5896.	7797.	5920.	12609.	4119.
2	12160.	11827.	13439.	9878.	14478.
3	8738.	9487.	9768.	10670.	8298.
4	3878.	5951.	6279.	5503.	7492.
5	2014.	2681.	4270.	3766.	3118.
6	871.	1586.	1762.	2627.	2224.
7	252.	961.	1529.	4838.	2092.
Total	33808.	40291.	42967.	49892.	41822.

AGE	2007
0	0.
1	7956.
2	6019.
3	14449.
4	5999.
5	6021.
6	2044.
7	3487.
Total	45974.

Mean Biomass

AGE	1982	1983	1984	1985	1986
0	16087.	16581.	10100.	12194.	11753.
1	11631.	14235.	15984.	10108.	11100.
2	5317.	6712.	5157.	7706.	4866.
3	2118.	2624.	2198.	1248.	2609.
4	1017.	545.	1128.	754.	311.
5	206.	124.	188.	425.	215.
6	270.	39.	9.	56.	115.
7	174.	106.	28.	26.	37.
Total	36820.	40967.	34792.	32517.	31005.

AGE	1987	1988	1989	1990	1991
0	9955.	3553.	4940.	6569.	3633.
1	12427.	9016.	2893.	6200.	5664.
2	4762.	4700.	3219.	1761.	2898.
3	1775.	1425.	963.	975.	699.
4	717.	520.	236.	186.	412.
5	110.	129.	76.	34.	33.
6	86.	41.	11.	22.	7.
7	137.	44.	6.	10.	3.
Total	29970.	19428.	12344.	15756.	13350.

AGE	1992	1993	1994	1995	1996
0	6894.	7651.	10904.	13390.	8335.
1	6592.	8002.	9362.	11560.	12427.
2	2523.	2905.	3293.	4375.	5798.
3	627.	954.	1397.	1394.	1946.
4	211.	118.	457.	432.	633.
5	191.	87.	48.	162.	95.
6	3.	63.	50.	14.	41.
7	3.	8.	19.	4.	9.
Total	17043.	19789.	25530.	31332.	29284.

AGE	1997	1998	1999	2000	2001
0	5528.	7245.	3700.	1948.	3139.
1	8749.	9916.	8092.	10341.	12365.
2	8247.	7418.	7354.	8809.	10417.
3	2842.	3921.	4252.	4770.	5251.
4	667.	1366.	1899.	2114.	2703.
5	210.	423.	591.	1029.	1222.
6	29.	44.	172.	211.	466.
7	12.	4.	56.	90.	160.
Total	26283.	30337.	26116.	29312.	35722.

Mean Biomass

AGE	2002	2003	2004	2005	2006
0	4669.	3539.	11806.	3105.	4207.
1	10839.	12733.	9731.	13127.	5297.
2	10783.	11398.	12577.	9061.	14823.
3	6934.	8032.	7603.	8904.	7236.
4	3247.	5572.	5160.	4133.	6769.
5	1855.	2380.	3449.	2776.	2578.
6	692.	1314.	1327.	1972.	1979.
7	180.	695.	1081.	3497.	1545.
Total	39199.	45663.	52735.	46576.	44433.

Spawning Stock Biomass

AGE	1982	1983	1984	1985	1986
0	6595.	6845.	4163.	4979.	5008.
1	9178.	10188.	12372.	7959.	8221.
2	3723.	4428.	2583.	4951.	2891.
3	1488.	1954.	1319.	716.	1454.
4	698.	319.	794.	473.	165.
5	98.	23.	123.	261.	143.
6	193.	33.	7.	40.	56.
7	127.	65.	15.	14.	17.
Total	22100.	23855.	21374.	19392.	17955.

AGE	1987	1988	1989	1990	1991
0	4283.	1402.	2237.	2691.	1957.
1	9483.	5926.	2250.	4978.	4272.
2	2894.	2271.	1771.	1245.	1567.
3	1271.	723.	476.	662.	418.
4	401.	209.	96.	96.	306.
5	90.	43.	43.	16.	10.
6	56.	14.	8.	12.	6.
7	83.	19.	2.	6.	2.
Total	18560.	10609.	6882.	9706.	8537.

AGE	1992	1993	1994	1995	1996
0	3065.	3415.	4390.	5188.	3294.
1	4749.	5758.	6981.	9106.	10312.
2	1383.	1954.	2118.	3019.	4325.
3	252.	725.	965.	1035.	1297.
4	149.	88.	321.	232.	454.
5	124.	69.	27.	91.	54.
6	1.	51.	36.	8.	28.
7	1.	6.	13.	2.	6.
Total	9724.	12067.	14851.	18682.	19770.

AGE	1997	1998	1999	2000	2001
0	2647.	2909.	2090.	1561.	1916.
1	8047.	8659.	8274.	9880.	11147.
2	6626.	6178.	6516.	7175.	9077.
3	2122.	2790.	3298.	3677.	4272.
4	531.	1022.	1472.	1610.	2214.
5	101.	305.	373.	748.	970.
6	25.	33.	118.	165.	436.
7	8.	2.	38.	59.	115.
Total	20106.	21899.	22179.	24875.	30147.

Spawning Stock Biomass

AGE	2002	2003	2004	2005	2006
0	2598.	1991.	3819.	1450.	2471.
1	10522.	12056.	9105.	12854.	5302.
2	9709.	10067.	11018.	8384.	14339.
3	6276.	6793.	6099.	7930.	6378.
4	2858.	4652.	4162.	3414.	6267.
5	1671.	1940.	2868.	2392.	2205.
6	706.	1270.	1385.	2577.	2316.
7	139.	543.	828.	2732.	1229.
Total	34479.	39311.	39284.	41733.	40508.

Catch Biomass

AGE	1982	1983	1984	1985	1986
0	1357.	1182.	1191.	601.	491.
1	8119.	11860.	10526.	6259.	7764.
2	6252.	7812.	9767.	11021.	7385.
3	1353.	2345.	3326.	1960.	4387.
4	625.	871.	1244.	856.	550.
5	324.	483.	205.	579.	279.
6	179.	41.	13.	80.	192.
7	116.	112.	39.	38.	61.
Total	18325.	24706.	26312.	21393.	21110.

AGE	1987	1988	1989	1990	1991
0	294.	251.	200.	468.	145.
1	7608.	9518.	2203.	3796.	4945.
2	7056.	9087.	5282.	1771.	5018.
3	1879.	2415.	1766.	1163.	880.
4	1056.	1120.	522.	340.	393.
5	72.	301.	124.	64.	81.
6	97.	74.	22.	28.	9.
7	155.	79.	11.	13.	4.
Total	18215.	22844.	10130.	7643.	11474.

AGE	1992	1993	1994	1995	1996
0	335.	339.	581.	231.	53.
1	5263.	5460.	5471.	3130.	3532.
2	4513.	3915.	4393.	4951.	5288.
3	1375.	827.	1329.	1308.	1928.
4	210.	121.	430.	651.	644.
5	189.	84.	71.	202.	139.
6	5.	56.	48.	15.	41.
7	4.	7.	19.	4.	9.
Total	11894.	10810.	12342.	10492.	11634.

AGE	1997	1998	1999	2000	2001
0	6.	12.	26.	1.	1.
1	1150.	1094.	811.	781.	1571.
2	5141.	4134.	3718.	5513.	3646.
3	2727.	4504.	3600.	4320.	3617.
4	682.	1295.	1671.	2034.	1874.
5	360.	333.	715.	821.	779.
6	28.	49.	149.	192.	319.
7	12.	4.	49.	82.	110.
Total	10107.	11424.	10739.	13745.	11917.

Catch Biomass

AGE	2002	2003	2004	2005	2006
0	40.	39.	33.	49.	28.
1	560.	803.	544.	831.	475.
2	3982.	3747.	4189.	2572.	3463.
3	3678.	4138.	4538.	3754.	3145.
4	1785.	2417.	2571.	2616.	2268.
5	670.	1167.	1347.	1577.	1429.
6	360.	643.	716.	963.	812.
7	94.	340.	583.	1708.	682.
Total	11168.	13293.	14520.	14071.	12302.

Catch Numbers

AGE	1982	1983	1984	1985	1986
0	5344.0	4925.0	4802.0	2078.0	1942.0
1	19423.0	28441.0	26582.0	14623.0	17140.0
2	10149.0	10911.0	15454.0	17979.0	11055.0
3	935.0	2181.0	3180.0	1767.0	3782.0
4	328.0	693.0	829.0	496.0	316.0
5	116.0	323.0	95.0	252.0	140.0
6	67.0	16.0	4.0	30.0	58.0
7	30.0	43.0	10.0	8.0	15.0
Total	36392.0	47533.0	50956.0	37233.0	34448.0

AGE	1987	1988	1989	1990	1991
0	1137.0	795.0	960.0	1856.0	1001.0
1	17212.0	20557.0	4790.0	8808.0	12149.0
2	10838.0	14562.0	7306.0	2187.0	7148.0
3	1648.0	2137.0	1692.0	995.0	742.0
4	544.0	644.0	353.0	221.0	217.0
5	25.0	121.0	55.0	30.0	32.0
6	29.0	19.0	9.0	8.0	3.0
7	44.0	21.0	4.0	3.0	1.0
Total	31477.0	38856.0	15169.0	14108.0	21293.0

AGE	1992	1993	1994	1995	1996
0	1368.0	1285.0	1638.0	592.0	162.0
1	11197.0	11235.0	10362.0	5828.0	6925.0
2	6026.0	5601.0	6996.0	7303.0	9278.0
3	1125.0	566.0	982.0	1239.0	1785.0
4	151.0	73.0	205.0	397.0	417.0
5	70.0	45.0	26.0	77.0	71.0
6	2.0	20.0	14.0	4.0	16.0
7	1.0	3.0	5.0	1.0	3.0
Total	19940.0	18828.0	20228.0	15441.0	18657.0

AGE	1997	1998	1999	2000	2001
0	30.0	45.0	181.0	22.0	11.0
1	2545.0	2233.0	2185.0	1538.0	2888.0
2	8046.0	6380.0	6260.0	7967.0	4760.0
3	3149.0	5243.0	4018.0	4670.0	3737.0
4	553.0	980.0	1161.0	1529.0	1293.0
5	160.0	138.0	358.0	370.0	363.0
6	11.0	19.0	55.0	74.0	123.0
7	4.0	1.0	14.0	29.0	33.0
Total	14498.0	15039.0	14232.0	16199.0	13208.0

Catch Numbers

AGE	2002	2003	2004	2005	2006
0	272.0	259.0	107.0	245.0	191.0
1	1135.0	1583.0	1053.0	1936.0	1072.0
2	5411.0	4937.0	5668.0	3717.0	5070.0
3	3839.0	4002.0	4688.0	4045.0	3276.0
4	1302.0	1579.0	1907.0	2206.0	1796.0
5	319.0	563.0	769.0	1049.0	869.0
6	135.0	233.0	304.0	510.0	372.0
7	25.0	86.0	156.0	470.0	180.0
Total	12438.0	13242.0	14652.0	14178.0	12826.0

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1982	27044.244	5544.020	18325.256	23869.276
1983	32588.264	1790.651	24705.643	26496.294
1984	34378.915	-6642.992	26311.969	19668.977
1985	27735.923	-683.298	21392.794	20709.496
1986	27052.624	-1089.676	21109.693	20020.017
1987	25962.949	-545.437	18215.288	17669.851
1988	25417.512	-13571.657	22844.063	9272.406
1989	11845.855	-1372.765	10129.975	8757.210
1990	10473.090	3671.898	7642.899	11314.797
1991	14144.988	-2205.229	11473.644	9268.415
1992	11939.759	2825.649	11893.667	14719.316
1993	14765.408	2955.978	10809.985	13765.963
1994	17721.386	3969.841	12342.219	16312.060
1995	21691.227	5152.681	10492.420	15645.101
1996	26843.909	-1817.382	11634.385	9817.003
1997	25026.527	-29.288	10107.389	10078.101
1998	24997.239	1624.348	11423.908	13048.256
1999	26621.587	146.933	10739.415	10886.348
2000	26768.520	1587.579	13744.550	15332.129
2001	28356.098	5451.901	11917.151	17369.052
2002	33807.999	6482.626	11167.880	17650.506
2003	40290.625	2676.324	13293.127	15969.451
2004	42966.949	6924.880	14520.135	21445.015
2005	49891.829	-8069.711	14070.761	6001.050
2006	41822.118	4151.659	12302.217	16453.876
2007	45973.776			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	NEC_W	1	JAN-1	NUMBER	0.1420E-03	0.2696E-04	0.1899E+00
2	NEC_W	2	JAN-1	NUMBER	0.4165E-03	0.4567E-04	0.1097E+00
3	NEC_W	3	JAN-1	NUMBER	0.3412E-03	0.4563E-04	0.1337E+00
4	NEC_W	4	JAN-1	NUMBER	0.3376E-03	0.6751E-04	0.2000E+00
5	NEC_W	5 - 7	JAN-1	NUMBER	0.4480E-03	0.7427E-04	0.1658E+00
6	NEC_S	1	JAN-1	NUMBER	0.1382E-04	0.1966E-05	0.1423E+00
7	NEC_S	2	JAN-1	NUMBER	0.3792E-04	0.3796E-05	0.1001E+00
8	NEC_S	3	JAN-1	NUMBER	0.3442E-04	0.5555E-05	0.1614E+00
9	NEC_S	4	JAN-1	NUMBER	0.3840E-04	0.4764E-05	0.1241E+00
10	NEC_S	5 - 7	JAN-1	NUMBER	0.6527E-04	0.8139E-05	0.1247E+00
11	NEC_F	2	JAN-1	NUMBER	0.6761E-04	0.4435E-05	0.6560E-01
12	NEC_F	3	JAN-1	NUMBER	0.8110E-04	0.1039E-04	0.1281E+00
13	NEC_F	4	JAN-1	NUMBER	0.7563E-04	0.1069E-04	0.1413E+00
15	MA_S	2	JAN-1	NUMBER	0.4066E-04	0.7665E-05	0.1885E+00
16	MA_S	3	JAN-1	NUMBER	0.4324E-04	0.7101E-05	0.1642E+00
18	MA_F	3	JAN-1	NUMBER	0.1682E-03	0.1785E-04	0.1061E+00
19	MA_F	4	JAN-1	NUMBER	0.6573E-04	0.1295E-04	0.1970E+00
21	CT_S	2	JAN-1	NUMBER	0.1735E-04	0.2786E-05	0.1606E+00
22	CT_S	3	JAN-1	NUMBER	0.1847E-04	0.2841E-05	0.1539E+00
23	CT_S	4	JAN-1	NUMBER	0.2959E-04	0.5606E-05	0.1894E+00
24	CT_F	2	JAN-1	NUMBER	0.4258E-04	0.6790E-05	0.1595E+00
25	CT_F	3	JAN-1	NUMBER	0.1078E-03	0.1382E-04	0.1282E+00
26	CT_F	4	JAN-1	NUMBER	0.8821E-04	0.1220E-04	0.1383E+00
27	CT_F	5 - 7	JAN-1	NUMBER	0.6061E-04	0.1057E-04	0.1743E+00
29	RI_F	3	JAN-1	NUMBER	0.1115E-03	0.1700E-04	0.1525E+00
30	RI_F	4	JAN-1	NUMBER	0.8545E-04	0.1805E-04	0.2112E+00
31	RI_X	1	JAN-1	NUMBER	0.1045E-04	0.2173E-05	0.2080E+00
32	RI_X	2 - 7	JAN-1	NUMBER	0.2095E-04	0.3534E-05	0.1687E+00
33	NJ	1	JAN-1	NUMBER	0.1582E-03	0.2363E-04	0.1493E+00
34	NJ	2	JAN-1	NUMBER	0.6880E-04	0.1540E-04	0.2238E+00
35	NJ	3	JAN-1	NUMBER	0.4369E-04	0.8036E-05	0.1839E+00
36	NJ	4 - 7	JAN-1	NUMBER	0.5884E-04	0.1018E-04	0.1730E+00
40	CT_Y	0	JAN-1	NUMBER	0.1846E-05	0.3986E-06	0.2160E+00
41	VA_CRY	0	JAN-1	NUMBER	0.2820E-04	0.3220E-05	0.1142E+00
43	MD_Y	0	JAN-1	NUMBER	0.2388E-03	0.3044E-04	0.1275E+00
44	NJ_Y	0	JAN-1	NUMBER	0.3928E-04	0.5839E-05	0.1487E+00
45	NEC_Y	0	JAN-1	NUMBER	0.8183E-05	0.1233E-05	0.1507E+00
50	DE_IY	0	JAN-1	NUMBER	0.5487E-05	0.1072E-05	0.1954E+00
51	RI_XY	0	JAN-1	NUMBER	0.1057E-05	0.2145E-06	0.2028E+00

Survey Index: 1 Tag: NEC_W AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.141956E-03 % Variance Contribution = 2.0475
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.598569E+01	N/A
1983	N/A	0.777287E+01	N/A
1984	N/A	0.853730E+01	N/A
1985	N/A	0.491096E+01	N/A
1986	N/A	0.527415E+01	N/A
1987	N/A	0.582907E+01	N/A
1988	N/A	0.485400E+01	N/A
1989	N/A	0.138973E+01	N/A
1990	N/A	0.298243E+01	N/A
1991	N/A	0.322155E+01	N/A
1992	0.715000E+01	0.314747E+01	0.820512E+00
1993	0.650000E+01	0.351828E+01	0.613829E+00
1994	0.376000E+01	0.363184E+01	0.346795E-01
1995	0.607000E+01	0.383134E+01	0.460143E+00
1996	0.221700E+02	0.436362E+01	0.162544E+01
1997	0.386000E+01	0.322818E+01	0.178748E+00
1998	0.168000E+01	0.334148E+01	-0.687619E+00
1999	0.211000E+01	0.358412E+01	-0.529825E+00
2000	0.700000E+00	0.330610E+01	-0.155244E+01
2001	0.307000E+01	0.378308E+01	-0.208860E+00
2002	0.277000E+01	0.353003E+01	-0.242458E+00
2003	0.817000E+01	0.405456E+01	0.700627E+00
2004	0.145000E+01	0.302842E+01	-0.736479E+00
2005	0.296000E+01	0.494054E+01	-0.512284E+00
2006	0.264000E+01	0.195512E+01	0.300327E+00
2007	0.277000E+01	0.360810E+01	-0.264333E+00

Survey Index: 2 Tag: NEC_W AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.416467E-03 % Variance Contribution = 0.6825
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.661760E+01	N/A
1983	N/A	0.715387E+01	N/A
1984	N/A	0.811568E+01	N/A
1985	N/A	0.106140E+02	N/A
1986	N/A	0.635063E+01	N/A
1987	N/A	0.629400E+01	N/A
1988	N/A	0.759106E+01	N/A
1989	N/A	0.405717E+01	N/A
1990	N/A	0.155847E+01	N/A
1991	N/A	0.388338E+01	N/A
1992	0.474000E+01	0.323239E+01	0.382815E+00
1993	0.670000E+01	0.340259E+01	0.677570E+00

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1994     0.720000E+01     0.427136E+01     0.522148E+00
1995     0.459000E+01     0.486275E+01    -0.577246E-01
1996     0.833000E+01     0.702008E+01     0.171089E+00
1997     0.480000E+01     0.788832E+01    -0.496768E+00
1998     0.325000E+01     0.679865E+01    -0.738069E+00
1999     0.480000E+01     0.718760E+01    -0.403742E+00
2000     0.652000E+01     0.778831E+01    -0.177749E+00
2001     0.533000E+01     0.736328E+01    -0.323154E+00
2002     0.107400E+02     0.800265E+01     0.294202E+00
2003     0.143600E+02     0.805239E+01     0.578477E+00
2004     0.868000E+01     0.914402E+01    -0.520787E-01
2005     0.403000E+01     0.687841E+01    -0.534621E+00
2006     0.906000E+01     0.111395E+02    -0.206624E+00
2007     0.618000E+01     0.429345E+01     0.364228E+00

Survey Index:    3 Tag:         NEC_W    AGE =  3
Time = JAN-1           Type = NUMBER
Catchability =    0.341157E-03   % Variance Contribution =     1.0150
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     N/A              0.737683E+00     N/A
1983     N/A              0.136957E+01     N/A
1984     N/A              0.149823E+01     N/A
1985     N/A              0.819107E+00     N/A
1986     N/A              0.170322E+01     N/A
1987     N/A              0.933731E+00     N/A
1988     N/A              0.959302E+00     N/A
1989     N/A              0.736510E+00     N/A
1990     N/A              0.527252E+00     N/A
1991     N/A              0.382213E+00     N/A
1992     0.330000E+00     0.460926E+00    -0.334145E+00
1993     0.310000E+00     0.362255E+00    -0.155775E+00
1994     0.820000E+00     0.592924E+00     0.324238E+00
1995     0.250000E+00     0.754462E+00    -0.110454E+01
1996     0.600000E+00     0.105167E+01    -0.561201E+00
1997     0.104000E+01     0.189128E+01    -0.598034E+00
1998     0.229000E+01     0.283631E+01    -0.213951E+00
1999     0.290000E+01     0.261156E+01     0.104763E+00
2000     0.496000E+01     0.290745E+01     0.534129E+00
2001     0.642000E+01     0.279342E+01     0.832150E+00
2002     0.558000E+01     0.347996E+01     0.472167E+00
2003     0.848000E+01     0.370984E+01     0.826721E+00
2004     0.456000E+01     0.388738E+01     0.159588E+00
2005     0.307000E+01     0.439558E+01    -0.358922E+00
2006     0.429000E+01     0.347310E+01     0.211240E+00
2007     0.515000E+01     0.591459E+01    -0.138425E+00

Survey Index:    4 Tag:         NEC_W    AGE =  4
Time = JAN-1           Type = NUMBER
Catchability =    0.337567E-03   % Variance Contribution =     2.2698
Residual = LN(Observed) - LN(Predicted)
```

Year	Observed	Predicted	Residual
1982	N/A	0.263309E+00	N/A
1983	N/A	0.315483E+00	N/A
1984	N/A	0.454103E+00	N/A
1985	N/A	0.267158E+00	N/A
1986	N/A	0.138030E+00	N/A
1987	N/A	0.256767E+00	N/A
1988	N/A	0.262477E+00	N/A
1989	N/A	0.142701E+00	N/A
1990	N/A	0.953159E-01	N/A
1991	N/A	0.129526E+00	N/A
1992	0.400000E-01	0.879242E-01	-0.787596E+00
1993	0.500000E-01	0.416751E-01	0.182118E+00
1994	0.260000E+00	0.123309E+00	0.745987E+00
1995	0.200000E-01	0.185508E+00	-0.222737E+01
1996	0.120000E+00	0.239137E+00	-0.689543E+00
1997	0.430000E+00	0.316386E+00	0.306821E+00
1998	0.420000E+00	0.586846E+00	-0.334508E+00
1999	0.840000E+00	0.728459E+00	0.142470E+00
2000	0.251000E+01	0.907322E+00	0.101754E+01
2001	0.244000E+01	0.952268E+00	0.940907E+00
2002	0.226000E+01	0.113631E+01	0.687579E+00
2003	0.267000E+01	0.165875E+01	0.476015E+00
2004	0.164000E+01	0.179541E+01	-0.905359E-01
2005	0.134000E+01	0.173371E+01	-0.257592E+00
2006	0.247000E+01	0.233605E+01	0.557554E-01
2007	0.154000E+01	0.182181E+01	-0.168048E+00

Survey Index: 5 Tag: NEC_W AGE = 5 - 7
Time = JAN-1 Type = NUMBER
Catchability = 0.447993E-03 % Variance Contribution = 1.3646
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.168212E+00	N/A
1983	N/A	0.198627E+00	N/A
1984	N/A	0.783709E-01	N/A
1985	N/A	0.187970E+00	N/A
1986	N/A	0.136512E+00	N/A
1987	N/A	0.780604E-01	N/A
1988	N/A	0.870151E-01	N/A
1989	N/A	0.404212E-01	N/A
1990	N/A	0.243346E-01	N/A
1991	N/A	0.194429E-01	N/A
1992	0.400000E-01	0.560117E-01	-0.336682E+00
1993	0.400000E-01	0.544552E-01	-0.308499E+00
1994	0.100000E-01	0.312442E-01	-0.113925E+01
1995	N/A	0.560531E-01	N/A
1996	0.300000E-01	0.592879E-01	-0.681208E+00
1997	0.150000E+00	0.105502E+00	0.351905E+00
1998	0.120000E+00	0.138226E+00	-0.141402E+00
1999	0.410000E+00	0.305012E+00	0.295807E+00

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2000     0.108000E+01     0.412287E+00     0.962997E+00
2001     0.134000E+01     0.530297E+00     0.926987E+00
2002     0.133000E+01     0.710651E+00     0.626753E+00
2003     0.196000E+01     0.111677E+01     0.562500E+00
2004     0.144000E+01     0.170866E+01    -0.171066E+00
2005     0.149000E+01     0.242867E+01    -0.488567E+00
2006     0.258000E+01     0.179781E+01     0.361219E+00
2007     0.119000E+01     0.270594E+01    -0.821496E+00

Survey Index:    6 Tag:         NEC_S    AGE =  1
Time = JAN-1           Type = NUMBER
Catchability =    0.138176E-04   % Variance Contribution =     3.1103
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     0.700000E+00     0.582628E+00     0.183531E+00
1983     0.320000E+00     0.756587E+00    -0.860497E+00
1984     0.170000E+00     0.830994E+00    -0.158682E+01
1985     0.550000E+00     0.478018E+00     0.140270E+00
1986     0.148000E+01     0.513370E+00     0.105880E+01
1987     0.470000E+00     0.567384E+00    -0.188303E+00
1988     0.600000E+00     0.472474E+00     0.238948E+00
1989     0.600000E-01     0.135272E+00    -0.812943E+00
1990     0.630000E+00     0.290300E+00     0.774804E+00
1991     0.790000E+00     0.313575E+00     0.923993E+00
1992     0.770000E+00     0.306365E+00     0.921612E+00
1993     0.730000E+00     0.342459E+00     0.756893E+00
1994     0.350000E+00     0.353512E+00    -0.998476E-02
1995     0.790000E+00     0.372931E+00     0.750639E+00
1996     0.108000E+01     0.424742E+00     0.933235E+00
1997     0.290000E+00     0.314221E+00    -0.802170E-01
1998     0.270000E+00     0.325249E+00    -0.186170E+00
1999     0.220000E+00     0.348867E+00    -0.461064E+00
2000     0.190000E+00     0.321806E+00    -0.526923E+00
2001     0.480000E+00     0.368233E+00     0.265070E+00
2002     0.340000E+00     0.343602E+00    -0.105380E-01
2003     0.540000E+00     0.394658E+00     0.313549E+00
2004     0.300000E+00     0.294777E+00     0.175616E-01
2005     0.260000E+00     0.480897E+00    -0.614971E+00
2006     0.400000E-01     0.190305E+00    -0.155975E+01
2007     0.240000E+00     0.351201E+00    -0.380720E+00

Survey Index:    7 Tag:         NEC_S    AGE =  2
Time = JAN-1           Type = NUMBER
Catchability =    0.379163E-04   % Variance Contribution =     1.5403
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     0.143000E+01     0.602485E+00     0.864367E+00
1983     0.390000E+00     0.651308E+00    -0.512836E+00
1984     0.330000E+00     0.738874E+00    -0.806035E+00
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1985	0.156000E+01	0.966324E+00	0.478942E+00
1986	0.430000E+00	0.578179E+00	-0.296098E+00
1987	0.430000E+00	0.573023E+00	-0.287141E+00
1988	0.810000E+00	0.691111E+00	0.158733E+00
1989	0.230000E+00	0.369376E+00	-0.473735E+00
1990	0.300000E-01	0.141888E+00	-0.155384E+01
1991	0.270000E+00	0.353554E+00	-0.269615E+00
1992	0.410000E+00	0.294286E+00	0.331606E+00
1993	0.500000E+00	0.309782E+00	0.478741E+00
1994	0.530000E+00	0.388877E+00	0.309614E+00
1995	0.270000E+00	0.442719E+00	-0.494512E+00
1996	0.560000E+00	0.639127E+00	-0.132167E+00
1997	0.670000E+00	0.718175E+00	-0.694357E-01
1998	0.520000E+00	0.618968E+00	-0.174224E+00
1999	0.740000E+00	0.654379E+00	0.122963E+00
2000	0.103000E+01	0.709069E+00	0.373361E+00
2001	0.890000E+00	0.670373E+00	0.283387E+00
2002	0.890000E+00	0.728584E+00	0.200119E+00
2003	0.129000E+01	0.733112E+00	0.565099E+00
2004	0.145000E+01	0.832497E+00	0.554889E+00
2005	0.650000E+00	0.626230E+00	0.372553E-01
2006	0.104000E+01	0.101417E+01	0.251533E-01
2007	0.520000E+00	0.390888E+00	0.285409E+00

Survey Index: 8 Tag: NEC_S AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.344239E-04 % Variance Contribution = 3.6939
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.120000E+00	0.744349E-01	0.477567E+00
1983	0.190000E+00	0.138195E+00	0.318360E+00
1984	0.900000E-01	0.151176E+00	-0.518638E+00
1985	0.210000E+00	0.826507E-01	0.932484E+00
1986	0.200000E+00	0.171860E+00	0.151635E+00
1987	0.200000E-01	0.942168E-01	-0.154987E+01
1988	0.700000E-01	0.967969E-01	-0.324120E+00
1989	0.200000E-01	0.743165E-01	-0.131260E+01
1990	0.600000E-01	0.532016E-01	0.120257E+00
1991	N/A	0.385666E-01	N/A
1992	0.100000E-01	0.465091E-01	-0.153706E+01
1993	0.400000E-01	0.365528E-01	0.901224E-01
1994	0.400000E-01	0.598281E-01	-0.402597E+00
1995	0.200000E-01	0.761279E-01	-0.133668E+01
1996	0.120000E+00	0.106117E+00	0.122951E+00
1997	0.900000E-01	0.190837E+00	-0.751609E+00
1998	0.320000E+00	0.286193E+00	0.111653E+00
1999	0.480000E+00	0.263515E+00	0.599674E+00
2000	0.630000E+00	0.293372E+00	0.764278E+00
2001	0.102000E+01	0.281866E+00	0.128613E+01
2002	0.740000E+00	0.351140E+00	0.745464E+00
2003	0.590000E+00	0.374336E+00	0.454968E+00
2004	0.850000E+00	0.392250E+00	0.773337E+00
2005	0.580000E+00	0.443529E+00	0.268264E+00

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2006     0.240000E+00     0.350448E+00    -0.378572E+00
2007     0.146000E+01     0.596803E+00     0.894605E+00

Survey Index:    9 Tag:         NEC_S    AGE =  4
Time = JAN-1           Type = NUMBER
Catchability =    0.383975E-04   % Variance Contribution =     1.5288
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     0.200000E-01     0.299508E-01    -0.403824E+00
1983     0.300000E-01     0.358854E-01    -0.179133E+00
1984     0.500000E-01     0.516531E-01    -0.325277E-01
1985     0.400000E-01     0.303886E-01     0.274811E+00
1986     0.200000E-01     0.157005E-01     0.242037E+00
1987     0.100000E-01     0.292066E-01    -0.107181E+01
1988     0.200000E-01     0.298561E-01    -0.400658E+00
1989     0.100000E-01     0.162319E-01    -0.484396E+00
1990     N/A              0.108420E-01     N/A
1991     0.200000E-01     0.147333E-01     0.305621E+00
1992     N/A              0.100012E-01     N/A
1993     N/A              0.474045E-02     N/A
1994     0.100000E-01     0.140261E-01    -0.338337E+00
1995     N/A              0.211011E-01     N/A
1996     N/A              0.272012E-01     N/A
1997     0.100000E-01     0.359882E-01    -0.128061E+01
1998     0.600000E-01     0.667524E-01    -0.106645E+00
1999     0.130000E+00     0.828605E-01     0.450376E+00
2000     0.120000E+00     0.103206E+00     0.150767E+00
2001     0.200000E+00     0.108318E+00     0.613244E+00
2002     0.310000E+00     0.129253E+00     0.874804E+00
2003     0.290000E+00     0.188679E+00     0.429836E+00
2004     0.270000E+00     0.204223E+00     0.279208E+00
2005     0.150000E+00     0.197205E+00    -0.273608E+00
2006     0.250000E+00     0.265720E+00    -0.609837E-01
2007     0.570000E+00     0.207227E+00     0.101182E+01

Survey Index:   10 Tag:         NEC_S    AGE =  5 -  7
Time = JAN-1           Type = NUMBER
Catchability =    0.652723E-04   % Variance Contribution =     0.8825
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     N/A              0.245084E-01     N/A
1983     0.200000E-01     0.289398E-01    -0.369487E+00
1984     0.200000E-01     0.114186E-01     0.560489E+00
1985     0.200000E-01     0.273872E-01    -0.314342E+00
1986     0.100000E-01     0.198897E-01    -0.687616E+00
1987     N/A              0.113734E-01     N/A
1988     N/A              0.126780E-01     N/A
1989     N/A              0.588935E-02     N/A
1990     N/A              0.354554E-02     N/A
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1991     N/A              0.283282E-02     N/A
1992     0.100000E-01     0.816088E-02     0.203233E+00
1993     N/A              0.793409E-02     N/A
1994     N/A              0.455226E-02     N/A
1995     0.100000E-01     0.816690E-02     0.202496E+00
1996     N/A              0.863821E-02     N/A
1997     N/A              0.153716E-01     N/A
1998     0.200000E-01     0.201395E-01    -0.695188E-02
1999     0.300000E-01     0.444400E-01    -0.392943E+00
2000     0.170000E+00     0.600700E-01     0.104029E+01
2001     0.100000E+00     0.772640E-01     0.257942E+00
2002     0.190000E+00     0.103541E+00     0.607052E+00
2003     0.210000E+00     0.162713E+00     0.255117E+00
2004     0.150000E+00     0.248951E+00    -0.506620E+00
2005     0.170000E+00     0.353856E+00    -0.733091E+00
2006     0.200000E+00     0.261940E+00    -0.269798E+00
2007     0.460000E+00     0.394254E+00     0.154231E+00

Survey Index:   11 Tag:         NEC_F    AGE =  2
Time = JAN-1           Type = NUMBER
Catchability =    0.676126E-04   % Variance Contribution =     0.6105
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual
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1982     N/A              0.107435E+01     N/A
1983     0.152000E+01     0.116142E+01     0.269071E+00
1984     0.146000E+01     0.131756E+01     0.102652E+00
1985     0.139000E+01     0.172315E+01    -0.214852E+00
1986     0.800000E+00     0.103101E+01    -0.253684E+00
1987     0.830000E+00     0.102182E+01    -0.207913E+00
1988     0.580000E+00     0.123239E+01    -0.753685E+00
1989     0.620000E+00     0.658673E+00    -0.605070E-01
1990     0.210000E+00     0.253015E+00    -0.186340E+00
1991     0.380000E+00     0.630459E+00    -0.506278E+00
1992     0.840000E+00     0.524772E+00     0.470438E+00
1993     0.104000E+01     0.552404E+00     0.632696E+00
1994     0.800000E+00     0.693447E+00     0.142937E+00
1995     0.670000E+00     0.789458E+00    -0.164069E+00
1996     0.116000E+01     0.113969E+01     0.176594E-01
1997     0.124000E+01     0.128065E+01    -0.322590E-01
1998     0.129000E+01     0.110375E+01     0.155932E+00
1999     0.213000E+01     0.116689E+01     0.601778E+00
2000     0.173000E+01     0.126442E+01     0.313511E+00
2001     0.120000E+01     0.119541E+01     0.383002E-02
2002     0.136000E+01     0.129921E+01     0.457252E-01
2003     0.117000E+01     0.130729E+01    -0.110952E+00
2004     0.131000E+01     0.148451E+01    -0.125060E+00
2005     0.149000E+01     0.111670E+01     0.288402E+00
2006     0.114000E+01     0.180847E+01    -0.461451E+00
2007     0.720000E+00     0.697033E+00     0.324187E-01

Survey Index:   12 Tag:         NEC_F    AGE =  3
Time = JAN-1           Type = NUMBER
Catchability =    0.811036E-04   % Variance Contribution =     2.3297
```

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.175370E+00	N/A
1983	0.400000E+00	0.325590E+00	0.205825E+00
1984	0.340000E+00	0.356175E+00	-0.464772E-01
1985	0.430000E+00	0.194727E+00	0.792186E+00
1986	0.460000E+00	0.404907E+00	0.127569E+00
1987	0.110000E+00	0.221977E+00	-0.702093E+00
1988	0.200000E+00	0.228056E+00	-0.131273E+00
1989	0.180000E+00	0.175091E+00	0.276487E-01
1990	0.500000E-01	0.125344E+00	-0.919040E+00
1991	0.300000E-01	0.908638E-01	-0.110816E+01
1992	0.900000E-01	0.109576E+00	-0.196813E+00
1993	0.250000E+00	0.861192E-01	0.106573E+01
1994	0.300000E-01	0.140956E+00	-0.154725E+01
1995	0.900000E-01	0.179359E+00	-0.689580E+00
1996	0.280000E+00	0.250014E+00	0.113274E+00
1997	0.570000E+00	0.449616E+00	0.237242E+00
1998	0.114000E+01	0.674278E+00	0.525141E+00
1999	0.163000E+01	0.620849E+00	0.965248E+00
2000	0.149000E+01	0.691191E+00	0.768115E+00
2001	0.122000E+01	0.664083E+00	0.608199E+00
2002	0.930000E+00	0.827295E+00	0.117023E+00
2003	0.860000E+00	0.881945E+00	-0.251973E-01
2004	0.103000E+01	0.924150E+00	0.108440E+00
2005	0.137000E+01	0.104497E+01	0.270827E+00
2006	0.540000E+00	0.825663E+00	-0.424617E+00
2007	0.122000E+01	0.140608E+01	-0.141956E+00

Survey Index: 13 Tag: NEC_F AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.756270E-04 % Variance Contribution = 2.3884
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.589906E-01	N/A
1983	0.300000E-01	0.706794E-01	-0.856956E+00
1984	0.120000E+00	0.101735E+00	0.165118E+00
1985	0.700000E-01	0.598530E-01	0.156604E+00
1986	0.500000E-01	0.309235E-01	0.480505E+00
1987	0.110000E+00	0.575249E-01	0.648263E+00
1988	0.300000E-01	0.588042E-01	-0.673016E+00
1989	0.300000E-01	0.319702E-01	-0.636069E-01
1990	N/A	0.213541E-01	N/A
1991	0.400000E-01	0.290185E-01	0.320945E+00
1992	N/A	0.196981E-01	N/A
1993	0.300000E-01	0.933671E-02	0.116724E+01
1994	0.100000E-01	0.276256E-01	-0.101616E+01
1995	0.100000E-01	0.415605E-01	-0.142456E+01
1996	0.200000E-01	0.535751E-01	-0.985352E+00
1997	0.400000E-01	0.708818E-01	-0.572134E+00

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1998     0.290000E+00     0.131474E+00     0.791068E+00
1999     0.330000E+00     0.163201E+00     0.704111E+00
2000     0.310000E+00     0.203272E+00     0.422025E+00
2001     0.400000E+00     0.213342E+00     0.628569E+00
2002     0.370000E+00     0.254574E+00     0.373912E+00
2003     0.350000E+00     0.371619E+00    -0.599349E-01
2004     0.250000E+00     0.402235E+00    -0.475576E+00
2005     0.660000E+00     0.388412E+00     0.530174E+00
2006     0.470000E+00     0.523359E+00    -0.107535E+00
2007     0.350000E+00     0.408150E+00    -0.153702E+00

Survey Index:   15 Tag:         MA_S     AGE =  2
Time = JAN-1           Type = NUMBER
Catchability =    0.406577E-04   % Variance Contribution =     5.0423
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     0.158400E+01     0.646045E+00     0.896840E+00
1983     0.599000E+00     0.698398E+00    -0.153527E+00
1984     0.780000E-01     0.792295E+00    -0.231822E+01
1985     0.126000E+01     0.103619E+01     0.195562E+00
1986     0.522000E+00     0.619981E+00    -0.172022E+00
1987     0.640000E+00     0.614453E+00     0.407355E-01
1988     0.100500E+01     0.741079E+00     0.304636E+00
1989     0.363000E+00     0.396082E+00    -0.872174E-01
1990     0.210000E-01     0.152146E+00    -0.198032E+01
1991     0.500000E-01     0.379116E+00    -0.202582E+01
1992     0.342000E+00     0.315563E+00     0.804533E-01
1993     0.492000E+00     0.332179E+00     0.392805E+00
1994     0.121700E+01     0.416993E+00     0.107108E+01
1995     0.130200E+01     0.474727E+00     0.100892E+01
1996     0.686000E+00     0.685336E+00     0.967934E-03
1997     0.127900E+01     0.770099E+00     0.507314E+00
1998     0.121200E+01     0.663719E+00     0.602168E+00
1999     0.878000E+00     0.701691E+00     0.224153E+00
2000     0.165900E+01     0.760335E+00     0.780211E+00
2001     0.102600E+01     0.718841E+00     0.355782E+00
2002     0.151100E+01     0.781260E+00     0.659618E+00
2003     0.144000E+01     0.786116E+00     0.605294E+00
2004     0.283000E+00     0.892687E+00    -0.114879E+01
2005     0.351000E+00     0.671506E+00    -0.648737E+00
2006     0.244000E+01     0.108749E+01     0.808125E+00
2007     N/A              0.419149E+00     N/A

Survey Index:   16 Tag:         MA_S     AGE =  3
Time = JAN-1           Type = NUMBER
Catchability =    0.432367E-04   % Variance Contribution =     3.8271
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     0.142000E+00     0.934907E-01     0.417965E+00
```

1983	0.450000E+00	0.173574E+00	0.952646E+00
1984	0.670000E-01	0.189879E+00	-0.104169E+01
1985	0.360000E-01	0.103810E+00	-0.105904E+01
1986	0.185000E+00	0.215858E+00	-0.154264E+00
1987	0.130000E-01	0.118337E+00	-0.220859E+01
1988	0.123000E+00	0.121578E+00	0.116315E-01
1989	0.102000E+00	0.933420E-01	0.887022E-01
1990	0.810000E-01	0.668215E-01	0.192424E+00
1991	0.120000E-01	0.484399E-01	-0.139542E+01
1992	0.900000E-01	0.584157E-01	0.432225E+00
1993	0.650000E-01	0.459105E-01	0.347693E+00
1994	0.480000E-01	0.751446E-01	-0.448213E+00
1995	0.530000E-01	0.956171E-01	-0.590060E+00
1996	0.114000E+00	0.133283E+00	-0.156280E+00
1997	0.181000E+00	0.239692E+00	-0.280860E+00
1998	0.659000E+00	0.359461E+00	0.606118E+00
1999	0.111200E+01	0.330977E+00	0.121187E+01
2000	0.120500E+01	0.368477E+00	0.118486E+01
2001	0.730000E+00	0.354026E+00	0.723674E+00
2002	0.397000E+00	0.441035E+00	-0.105188E+00
2003	0.624000E+00	0.470169E+00	0.283058E+00
2004	0.323000E+00	0.492669E+00	-0.422184E+00
2005	0.102900E+01	0.557076E+00	0.613641E+00
2006	0.975000E+00	0.440165E+00	0.795289E+00
2007	N/A	0.749589E+00	N/A

Survey Index: 18 Tag: MA_F AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.168215E-03 % Variance Contribution = 1.5980
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.405000E+00	0.363731E+00	0.107472E+00
1983	0.166200E+01	0.675298E+00	0.900622E+00
1984	0.625000E+00	0.738734E+00	-0.167187E+00
1985	0.267000E+00	0.403879E+00	-0.413866E+00
1986	0.189500E+01	0.839808E+00	0.813801E+00
1987	0.679000E+00	0.460397E+00	0.388532E+00
1988	0.663000E+00	0.473005E+00	0.337669E+00
1989	0.429000E+00	0.363153E+00	0.166633E+00
1990	0.317000E+00	0.259973E+00	0.198323E+00
1991	N/A	0.188458E+00	N/A
1992	0.288000E+00	0.227270E+00	0.236822E+00
1993	0.186000E+00	0.178618E+00	0.404988E-01
1994	0.478000E+00	0.292354E+00	0.491644E+00
1995	0.760000E-01	0.372004E+00	-0.158817E+01
1996	0.506000E+00	0.518547E+00	-0.244945E-01
1997	0.128200E+01	0.932538E+00	0.318267E+00
1998	0.150800E+01	0.139850E+01	0.753813E-01
1999	0.590000E+00	0.128769E+01	-0.780480E+00
2000	0.940000E+00	0.143358E+01	-0.422052E+00
2001	0.230300E+01	0.137736E+01	0.514045E+00
2002	0.108300E+01	0.171587E+01	-0.460187E+00
2003	0.130200E+01	0.182922E+01	-0.339988E+00

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2004     0.125400E+01     0.191676E+01    -0.424296E+00
2005     0.145500E+01     0.216734E+01    -0.398494E+00
2006     0.204900E+01     0.171249E+01     0.179405E+00
2007     0.374500E+01     0.291632E+01     0.250099E+00

Survey Index:   19 Tag:         MA_F     AGE =  4
Time = JAN-1           Type = NUMBER
Catchability =    0.657295E-04   % Variance Contribution =     4.6457
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     0.120000E-01     0.512704E-01    -0.145221E+01
1983     0.200000E-01     0.614294E-01    -0.112216E+01
1984     0.154000E+00     0.884208E-01     0.554845E+00
1985     0.127000E+00     0.520198E-01     0.892562E+00
1986     0.400000E-01     0.268765E-01     0.397627E+00
1987     0.214000E+00     0.499964E-01     0.145402E+01
1988     0.110000E-01     0.511083E-01    -0.153605E+01
1989     0.600000E-02     0.277862E-01    -0.153278E+01
1990     0.160000E-01     0.185595E-01    -0.148392E+00
1991     0.110000E-01     0.252208E-01    -0.829773E+00
1992     0.600000E-02     0.171202E-01    -0.104850E+01
1993     N/A              0.811479E-02     N/A
1994     0.300000E-01     0.240102E-01     0.222719E+00
1995     N/A              0.361214E-01     N/A
1996     N/A              0.465636E-01     N/A
1997     0.114000E+00     0.616053E-01     0.615451E+00
1998     0.351000E+00     0.114268E+00     0.112224E+01
1999     0.262000E+00     0.141842E+00     0.613629E+00
2000     0.379000E+00     0.176670E+00     0.763255E+00
2001     0.494000E+00     0.185421E+00     0.979905E+00
2002     0.307000E+00     0.221257E+00     0.327523E+00
2003     0.178000E+00     0.322984E+00    -0.595819E+00
2004     0.256000E+00     0.349594E+00    -0.311594E+00
2005     0.136000E+00     0.337579E+00    -0.909146E+00
2006     0.135000E+01     0.454865E+00     0.108786E+01
2007     0.559000E+00     0.354735E+00     0.454780E+00

Survey Index:   21 Tag:         CT_S     AGE =  2
Time = JAN-1           Type = NUMBER
Catchability =    0.173459E-04   % Variance Contribution =     3.0870
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     N/A              0.275624E+00     N/A
1983     N/A              0.297959E+00     N/A
1984     0.271000E+00     0.338019E+00    -0.220982E+00
1985     0.325000E+00     0.442072E+00    -0.307647E+00
1986     0.100000E+00     0.264504E+00    -0.972686E+00
1987     0.860000E-01     0.262146E+00    -0.111455E+01
1988     0.223000E+00     0.316168E+00    -0.349102E+00
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1989	0.490000E-01	0.168981E+00	-0.123797E+01
1990	0.220000E-01	0.649105E-01	-0.108197E+01
1991	0.189000E+00	0.161743E+00	0.155737E+00
1992	0.188000E+00	0.134629E+00	0.333917E+00
1993	0.151000E+00	0.141718E+00	0.634391E-01
1994	0.314000E+00	0.177903E+00	0.568157E+00
1995	0.510000E-01	0.202534E+00	-0.137908E+01
1996	0.266000E+00	0.292387E+00	-0.945805E-01
1997	0.507000E+00	0.328549E+00	0.433824E+00
1998	0.594000E+00	0.283164E+00	0.740853E+00
1999	0.593000E+00	0.299364E+00	0.683534E+00
2000	0.726000E+00	0.324384E+00	0.805623E+00
2001	0.340000E+00	0.306681E+00	0.103138E+00
2002	0.126400E+01	0.333311E+00	0.133296E+01
2003	0.101600E+01	0.335383E+00	0.110836E+01
2004	0.818000E+00	0.380849E+00	0.764459E+00
2005	0.264000E+00	0.286486E+00	-0.817412E-01
2006	0.360000E+00	0.463959E+00	-0.253692E+00
2007	N/A	0.178822E+00	N/A

Survey Index: 22 Tag: CT_S AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.184656E-04 % Variance Contribution = 2.8328
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.399282E-01	N/A
1983	N/A	0.741301E-01	N/A
1984	0.440000E-01	0.810937E-01	-0.611415E+00
1985	0.400000E-01	0.443353E-01	-0.102902E+00
1986	0.820000E-01	0.921889E-01	-0.117121E+00
1987	0.140000E-01	0.505395E-01	-0.128370E+01
1988	0.350000E-01	0.519236E-01	-0.394425E+00
1989	0.240000E-01	0.398647E-01	-0.507436E+00
1990	0.130000E-01	0.285383E-01	-0.786296E+00
1991	0.290000E-01	0.206878E-01	0.337752E+00
1992	0.210000E-01	0.249483E-01	-0.172282E+00
1993	0.150000E-01	0.196075E-01	-0.267864E+00
1994	0.250000E-01	0.320929E-01	-0.249758E+00
1995	0.200000E-01	0.408363E-01	-0.713840E+00
1996	0.860000E-01	0.569229E-01	0.412649E+00
1997	0.570000E-01	0.102368E+00	-0.585525E+00
1998	0.503000E+00	0.153519E+00	0.118677E+01
1999	0.385000E+00	0.141354E+00	0.100197E+01
2000	0.524000E+00	0.157370E+00	0.120289E+01
2001	0.365000E+00	0.151198E+00	0.881308E+00
2002	0.465000E+00	0.188358E+00	0.903694E+00
2003	0.395000E+00	0.200800E+00	0.676574E+00
2004	0.410000E+00	0.210410E+00	0.667101E+00
2005	0.150000E+00	0.237917E+00	-0.461286E+00
2006	0.680000E-01	0.187986E+00	-0.101686E+01
2007	N/A	0.320135E+00	N/A

Survey Index: 23 Tag: CT_S AGE = 4

Time = JAN-1 Type = NUMBER
Catchability = 0.295921E-04 % Variance Contribution = 3.9209
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.230824E-01	N/A
1983	N/A	0.276561E-01	N/A
1984	N/A	0.398079E-01	N/A
1985	0.580000E-01	0.234198E-01	0.906860E+00
1986	0.800000E-02	0.121001E-01	-0.413769E+00
1987	0.400000E-02	0.225089E-01	-0.172762E+01
1988	0.900000E-02	0.230095E-01	-0.938681E+00
1989	0.160000E-01	0.125096E-01	0.246092E+00
1990	0.600000E-02	0.835565E-02	-0.331179E+00
1991	0.280000E-01	0.113546E-01	0.902578E+00
1992	0.400000E-02	0.770768E-02	-0.655923E+00
1993	0.180000E-01	0.365336E-02	0.159473E+01
1994	0.180000E-01	0.108096E-01	0.509935E+00
1995	0.500000E-02	0.162622E-01	-0.117940E+01
1996	0.230000E-01	0.209634E-01	0.927172E-01
1997	0.360000E-01	0.277353E-01	0.260813E+00
1998	0.116000E+00	0.514446E-01	0.813085E+00
1999	0.139000E+00	0.638588E-01	0.777800E+00
2000	0.740000E-01	0.795384E-01	-0.721746E-01
2001	0.120000E+00	0.834784E-01	0.362903E+00
2002	0.233000E+00	0.996121E-01	0.849755E+00
2003	0.232000E+00	0.145410E+00	0.467177E+00
2004	0.194000E+00	0.157390E+00	0.209129E+00
2005	0.330000E-01	0.151981E+00	-0.152725E+01
2006	0.650000E-01	0.204785E+00	-0.114757E+01
2007	N/A	0.159705E+00	N/A

Survey Index: 24 Tag: CT_F AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.425758E-04 % Variance Contribution = 3.0428
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.676523E+00	N/A
1983	N/A	0.731346E+00	N/A
1984	N/A	0.829673E+00	N/A
1985	0.571000E+00	0.108507E+01	-0.642013E+00
1986	0.339000E+00	0.649230E+00	-0.649787E+00
1987	0.117000E+01	0.643441E+00	0.597929E+00
1988	0.106700E+01	0.776040E+00	0.318402E+00
1989	0.884000E+00	0.414767E+00	0.756739E+00
1990	0.290000E-01	0.159324E+00	-0.170364E+01
1991	0.674000E+00	0.397002E+00	0.529290E+00
1992	0.826000E+00	0.330450E+00	0.916140E+00
1993	0.570000E+00	0.347850E+00	0.493865E+00
1994	0.827000E+00	0.436665E+00	0.638638E+00

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1995     0.300000E+00     0.497123E+00    -0.505055E+00
1996     0.384000E+00     0.717668E+00    -0.625365E+00
1997     0.887000E+00     0.806430E+00     0.952279E-01
1998     0.681000E+00     0.695031E+00    -0.203946E-01
1999     0.269000E+00     0.734795E+00    -0.100488E+01
2000     0.679000E+00     0.796205E+00    -0.159236E+00
2001     0.395000E+00     0.752754E+00    -0.644852E+00
2002     0.268900E+01     0.818118E+00     0.118992E+01
2003     0.308700E+01     0.823203E+00     0.132175E+01
2004     0.145900E+01     0.934801E+00     0.445173E+00
2005     0.385000E+00     0.703186E+00    -0.602377E+00
2006     0.109300E+01     0.113880E+01    -0.410449E-01
2007     0.217000E+00     0.438923E+00    -0.704427E+00

Survey Index:   25 Tag:         CT_F     AGE =  3
Time = JAN-1           Type = NUMBER
Catchability =    0.107830E-03   % Variance Contribution =     1.9665
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual
```

```
1982     N/A              0.233161E+00     N/A
1983     N/A              0.432884E+00     N/A
1984     N/A              0.473548E+00     N/A
1985     0.331000E+00     0.258897E+00     0.245689E+00
1986     0.528000E+00     0.538339E+00    -0.193923E-01
1987     0.298000E+00     0.295127E+00     0.968938E-02
1988     0.223000E+00     0.303209E+00    -0.307249E+00
1989     0.481000E+00     0.232790E+00     0.725728E+00
1990     0.950000E-01     0.166650E+00    -0.562017E+00
1991     0.110000E+00     0.120807E+00    -0.937124E-01
1992     0.340000E+00     0.145686E+00     0.847492E+00
1993     0.366000E+00     0.114499E+00     0.116207E+01
1994     0.152000E+00     0.187407E+00    -0.209401E+00
1995     0.850000E-01     0.238464E+00    -0.103157E+01
1996     0.117000E+00     0.332402E+00    -0.104417E+01
1997     0.118800E+01     0.597781E+00     0.686801E+00
1998     0.137300E+01     0.896478E+00     0.426280E+00
1999     0.105400E+01     0.825441E+00     0.244430E+00
2000     0.148400E+01     0.918964E+00     0.479249E+00
2001     0.871000E+00     0.882923E+00    -0.135964E-01
2002     0.113700E+01     0.109992E+01     0.331563E-01
2003     0.193000E+01     0.117258E+01     0.498315E+00
2004     0.131900E+01     0.122869E+01     0.709243E-01
2005     0.755000E+00     0.138932E+01    -0.609852E+00
2006     0.744000E+00     0.109775E+01    -0.388976E+00
2007     0.592000E+00     0.186944E+01    -0.114989E+01

Survey Index:   26 Tag:         CT_F     AGE =  4
Time = JAN-1           Type = NUMBER
Catchability =    0.882136E-04   % Variance Contribution =     2.2883
Residual = LN(Observed) - LN(Predicted)
```

Year	Observed	Predicted	Residual
1982	N/A	0.688084E-01	N/A
1983	N/A	0.824425E-01	N/A
1984	N/A	0.118667E+00	N/A
1985	0.720000E-01	0.698143E-01	0.308278E-01
1986	0.750000E-01	0.360701E-01	0.732023E+00
1987	0.720000E-01	0.670987E-01	0.705011E-01
1988	0.330000E-01	0.685910E-01	-0.731653E+00
1989	0.370000E-01	0.372910E-01	-0.783372E-02
1990	0.150000E-01	0.249081E-01	-0.507143E+00
1991	0.420000E-01	0.338481E-01	0.215788E+00
1992	0.360000E-01	0.229765E-01	0.449047E+00
1993	0.460000E-01	0.108906E-01	0.144074E+01
1994	0.390000E-01	0.322234E-01	0.190870E+00
1995	0.240000E-01	0.484774E-01	-0.703043E+00
1996	0.120000E-01	0.624916E-01	-0.165013E+01
1997	0.420000E-01	0.826786E-01	-0.677291E+00
1998	0.373000E+00	0.153356E+00	0.888819E+00
1999	0.321000E+00	0.190362E+00	0.522512E+00
2000	0.346000E+00	0.237103E+00	0.377944E+00
2001	0.341000E+00	0.248848E+00	0.315039E+00
2002	0.436000E+00	0.296942E+00	0.384104E+00
2003	0.479000E+00	0.433467E+00	0.998852E-01
2004	0.407000E+00	0.469179E+00	-0.142171E+00
2005	0.440000E+00	0.453055E+00	-0.292389E-01
2006	0.355000E+00	0.610461E+00	-0.542097E+00
2007	0.230000E+00	0.476079E+00	-0.727503E+00

Survey Index: 27 Tag: CT_F AGE = 5 - 7
Time = JAN-1 Type = NUMBER
Catchability = 0.606059E-04 % Variance Contribution = 3.6369
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.227563E-01	N/A
1983	N/A	0.268709E-01	N/A
1984	N/A	0.106023E-01	N/A
1985	0.250000E-01	0.254292E-01	-0.170228E-01
1986	0.900000E-02	0.184677E-01	-0.718801E+00
1987	0.700000E-02	0.105603E-01	-0.411188E+00
1988	0.300000E-02	0.117717E-01	-0.136708E+01
1989	0.300000E-02	0.546831E-02	-0.600358E+00
1990	0.100000E-02	0.329206E-02	-0.119151E+01
1991	0.120000E-01	0.263030E-02	0.151781E+01
1992	0.220000E-01	0.757744E-02	0.106587E+01
1993	0.250000E-01	0.736687E-02	0.122188E+01
1994	0.700000E-02	0.422681E-02	0.504462E+00
1995	0.900000E-02	0.758303E-02	0.171311E+00
1996	0.500000E-02	0.802065E-02	-0.472582E+00
1997	0.500000E-02	0.142726E-01	-0.104891E+01
1998	0.400000E-01	0.186997E-01	0.760371E+00

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1999     0.750000E-01     0.412629E-01     0.597523E+00
2000     0.127000E+00     0.557755E-01     0.822853E+00
2001     0.191000E+00     0.717403E-01     0.979221E+00
2002     0.134000E+00     0.961391E-01     0.332044E+00
2003     0.183000E+00     0.151081E+00     0.191671E+00
2004     0.203000E+00     0.231153E+00    -0.129874E+00
2005     0.119000E+00     0.328558E+00    -0.101559E+01
2006     0.151000E+00     0.243214E+00    -0.476660E+00
2007     0.179000E+00     0.366068E+00    -0.715434E+00

Survey Index:   29 Tag:         RI_F     AGE =  3
Time = JAN-1           Type = NUMBER
Catchability =    0.111458E-03   % Variance Contribution =     3.5748
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

_____________________________________________________________________________

1982     0.174000E+01     0.241007E+00     0.197682E+01
1983     0.520000E+00     0.447450E+00     0.150265E+00
1984     0.420000E+00     0.489482E+00    -0.153093E+00
1985     0.490000E+00     0.267608E+00     0.604882E+00
1986     0.280000E+00     0.556453E+00    -0.686793E+00
1987     0.510000E+00     0.305057E+00     0.513913E+00
1988     0.370000E+00     0.313411E+00     0.165988E+00
1989     0.240000E+00     0.240623E+00    -0.259405E-02
1990     0.700000E-01     0.172257E+00    -0.900493E+00
1991     0.120000E+00     0.124872E+00    -0.397952E-01
1992     0.800000E-01     0.150588E+00    -0.632521E+00
1993     0.410000E+00     0.118351E+00     0.124250E+01
1994     0.220000E+00     0.193713E+00     0.127251E+00
1995     0.300000E-01     0.246488E+00    -0.210612E+01
1996     0.200000E+00     0.343587E+00    -0.541123E+00
1997     0.103000E+01     0.617895E+00     0.510995E+00
1998     0.960000E+00     0.926642E+00     0.353657E-01
1999     0.360000E+00     0.853215E+00    -0.862908E+00
2000     0.191000E+01     0.949886E+00     0.698517E+00
2001     0.124000E+01     0.912632E+00     0.306534E+00
2002     0.630000E+00     0.113693E+01    -0.590366E+00
2003     0.138000E+01     0.121203E+01     0.129784E+00
2004     0.208000E+01     0.127003E+01     0.493324E+00
2005     0.130000E+01     0.143607E+01    -0.995446E-01
2006     0.138000E+01     0.113469E+01     0.195728E+00
2007     0.113000E+01     0.193234E+01    -0.536514E+00

Survey Index:   30 Tag:         RI_F     AGE =  4
Time = JAN-1           Type = NUMBER
Catchability =    0.854502E-04   % Variance Contribution =     4.4307
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

_____________________________________________________________________________

1982     0.200000E+00     0.666529E-01     0.109882E+01
1983     0.700000E-01     0.798599E-01    -0.131779E+00
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1984	0.110000E+00	0.114950E+00	-0.440133E-01
1985	0.100000E+00	0.676273E-01	0.391159E+00
1986	0.200000E-01	0.349402E-01	-0.557906E+00
1987	0.130000E+00	0.649968E-01	0.693197E+00
1988	0.200000E-01	0.664423E-01	-0.120060E+01
1989	N/A	0.361228E-01	N/A
1990	N/A	0.241278E-01	N/A
1991	N/A	0.327877E-01	N/A
1992	0.100000E-01	0.222567E-01	-0.800060E+00
1993	0.110000E+00	0.105495E-01	0.234441E+01
1994	0.700000E-01	0.312139E-01	0.807631E+00
1995	N/A	0.469588E-01	N/A
1996	N/A	0.605340E-01	N/A
1997	0.100000E-01	0.800886E-01	-0.208055E+01
1998	0.300000E-01	0.148552E+00	-0.159974E+01
1999	0.900000E-01	0.184399E+00	-0.717292E+00
2000	0.350000E+00	0.229676E+00	0.421266E+00
2001	0.450000E+00	0.241053E+00	0.624231E+00
2002	0.300000E+00	0.287640E+00	0.420715E-01
2003	0.400000E+00	0.419888E+00	-0.485237E-01
2004	0.490000E+00	0.454481E+00	0.752483E-01
2005	0.780000E+00	0.438863E+00	0.575107E+00
2006	0.690000E+00	0.591338E+00	0.154304E+00
2007	0.440000E+00	0.461165E+00	-0.469809E-01

Survey Index: 31 Tag: RI_X AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.104477E-04 % Variance Contribution = 2.7813
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.440535E+00	N/A
1983	N/A	0.572068E+00	N/A
1984	N/A	0.628328E+00	N/A
1985	N/A	0.361437E+00	N/A
1986	N/A	0.388167E+00	N/A
1987	N/A	0.429008E+00	N/A
1988	N/A	0.357245E+00	N/A
1989	N/A	0.102281E+00	N/A
1990	0.170000E+00	0.219501E+00	-0.255557E+00
1991	0.700000E-01	0.237099E+00	-0.121998E+01
1992	0.150000E+00	0.231648E+00	-0.434583E+00
1993	0.110000E+00	0.258939E+00	-0.856111E+00
1994	0.800000E-01	0.267296E+00	-0.120633E+01
1995	0.200000E+00	0.281979E+00	-0.343516E+00
1996	0.410000E+00	0.321154E+00	0.244237E+00
1997	0.170000E+00	0.237588E+00	-0.334739E+00
1998	0.700000E-01	0.245926E+00	-0.125654E+01
1999	0.260000E+00	0.263784E+00	-0.144493E-01
2000	0.630000E+00	0.243322E+00	0.951333E+00
2001	0.420000E+00	0.278427E+00	0.411099E+00
2002	0.810000E+00	0.259803E+00	0.113711E+01
2003	0.148000E+01	0.298407E+00	0.160134E+01
2004	0.540000E+00	0.222886E+00	0.884909E+00

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2005     0.550000E+00     0.363614E+00     0.413827E+00
2006     0.190000E+00     0.143893E+00     0.277954E+00
2007     N/A              0.265549E+00     N/A
Survey Index:   32 Tag:         RI_X     AGE =  2 -  7
Time = JAN-1           Type = NUMBER
Catchability =    0.209505E-04   % Variance Contribution =     1.8304
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     N/A              0.402411E+00     N/A
1983     N/A              0.472852E+00     N/A
1984     N/A              0.532117E+00     N/A
1985     N/A              0.609611E+00     N/A
1986     N/A              0.439016E+00     N/A
1987     N/A              0.393549E+00     N/A
1988     N/A              0.461141E+00     N/A
1989     N/A              0.260073E+00     N/A
1990     0.100000E+00     0.117832E+00    -0.164088E+00
1991     0.800000E-01     0.227775E+00    -0.104633E+01
1992     0.180000E+00     0.198988E+00    -0.100290E+00
1993     0.140000E+00     0.198548E+00    -0.349388E+00
1994     0.500000E-01     0.260398E+00    -0.165019E+01
1995     0.220000E+00     0.305089E+00    -0.326975E+00
1996     0.530000E+00     0.435345E+00     0.196739E+00
1997     0.520000E+00     0.537539E+00    -0.331722E-01
1998     0.360000E+00     0.559072E+00    -0.440175E+00
1999     0.610000E+00     0.581426E+00     0.479754E-01
2000     0.189000E+01     0.645933E+00     0.107364E+01
2001     0.550000E+00     0.625857E+00    -0.129204E+00
2002     0.111000E+01     0.720038E+00     0.432811E+00
2003     0.225000E+01     0.788074E+00     0.104909E+01
2004     0.153000E+01     0.890053E+00     0.541742E+00
2005     0.189000E+01     0.837131E+00     0.814351E+00
2006     0.109000E+01     0.100272E+01     0.834653E-01
2007     N/A              0.818811E+00     N/A

Survey Index:   33 Tag:         NJ       AGE =  1
Time = JAN-1           Type = NUMBER
Catchability =    0.158198E-03   % Variance Contribution =     1.8036
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     N/A              0.667054E+01     N/A
1983     N/A              0.866220E+01     N/A
1984     N/A              0.951409E+01     N/A
1985     N/A              0.547285E+01     N/A
1986     N/A              0.587759E+01     N/A
1987     N/A              0.649600E+01     N/A
1988     0.306000E+01     0.540937E+01    -0.569718E+00
1989     0.510000E+00     0.154873E+01    -0.111078E+01
1990     0.144000E+01     0.332366E+01    -0.836424E+00
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1991	0.269000E+01	0.359014E+01	-0.288649E+00
1992	0.300000E+01	0.350759E+01	-0.156317E+00
1993	0.569000E+01	0.392083E+01	0.372408E+00
1994	0.107000E+01	0.404738E+01	-0.133041E+01
1995	0.293000E+01	0.426970E+01	-0.376542E+00
1996	0.510000E+01	0.486288E+01	0.476089E-01
1997	0.825000E+01	0.359753E+01	0.829964E+00
1998	0.580000E+01	0.372379E+01	0.443116E+00
1999	0.612000E+01	0.399420E+01	0.426720E+00
2000	0.391000E+01	0.368437E+01	0.594390E-01
2001	0.332000E+01	0.421592E+01	-0.238902E+00
2002	0.911000E+01	0.393391E+01	0.839738E+00
2003	0.561000E+01	0.451846E+01	0.216380E+00
2004	0.627000E+01	0.337492E+01	0.619405E+00
2005	0.599000E+01	0.550580E+01	0.842885E-01
2006	0.574000E+01	0.217881E+01	0.968678E+00
2007	N/A	0.402091E+01	N/A

Survey Index: 34 Tag: NJ AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.688016E-04 % Variance Contribution = 4.0492
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual

1982	N/A	0.109325E+01	N/A
1983	N/A	0.118184E+01	N/A
1984	N/A	0.134073E+01	N/A
1985	N/A	0.175346E+01	N/A
1986	N/A	0.104914E+01	N/A
1987	N/A	0.103979E+01	N/A
1988	0.103000E+01	0.125407E+01	-0.196832E+00
1989	0.180000E+00	0.670256E+00	-0.131470E+01
1990	0.110000E+00	0.257464E+00	-0.850400E+00
1991	0.270000E+00	0.641546E+00	-0.865460E+00
1992	0.570000E+00	0.534000E+00	0.652400E-01
1993	0.200000E+00	0.562118E+00	-0.103340E+01
1994	0.800000E-01	0.705642E+00	-0.217708E+01
1995	0.280000E+00	0.803341E+00	-0.105399E+01
1996	0.270000E+01	0.115974E+01	0.845058E+00
1997	0.525000E+01	0.130317E+01	0.139342E+01
1998	0.267000E+01	0.112316E+01	0.865935E+00
1999	0.346000E+01	0.118741E+01	0.106949E+01
2000	0.182000E+01	0.128665E+01	0.346793E+00
2001	0.118000E+01	0.121643E+01	-0.304099E-01
2002	0.413000E+01	0.132206E+01	0.113909E+01
2003	0.255000E+01	0.133028E+01	0.650705E+00
2004	0.249000E+01	0.151062E+01	0.499763E+00
2005	0.124000E+01	0.113633E+01	0.873045E-01
2006	0.322000E+01	0.184027E+01	0.559469E+00
2007	N/A	0.709291E+00	N/A

Survey Index: 35 Tag: NJ AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.436851E-04 % Variance Contribution = 1.9201

Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.944603E-01	N/A
1983	N/A	0.175374E+00	N/A
1984	N/A	0.191848E+00	N/A
1985	N/A	0.104887E+00	N/A
1986	N/A	0.218097E+00	N/A
1987	N/A	0.119564E+00	N/A
1988	N/A	0.122838E+00	N/A
1989	N/A	0.943101E-01	N/A
1990	0.300000E-01	0.675146E-01	-0.811146E+00
1991	0.200000E-01	0.489423E-01	-0.894910E+00
1992	0.600000E-01	0.590216E-01	0.164418E-01
1993	0.100000E-01	0.463867E-01	-0.153443E+01
1994	N/A	0.759239E-01	N/A
1995	0.500000E-01	0.966088E-01	-0.658647E+00
1996	0.180000E+00	0.134666E+00	0.290161E+00
1997	0.102000E+01	0.242178E+00	0.143788E+01
1998	0.290000E+00	0.363189E+00	-0.225042E+00
1999	0.650000E+00	0.334410E+00	0.664605E+00
2000	0.450000E+00	0.372299E+00	0.189551E+00
2001	0.410000E+00	0.357698E+00	0.136469E+00
2002	0.128000E+01	0.445609E+00	0.105517E+01
2003	0.570000E+00	0.475045E+00	0.182227E+00
2004	0.570000E+00	0.497778E+00	0.135482E+00
2005	0.530000E+00	0.562853E+00	-0.601423E-01
2006	0.480000E+00	0.444730E+00	0.763197E-01
2007	N/A	0.757363E+00	N/A

Survey Index: 36 Tag: NJ AGE = 4 - 7
Time = JAN-1 Type = NUMBER
Catchability = 0.588380E-04 % Variance Contribution = 1.4859
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.679873E-01	N/A
1983	N/A	0.810758E-01	N/A
1984	N/A	0.894432E-01	N/A
1985	N/A	0.712532E-01	N/A
1986	N/A	0.419876E-01	N/A
1987	N/A	0.550067E-01	N/A
1988	N/A	0.571781E-01	N/A
1989	N/A	0.301817E-01	N/A
1990	N/A	0.198096E-01	N/A
1991	N/A	0.251301E-01	N/A
1992	0.200000E-01	0.226816E-01	-0.125823E+00
1993	0.100000E-01	0.144160E-01	-0.365751E+00
1994	0.200000E-01	0.255963E-01	-0.246717E+00
1995	0.160000E+00	0.396960E-01	0.139392E+01
1996	0.500000E-01	0.494683E-01	0.106918E-01
1997	0.180000E+00	0.690025E-01	0.958814E+00

```
1998     0.400000E-01     0.120442E+00    -0.110229E+01
1999     0.180000E+00     0.167030E+00     0.747840E-01
2000     0.220000E+00     0.212295E+00     0.356508E-01
2001     0.150000E+00     0.235628E+00    -0.451620E+00
2002     0.810000E+00     0.291394E+00     0.102236E+01
2003     0.510000E+00     0.435794E+00     0.157241E+00
2004     0.430000E+00     0.537350E+00    -0.222865E+00
2005     0.320000E+00     0.621159E+00    -0.663266E+00
2006     0.400000E+00     0.643293E+00    -0.475137E+00
2007     N/A              0.672932E+00     N/A

Survey Index:   40 Tag:         CT_Y     AGE =  0
Time = JAN-1           Type = NUMBER
Catchability =    0.184557E-05   % Variance Contribution =     3.7718
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual
```

```
1982     N/A              0.134296E+00     N/A
1983     N/A              0.145585E+00     N/A
1984     N/A              0.877426E-01     N/A
1985     0.240000E+00     0.879787E-01     0.100354E+01
1986     0.172000E+00     0.965143E-01     0.577803E+00
1987     0.750000E-01     0.793931E-01    -0.569234E-01
1988     0.150000E-01     0.236851E-01    -0.456796E+00
1989     N/A              0.493129E-01     N/A
1990     0.320000E-01     0.549313E-01    -0.540348E+00
1991     0.360000E-01     0.520172E-01    -0.368055E+00
1992     0.130000E-01     0.586519E-01    -0.150667E+01
1993     0.840000E-01     0.602864E-01     0.331710E+00
1994     0.132000E+00     0.641722E-01     0.721232E+00
1995     0.230000E-01     0.704972E-01    -0.112008E+01
1996     0.690000E-01     0.515917E-01     0.290746E+00
1997     0.330000E-01     0.531220E-01    -0.476084E+00
1998     N/A              0.570056E-01     N/A
1999     0.440000E-01     0.528677E-01    -0.183602E+00
2000     0.120000E-01     0.601181E-01    -0.161140E+01
2001     0.210000E-01     0.560774E-01    -0.982210E+00
2002     0.442000E+00     0.649381E-01     0.191788E+01
2003     N/A              0.486171E-01     N/A
2004     0.255000E+00     0.786710E-01     0.117599E+01
2005     0.670000E-01     0.315450E-01     0.753276E+00
2006     0.980000E-01     0.576836E-01     0.529995E+00
2007     N/A              0.000000E+00     N/A

Survey Index:   41 Tag:         VA_CRY   AGE =  0
Time = JAN-1           Type = NUMBER
Catchability =    0.281985E-04   % Variance Contribution =     1.8494
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual
```

```
1982     0.227000E+01     0.205191E+01     0.101010E+00
```

1983	0.501000E+01	0.222439E+01	0.811954E+00
1984	0.158000E+01	0.134062E+01	0.164292E+00
1985	0.126000E+01	0.134423E+01	-0.647082E-01
1986	0.126000E+01	0.147464E+01	-0.157305E+00
1987	0.390000E+00	0.121305E+01	-0.113475E+01
1988	0.540000E+00	0.361885E+00	0.400242E+00
1989	0.124000E+01	0.753453E+00	0.498200E+00
1990	0.254000E+01	0.839296E+00	0.110736E+01
1991	0.264000E+01	0.794772E+00	0.120048E+01
1992	0.890000E+00	0.896143E+00	-0.687871E-02
1993	0.500000E+00	0.921117E+00	-0.610979E+00
1994	0.241000E+01	0.980488E+00	0.899332E+00
1995	0.630000E+00	0.107713E+01	-0.536333E+00
1996	0.810000E+00	0.788270E+00	0.271930E-01
1997	0.890000E+00	0.811652E+00	0.921498E-01
1998	0.730000E+00	0.870989E+00	-0.176585E+00
1999	0.530000E+00	0.807766E+00	-0.421395E+00
2000	0.570000E+00	0.918545E+00	-0.477155E+00
2001	0.470000E+00	0.856807E+00	-0.600480E+00
2002	0.770000E+00	0.992190E+00	-0.253524E+00
2003	0.440000E+00	0.742821E+00	-0.523681E+00
2004	0.130000E+01	0.120202E+01	0.783647E-01
2005	0.350000E+00	0.481977E+00	-0.319964E+00
2006	0.800000E+00	0.881348E+00	-0.968410E-01
2007	N/A	0.000000E+00	N/A

Survey Index: 43 Tag: MD_Y AGE = 0
Time = JAN-1 Type = NUMBER
Catchability = 0.238811E-03 % Variance Contribution = 2.3052
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	0.340800E+01	0.173774E+02	-0.162905E+01
1983	0.176990E+02	0.188382E+02	-0.623780E-01
1984	0.133100E+02	0.113536E+02	0.158979E+00
1985	0.128430E+02	0.113842E+02	0.120575E+00
1986	0.595260E+02	0.124886E+02	0.156159E+01
1987	0.758400E+01	0.102732E+02	-0.303500E+00
1988	0.176300E+01	0.306478E+01	-0.552959E+00
1989	0.285500E+01	0.638094E+01	-0.804243E+00
1990	0.473300E+01	0.710794E+01	-0.406653E+00
1991	0.733700E+01	0.673086E+01	0.862266E-01
1992	0.848700E+01	0.758937E+01	0.111787E+00
1993	0.414500E+01	0.780087E+01	-0.632333E+00
1994	0.223110E+02	0.830368E+01	0.988381E+00
1995	0.130670E+02	0.912211E+01	0.359388E+00
1996	0.649300E+01	0.667581E+01	-0.277653E-01
1997	0.799700E+01	0.687382E+01	0.151346E+00
1998	0.149830E+02	0.737634E+01	0.708638E+00
1999	0.856500E+01	0.684091E+01	0.224763E+00
2000	0.987400E+01	0.777909E+01	0.238465E+00
2001	0.135430E+02	0.725624E+01	0.624009E+00
2002	0.540600E+01	0.840278E+01	-0.441054E+00
2003	0.818000E+01	0.629090E+01	0.262588E+00

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2004     0.699300E+01     0.101798E+02    -0.375494E+00
2005     0.219800E+01     0.408183E+01    -0.618998E+00
2006     0.965800E+01     0.746407E+01     0.257685E+00
2007     N/A              0.000000E+00     N/A

Survey Index:   44 Tag:         NJ_Y     AGE =  0
Time = JAN-1           Type = NUMBER
Catchability =    0.392777E-04   % Variance Contribution =     1.7872
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     N/A              0.285810E+01     N/A
1983     N/A              0.309835E+01     N/A
1984     N/A              0.186735E+01     N/A
1985     N/A              0.187237E+01     N/A
1986     N/A              0.205403E+01     N/A
1987     N/A              0.168965E+01     N/A
1988     0.170000E+00     0.504069E+00    -0.108691E+01
1989     0.100000E+01     0.104948E+01    -0.482972E-01
1990     0.128000E+01     0.116905E+01     0.906653E-01
1991     0.100000E+01     0.110704E+01    -0.101686E+00
1992     0.110000E+01     0.124824E+01    -0.126421E+00
1993     0.255000E+01     0.128302E+01     0.686875E+00
1994     0.166000E+01     0.136572E+01     0.195136E+00
1995     0.495000E+01     0.150033E+01     0.119370E+01
1996     0.166000E+01     0.109798E+01     0.413345E+00
1997     0.165000E+01     0.113055E+01     0.378073E+00
1998     0.670000E+00     0.121320E+01    -0.593738E+00
1999     0.103000E+01     0.112513E+01    -0.883442E-01
2000     0.950000E+00     0.127944E+01    -0.297716E+00
2001     0.620000E+00     0.119344E+01    -0.654879E+00
2002     0.151000E+01     0.138202E+01     0.885644E-01
2003     0.600000E+00     0.103467E+01    -0.544912E+00
2004     0.900000E+00     0.167428E+01    -0.620746E+00
2005     0.311000E+01     0.671345E+00     0.153309E+01
2006     0.810000E+00     0.122763E+01    -0.415805E+00
2007     N/A              0.000000E+00     N/A

Survey Index:   45 Tag:         NEC_Y    AGE =  0
Time = JAN-1           Type = NUMBER
Catchability =    0.818325E-05   % Variance Contribution =     3.2225
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual

-------------------------------------------------------------------------------

1982     0.550000E+00     0.595466E+00    -0.794252E-01
1983     0.960000E+00     0.645520E+00     0.396877E+00
1984     0.180000E+00     0.389049E+00    -0.770750E+00
1985     0.590000E+00     0.390096E+00     0.413729E+00
1986     0.390000E+00     0.427943E+00    -0.928436E-01
1987     0.700000E-01     0.352028E+00    -0.161522E+01
1988     0.600000E-01     0.105019E+00    -0.559801E+00
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1989     0.310000E+00     0.218653E+00     0.349087E+00
1990     0.440000E+00     0.243565E+00     0.591392E+00
1991     0.760000E+00     0.230644E+00     0.119244E+01
1992     0.990000E+00     0.260062E+00     0.133679E+01
1993     0.230000E+00     0.267309E+00    -0.150327E+00
1994     0.750000E+00     0.284539E+00     0.969204E+00
1995     0.930000E+00     0.312584E+00     0.109031E+01
1996     0.110000E+00     0.228757E+00    -0.732180E+00
1997     0.170000E+00     0.235542E+00    -0.326092E+00
1998     0.380000E+00     0.252762E+00     0.407723E+00
1999     0.210000E+00     0.234414E+00    -0.109983E+00
2000     0.220000E+00     0.266563E+00    -0.191983E+00
2001     0.120000E+00     0.248646E+00    -0.728540E+00
2002     0.600000E-01     0.287935E+00    -0.156839E+01
2003     0.180000E+00     0.215568E+00    -0.180317E+00
2004     0.360000E+00     0.348826E+00     0.315304E-01
2005     0.160000E+00     0.139870E+00     0.134458E+00
2006     0.310000E+00     0.255768E+00     0.192301E+00
2007     N/A              0.000000E+00     N/A

Survey Index:   50 Tag:         DE_IY    AGE =  0
Time = JAN-1           Type = NUMBER
Catchability =    0.548734E-05   % Variance Contribution =     3.7931
Residual = LN(Observed) - LN(Predicted)

Year      Observed        Predicted         Residual
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```
1982     N/A              0.399294E+00     N/A
1983     N/A              0.432858E+00     N/A
1984     N/A              0.260880E+00     N/A
1985     N/A              0.261582E+00     N/A
1986     0.320000E+00     0.286960E+00     0.108977E+00
1987     0.260000E+00     0.236055E+00     0.966172E-01
1988     0.100000E-01     0.704216E-01    -0.195191E+01
1989     0.140000E+00     0.146619E+00    -0.461964E-01
1990     0.360000E+00     0.163324E+00     0.790368E+00
1991     0.380000E+00     0.154660E+00     0.898944E+00
1992     0.370000E+00     0.174386E+00     0.752230E+00
1993     0.500000E-01     0.179246E+00    -0.127674E+01
1994     0.570000E+00     0.190799E+00     0.109441E+01
1995     0.300000E+00     0.209605E+00     0.358557E+00
1996     0.800000E-01     0.153395E+00    -0.650987E+00
1997     0.220000E+00     0.157945E+00     0.331383E+00
1998     0.390000E+00     0.169491E+00     0.833345E+00
1999     0.350000E+00     0.157188E+00     0.800488E+00
2000     0.210000E+00     0.178746E+00     0.161144E+00
2001     0.140000E+00     0.166732E+00    -0.174743E+00
2002     0.130000E+00     0.193077E+00    -0.395552E+00
2003     0.210000E+00     0.144550E+00     0.373479E+00
2004     0.270000E+00     0.233908E+00     0.143495E+00
2005     0.100000E-01     0.937911E-01    -0.223848E+01
2006     0.170000E+00     0.171507E+00    -0.882677E-02
2007     N/A              0.000000E+00     N/A

Survey Index:   51 Tag:         RI_XY    AGE =  0
```

Time = JAN-1 Type = NUMBER
Catchability = 0.105736E-05 % Variance Contribution = 2.0427
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1982	N/A	0.769404E-01	N/A
1983	N/A	0.834080E-01	N/A
1984	N/A	0.502693E-01	N/A
1985	N/A	0.504046E-01	N/A
1986	N/A	0.552948E-01	N/A
1987	N/A	0.454857E-01	N/A
1988	N/A	0.135696E-01	N/A
1989	N/A	0.282522E-01	N/A
1990	0.200000E-01	0.314711E-01	-0.453338E+00
1991	N/A	0.298016E-01	N/A
1992	0.100000E-01	0.336027E-01	-0.121202E+01
1993	0.100000E-01	0.345392E-01	-0.123951E+01
1994	0.400000E-01	0.367654E-01	0.843227E-01
1995	0.300000E-01	0.403891E-01	-0.297362E+00
1996	0.200000E-01	0.295578E-01	-0.390616E+00
1997	0.400000E-01	0.304345E-01	0.273301E+00
1998	N/A	0.326595E-01	N/A
1999	0.300000E-01	0.302888E-01	-0.958128E-02
2000	0.900000E-01	0.344427E-01	0.960512E+00
2001	0.100000E-01	0.321277E-01	-0.116713E+01
2002	0.110000E+00	0.372042E-01	0.108406E+01
2003	0.500000E-01	0.278536E-01	0.585061E+00
2004	0.100000E+00	0.450720E-01	0.796909E+00
2005	0.400000E-01	0.180727E-01	0.794476E+00
2006	0.400000E-01	0.330479E-01	0.190920E+00
2007	N/A	0.000000E+00	N/A

Bootstrap Summary Report

Number of Bootstrap Repetitions Requested = 1000
Number of Bootstrap Repetitions Completed = 1000
Bootstrap Output Variable: Stock Estimates (2007)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 1	25417.	26349.	7012.	0.2661
N 2	10309.	10557.	1972.	0.1868
N 3	17337.	17551.	3000.	0.1709
N 4	5397.	5530.	1089.	0.1969
N 5	4052.	4183.	999.	0.2387
N 6	1050.	1070.	618.	0.5770

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
N 1	932.	224.	3.6667	24485.	0.2864
N 2	248.	63.	2.4016	10062.	0.1960
N 3	214.	95.	1.2362	17123.	0.1752
N 4	133.	35.	2.4735	5263.	0.2069
N 5	131.	32.	3.2207	3922.	0.2546
N 6	20.	20.	1.8983	1030.	0.5993

	LOWER 80. % CI	UPPER 80. % CI
N 1	18111.	35811.
N 2	8156.	12982.
N 3	13838.	21682.
N 4	4150.	7029.
N 5	2961.	5484.
N 6	314.	1912.

Bootstrap Output Variable: Catchability Estimates

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
Q 1	0.141956E-03	0.144377E-03	0.268216E-04	0.1858
Q 2	0.416467E-03	0.417257E-03	0.460376E-04	0.1103
Q 3	0.341157E-03	0.344519E-03	0.446112E-04	0.1295
Q 4	0.337567E-03	0.344664E-03	0.692883E-04	0.2010
Q 5	0.447993E-03	0.454280E-03	0.762677E-04	0.1679
Q 6	0.138176E-04	0.140125E-04	0.201795E-05	0.1440
Q 7	0.379163E-04	0.379396E-04	0.372445E-05	0.0982
Q 8	0.344239E-04	0.347738E-04	0.566360E-05	0.1629
Q 9	0.383975E-04	0.387446E-04	0.490521E-05	0.1266
Q 10	0.652723E-04	0.653020E-04	0.828351E-05	0.1268
Q 11	0.676126E-04	0.677628E-04	0.435628E-05	0.0643
Q 12	0.811036E-04	0.814997E-04	0.101574E-04	0.1246
Q 13	0.756270E-04	0.759580E-04	0.104538E-04	0.1376
Q 15	0.406577E-04	0.408039E-04	0.750765E-05	0.1840
Q 16	0.432367E-04	0.438196E-04	0.691473E-05	0.1578
Q 18	0.168215E-03	0.169128E-03	0.178186E-04	0.1054
Q 19	0.657295E-04	0.663685E-04	0.123035E-04	0.1854
Q 21	0.173459E-04	0.175807E-04	0.277520E-05	0.1579
Q 22	0.184656E-04	0.184226E-04	0.282619E-05	0.1534
Q 23	0.295921E-04	0.299883E-04	0.548508E-05	0.1829
Q 24	0.425758E-04	0.430757E-04	0.671349E-05	0.1559
Q 25	0.107830E-03	0.108402E-03	0.137740E-04	0.1271
Q 26	0.882136E-04	0.889029E-04	0.121949E-04	0.1372
Q 27	0.606059E-04	0.610114E-04	0.103205E-04	0.1692
Q 29	0.111458E-03	0.112712E-03	0.167646E-04	0.1487
Q 30	0.854502E-04	0.879589E-04	0.177854E-04	0.2022
Q 31	0.104477E-04	0.107553E-04	0.217898E-05	0.2026
Q 32	0.209505E-04	0.213432E-04	0.354405E-05	0.1661
Q 33	0.158198E-03	0.160302E-03	0.235884E-04	0.1471
Q 34	0.688016E-04	0.702375E-04	0.151014E-04	0.2150
Q 35	0.436851E-04	0.441118E-04	0.834166E-05	0.1891
Q 36	0.588380E-04	0.595460E-04	0.102164E-04	0.1716
Q 40	0.184557E-05	0.187828E-05	0.417155E-06	0.2221
Q 41	0.281985E-04	0.283534E-04	0.304266E-05	0.1073
Q 43	0.238811E-03	0.238872E-03	0.293040E-04	0.1227
Q 44	0.392777E-04	0.397527E-04	0.601836E-05	0.1514
Q 45	0.818325E-05	0.825855E-05	0.120797E-05	0.1463
Q 50	0.548734E-05	0.560958E-05	0.107908E-05	0.1924
Q 51	0.105736E-05	0.107593E-05	0.216337E-06	0.2011

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
Q 1	0.2421E-05	0.8516E-06	1.7053	0.1395E-03	0.1922
Q 2	0.7895E-06	0.1456E-05	0.1896	0.4157E-03	0.1108
Q 3	0.3363E-05	0.1415E-05	0.9856	0.3378E-03	0.1321
Q 4	0.7097E-05	0.2203E-05	2.1022	0.3305E-03	0.2097
Q 5	0.6287E-05	0.2420E-05	1.4034	0.4417E-03	0.1727
Q 6	0.1949E-06	0.6411E-07	1.4107	0.1362E-04	0.1481
Q 7	0.2328E-07	0.1178E-06	0.0614	0.3789E-04	0.0983
Q 8	0.3499E-06	0.1794E-06	1.0165	0.3407E-04	0.1662
Q 9	0.3471E-06	0.1555E-06	0.9040	0.3805E-04	0.1289
Q 10	0.2969E-07	0.2619E-06	0.0455	0.6524E-04	0.1270
Q 11	0.1502E-06	0.1378E-06	0.2222	0.6746E-04	0.0646
Q 12	0.3961E-06	0.3214E-06	0.4884	0.8071E-04	0.1259
Q 13	0.3309E-06	0.3307E-06	0.4376	0.7530E-04	0.1388
Q 15	0.1462E-06	0.2375E-06	0.3596	0.4051E-04	0.1853
Q 16	0.5829E-06	0.2194E-06	1.3482	0.4265E-04	0.1621
Q 18	0.9127E-06	0.5642E-06	0.5426	0.1673E-03	0.1065
Q 19	0.6390E-06	0.3896E-06	0.9722	0.6509E-04	0.1890
Q 21	0.2348E-06	0.8807E-07	1.3539	0.1711E-04	0.1622
Q 22	-0.4295E-07	0.8938E-07	-0.2326	0.1851E-04	0.1527
Q 23	0.3962E-06	0.1739E-06	1.3388	0.2920E-04	0.1879
Q 24	0.5000E-06	0.2129E-06	1.1743	0.4208E-04	0.1596
Q 25	0.5713E-06	0.4359E-06	0.5298	0.1073E-03	0.1284
Q 26	0.6893E-06	0.3863E-06	0.7814	0.8752E-04	0.1393
Q 27	0.4055E-06	0.3266E-06	0.6690	0.6020E-04	0.1714
Q 29	0.1254E-05	0.5316E-06	1.1250	0.1102E-03	0.1521
Q 30	0.2509E-05	0.5680E-06	2.9358	0.8294E-04	0.2144
Q 31	0.3076E-06	0.6959E-07	2.9443	0.1014E-04	0.2149
Q 32	0.3926E-06	0.1128E-06	1.8741	0.2056E-04	0.1724
Q 33	0.2104E-05	0.7489E-06	1.3303	0.1561E-03	0.1511
Q 34	0.1436E-05	0.4797E-06	2.0870	0.6737E-04	0.2242
Q 35	0.4267E-06	0.2641E-06	0.9767	0.4326E-04	0.1928
Q 36	0.7080E-06	0.3238E-06	1.2032	0.5813E-04	0.1758
Q 40	0.3271E-07	0.1323E-07	1.7724	0.1813E-05	0.2301
Q 41	0.1548E-06	0.9634E-07	0.5490	0.2804E-04	0.1085
Q 43	0.6051E-07	0.9267E-06	0.0253	0.2388E-03	0.1227
Q 44	0.4751E-06	0.1909E-06	1.2095	0.3880E-04	0.1551
Q 45	0.7530E-07	0.3827E-07	0.9202	0.8108E-05	0.1490
Q 50	0.1222E-06	0.3434E-07	2.2277	0.5365E-05	0.2011
Q 51	0.1857E-07	0.6866E-08	1.7565	0.1039E-05	0.2083

	LOWER 80. % CI	UPPER 80. % CI
Q 1	0.112036E-03	0.180010E-03
Q 2	0.359080E-03	0.478381E-03
Q 3	0.286682E-03	0.401303E-03
Q 4	0.261438E-03	0.438939E-03
Q 5	0.358378E-03	0.556110E-03
Q 6	0.115449E-04	0.167038E-04
Q 7	0.332723E-04	0.428684E-04
Q 8	0.280821E-04	0.420938E-04
Q 9	0.330031E-04	0.449621E-04
Q 10	0.549324E-04	0.763026E-04
Q 11	0.624910E-04	0.733437E-04
Q 12	0.688536E-04	0.947504E-04
Q 13	0.628368E-04	0.900336E-04
Q 15	0.317869E-04	0.504297E-04
Q 16	0.352138E-04	0.530894E-04
Q 18	0.146402E-03	0.191180E-03
Q 19	0.507996E-04	0.820121E-04
Q 21	0.141584E-04	0.211271E-04
Q 22	0.147976E-04	0.220057E-04
Q 23	0.233439E-04	0.373245E-04
Q 24	0.348111E-04	0.521047E-04
Q 25	0.913635E-04	0.126317E-03
Q 26	0.743632E-04	0.105116E-03
Q 27	0.482438E-04	0.746251E-04
Q 29	0.920065E-04	0.134781E-03
Q 30	0.661910E-04	0.111862E-03
Q 31	0.807179E-05	0.138281E-04
Q 32	0.169426E-04	0.258124E-04
Q 33	0.131372E-03	0.191889E-03
Q 34	0.519500E-04	0.895232E-04
Q 35	0.337537E-04	0.551920E-04
Q 36	0.471333E-04	0.735044E-04
Q 40	0.138653E-05	0.241088E-05
Q 41	0.245639E-04	0.322148E-04
Q 43	0.201019E-03	0.275279E-03
Q 44	0.323671E-04	0.475623E-04
Q 45	0.674154E-05	0.988610E-05
Q 50	0.428971E-05	0.711304E-05
Q 51	0.813957E-06	0.135144E-05

Bootstrap Output Variable: Fishing Mortality (2006)

		NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AGE	0	0.0068	0.0070	0.001881	0.2691
AGE	1	0.0897	0.0905	0.016744	0.1850
AGE	2	0.2336	0.2366	0.037063	0.1567
AGE	3	0.4346	0.4376	0.072465	0.1656
AGE	4	0.3351	0.3402	0.070982	0.2086
AGE	5	0.5542	0.8471	0.966894	1.1414
AGE	6	0.4413	0.5416	0.322605	0.5956
AGE	7	0.4413	0.5416	0.322605	0.5956

		Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AGE	0	0.000226	0.000060	3.3477	0.0065	0.2877
AGE	1	0.000871	0.000530	0.9712	0.0888	0.1886
AGE	2	0.002987	0.001176	1.2785	0.2306	0.1607
AGE	3	0.002936	0.002293	0.6754	0.4317	0.1679
AGE	4	0.005071	0.002250	1.5131	0.3301	0.2151
AGE	5	0.292848	0.031949	52.8383	0.2614	3.6991
AGE	6	0.100285	0.010684	22.7231	0.3410	0.9459
AGE	7	0.100285	0.010684	22.7231	0.3410	0.9459

		LOWER 80. % CI	UPPER 80. % CI
AGE	0	0.004805	0.009459
AGE	1	0.071776	0.111962
AGE	2	0.190978	0.284672
AGE	3	0.349422	0.533902
AGE	4	0.257760	0.433694
AGE	5	0.342392	1.237426
AGE	6	0.366798	0.661731
AGE	7	0.366798	0.661731

Bootstrap Output Variable: Average F (2006) AGES 3 - 5

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.4413	0.5416	0.322605	0.5956
N WTD	0.4128	0.4215	0.065338	0.1550
B WTD	0.4149	0.4287	0.080532	0.1879
C WTD	0.4221	0.4680	0.147340	0.3148

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.100285	0.010684	22.7231	0.3410	0.9459
N WTD	0.008625	0.002084	2.0892	0.4042	0.1616
B WTD	0.013761	0.002584	3.3164	0.4012	0.2007
C WTD	0.045987	0.004881	10.8961	0.3761	0.3918

	LOWER 80. % CI	UPPER 80. % CI
AVG F	0.366798	0.661731
N WTD	0.351353	0.500226
B WTD	0.351202	0.509919
C WTD	0.364438	0.541993

Bootstrap Output Variable: Biomass

JAN-1 Biomass (2007) Mean Biomass & SSB (2006)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
JAN-1	45974.	46852.	4806.	0.1026
MEAN	44433.	45150.	4011.	0.0888
SSB	40508.	41148.	4108.	0.0998

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
JAN-1	878.	155.	1.9098	45096.	0.1066
MEAN	717.	129.	1.6140	43716.	0.0918
SSB	640.	131.	1.5809	39868.	0.1030

	LOWER 80. % CI	UPPER 80. % CI
JAN-1	40829.	52971.
MEAN	40097.	50304.
SSB	35922.	46331.

Plus Group Diagnostic Report

Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1982	67.	67.	0.663932	0.663932	1.000000
1983	71.	92.	0.713070	1.057326	1.482781
1984	14.	44.	0.283633	1.391481	4.905918
1985	11.	29.	0.366595	1.434884	3.914087
1986	20.	24.	1.089646	1.670284	1.532869
1987	71.	54.	2.078124	1.125094	0.541399
1988	27.	26.	2.078124	1.794470	0.863505
1989	5.	5.	2.078124	1.878650	0.904013
1990	4.	4.	2.078124	1.278000	0.614978
1991	2.	3.	0.506289	1.189165	2.348787
1992	1.	3.	0.567854	1.779020	3.132882
1993	6.	4.	2.078124	0.887367	0.427004
1994	9.	12.	0.575801	0.956601	1.661340
1995	2.	14.	0.085042	1.036577	12.188986
1996	5.	12.	0.317148	1.005173	3.169409
1997	7.	15.	0.334670	0.984998	2.943196
1998	2.	15.	0.077002	1.100186	14.287727
1999	26.	20.	1.455874	0.869515	0.597246
2000	53.	39.	1.598323	0.908901	0.568660
2001	73.	51.	1.207716	0.680871	0.563767
2002	67.	125.	0.247970	0.519636	2.095560
2003	246.	257.	0.455602	0.481929	1.057786
2004	424.	471.	0.450762	0.515088	1.142705
2005	1312.	650.	1.510305	0.497472	0.329385
2006	605.	826.	0.273436	0.394353	1.442211
2007	1072.	1253.	N/A	N/A	

Warning **** Infeasible Mass Balance in Plus Group
Year = 1993
Year = 2005

ASAP BASE RUN (F08_BASE_T5.REP)

```
Age Structured Assessment Program (ASAP) Version 2.0
Start time for run: Thu Mar 20 13:54:36 2008

obj_fun        = 2432.1

Component                 Lambda          obj_fun
__Catch_Fleet_1                10          2043.75
Catch_Fleet_Total              10          2043.75
Discard_Fleet_Total            0           0
__Index_Fit_1                  1           60.3058
__Index_Fit_2                  1           41.137
__Index_Fit_3                  1           29.3885
__Index_Fit_4                  1           24.6812
__Index_Fit_5                  1           1.52122
__Index_Fit_6                  1           18.1862
__Index_Fit_7                  1           2.50131
__Index_Fit_8                  1           -6.82516
__Index_Fit_9                  1           -49.274
__Index_Fit_10                 1           -36.0871
__Index_Fit_11                 1           11.1283
__Index_Fit_12                 1           -7.49735
__Index_Fit_13                 1           -37.3766
__Index_Fit_14                 1           26.59
__Index_Fit_15                 1           -16.7199
__Index_Fit_16                 1           10.2498
__Index_Fit_17                 1           -24.5756
__Index_Fit_18                 1           -5.86537
__Index_Fit_19                 1           -33.9867
__Index_Fit_20                 1           -46.5534
__Index_Fit_21                 1           16.2196
__Index_Fit_22                 1           -1.02528
__Index_Fit_23                 1           -36.1572
__Index_Fit_24                 1           -48.7597
__Index_Fit_25                 1           9.03927
__Index_Fit_26                 1           -12.5549
__Index_Fit_27                 1           3.06733
__Index_Fit_28                 1           9.92303
__Index_Fit_29                 1           43.3967
__Index_Fit_30                 1           29.4228
__Index_Fit_31                 1           -4.5913
__Index_Fit_32                 1           -10.0133
__Index_Fit_33                 1           -21.8198
__Index_Fit_34                 1           19.6959
__Index_Fit_35                 1           73.8095
__Index_Fit_36                 1           19.844
__Index_Fit_37                 1           -2.64469
__Index_Fit_38                 1           -4.71552
__Index_Fit_39                 1           -31.8191
Index_Fit_Total               39           11.2457
Catch_Age_Comps       see_below            308.56
Discard_Age_Comps     see_below            0
Survey_Age_Comps      see_below            0
__Sel_Param_1                  1           0.863394
__Sel_Param_2                  1           3.3608
```

```
__Sel_Param_3                 1          1.03693
__Sel_Param_4                 1          2.20092
Sel_Params_Total              4          7.46205
Index_Sel_Params_Total        0          0
q_year1_Total                 0          0
q_devs_Total                  390000          0
__Fmult_year1_fleet_1         1          0.659681
Fmult_year1_fleet_Total       1          0.659681
Fmult_devs_fleet_Total        0          0
N_year_1                      1          60.4297
Recruit_devs                  0          0
SRR_steepness                 0          0
SRR_unexpl_stock              0          0
Fmult_Max_penalty          1000          0
F_penalty                     0          0

 Input and Estimated effective sample sizes for fleet 1
1982  31  28.7442
1983  33  23.4986
1984  43  15.9284
1985  379  521.988
1986  39  30.8231
1987  46  24.0466
1988  663  3022.23
1989  92  422.065
1990  2270  2540.09
1991  58  35.5184
1992  173  610.607
1993  415  226.366
1994  106  74.3798
1995  75  147.862
1996  222  65.0925
1997  267  240.79
1998  151  245.995
1999  187  228.668
2000  125  155.017
2001  215  168.078
2002  61  77.8285
2003  236  685.159
2004  139  176.307
2005  368  736.875
2006  194  210.521
 Total  6588  10714.5

 Input and Estimated effective Discard sample sizes for fleet 1
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
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1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16

Observed and predicted total fleet catch by year and standardized residual
 fleet 1 total catches
1982  18963  19367.1  -0.211396
1983  26466  25834.1  0.242253
1984  26057  25525.9  0.206445
1985  20432  20682.4  -0.122114
1986  20866  20991.6  -0.0601668
1987  18312  18204.7  0.0589384
1988  21761  21474.1  0.133067
1989  10314  9969.74  0.340321
1990  7976  7517.96  0.5929
1991  11316  11128.7  0.167288
1992  11805  12112.1  -0.257497
1993  10781  11199.4  -0.381715
1994  12182  12337.4  -0.1271
1995  10495  9883.26  0.602067
1996  11643  11489.9  0.132658
1997  10325  10533.6  -0.200542
1998  11641  11695.6  -0.0469193
1999  10851  10769.8  0.0753135
2000  13756  13901.1  -0.105196
2001  11932  12097.7  -0.138288
2002  11308  11564  -0.224434
2003  12927  13324.6  -0.303678
2004  13832  14177.2  -0.247146
2005  13444  13500  -0.041658
2006  12853  12857.6  -0.00360121
Observed and predicted total fleet Discards by year and standardized residual
 fleet 1 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
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1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0

Index data
index number 1
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  7.15  3.16304  2.77823
1993  6.5  3.24178  2.3698
1994  3.76  3.64624  0.104657
1995  6.07  4.36675  1.12188
1996  22.17  4.91778  5.12972
1997  3.86  3.52732  0.307016
1998  1.68  3.59798  -2.59428
1999  2.11  3.92443  -2.11382
2000  0.7  3.03344  -4.99513
2001  3.07  3.79754  -0.724475
2002  2.77  3.57498  -0.86903
2003  8.17  4.03331  2.40455
2004  1.45  2.87259  -2.32883
2005  2.96  4.33083  -1.29639
2006  2.64  2.14577  0.706093
index number 2
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  4.74  3.85823  0.701143
1993  6.7  3.14297  2.57848
1994  7.2  3.53907  2.41932
1995  4.59  4.14529  0.347144
1996  8.33  7.8728  0.192293
1997  4.8  9.25791  -2.23757
1998  3.25  7.14545  -2.68368
1999  4.8  7.36054  -1.45632
2000  6.52  8.20581  -0.783374
2001  5.33  6.29553  -0.567136
2002  10.74  8.08377  0.967831
2003  14.36  7.71695  2.1155
2004  8.68  8.73891  -0.0230396
2005  4.03  6.20619  -1.47084
2006  9.06  9.32924  -0.0997554
index number 3
```

```
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.33  0.43957  -0.976644
1993  0.31  0.565482  -2.04764
1994  0.82  0.545626  1.38769
1995  0.25  0.660864  -3.31137
1996  0.6  0.885932  -1.32753
1997  1.04  2.04526  -2.3038
1998  2.29  3.34906  -1.29489
1999  2.9  2.70213  0.240733
2000  4.96  3.07227  1.63166
2001  6.42  3.31135  2.25528
2002  5.58  2.84875  2.29019
2003  8.48  3.89589  2.6495
2004  4.56  3.78241  0.636878
2005  3.07  4.22825  -1.09044
2006  4.29  2.96325  1.26039
index number 4
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.04  0.0405787  -0.048931
1993  0.05  0.0770519  -1.47314
1994  0.26  0.118014  2.69068
1995  0.02  0.122756  -6.18089
1996  0.12  0.117134  0.0823584
1997  0.43  0.204667  2.52895
1998  0.42  0.740608  -1.9322
1999  0.84  1.288  -1.45608
2000  2.51  1.18823  2.54742
2001  2.44  1.29046  2.16992
2002  2.26  1.62483  1.124
2003  2.67  1.5227  1.91305
2004  1.64  2.13066  -0.891596
2005  1.34  2.03259  -1.41926
2006  2.47  2.23162  0.345716
index number 5
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.04  0.0369633  0.268951
1993  0.04  0.0164468  3.02749
1994  0.01  0.0263973  -3.30656
1996  0.03  0.0371273  -0.726099
1997  0.15  0.0455082  4.06302
1998  0.12  0.11962  0.0107914
1999  0.41  0.444185  -0.272805
2000  1.08  0.984701  0.314683
2001  1.34  1.09454  0.689259
2002  1.33  1.40645  -0.190374
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2003  1.96  1.94811  0.0207343
2004  1.44  2.19696  -1.43899
2005  1.49  2.74884  -2.08612
2006  2.6  2.9017  -0.37398
index number 6
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.7  0.607028  0.369901
1983  0.32  0.590939  -1.59218
1984  0.17  0.94034  -4.43979
1985  0.55  0.411521  0.752903
1986  1.48  0.546534  2.58583
1987  0.47  0.659924  -0.880957
1988  0.6  0.484104  0.557113
1989  0.06  0.132534  -2.05708
1990  0.63  0.266326  2.23489
1991  0.79  0.385753  1.86069
1992  0.77  0.308088  2.37767
1993  0.73  0.315757  2.17538
1994  0.35  0.355153  -0.0379369
1995  0.79  0.425332  1.60716
1996  1.08  0.479005  2.11031
1997  0.29  0.34357  -0.439999
1998  0.27  0.350452  -0.676965
1999  0.22  0.38225  -1.43398
2000  0.19  0.295465  -1.14607
2001  0.48  0.369891  0.676383
2002  0.34  0.348212  -0.0619517
2003  0.54  0.392855  0.825764
2004  0.3  0.279798  0.180959
2005  0.26  0.421834  -1.25613
2006  0.04  0.209003  -4.29191
index number 7
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.43  0.880047  1.26009
1983  0.39  0.779923  -1.79894
1984  0.33  0.603862  -1.56846
1985  1.56  0.927726  1.34899
1986  0.43  0.416326  0.0838841
1987  0.43  0.481866  -0.295598
1988  0.81  0.701762  0.372326
1989  0.23  0.381867  -1.316
1990  0.03  0.121554  -3.6318
1991  0.27  0.293617  -0.217657
1992  0.41  0.364524  0.305163
1993  0.5  0.296946  1.3525
1994  0.53  0.33437  1.19566
1995  0.27  0.391645  -0.965425
1996  0.56  0.743818  -0.736814
1997  0.67  0.874683  -0.691971
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1998  0.52  0.675099  -0.677555
1999  0.74  0.69542  0.161282
2000  1.03  0.77528  0.737409
2001  0.89  0.594799  1.04606
2002  0.89  0.76375  0.397091
2003  1.29  0.729094  1.48109
2004  1.45  0.825648  1.46177
2005  0.65  0.586357  0.267468
2006  1.04  0.881422  0.429431
index number 8
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.12  0.0954294  0.594687
1983  0.19  0.218937  -0.367963
1984  0.09  0.128517  -0.924729
1985  0.21  0.0934103  2.10279
1986  0.2  0.15014  0.744309
1987  0.02  0.0526082  -2.5104
1988  0.07  0.0853021  -0.513178
1989  0.02  0.0725865  -3.34597
1990  0.06  0.0518028  0.381311
1992  0.01  0.0420305  -3.72693
1993  0.04  0.0540699  -0.782337
1994  0.04  0.0521713  -0.689555
1995  0.02  0.0631901  -2.98613
1996  0.12  0.0847105  0.903956
1997  0.09  0.195563  -2.01444
1998  0.32  0.320228  -0.00185237
1999  0.48  0.258371  1.60775
2000  0.63  0.293762  1.98039
2001  1.02  0.316623  3.03657
2002  0.74  0.27239  2.59418
2003  0.59  0.372515  1.19362
2004  0.85  0.361664  2.21808
2005  0.58  0.404294  0.936747
2006  0.24  0.283338  -0.430888
index number 9
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.02  0.0237056  -0.441214
1983  0.03  0.0319525  -0.163664
1984  0.05  0.0479511  0.108608
1985  0.04  0.0263726  1.08124
1986  0.02  0.0200818  -0.0106003
1987  0.01  0.0250139  -2.37985
1988  0.02  0.0124052  1.23975
1989  0.01  0.0115623  -0.376812
1991  0.02  0.0130602  1.10618
1994  0.01  0.012651  -0.610384
1997  0.01  0.0219401  -2.03952
1998  0.06  0.0793926  -0.726951
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1999  0.13  0.138073  -0.156383
2000  0.12  0.127377  -0.154853
2001  0.2  0.138336  0.956859
2002  0.31  0.17418  1.49637
2003  0.29  0.163232  1.49177
2004  0.27  0.228405  0.43426
2005  0.15  0.217891  -0.969134
2006  0.25  0.239228  0.114322
index number 10
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.02  0.0188945  0.147593
1984  0.02  0.01364  0.99344
1985  0.02  0.0165861  0.485823
1986  0.01  0.0112334  -0.301895
1992  0.01  0.00445949  2.09615
1995  0.01  0.0052904  1.65266
1998  0.02  0.0144318  0.846975
1999  0.03  0.0535894  -1.5059
2000  0.17  0.118801  0.930172
2001  0.1  0.132052  -0.721667
2002  0.19  0.169683  0.29356
2003  0.2  0.235032  -0.418957
2004  0.16  0.265055  -1.31021
2005  0.17  0.331637  -1.73456
2006  0.2  0.35008  -1.45318
index number 11
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  1.52  1.42787  0.112763
1984  1.46  1.10554  0.501528
1985  1.39  1.69846  -0.361433
1986  0.8  0.762201  0.0872867
1987  0.83  0.882189  -0.109972
1988  0.58  1.28477  -1.43425
1989  0.62  0.699114  -0.216576
1990  0.21  0.222539  -0.104585
1991  0.38  0.537547  -0.625495
1992  0.84  0.667363  0.414901
1993  1.04  0.543643  1.16982
1994  0.8  0.612157  0.482628
1995  0.67  0.717015  -0.122304
1996  1.16  1.36177  -0.289196
1997  1.24  1.60135  -0.461191
1998  1.29  1.23596  0.0771791
1999  2.13  1.27316  0.928057
2000  1.73  1.41937  0.356908
2001  1.2  1.08894  0.175131
2002  1.36  1.39826  -0.0500306
2003  1.17  1.33481  -0.237659
2004  1.31  1.51158  -0.258113
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2005  1.49  1.07349  0.591258
2006  1.14  1.61369  -0.626666
index number 12
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.4  0.556078  -0.594114
1984  0.34  0.326422  0.0734985
1985  0.43  0.237253  1.0724
1986  0.46  0.381342  0.338191
1987  0.11  0.13362  -0.350788
1988  0.2  0.216659  -0.144283
1989  0.18  0.184363  -0.0431863
1990  0.05  0.131574  -1.74486
1991  0.03  0.0583192  -1.19877
1992  0.09  0.106753  -0.307859
1993  0.25  0.137332  1.08033
1994  0.03  0.13251  -2.67886
1995  0.09  0.160497  -1.04319
1996  0.28  0.215156  0.475055
1997  0.57  0.49671  0.2482
1998  1.14  0.813349  0.608865
1999  1.63  0.656236  1.64074
2000  1.49  0.746127  1.24729
2001  1.22  0.804191  0.751596
2002  0.93  0.691844  0.533485
2003  0.86  0.946152  -0.172171
2004  1.03  0.918591  0.20644
2005  1.37  1.02687  0.519911
2006  0.54  0.71965  -0.517925
index number 13
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.03  0.0677471  -1.46901
1984  0.12  0.101668  0.298961
1985  0.07  0.0559165  0.405105
1986  0.05  0.0425785  0.289758
1987  0.11  0.0530356  1.3156
1988  0.03  0.026302  0.237238
1989  0.03  0.024515  0.364124
1991  0.04  0.0276909  0.66324
1993  0.03  0.017513  0.970676
1994  0.01  0.0268233  -1.77937
1995  0.01  0.027901  -1.85041
1996  0.02  0.0266231  -0.515854
1997  0.04  0.0465185  -0.272259
1998  0.29  0.168332  0.980939
1999  0.33  0.292749  0.216007
2000  0.31  0.27007  0.248669
2001  0.4  0.293306  0.559496
2002  0.37  0.369305  0.00338905
2003  0.35  0.346091  0.0202528
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2004  0.25  0.484276  -1.19239
2005  0.66  0.461984  0.643286
2006  0.47  0.507223  -0.13745
index number 14
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.584  0.954509  0.913434
1983  0.599  0.845914  -0.622449
1984  0.078  0.654956  -3.83735
1985  1.26  1.00622  0.405596
1986  0.522  0.451552  0.261448
1987  0.64  0.522637  0.365331
1988  1.005  0.76114  0.501207
1989  0.363  0.414177  -0.237851
1990  0.021  0.131839  -3.31292
1991  0.05  0.31846  -3.33892
1992  0.342  0.395367  -0.261498
1993  0.492  0.322072  0.764103
1994  1.217  0.362661  2.18331
1995  1.302  0.424783  2.01993
1996  0.686  0.806754  -0.292404
1997  1.279  0.948692  0.53876
1998  1.212  0.73222  0.908807
1999  0.878  0.754261  0.273949
2000  1.659  0.840879  1.22544
2001  1.026  0.645126  0.83673
2002  1.511  0.828373  1.08395
2003  1.44  0.790784  1.0809
2004  0.283  0.895507  -2.0774
2005  0.351  0.63597  -1.07187
2006  2.44  0.956001  1.68976
index number 15
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.142  0.126831  0.203737
1983  0.45  0.290978  0.786275
1984  0.067  0.170806  -1.68767
1985  0.036  0.124147  -2.23249
1986  0.185  0.199544  -0.136479
1987  0.013  0.0699189  -3.03399
1988  0.123  0.113371  0.147013
1989  0.102  0.0964711  0.100501
1990  0.081  0.0688485  0.293123
1991  0.012  0.0305166  -1.68321
1992  0.09  0.0558607  0.860121
1993  0.065  0.0718616  -0.180979
1994  0.048  0.0693383  -0.663279
1995  0.053  0.0839829  -0.830136
1996  0.114  0.112585  0.0225302
1997  0.181  0.259913  -0.652552
1998  0.659  0.4256  0.788482
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1999  1.112  0.343388  2.11907
2000  1.205  0.390425  2.03241
2001  0.73  0.420808  0.993427
2002  0.397  0.36202  0.166338
2003  0.624  0.495092  0.417316
2004  0.323  0.48067  -0.716896
2005  1.029  0.537328  1.17172
2006  0.975  0.37657  1.71562
index number 16
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.405  0.479015  -0.302689
1983  1.662  1.09897  0.745968
1984  0.625  0.645103  -0.0570911
1985  0.267  0.46888  -1.01548
1986  1.895  0.75364  1.66283
1987  0.679  0.264071  1.70312
1988  0.663  0.42818  0.788496
1989  0.429  0.364353  0.294552
1990  0.317  0.260028  0.357274
1992  0.288  0.210975  0.561248
1993  0.186  0.271408  -0.681455
1994  0.478  0.261878  1.08516
1995  0.076  0.317187  -2.5766
1996  0.506  0.425211  0.313701
1997  1.282  0.981641  0.481415
1998  1.508  1.60741  -0.115128
1999  0.59  1.29691  -1.42038
2000  0.94  1.47456  -0.811947
2001  2.303  1.58931  0.668896
2002  1.083  1.36728  -0.42035
2003  1.302  1.86987  -0.652764
2004  1.254  1.8154  -0.667192
2005  1.455  2.02939  -0.600035
2006  2.049  1.42223  0.658456
index number 17
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.012  0.0428687  -2.29613
1983  0.02  0.0577822  -1.9133
1984  0.154  0.0867138  1.03576
1985  0.127  0.0476917  1.76629
1986  0.04  0.0363156  0.174265
1987  0.214  0.0452346  2.80267
1988  0.011  0.0224333  -1.28518
1989  0.006  0.0209091  -2.25139
1990  0.016  0.0235281  -0.6954
1991  0.011  0.0236179  -1.37798
1992  0.006  0.00786646  -0.488444
1994  0.03  0.0228778  0.488769
1997  0.114  0.0396761  1.90338
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1998  0.351  0.143572  1.61214
1999  0.262  0.249688  0.0868004
2000  0.379  0.230346  0.898006
2001  0.494  0.250164  1.22706
2002  0.307  0.314984  -0.0463011
2003  0.178  0.295185  -0.912184
2004  0.256  0.413044  -0.862695
2005  0.136  0.39403  -1.91839
2006  1.35  0.432615  2.05227
index number 18
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.271  0.286586  -0.100845
1985  0.325  0.440288  -0.547514
1986  0.1  0.197583  -1.22809
1987  0.086  0.228688  -1.76373
1988  0.223  0.333048  -0.723364
1989  0.049  0.181229  -2.35873
1990  0.022  0.0576881  -1.73848
1991  0.189  0.139347  0.549635
1992  0.188  0.172999  0.149965
1993  0.151  0.140927  0.124499
1994  0.314  0.158688  1.23073
1995  0.051  0.18587  -2.33218
1996  0.266  0.353007  -0.510344
1997  0.507  0.415114  0.3606
1998  0.594  0.320394  1.11328
1999  0.593  0.330038  1.05676
2000  0.726  0.367939  1.22564
2001  0.34  0.282284  0.335485
2002  1.264  0.362467  2.25261
2003  1.016  0.346019  1.94249
2004  0.818  0.391843  1.32729
2005  0.264  0.278278  -0.0949888
2006  0.36  0.418312  -0.270732
index number 19
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.044  0.0756012  -0.976141
1985  0.04  0.0549492  -0.572629
1986  0.082  0.088321  -0.133917
1987  0.014  0.0309471  -1.43048
1988  0.035  0.0501795  -0.649685
1989  0.024  0.0426995  -1.03899
1990  0.013  0.0304733  -1.53631
1991  0.029  0.0135071  1.37793
1992  0.021  0.0247247  -0.29446
1993  0.015  0.031807  -1.35549
1994  0.025  0.0306901  -0.369811
1995  0.02  0.037172  -1.11778
1996  0.086  0.0498315  0.984105
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1997  0.057  0.115041  -1.2664
1998  0.503  0.188377  1.77119
1999  0.385  0.151988  1.67614
2000  0.524  0.172807  2.00052
2001  0.365  0.186255  1.21328
2002  0.465  0.160235  1.92132
2003  0.395  0.219135  1.06255
2004  0.41  0.212751  1.18308
2005  0.15  0.237829  -0.831209
2006  0.068  0.166675  -1.61681
index number 20
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.058  0.022186  1.73302
1986  0.008  0.0168939  -1.34805
1987  0.004  0.021043  -2.99411
1988  0.009  0.0104359  -0.266944
1989  0.016  0.00972683  0.897545
1990  0.006  0.0109452  -1.08409
1991  0.028  0.0109869  1.68706
1992  0.004  0.00365945  0.160469
1993  0.018  0.00694865  1.7165
1994  0.018  0.0106427  0.947676
1995  0.005  0.0110703  -1.43338
1996  0.023  0.0105633  1.40323
1997  0.036  0.0184572  1.20478
1998  0.116  0.0667891  0.995559
1999  0.139  0.116154  0.32381
2000  0.074  0.107156  -0.667648
2001  0.12  0.116375  0.0553137
2002  0.233  0.146529  0.836431
2003  0.232  0.137319  0.945752
2004  0.194  0.192146  0.0173143
2005  0.033  0.183301  -3.09213
2006  0.065  0.201251  -2.03812
index number 21
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.571  1.10752  -1.19472
1986  0.339  0.497009  -0.689988
1987  1.17  0.57525  1.28032
1988  1.067  0.837762  0.436189
1989  0.884  0.455872  1.19428
1990  0.029  0.145111  -2.90381
1991  0.674  0.350519  1.17908
1992  0.826  0.435168  1.15572
1993  0.57  0.354494  0.85651
1994  0.827  0.399169  1.31362
1995  0.3  0.467544  -0.800183
1996  0.384  0.887968  -1.51176
1997  0.887  1.04419  -0.294233
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1998  0.681  0.805931  -0.303755
1999  0.269  0.83019  -2.03231
2000  0.679  0.925528  -0.558585
2001  0.395  0.710069  -1.05764
2002  2.689  0.911763  1.95044
2003  3.087  0.87039  2.28311
2004  1.459  0.985656  0.707286
2005  0.385  0.699992  -1.07811
2006  1.093  1.05224  0.0685397
index number 22
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.331  0.337018  -0.0324959
1986  0.528  0.541697  -0.0461848
1987  0.298  0.189807  0.813481
1988  0.223  0.307765  -0.580984
1989  0.481  0.261888  1.09637
1990  0.095  0.186901  -1.22036
1991  0.11  0.0828426  0.511329
1992  0.34  0.151644  1.45608
1993  0.366  0.195081  1.13472
1994  0.152  0.188231  -0.385543
1995  0.085  0.227986  -1.77928
1996  0.117  0.30563  -1.73161
1997  1.188  0.705578  0.93958
1998  1.373  1.15536  0.311232
1999  1.054  0.932186  0.221484
2000  1.484  1.05987  0.607001
2001  0.871  1.14236  -0.489088
2002  1.137  0.982766  0.262893
2003  1.93  1.34401  0.652574
2004  1.319  1.30486  0.0194359
2005  0.755  1.45867  -1.18764
2006  0.744  1.02227  -0.572998
index number 23
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.072  0.0683598  0.0935607
1986  0.075  0.0520536  0.65862
1987  0.072  0.0648378  0.188953
1988  0.033  0.0321551  0.0467722
1989  0.037  0.0299704  0.379984
1990  0.015  0.0337245  -1.46106
1991  0.042  0.0338531  0.38888
1992  0.036  0.0112755  2.09352
1993  0.046  0.0214103  1.37917
1994  0.039  0.0327924  0.312645
1995  0.024  0.0341099  -0.633952
1996  0.012  0.0325477  -1.79942
1997  0.042  0.0568705  -0.546618
1998  0.373  0.205791  1.0725
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1999  0.321  0.357895  -0.196206
2000  0.346  0.33017  0.084454
2001  0.341  0.358577  -0.0906388
2002  0.436  0.451488  -0.0629518
2003  0.479  0.423109  0.223749
2004  0.407  0.592044  -0.675849
2005  0.44  0.564791  -0.450271
2006  0.355  0.620097  -1.00585
index number 24
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.025  0.0190733  0.487974
1986  0.009  0.0129179  -0.65172
1987  0.007  0.0073911  -0.0980446
1988  0.003  0.0112748  -2.38761
1989  0.003  0.0040968  -0.561922
1990  0.001  0.00406497  -2.52908
1991  0.012  0.00631831  1.15679
1992  0.022  0.0051282  2.62625
1993  0.025  0.00228178  4.31715
1994  0.007  0.0036623  1.16827
1995  0.009  0.00608371  0.706223
1996  0.005  0.00515095  -0.0536377
1997  0.005  0.0063137  -0.420702
1998  0.04  0.0165959  1.58648
1999  0.075  0.0616252  0.354215
2000  0.127  0.136615  -0.131611
2001  0.191  0.151853  0.413621
2002  0.134  0.195127  -0.67773
2003  0.183  0.270276  -0.703241
2004  0.203  0.304801  -0.732988
2005  0.119  0.381367  -2.10029
2006  0.151  0.402575  -1.7684
index number 25
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.74  0.334045  2.97624
1983  0.52  0.766374  -0.699428
1984  0.42  0.449867  -0.123888
1985  0.49  0.326977  0.729498
1986  0.28  0.525557  -1.13553
1987  0.51  0.184152  1.83702
1988  0.37  0.298595  0.386675
1989  0.24  0.254084  -0.102843
1990  0.07  0.181332  -1.71653
1991  0.12  0.0803742  0.722793
1992  0.08  0.147125  -1.09873
1993  0.41  0.189268  1.394
1994  0.22  0.182622  0.335802
1995  0.03  0.221193  -3.60287
1996  0.2  0.296524  -0.710192
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1997  1.03  0.684555  0.736764
1998  0.96  1.12094  -0.279505
1999  0.36  0.904411  -1.66124
2000  1.91  1.0283  1.11666
2001  1.24  1.10832  0.202462
2002  0.63  0.953484  -0.747327
2003  1.38  1.30397  0.102203
2004  2.08  1.26598  0.895416
2005  1.3  1.41521  -0.153128
2006  1.38  0.991806  0.595678
index number 26
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.2  0.0551176  2.32429
1983  0.07  0.0742923  -0.107322
1984  0.11  0.11149  -0.0242702
1985  0.1  0.0613186  0.88201
1986  0.02  0.046692  -1.52898
1987  0.13  0.0581594  1.45055
1988  0.02  0.0288431  -0.660287
1992  0.01  0.0101141  -0.020466
1993  0.11  0.019205  3.14747
1994  0.07  0.0294147  1.56354
1997  0.01  0.0510127  -2.9386
1998  0.03  0.184595  -3.27668
1999  0.09  0.321031  -2.29342
2000  0.35  0.296162  0.301213
2001  0.45  0.321643  0.605588
2002  0.3  0.404984  -0.541134
2003  0.4  0.379528  0.0947449
2004  0.49  0.531062  -0.145125
2005  0.78  0.506616  0.778232
2006  0.69  0.556226  0.388659
index number 27
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.17  0.196744  -0.26348
1991  0.07  0.284968  -2.53174
1992  0.15  0.227595  -0.751887
1993  0.11  0.23326  -1.35556
1994  0.08  0.262363  -2.14188
1995  0.2  0.314207  -0.814649
1996  0.41  0.353856  0.265577
1997  0.17  0.253807  -0.722749
1998  0.07  0.25889  -2.35866
1999  0.26  0.28238  -0.14891
2000  0.63  0.218269  1.91157
2001  0.42  0.27325  0.775216
2002  0.81  0.257236  2.06856
2003  1.48  0.290215  2.93803
2004  0.54  0.206696  1.73183
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2005  0.55  0.311622  1.02455
2006  0.19  0.154398  0.37419
index number 28
units = 2
month = 1
starting and ending ages for selectivity = 3  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.1  0.103487  -0.0618175
1991  0.08  0.249976  -2.05466
1992  0.18  0.310344  -0.982347
1993  0.14  0.252811  -1.0658
1994  0.05  0.284672  -3.13665
1995  0.22  0.333434  -0.749877
1996  0.53  0.633263  -0.321019
1997  0.52  0.744677  -0.647635
1998  0.36  0.574758  -0.843703
1999  0.61  0.592058  0.0538383
2000  1.89  0.660049  1.89719
2001  0.55  0.506393  0.148971
2002  1.11  0.650233  0.964423
2003  2.25  0.620727  2.32239
2004  1.53  0.70293  1.40261
2005  1.89  0.499206  2.40087
2006  1.09  0.750414  0.673217
index number 29
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  3.06  5.42727  -1.03338
1989  0.51  1.48584  -1.9284
1990  1.44  2.98577  -1.31505
1991  2.69  4.32465  -0.856231
1992  3  3.45396  -0.254115
1993  5.69  3.53994  0.855886
1994  1.07  3.9816  -2.36969
1995  2.93  4.76838  -0.878256
1996  5.1  5.3701  -0.0930659
1997  8.25  3.85175  1.37361
1998  5.8  3.92891  0.702413
1999  6.12  4.28538  0.64264
2000  3.91  3.31244  0.299095
2001  3.32  4.14683  -0.401034
2002  9.11  3.90379  1.52823
2003  5.61  4.40428  0.436372
2004  6.27  3.1368  1.24898
2005  5.99  4.72916  0.426219
2006  5.74  2.34313  1.61578
index number 30
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  1.03  1.28013  -0.392065
```

```
1989  0.18  0.69659  -2.44041
1990  0.11  0.221735  -1.26418
1991  0.27  0.535607  -1.23528
1992  0.57  0.664953  -0.277866
1993  0.2  0.54168  -1.79682
1994  0.08  0.609947  -3.6633
1995  0.28  0.714426  -1.68921
1996  2.7  1.35685  1.24088
1997  5.25  1.59557  2.14782
1998  2.67  1.23149  1.39555
1999  3.46  1.26856  1.80949
2000  1.82  1.41424  0.45489
2001  1.18  1.08501  0.151344
2002  4.13  1.39321  1.95968
2003  2.55  1.32999  1.17386
2004  2.49  1.50612  0.906643
2005  1.24  1.06962  0.266563
2006  3.22  1.60786  1.25241
index number 31
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.03  0.0703169  -1.53615
1991  0.02  0.0311674  -0.800056
1992  0.06  0.0570521  0.0908548
1993  0.01  0.0733942  -3.59461
1995  0.05  0.085774  -0.973274
1996  0.18  0.114986  0.808184
1997  1.02  0.265456  2.42755
1998  0.29  0.434677  -0.729869
1999  0.65  0.350712  1.1127
2000  0.45  0.398751  0.218046
2001  0.41  0.429783  -0.0849794
2002  1.28  0.369741  2.23946
2003  0.57  0.505651  0.216027
2004  0.57  0.490921  0.26934
2005  0.53  0.548788  -0.06282
2006  0.48  0.384602  0.39959
index number 32
units = 2
month = 1
starting and ending ages for selectivity = 5  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.02  0.0100584  1.23951
1993  0.01  0.0190992  -1.1669
1994  0.02  0.0292526  -0.685714
1995  0.16  0.030428  2.99328
1996  0.05  0.0290343  0.980218
1997  0.18  0.0507316  2.28382
1998  0.04  0.183577  -2.74792
1999  0.18  0.319262  -1.03344
2000  0.22  0.29453  -0.526144
2001  0.15  0.31987  -1.36567
2002  0.81  0.402753  1.26004
```

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2003  0.51  0.377436  0.542834
2004  0.43  0.528136  -0.370719
2005  0.32  0.503825  -0.81857
2006  0.4  0.553161  -0.584631
index number 33
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.24  0.0902408  1.76399
1986  0.172  0.11012  0.804176
1987  0.075  0.0796273  -0.107966
1988  0.015  0.0223054  -0.715548
1990  0.032  0.0632745  -1.22945
1991  0.036  0.051137  -0.632968
1992  0.013  0.0523304  -2.51145
1993  0.084  0.0584357  0.654429
1994  0.132  0.0697654  1.14995
1995  0.023  0.0760495  -2.15665
1996  0.069  0.0543406  0.430711
1997  0.033  0.0550736  -0.923626
1999  0.044  0.0463034  -0.0920175
2000  0.012  0.058005  -2.84145
2001  0.021  0.0544841  -1.71932
2002  0.442  0.061394  3.55988
2004  0.255  0.0659176  2.43972
2005  0.067  0.0326682  1.29535
2006  0.098  0.0617742  0.832229
index number 34
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  1.50466  0.741577
1983  5.01  2.43677  1.29981
1984  1.58  1.06929  0.704101
1985  1.26  1.41737  -0.212238
1986  1.26  1.72959  -0.571268
1987  0.39  1.25067  -2.10145
1988  0.54  0.35034  0.78026
1989  1.24  0.695903  1.04174
1990  2.54  0.993821  1.69223
1991  2.64  0.803183  2.14594
1992  0.89  0.821928  0.143494
1993  0.5  0.91782  -1.09536
1994  2.41  1.09577  1.42137
1995  0.63  1.19447  -1.15369
1996  0.81  0.8535  -0.0943377
1997  0.89  0.865013  0.0513553
1998  0.73  0.942684  -0.461101
1999  0.53  0.727263  -0.570611
2000  0.57  0.911054  -0.845726
2001  0.47  0.855753  -1.08068
2002  0.77  0.964284  -0.405753
2003  0.44  0.686553  -0.802342
```

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2004  1.3  1.03533  0.410522
2005  0.35  0.513103  -0.689873
2006  0.8  0.970255  -0.347959
index number 35
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  3.408  12.7428  -2.37838
1983  17.699  20.6369  -0.276948
1984  13.31  9.05571  0.69452
1985  12.843  12.0036  0.121899
1986  59.526  14.6478  2.52856
1987  7.584  10.5918  -0.6024
1988  1.763  2.96701  -0.938727
1989  2.855  5.89356  -1.30707
1990  4.733  8.41659  -1.03811
1991  7.337  6.8021  0.136515
1992  8.487  6.96085  0.357493
1993  4.145  7.77295  -1.13387
1994  22.311  9.27999  1.58196
1995  13.067  10.1159  0.461637
1996  6.493  7.22823  -0.193448
1997  7.997  7.32573  0.158109
1998  14.983  7.98352  1.1353
1999  8.565  6.15914  0.594661
2000  9.874  7.71565  0.444812
2001  13.543  7.24731  1.12755
2002  5.406  8.16645  -0.743941
2003  8.18  5.81437  0.615602
2004  6.993  8.76817  -0.407959
2005  2.198  4.34543  -1.22915
2006  9.658  8.21702  0.291388
index number 36
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  0.17  0.482823  -1.88247
1989  1  0.959063  0.0753784
1990  1.28  1.36964  -0.122066
1991  1  1.10691  -0.183175
1992  1.1  1.13274  -0.0528985
1993  2.55  1.2649  1.26435
1994  1.66  1.51014  0.170628
1995  4.95  1.64617  1.98542
1996  1.66  1.17626  0.621232
1997  1.65  1.19212  0.586172
1998  0.67  1.29917  -1.1942
1999  1.03  1.00228  0.0491955
2000  0.95  1.25557  -0.502939
2001  0.62  1.17936  -1.15959
2002  1.51  1.32893  0.230352
2003  0.6  0.946177  -0.821442
2004  0.9  1.42685  -0.831055
```

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2005  3.11  0.707136  2.67109
2006  0.81  1.33716  -0.903985
index number 37
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.55  0.436653  0.416182
1983  0.96  0.707155  0.551266
1984  0.18  0.310308  -0.982139
1985  0.59  0.411321  0.650567
1986  0.39  0.50193  -0.45502
1987  0.07  0.362944  -2.96793
1988  0.06  0.101669  -0.951067
1989  0.31  0.201952  0.772827
1990  0.44  0.288408  0.761748
1991  0.76  0.233084  2.13145
1992  0.99  0.238524  2.56664
1993  0.23  0.266352  -0.26463
1994  0.75  0.317993  1.54738
1995  0.93  0.346636  1.77977
1996  0.11  0.247687  -1.46378
1997  0.17  0.251028  -0.702895
1998  0.38  0.273568  0.59263
1999  0.21  0.211053  -0.00901634
2000  0.22  0.264389  -0.33145
2001  0.12  0.248341  -1.31162
2002  0.06  0.279836  -2.77696
2003  0.18  0.199239  -0.183126
2004  0.36  0.300455  0.326062
2005  0.16  0.148903  0.129625
2006  0.31  0.281569  0.173475
index number 38
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1986  0.32  0.330346  -0.0573819
1987  0.26  0.238872  0.152842
1988  0.01  0.0669136  -3.4279
1989  0.14  0.132915  0.0936567
1990  0.36  0.189816  1.15426
1991  0.38  0.153405  1.63583
1992  0.37  0.156985  1.54614
1993  0.05  0.1753  -2.2623
1994  0.57  0.209288  1.80686
1995  0.3  0.228139  0.493815
1996  0.08  0.163015  -1.28368
1997  0.22  0.165214  0.516463
1998  0.39  0.180049  1.39387
1999  0.35  0.138904  1.66659
2000  0.21  0.174008  0.33905
2001  0.14  0.163446  -0.279231
2002  0.13  0.184174  -0.628207
2003  0.21  0.131129  0.84926
```

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2004  0.27  0.197745  0.561654
2005  0.01  0.0980007  -4.11602
2006  0.17  0.185315  -0.155558
index number 39
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.02  0.036712  -1.09532
1992  0.01  0.0303622  -2.00286
1993  0.01  0.0339045  -2.20186
1994  0.04  0.0404779  -0.0214205
1995  0.03  0.044124  -0.695757
1996  0.02  0.0315285  -0.820827
1997  0.04  0.0319538  0.405021
1999  0.03  0.0268653  0.199027
2000  0.09  0.0336545  1.77392
2001  0.01  0.0316117  -2.07559
2002  0.11  0.0356209  2.0334
2003  0.05  0.0253614  1.22412
2004  0.1  0.0382455  1.73331
2005  0.04  0.0189541  1.34687
2006  0.04  0.0358415  0.197965

Input and Estimated effective sample sizes for index 1
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 2
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
```

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2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 3
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 4
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 5
1992  0  0
1993  0  0
1994  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 6
1982  0  0
1983  0  0
1984  0  0
1985  0  0
```

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1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 7
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 8
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
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1989  0  0
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 9
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1991  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 10
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1992  0  0
1995  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
```

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Input and Estimated effective sample sizes for index 11
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 12
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 13
1983  0  0
1984  0  0
1985  0  0
1986  0  0
```

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1987  0  0
1988  0  0
1989  0  0
1991  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 14
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 15
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
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1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 16
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 17
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1994  0  0
1997  0  0
1998  0  0
```

```
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 18
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 19
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
```

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2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 20
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 21
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 22
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
```

```
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 23
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 24
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
```

```
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 25
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 26
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1992  0  0
1993  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
```

```
Input and Estimated effective sample sizes for index 27
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 28
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 29
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
```

```
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 30
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 31
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 32
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
```

```
 Total  0  0
Input and Estimated effective sample sizes for index 33
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 34
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 35
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
```

```
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 36
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 37
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
```

```
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 38
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 39
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0

Survey proportions at age by index
 Index number 1
 N/A
 Index number 2
 N/A
 Index number 3
```

```
N/A
Index number 4
N/A
Index number 5
N/A
Index number 6
N/A
Index number 7
N/A
Index number 8
N/A
Index number 9
N/A
Index number 10
N/A
Index number 11
N/A
Index number 12
N/A
Index number 13
N/A
Index number 14
N/A
Index number 15
N/A
Index number 16
N/A
Index number 17
N/A
Index number 18
N/A
Index number 19
N/A
Index number 20
N/A
Index number 21
N/A
Index number 22
N/A
Index number 23
N/A
Index number 24
N/A
Index number 25
N/A
Index number 26
N/A
Index number 27
N/A
Index number 28
N/A
Index number 29
N/A
Index number 30
N/A
Index number 31
N/A
```

```
 Index number 32
 N/A
 Index number 33
 N/A
 Index number 34
 N/A
 Index number 35
 N/A
 Index number 36
 N/A
 Index number 37
 N/A
 Index number 38
 N/A
 Index number 39
 N/A

Index Selectivity at Age
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
```

```
Deviations section: only applicable if associated lambda > 0
Nyear1 observed, expected, standardized residual
2  42223.2  26071.1  0.625936
3  22193.6  12144.6  0.782736
4  2871.67  3605.15  -0.295312
5  613.233  1037.69  -0.682885
6  278.133  298.335  -0.0910306
7  86.5266  85.767  0.0114464
8  34.2466  34.6052  -0.0135258

Fleet Obs, Initial, and Stadardized Residual for Fmult
1  1.04658  1  0.0591107

Standardized Residuals for Fmult_devs by fleet and year
N/A

Index Obs, Initial, and Standardized Residual for q_year1
N/A

Standardized Residuals for catchability deviations by index and year
 index 1 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 2 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 3 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
```

```
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 4 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 5 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
 index 6 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
```

```
20  0
21  0
22  0
23  0
24  0
25  0
 index 7 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 8 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 9 q_devs standardized residuals
2  0
```

```
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
 index 10 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 11 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
```

```
 index 12 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 13 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 14 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
```

```
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 15 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 16 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
```

```
19  0
20  0
21  0
22  0
23  0
24  0
 index 17 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 18 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 19 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
```

```
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 20 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 21 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
```

```
19  0
20  0
21  0
22  0
 index 22 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 23 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 24 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
```

```
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 25 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 26 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
```

```
20  0
 index 27 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 28 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 29 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 30 q_devs standardized residuals
2  0
3  0
```

```
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 31 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 32 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 33 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
```

```
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 34 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 35 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
```

```
24  0
25  0
 index 36 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 37 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 38 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
```

```
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
 index 39 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0

Obs, Initial, and Stadardized Residual for SRR steepness
N/A

Obs, Initial, and Stadardized Residual for SRR unexpl S
N/A

End of Deviations Section

Selectivity by age and year for each fleet
 fleet 1 selectivity at age
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0413693 0.538843 0.96936 0.998834 0.999957 0.999998 1 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
```

```
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1
 0.0139015 0.158404 0.71534 0.971058 0.997774 0.999834 0.999988 1

Fmult by year for each fleet
1982   1.04658
1983   1.47154
1984   1.53676
1985   1.49015
1986   1.7454
1987   1.39761
1988   1.95195
1989   1.67219
1990   1.33065
1991   1.61674
1992   1.58005
1993   1.4054
1994   1.33018
1995   1.61383
1996   1.34096
1997   0.878117
1998   0.816099
1999   0.678098
2000   0.725304
2001   0.565204
2002   0.477099
2003   0.453508
2004   0.471593
2005   0.490137
2006   0.427629

Directed F by age and year for each fleet
 fleet 1 directed F at age
 0.0432965 0.563944 1.01452 1.04536 1.04654 1.04658 1.04658 1.04658
 0.0608767 0.792931 1.42646 1.46983 1.47148 1.47154 1.47154 1.47154
 0.0635745 0.82807 1.48967 1.53496 1.53669 1.53675 1.53676 1.53676
 0.0616465 0.802956 1.44449 1.48841 1.49009 1.49015 1.49015 1.49015
 0.072206 0.940497 1.69192 1.74337 1.74533 1.7454 1.7454 1.7454
 0.0578183 0.753094 1.35479 1.39598 1.39755 1.39761 1.39761 1.39761
 0.0807507 1.05179 1.89214 1.94967 1.95186 1.95194 1.95195 1.95195
 0.0691773 0.901047 1.62095 1.67024 1.67212 1.67219 1.67219 1.67219
 0.0550481 0.717011 1.28988 1.3291 1.33059 1.33065 1.33065 1.33065
 0.0668834 0.871169 1.5672 1.61486 1.61667 1.61674 1.61674 1.61674
 0.0653657 0.8514 1.53164 1.57821 1.57998 1.58005 1.58005 1.58005
 0.0581406 0.757292 1.36234 1.40377 1.40534 1.4054 1.4054 1.4054
 0.0550286 0.716758 1.28942 1.32863 1.33012 1.33018 1.33018 1.33018
 0.0224348 0.255638 1.15444 1.56713 1.61024 1.61357 1.61382 1.61383
 0.0186414 0.212414 0.959241 1.30215 1.33797 1.34074 1.34094 1.34096
 0.0122072 0.139098 0.628152 0.852702 0.876161 0.877971 0.878106 0.878117
 0.011345 0.129274 0.583788 0.79248 0.814282 0.815963 0.81609 0.816099
 0.00942661 0.107414 0.485071 0.658473 0.676589 0.677986 0.67809 0.678098
 0.0100828 0.114891 0.518839 0.704312 0.723689 0.725183 0.725295 0.725304
 0.00785721 0.0895309 0.404313 0.548846 0.563946 0.56511 0.565198 0.565204
 0.00663241 0.0755746 0.341288 0.463291 0.476037 0.47702 0.477093 0.477099
 0.00630446 0.0718377 0.324412 0.440383 0.452498 0.453433 0.453503 0.453508
 0.00655588 0.0747025 0.33735 0.457945 0.470543 0.471515 0.471588 0.471593
```

```
 0.00681366 0.0776399 0.350615 0.475952 0.489046 0.490056 0.490131 0.490137
 0.0059447 0.0677383 0.3059 0.415253 0.426677 0.427558 0.427624 0.427629
Discard F by age and year for each fleet
 fleet 1 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
Total F
 0.0432965 0.563944 1.01452 1.04536 1.04654 1.04658 1.04658 1.04658
 0.0608767 0.792931 1.42646 1.46983 1.47148 1.47154 1.47154 1.47154
 0.0635745 0.82807 1.48967 1.53496 1.53669 1.53675 1.53676 1.53676
 0.0616465 0.802956 1.44449 1.48841 1.49009 1.49015 1.49015 1.49015
 0.072206 0.940497 1.69192 1.74337 1.74533 1.7454 1.7454 1.7454
 0.0578183 0.753094 1.35479 1.39598 1.39755 1.39761 1.39761 1.39761
 0.0807507 1.05179 1.89214 1.94967 1.95186 1.95194 1.95195 1.95195
 0.0691773 0.901047 1.62095 1.67024 1.67212 1.67219 1.67219 1.67219
 0.0550481 0.717011 1.28988 1.3291 1.33059 1.33065 1.33065 1.33065
 0.0668834 0.871169 1.5672 1.61486 1.61667 1.61674 1.61674 1.61674
 0.0653657 0.8514 1.53164 1.57821 1.57998 1.58005 1.58005 1.58005
 0.0581406 0.757292 1.36234 1.40377 1.40534 1.4054 1.4054 1.4054
 0.0550286 0.716758 1.28942 1.32863 1.33012 1.33018 1.33018 1.33018
 0.0224348 0.255638 1.15444 1.56713 1.61024 1.61357 1.61382 1.61383
 0.0186414 0.212414 0.959241 1.30215 1.33797 1.34074 1.34094 1.34096
 0.0122072 0.139098 0.628152 0.852702 0.876161 0.877971 0.878106 0.878117
 0.011345 0.129274 0.583788 0.79248 0.814282 0.815963 0.81609 0.816099
 0.00942661 0.107414 0.485071 0.658473 0.676589 0.677986 0.67809 0.678098
 0.0100828 0.114891 0.518839 0.704312 0.723689 0.725183 0.725295 0.725304
 0.00785721 0.0895309 0.404313 0.548846 0.563946 0.56511 0.565198 0.565204
 0.00663241 0.0755746 0.341288 0.463291 0.476037 0.47702 0.477093 0.477099
 0.00630446 0.0718377 0.324412 0.440383 0.452498 0.453433 0.453503 0.453508
 0.00655588 0.0747025 0.33735 0.457945 0.470543 0.471515 0.471588 0.471593
 0.00681366 0.0776399 0.350615 0.475952 0.489046 0.490056 0.490131 0.490137
 0.0059447 0.0677383 0.3059 0.415253 0.426677 0.427558 0.427624 0.427629

Average F for ages 3 to 5
```

```
Freport unweighted in .std and MCMC files
year    unweighted   Nweighted    Bweighted
1982  1.03547  1.01873  1.02567
1983  1.45592  1.43838  1.44286
1984  1.52044  1.50115  1.50738
1985  1.47433  1.45024  1.4543
1986  1.72687  1.70867  1.71504
1987  1.38278  1.36125  1.36579
1988  1.93123  1.90025  1.905
1989  1.65444  1.6311  1.63477
1990  1.31652  1.30496  1.3096
1991  1.59958  1.57309  1.578
1992  1.56328  1.53773  1.54127
1993  1.39048  1.37055  1.37561
1994  1.31606  1.29667  1.30173
1995  1.44394  1.232  1.26369
1996  1.19979  1.00534  1.029
1997  0.785672  0.679438  0.690909
1998  0.730183  0.670307  0.691404
1999  0.606711  0.555429  0.577432
2000  0.648946  0.591884  0.616171
2001  0.505702  0.473633  0.488283
2002  0.426872  0.39157  0.40506
2003  0.405764  0.378845  0.392856
2004  0.421946  0.393166  0.408061
2005  0.438537  0.421346  0.434706
2006  0.38261  0.35137  0.367

Population Numbers at the Start of the Year
 52426.1 42223.2 22193.6 2871.67 613.233 278.133 86.5266 34.2466
 84903.3 41104.1 19668.6 6588.25 826.569 176.303 79.9592 34.7205
 37256.6 65407.5 15228.6 3867.35 1240.43 155.369 33.1375 21.5548
 49384.6 28624.3 23396 2810.91 682.226 218.443 27.3591 9.63081
 60263.4 38015.4 10499.2 4518.03 519.491 125.873 40.3011 6.82435
 43576.3 45902.5 12152 1583.09 647.077 74.2565 17.9911 6.73564
 12206.7 33673 17697.5 2566.91 320.906 130.963 15.028 5.00417
 24247 9218.73 9630.18 2184.28 299.103 37.3108 15.2254 2.32889
 34627.2 18524.9 3065.44 1558.85 336.568 46.0013 5.73792 2.69962
 27984.9 26831.9 7404.63 690.949 337.851 72.8358 9.95448 1.82584
 28638 21429.8 9192.82 1264.78 112.529 54.9232 11.8398 1.91495
 31979.1 21963.2 7488.6 1627.07 213.673 18.977 9.26168 2.31946
 38179.3 24703.5 8432.36 1569.94 327.266 42.9099 3.81074 2.32559
 41618.3 29584.9 9876.77 1901.52 340.415 70.856 9.28987 1.3285
 29738.1 33318.3 18758.1 2549.11 324.824 55.6968 11.5546 1.73112
 30139.2 23897.8 22058.4 5884.88 567.563 69.7773 11.9316 2.84552
 32845.5 24376.5 17025.1 9636.33 2053.78 193.483 23.7442 5.02774
 25339.7 26588.2 17537.6 7774.91 3571.77 744.831 70.0513 10.4157
 31743.4 20551.7 19551.6 8839.9 3295.07 1486.57 309.566 33.4401
 29816.6 25728.6 15000 9527.83 3578.57 1308.31 589.364 135.972
 33598.1 24220.7 19260.8 8196.77 4505.82 1666.99 608.736 337.457
 23921.2 27325.9 18386.8 11209.7 4222.59 2291.79 847.044 480.752
 36073.6 19462 20821.8 10883.2 5908.55 2198.89 1192.32 690.745
 17877.8 29341.6 14787.2 12166 5636.57 3021.81 1123.49 962.05
 33806.1 14537.7 22228.3 8526.21 6188.53 2829.87 1515.59 1045.91

q by index
 index 1 q over time
```

```
1992  0.0001476
1993  0.0001476
1994  0.0001476
1995  0.0001476
1996  0.0001476
1997  0.0001476
1998  0.0001476
1999  0.0001476
2000  0.0001476
2001  0.0001476
2002  0.0001476
2003  0.0001476
2004  0.0001476
2005  0.0001476
2006  0.0001476
 index 2 q over time
1992  0.000419701
1993  0.000419701
1994  0.000419701
1995  0.000419701
1996  0.000419701
1997  0.000419701
1998  0.000419701
1999  0.000419701
2000  0.000419701
2001  0.000419701
2002  0.000419701
2003  0.000419701
2004  0.000419701
2005  0.000419701
2006  0.000419701
 index 3 q over time
1992  0.000347545
1993  0.000347545
1994  0.000347545
1995  0.000347545
1996  0.000347545
1997  0.000347545
1998  0.000347545
1999  0.000347545
2000  0.000347545
2001  0.000347545
2002  0.000347545
2003  0.000347545
2004  0.000347545
2005  0.000347545
2006  0.000347545
 index 4 q over time
1992  0.000360607
1993  0.000360607
1994  0.000360607
1995  0.000360607
1996  0.000360607
1997  0.000360607
1998  0.000360607
1999  0.000360607
2000  0.000360607
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2001  0.000360607
2002  0.000360607
2003  0.000360607
2004  0.000360607
2005  0.000360607
2006  0.000360607
 index 5 q over time
1992  0.000538212
1993  0.000538212
1994  0.000538212
1996  0.000538212
1997  0.000538212
1998  0.000538212
1999  0.000538212
2000  0.000538212
2001  0.000538212
2002  0.000538212
2003  0.000538212
2004  0.000538212
2005  0.000538212
2006  0.000538212
 index 6 q over time
1982  1.43766e-05
1983  1.43766e-05
1984  1.43766e-05
1985  1.43766e-05
1986  1.43766e-05
1987  1.43766e-05
1988  1.43766e-05
1989  1.43766e-05
1990  1.43766e-05
1991  1.43766e-05
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2002  1.43766e-05
2003  1.43766e-05
2004  1.43766e-05
2005  1.43766e-05
2006  1.43766e-05
 index 7 q over time
1982  3.96531e-05
1983  3.96531e-05
1984  3.96531e-05
1985  3.96531e-05
1986  3.96531e-05
1987  3.96531e-05
1988  3.96531e-05
1989  3.96531e-05
1990  3.96531e-05
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1991  3.96531e-05
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2002  3.96531e-05
2003  3.96531e-05
2004  3.96531e-05
2005  3.96531e-05
2006  3.96531e-05
 index 8 q over time
1982  3.32314e-05
1983  3.32314e-05
1984  3.32314e-05
1985  3.32314e-05
1986  3.32314e-05
1987  3.32314e-05
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2002  3.32314e-05
2003  3.32314e-05
2004  3.32314e-05
2005  3.32314e-05
2006  3.32314e-05
 index 9 q over time
1982  3.86567e-05
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1984  3.86567e-05
1985  3.86567e-05
1986  3.86567e-05
1987  3.86567e-05
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1999  3.86567e-05
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2001  3.86567e-05
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2002  3.86567e-05
2003  3.86567e-05
2004  3.86567e-05
2005  3.86567e-05
2006  3.86567e-05
 index 10 q over time
1983  6.49334e-05
1984  6.49334e-05
1985  6.49334e-05
1986  6.49334e-05
1992  6.49334e-05
1995  6.49334e-05
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2002  6.49334e-05
2003  6.49334e-05
2004  6.49334e-05
2005  6.49334e-05
2006  6.49334e-05
 index 11 q over time
1983  7.25961e-05
1984  7.25961e-05
1985  7.25961e-05
1986  7.25961e-05
1987  7.25961e-05
1988  7.25961e-05
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2004  7.25961e-05
2005  7.25961e-05
2006  7.25961e-05
 index 12 q over time
1983  8.44044e-05
1984  8.44044e-05
1985  8.44044e-05
1986  8.44044e-05
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2002  8.44044e-05
2003  8.44044e-05
2004  8.44044e-05
2005  8.44044e-05
2006  8.44044e-05
 index 13 q over time
1983  8.19618e-05
1984  8.19618e-05
1985  8.19618e-05
1986  8.19618e-05
1987  8.19618e-05
1988  8.19618e-05
1989  8.19618e-05
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2000  8.19618e-05
2001  8.19618e-05
2002  8.19618e-05
2003  8.19618e-05
2004  8.19618e-05
2005  8.19618e-05
2006  8.19618e-05
 index 14 q over time
1982  4.30083e-05
1983  4.30083e-05
1984  4.30083e-05
1985  4.30083e-05
1986  4.30083e-05
1987  4.30083e-05
1988  4.30083e-05
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1996  4.30083e-05
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1998  4.30083e-05
1999  4.30083e-05
2000  4.30083e-05
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2001  4.30083e-05
2002  4.30083e-05
2003  4.30083e-05
2004  4.30083e-05
2005  4.30083e-05
2006  4.30083e-05
 index 15 q over time
1982  4.41662e-05
1983  4.41662e-05
1984  4.41662e-05
1985  4.41662e-05
1986  4.41662e-05
1987  4.41662e-05
1988  4.41662e-05
1989  4.41662e-05
1990  4.41662e-05
1991  4.41662e-05
1992  4.41662e-05
1993  4.41662e-05
1994  4.41662e-05
1995  4.41662e-05
1996  4.41662e-05
1997  4.41662e-05
1998  4.41662e-05
1999  4.41662e-05
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2006  4.41662e-05
 index 16 q over time
1982  0.000166807
1983  0.000166807
1984  0.000166807
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1987  0.000166807
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2005  0.000166807
2006  0.000166807
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 index 17 q over time
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1983  6.9906e-05
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2003  6.9906e-05
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2005  6.9906e-05
2006  6.9906e-05
 index 18 q over time
1984  1.88189e-05
1985  1.88189e-05
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1988  1.88189e-05
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2006  1.88189e-05
 index 19 q over time
1984  1.95486e-05
1985  1.95486e-05
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 index 20 q over time
1985  3.252e-05
1986  3.252e-05
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 index 21 q over time
1985  4.73378e-05
1986  4.73378e-05
1987  4.73378e-05
1988  4.73378e-05
1989  4.73378e-05
1990  4.73378e-05
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 index 22 q over time
1985  0.000119897
1986  0.000119897
1987  0.000119897
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1985  0.000100201
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2006  0.000100201
 index 24 q over time
1985  7.46703e-05
1986  7.46703e-05
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 index 25 q over time
1982  0.000116324
1983  0.000116324
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 index 26 q over time
1982  8.98802e-05
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 index 27 q over time
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1990  3.37594e-05
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 index 29 q over time
1988  0.000161176
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1988  7.2334e-05
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 index 31 q over time
1990  4.51081e-05
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 index 32 q over time
1992  8.9385e-05
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 index 33 q over time
1985  1.82731e-06
1986  1.82731e-06
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2006  1.82731e-06
 index 34 q over time
1982  2.87006e-05
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 index 35 q over time
1982  0.000243063
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2006  0.000243063
 index 36 q over time
1988  3.95539e-05
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2006  3.95539e-05
 index 37 q over time
1982  8.32894e-06
1983  8.32894e-06
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1985  8.32894e-06
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 index 38 q over time
1986  5.4817e-06
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 index 39 q over time
1990  1.06021e-06
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2003  1.06021e-06
2004  1.06021e-06
2005  1.06021e-06
2006  1.06021e-06

Proportions of catch at age by fleet
 fleet 1
Year 1 Obs  =  0.146845 0.533716 0.27888 0.0256925 0.00901297 0.00318751
0.00184106 0.000824357
Year 1 Pred =  0.0592209 0.489379 0.383148 0.050457 0.010782 0.00489029
0.00152136 0.000602143
Year 2 Obs  =  0.103612 0.598342 0.229546 0.0458839 0.0145793 0.00679528
0.000336608 0.000904635
Year 2 Pred =  0.102057 0.463542 0.310881 0.105598 0.0132553 0.00282735
0.00128229 0.000556808
Year 3 Obs  =  0.0942382 0.521666 0.303281 0.0624068 0.0162689 0.00186435
7.84991e-05 0.000196248
Year 3 Pred =  0.0410321 0.666849 0.215747 0.0555328 0.0178208 0.00223216
0.000476081 0.000309674
```

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Year 4 Obs  =  0.0558107 0.392743 0.482878 0.0474579 0.0133215 0.00676819
0.000805737 0.000214863
Year 4 Pred =  0.0734577 0.397929 0.454732 0.0553941 0.0134514 0.00430712
0.000539449 0.000189894
Year 5 Obs  =  0.0563748 0.497562 0.320918 0.109789 0.00917325 0.0040641
0.0016837 0.000435439
Year 5 Pred =  0.102635 0.57463 0.214828 0.0935601 0.0107625 0.0026078
0.000834946 0.000141385
Year 6 Obs  =  0.0361216 0.546812 0.344315 0.0523557 0.0172825 0.000794231
0.000921308 0.00139785
Year 6 Pred =  0.0644045 0.646281 0.242203 0.0320152 0.0130931 0.00150255
0.000364043 0.000136293
Year 7 Obs  =  0.0204602 0.529056 0.374768 0.0549979 0.016574 0.00311406
0.000488985 0.000540457
Year 7 Pred =  0.0229019 0.538329 0.373879 0.0548102 0.00685486 0.00279753
0.000321017 0.000106896
Year 8 Obs  =  0.063287 0.315776 0.48164 0.111543 0.0232711 0.00362582
0.000593315 0.000263696
Year 8 Pred =  0.0942143 0.322615 0.460312 0.105718 0.0144832 0.0018067
0.00073726 0.000112772
Year 9 Obs  =  0.131557 0.624327 0.155018 0.0705274 0.0156649 0.00212645
0.000567054 0.000212645
Year 9 Pred =  0.122267 0.631862 0.149391 0.0771245 0.0166611 0.00227725
0.00028405 0.000133642
Year 10 Obs  =  0.0470108 0.570563 0.335697 0.0348471 0.0101911 0.00150284
0.000140891 4.69638e-05
Year 10 Pred =  0.0737896 0.644374 0.244576 0.0231181 0.0113094 0.00243818
0.000333227 6.11202e-05
Year 11 Obs  =  0.0686058 0.561535 0.302207 0.0564193 0.00757272 0.00351053
0.000100301 5.01505e-05
Year 11 Pred =  0.0794587 0.545587 0.323407 0.0450847 0.00401318 0.00195879
0.000422258 6.8295e-05
Year 12 Obs  =  0.0682494 0.596718 0.297482 0.0300616 0.0038772 0.00239006
0.00106225 0.000159337
Year 12 Pred =  0.0871078 0.568989 0.274343 0.0604773 0.00794637 0.000705756
0.000344443 8.62611e-05
Year 13 Obs  =  0.0809769 0.51226 0.345857 0.0485466 0.0101345 0.00128535
0.00069211 0.000247182
Year 13 Pred =  0.0907913 0.567534 0.276807 0.0523202 0.0109126 0.00143085
0.000127071 7.75481e-05
Year 14 Obs  =  0.0383395 0.377437 0.472962 0.0802409 0.0257108 0.00498672
0.000259051 6.47626e-05
Year 14 Pred =  0.0562998 0.40852 0.420033 0.0940353 0.0170324 0.00354833
0.00046525 6.65332e-05
Year 15 Obs  =  0.00868307 0.371174 0.497293 0.0956745 0.0223509 0.00380554
0.000857587 0.000160798
Year 15 Pred =  0.0262955 0.306257 0.562529 0.09071 0.0117171 0.00201116
0.000417258 6.25143e-05
Year 16 Obs  =  0.00206925 0.175541 0.554973 0.217202 0.0381432 0.011036
0.000758725 0.0002759
Year 16 Pred =  0.020685 0.175913 0.587926 0.193638 0.019004 0.00233947
0.000400078 9.54138e-05
Year 17 Obs  =  0.00299222 0.148481 0.42423 0.348627 0.0651639 0.00917614
0.00126338 6.64938e-05
Year 17 Pred =  0.0211014 0.168677 0.432836 0.304215 0.0660169 0.00622781
0.000764353 0.00016185
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Year 18 Obs  =  0.0127178 0.153527 0.439854 0.282322 0.0815767 0.0251546
0.00386453 0.000983699
Year 18 Pred =  0.015123 0.172531 0.432152 0.241122 0.112938 0.0235858
0.00221848 0.00032986
Year 19 Obs  =  0.00135811 0.0949441 0.49182 0.288289 0.0943885 0.0228409
0.00456818 0.00179023
Year 19 Pred =  0.017965 0.126056 0.450238 0.255008 0.0968687 0.0437648
0.00911462 0.000984591
Year 20 Obs  =  0.000832829 0.218655 0.360388 0.282935 0.0978952 0.0274833
0.00931254 0.00249849
Year 20 Pred =  0.0167107 0.158 0.359582 0.290776 0.111479 0.0408196
0.0183904 0.0042429
Year 21 Obs  =  0.0218685 0.0912526 0.435038 0.308651 0.104679 0.0256472
0.0108538 0.00200997
Year 21 Pred =  0.0166133 0.132027 0.418901 0.229068 0.128653 0.0476744
0.0174114 0.00965223
Year 22 Obs  =  0.019559 0.119544 0.372829 0.30222 0.119242 0.0425162
0.0175955 0.00649449
Year 22 Pred =  0.0106871 0.1348 0.364041 0.285904 0.110063 0.0598345
0.0221175 0.0125532
Year 23 Obs  =  0.00730276 0.0718673 0.386841 0.319956 0.130153 0.0524843
0.020748 0.010647
Year 23 Pred =  0.0152638 0.0908152 0.388194 0.260872 0.144712 0.0539427
0.0292534 0.0169475
Year 24 Obs  =  0.0172803 0.13655 0.262167 0.285301 0.155593 0.0739879
0.0359712 0.03315
Year 24 Pred =  0.0078072 0.141127 0.282852 0.29861 0.14133 0.0758907
0.0282189 0.0241643
Year 25 Obs  =  0.0148916 0.0835802 0.395291 0.255419 0.140028 0.067753
0.0290036 0.014034
Year 25 Pred =  0.0143006 0.0680254 0.420181 0.2082 0.15448 0.070758
0.0379004 0.0261555

Proportions of Discards at age by fleet
 fleet 1
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
```

```
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15

F Reference Points Using Final Year Selectivity and Freport options
 refpt           F       slope to plot on SRR
  F0.1     0.149933     0.314057
  Fmax     0.279354     0.506019
  F30%SPR  0.233529     0.436013
  F40%SPR  0.159166     0.327017
  Fmsy     0.279356     0.506023    SSBmsy    65713     MSY   16683.6
  Fcurrent 0.38261     0.666407

Stock-Recruitment Relationship Parameters
 alpha     = 33252.3
 beta      = 0.0266636
 unexpl    = 269287
 steepness = 1
Spawning Stock, Obs Recruits(year+1), Pred Recruits(year+1), standardized
residual
init  xxxx  52426.1  33252.2  0.963802
1982  23323.7  84903.3  33252.3  1.9844
1983  21896.3  37256.6  33252.3  0.240711
1984  19715.1  49384.6  33252.2  0.837283
1985  16626.9  60263.4  33252.2  1.25874
1986  15792.8  43576.3  33252.2  0.572402
1987  17258.9  12206.7  33252.2  -2.12146
1988  10160.4  24247  33252.2  -0.668587
1989  6341.52  34627.2  33252.2  0.0857779
1990  8811.5  27984.9  33252.2  -0.365078
1991  8781.53  28638  33252.2  -0.31624
1992  9619.62  31979.1  33252.2  -0.0826387
```

```
1993  10714.1  38179.3  33252.2  0.292504
1994  13549.5  41618.3  33252.2  0.47508
1995  18950.7  29738.1  33252.2  -0.236449
1996  20991.7  30139.2  33252.3  -0.208085
1997  21747.5  32845.5  33252.3  -0.0260564
1998  24144  25339.7  33252.3  -0.575281
1999  24936.4  31743.4  33252.3  -0.0983053
2000  27156.5  29816.6  33252.3  -0.230869
2001  31933.9  33598.1  33252.3  0.0219008
2002  36026  23921.2  33252.3  -0.697226
2003  39927.8  36073.6  33252.3  0.172402
2004  39008  17877.8  33252.3  -1.31369
2005  37606.1  33806.1  33252.3  0.03497
2006  38568.8       xxxx   33252.3

Root Mean Square Error computed from Standardized Residuals
Component                  #resids         RMSE
_Catch_Fleet_1                25           0.250838
Catch_Fleet_Total             25           0.250838
_Discard_Fleet_1              0            0
Discard_Fleet_Total           0            0
_Index_1                      15           2.47422
_Index_2                      15           1.54923
_Index_3                      15           1.82645
_Index_4                      15           2.29378
_Index_5                      14           1.78194
_Index_6                      25           1.85506
_Index_7                      25           1.20796
_Index_8                      24           1.8581
_Index_9                      20           1.0392
_Index_10                      15           1.1527
_Index_11                      24           0.536144
_Index_12                      24           0.960525
_Index_13                      22           0.851905
_Index_14                      25           1.57969
_Index_15                      25           1.23703
_Index_16                      24           0.959367
_Index_17                      22           1.48635
_Index_18                      23           1.25775
_Index_19                      23           1.24994
_Index_20                      22           1.42834
_Index_21                      22           1.31644
_Index_22                      22           0.893067
_Index_23                      22           0.857093
_Index_24                      22           1.5647
_Index_25                      25           1.28614
_Index_26                      20           1.57465
_Index_27                      17           1.56556
_Index_28                      17           1.45712
_Index_29                      19           1.13238
_Index_30                      19           1.59104
_Index_31                      16           1.38172
_Index_32                      15           1.46736
_Index_33                      19           1.65396
_Index_34                      25           1.00526
_Index_35                      25           1.03288
_Index_36                      19           1.08328
```

```
_Index_37                      25           1.30295
_Index_38                      21           1.57414
_Index_39                      15           1.39922
Index_Total                   802           1.39533
Nyear1                          7          0.473077
Fmult_Year1                     1         0.0591107
_Fmult_devs_Fleet_1             0                 0
Fmult_devs_Total                0                 0
Recruit_devs                    0                 0
Fleet_Sel_params                4           1.64315
Index_Sel_params                0                 0
q_year1                         0                 0
q_devs                          0                 0
SRR_steepness                   0                 0
SRR_unexpl_S                    0                 0

Projections not requested

that's all
```

SS2 BASE RUN (F08_BASE_T2.REP)

```
Code_version_:__2.00o;_01/31/08;_Stock_Synthesis_2_by_Richard_Methot_(NOAA);_
using_Otter_Research_ADMB_7.0.1

Time: Fri Mar 07 09:59:38 2008

Data_File: F08_BASE_T2.DAT
Control_File: F08_BASE_T2.CTL

Convergence_Level:
Hessian:
Sum_of_months_on_read_was:_ 12 rescaled_to_sum_to: 1

LIKELIHOOD 1049.61
indices 980.127
discard 0
length_comps 0
age_comps 62.5156
size-at-age 0
mean_body_wt 0
Equil_catch 0
catch 6.96389
Recruitment 0
Parm_priors 0
Parm_devs 0
penalties 0
Forecast_Recruitment 0

Fleet surv_lambda surv_like disc_lambda disc_like length_lambda length_like
age_lambda age_like sizeage_lambda sizeage_like
1 0 0 0 0 0 0 1 62.5156 0 0
2 1 45.0328 0 0 0 0 0 0 0 0
3 1 12.5742 0 0 0 0 0 0 0 0
4 1 28.7336 0 0 0 0 0 0 0 0
5 1 38.7276 0 0 0 0 0 0 0 0
6 1 20.2474 0 0 0 0 0 0 0 0
7 1 37.3957 0 0 0 0 0 0 0 0
8 1 20.22 0 0 0 0 0 0 0 0
9 1 45.0815 0 0 0 0 0 0 0 0
10 1 13.0915 0 0 0 0 0 0 0 0
11 1 6.40653 0 0 0 0 0 0 0 0
12 1 24.0979 0 0 0 0 0 0 0 0
13 1 9.3846 0 0 0 0 0 0 0 0
14 1 26.7067 0 0 0 0 0 0 0 0
15 1 16.351 0 0 0 0 0 0 0 0
16 1 60.9862 0 0 0 0 0 0 0 0
17 1 41.6652 0 0 0 0 0 0 0 0
18 1 137.576 0 0 0 0 0 0 0 0
19 1 44.8097 0 0 0 0 0 0 0 0
20 1 17.8631 0 0 0 0 0 0 0 0
21 1 17.8111 0 0 0 0 0 0 0 0
22 1 18.2993 0 0 0 0 0 0 0 0
23 1 14.9983 0 0 0 0 0 0 0 0
24 1 8.38893 0 0 0 0 0 0 0 0
25 1 6.84621 0 0 0 0 0 0 0 0
```

```
26 1 21.3152 0 0 0 0 0 0 0 0
27 1 17.3603 0 0 0 0 0 0 0 0
28 1 20.9734 0 0 0 0 0 0 0 0
29 1 19.1558 0 0 0 0 0 0 0 0
30 1 18.1813 0 0 0 0 0 0 0 0
31 1 11.2386 0 0 0 0 0 0 0 0
32 1 24.9327 0 0 0 0 0 0 0 0
33 1 14.454 0 0 0 0 0 0 0 0
34 1 12.8309 0 0 0 0 0 0 0 0
35 1 23.0387 0 0 0 0 0 0 0 0
36 1 10.8479 0 0 0 0 0 0 0 0
37 1 9.90421 0 0 0 0 0 0 0 0
38 1 12.9866 0 0 0 0 0 0 0 0
39 1 22.3021 0 0 0 0 0 0 0 0
40 1 27.3099 0 0 0 0 0 0 0 0

Source Lambda Like
mean_body_wt 0 0
Equil_catch 0 0
Catch 10 0.696389
Recruitment 0 0
Parm_priors 0 0
Parm_devs 1 0
penalties 0


Variance_adjustments_to_input_values 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
Index_extra_CV  0 0.14 0.14 0.14 0.14 0.14 0.19 0.19 0.19 0.19 0.19 0.2 0.2
0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2
0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2
Discard_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
MeanBodyWt_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
effN_mult_Lencomp  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1
effN_mult_Agecomp  1.863 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1
effN_mult_Len-at-age  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1

PARAMETERS
Num Value Phase Min Max Init Prior PR_type SD Active_Cnt Prior_Like Bound
M-G_parmsUsing_offset_approach_#:_3
Gender:_1__Pattern:_1
1 0.2 -3
2 0 -3
3 28.1 -2
4 60.2 -2
5 0.2052 -3
6 0.1 -2
7 0 -3
biology_parms
8 2.44e-006 -3
9 3.34694 -3
10 28.1 -3
```

```
11 -0.25 -3
12 1 -3
13 0 -3
recrdist_by_growthpattern:1
14 0 -3
recrdist_by_area:1
15 0 -3
recrdist_by_seas:1
16 4 -3
cohort_growth_dev:2
17 1 -3
MGparm_env_linkages
MG_parm_blockparms
M-G_parm_devs 1
1_YR1982 0 -

MGParm_Block_Assignments
SR_parms
1 10.7176 1  3 31 10.1121 0 -1 99 1 0
2 0.939164 1  0.2 1 0.8 0 -1 99 2 0
3 0.6 -1
4 0 -1
5 0.0676784 1  -5 5 0 0 -1 99 3 0
6 0 -1
Recr_Devs
1982 0.649771 - - - - - - - 4
1983 0.696608 - - - - - - - 5
1984 0.205706 - - - - - - - 6
1985 0.470484 - - - - - - - 7
1986 0.549011 - - - - - - - 8
1987 0.239684 - - - - - - - 9
1988 -1.08107 - - - - - - - 10
1989 -0.0240164 - - - - - - - 11
1990 0.306391 - - - - - - - 12
1991 -0.0233986 - - - - - - - 13
1992 0.1834 - - - - - - - 14
1993 0.212817 - - - - - - - 15
1994 0.129323 - - - - - - - 16
1995 0.130302 - - - - - - - 17
1996 -0.239727 - - - - - - - 18
1997 -0.17978 - - - - - - - 19
1998 -0.094609 - - - - - - - 20
1999 -0.334627 - - - - - - - 21
2000 -0.131961 - - - - - - - 22
2001 -0.177638 - - - - - - - 23
2002 -0.169975 - - - - - - - 24
2003 -0.467014 - - - - - - - 25
2004 -0.0922965 - - - - - - - 26
2005 -0.725908 - - - - - - - 27
2006 -0.0314726 - - - - - - - 28
init_F_parms
1 1.31198 1 0 2 1 1 -1 10 29 0
Q_parms
sel_parms
#_size_sel:_1
#_male
#_size_sel:_2
```

```
#_male
#_size_sel:_3
#_male
#_size_sel:_4
#_male
#_size_sel:_5
#_male
#_size_sel:_6
#_male
#_size_sel:_7
#_male
#_size_sel:_8
#_male
#_size_sel:_9
#_male
#_size_sel:_10
#_male
#_size_sel:_11
#_male
#_size_sel:_12
#_male
#_size_sel:_13
#_male
#_size_sel:_14
#_male
#_size_sel:_15
#_male
#_size_sel:_16
#_male
#_size_sel:_17
#_male
#_size_sel:_18
#_male
#_size_sel:_19
#_male
#_size_sel:_20
#_male
#_size_sel:_21
#_male
#_size_sel:_22
#_male
#_size_sel:_23
#_male
#_size_sel:_24
#_male
#_size_sel:_25
#_male
#_size_sel:_26
#_male
#_size_sel:_27
#_male
#_size_sel:_28
#_male
#_size_sel:_29
#_male
#_size_sel:_30
#_male
```

```
#_size_sel:_31
#_male
#_size_sel:_32
#_male
#_size_sel:_33
#_male
#_size_sel:_34
#_male
#_size_sel:_35
#_male
#_size_sel:_36
#_male
#_size_sel:_37
#_male
#_size_sel:_38
#_male
#_size_sel:_39
#_male
#_size_sel:_40
#_male
#_age_sel:_1
1 1.82586 2 0.5 9 4 4 -1 99 30 0
2 -3 -3
3 0.0263013 3 0 9 2 2 -1 99 31 0 LO
4 9 -3
5 -999 -2
6 -999 -2
#_male
#_age_sel:_2
7 1 -3
8 1 -3
#_male
#_age_sel:_3
9 2 -3
10 2 -3
#_male
#_age_sel:_4
11 3 -3
12 3 -3
#_male
#_age_sel:_5
13 4 -3
14 4 -3
#_male
#_age_sel:_6
15 5 -3
16 15 -3
#_male
#_age_sel:_7
17 1 -3
18 1 -3
#_male
#_age_sel:_8
19 2 -3
20 2 -3
#_male
#_age_sel:_9
```

```
21 3 -3
22 3 -3
#_male
#_age_sel:_10
23 4 -3
24 4 -3
#_male
#_age_sel:_11
25 5 -3
26 15 -3
#_male
#_age_sel:_12
27 0 -3
28 0 -3
#_male
#_age_sel:_13
29 2 -3
30 2 -3
#_male
#_age_sel:_14
31 3 -3
32 3 -3
#_male
#_age_sel:_15
33 4 -3
34 4 -3
#_male
#_age_sel:_16
35 2 -3
36 2 -3
#_male
#_age_sel:_17
37 3 -3
38 3 -3
#_male
#_age_sel:_18
39 3 -3
40 3 -3
#_male
#_age_sel:_19
41 4 -3
42 4 -3
#_male
#_age_sel:_20
43 2 -3
44 2 -3
#_male
#_age_sel:_21
45 3 -3
46 3 -3
#_male
#_age_sel:_22
47 4 -3
48 4 -3
#_male
#_age_sel:_23
49 2 -3
```

```
50 2 -3
#_male
#_age_sel:_24
51 3 -3
52 3 -3
#_male
#_age_sel:_25
53 4 -3
54 4 -3
#_male
#_age_sel:_26
55 5 -3
56 15 -3
#_male
#_age_sel:_27
57 3 -3
58 3 -3
#_male
#_age_sel:_28
59 4 -3
60 4 -3
#_male
#_age_sel:_29
61 1 -3
62 1 -3
#_male
#_age_sel:_30
63 2 -3
64 15 -3
#_male
#_age_sel:_31
65 1 -3
66 1 -3
#_male
#_age_sel:_32
67 2 -3
68 2 -3
#_male
#_age_sel:_33
69 3 -3
70 3 -3
#_male
#_age_sel:_34
71 4 -3
72 15 -3
#_male
#_age_sel:_35
73 0 -3
74 0 -3
#_male
#_age_sel:_36
75 0 -3
76 0 -3
#_male
#_age_sel:_37
77 0 -3
78 0 -3
```

```
#_male
#_age_sel:_38
79 0 -3
80 0 -3
#_male
#_age_sel:_39
81 0 -3
82 0 -3
#_male
#_age_sel:_40
83 4 -3
84 15 -3
#_male
sel_parm_env_linkages
sel_parm_blockparms
85 2.81625 2 0.5 9 4 4 -1 99 32 0
86 -3 -3
87 0.538898 3 0 9 2 2 -1 99 33 0
88 9 -3
SEL_parm_devs
1_YR1982 0
Forecast_Recr_Devs
2007 0 - - - - - - - 34

Selex_Block_Assignments Years:
Base_parm#  1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
1  0 0 0 0 0 0 0 0 0 0 0 0 0 85 85 85 85 85 85 85 85 85 85 85 85
2  0 0 0 0 0 0 0 0 0 0 0 0 0 86 86 86 86 86 86 86 86 86 86 86 86
3  0 0 0 0 0 0 0 0 0 0 0 0 0 87 87 87 87 87 87 87 87 87 87 87 87
4  0 0 0 0 0 0 0 0 0 0 0 0 0 88 88 88 88 88 88 88 88 88 88 88 88

RECR_DIST
G_pattern gender Seas Area Value Used?
1 1 1 1 1 1

MOVEMENT
Seas Source Dist  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SUBMORPHDIST 1

MGparm_By_Year_after_adjustments
Year
1982  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1983  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1984  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1985  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1986  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1987  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1988  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1989  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1990  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1991  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1992  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1993  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1994  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1995  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
```

```
1996  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1997  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1998  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1999  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2000  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2001  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2002  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2003  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2004  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2005  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2006  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1

SELparm(Size)_By_Year_after_adjustments
Fleet/Svy Year

SELparm(Age)_By_Year_after_adjustments
Fleet/Svy Year
1 1982  1.82586 -3 0.0263013 9 -999 -999
1 1995  2.81625 -3 0.538898 9 -999 -999
2 1982  1 1
3 1982  2 2
4 1982  3 3
5 1982  4 4
6 1982  5 15
7 1982  1 1
8 1982  2 2
9 1982  3 3
10 1982  4 4
11 1982  5 15
12 1982  0 0
13 1982  2 2
14 1982  3 3
15 1982  4 4
16 1982  2 2
17 1982  3 3
18 1982  3 3
19 1982  4 4
20 1982  2 2
21 1982  3 3
22 1982  4 4
23 1982  2 2
24 1982  3 3
25 1982  4 4
26 1982  5 15
27 1982  3 3
28 1982  4 4
29 1982  1 1
30 1982  2 15
31 1982  1 1
32 1982  2 2
33 1982  3 3
34 1982  4 15
35 1982  0 0
36 1982  0 0
37 1982  0 0
38 1982  0 0
39 1982  0 0
```

```
40 1982  4 15

EXPLOITATION   Hrate_is_Continuous_F  Fleet_in_columns;_year_in_rows
yr seas 1
init_yr 1  1.31198
1982 1  1.13836
1983 1  1.55817
1984 1  1.54648
1985 1  1.43054
1986 1  1.66612
1987 1  1.34542
1988 1  1.84378
1989 1  1.53288
1990 1  1.33127
1991 1  1.4755
1992 1  1.58689
1993 1  1.39564
1994 1  1.31609
1995 1  1.65754
1996 1  1.34458
1997 1  0.882212
1998 1  0.825846
1999 1  0.648569
2000 1  0.732475
2001 1  0.60453
2002 1  0.504336
2003 1  0.511568
2004 1  0.534382
2005 1  0.490766
2006 1  0.430377
2007 1  -0.0753161

TIME_SERIES    Bio-Smry_age:_1  Hrate_is_Continuous_F
pop year period season bio-all bio-smry SpawnBio recruit-0  enc_catch:_1
dead_catch:_1 ret_catch:_1 obs_cat:_1 Hrate-1 SPB_vir_LH
1 1980 VIRG 1 361392 361084 359812 45141.5 0 0 0 0 0  359835
1 1981 INIT 1 26232 25902.8 24825.9 48302.3 20518.6 20518.6 20518.6 10000
1.31198 24825.9
1 1982 TIME 1 26306.7 25902.8 24825.9 59260.4 18893.4 18893.4 18893.4 18963
1.13836 24854.3
1 1983 TIME 1 30829.6 30394.5 28937.2 63849.3 26441 26441 26441 26466 1.55817
29102.6
1 1984 TIME 1 29872.1 29607.2 28076.1 38877.9 25307.8 25307.8 25307.8 26057
1.54648 28176.8
1 1985 TIME 1 24561.8 24228.7 23199.9 48873.9 20587.2 20587.2 20587.2 20432
1.43054 23326.4
1 1986 TIME 1 23610.6 23254 22093 52333.3 20866.3 20866.3 20866.3 20866
1.66612 22228.5
1 1987 TIME 1 23209 22948.2 21708 38266.1 18103.6 18103.6 18103.6 18312
1.34542 21807.1
1 1988 TIME 1 22768.5 22698.9 21697.8 10213.5 21465.3 21465.3 21465.3 21761
1.84378 21724.3
1 1989 TIME 1 11125.5 10961.7 10636.5 24033.7 9958.29 9958.29 9958.29 10314
1.53288 10698.7
1 1990 TIME 1 9914.97 9699.42 9166.09 31629 7541.43 7541.43 7541.43 7976
1.33127 9247.99
```

```
1 1991 TIME 1 13576.3 13402.5 12648.1 25499.1 11132.6 11132.6 11132.6 11316
1.4755 12714.1
1 1992 TIME 1 13699.6 13484.9 12839.5 31507 12014.5 12014.5 12014.5 11805
1.58689 12921.1
1 1993 TIME 1 13873.5 13651.9 12913 32505.9 11055 11055 11055 10781 1.39564
12997.1
1 1994 TIME 1 15741.9 15529.9 14733.8 31111.1 12255.9 12255.9 12255.9 12182
1.31609 14814.4
1 1995 TIME 1 16677.8 16461.9 15682.9 31691.4 9961.4 9961.4 9961.4 10495
1.65754 15764.9
1 1996 TIME 1 20798.4 20640.3 19763 23202.9 11615.2 11615.2 11615.2 11643
1.34458 19823.1
1 1997 TIME 1 22566.4 22395 21679.7 25149.1 10675.6 10675.6 10675.6 10325
0.882212 21744.8
1 1998 TIME 1 25380 25188.7 24474.2 28072.7 11880.4 11880.4 11880.4 11641
0.825846 24546.9
1 1999 TIME 1 27843.3 27690.2 26895.3 22476.6 10792.5 10792.5 10792.5 10851
0.648569 26953.5
1 2000 TIME 1 30862.4 30671.3 29970.9 28045.7 13926.2 13926.2 13926.2 13756
0.732475 30043.5
1 2001 TIME 1 31673 31489.7 30711.7 26900.5 12108.4 12108.4 12108.4 11932
0.60453 30781.3
1 2002 TIME 1 34515.3 34328 33529.4 27480.8 11553.9 11553.9 11553.9 11308
0.504336 33600.6
1 2003 TIME 1 38468.2 38326.8 37520.3 20750 13359.7 13359.7 13359.7 12927
0.511568 37574.1
1 2004 TIME 1 39429.8 39223.3 38559.6 30293.8 14728.8 14728.8 14728.8 14306
0.534382 38638
1 2005 TIME 1 40151.2 40041.4 39221.1 16112.3 13511.3 13511.3 13511.3 13446
0.490766 39262.9
1 2006 TIME 1 39624.5 39404.9 38820.4 32222.4 12585.5 12585.5 12585.5 12574
0.430377 38903.9
1 2007 FORE 1 42413.6 42140.1 41414.3 40143.5 -2798.3 -2798.3 -2798.3 -2798.3
-0.0753161 41414.3

SPR_series  uses_R0= 45141.5   ###note_Y/R_unit_is_Dead_Biomass
Year Bio_all Bio_Smry SPBzero SPBfished SPBfished/R SPR Y/R GenTime Actual:
Bio_all Bio_Smry Enc_Catch Dead_Catch Retain_Catch SPB Recruits Tot_Exploit
More_F(by_morph):  aveF-1 maxF-1
1982 27478.1 27170.5  359812 26139.4 0.579056 0.0726475 0.439307 0.267242 +
26306.7 25902.8 18893.4 18893.4 18893.4 24825.9 59260.4 0.718197 +  1.09592
1.13834
1983 21500.3 21192.7  359812 20218.2 0.447886 0.0561911 0.407957 0.176843 +
30829.6 30394.5 26441 26441 26441 28937.2 63849.3 0.857647 +  1.50008
1.55815
1984 21620.7 21313.1  359812 20337.2 0.450521 0.0565217 0.408674 0.178888 +
29872.1 29607.2 25307.8 25307.8 25307.8 28076.1 38877.9 0.847203 +  1.48883
1.54646
1985 22927.2 22619.5  359812 21628.9 0.479136 0.0601117 0.416208 0.200496 +
24561.8 24228.7 20587.2 20587.2 20587.2 23199.9 48873.9 0.838182 +  1.37721
1.43052
1986 20471 20163.3  359812 19201.9 0.425372 0.0533666 0.401664 0.159029 +
23610.6 23254 20866.3 20866.3 20866.3 22093 52333.3 0.883768 +  1.60401
1.6661
1987 24037.5 23729.8  359812 22727.9 0.503482 0.0631662 0.422274 0.218003 +
23209 22948.2 18103.6 18103.6 18103.6 21708 38266.1 0.780027 +  1.29526
1.3454
```

```
1988 19047.5 18739.8  359812 17798.8 0.394289 0.0494668 0.392454 0.133534 +
22768.5 22698.9 21465.3 21465.3 21465.3 21697.8 10213.5 0.942762 +  1.77504
1.84375
1989 21763.3 21455.7  359812 20478.1 0.453642 0.0569133 0.409518 0.181297 +
11125.5 10961.7 9958.29 9958.29 9958.29 10636.5 24033.7 0.895087 +  1.47573
1.53286
1990 24236.6 23929  359812 22925.1 0.507851 0.0637142 0.42333 0.221058 +
9914.97 9699.42 7541.43 7541.43 7541.43 9166.09 31629 0.76061 +  1.28164
1.33125
1991 22395 22087.4  359812 21102.6 0.467476 0.0586489 0.413193 0.191823 +
13576.3 13402.5 11132.6 11132.6 11132.6 12648.1 25499.1 0.820001 +  1.42049
1.47547
1992 21212.2 20904.6  359812 19933.7 0.441582 0.0554003 0.406225 0.171918 +
13699.6 13484.9 12014.5 12014.5 12014.5 12839.5 31507 0.876998 +  1.52773
1.58687
1993 23365.1 23057.5  359812 22062.3 0.488736 0.0613161 0.418636 0.207496 +
13873.5 13651.9 11055 11055 11055 12913 32505.9 0.796848 +  1.34361  1.39562
1994 24455.2 24147.6  359812 23141.7 0.512649 0.0643161 0.42448 0.224383 +
15741.9 15529.9 12255.9 12255.9 12255.9 14733.8 31111.1 0.778554 +  1.26703
1.31607
1995 33624.2 33316.6  359812 32168.9 0.712624 0.0894047 0.493758 0.1597 +
16677.8 16461.9 9961.4 9961.4 9961.4 15682.9 31691.4 0.597284 +  1.52121
1.65753
1996 37919.1 37611.5  359812 36446.4 0.807381 0.101293 0.511005 0.217435 +
20798.4 20640.3 11615.2 11615.2 11615.2 19763 23202.9 0.558465 +  1.23399
1.34456
1997 49621.9 49314.3  359812 48122.1 1.06603 0.133742 0.54504 0.343034 +
22566.4 22395 10675.6 10675.6 10675.6 21679.7 25149.1 0.473074 +  0.809652
0.882203
1998 51922 51614.3  359812 50418.8 1.11691 0.140125 0.549958 0.36264 +  25380
25188.7 11880.4 11880.4 11880.4 24474.2 28072.7 0.468101 +  0.757922
0.825837
1999 61662.1 61354.5  359812 60148 1.33243 0.167165 0.565842 0.431911 +
27843.3 27690.2 10792.5 10792.5 10792.5 26895.3 22476.6 0.387617 +  0.595225
0.648562
2000 56486.7 56179  359812 54977.8 1.2179 0.152796 0.558328 0.397614 +
30862.4 30671.3 13926.2 13926.2 13926.2 29970.9 28045.7 0.451235 +  0.67223
0.732467
2001 64921.6 64614  359812 63404.8 1.40458 0.176216 0.569624 0.45108 +  31673
31489.7 12108.4 12108.4 12108.4 30711.7 26900.5 0.382294 +  0.554808
0.604523
2002 74285.1 73977.4  359812 72761.9 1.61186 0.202222 0.576993 0.497922 +
34515.3 34328 11553.9 11553.9 11553.9 33529.4 27480.8 0.334747 +  0.462856
0.504331
2003 73497.5 73189.9  359812 71974.8 1.59443 0.200035 0.576554 0.494384 +
38468.2 38326.8 13359.7 13359.7 13359.7 37520.3 20750 0.347291 +  0.469493
0.511563
2004 71140 70832.3  359812 69618.7 1.54223 0.193486 0.575052 0.483386 +
39429.8 39223.3 14728.8 14728.8 14728.8 38559.6 30293.8 0.373545 +  0.49043
0.534376
2005 75819 75511.4  359812 74295 1.64583 0.206483 0.57776 0.504629 +  40151.2
40041.4 13511.3 13511.3 13511.3 39221.1 16112.3 0.336511 +  0.450401
0.490761
2006 83672.4 83364.7  359812 82144.5 1.81971 0.228298 0.580004 0.535592 +
39624.5 39404.9 12585.5 12585.5 12585.5 38820.4 32222.4 0.317618 +  0.39498
0.430373
```

```
2007 361368 361061  359812 359812 7.97076 1 0 0.818731 +  42413.6 42140.1 -
2798.3 -2798.3 -2798.3 41414.3 40143.5 -0.0659764 +  0  0

SPAWN_RECRUIT Function: 3 - - - - -
10.7176 Ln(R0) 45141.5
0.939164 steep
0.6 stddev_recr
0 env_link_
0.0676784 init-eq 48302.3
1982 2006 recdev:start_end 1957 first_year_with_full_bias_adjustment
year spawn_bio exp-recr with-env bias-adj pred-recr dev
S/Rcurve 359812 45141.5
Virg 359812 45141.5 45141.5 37705.3 45141.5
Init 24825.9 48302.3 48302.3 40345.5 48302.3
1982 24825.9 37046.3 37046.3 30943.7 59260.4 0.649771
1983 28937.2 38088.7 38088.7 31814.4 63849.3 0.696608
1984 28076.1 37891.3 37891.3 31649.4 38877.9 0.205706
1985 23199.9 36552.9 36552.9 30531.5 48873.9 0.470484
1986 22093 36184.2 36184.2 30223.6 52333.3 0.549011
1987 21708 36049 36049 30110.7 38266.1 0.239684
1988 21697.8 36045.4 36045.4 30107.7 10213.5 -1.08107
1989 10636.5 29473 29473 24617.9 24033.7 -0.0240164
1990 9166.09 27873.7 27873.7 23282.1 31629 0.306391
1991 12648.1 31250.7 31250.7 26102.8 25499.1 -0.0233986
1992 12839.5 31400 31400 26227.5 31507 0.1834
1993 12913 31456.5 31456.5 26274.7 32505.9 0.212817
1994 14733.8 32728.3 32728.3 27337 31111.1 0.129323
1995 15682.9 33306.2 33306.2 27819.7 31691.4 0.130302
1996 19763 35304.3 35304.3 29488.6 23202.9 -0.239727
1997 21679.7 36039 36039 30102.3 25149.1 -0.17978
1998 24474.2 36944.1 36944.1 30858.3 28072.7 -0.094609
1999 26895.3 37603.7 37603.7 31409.2 22476.6 -0.334627
2000 29970.9 38313.2 38313.2 32001.9 28045.7 -0.131961
2001 30711.7 38466.3 38466.3 32129.8 26900.5 -0.177638
2002 33529.4 38996.1 38996.1 32572.3 27480.8 -0.169975
2003 37520.3 39628.9 39628.9 33100.9 20750 -0.467014
2004 38559.6 39775.1 39775.1 33222.9 30293.8 -0.0922965
2005 39221.1 39864.6 39864.6 33297.7 16112.3 -0.725908
2006 38820.4 39810.7 39810.7 33252.7 32222.4 -0.0314726
2007 41414.3 40143.5 40143.5 40143.5 40143.5 0 forecast

N_est r.m.s.e.
25 0.397466

INDEX_2
index year vuln_bio obs exp eff_Q SE Dev Like Like+log(s)
2 1982 37579.7 -0.001 6.32077 0.000168196 0.16
2 1983 46417.5 -0.001 7.80725 0.000168196 0.16
2 1984 49202.1 -0.001 8.27562 0.000168196 0.16
2 1985 29972.9 -0.001 5.04132 0.000168196 0.16
2 1986 37849.5 -0.001 6.36615 0.000168196 0.16
2 1987 40159 -0.001 6.7546 0.000168196 0.16
2 1988 29732.7 -0.001 5.00094 0.000168196 0.16
2 1989 7783.54 -0.001 1.30916 0.000168196 0.16
2 1990 18538.6 -0.001 3.11812 0.000168196 0.16
2 1991 24589.3 -0.001 4.13582 0.000168196 0.16
2 1992 19712.8 7.15 3.31563 0.000168196 0.3 0.768465 3.28077 2.0768
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2 1993 24252.1 6.5 4.07911 0.000168196 0.3 0.465923 1.20602 0.00204876
2 1994 25207.8 3.76 4.23986 0.000168196 0.3 -0.120112 0.0801492 -1.12382
2 1995 24200.9 6.07 4.07049 0.000168196 0.3 0.399594 0.887087 -0.316886
2 1996 25529.3 22.17 4.29394 0.000168196 0.3 1.64154 14.9702 13.7662
2 1997 18748.7 3.86 3.15345 0.000168196 0.3 0.202169 0.227068 -0.976904
2 1998 20413.3 1.68 3.43345 0.000168196 0.3 -0.714771 2.83832 1.63435
2 1999 22799 2.11 3.8347 0.000168196 0.3 -0.597405 1.98273 0.778762
2 2000 18285.9 0.7 3.07562 0.000168196 0.3 -1.48018 12.1719 10.9679
2 2001 22797.9 3.07 3.83452 0.000168196 0.3 -0.222366 0.274704 -0.929269
2 2002 21894.4 2.77 3.68255 0.000168196 0.3 -0.284759 0.450487 -0.753486
2 2003 22388.6 8.17 3.76568 0.000168196 0.3 0.77454 3.33285 2.12887
2 2004 16903.8 1.45 2.84316 0.000168196 0.3 -0.673353 2.51892 1.31494
2 2005 24673.2 2.96 4.14993 0.000168196 0.3 -0.337903 0.634325 -0.569648
2 2006 13128.4 2.64 2.20815 0.000168196 0.3 0.178623 0.177257 -1.02672
3 1982 15661.9 -0.001 7.33616 0.000468409 0.16
3 1983 17125.8 -0.001 8.02186 0.000468409 0.16
3 1984 17042.9 -0.001 7.98305 0.000468409 0.16
3 1985 18174.3 -0.001 8.51302 0.000468409 0.16
3 1986 11752.2 -0.001 5.50482 0.000468409 0.16
3 1987 13146 -0.001 6.15768 0.000468409 0.16
3 1988 16451.2 -0.001 7.7059 0.000468409 0.16
3 1989 9424.47 -0.001 4.41451 0.000468409 0.16
3 1990 2895.29 -0.001 1.35618 0.000468409 0.16
3 1991 7649.87 -0.001 3.58327 0.000468409 0.16
3 1992 9420.76 4.74 4.41277 0.000468409 0.3 0.0715343 0.0284287 -1.17554
3 1993 7131.67 6.7 3.34054 0.000468409 0.3 0.695975 2.69101 1.48703
3 1994 9681.42 7.2 4.53486 0.000468409 0.3 0.462286 1.18727 -0.0167046
3 1995 10483.5 4.59 4.91056 0.000468409 0.3 -0.0675087 0.025319 -1.17865
3 1996 15556.2 8.33 7.28666 0.000468409 0.3 0.133818 0.099484 -1.10449
3 1997 17177.1 4.8 8.04592 0.000468409 0.3 -0.51655 1.48235 0.27838
3 1998 13495.5 3.25 6.32142 0.000468409 0.3 -0.665289 2.45894 1.25497
3 1999 14815.2 4.8 6.93956 0.000468409 0.3 -0.368622 0.754901 -0.449071
3 2000 16980.3 6.52 7.95372 0.000468409 0.3 -0.198766 0.219488 -0.984485
3 2001 13453.2 5.33 6.30162 0.000468409 0.3 -0.167456 0.155785 -1.04819
3 2002 17089 10.74 8.00462 0.000468409 0.3 0.293956 0.480056 -0.723917
3 2003 16653.5 14.36 7.80064 0.000468409 0.3 0.610241 2.06886 0.864884
3 2004 17011.4 8.68 7.96831 0.000468409 0.3 0.0855489 0.040659 -1.16331
3 2005 12801.3 4.03 5.99623 0.000468409 0.3 -0.397365 0.877214 -0.326759
3 2006 18804.3 9.06 8.8081 0.000468409 0.3 0.0281969 0.00441702 -1.19956
4 1982 3459.49 -0.001 1.31103 0.000378967 0.16
4 1983 4114.39 -0.001 1.55922 0.000378967 0.16
4 1984 2958.36 -0.001 1.12112 0.000378967 0.16
4 1985 2978.61 -0.001 1.1288 0.000378967 0.16
4 1986 3566.24 -0.001 1.35149 0.000378967 0.16
4 1987 1822.64 -0.001 0.690722 0.000378967 0.16
4 1988 2808.39 -0.001 1.06429 0.000378967 0.16
4 1989 2136.67 -0.001 0.809726 0.000378967 0.16
4 1990 1669.65 -0.001 0.632744 0.000378967 0.16
4 1991 627.328 -0.001 0.237737 0.000378967 0.16
4 1992 1435.19 0.33 0.543889 0.000378967 0.3 -0.499653 1.38696 0.18299
4 1993 1581.37 0.31 0.599286 0.000378967 0.3 -0.659166 2.41389 1.20991
4 1994 1449.03 0.82 0.549135 0.000378967 0.3 0.40096 0.893162 -0.310811
4 1995 2129.73 0.25 0.807097 0.000378967 0.3 -1.17198 7.6308 6.42683
4 1996 2789.92 0.6 1.05729 0.000378967 0.3 -0.566533 1.78311 0.579139
4 1997 5118.47 1.04 1.93973 0.000378967 0.3 -0.623329 2.15855 0.954581
4 1998 7732.66 2.29 2.93042 0.000378967 0.3 -0.246596 0.33783 -0.866143
4 1999 6311.96 2.9 2.39203 0.000378967 0.3 0.192569 0.206017 -0.997956
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4 2001 8460.83 6.42 3.20638 0.000378967 0.3 0.694276 2.67789 1.47392
4 2002 7310.84 5.58 2.77057 0.000378967 0.3 0.700136 2.72328 1.51931
4 2003 9939.34 8.48 3.76668 0.000378967 0.3 0.811515 3.65865 2.45468
4 2004 9638.67 4.56 3.65274 0.000378967 0.3 0.221845 0.273417 -0.930556
4 2005 9694.74 3.07 3.67399 0.000378967 0.3 -0.1796 0.179201 -1.02477
4 2006 7514.34 4.29 2.84769 0.000378967 0.3 0.40978 0.932885 -0.271088
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5 1983 907.354 -0.001 0.363616 0.000400743 0.16
5 1984 709.173 -0.001 0.284196 0.000400743 0.16
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5 1986 583.297 -0.001 0.233752 0.000400743 0.16
5 1987 551.79 -0.001 0.221126 0.000400743 0.16
5 1988 388.637 -0.001 0.155743 0.000400743 0.16
5 1989 363.804 -0.001 0.145792 0.000400743 0.16
5 1990 377.718 -0.001 0.151368 0.000400743 0.16
5 1991 361.088 -0.001 0.144704 0.000400743 0.16
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39 2002 27480.8 0.13 0.170575 6.20708e-006 0.6 -0.271643 0.102486 -0.40834
39 2003 20750 0.21 0.128797 6.20708e-006 0.6 0.488872 0.331938 -0.178888
39 2004 30293.8 0.27 0.188036 6.20708e-006 0.6 0.361787 0.181792 -0.329034
39 2005 16112.3 0.01 0.10001 6.20708e-006 0.6 -2.30269 7.36439 6.85357
39 2006 32222.4 0.17 0.200007 6.20708e-006 0.6 -0.162555 0.0367001 -0.474125
40 1982 978.52 -0.001 0.0192978 1.97215e-005 0.4
40 1983 1164.04 -0.001 0.0229565 1.97215e-005 0.4
40 1984 909.852 -0.001 0.0179436 1.97215e-005 0.4
40 1985 674.611 -0.001 0.0133043 1.97215e-005 0.4
40 1986 715.43 -0.001 0.0141093 1.97215e-005 0.4
40 1987 662.507 -0.001 0.0130656 1.97215e-005 0.4
40 1988 529.92 -0.001 0.0104508 1.97215e-005 0.4
40 1989 432.468 -0.001 0.00852889 1.97215e-005 0.4
40 1990 454.181 0.02 0.00895711 1.97215e-005 0.6 0.803285 0.896204 0.385378
40 1991 459.325 -0.001 0.00905855 1.97215e-005 0.4
40 1992 203.457 0.01 0.00401247 1.97215e-005 0.6 0.913178 1.15819 0.647361
40 1993 274.459 0.01 0.00541272 1.97215e-005 0.6 0.613833 0.52332 0.0124947
40 1994 376.337 0.04 0.00742192 1.97215e-005 0.6 1.68444 3.94076 3.42993
40 1995 400.811 0.03 0.00790458 1.97215e-005 0.6 1.33376 2.4707 1.95987
40 1996 395.369 0.02 0.00779725 1.97215e-005 0.6 0.941961 1.23235 0.721522
40 1997 680.42 0.04 0.0134189 1.97215e-005 0.6 1.09222 1.65686 1.14603
40 1998 1966.21 -0.001 0.0387766 1.97215e-005 0.4
40 1999 3478.91 0.03 0.0686091 1.97215e-005 0.6 -0.827228 0.950425 0.439599
40 2000 4192.25 0.09 0.0826773 1.97215e-005 0.6 0.0848644 0.0100027 -0.500823
40 2001 4727.4 0.01 0.0932312 1.97215e-005 0.6 -2.2325 6.92228 6.41146
40 2002 5901.09 0.11 0.116378 1.97215e-005 0.6 -0.0563631 0.00441222 -
0.506413
40 2003 6534.13 0.05 0.128862 1.97215e-005 0.6 -0.946723 1.24484 0.734013
40 2004 8088.69 0.1 0.159521 1.97215e-005 0.6 -0.467004 0.302906 -0.20792
40 2005 8507.98 0.04 0.16779 1.97215e-005 0.6 -1.43383 2.85538 2.34456
40 2006 9125.4 0.04 0.179966 1.97215e-005 0.6 -1.50389 3.14123 2.6304

INDEX_1
Index Do_Power Power Do_Env_var Env_Link Do_ExtraVar Qtype  Q Num=0/Bio=1
Err_type N Npos r.m.s.e. mean_input_SE mean_(Input+extra)_SE pen_mean_Qdev
rmse_Qdev
1 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
2 0  1.0 0  0.00  0.0 0 0.000168196  0 0 25 15 0.735114 0.3 0.3 0 0
3 0  1.0 0  0.00  0.0 0 0.000468409  0 0 25 15 0.388446 0.3 0.3 0 0
4 0  1.0 0  0.00  0.0 0 0.000378967  0 0 25 15 0.587199 0.3 0.3 0 0
5 0  1.0 0  0.00  0.0 0 0.000400743  0 0 25 15 0.681712 0.3 0.3 0 0
6 0  1.0 0  0.00  0.0 0 0.000592793  0 0 25 14 0.510219 0.3 0.3 0 0
7 0  1.0 0  0.00  0.0 0 1.60235e-005  0 0 25 25 0.691856 0.4 0.4 0 0
8 0  1.0 0  0.00  0.0 0 4.33039e-005  0 0 25 25 0.50874 0.4 0.4 0 0
9 0  1.0 0  0.00  0.0 0 3.5748e-005  0 0 25 24 0.775298 0.4 0.4 0 0
10 0  1.0 0  0.00  0.0 0 4.23331e-005  0 0 25 20 0.457672 0.4 0.4 0 0
11 0  1.0 0  0.00  0.0 0 7.61515e-005  0 0 25 15 0.369693 0.4 0.4 0 0
```

```
12 0  1.0 0  0.00  0.0 0 9.2937e-006  0 0 25 25 0.708116 0.51 0.51 0 0
13 0  1.0 0  0.00  0.0 0 7.67662e-005  0 0 25 25 0.441899 0.51 0.51 0 0
14 0  1.0 0  0.00  0.0 0 9.69511e-005  0 0 25 25 0.745462 0.51 0.51 0 0
15 0  1.0 0  0.00  0.0 0 0.000100846  0 0 25 23 0.608126 0.51 0.51 0 0
16 0  1.0 0  0.00  0.0 0 4.69679e-005  0 0 25 25 0.905617 0.41 0.41 0 0
17 0  1.0 0  0.00  0.0 0 4.75558e-005  0 0 25 25 0.748541 0.41 0.41 0 0
18 0  1.0 0  0.00  0.0 0 0.000136271  0 0 25 24 1.38824 0.41 0.41 0 0
19 0  1.0 0  0.00  0.0 0 0.000753321  0 0 25 24 0.792281 0.41 0.41 0 0
20 0  1.0 0  0.00  0.0 0 2.02756e-005  0 0 25 23 0.747792 0.6 0.6 0 0
21 0  1.0 0  0.00  0.0 0 2.09241e-005  0 0 25 23 0.746703 0.6 0.6 0 0
22 0  1.0 0  0.00  0.0 0 3.45572e-005  0 0 25 22 0.773877 0.6 0.6 0 0
23 0  1.0 0  0.00  0.0 0 5.14376e-005  0 0 25 22 0.70061 0.6 0.6 0 0
24 0  1.0 0  0.00  0.0 0 0.000127172  0 0 25 22 0.523972 0.6 0.6 0 0
25 0  1.0 0  0.00  0.0 0 0.000106478  0 0 25 22 0.473347 0.6 0.6 0 0
26 0  1.0 0  0.00  0.0 0 7.93041e-005  0 0 25 22 0.835217 0.6 0.6 0 0
27 0  1.0 0  0.00  0.0 0 0.000125252  0 0 25 25 0.70709 0.6 0.6 0 0
28 0  1.0 0  0.00  0.0 0 9.89305e-005  0 0 25 20 0.868932 0.6 0.6 0 0
29 0  1.0 0  0.00  0.0 0 1.19787e-005  0 0 25 17 0.900723 0.6 0.6 0 0
30 0  1.0 0  0.00  0.0 0 2.0766e-005  0 0 25 17 0.877515 0.6 0.6 0 0
31 0  1.0 0  0.00  0.0 0 0.000182296  0 0 25 19 0.652598 0.6 0.6 0 0
32 0  1.0 0  0.00  0.0 0 7.93802e-005  0 0 25 19 0.972017 0.6 0.6 0 0
33 0  1.0 0  0.00  0.0 0 4.87617e-005  0 0 25 16 0.806493 0.6 0.6 0 0
34 0  1.0 0  0.00  0.0 0 6.94122e-005  0 0 25 15 0.784781 0.6 0.6 0 0
35 0  1.0 0  0.00  0.0 0 2.06377e-006  0 0 25 19 0.93437 0.6 0.6 0 0
36 0  1.0 0  0.00  0.0 0 3.2025e-005  0 0 25 25 0.558944 0.6 0.6 0 0
37 0  1.0 0  0.00  0.0 0 4.47349e-005  0 0 25 19 0.612632 0.6 0.6 0 0
38 0  1.0 0  0.00  0.0 0 0.000271218  0 0 25 25 0.611568 0.6 0.6 0 0
39 0  1.0 0  0.00  0.0 0 6.20708e-006  0 0 25 21 0.87444 0.6 0.6 0 0
40 0  1.0 0  0.00  0.0 0 1.97215e-005  0 0 25 15 1.14493 0.6 0.6 0 0
rmse_Qdev_not_in_logL
pen_mean_Qdev_not_in_logL_in_randwalk_approach

INDEX_3
Index  Q_parm_assignments
1 0 -- 0 --  0 0
2 0 -- 0 --  0 0
3 0 -- 0 --  0 0
4 0 -- 0 --  0 0
5 0 -- 0 --  0 0
6 0 -- 0 --  0 0
7 0 -- 0 --  0 0
8 0 -- 0 --  0 0
9 0 -- 0 --  0 0
10 0 -- 0 --  0 0
11 0 -- 0 --  0 0
12 0 -- 0 --  0 0
13 0 -- 0 --  0 0
14 0 -- 0 --  0 0
15 0 -- 0 --  0 0
16 0 -- 0 --  0 0
17 0 -- 0 --  0 0
18 0 -- 0 --  0 0
19 0 -- 0 --  0 0
20 0 -- 0 --  0 0
21 0 -- 0 --  0 0
22 0 -- 0 --  0 0
23 0 -- 0 --  0 0
```

```
24 0 -- 0 --  0 0
25 0 -- 0 --  0 0
26 0 -- 0 --  0 0
27 0 -- 0 --  0 0
28 0 -- 0 --  0 0
29 0 -- 0 --  0 0
30 0 -- 0 --  0 0
31 0 -- 0 --  0 0
32 0 -- 0 --  0 0
33 0 -- 0 --  0 0
34 0 -- 0 --  0 0
35 0 -- 0 --  0 0
36 0 -- 0 --  0 0
37 0 -- 0 --  0 0
38 0 -- 0 --  0 0
39 0 -- 0 --  0 0
40 0 -- 0 --  0 0

DISCARD  log(L)_based_on_T-distribution_with_DF=_30
as_fraction
index year seas obs exp cv Dev Like Like+log(s)


MEAN_BODY_WT log(L)_based_on_T-distribution_with_DF=_30
 year seas index Mkt obs exp cv Dev Like Like+log(s)
 1982 1 1 0 0.504 0.619221 0.1 -0.115221 2.48929 2.48929
 1983 1 1 0 0.521 0.598493 0.1 -0.0774935 1.10287 1.10287
 1984 1 1 0 0.518 0.590682 0.1 -0.0726816 0.985202 0.985202
 1985 1 1 0 0.575 0.631041 0.1 -0.0560408 0.483167 0.483167
 1986 1 1 0 0.613 0.581626 0.1 0.031374 0.134753 0.134753
 1987 1 1 0 0.581 0.578985 0.1 0.00201513 0.00062152 0.00062152
 1988 1 1 0 0.588 0.6381 0.1 -0.0500996 0.370614 0.370614
 1989 1 1 0 0.668 0.704673 0.1 -0.0366728 0.154943 0.154943
 1990 1 1 0 0.54 0.558556 0.1 -0.0185558 0.0608879 0.0608879
 1991 1 1 0 0.537 0.560992 0.1 -0.0239924 0.102794 0.102794
 1992 1 1 0 0.595 0.589711 0.1 0.00528873 0.00408152 0.00408152
 1993 1 1 0 0.571 0.566771 0.1 0.00422915 0.00283404 0.00283404
 1994 1 1 0 0.605 0.588205 0.1 0.0167955 0.0397673 0.0397673
 1995 1 1 0 0.675 0.717821 0.1 -0.0428207 0.206544 0.206544
 1996 1 1 0 0.621 0.758726 0.1 -0.137726 2.35329 2.35329
 1997 1 1 0 0.697 0.853032 0.1 -0.156032 2.39441 2.39441
 1998 1 1 0 0.759 0.937301 0.1 -0.178301 2.61728 2.61728
 1999 1 1 0 0.755 0.969756 0.1 -0.214756 3.70105 3.70105
 2000 1 1 0 0.85 1.01567 0.1 -0.165674 1.84814 1.84814
 2001 1 1 0 0.903 1.04998 0.1 -0.146984 1.3118 1.3118
 2002 1 1 0 0.898 1.06486 0.1 -0.166865 1.68856 1.68856
 2003 1 1 0 0.999 1.1078 0.1 -0.108801 0.601036 0.601036
 2004 1 1 0 0.983 1.1556 0.1 -0.172604 1.51632 1.51632
 2005 1 1 0 0.949 1.18586 0.1 -0.23686 2.92448 2.92448
 2006 1 1 0 0.947 1.19757 0.1 -0.250569 3.25105 3.25105

FIT_LEN_COMPS
Index Year Seas Gender Mkt Nsamp effN Like

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
1 0 0 0 0 0 0 -1.#IND
```

```
2 0 0 0 0 0 0 -1.#IND
3 0 0 0 0 0 0 -1.#IND
4 0 0 0 0 0 0 -1.#IND
5 0 0 0 0 0 0 -1.#IND
6 0 0 0 0 0 0 -1.#IND
7 0 0 0 0 0 0 -1.#IND
8 0 0 0 0 0 0 -1.#IND
9 0 0 0 0 0 0 -1.#IND
10 0 0 0 0 0 0 -1.#IND
11 0 0 0 0 0 0 -1.#IND
12 0 0 0 0 0 0 -1.#IND
13 0 0 0 0 0 0 -1.#IND
14 0 0 0 0 0 0 -1.#IND
15 0 0 0 0 0 0 -1.#IND
16 0 0 0 0 0 0 -1.#IND
17 0 0 0 0 0 0 -1.#IND
18 0 0 0 0 0 0 -1.#IND
19 0 0 0 0 0 0 -1.#IND
20 0 0 0 0 0 0 -1.#IND
21 0 0 0 0 0 0 -1.#IND
22 0 0 0 0 0 0 -1.#IND
23 0 0 0 0 0 0 -1.#IND
24 0 0 0 0 0 0 -1.#IND
25 0 0 0 0 0 0 -1.#IND
26 0 0 0 0 0 0 -1.#IND
27 0 0 0 0 0 0 -1.#IND
28 0 0 0 0 0 0 -1.#IND
29 0 0 0 0 0 0 -1.#IND
30 0 0 0 0 0 0 -1.#IND
31 0 0 0 0 0 0 -1.#IND
32 0 0 0 0 0 0 -1.#IND
33 0 0 0 0 0 0 -1.#IND
34 0 0 0 0 0 0 -1.#IND
35 0 0 0 0 0 0 -1.#IND
36 0 0 0 0 0 0 -1.#IND
37 0 0 0 0 0 0 -1.#IND
38 0 0 0 0 0 0 -1.#IND
39 0 0 0 0 0 0 -1.#IND
40 0 0 0 0 0 0 -1.#IND

FIT_AGE_COMPS
Index Year Seas Gender Mkt Ageerr Lbin_lo Lbin_hi Nsamp effN Like
1 1982 1 0 0 1 1 70 152.766 76.7753 6.94297
1 1983 1 0 0 1 1 70 128.547 136.919 1.64938
1 1984 1 0 0 1 1 70 98.739 58.403 2.3275
1 1985 1 0 0 1 1 70 121.095 41.1938 3.1194
1 1986 1 0 0 1 1 70 145.314 33.0397 5.67836
1 1987 1 0 0 1 1 70 122.958 62.0682 2.66351
1 1988 1 0 0 1 1 70 167.67 2680.39 0.633005
1 1989 1 0 0 1 1 70 156.492 372.092 1.40647
1 1990 1 0 0 1 1 70 63.342 573.118 0.217351
1 1991 1 0 0 1 1 70 85.698 59.5326 1.67836
1 1992 1 0 0 1 1 70 63.342 207.712 0.496468
1 1993 1 0 0 1 1 70 67.068 156.05 1.10289
1 1994 1 0 0 1 1 70 74.52 131.993 0.454891
1 1995 1 0 0 1 1 70 55.89 597.119 0.394825
1 1996 1 0 0 1 1 70 85.698 47.2827 2.11532
```

```
1 1997 1 0 0 1 1 70 165.807 897.926 3.1689
1 1998 1 0 0 1 1 70 188.163 330.883 2.32368
1 1999 1 0 0 1 1 70 195.615 300.509 1.48002
1 2000 1 0 0 1 1 70 204.93 185.764 4.53811
1 2001 1 0 0 1 1 70 191.889 148.25 5.11785
1 2002 1 0 0 1 1 70 137.862 100.321 4.25713
1 2003 1 0 0 1 1 70 162.081 1544.24 1.57472
1 2004 1 0 0 1 1 70 260.82 349.134 2.4554
1 2005 1 0 0 1 1 70 320.436 489.656 4.24492
1 2006 1 0 0 1 1 70 337.203 468.529 2.47418

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
1 0 25 401.956 150.158 119.859 2.99406 2.67689
2 0 0 0 0 0 0 -1.#IND
3 0 0 0 0 0 0 -1.#IND
4 0 0 0 0 0 0 -1.#IND
5 0 0 0 0 0 0 -1.#IND
6 0 0 0 0 0 0 -1.#IND
7 0 0 0 0 0 0 -1.#IND
8 0 0 0 0 0 0 -1.#IND
9 0 0 0 0 0 0 -1.#IND
10 0 0 0 0 0 0 -1.#IND
11 0 0 0 0 0 0 -1.#IND
12 0 0 0 0 0 0 -1.#IND
13 0 0 0 0 0 0 -1.#IND
14 0 0 0 0 0 0 -1.#IND
15 0 0 0 0 0 0 -1.#IND
16 0 0 0 0 0 0 -1.#IND
17 0 0 0 0 0 0 -1.#IND
18 0 0 0 0 0 0 -1.#IND
19 0 0 0 0 0 0 -1.#IND
20 0 0 0 0 0 0 -1.#IND
21 0 0 0 0 0 0 -1.#IND
22 0 0 0 0 0 0 -1.#IND
23 0 0 0 0 0 0 -1.#IND
24 0 0 0 0 0 0 -1.#IND
25 0 0 0 0 0 0 -1.#IND
26 0 0 0 0 0 0 -1.#IND
27 0 0 0 0 0 0 -1.#IND
28 0 0 0 0 0 0 -1.#IND
29 0 0 0 0 0 0 -1.#IND
30 0 0 0 0 0 0 -1.#IND
31 0 0 0 0 0 0 -1.#IND
32 0 0 0 0 0 0 -1.#IND
33 0 0 0 0 0 0 -1.#IND
34 0 0 0 0 0 0 -1.#IND
35 0 0 0 0 0 0 -1.#IND
36 0 0 0 0 0 0 -1.#IND
37 0 0 0 0 0 0 -1.#IND
38 0 0 0 0 0 0 -1.#IND
39 0 0 0 0 0 0 -1.#IND
40 0 0 0 0 0 0 -1.#IND

LEN_SELEX
fleet year gender label  10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5 19.5
20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
```

```
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1982 1 1982-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2006 1 2006-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2007 1 2007-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 1982 1 1982-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2006 1 2006-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 1982 1 1982-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2006 1 2006-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 1982 1 1982-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2006 1 2006-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 1982 1 1982-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2006 1 2006-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 1982 1 1982-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2006 1 2006-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 1982 1 1982-7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 2006 1 2006-7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 1982 1 1982-8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 2006 1 2006-8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 1982 1 1982-9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 2006 1 2006-9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10 1982 1 1982-10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1
10 2006 1 2006-10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1
11 1982 1 1982-11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1
11 2006 1 2006-11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1
12 1982 1 1982-12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
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DISCARD_MORT
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DEADFISH equals_sel*(retain+(1-retain)*discmort)
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33 1982 1 1982-33 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
33 2006 1 2006-33 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
34 1982 1 1982-34 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1
34 2006 1 2006-34 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1
35 1982 1 1982-35 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
35 2006 1 2006-35 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
36 1982 1 1982-36 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
36 2006 1 2006-36 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
37 1982 1 1982-37 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
37 2006 1 2006-37 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
38 1982 1 1982-38 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
38 2006 1 2006-38 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
39 1982 1 1982-39 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
39 2006 1 2006-39 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
40 1982 1 1982-40 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1
40 2006 1 2006-40 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX_from_size_selex_in_endyear
fleet year morph season 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
11 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
12 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
13 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
14 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
15 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
16 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
17 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
18 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
19 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
20 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
21 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
22 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
23 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
24 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
25 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
26 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
27 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
28 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
29 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
30 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
31 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
32 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
33 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
34 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
35 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
36 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
37 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
38 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
39 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
40 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX_mortality_in_endyear
fleet year morph season label 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2006 1 1 sel*wt  0.00175216 0.0650588 0.547453 1.22351 1.66059 2.08805
2.48758 2.84635 3.15658 3.41595 3.62709 3.7956 3.92812 4.03111 4.1102 4.17007
1 2006 1 1 sel*ret*wt  0.00175216 0.0650588 0.547453 1.22351 1.66059 2.08805
2.48758 2.84635 3.15658 3.41595 3.62709 3.7956 3.92812 4.03111 4.1102 4.17007
1 2006 1 1 sel_nums  0.00978427 0.145956 0.677984 0.999163 0.999989 0.999945
0.99966 0.999127 0.998348 0.997323 0.996054 0.99454 0.992784 0.990787
0.988549 0.986073
1 2006 1 1 sel*ret_nums  0.00978427 0.145956 0.677984 0.999163 0.999989
0.999945 0.99966 0.999127 0.998348 0.997323 0.996054 0.99454 0.992784
0.990787 0.988549 0.986073
1 2006 1 1 dead_nums  0.00978427 0.145956 0.677984 0.999163 0.999989 0.999945
0.99966 0.999127 0.998348 0.997323 0.996054 0.99454 0.992784 0.990787
0.988549 0.986073
1 2006 1 1 dead*wt  0.00175216 0.0650588 0.547453 1.22351 1.66059 2.08805
2.48758 2.84635 3.15658 3.41595 3.62709 3.7956 3.92812 4.03111 4.1102 4.17007

ENVIRONMENTAL_DATA Begins_in_startyr-1

NUMBERS_AT_AGE
Population 1 gmorph 1 gender: 1 GrowPattern: 1 birthseason: 1
Year Per Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1980 VIRG 1  45141.5 36958.7 30259.2 24774.2 20283.4 16606.6 13596.3 11131.7
9113.9 7461.83 6109.23 5001.82 4095.14 3352.82 2745.06 12373.3
1981 INIT 1  48302.3 37579.7 15661.9 3459.49 762.742 168.175 37.0935 8.18712
1.80884 0.400171 0.088676 0.0196889 0.00438156 0.000977613 0.000218762
6.33933e-005
1982 TIME 1  59260.4 37579.7 15661.9 3459.49 762.742 168.175 37.0935 8.18712
1.80884 0.400171 0.088676 0.0196889 0.00438156 0.000977613 0.000218762
6.33933e-005
1983 TIME 1  63849.3 46417.5 17125.8 4114.39 907.354 200.059 44.124 9.73797
2.1512 0.475827 0.105418 0.0234 0.00520587 0.00116113 0.000259728 7.52244e-
005
1984 TIME 1  38877.9 49202.1 17042.9 2958.36 709.173 156.403 34.4992 7.61513
1.68263 0.372293 0.0825094 0.0183225 0.00407817 0.000910089 0.000203694
5.90414e-005
1985 TIME 1  48873.9 29972.9 18174.3 2978.61 515.91 123.679 27.288 6.02398
1.33127 0.294616 0.0653124 0.0145085 0.00323052 0.00072125 0.00016151
4.68484e-005
1986 TIME 1  52333.3 37849.5 11752.2 3566.24 583.297 101.034 24.2304 5.35004
1.18235 0.261671 0.0580131 0.0128883 0.00287015 0.000640898 0.000143544
4.16501e-005
1987 TIME 1  38266.1 40159 13146 1822.64 551.79 90.2559 15.6405 3.7542
0.829982 0.183733 0.040748 0.00905655 0.00201787 0.000450856 0.000101049
2.93488e-005
```

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1988 TIME 1  10213.5 29732.7 16451.2 2808.39 388.637 117.661 19.2528 3.33867
0.802208 0.177594 0.0393805 0.00875137 0.00194962 0.000435553 9.76077e-005
2.83472e-005
1989 TIME 1  24033.7 7783.54 9424.47 2136.67 363.804 50.3475 15.2505 2.49782
0.433764 0.104418 0.0231698 0.00515201 0.00114859 0.00025682 5.76104e-005
1.67546e-005
1990 TIME 1  31629 18538.6 2895.29 1669.65 377.718 64.3159 8.9045 2.69937
0.442637 0.0769862 0.0185683 0.00412968 0.000920726 0.000205893 4.61939e-005
1.34391e-005
1991 TIME 1  25499.1 24589.3 7649.87 627.328 361.088 81.6906 13.9149 1.92784
0.585015 0.0960587 0.0167351 0.00404439 0.000901583 0.000201543 4.52026e-005
1.31457e-005
1992 TIME 1  31507 19712.8 9420.76 1435.19 117.448 67.6059 15.3009 2.6083
0.361776 0.109947 0.0180866 0.00315798 0.000765157 0.00017107 3.83673e-005
1.11581e-005
1993 TIME 1  32505.9 24252.1 7131.67 1581.37 240.372 19.6717 11.3284 2.566
0.437951 0.060842 0.0185273 0.00305506 0.0005349 0.000130011 2.91701e-005
8.48611e-006
1994 TIME 1  31111.1 25207.8 9681.42 1449.03 320.674 48.7453 3.99076 2.29983
0.521495 0.0891314 0.0124042 0.00378519 0.000625678 0.000109852 2.67833e-005
7.79078e-006
1995 TIME 1  31691.4 24200.9 10483.5 2129.73 318.168 70.4141 10.7074 0.877211
0.506036 0.114898 0.0196703 0.00274289 0.000838922 0.000139033 2.44819e-005
7.73652e-006
1996 TIME 1  23202.9 25529.3 15556.2 2789.92 332.817 49.6527 10.9895 1.67189
0.137092 0.0791863 0.0180102 0.00308981 0.000431934 0.000132494 2.20308e-005
5.12927e-006
1997 TIME 1  25149.1 18748.7 17177.1 5118.47 596.044 71.0247 10.5968 2.34625
0.357204 0.0293207 0.0169594 0.00386386 0.000664229 9.30741e-005 2.86268e-005
5.88964e-006
1998 TIME 1  28072.7 20413.3 13495.5 7732.66 1735.65 201.969 24.0675 3.59174
0.795629 0.121213 0.00995866 0.00576666 0.00131557 0.000226508 3.17951e-005
1.18189e-005
1999 TIME 1  22476.6 22799 14815.2 6311.96 2774.02 622.224 72.4076 8.63047
1.28854 0.285617 0.0435503 0.00358176 0.00207665 0.000474442 8.18217e-005
1.57926e-005
2000 TIME 1  28045.7 18285.9 16980.3 7814.12 2703.16 1187.36 266.338 30.9992
3.69617 0.552122 0.122464 0.0186885 0.00153853 0.000893031 0.000204291
4.2104e-005
2001 TIME 1  26900.5 22797.9 13453.2 8460.83 3077.35 1063.91 467.34 104.851
12.2084 1.45649 0.21773 0.0483388 0.00738486 0.000608741 0.000353858 9.7823e-
005
2002 TIME 1  27480.8 21894.4 17089 7310.84 3786.43 1376.5 475.902 209.083
46.9245 5.46627 0.652542 0.0976227 0.0216933 0.00331767 0.00027381
0.000203505
2003 TIME 1  20750 22388.6 16653.5 9939.34 3616.27 1872.16 680.613 235.344
103.424 23.2205 2.70638 0.323283 0.0484013 0.0107651 0.00164802 0.000237495
2004 TIME 1  30293.8 16903.8 17011.4 9638.67 4881.05 1775.14 919.02 334.153
115.576 50.8111 11.414 1.33117 0.159135 0.0238468 0.00530926 0.000931136
2005 TIME 1  16112.3 24673.2 12801.3 9694.74 4626.72 2341.95 851.742 441.028
160.402 55.5025 24.4141 5.488 0.640566 0.0766484 0.0114982 0.00301313
2006 TIME 1  32222.4 13128.4 18804.3 7514.34 4860.92 2318.89 1173.8 426.958
221.134 80.4575 27.854 12.2599 2.75792 0.322185 0.0385896 0.0073158
2007 FORE 1  40143.5 26270.7 10094.2 11499.4 4002.01 2587.92 1234.58 625.011
227.394 117.814 42.8842 14.8544 6.54241 1.47286 0.17221 0.0245646

CATCH_AT_AGE
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```
 fleet 1 fleetarea 1 gmorph 1
Year Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1981 E  2179.22 16909.4 10586.3 2340.03 515.916 113.737 25.08 5.53341 1.22191
0.270152 0.059819 0.0132699 0.0029501 0.000657477 0.000146939 4.25207e-005
1982 1  2327.32 15248.6 9819.77 2170.75 478.594 105.508 23.2647 5.13271
1.13337 0.250561 0.0554766 0.0123056 0.00273543 0.000609564 0.000136213
3.94117e-005
1983 1  3405.54 23511.1 12553.7 3017.85 665.523 146.721 32.3527 7.1377
1.57607 0.348422 0.0771406 0.01711 0.00380314 0.000847422 0.000189347
5.47732e-005
1984 1  2058.53 24796.9 12451.7 2162.75 518.443 114.325 25.2119 5.56324
1.2287 0.271706 0.0601765 0.0133527 0.00296938 0.000661988 0.000148 4.28457e-
005
1985 1  2398.96 14328.4 12814 2101.5 363.986 87.247 19.2451 4.24693 0.938101
0.207483 0.0459633 0.0102018 0.00226943 0.000506135 0.000113204 3.27938e-005
1986 1  2978.72 20031.5 8863.98 2691.37 440.198 76.2393 18.28 4.03493
0.891339 0.197164 0.0436844 0.00969799 0.00215789 0.0004814 0.000107709
3.12165e-005
1987 1  1769.32 18394.8 8998.06 1248.42 377.944 61.8117 10.7087 2.56943
0.567767 0.125608 0.0278364 0.00618146 0.00137591 0.000307078 6.87387e-005
1.99373e-005
1988 1  641.2 16773.1 12912 2205.36 305.184 92.3862 15.1141 2.62023 0.629344
0.13926 0.0308627 0.00685399 0.00152578 0.000340576 7.62517e-005 2.2122e-005
1989 1  1261.68 3899.66 6858.66 1555.94 264.921 36.6585 11.1015 1.81765
0.315505 0.0759075 0.0168321 0.00373984 0.000833017 0.000186071 4.16931e-005
1.21105e-005
1990 1  1447.44 8428.42 1971.37 1137.65 257.361 43.8163 6.06477 1.83781
0.301208 0.0523551 0.012618 0.00280385 0.000624502 0.000139494 3.12575e-005
9.0811e-006
1991 1  1289.87 12006.4 5471.92 449.016 258.449 58.4627 9.95597 1.37887
0.41823 0.0686329 0.0119487 0.00288533 0.000642609 0.000143501 3.21477e-005
9.33722e-006
1992 1  1710.56 10106.3 6960.85 1061.08 86.8322 49.9768 11.3085 1.92709
0.267173 0.081152 0.013341 0.00232762 0.000563477 0.000125857 2.81961e-005
8.19029e-006
1993 1  1557.64 11397.3 4969.48 1102.67 167.607 13.7149 7.89605 1.78789
0.304998 0.0423459 0.0128856 0.00212297 0.000371345 9.01601e-005 2.02044e-005
5.86999e-006
1994 1  1407.9 11367.8 6554.25 981.679 217.244 33.0186 2.70252 1.55683
0.352837 0.060267 0.00838087 0.00255518 0.000421937 7.39961e-005 1.80184e-005
5.23395e-006
1995 1  462.2 4732.41 6531.22 1603.29 239.604 53.0261 8.06238 0.660369
0.380824 0.0864313 0.014789 0.00206092 0.000629875 0.000104301 1.83486e-005
5.79223e-006
1996 1  274.911 4136.58 8559.77 1909.6 227.894 33.9986 7.52375 1.14433
0.0937963 0.0541506 0.0123083 0.00211 0.000294705 9.03088e-005 1.49995e-005
3.48785e-006
1997 1  195.933 2057.45 7077.81 2757.23 321.247 38.2788 5.71008 1.26385
0.192319 0.015776 0.00911759 0.00207524 0.000356348 4.98685e-005 1.53159e-005
3.14601e-006
1998 1  204.791 2105.18 5292.92 3991.25 896.349 104.301 12.4266 1.85385
0.410447 0.0624891 0.00512969 0.00296742 0.000676184 0.000116267 1.62962e-005
6.04761e-006
1999 1  128.878 1869.3 4812.26 2757.7 1212.69 272.003 31.6462 3.77056
0.562632 0.12462 0.0189844 0.00155964 0.000903102 0.000206027 3.54731e-005
6.83434e-006
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2000 1  181.542 1683.41 6073.47 3720.14 1287.65 565.585 126.842 14.7577
1.75868 0.262519 0.0581773 0.00886875 0.000729228 0.000422687 9.65432e-005
1.98628e-005
2001 1  143.8 1747.62 4128.04 3511.65 1278.03 441.83 194.04 43.517 5.06403
0.603692 0.0901605 0.0199943 0.0030506 0.00025109 0.000145713 4.02072e-005
2002 1  122.613 1409.99 4511.05 2644.85 1370.7 498.282 172.234 75.638 16.9651
1.9747 0.235499 0.0351899 0.007809 0.0011924 9.82361e-005 7.28701e-005
2003 1  93.9061 1461.75 4449.2 3635.7 1323.64 685.231 249.057 86.0839 37.8075
8.4817 0.987575 0.117829 0.017617 0.00391213 0.000597855 8.5989e-005
2004 1  143.196 1151.04 4714.29 3646.18 1847.6 671.915 347.785 126.402
43.6934 19.194 4.30745 0.501779 0.059904 0.00896291 0.00199204 0.000348692
2005 1  69.9594 1547.65 3302.09 3433.43 1639.63 829.92 301.765 156.187
56.7708 19.6281 8.62529 1.93655 0.225724 0.0269668 0.00403819 0.00105613
2006 1  122.729 725.209 4334.14 2397.34 1551.84 740.274 374.633 136.21
70.5031 25.6306 8.86404 3.89671 0.875332 0.102091 0.0122056 0.00230924

BIOLOGY 1 70 15 1 N_Used_morphs;_lengths;_ages;_season;_by_season_in_endyr
bin low Mean_Size Wt_len-F mat_len spawn Wt_len-M
1 10 10.5 0.0063863 1 0.0063863
2 11 11.5 0.00865928 1 0.00865928
3 12 12.5 0.0114467 1 0.0114467
4 13 13.5 0.0148098 1 0.0148098
5 14 14.5 0.0188113 1 0.0188113
6 15 15.5 0.0235157 1 0.0235157
7 16 16.5 0.0289892 1 0.0289892
8 17 17.5 0.0352991 1 0.0352991
9 18 18.5 0.0425145 1 0.0425145
10 19 19.5 0.0507059 1 0.0507059
11 20 20.5 0.0599448 1 0.0599448
12 21 21.5 0.0703042 1 0.0703042
13 22 22.5 0.0818585 1 0.0818585
14 23 23.5 0.0946829 1 0.0946829
15 24 24.5 0.108854 1 0.108854
16 25 25.5 0.12445 1 0.12445
17 26 26.5 0.14155 1 0.14155
18 27 27.5 0.160232 1 0.160232
19 28 28.5 0.180579 1 0.180579
20 29 29.5 0.202673 1 0.202673
21 30 30.5 0.226596 1 0.226596
22 31 31.5 0.252433 1 0.252433
23 32 32.5 0.280267 1 0.280267
24 33 33.5 0.310187 1 0.310187
25 34 34.5 0.342277 1 0.342277
26 35 35.5 0.376627 1 0.376627
27 36 36.5 0.413324 1 0.413324
28 37 37.5 0.452458 1 0.452458
29 38 38.5 0.494119 1 0.494119
30 39 39.5 0.538399 1 0.538399
31 40 40.5 0.58539 1 0.58539
32 41 41.5 0.635184 1 0.635184
33 42 42.5 0.687876 1 0.687876
34 43 43.5 0.743558 1 0.743558
35 44 44.5 0.802328 1 0.802328
36 45 45.5 0.86428 1 0.86428
37 46 46.5 0.929512 1 0.929512
38 47 47.5 0.99812 1 0.99812
39 48 48.5 1.0702 1 1.0702
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40 49 49.5 1.14586 1 1.14586
41 50 50.5 1.22519 1 1.22519
42 51 51.5 1.3083 1 1.3083
43 52 52.5 1.39527 1 1.39527
44 53 53.5 1.48623 1 1.48623
45 54 54.5 1.58127 1 1.58127
46 55 55.5 1.68048 1 1.68048
47 56 56.5 1.78398 1 1.78398
48 57 57.5 1.89188 1 1.89188
49 58 58.5 2.00426 1 2.00426
50 59 59.5 2.12125 1 2.12125
51 60 60.5 2.24294 1 2.24294
52 61 61.5 2.36945 1 2.36945
53 62 62.5 2.50088 1 2.50088
54 63 63.5 2.63734 1 2.63734
55 64 64.5 2.77893 1 2.77893
56 65 65.5 2.92577 1 2.92577
57 66 66.5 3.07797 1 3.07797
58 67 67.5 3.23564 1 3.23564
59 68 68.5 3.39888 1 3.39888
60 69 69.5 3.56782 1 3.56782
61 70 70.5 3.74255 1 3.74255
62 71 71.5 3.9232 1 3.9232
63 72 72.5 4.10988 1 4.10988
64 73 73.5 4.30271 1 4.30271
65 74 74.5 4.50178 1 4.50178
66 75 75.5 4.70723 1 4.70723
67 76 76.5 4.91917 1 4.91917
68 77 77.5 5.13771 1 5.13771
69 78 78.5 5.36296 1 5.36296
70 79 79.5 5.59506 1 5.59506

Growth_Parameters
 Count Yr Morph A1 A2 L-at-A1 L-at-A2 K A-at-L0 Linf CVmin CVmax natM_amin
natM_max M_young M_old
 1 1982 1 0.5 6 28.1 60.2 0.2052 -1.76669 75.5491 0.1 0.1 0 2 0.2 0.2

Season gmorph GrowPattern Sex BirthSeas age age_Beg age_Mid M Len_Beg Len_Mid
SD_Beg SD_Mid Wt_Beg Wt_Mid Len_Mat Age_Mat Mat*Fecund Len:_1 SelWt:_1
RetWt:_1 Len:_2 SelWt:_2 RetWt:_2 Len:_3 SelWt:_3 RetWt:_3 Len:_4 SelWt:_4
RetWt:_4 Len:_5 SelWt:_5 RetWt:_5 Len:_6 SelWt:_6 RetWt:_6 Len:_7 SelWt:_7
RetWt:_7 Len:_8 SelWt:_8 RetWt:_8 Len:_9 SelWt:_9 RetWt:_9 Len:_10 SelWt:_10
RetWt:_10 Len:_11 SelWt:_11 RetWt:_11 Len:_12 SelWt:_12 RetWt:_12 Len:_13
SelWt:_13 RetWt:_13 Len:_14 SelWt:_14 RetWt:_14 Len:_15 SelWt:_15 RetWt:_15
Len:_16 SelWt:_16 RetWt:_16 Len:_17 SelWt:_17 RetWt:_17 Len:_18 SelWt:_18
RetWt:_18 Len:_19 SelWt:_19 RetWt:_19 Len:_20 SelWt:_20 RetWt:_20 Len:_21
SelWt:_21 RetWt:_21 Len:_22 SelWt:_22 RetWt:_22 Len:_23 SelWt:_23 RetWt:_23
Len:_24 SelWt:_24 RetWt:_24 Len:_25 SelWt:_25 RetWt:_25 Len:_26 SelWt:_26
RetWt:_26 Len:_27 SelWt:_27 RetWt:_27 Len:_28 SelWt:_28 RetWt:_28 Len:_29
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1 1983 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
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1 1994 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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1 1996 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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MEAN_SIZE_TIMESERIES
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1 1982 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1982 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1983 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1983 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1984 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1984 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1985 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1985 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1986 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1987 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1987 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1988 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2001 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2002 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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 sdwithin 1
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40 1982 L 1 24 1
40 1982 L 1 25 1
40 1982 L 1 26 1
40 1982 L 1 27 1
40 1982 L 1 28 1
40 1982 L 1 29 1
40 1982 L 1 30 1
40 1982 L 1 31 1
40 1982 L 1 32 1
40 1982 L 1 33 1
40 1982 L 1 34 1
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40 1982 L 1 35 1
40 1982 L 1 36 1
40 1982 L 1 37 1
40 1982 L 1 38 1
40 1982 L 1 39 1
40 1982 L 1 40 1
40 1982 L 1 41 1
40 1982 L 1 42 1
40 1982 L 1 43 1
40 1982 L 1 44 1
40 1982 L 1 45 1
40 1982 L 1 46 1
40 1982 L 1 47 1
40 1982 L 1 48 1
40 1982 L 1 49 1
40 1982 L 1 50 1
40 1982 L 1 51 1
40 1982 L 1 52 1
40 1982 L 1 53 1
40 1982 L 1 54 1
40 1982 L 1 55 1
40 1982 L 1 56 1
40 1982 L 1 57 1
40 1982 L 1 58 1
40 1982 L 1 59 1
40 1982 L 1 60 1
40 1982 L 1 61 1
40 1982 L 1 62 1
40 1982 L 1 63 1
40 1982 L 1 64 1
40 1982 L 1 65 1
40 1982 L 1 66 1
40 1982 L 1 67 1
40 1982 L 1 68 1
40 1982 L 1 69 1
40 1982 L 1 70 1
40 1982 L 1 71 1
40 1982 L 1 72 1
40 1982 L 1 73 1
40 1982 L 1 74 1
40 1982 L 1 75 1
40 1982 L 1 76 1
40 1982 L 1 77 1
40 1982 L 1 78 1
40 1982 L 1 79 1
40 1982 A 1 0 0
40 1982 A 1 1 0
40 1982 A 1 2 0
40 1982 A 1 3 0
40 1982 A 1 4 1
40 1982 A 1 5 1
40 1982 A 1 6 1
40 1982 A 1 7 1
40 1982 A 1 8 1
40 1982 A 1 9 1
40 1982 A 1 10 1
40 1982 A 1 11 1
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40 1982 A 1 12 1
40 1982 A 1 13 1
40 1982 A 1 14 1
40 1982 A 1 15 1
40 2006 L 1 10 1
40 2006 L 1 11 1
40 2006 L 1 12 1
40 2006 L 1 13 1
40 2006 L 1 14 1
40 2006 L 1 15 1
40 2006 L 1 16 1
40 2006 L 1 17 1
40 2006 L 1 18 1
40 2006 L 1 19 1
40 2006 L 1 20 1
40 2006 L 1 21 1
40 2006 L 1 22 1
40 2006 L 1 23 1
40 2006 L 1 24 1
40 2006 L 1 25 1
40 2006 L 1 26 1
40 2006 L 1 27 1
40 2006 L 1 28 1
40 2006 L 1 29 1
40 2006 L 1 30 1
40 2006 L 1 31 1
40 2006 L 1 32 1
40 2006 L 1 33 1
40 2006 L 1 34 1
40 2006 L 1 35 1
40 2006 L 1 36 1
40 2006 L 1 37 1
40 2006 L 1 38 1
40 2006 L 1 39 1
40 2006 L 1 40 1
40 2006 L 1 41 1
40 2006 L 1 42 1
40 2006 L 1 43 1
40 2006 L 1 44 1
40 2006 L 1 45 1
40 2006 L 1 46 1
40 2006 L 1 47 1
40 2006 L 1 48 1
40 2006 L 1 49 1
40 2006 L 1 50 1
40 2006 L 1 51 1
40 2006 L 1 52 1
40 2006 L 1 53 1
40 2006 L 1 54 1
40 2006 L 1 55 1
40 2006 L 1 56 1
40 2006 L 1 57 1
40 2006 L 1 58 1
40 2006 L 1 59 1
40 2006 L 1 60 1
40 2006 L 1 61 1
40 2006 L 1 62 1
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40 2006 L 1 63 1
40 2006 L 1 64 1
40 2006 L 1 65 1
40 2006 L 1 66 1
40 2006 L 1 67 1
40 2006 L 1 68 1
40 2006 L 1 69 1
40 2006 L 1 70 1
40 2006 L 1 71 1
40 2006 L 1 72 1
40 2006 L 1 73 1
40 2006 L 1 74 1
40 2006 L 1 75 1
40 2006 L 1 76 1
40 2006 L 1 77 1
40 2006 L 1 78 1
40 2006 L 1 79 1
```

ASAP ALTERNATIVE RUN (F08_MULTI.REP)

```
Age Structured Assessment Program (ASAP) Version 2.0
Start time for run: Fri Mar 28 14:03:48 2008

obj_fun        = 15241

Component                Lambda          obj_fun
__Catch_Fleet_1               10           1877.04
__Catch_Fleet_2               10           1544.39
__Catch_Fleet_3               10           1939.13
__Catch_Fleet_4               10           739.297
__Catch_Fleet_5               10           1782.98
__Catch_Fleet_6               10           1211.04
Catch_Fleet_Total             60           9093.88
Discard_Fleet_Total           0           0
__Index_Fit_1                 1           66.6243
__Index_Fit_2                 1           80.0002
__Index_Fit_3                 1           67.5598
__Index_Fit_4                 1           51.4012
__Index_Fit_5                 1           -0.0202589
__Index_Fit_6                 1           153.535
__Index_Fit_7                 1           239.541
__Index_Fit_8                 1           200.97
__Index_Fit_9                 1           196.886
__Index_Fit_10                 1           -16.6202
__Index_Fit_11                 1           86.1327
__Index_Fit_12                 1           91.1568
__Index_Fit_13                 1           52.1087
__Index_Fit_14                 1           150.254
__Index_Fit_15                 1           99.362
__Index_Fit_16                 1           134.953
__Index_Fit_17                 1           122.561
__Index_Fit_18                 1           2.24523
__Index_Fit_19                 1           8.671
__Index_Fit_20                 1           28.7793
__Index_Fit_21                 1           47.6055
__Index_Fit_22                 1           16.6357
__Index_Fit_23                 1           16.9894
__Index_Fit_24                 1           -51.5095
__Index_Fit_25                 1           135.333
__Index_Fit_26                 1           103.877
__Index_Fit_27                 1           4.76758
__Index_Fit_28                 1           18.3802
__Index_Fit_29                 1           51.2794
__Index_Fit_30                 1           35.4177
__Index_Fit_31                 1           2.77264
__Index_Fit_32                 1           -2.8089
__Index_Fit_33                 1           -8.864
__Index_Fit_34                 1           22.0102
__Index_Fit_35                 1           84.0859
__Index_Fit_36                 1           29.798
__Index_Fit_37                 1           -1.6381
__Index_Fit_38                 1           10.6022
__Index_Fit_39                 1           -26.1076
Index_Fit_Total               39           2304.73
```

```
Catch_Age_Comps       see_below          2969.88
Discard_Age_Comps     see_below          0
Survey_Age_Comps      see_below          0
__Sel_Param_1                 1          0.936118
__Sel_Param_2                 1          9.50888
__Sel_Param_3                 1          1.07152
__Sel_Param_4                 1          3.29308
__Sel_Param_5                 0          0
__Sel_Param_6                 0          0
__Sel_Param_7                 0          0
__Sel_Param_8                 0          0
__Sel_Param_9                 1          31.9103
__Sel_Param_11                1          27.3277
__Sel_Param_12                1          36.5316
__Sel_Param_13                1          127.817
__Sel_Param_17                1          43.6811
__Sel_Param_18                1          52.9685
__Sel_Param_20                1          32.7438
__Sel_Param_21                1          127.076
__Sel_Param_25                1          5.63047
__Sel_Param_26                1          6.40689
__Sel_Param_27                1          0.964431
__Sel_Param_28                1          2.43487
__Sel_Param_29                1          0.983463
__Sel_Param_30                1          6.26073
__Sel_Param_31                1          1.87898
__Sel_Param_32                1          0.471283
__Sel_Param_33                1          0.862186
__Sel_Param_34                1          3.08129
__Sel_Param_35                1          1.69466
__Sel_Param_36                1          0.45685
Sel_Params_Total             24           525.991
Index_Sel_Params_Total        0          0
q_year1_Total                 0          0
q_devs_Total                  390000           0
__Fmult_year1_fleet_1         1          -0.0337486
__Fmult_year1_fleet_2         1          -0.947953
__Fmult_year1_fleet_3         1          119.098
__Fmult_year1_fleet_4         1          119.098
__Fmult_year1_fleet_5         1          -0.912333
__Fmult_year1_fleet_6         1          -2.32929
Fmult_year1_fleet_Total       6          233.973
Fmult_devs_fleet_Total        0          0
N_year_1                      1          112.517
Recruit_devs                  0          0
SRR_steepness                 0          0
SRR_unexpl_stock              0          0
Fmult_Max_penalty          1000          0
F_penalty                     0          0

 Input and Estimated effective sample sizes for fleet 1
1982  31  0.147417
1983  33  0.898701
1984  43  5.6284
1985  379  28.2572
1986  39  1.61224
1987  46  1.9825
```

```
1988  663  6.13933
1989  92  0.268166
1990  2270  14.4763
1991  58  5.38301
1992  173  36.1143
1993  415  0.543977
1994  106  27.0134
1995  75  5.5447
1996  222  74.3296
1997  267  29.7625
1998  151  34.9819
1999  187  35.1401
2000  125  220.538
2001  215  64.1492
2002  61  54.2717
2003  236  190.693
2004  139  198.832
2005  368  108.406
2006  194  137.673
 Total  6588  1282.79
 Input and Estimated effective sample sizes for fleet 2
1982  10  0.712283
1983  10  3.03629
1984  10  6.36126
1985  10  16.0141
1986  10  3.56065
1987  10  4.11491
1988  10  4.53438
1989  10  0.274052
1990  10  1.73521
1991  10  1.26817
1992  10  1.42726
1993  10  0.346909
1994  10  1.9512
1995  10  14.0067
1996  10  492.898
1997  10  52.9347
1998  10  3.472
1999  10  57.4301
2000  10  11.5192
2001  10  98.716
2002  10  17.431
2003  10  35.0355
2004  10  121.414
2005  10  73.0833
2006  10  21.8506
 Total  250  1045.13
 Input and Estimated effective sample sizes for fleet 3
1982  0  0.465551
1983  0  0.0121706
1984  0  0.0209155
1985  0  0.074156
1986  0  0.0108732
1987  0  0.0129946
1988  0  0.156564
1989  10  0.0196182
1990  10  0.15668
```

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1991  10  0.319361
1992  10  0.105662
1993  10  0.00947753
1994  10  0.187696
1995  10  0.0592449
1996  10  0.145677
1997  10  0.0946546
1998  10  0.0745172
1999  10  0.0840536
2000  10  0.0706801
2001  10  0.0532664
2002  10  0.0806595
2003  10  0.142673
2004  10  0.11657
2005  10  0.0653514
2006  10  0.134733
 Total  180  2.6738
 Input and Estimated effective sample sizes for fleet 4
1982  0  0.686486
1983  0  1.21655
1984  0  0.0572049
1985  0  0.030537
1986  0  0.205963
1987  0  0.0968318
1988  0  0.0207169
1989  0  0.661225
1990  0  0.0322526
1991  0  0.0945405
1992  0  0.0561221
1993  0  0.602836
1994  10  0.0372712
1995  10  0.273627
1996  10  0.0435081
1997  10  0.170818
1998  10  0.119031
1999  10  0.160654
2000  10  0.146684
2001  10  0.0809365
2002  10  0.147593
2003  10  0.176547
2004  10  0.358269
2005  10  0.525562
2006  10  0.36881
 Total  130  6.37058
 Input and Estimated effective sample sizes for fleet 5
1982  10  0.175635
1983  10  1.07349
1984  10  11.7974
1985  10  0.984143
1986  10  0.835117
1987  10  11.3206
1988  10  0.419009
1989  10  1.0212
1990  10  1.15092
1991  10  1.93541
1992  10  0.220628
1993  10  1.35793
```

```
1994  10  1.89303
1995  10  14.9871
1996  10  149.609
1997  10  124.659
1998  10  41.583
1999  10  12.8314
2000  10  33.1151
2001  10  81.1593
2002  10  18.3198
2003  10  26.2859
2004  10  33.2905
2005  10  25.1711
2006  10  16.5029
 Total  250  611.699
 Input and Estimated effective sample sizes for fleet 6
1982  10  0.489658
1983  10  104.521
1984  10  6.07525
1985  10  2.28558
1986  10  14.9846
1987  10  10.7144
1988  10  1.01669
1989  10  32.2254
1990  10  3.54807
1991  10  4.52461
1992  10  1.67619
1993  10  21.4085
1994  10  3.55157
1995  10  6.61065
1996  10  2.5926
1997  10  23.9414
1998  10  17.7821
1999  10  6.75535
2000  10  11.8739
2001  10  96.8511
2002  10  69.6861
2003  10  749.762
2004  10  72.6829
2005  10  42.7866
2006  10  1495.42
 Total  250  2803.77

 Input and Estimated effective Discard sample sizes for fleet 1
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
```

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1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 2
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 3
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
```

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1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 4
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 5
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
```

```
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 6
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16

Observed and predicted total fleet catch by year and standardized residual
 fleet 1 total catches
1982  7536  6808.31  1.018
1983  10201  8780.13  1.50368
1984  11455  11409.2  0.0401375
1985  10767  11248.1  -0.438256
1986  9500  9556.78  -0.0597368
1987  9945  9795.27  0.152079
1988  11616  8659.4  2.94471
1989  6218  6391.27  -0.275538
1990  2962  3195.09  -0.759405
1991  4629  4805.83  -0.375827
1992  6361  6431.46  -0.110439
1993  4401  4267.02  0.30994
1994  4969  4949  0.0404371
1995  4911  4946.34  -0.0718918
1996  3947  3887.15  0.153165
1997  3313  3298.67  0.0434524
1998  3730  3688.7  0.11163
1999  3551  3505.36  0.129687
2000  3564  3538.21  0.0728044
2001  3705  3681.62  0.0634488
2002  4723  4710.29  0.0270092
```

```
2003  4835  4837.98  -0.0061673
2004  6036  6030.34  0.00940711
2005  5984  5946.27  0.0634089
2006  4481  4479.84  0.00258531
 fleet 2 total catches
1982  2864  2756.09  0.385008
1983  3201  3062.1  0.444739
1984  5674  5666.49  0.0132711
1985  3907  3960.58  -0.136546
1986  2687  2690.51  -0.0130697
1987  2326  2318.15  0.0339056
1988  3071  2810.69  0.887935
1989  1908  1932.72  -0.129074
1990  1237  1271.82  -0.278293
1991  1595  1613.29  -0.114287
1992  1168  1169.96  -0.0167759
1993  1313  1300.87  0.0930692
1994  1620  1618.14  0.0115446
1995  2066  2077.57  -0.0559815
1996  1913  1891.75  0.111965
1997  681  680.057  0.013885
1998  1346  1341.01  0.0372674
1999  1271  1265.3  0.0450859
2000  1521  1516.72  0.0282323
2001  1265  1262.73  0.0180238
2002  1850  1847.32  0.014526
2003  1614  1614.25  -0.0015759
2004  2193  2190.99  0.00917416
2005  1841  1837.65  0.0182392
2006  1781  1780.86  0.000765442
 fleet 3 total catches
1982  0  1.40667e-05  -8.80433
1983  0  1.47689e-09  -0.00148046
1984  0  6.96215e-16  -6.97961e-10
1985  0  7.38186e-23  0
1986  0  4.60965e-16  -4.62114e-10
1987  0  4.43437e-10  -0.000444533
1988  0  2.02826e-05  -11.1075
1989  709  343.032  7.27843
1990  1214  1227.14  -0.107945
1991  1052  1038.78  0.126742
1992  690  697.592  -0.109703
1993  846  838.904  0.0844358
1994  434  433.774  0.00522764
1995  138  138.032  -0.00234467
1996  355  355.288  -0.00813577
1997  239  238.914  0.00360223
1998  254  253.854  0.00574547
1999  1181  1176.88  0.0350503
2000  592  591.107  0.0151337
2001  230  229.99  0.000455151
2002  307  306.853  0.00481126
2003  445  445.314  -0.00707772
2004  170  170.006  -0.000331974
2005  153  153.004  -0.000237102
2006  214  214.006  -0.00030281
 fleet 4 total catches
```

```
1982  0  1.03116e-05  -7.10375
1983  0  5.16666e-10  -0.00051794
1984  0  3.2367e-15  -3.24477e-09
1985  0  2.22793e-19  -2.31502e-13
1986  0  4.26525e-23  0
1987  0  7.94291e-17  -7.96367e-11
1988  0  1.13948e-19  -1.24655e-13
1989  0  1.9091e-24  0
1990  0  1.06716e-20  -1.78078e-14
1991  0  9.79708e-16  -9.82156e-10
1992  0  1.2577e-11  -1.26083e-05
1993  0  1.00546e-05  -6.9761
1994  472  333.056  3.49538
1995  170  169.807  0.0113972
1996  108  108.009  -0.000879486
1997  86  86.0074  -0.0008571
1998  135  134.911  0.00664133
1999  367  366.362  0.017434
2000  134  133.944  0.00415458
2001  238  237.756  0.0102942
2002  142  142.026  -0.00184111
2003  83  82.9992  9.1354e-05
2004  74  74.0098  -0.0013227
2005  77  76.9847  0.00199767
2006  74  73.9997  3.75302e-05
 fleet 5 total catches
1982  8267  7849.96  0.518921
1983  12687  11645.9  0.858355
1984  8512  8505.84  0.00726035
1985  5665  5727.57  -0.110116
1986  8102  8106.96  -0.00614051
1987  5519  5494.02  0.045485
1988  6634  6091.35  0.855509
1989  1435  1445.04  -0.0699211
1990  2329  2404.04  -0.317924
1991  3611  3704.07  -0.255098
1992  3242  3233.12  0.0274908
1993  4006  3926.26  0.201564
1994  4231  4230.83  0.00039813
1995  2459  2466.04  -0.0286794
1996  4454  4404.8  0.111347
1997  5382  5348.39  0.0627967
1998  5659  5564.69  0.168474
1999  3795  3743.22  0.137728
2000  7470  7353.87  0.157069
2001  5279  5231.99  0.0896783
2002  3632  3624.77  0.0199651
2003  5279  5284.45  -0.0103434
2004  4831  4829.44  0.00323729
2005  4724  4701.11  0.0486843
2006  4992  4990.71  0.00259726
 fleet 6 total catches
1982  296  292.638  0.114522
1983  376  374.429  0.0419676
1984  415  415.391  -0.00942972
1985  92  92.0251  -0.00273715
1986  578  577.949  0.000880506
```

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1987  522  521.61  0.00748324
1988  341  336.182  0.142656
1989  45  45.0274  -0.00609459
1990  234  235.446  -0.0617614
1991  429  429.566  -0.0132188
1992  344  344.109  -0.00317179
1993  910  903.223  0.0749427
1994  687  686.749  0.0036706
1995  752  752.206  -0.00275198
1996  681  681.467  -0.00687548
1997  556  555.933  0.00120232
1998  734  732.367  0.0223255
1999  711  709.099  0.0268445
2000  952  949.437  0.027028
2001  1274  1270.68  0.0261641
2002  777  776.799  0.00259448
2003  882  882.647  -0.00735179
2004  1034  1035.26  -0.0122511
2005  999  998.253  0.00749436
2006  795  794.89  0.00139047
Observed and predicted total fleet Discards by year and standardized residual
 fleet 1 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 2 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
```

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1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 3 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 4 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
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1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 5 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 6 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
```

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2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0

Index data
index number 1
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  7.15  1.7176  4.85822
1993  6.5  5.96706  0.291415
1994  3.76  3.53126  0.213805
1995  6.07  4.17676  1.27341
1996  22.17  5.43429  4.78951
1997  3.86  3.8345  0.0225808
1998  1.68  3.68081  -2.67181
1999  2.11  4.5485  -2.61653
2000  0.7  3.40354  -5.38728
2001  3.07  4.10199  -0.987175
2002  2.77  3.74054  -1.02324
2003  8.17  3.99914  2.43354
2004  1.45  2.37909  -1.68672
2005  2.96  3.76141  -0.816199
2006  2.64  1.79904  1.30647
index number 2
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  4.74  2.38615  2.33804
1993  6.7  0.521387  8.69794
1994  7.2  7.41539  -0.100412
1995  4.59  4.58809  0.00142151
1996  8.33  9.25007  -0.356887
1997  4.8  11.9637  -3.11099
1998  3.25  8.86642  -3.41877
1999  4.8  8.50088  -1.94697
2000  6.52  9.73104  -1.3641
2001  5.33  7.56103  -1.19109
2002  10.74  9.72665  0.3376
2003  14.36  9.10086  1.55361
2004  8.68  9.5817  -0.336673
2005  4.03  5.6944  -1.17767
2006  9.06  8.86279  0.0749661
index number 3
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.33  0.589386  -1.9757
```

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1993  0.31  0.221784  1.14071
1994  0.82  0.162039  5.52345
1995  0.25  2.22421  -7.44548
1996  0.6  0.96853  -1.63118
1997  1.04  2.27324  -2.66379
1998  2.29  4.17855  -2.04869
1999  2.9  3.11713  -0.245953
2000  4.96  3.33931  1.34773
2001  6.42  3.60312  1.96763
2002  5.58  3.08997  2.01331
2003  8.48  4.32702  2.29197
2004  4.56  4.07383  0.38404
2005  3.07  4.04302  -0.937842
2006  4.29  2.19686  2.27979
index number 4
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.04  0.314245  -7.0217
1993  0.05  0.0582018  -0.517419
1994  0.26  0.0727777  4.33734
1995  0.02  0.0540931  -3.38933
1996  0.12  0.325862  -3.40299
1997  0.43  0.172074  3.11984
1998  0.42  0.696821  -1.7246
1999  0.84  1.29958  -1.48656
2000  2.51  1.17806  2.5767
2001  2.44  1.13166  2.61723
2002  2.26  1.42667  1.56704
2003  2.67  1.29098  2.47539
2004  1.64  1.83843  -0.389071
2005  1.34  1.60086  -0.605915
2006  2.47  1.43747  1.84404
index number 5
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.04  0.0364937  0.312509
1993  0.04  0.0528952  -0.951876
1994  0.01  0.0514255  -5.57823
1996  0.03  0.0221543  1.03273
1997  0.15  0.090818  1.70928
1998  0.12  0.113978  0.175374
1999  0.41  0.372351  0.328108
2000  1.08  0.922711  0.536175
2001  1.34  0.995307  1.01299
2002  1.33  1.18012  0.407287
2003  1.96  1.51704  0.872671
2004  1.44  1.63542  -0.433492
2005  1.49  1.90465  -0.836351
2006  2.6  1.71731  1.41283
index number 6
units = 2
```

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month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.7  0.00284095  14.2943
1983  0.32  1.2295  -3.49392
1984  0.17  1.23459  -5.14648
1985  0.55  0.348088  1.18744
1986  1.48  0.721365  1.8654
1987  0.47  0.955739  -1.8423
1988  0.6  0.136305  3.84692
1989  0.06  0.574106  -5.8623
1990  0.63  0.323374  1.7311
1991  0.79  0.407191  1.7203
1992  0.77  0.210314  3.36866
1993  0.73  0.730644  -0.00228805
1994  0.35  0.432389  -0.548711
1995  0.79  0.511428  1.12868
1996  1.08  0.665408  1.25714
1997  0.29  0.46952  -1.25068
1998  0.27  0.450701  -1.32999
1999  0.22  0.556946  -2.41099
2000  0.19  0.416751  -2.03883
2001  0.48  0.502273  -0.117737
2002  0.34  0.458014  -0.773401
2003  0.54  0.489679  0.253907
2004  0.3  0.29131  0.0762957
2005  0.26  0.46057  -1.48418
2006  0.04  0.220285  -4.42837
index number 7
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.43  0.00572953  14.3277
1983  0.39  0.00376573  12.0446
1984  0.33  1.64693  -4.17278
1985  1.56  1.5154  0.0752948
1986  0.43  0.318085  0.782516
1987  0.43  0.754771  -1.46041
1988  0.81  1.25758  -1.14186
1989  0.23  0.066575  3.21801
1990  0.03  0.693247  -8.15098
1991  0.27  0.449443  -1.32273
1992  0.41  0.376445  0.221634
1993  0.5  0.0822553  4.68466
1994  0.53  1.16987  -2.0552
1995  0.27  0.723827  -2.5597
1996  0.56  1.45931  -2.48612
1997  0.67  1.88743  -2.68834
1998  0.52  1.39879  -2.56852
1999  0.74  1.34112  -1.54343
2000  1.03  1.53519  -1.03593
2001  0.89  1.19285  -0.760219
2002  0.89  1.5345  -1.41397
2003  1.29  1.43577  -0.277899
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2004  1.45  1.51163  -0.108051
2005  0.65  0.898363  -0.839972
2006  1.04  1.39822  -0.768264
index number 8
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.12  0.0147666  5.4383
1983  0.19  0.00152039  12.5322
1984  0.09  0.0010045  11.6685
1985  0.21  0.402015  -1.6856
1986  0.2  0.267596  -0.755766
1987  0.02  0.0654596  -3.07772
1988  0.07  0.197092  -2.68701
1989  0.02  0.116296  -4.56948
1990  0.06  0.0163915  3.36813
1992  0.01  0.104575  -6.09292
1993  0.04  0.0393511  0.0424538
1994  0.04  0.0287506  0.857157
1995  0.02  0.394642  -7.741
1996  0.12  0.171846  -0.932131
1997  0.09  0.40334  -3.89346
1998  0.32  0.7414  -2.18095
1999  0.48  0.553072  -0.367813
2000  0.63  0.592493  0.159324
2001  1.02  0.6393  1.21267
2002  0.74  0.548252  0.77849
2003  0.59  0.767742  -0.683527
2004  0.85  0.722819  0.420705
2005  0.58  0.717351  -0.551682
2006  0.24  0.389789  -1.25883
index number 9
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.02  0.81385  -9.61976
1983  0.03  0.00427795  5.0557
1984  0.05  0.000438595  12.2937
1985  0.04  0.000265065  13.0217
1986  0.02  0.0764775  -3.48152
1987  0.01  0.0599833  -4.65014
1988  0.02  0.0185425  0.196414
1989  0.01  0.0199184  -1.78859
1991  0.02  0.00657355  2.88817
1994  0.01  0.0151058  -1.0707
1997  0.01  0.0357157  -3.30433
1998  0.06  0.144632  -2.28382
1999  0.13  0.269742  -1.89468
2000  0.12  0.244518  -1.84761
2001  0.2  0.234887  -0.417352
2002  0.31  0.296121  0.118896
2003  0.29  0.267956  0.20521
2004  0.27  0.381585  -0.897883
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2005  0.15  0.332275  -2.06443
2006  0.25  0.298361  -0.459031
index number 10
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.02  0.172594  -5.59427
1984  0.02  0.0538135  -2.5692
1985  0.02  0.0151936  0.713452
1986  0.01  0.00309704  3.04251
1992  0.01  0.00420913  2.24613
1995  0.01  0.0068009  1.00072
1998  0.02  0.0131461  1.08917
1999  0.03  0.0429465  -0.931226
2000  0.17  0.106424  1.21573
2001  0.1  0.114797  -0.358202
2002  0.19  0.136113  0.865757
2003  0.2  0.174974  0.346997
2004  0.16  0.188627  -0.427247
2005  0.17  0.219679  -0.665459
2006  0.2  0.198072  0.0251384
index number 11
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  1.52  0.00558967  10.109
1984  1.46  2.44463  -0.929565
1985  1.39  2.24938  -0.868062
1986  0.8  0.47215  0.950953
1987  0.83  1.12034  -0.540953
1988  0.58  1.86668  -2.10796
1989  0.62  0.0988206  3.31176
1990  0.21  1.02902  -2.86604
1991  0.38  0.667131  -1.01497
1992  0.84  0.558776  0.735154
1993  1.04  0.122096  3.86316
1994  0.8  1.7365  -1.39765
1995  0.67  1.07441  -0.851653
1996  1.16  2.16613  -1.12626
1997  1.24  2.80161  -1.4699
1998  1.29  2.07629  -0.858304
1999  2.13  1.99069  0.12198
2000  1.73  2.27876  -0.496853
2001  1.2  1.7706  -0.701514
2002  1.36  2.27773  -0.929999
2003  1.17  2.13119  -1.08145
2004  1.31  2.24379  -0.970474
2005  1.49  1.33349  0.200139
2006  1.14  2.07544  -1.08049
index number 12
units = 2
month = 1
starting and ending ages for selectivity = 4  4
```

```
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.4  0.0032314  8.68969
1984  0.34  0.00213494  9.14407
1985  0.43  0.854435  -1.2383
1986  0.46  0.568744  -0.382685
1987  0.11  0.139127  -0.423624
1988  0.2  0.418897  -1.33325
1989  0.18  0.247174  -0.571916
1990  0.05  0.0348382  0.651579
1991  0.03  0.543435  -5.22389
1992  0.09  0.222261  -1.63034
1993  0.25  0.0836361  1.97468
1994  0.03  0.0611059  -1.28295
1995  0.09  0.838764  -4.02537
1996  0.28  0.365238  -0.479268
1997  0.57  0.857251  -0.735952
1998  1.14  1.57576  -0.58377
1999  1.63  1.17549  0.58952
2000  1.49  1.25928  0.303401
2001  1.22  1.35876  -0.19426
2002  0.93  1.16524  -0.406666
2003  0.86  1.63174  -1.15502
2004  1.03  1.53627  -0.720985
2005  1.37  1.52465  -0.192874
2006  0.54  0.828451  -0.771827
index number 13
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.03  0.0097682  2.02351
1984  0.12  0.00100148  8.63102
1985  0.07  0.000605246  8.56719
1986  0.05  0.174627  -2.25537
1987  0.11  0.136965  -0.395381
1988  0.03  0.0423395  -0.621308
1989  0.03  0.0454813  -0.750396
1991  0.04  0.0150099  1.76762
1993  0.03  0.0275841  0.151405
1994  0.01  0.0344922  -2.23286
1995  0.01  0.0256368  -1.69779
1996  0.02  0.154439  -3.68624
1997  0.04  0.0815525  -1.28467
1998  0.29  0.330251  -0.23439
1999  0.33  0.615923  -1.12537
2000  0.31  0.558327  -1.06106
2001  0.4  0.536336  -0.528927
2002  0.37  0.676157  -1.0873
2003  0.35  0.611846  -1.00728
2004  0.25  0.871305  -2.25158
2005  0.66  0.758712  -0.25136
2006  0.47  0.681272  -0.669469
index number 14
units = 2
month = 1
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```
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.584  0.00621432  9.99228
1983  0.599  0.00408436  8.99545
1984  0.078  1.78628  -5.64673
1985  1.26  1.64362  -0.47932
1986  0.522  0.344999  0.746829
1987  0.64  0.818633  -0.443936
1988  1.005  1.36398  -0.55079
1989  0.363  0.072208  2.9122
1990  0.021  0.751904  -6.45266
1991  0.05  0.487472  -4.10668
1992  0.342  0.408297  -0.31953
1993  0.492  0.0892151  3.07915
1994  1.217  1.26886  -0.0752493
1995  1.302  0.785072  0.912299
1996  0.686  1.58279  -1.50775
1997  1.279  2.04713  -0.848239
1998  1.212  1.51714  -0.404961
1999  0.878  1.45459  -0.910413
2000  1.659  1.66509  -0.00660555
2001  1.026  1.29378  -0.4182
2002  1.511  1.66434  -0.174306
2003  1.44  1.55726  -0.141174
2004  0.283  1.63954  -3.16804
2005  0.351  0.974375  -1.84127
2006  2.44  1.51652  0.857651
index number 15
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.142  0.0178219  3.74274
1983  0.45  0.00183496  9.92262
1984  0.067  0.00121233  7.23544
1985  0.036  0.485194  -4.69065
1986  0.185  0.322963  -1.00481
1987  0.013  0.0790035  -3.25428
1988  0.123  0.237872  -1.18942
1989  0.102  0.140358  -0.575688
1990  0.081  0.019783  2.5421
1991  0.012  0.308591  -5.85579
1992  0.09  0.126212  -0.609814
1993  0.065  0.047493  0.56591
1994  0.048  0.0346992  0.585171
1995  0.053  0.476295  -3.95977
1996  0.114  0.207402  -1.07925
1997  0.181  0.486793  -1.78416
1998  0.659  0.894799  -0.551611
1999  1.112  0.667505  0.920392
2000  1.205  0.715083  0.941071
2001  0.73  0.771575  -0.0998872
2002  0.397  0.661688  -0.921272
2003  0.624  0.926591  -0.71299
2004  0.323  0.872373  -1.79178
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2005  1.029  0.865775  0.311477
2006  0.975  0.470438  1.31426
index number 16
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.405  0.0741221  3.06246
1983  1.662  0.00763169  9.70846
1984  0.625  0.00504215  8.69216
1985  0.267  2.01794  -3.6475
1986  1.895  1.34322  0.620636
1987  0.679  0.328579  1.30897
1988  0.663  0.98932  -0.721791
1989  0.429  0.583757  -0.555494
1990  0.317  0.0822783  2.43239
1992  0.288  0.52492  -1.08254
1993  0.186  0.197526  -0.108424
1994  0.478  0.144316  2.15975
1995  0.076  1.98093  -5.8801
1996  0.506  0.862593  -0.961937
1997  1.282  2.02459  -0.824053
1998  1.508  3.72151  -1.62908
1999  0.59  2.77618  -2.79292
2000  0.94  2.97406  -2.07715
2001  2.303  3.20902  -0.598275
2002  1.083  2.75199  -1.68182
2003  1.302  3.85374  -1.95693
2004  1.254  3.62824  -1.91593
2005  1.455  3.6008  -1.63414
2006  2.049  1.95657  0.0832379
index number 17
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.012  1.25126  -8.38033
1983  0.02  0.00657719  2.00559
1984  0.154  0.000674324  9.79417
1985  0.127  0.000407528  10.3547
1986  0.04  0.117581  -1.9445
1987  0.214  0.0922221  1.51805
1988  0.011  0.0285083  -1.71737
1989  0.006  0.0306238  -2.93955
1990  0.016  0.0474074  -1.95882
1991  0.011  0.0101066  0.152759
1992  0.006  0.100281  -5.07872
1994  0.03  0.0232246  0.461643
1997  0.114  0.0549115  1.31733
1998  0.351  0.222367  0.823168
1999  0.262  0.414718  -0.828211
2000  0.379  0.375937  0.0146346
2001  0.494  0.36113  0.564997
2002  0.307  0.455275  -0.710629
2003  0.178  0.411973  -1.51335
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2004  0.256  0.586673  -1.49553
2005  0.136  0.510861  -2.38668
2006  1.35  0.458719  1.94661
index number 18
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.271  0.497999  -1.09732
1985  0.325  0.458225  -0.619526
1986  0.1  0.0961823  0.0701957
1987  0.086  0.228227  -1.76009
1988  0.223  0.380265  -0.962459
1989  0.049  0.0201309  1.60423
1990  0.022  0.209624  -4.06532
1991  0.189  0.135902  0.594775
1992  0.188  0.113829  0.904835
1993  0.151  0.0248723  3.25245
1994  0.314  0.353745  -0.214932
1995  0.051  0.21887  -2.62691
1996  0.266  0.441266  -0.912787
1997  0.507  0.57072  -0.213497
1998  0.594  0.422964  0.612413
1999  0.593  0.405527  0.685299
2000  0.726  0.46421  0.806495
2001  0.34  0.360692  -0.106543
2002  1.264  0.464001  1.80726
2003  1.016  0.434148  1.53331
2004  0.818  0.457087  1.04955
2005  0.264  0.271646  -0.0514908
2006  0.36  0.422792  -0.28994
index number 19
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.044  0.000395303  8.49807
1985  0.04  0.158206  -2.47969
1986  0.082  0.105308  -0.451149
1987  0.014  0.0257605  -1.09968
1988  0.035  0.0775623  -1.43501
1989  0.024  0.0457663  -1.16408
1990  0.013  0.00645059  1.26377
1991  0.029  0.100622  -2.24354
1992  0.021  0.0411535  -1.21329
1993  0.015  0.0154859  -0.0574964
1994  0.025  0.0113143  1.42974
1995  0.02  0.155304  -3.69631
1996  0.086  0.067627  0.433426
1997  0.057  0.158727  -1.84691
1998  0.503  0.291765  0.982198
1999  0.385  0.217652  1.02856
2000  0.524  0.233165  1.46028
2001  0.365  0.251586  0.671065
2002  0.465  0.215755  1.38481
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2003  0.395  0.302131  0.48335
2004  0.41  0.284453  0.6593
2005  0.15  0.282301  -1.14035
2006  0.068  0.153395  -1.46706
index number 20
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.058  0.00015053  10.7374
1986  0.008  0.0434313  -3.05086
1987  0.004  0.0340643  -3.86277
1988  0.009  0.0105302  -0.283173
1989  0.016  0.0113116  0.625342
1990  0.006  0.017511  -1.93155
1991  0.028  0.0037331  3.63376
1992  0.004  0.037041  -4.01385
1993  0.018  0.00686041  1.73955
1994  0.018  0.00857852  1.33651
1995  0.005  0.0063761  -0.438437
1996  0.023  0.0384103  -0.924831
1997  0.036  0.0202828  1.03468
1998  0.116  0.0821363  0.622547
1999  0.139  0.153185  -0.175244
2000  0.074  0.138861  -1.13506
2001  0.12  0.133391  -0.190791
2002  0.233  0.168166  0.58806
2003  0.232  0.152171  0.760541
2004  0.194  0.216701  -0.199563
2005  0.033  0.188698  -3.14445
2006  0.065  0.169438  -1.72782
index number 21
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.571  1.18195  -1.31202
1986  0.339  0.248094  0.563001
1987  1.17  0.588693  1.23866
1988  1.067  0.980861  0.1518
1989  0.884  0.051926  5.11194
1990  0.029  0.540707  -5.27595
1991  0.674  0.350549  1.17893
1992  0.826  0.293613  1.8653
1993  0.57  0.064156  3.93916
1994  0.827  0.912455  -0.177334
1995  0.3  0.564558  -1.14021
1996  0.384  1.13821  -1.9595
1997  0.887  1.47212  -0.913624
1998  0.681  1.091  -0.849915
1999  0.269  1.04602  -2.44907
2000  0.679  1.19739  -1.02302
2001  0.395  0.930376  -1.54496
2002  2.689  1.19685  1.45979
2003  3.087  1.11985  1.82864
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2004  1.459  1.17902  0.384248
2005  0.385  0.700689  -1.0799
2006  1.093  1.09056  0.0040374
index number 22
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.331  0.764198  -1.50891
1986  0.528  0.508679  0.0672297
1987  0.298  0.124434  1.57493
1988  0.223  0.374657  -0.935666
1989  0.481  0.22107  1.40193
1990  0.095  0.0311589  2.01037
1991  0.11  0.486043  -2.6795
1992  0.34  0.198788  0.967889
1993  0.366  0.0748033  2.86336
1994  0.152  0.0546525  1.84466
1995  0.085  0.750182  -3.92717
1996  0.117  0.326665  -1.85165
1997  1.188  0.766717  0.789718
1998  1.373  1.40934  -0.0471127
1999  1.054  1.05134  0.00454875
2000  1.484  1.12628  0.497407
2001  0.871  1.21526  -0.600654
2002  1.137  1.04218  0.157032
2003  1.93  1.45942  0.504017
2004  1.319  1.37402  -0.0736991
2005  0.755  1.36363  -1.06614
2006  0.744  0.740958  0.00738932
index number 23
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.072  0.000463814  9.09796
1986  0.075  0.133821  -1.04419
1987  0.072  0.104959  -0.67971
1988  0.033  0.0324458  0.0305435
1989  0.037  0.0348534  0.107781
1990  0.015  0.0539551  -2.30852
1991  0.042  0.0115025  2.33558
1992  0.036  0.114131  -2.0808
1993  0.046  0.0211384  1.40222
1994  0.039  0.0264322  0.701476
1995  0.024  0.0196461  0.36099
1996  0.012  0.11835  -4.12748
1997  0.042  0.0624957  -0.716714
1998  0.373  0.253079  0.699489
1999  0.321  0.471997  -0.695261
2000  0.346  0.42786  -0.38296
2001  0.341  0.411007  -0.336744
2002  0.436  0.518155  -0.311323
2003  0.479  0.468872  0.038538
2004  0.407  0.667702  -0.892727
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2005  0.44  0.581419  -0.502598
2006  0.355  0.522075  -0.695554
index number 24
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.025  0.0172014  0.67426
1986  0.009  0.00350631  1.69998
1987  0.007  0.0150196  -1.37679
1988  0.003  0.0185429  -3.28482
1989  0.003  0.00357342  -0.31543
1990  0.001  0.00532877  -3.01728
1991  0.012  0.012465  -0.0685657
1992  0.022  0.00476537  2.75858
1993  0.025  0.00690708  2.31974
1994  0.007  0.00671517  0.074915
1995  0.009  0.00769963  0.281422
1996  0.005  0.00289292  0.986763
1997  0.005  0.0118591  -1.5575
1998  0.04  0.0148834  1.78289
1999  0.075  0.0486218  0.781614
2000  0.127  0.120488  0.094922
2001  0.191  0.129968  0.69428
2002  0.134  0.154101  -0.252052
2003  0.183  0.198096  -0.142949
2004  0.203  0.213554  -0.091402
2005  0.119  0.24871  -1.32939
2006  0.151  0.224247  -0.713185
index number 25
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.74  0.0469391  6.51525
1983  0.52  0.0048329  8.43692
1984  0.42  0.00319303  8.79922
1985  0.49  1.2779  -1.72866
1986  0.28  0.850616  -2.00387
1987  0.51  0.208079  1.61673
1988  0.37  0.626504  -0.949755
1989  0.24  0.369674  -0.779032
1990  0.07  0.0521041  0.532451
1991  0.12  0.812764  -3.44978
1992  0.08  0.332414  -2.56866
1993  0.41  0.125087  2.14089
1994  0.22  0.0913903  1.58425
1995  0.03  1.25446  -6.73251
1996  0.2  0.546252  -1.81197
1997  1.03  1.28211  -0.394846
1998  0.96  2.35671  -1.6196
1999  0.36  1.75807  -2.85992
2000  1.91  1.88338  0.0253137
2001  1.24  2.03216  -0.890853
2002  0.63  1.74274  -1.83494
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2003  1.38  2.44044  -1.0281
2004  2.08  2.29765  -0.179467
2005  1.3  2.28027  -1.01337
2006  1.38  1.23903  0.194317
index number 26
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.2  1.61003  -3.76131
1983  0.07  0.00846304  3.81017
1984  0.11  0.000867669  8.73275
1985  0.1  0.000524377  9.46906
1986  0.02  0.151295  -3.64915
1987  0.13  0.118665  0.16453
1988  0.02  0.0366824  -1.09387
1992  0.01  0.129034  -4.61213
1993  0.11  0.0238985  2.75316
1994  0.07  0.0298836  1.53501
1997  0.01  0.070656  -3.52605
1998  0.03  0.286125  -4.06705
1999  0.09  0.533628  -3.20982
2000  0.35  0.483727  -0.583554
2001  0.45  0.464675  -0.0578707
2002  0.3  0.585813  -1.20686
2003  0.4  0.530095  -0.50782
2004  0.49  0.754887  -0.779356
2005  0.78  0.657338  0.308551
2006  0.69  0.590245  0.281605
index number 27
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.17  0.192384  -0.223068
1991  0.07  0.242248  -2.23884
1992  0.15  0.125121  0.327044
1993  0.11  0.434679  -2.47808
1994  0.08  0.25724  -2.10632
1995  0.2  0.304262  -0.75665
1996  0.41  0.395869  0.0632528
1997  0.17  0.27933  -0.89555
1998  0.07  0.268134  -2.42193
1999  0.26  0.331342  -0.437266
2000  0.63  0.247936  1.68174
2001  0.42  0.298816  0.613921
2002  0.81  0.272485  1.9647
2003  1.48  0.291323  2.93116
2004  0.54  0.173308  2.04954
2005  0.55  0.274005  1.25655
2006  0.19  0.131054  0.669808
index number 28
units = 2
month = 1
starting and ending ages for selectivity = 3  8
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selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.1  0.330508  -2.15587
1991  0.08  0.214274  -1.77674
1992  0.18  0.179471  0.00530416
1993  0.14  0.0392155  2.29493
1994  0.05  0.55774  -4.34953
1995  0.22  0.345087  -0.811828
1996  0.53  0.695733  -0.49068
1997  0.52  0.899838  -0.98895
1998  0.36  0.666876  -1.11179
1999  0.61  0.639383  -0.0848404
2000  1.89  0.731908  1.71083
2001  0.55  0.568694  -0.0602757
2002  1.11  0.731577  0.751853
2003  2.25  0.68451  2.146
2004  1.53  0.720676  1.35765
2005  1.89  0.428298  2.67715
2006  1.09  0.666604  0.886791
index number 29
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  3.06  1.24591  1.62042
1989  0.51  5.2477  -4.20393
1990  1.44  2.95585  -1.29689
1991  2.69  3.72199  -0.585589
1992  3  1.92241  0.802566
1993  5.69  6.67856  -0.288889
1994  1.07  3.95232  -2.35638
1995  2.93  4.67479  -0.842508
1996  5.1  6.08226  -0.317641
1997  8.25  4.29172  1.17856
1998  5.8  4.1197  0.616896
1999  6.12  5.09085  0.332033
2000  3.91  3.80938  0.0470178
2001  3.32  4.59111  -0.584579
2002  9.11  4.18655  1.40212
2003  5.61  4.47599  0.407246
2004  6.27  2.66277  1.54444
2005  5.99  4.20991  0.635963
2006  5.74  2.01355  1.88915
index number 30
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  1.03  1.4517  -0.618874
1989  0.18  0.0768516  1.53483
1990  0.11  0.800258  -3.57873
1991  0.27  0.51882  -1.17785
1992  0.57  0.434553  0.489289
1993  0.2  0.0949523  1.34342
1994  0.08  1.35045  -5.09667
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1995  0.28  0.835558  -1.97166
1996  2.7  1.68458  0.850725
1997  5.25  2.17877  1.58601
1998  2.67  1.61471  0.906968
1999  3.46  1.54814  1.45031
2000  1.82  1.77217  0.0480312
2001  1.18  1.37698  -0.278398
2002  4.13  1.77137  1.52661
2003  2.55  1.6574  0.776975
2004  2.49  1.74497  0.641184
2005  1.24  1.03704  0.322346
2006  3.22  1.61405  1.24548
index number 31
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.03  0.0110983  1.7933
1991  0.02  0.17312  -3.89216
1992  0.06  0.0708049  -0.298611
1993  0.01  0.0266437  -1.76726
1995  0.05  0.267202  -3.02244
1996  0.18  0.116353  0.786872
1997  1.02  0.273092  2.37641
1998  0.29  0.501984  -0.989493
1999  0.65  0.374471  0.994489
2000  0.45  0.401163  0.207172
2001  0.41  0.432855  -0.0978247
2002  1.28  0.371208  2.23232
2003  0.57  0.519819  0.166191
2004  0.57  0.489403  0.274926
2005  0.53  0.485701  0.157406
2006  0.48  0.263917  1.0787
index number 32
units = 2
month = 1
starting and ending ages for selectivity = 5  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.02  0.0778932  -2.45189
1993  0.01  0.0144267  -0.660934
1994  0.02  0.0180397  0.186033
1995  0.16  0.0134083  4.47114
1996  0.05  0.0807727  -0.864931
1997  0.18  0.0426526  2.59664
1998  0.04  0.172724  -2.63802
1999  0.18  0.322132  -1.04958
2000  0.22  0.292009  -0.510643
2001  0.15  0.280508  -1.12886
2002  0.81  0.353635  1.49459
2003  0.51  0.32  0.840538
2004  0.43  0.455699  -0.104681
2005  0.32  0.396812  -0.387983
2006  0.4  0.35631  0.208584
index number 33
units = 2
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month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.24  0.105105  1.48902
1986  0.172  0.146459  0.289887
1987  0.075  0.0205409  2.33551
1988  0.015  0.0938963  -3.30766
1990  0.032  0.0547498  -0.968484
1991  0.036  0.0338879  0.109033
1992  0.013  0.105233  -3.77128
1993  0.084  0.0607116  0.585527
1994  0.132  0.069827  1.14836
1995  0.023  0.0768581  -2.17572
1996  0.069  0.0542471  0.433816
1997  0.033  0.0519164  -0.817161
1999  0.044  0.0479008  -0.153185
2000  0.012  0.0579012  -2.83822
2001  0.021  0.0527185  -1.65991
2002  0.442  0.0561757  3.72007
2004  0.255  0.052937  2.83521
2005  0.067  0.025363  1.75181
2006  0.098  0.0564932  0.993388
index number 34
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  2.80526  -0.381808
1983  5.01  2.99392  0.928475
1984  1.58  0.838443  1.14269
1985  1.26  1.62622  -0.460128
1986  1.26  2.26607  -1.05847
1987  0.39  0.317815  0.369112
1988  0.54  1.45279  -1.78476
1989  1.24  0.649391  1.16649
1990  2.54  0.847106  1.98028
1991  2.64  0.524325  2.91503
1992  0.89  1.62819  -1.08925
1993  0.5  0.939349  -1.13718
1994  2.41  1.08039  1.44687
1995  0.63  1.18917  -1.14568
1996  0.81  0.839329  -0.0641447
1997  0.89  0.803267  0.184908
1998  0.73  0.992804  -0.55452
1999  0.53  0.741137  -0.604691
2000  0.57  0.895866  -0.815408
2001  0.47  0.815677  -0.994181
2002  0.77  0.869169  -0.218475
2003  0.44  0.517397  -0.292214
2004  1.3  0.819058  0.8331
2005  0.35  0.392425  -0.206327
2006  0.8  0.874082  -0.159712
index number 35
units = 2
month = 1
```

```
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  3.408  23.7576  -3.50177
1983  17.699  25.3553  -0.648281
1984  13.31  7.10071  1.1331
1985  12.843  13.7723  -0.125991
1986  59.526  19.1912  2.04136
1987  7.584  2.69155  1.86817
1988  1.763  12.3036  -3.50375
1989  2.855  5.49965  -1.18232
1990  4.733  7.17408  -0.750056
1991  7.337  4.44047  0.905604
1992  8.487  13.7891  -0.875254
1993  4.145  7.95528  -1.17569
1994  22.311  9.14972  1.60746
1995  13.067  10.071  0.469651
1996  6.493  7.10822  -0.163256
1997  7.997  6.80281  0.291662
1998  14.983  8.40798  1.04188
1999  8.565  6.27664  0.560581
2000  9.874  7.58702  0.47513
2001  13.543  6.90791  1.21404
2002  5.406  7.36093  -0.556663
2003  8.18  4.3818  1.12573
2004  6.993  6.93654  0.0146185
2005  2.198  3.32342  -0.745601
2006  9.658  7.40254  0.479635
index number 36
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  0.17  1.96287  -4.41174
1989  1  0.877393  0.235884
1990  1.28  1.14453  0.201744
1991  1  0.708416  0.621669
1992  1.1  2.19985  -1.24989
1993  2.55  1.26916  1.2583
1994  1.66  1.45971  0.231878
1995  4.95  1.60669  2.02919
1996  1.66  1.13402  0.68718
1997  1.65  1.08529  0.75548
1998  0.67  1.34138  -1.25186
1999  1.03  1.00135  0.0508711
2000  0.95  1.21041  -0.436867
2001  0.62  1.10206  -1.03734
2002  1.51  1.17433  0.453385
2003  0.6  0.699056  -0.275559
2004  0.9  1.10663  -0.372723
2005  3.11  0.530205  3.19039
2006  0.81  1.18097  -0.679983
index number 37
units = 2
month = 1
starting and ending ages for selectivity = 1  1
```

```
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.55  0.81409  -0.707202
1983  0.96  0.86884  0.179932
1984  0.18  0.243317  -0.543555
1985  0.59  0.471931  0.402678
1986  0.39  0.657615  -0.94222
1987  0.07  0.0922302  -0.49736
1988  0.06  0.421603  -3.51609
1989  0.31  0.188454  0.897577
1990  0.44  0.245831  1.0498
1991  0.76  0.15216  2.90054
1992  0.99  0.472504  1.33389
1993  0.23  0.2726  -0.306444
1994  0.75  0.313529  1.57288
1995  0.93  0.345099  1.78779
1996  0.11  0.243574  -1.43359
1997  0.17  0.233109  -0.569342
1998  0.38  0.288113  0.499212
1999  0.21  0.215079  -0.0430957
2000  0.22  0.259981  -0.301133
2001  0.12  0.23671  -1.22512
2002  0.06  0.252234  -2.58968
2003  0.18  0.150149  0.327002
2004  0.36  0.237691  0.74864
2005  0.16  0.113882  0.61317
2006  0.31  0.25366  0.361722
index number 38
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1986  0.32  0.447973  -0.606679
1987  0.26  0.0628279  2.56131
1988  0.01  0.287199  -6.05502
1989  0.14  0.128376  0.156311
1990  0.36  0.167462  1.38021
1991  0.38  0.103652  2.34283
1992  0.37  0.321873  0.251293
1993  0.05  0.185697  -2.36621
1994  0.57  0.213579  1.77026
1995  0.3  0.235084  0.439733
1996  0.08  0.165925  -1.31558
1997  0.22  0.158796  0.58792
1998  0.39  0.196265  1.23835
1999  0.35  0.146513  1.57042
2000  0.21  0.177101  0.307271
2001  0.14  0.161249  -0.254832
2002  0.13  0.171824  -0.503025
2003  0.21  0.102283  1.29729
2004  0.27  0.161917  0.922136
2005  0.01  0.0775773  -3.69458
2006  0.17  0.172795  -0.0294071
index number 39
units = 2
month = 1
```

```
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.02  0.0325733  -0.879617
1992  0.01  0.0626079  -3.30796
1993  0.01  0.0361202  -2.31603
1994  0.04  0.0415434  -0.0682761
1995  0.03  0.0457265  -0.760093
1996  0.02  0.0322742  -0.862985
1997  0.04  0.0308875  0.466223
1999  0.03  0.0284985  0.092597
2000  0.09  0.0344482  1.73189
2001  0.01  0.0313647  -2.06145
2002  0.11  0.0334216  2.14833
2003  0.05  0.0198952  1.6619
2004  0.1  0.0314947  2.08354
2005  0.04  0.0150897  1.75806
2006  0.04  0.0336105  0.313861

Input and Estimated effective sample sizes for index 1
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 2
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 3
1992  0  0
1993  0  0
1994  0  0
```

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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 4
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 5
1992  0  0
1993  0  0
1994  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 6
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
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1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 7
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 8
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
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1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 9
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1991  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 10
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1992  0  0
1995  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 11
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
```

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1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 12
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 13
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1991  0  0
1993  0  0
1994  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 14
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 15
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
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1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 16
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 17
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
```

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2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 18
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 19
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 20
1985  0  0
1986  0  0
1987  0  0
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1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 21
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 22
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
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1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 23
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 24
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
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2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 25
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 26
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1992  0  0
1993  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 27
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 28
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 29
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 30
1988  0  0
1989  0  0
1990  0  0
```

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1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 31
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 32
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 33
1985  0  0
1986  0  0
1987  0  0
1988  0  0
```

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1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 34
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 35
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 36
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 37
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
```

```
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 38
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 39
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0

Survey proportions at age by index
 Index number 1
 N/A
 Index number 2
 N/A
 Index number 3
 N/A
 Index number 4
 N/A
 Index number 5
 N/A
 Index number 6
```

N/A
Index number 7
N/A
Index number 8
N/A
Index number 9
N/A
Index number 10
N/A
Index number 11
N/A
Index number 12
N/A
Index number 13
N/A
Index number 14
N/A
Index number 15
N/A
Index number 16
N/A
Index number 17
N/A
Index number 18
N/A
Index number 19
N/A
Index number 20
N/A
Index number 21
N/A
Index number 22
N/A
Index number 23
N/A
Index number 24
N/A
Index number 25
N/A
Index number 26
N/A
Index number 27
N/A
Index number 28
N/A
Index number 29
N/A
Index number 30
N/A
Index number 31
N/A
Index number 32
N/A
Index number 33
N/A
Index number 34
N/A

```
 Index number 35
 N/A
 Index number 36
 N/A
 Index number 37
 N/A
 Index number 38
 N/A
 Index number 39
 N/A

Index Selectivity at Age
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0

Deviations section: only applicable if associated lambda > 0
Nyear1 observed, expected, standardized residual
2  141.934  9935.01  -5.51549
3  66.7132  3069.19  -4.97064
4  194.838  922.91  -2.01923
```

```
5  11323.2  281.933  4.7943
6  1.87289  87.1656  -4.98564
7  2.45433  27.1575  -3.1207
8  4.12177  12.3833  -1.42815

Fleet Obs, Initial, and Stadardized Residual for Fmult
1  0.521288  0.5  0.054129
2  0.187429  0.2  -0.0842775
3  3.05902e-07  0.05  -15.5843
4  3.05902e-07  0.05  -15.5843
5  0.248121  0.2  0.279897
6  0.0552852  0.05  0.130449

Standardized Residuals for Fmult_devs by fleet and year
N/A

Index Obs, Initial, and Standardized Residual for q_year1
N/A

Standardized Residuals for catchability deviations by index and year
 index 1 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 2 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 3 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
```

```
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 4 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 5 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
 index 6 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
```

```
21  0
22  0
23  0
24  0
25  0
 index 7 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 8 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 9 q_devs standardized residuals
2  0
3  0
```

```
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
 index 10 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 11 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 12 q_devs standardized residuals
```

```
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 13 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 14 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
```

```
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 15 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 16 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
```

```
20  0
21  0
22  0
23  0
24  0
 index 17 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 18 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 19 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
```

```
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 20 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 21 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
```

```
20  0
21  0
22  0
 index 22 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 23 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 24 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
```

```
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 25 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 26 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
```

```
 index 27 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 28 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 29 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 30 q_devs standardized residuals
2  0
3  0
4  0
```

```
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 31 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 32 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 33 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
```

```
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 34 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 35 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
```

```
25  0
 index 36 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 37 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 38 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
```

```
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
 index 39 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0

Obs, Initial, and Stadardized Residual for SRR steepness
N/A

Obs, Initial, and Stadardized Residual for SRR unexpl S
N/A

End of Deviations Section

Selectivity by age and year for each fleet
 fleet 1 selectivity at age
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00580595 0.928253 0.999965 1 1 1 1 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
 0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
```

```
0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
0.00373551 0.0887332 0.716613 0.985001 0.999414 0.999977 0.999999 1
fleet 2 selectivity at age
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.0887848 1 1 1 1 1 1 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
0.00249365 0.0434757 0.452471 0.937598 0.996353 0.999799 0.99999 1
fleet 3 selectivity at age
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
0.000178184 1 0.0307623 0.0178024 0.000258322 0.1 0.05 0.01
fleet 4 selectivity at age
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
```

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9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
9.71564e-05 0.00779516 1 0.0220854 0.000264039 0.1 0.05 0.01
fleet 5 selectivity at age
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.944672 0.999709 0.999999 1 1 1 1 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
0.0173609 0.213751 0.807073 0.984703 0.998992 0.999935 0.999996 1
fleet 6 selectivity at age
0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
```

```
 0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
 0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
 0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
 0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
 0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
 0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
 0.0625968 1 0.81068 0.525004 0.307883 0.16855 0.0884957 0.0453967
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792
 0.0747722 0.788501 1 0.424348 0.122107 0.0306687 0.00742106 0.0017792

Fmult by year for each fleet
1982   0.521288 0.187429 3.05902e-07 3.05902e-07 0.248121 0.0552852
1983   0.507254 0.153069 9.56217e-14 1.15974e-12 0.318157 0.0221546
1984   0.522591 0.243205 4.88672e-20 4.60164e-19 0.302538 0.0207659
1985   0.891369 0.283309 1.8385e-26 4.06515e-23 0.227198 0.00873151
1986   0.746492 0.182684 5.21989e-20 2.9986e-26 0.288395 0.0472542
1987   0.583673 0.129808 3.53759e-14 2.29538e-20 0.277598 0.0328753
1988   1.30802 0.364014 1.3973e-08 3.08436e-23 0.33606 0.0588706
1989   0.751535 0.206242 0.045678 4.76305e-27 0.113104 0.00527246
1990   0.353189 0.128993 0.283615 2.41906e-24 0.158637 0.0282064
1991   0.557866 0.177547 0.238097 4.57774e-19 0.342331 0.0592459
1992   1.43186 0.210601 0.360393 9.02557e-15 0.213568 0.0815981
1993   0.361877 0.0986608 0.074113 1.82601e-08 0.204377 0.0727248
1994   0.372171 0.109749 0.0571846 0.0596927 0.174909 0.0535003
1995   0.791324 0.436711 0.0120782 0.0507991 0.302837 0.0526683
1996   0.524364 0.363901 0.0252194 0.0183976 0.450205 0.037968
1997   0.291674 0.082763 0.0257921 0.0087838 0.400259 0.0303182
1998   0.273095 0.123019 0.0264536 0.0180271 0.360747 0.0414856
1999   0.231846 0.0993108 0.134573 0.0525124 0.222679 0.0444391
2000   0.195536 0.100028 0.063258 0.0146137 0.367851 0.0521789
2001   0.186493 0.0748835 0.0188333 0.0285521 0.238559 0.0631401
2002   0.211614 0.0976813 0.029474 0.0134594 0.148385 0.0375068
2003   0.183317 0.070289 0.0389514 0.00798759 0.184645 0.0398903
2004   0.236922 0.098403 0.0236614 0.00722162 0.177337 0.0549689
2005   0.293224 0.100784 0.0170709 0.0134306 0.215437 0.0663781
2006   0.230658 0.105227 0.0452286 0.00867249 0.240913 0.0585164

Directed F by age and year for each fleet
 fleet 1 directed F at age
 0.00302657 0.483887 0.52127 0.521288 0.521288 0.521288 0.521288 0.521288
 0.00294509 0.47086 0.507237 0.507254 0.507254 0.507254 0.507254 0.507254
 0.00303414 0.485096 0.522572 0.522591 0.522591 0.522591 0.522591 0.522591
 0.00517525 0.827416 0.891338 0.891369 0.891369 0.891369 0.891369 0.891369
 0.0043341 0.692934 0.746466 0.746492 0.746492 0.746492 0.746492 0.746492
 0.00338878 0.541796 0.583652 0.583673 0.583673 0.583673 0.583673 0.583673
 0.00759427 1.21417 1.30797 1.30802 1.30802 1.30802 1.30802 1.30802
 0.00436338 0.697615 0.751509 0.751535 0.751535 0.751535 0.751535 0.751535
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 0.0020506 0.327849 0.353177 0.353189 0.353189 0.353189 0.353189 0.353189
 0.00323894 0.517841 0.557847 0.557866 0.557866 0.557866 0.557866 0.557866
 0.00831332 1.32913 1.43181 1.43186 1.43186 1.43186 1.43186 1.43186
 0.00210104 0.335914 0.361865 0.361877 0.361877 0.361877 0.361877 0.361877
 0.0021608 0.345468 0.372158 0.372171 0.372171 0.372171 0.372171 0.372171
 0.002956 0.0702167 0.567073 0.779455 0.79086 0.791306 0.791323 0.791324
 0.00195877 0.0465285 0.375766 0.516499 0.524057 0.524352 0.524364 0.524364
 0.00108955 0.0258811 0.209017 0.287299 0.291503 0.291667 0.291673 0.291674
 0.00102015 0.0242326 0.195703 0.268999 0.272935 0.273089 0.273095 0.273095
 0.000866064 0.0205724 0.166144 0.228368 0.23171 0.231841 0.231846 0.231846
 0.000730428 0.0173505 0.140124 0.192603 0.195422 0.195532 0.195536 0.195536
 0.000696646 0.0165481 0.133643 0.183695 0.186383 0.186488 0.186493 0.186493
 0.000790488 0.0187772 0.151646 0.20844 0.21149 0.21161 0.211614 0.211614
 0.000684782 0.0162663 0.131367 0.180567 0.183209 0.183313 0.183317 0.183317
 0.000885027 0.0210229 0.169782 0.233369 0.236783 0.236917 0.236922 0.236922
 0.00109534 0.0260187 0.210128 0.288825 0.293052 0.293217 0.293223 0.293224
 0.000861628 0.0204671 0.165293 0.227199 0.230523 0.230653 0.230658 0.230658
 fleet 2 directed F at age
 0.0166409 0.187429 0.187429 0.187429 0.187429 0.187429 0.187429 0.187429
 0.0135902 0.153069 0.153069 0.153069 0.153069 0.153069 0.153069 0.153069
 0.0215929 0.243205 0.243205 0.243205 0.243205 0.243205 0.243205 0.243205
 0.0251535 0.283309 0.283309 0.283309 0.283309 0.283309 0.283309 0.283309
 0.0162196 0.182684 0.182684 0.182684 0.182684 0.182684 0.182684 0.182684
 0.011525 0.129808 0.129808 0.129808 0.129808 0.129808 0.129808 0.129808
 0.0323189 0.364014 0.364014 0.364014 0.364014 0.364014 0.364014 0.364014
 0.0183112 0.206242 0.206242 0.206242 0.206242 0.206242 0.206242 0.206242
 0.0114526 0.128993 0.128993 0.128993 0.128993 0.128993 0.128993 0.128993
 0.0157635 0.177547 0.177547 0.177547 0.177547 0.177547 0.177547 0.177547
 0.0186981 0.210601 0.210601 0.210601 0.210601 0.210601 0.210601 0.210601
 0.00875958 0.0986608 0.0986608 0.0986608 0.0986608 0.0986608 0.0986608
0.0986608
 0.00974404 0.109749 0.109749 0.109749 0.109749 0.109749 0.109749 0.109749
 0.001089 0.0189863 0.197599 0.409459 0.435119 0.436623 0.436707 0.436711
 0.000907441 0.0158209 0.164655 0.341193 0.362574 0.363828 0.363897 0.363901
 0.000206382 0.00359818 0.0374478 0.0775984 0.0824612 0.0827464 0.0827621
0.082763
 0.000306766 0.00534835 0.0556626 0.115343 0.122571 0.122995 0.123018
0.123019
 0.000247646 0.00431761 0.0449352 0.0931136 0.0989487 0.0992909 0.0993098
0.0993108
 0.000249436 0.00434881 0.0452599 0.0937865 0.0996637 0.100008 0.100027
0.100028
 0.000186733 0.00325561 0.0338826 0.0702106 0.0746104 0.0748684 0.0748827
0.0748835
 0.000243583 0.00424677 0.0441979 0.0915858 0.0973251 0.0976617 0.0976803
0.0976813
 0.000175276 0.00305586 0.0318037 0.0659028 0.0700326 0.0702749 0.0702882
0.070289
 0.000245382 0.00427814 0.0445245 0.0922625 0.0980442 0.0983833 0.098402
0.098403
 0.000251319 0.00438164 0.0456016 0.0944946 0.100416 0.100763 0.100783
0.100784
 0.0002624 0.00457484 0.0476123 0.0986611 0.104844 0.105206 0.105226 0.105227
 fleet 3 directed F at age
 5.45068e-11 3.05902e-07 9.41026e-09 5.4458e-09 7.90214e-11 3.05902e-08
1.52951e-08 3.05902e-09
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1.70382e-17 9.56217e-14 2.94154e-15 1.7023e-15 2.47012e-17 9.56217e-15
4.78108e-15 9.56217e-16
8.70734e-24 4.88672e-20 1.50327e-21 8.69954e-22 1.26235e-23 4.88672e-21
2.44336e-21 4.88672e-22
3.27591e-30 1.8385e-26 5.65565e-28 3.27297e-28 4.74926e-30 1.8385e-27
9.1925e-28 1.8385e-28
9.30099e-24 5.21989e-20 1.60576e-21 9.29266e-22 1.34841e-23 5.21989e-21
2.60995e-21 5.21989e-22
6.30341e-18 3.53759e-14 1.08825e-15 6.29777e-16 9.13839e-18 3.53759e-15
1.7688e-15 3.53759e-16
2.48976e-12 1.3973e-08 4.29842e-10 2.48753e-10 3.60954e-12 1.3973e-09
6.9865e-10 1.3973e-10
8.13907e-06 0.045678 0.00140516 0.000813178 1.17996e-05 0.0045678 0.0022839
0.00045678
5.05355e-05 0.283615 0.00872465 0.00504903 7.3264e-05 0.0283615 0.0141807
0.00283615
4.2425e-05 0.238097 0.00732442 0.0042387 6.15058e-05 0.0238097 0.0119049
0.00238097
6.42161e-05 0.360393 0.0110865 0.00641586 9.30975e-05 0.0360393 0.0180197
0.00360393
1.32057e-05 0.074113 0.00227989 0.00131939 1.9145e-05 0.0074113 0.00370565
0.00074113
1.01894e-05 0.0571846 0.00175913 0.00101802 1.47721e-05 0.00571846
0.00285923 0.000571846
2.15214e-06 0.0120782 0.000371555 0.000215022 3.12008e-06 0.00120782
0.000603912 0.000120782
4.49369e-06 0.0252194 0.000775807 0.000448966 6.51474e-06 0.00252194
0.00126097 0.000252194
4.59572e-06 0.0257921 0.000793424 0.000459161 6.66267e-06 0.00257921
0.0012896 0.000257921
4.7136e-06 0.0264536 0.000813774 0.000470938 6.83356e-06 0.00264536
0.00132268 0.000264536
2.39787e-05 0.134573 0.00413978 0.00239572 3.47632e-05 0.0134573 0.00672865
0.00134573
1.12715e-05 0.063258 0.00194596 0.00112615 1.6341e-05 0.0063258 0.0031629
0.00063258
3.35578e-06 0.0188333 0.000579356 0.000335278 4.86506e-06 0.00188333
0.000941665 0.000188333
5.25178e-06 0.029474 0.000906688 0.000524708 7.61379e-06 0.0029474 0.0014737
0.00029474
6.94051e-06 0.0389514 0.00119824 0.000693429 1.0062e-05 0.00389514
0.00194757 0.000389514
4.21607e-06 0.0236614 0.000727878 0.000421229 6.11226e-06 0.00236614
0.00118307 0.000236614
3.04176e-06 0.0170709 0.000525141 0.000303904 4.4098e-06 0.00170709
0.000853547 0.000170709
8.05899e-06 0.0452286 0.00139134 0.000805178 1.16836e-05 0.00452286
0.00226143 0.000452286
fleet 4 directed F at age
2.97204e-11 2.38456e-09 3.05902e-07 6.75599e-09 8.07701e-11 3.05902e-08
1.52951e-08 3.05902e-09
1.12676e-16 9.04037e-15 1.15974e-12 2.56134e-14 3.06217e-16 1.15974e-13
5.79871e-14 1.15974e-14
4.47079e-23 3.58705e-21 4.60164e-19 1.01629e-20 1.21501e-22 4.60164e-20
2.30082e-20 4.60164e-21
3.94956e-27 3.16885e-25 4.06515e-23 8.97807e-25 1.07336e-26 4.06515e-24
2.03258e-24 4.06515e-25

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 2.91334e-30 2.33746e-28 2.9986e-26 6.62255e-28 7.91748e-30 2.9986e-27
1.4993e-27 2.9986e-28
 2.23011e-24 1.78929e-22 2.29538e-20 5.06945e-22 6.06069e-24 2.29538e-21
1.14769e-21 2.29538e-22
 2.99665e-27 2.4043e-25 3.08436e-23 6.81194e-25 8.14389e-27 3.08436e-24
1.54218e-24 3.08436e-25
 4.62761e-31 3.71287e-29 4.76305e-27 1.05194e-28 1.25763e-30 4.76305e-28
2.38152e-28 4.76305e-29
 2.35027e-28 1.8857e-26 2.41906e-24 5.3426e-26 6.38725e-28 2.41906e-25
1.20953e-25 2.41906e-26
 4.44757e-23 3.56842e-21 4.57774e-19 1.01101e-20 1.2087e-22 4.57774e-20
2.28887e-20 4.57774e-21
 8.76892e-19 7.03557e-17 9.02557e-15 1.99334e-16 2.3831e-18 9.02557e-16
4.51278e-16 9.02557e-17
 1.77409e-12 1.42341e-10 1.82601e-08 4.03283e-10 4.82138e-12 1.82601e-09
9.13007e-10 1.82601e-10
 5.79953e-06 0.000465314 0.0596927 0.00131834 1.57612e-05 0.00596927
0.00298463 0.000596927
 4.93546e-06 0.000395987 0.0507991 0.00112192 1.34129e-05 0.00507991
0.00253996 0.000507991
 1.78744e-06 0.000143412 0.0183976 0.000406318 4.85767e-06 0.00183976
0.000919878 0.000183976
 8.53403e-07 6.84711e-05 0.0087838 0.000193994 2.31926e-06 0.00087838
0.00043919 8.7838e-05
 1.75145e-06 0.000140524 0.0180271 0.000398136 4.75985e-06 0.00180271
0.000901355 0.000180271
 5.10191e-06 0.000409342 0.0525124 0.00115976 1.38653e-05 0.00525124
0.00262562 0.000525124
 1.41981e-06 0.000113916 0.0146137 0.00032275 3.85858e-06 0.00146137
0.000730684 0.000146137
 2.77402e-06 0.000222568 0.0285521 0.000630585 7.53885e-06 0.00285521
0.0014276 0.000285521
 1.30767e-06 0.000104918 0.0134594 0.000297256 3.5538e-06 0.00134594
0.000672969 0.000134594
 7.76046e-07 6.22646e-05 0.00798759 0.00017641 2.10903e-06 0.000798759
0.00039938 7.98759e-05
 7.01627e-07 5.62937e-05 0.00722162 0.000159493 1.90679e-06 0.000722162
0.000361081 7.22162e-05
 1.30487e-06 0.000104694 0.0134306 0.000296622 3.54621e-06 0.00134306
0.000671532 0.000134306
 8.42588e-07 6.76034e-05 0.00867249 0.000191536 2.28987e-06 0.000867249
0.000433624 8.67249e-05
 fleet 5 directed F at age
 0.234393 0.248049 0.24812 0.248121 0.248121 0.248121 0.248121 0.248121
 0.300554 0.318064 0.318157 0.318157 0.318157 0.318157 0.318157 0.318157
 0.285799 0.30245 0.302537 0.302538 0.302538 0.302538 0.302538 0.302538
 0.214628 0.227132 0.227198 0.227198 0.227198 0.227198 0.227198 0.227198
 0.272439 0.288311 0.288395 0.288395 0.288395 0.288395 0.288395 0.288395
 0.262239 0.277517 0.277597 0.277598 0.277598 0.277598 0.277598 0.277598
 0.317467 0.335962 0.33606 0.33606 0.33606 0.33606 0.33606 0.33606
 0.106847 0.113072 0.113104 0.113104 0.113104 0.113104 0.113104 0.113104
 0.14986 0.158591 0.158637 0.158637 0.158637 0.158637 0.158637 0.158637
 0.323391 0.342231 0.34233 0.342331 0.342331 0.342331 0.342331 0.342331
 0.201751 0.213506 0.213567 0.213568 0.213568 0.213568 0.213568 0.213568
 0.19307 0.204318 0.204377 0.204377 0.204377 0.204377 0.204377 0.204377
 0.165232 0.174858 0.174909 0.174909 0.174909 0.174909 0.174909 0.174909
 0.00525752 0.0647318 0.244412 0.298205 0.302532 0.302817 0.302836 0.302837
```

```
 0.00781595 0.0962318 0.363348 0.443318 0.449751 0.450175 0.450203 0.450205
 0.00694886 0.0855559 0.323039 0.394137 0.399856 0.400233 0.400258 0.400259
 0.00626289 0.0771102 0.29115 0.355229 0.360384 0.360724 0.360746 0.360747
 0.00386591 0.047598 0.179718 0.219273 0.222455 0.222665 0.222678 0.222679
 0.00638621 0.0786285 0.296882 0.362224 0.36748 0.367827 0.367849 0.367851
 0.0041416 0.0509923 0.192535 0.23491 0.238319 0.238544 0.238558 0.238559
 0.0025761 0.0317175 0.119758 0.146115 0.148236 0.148376 0.148385 0.148385
 0.0032056 0.039468 0.149022 0.18182 0.184459 0.184633 0.184644 0.184645
 0.00307873 0.037906 0.143124 0.174624 0.177158 0.177325 0.177336 0.177337
 0.00374018 0.04605 0.173874 0.212142 0.21522 0.215423 0.215436 0.215437
 0.00418246 0.0514954 0.194434 0.237228 0.24067 0.240897 0.240912 0.240913
 fleet 6 directed F at age
 0.00346068 0.0552852 0.0448186 0.0290249 0.0170214 0.00931829 0.0048925
0.00250976
 0.00138681 0.0221546 0.0179603 0.0116312 0.00682103 0.00373414 0.00196059
0.00100574
 0.00129988 0.0207659 0.0168345 0.0109022 0.00639348 0.00350008 0.00183769
0.000942704
 0.000546565 0.00873151 0.00707846 0.00458408 0.00268829 0.00147169
0.000772702 0.000396382
 0.00295796 0.0472542 0.038308 0.0248086 0.0145488 0.00796467 0.00418179
0.00214518
 0.00205789 0.0328753 0.0266513 0.0172597 0.0101218 0.00554112 0.00290933
0.00149243
 0.00368511 0.0588706 0.0477252 0.0309073 0.0181253 0.00992261 0.0052098
0.00267253
 0.000330039 0.00527246 0.00427427 0.00276806 0.0016233 0.00088867 0.00046659
0.000239352
 0.00176563 0.0282064 0.0228664 0.0148085 0.00868429 0.00475418 0.00249615
0.00128048
 0.0037086 0.0592459 0.0480294 0.0311043 0.0182408 0.00998587 0.00524301
0.00268957
 0.00510778 0.0815981 0.0661499 0.0428393 0.0251227 0.0137533 0.00722108
0.00370428
 0.00455234 0.0727248 0.0589565 0.0381808 0.0223908 0.0122577 0.00643583
0.00330146
 0.00334895 0.0535003 0.0433716 0.0280879 0.0164719 0.00901746 0.00473455
0.00242874
 0.00393812 0.041529 0.0526683 0.0223497 0.00643116 0.00161527 0.000390855
9.37072e-05
 0.00283895 0.0299378 0.037968 0.0161117 0.00463616 0.00116443 0.000281763
6.75526e-05
 0.00226696 0.023906 0.0303182 0.0128655 0.00370206 0.000929821 0.000224994
5.39421e-05
 0.00310197 0.0327114 0.0414856 0.0176043 0.00506567 0.00127231 0.000307867
7.3811e-05
 0.00332281 0.0350403 0.0444391 0.0188577 0.00542632 0.00136289 0.000329786
7.90659e-05
 0.00390153 0.0411431 0.0521789 0.022142 0.0063714 0.00160026 0.000387223
9.28365e-05
 0.00472113 0.0497861 0.0631401 0.0267934 0.00770984 0.00193643 0.000468567
0.000112339
 0.00280447 0.0295742 0.0375068 0.015916 0.00457984 0.00115029 0.000278341
6.6732e-05
 0.00298268 0.0314535 0.0398903 0.0169274 0.00487087 0.00122338 0.000296028
7.09726e-05
```

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 0.00411014 0.043343 0.0549689 0.0233259 0.00671207 0.00168582 0.000407927
9.78004e-05
 0.00496324 0.0523392 0.0663781 0.0281674 0.00810522 0.00203573 0.000492596
0.0001181
 0.0043754 0.0461403 0.0585164 0.0248313 0.00714526 0.00179462 0.000434254
0.000104112
Discard F by age and year for each fleet
 fleet 1 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
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 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 fleet 2 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
fleet 3 Discard F at age
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0
fleet 4 Discard F at age
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
fleet 5 Discard F at age
0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
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 0 0 0 0 0 0 0 0
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 0 0 0 0 0 0 0 0
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 fleet 6 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
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 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
Total F
 0.257521 0.97465 1.00164 0.985863 0.973859 0.966156 0.96173 0.959347
 0.318476 0.964148 0.996422 0.990111 0.985301 0.982214 0.980441 0.979486
 0.311726 1.05152 1.08515 1.07924 1.07473 1.07183 1.07017 1.06928
 0.245503 1.34659 1.40892 1.40646 1.40456 1.40335 1.40265 1.40227
 0.295951 1.21118 1.25585 1.24238 1.23212 1.22554 1.22175 1.21972
 0.279211 0.981997 1.01771 1.00834 1.0012 0.99662 0.993988 0.992571
 0.361065 1.97302 2.05577 2.039 2.02621 2.01801 2.0133 2.01076
```

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 0.129859 1.06788 1.07654 1.07446 1.07252 1.07634 1.07363 1.07158
 0.165179 0.927253 0.672397 0.660676 0.649576 0.673934 0.657495 0.644935
 0.346144 1.33496 1.13308 1.11309 1.09605 1.11154 1.09489 1.08281
 0.233935 2.19523 1.93322 1.90529 1.88125 1.90582 1.88127 1.86334
 0.208496 0.78573 0.726139 0.704416 0.687325 0.684585 0.675057 0.668958
 0.180501 0.741226 0.761639 0.687253 0.673331 0.677534 0.667407 0.660426
 0.0132477 0.207938 1.11292 1.51081 1.53496 1.53865 1.5344 1.53159
 0.0135274 0.213882 0.96091 1.31798 1.34103 1.34388 1.34093 1.33897
 0.0105172 0.164802 0.609399 0.772552 0.777531 0.779034 0.776647 0.775096
 0.0106982 0.165997 0.602842 0.758044 0.760966 0.762527 0.75939 0.75738
 0.00833151 0.242511 0.491889 0.563168 0.558588 0.573868 0.563518 0.555786
 0.0112803 0.204843 0.551005 0.672204 0.668957 0.672754 0.667693 0.664287
 0.00975224 0.139638 0.452332 0.516575 0.507035 0.506576 0.502771 0.500522
 0.0064212 0.113895 0.367474 0.46288 0.461642 0.463091 0.460104 0.458177
 0.00705605 0.129257 0.361269 0.446087 0.442584 0.444137 0.440892 0.438791
 0.0083242 0.130268 0.420348 0.524162 0.518706 0.5174 0.514613 0.513069
 0.0100544 0.145965 0.509937 0.62423 0.616801 0.614489 0.61146 0.609868
 0.00969079 0.167974 0.47592 0.588916 0.583196 0.583941 0.579926 0.577442

Average F for ages 3 to 5
Freport unweighted in .std and MCMC files
year    unweighted   Nweighted    Bweighted
1982  0.98712  0.974221  0.974041
1983  0.990612  0.990034  0.988165
1984  1.0797  1.08514  1.08513
1985  1.40665  1.40835  1.40809
1986  1.24345  1.24708  1.24417
1987  1.00908  1.01562  1.01362
1988  2.04033  2.05284  2.05109
1989  1.07451  1.07488  1.07458
1990  0.660883  0.670983  0.669797
1991  1.11407  1.12493  1.12184
1992  1.90658  1.92037  1.91342
1993  0.70596  0.715317  0.710301
1994  0.707407  0.758347  0.754387
1995  1.38623  1.26793  1.30055
1996  1.20664  1.0187  1.05256
1997  0.719827  0.643643  0.651303
1998  0.707284  0.668238  0.683283
1999  0.537882  0.520782  0.529045
2000  0.630722  0.597362  0.612426
2001  0.491981  0.480492  0.485946
2002  0.430665  0.404369  0.414133
2003  0.416647  0.399284  0.40863
2004  0.487739  0.466956  0.478453
2005  0.583656  0.574129  0.584758
2006  0.549344  0.516056  0.53054

Population Numbers at the Start of the Year
 97062.2 141.934 66.7132 194.838 11323.2 1.87289 2.45433 4.12177
 103590 61425.9 43.8472 20.0607 59.5196 3500.81 0.583523 2.06103
 29010.2 61680.2 19176.4 13.2539 6.10222 18.1924 1073.34 0.812862
 56267.3 17390.4 17644.9 5304.38 3.68788 1.70562 5.09965 301.606
 78406 36039.3 3703.7 3530.8 1064.04 0.74118 0.343207 61.7818
 10996.4 47748.6 8788.35 863.707 834.555 254.095 0.178164 15.0206
 50266.8 6809.77 14642.9 2600.53 257.983 251.061 76.791 4.61183
 22469 28682.3 775.181 1534.47 277.127 27.8457 27.3218 8.90182
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 29309.9 16155.7 8071.99 216.277 429.009 77.6304 7.77055 10.141
 18141.7 20343.2 5233.2 3373.68 91.4586 183.442 32.3957 7.65287
 56335.6 10507.3 4383.22 1379.81 907.48 25.0241 49.4203 10.9959
 32501.5 36502.9 957.759 519.218 168.076 113.231 3.04657 7.56305
 37381.4 21602.1 13621.7 379.349 210.168 69.2061 46.7513 4.44178
 41145.4 25550.9 8428.05 5207.1 156.21 87.7575 28.7764 21.5162
 29040.8 33243.7 16991.9 2267.42 941.027 27.5567 15.424 8.88761
 27793.1 23457.2 21976.7 5321.87 496.916 201.531 5.88475 5.21085
 34351 22517 16287.1 9782.4 2012.29 186.959 75.7099 4.18133
 25643.4 27825 15615.6 7297.5 3752.95 769.746 71.4046 30.6117
 30997 20820.8 17875.4 7817.65 3402 1757.61 355.027 47.6528
 28222.5 25093.5 13889.2 8435.25 3268.01 1426.76 734.326 169.161
 30073.3 22882.4 17867.3 7233.9 4119.96 1611.47 703.865 447.606
 17902 24464.3 16717.8 10130 3728.1 2125.91 830.319 595.523
 28339.4 14553.8 17601 9537.23 5309.04 1960.73 1116.35 751.825
 13577.9 23010 10460.3 9465.09 4622.99 2587.53 956.873 914.819
 30243.3 11005.4 16280.5 5143.07 4151.13 2042.63 1145.93 832.07

q by index
 index 1 q over time
1992  0.000163468
1993  0.000163468
1994  0.000163468
1995  0.000163468
1996  0.000163468
1997  0.000163468
1998  0.000163468
1999  0.000163468
2000  0.000163468
2001  0.000163468
2002  0.000163468
2003  0.000163468
2004  0.000163468
2005  0.000163468
2006  0.000163468
 index 2 q over time
1992  0.000544383
1993  0.000544383
1994  0.000544383
1995  0.000544383
1996  0.000544383
1997  0.000544383
1998  0.000544383
1999  0.000544383
2000  0.000544383
2001  0.000544383
2002  0.000544383
2003  0.000544383
2004  0.000544383
2005  0.000544383
2006  0.000544383
 index 3 q over time
1992  0.00042715
1993  0.00042715
1994  0.00042715
1995  0.00042715
1996  0.00042715
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1997  0.00042715
1998  0.00042715
1999  0.00042715
2000  0.00042715
2001  0.00042715
2002  0.00042715
2003  0.00042715
2004  0.00042715
2005  0.00042715
2006  0.00042715
 index 4 q over time
1992  0.000346283
1993  0.000346283
1994  0.000346283
1995  0.000346283
1996  0.000346283
1997  0.000346283
1998  0.000346283
1999  0.000346283
2000  0.000346283
2001  0.000346283
2002  0.000346283
2003  0.000346283
2004  0.000346283
2005  0.000346283
2006  0.000346283
 index 5 q over time
1992  0.000427125
1993  0.000427125
1994  0.000427125
1996  0.000427125
1997  0.000427125
1998  0.000427125
1999  0.000427125
2000  0.000427125
2001  0.000427125
2002  0.000427125
2003  0.000427125
2004  0.000427125
2005  0.000427125
2006  0.000427125
 index 6 q over time
1982  2.00161e-05
1983  2.00161e-05
1984  2.00161e-05
1985  2.00161e-05
1986  2.00161e-05
1987  2.00161e-05
1988  2.00161e-05
1989  2.00161e-05
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1993  2.00161e-05
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1997  2.00161e-05
1998  2.00161e-05
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2002  2.00161e-05
2003  2.00161e-05
2004  2.00161e-05
2005  2.00161e-05
2006  2.00161e-05
 index 7 q over time
1982  8.58831e-05
1983  8.58831e-05
1984  8.58831e-05
1985  8.58831e-05
1986  8.58831e-05
1987  8.58831e-05
1988  8.58831e-05
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2003  8.58831e-05
2004  8.58831e-05
2005  8.58831e-05
2006  8.58831e-05
 index 8 q over time
1982  7.57892e-05
1983  7.57892e-05
1984  7.57892e-05
1985  7.57892e-05
1986  7.57892e-05
1987  7.57892e-05
1988  7.57892e-05
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2002  7.57892e-05
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2003  7.57892e-05
2004  7.57892e-05
2005  7.57892e-05
2006  7.57892e-05
 index 9 q over time
1982  7.18747e-05
1983  7.18747e-05
1984  7.18747e-05
1985  7.18747e-05
1986  7.18747e-05
1987  7.18747e-05
1988  7.18747e-05
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2002  7.18747e-05
2003  7.18747e-05
2004  7.18747e-05
2005  7.18747e-05
2006  7.18747e-05
 index 10 q over time
1983  4.9264e-05
1984  4.9264e-05
1985  4.9264e-05
1986  4.9264e-05
1992  4.9264e-05
1995  4.9264e-05
1998  4.9264e-05
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2002  4.9264e-05
2003  4.9264e-05
2004  4.9264e-05
2005  4.9264e-05
2006  4.9264e-05
 index 11 q over time
1983  0.000127481
1984  0.000127481
1985  0.000127481
1986  0.000127481
1987  0.000127481
1988  0.000127481
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2001  0.000127481
2002  0.000127481
2003  0.000127481
2004  0.000127481
2005  0.000127481
2006  0.000127481
 index 12 q over time
1983  0.000161081
1984  0.000161081
1985  0.000161081
1986  0.000161081
1987  0.000161081
1988  0.000161081
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Proportions of catch at age by fleet
 fleet 1
Year 1 Obs  =  0.0999237 0.477013 0.390403 0.0160876 0.00422994 0.0067263
0.00395257 0.00166424
Year 1 Pred =  0.0615149 0.0105437 0.00528093 0.015522 0.906459 0.000150399
0.000197444 0.000331906
Year 2 Obs  =  0.10236 0.634204 0.227746 0.0289916 0.00156994 0.00324454
0.000680308 0.00120362
Year 2 Pred =  0.0129341 0.928445 0.0007047 0.000323243 0.000960914 0.0565892
9.43918e-06 3.33525e-05
Year 3 Obs  =  0.0664268 0.506889 0.31883 0.0766062 0.0272241 0.00340893
0.000142039 0.000473462
Year 3 Pred =  0.00298161 0.738669 0.244113 0.000169121 7.80045e-05
0.00023282 0.0137453 1.04133e-05
Year 4 Obs  =  0.0447546 0.343172 0.536416 0.0509351 0.0140125 0.00900421
0.00133198 0.000372955
Year 4 Pred =  0.013151 0.409802 0.437609 0.131678 9.16141e-05 4.23899e-05
0.000126775 0.00749886
Year 5 Obs  =  0.0249296 0.431275 0.39042 0.135673 0.00967781 0.00569644
0.00177631 0.000551268
Year 5 Pred =  0.0158082 0.789545 0.0859204 0.0823363 0.0249109 1.73962e-05
8.06714e-06 0.00145333
Year 6 Obs  =  0.0183903 0.493436 0.413006 0.0517919 0.0186673 0.00127403
0.00132942 0.00210491
Year 6 Pred =  0.00157162 0.805541 0.157439 0.0155317 0.0150506 0.00459088
3.22241e-06 0.000271828
Year 7 Obs  =  0.0137816 0.502282 0.406308 0.0578374 0.0147757 0.00356965
0.000813339 0.000632597
Year 7 Pred =  0.0225917 0.260734 0.587743 0.104959 0.010456 0.010203
0.00312558 0.000187869
Year 8 Obs  =  0.0113879 0.295492 0.572835 0.0997628 0.0180308 0.00189798
0.000355872 0.000237248
Year 8 Pred =  0.00665445 0.903626 0.0262184 0.0519437 0.00938833 0.000941912
0.000925182 0.000301683
Year 9 Obs  =  0 0.651696 0.210154 0.112033 0.0197706 0.00439346 0.00146449
0.000488162
Year 9 Pred =  0.00949134 0.598819 0.358541 0.00965533 0.0192439 0.00344604
0.000347377 0.0004558
Year 10 Obs  =  0 0.519579 0.450533 0.0196485 0.00844057 0.00152207
0.00013837 0.00013837
Year 10 Pred =  0.00552959 0.657586 0.196935 0.127963 0.0034924 0.0069622
0.00123761 0.000293762
Year 11 Obs  =  0.0115983 0.586021 0.36372 0.034388 0.00193306 0.00223827 0
0.00010174
Year 11 Pred =  0.0391928 0.546609 0.267525 0.0850104 0.056365 0.00154146
0.00306955 0.000687123
Year 12 Obs  =  0.0213669 0.609594 0.331116 0.0246215 0.00410358 0.00608462
0.00268855 0.000424508
Year 12 Pred =  0.00677607 0.942489 0.027317 0.0149468 0.00487381 0.00328727
8.88082e-05 0.000221041
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Year 13 Obs  =  0.0151246 0.470005 0.469243 0.0345704 0.00813421 0.00152517
0.000762583 0.000635486
Year 13 Pred =  0.00806068 0.580154 0.390711 0.01123 0.0062588 0.00205725
0.00139579 0.00013301
Year 14 Obs  =  0.00640312 0.357183 0.595768 0.0335468 0.00556793 0.00111359
0.000278396 0.000139198
Year 14 Pred =  0.0173923 0.233929 0.422512 0.308626 0.00931208 0.00522739
0.00171678 0.00128495
Year 15 Obs  =  0 0.251933 0.573098 0.143499 0.0280525 0.00269736 0.000539471
0.000179824
Year 15 Pred =  0.00858986 0.212416 0.633469 0.101027 0.0421735 0.00123436
0.000691682 0.000398853
Year 16 Obs  =  0 0.086758 0.557534 0.277169 0.059589 0.0157534 0.00228311
0.000913242
Year 16 Pred =  0.00569526 0.106094 0.656777 0.203908 0.0192777 0.00781778
0.000228515 0.000202478
Year 17 Obs  =  0 0.0439265 0.385253 0.45316 0.0979381 0.0161363 0.00336172
0.000224115
Year 17 Pred =  0.00662072 0.0957429 0.459155 0.354726 0.0739455 0.00686955
0.00278559 0.000153974
Year 18 Obs  =  0 0.0307962 0.39309 0.381072 0.14647 0.0400601 0.00650976
0.002003
Year 18 Pred =  0.00469388 0.1083 0.43842 0.272922 0.142697 0.0290896
0.00271074 0.00116605
Year 19 Obs  =  0 0.0548229 0.500129 0.280062 0.116111 0.0307732 0.0121541
0.00594776
Year 19 Pred =  0.00535727 0.0779794 0.462343 0.263719 0.116604 0.0601779
0.0121823 0.00163753
Year 20 Obs  =  0 0.192057 0.381393 0.272035 0.0900435 0.0421654 0.0160501
0.0062568
Year 20 Pred =  0.00494308 0.0981263 0.380003 0.30831 0.121705 0.0531755
0.027415 0.00632167
Year 21 Obs  =  0 0.0797956 0.53184 0.270244 0.0752752 0.0261399 0.0147406
0.00196541
Year 21 Pred =  0.00464383 0.079727 0.447021 0.238335 0.137802 0.0538951
0.0235724 0.0150032
Year 22 Obs  =  0 0.0960949 0.431814 0.276631 0.108771 0.0521366 0.0224903
0.012063
Year 22 Pred =  0.0025383 0.077725 0.385256 0.308855 0.115511 0.0658603
0.025761 0.0184937
Year 23 Obs  =  0 0.048398 0.439966 0.297639 0.126138 0.0507589 0.0202361
0.0168634
Year 23 Pred =  0.00401573 0.0462162 0.394942 0.280887 0.15903 0.0587996
0.0335197 0.0225899
Year 24 Obs  =  0 0.084207 0.228491 0.271093 0.181561 0.112332 0.0605758
0.0617407
Year 24 Pred =  0.00232233 0.0876187 0.272462 0.322375 0.160274 0.0898475
0.0332701 0.0318298
Year 25 Obs  =  0 0.0787154 0.466205 0.232997 0.121327 0.0579345 0.0277078
0.0151134
Year 25 Pred =  0.00548825 0.0439977 0.456674 0.188689 0.15491 0.0762444
0.0428493 0.031147
 fleet 2
Year 1 Obs  =  0.172408 0.608612 0.179438 0.0249561 0.00913884 0.00333919
0.00105448 0.00105448
Year 1 Pred =  0.500369 0.00604186 0.00280912 0.00825643 0.482162 8.00002e-05
0.000105024 0.000176547
```

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Year 2 Obs  =  0.0778358 0.59769 0.250119 0.0454042 0.0213574 0.00648632
0.000474608 0.000632811
Year 2 Pred =  0.157398 0.795952 0.000560811 0.000257233 0.000764684 0.045033
7.51159e-06 2.65415e-05
Year 3 Obs  =  0.0814915 0.508356 0.349416 0.049416 0.00961366 0.00161725
8.98473e-05 0
Year 3 Pred =  0.0414607 0.723608 0.221986 0.000153786 7.09315e-05
0.000211709 0.012499 9.46907e-06
Year 4 Obs  =  0.0274049 0.415828 0.493428 0.0472595 0.0118848 0.0033557
0.000699105 0.000139821
Year 4 Pred =  0.164889 0.361972 0.358813 0.107965 7.51154e-05 3.4756e-05
0.000103944 0.0061484
Year 5 Obs  =  0.0420725 0.482665 0.369497 0.0932996 0.00564862 0.00623296
0.00019478 0.00038956
Year 5 Pred =  0.187838 0.660915 0.0667646 0.0639773 0.0193563 1.35173e-05
6.26837e-06 0.00112928
Year 6 Obs  =  0.054914 0.570351 0.306151 0.0624558 0.00589206 0.000235682 0
0
Year 6 Pred =  0.022156 0.800018 0.145146 0.0143185 0.013875 0.00423228
2.97071e-06 0.000250596
Year 7 Obs  =  0 0.495499 0.377951 0.0800068 0.0385595 0.00662477 0.000169866
0.00118906
Year 7 Pred =  0.25723 0.20914 0.437631 0.0781494 0.00778527 0.00759683
0.00232721 0.000139882
Year 8 Obs  =  0.000823384 0.0201729 0.591601 0.294772 0.076163 0.0152326
0.000411692 0.000823384
Year 8 Pred =  0.0873515 0.835632 0.0225068 0.0445888 0.008059 0.000808543
0.000794181 0.000258966
Year 9 Obs  =  0.00140449 0.100421 0.51264 0.293539 0.0821629 0.00842697
0.000702247 0.000702247
Year 9 Pred =  0.122799 0.545797 0.303359 0.00816901 0.0162815 0.00291556
0.000293902 0.000385634
Year 10 Obs  =  0 0.142431 0.611857 0.194258 0.0432513 0.00745712 0.000745712
0
Year 10 Pred =  0.0748398 0.62699 0.174306 0.113256 0.003091 0.00616199
0.00109537 0.000259998
Year 11 Obs  =  0 0.0214031 0.472652 0.414388 0.0778835 0.0124851 0.00118906
0
Year 11 Pred =  0.374024 0.367484 0.166958 0.0530518 0.0351753 0.00096197
0.00191559 0.000428808
Year 12 Obs  =  0 0.269211 0.575536 0.13173 0.0230005 0.000522739 0 0
Year 12 Pred =  0.0885873 0.868037 0.0233548 0.0127784 0.00416675 0.00281037
7.59244e-05 0.000188974
Year 13 Obs  =  0.00277649 0.119389 0.583989 0.232763 0.0532161 0.00647848
0.00138825 0
Year 13 Pred =  0.106257 0.538762 0.336814 0.00968051 0.00539525 0.0017734
0.00120321 0.000114658
Year 14 Obs  =  0 0.0642528 0.493788 0.304934 0.117501 0.0188143 0.000709975
0
Year 14 Pred =  0.0164851 0.162741 0.378787 0.417122 0.0131815 0.00742094
0.0024376 0.00182447
Year 15 Obs  =  0 0.164492 0.620533 0.157119 0.0374362 0.015882 0.0036869
0.000850822
Year 15 Pred =  0.00881751 0.160038 0.615044 0.147874 0.0646521 0.00189776
0.0010636 0.000613321
Year 16 Obs  =  0 0.0163305 0.600384 0.363112 0.0172911 0.00288184 0 0
```

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Year 16 Pred =  0.00549377 0.0751143 0.599233 0.28047 0.0277712 0.0112948
0.000330204 0.000292584
Year 17 Obs  =  0.0118421 0.359868 0.456579 0.151316 0.0184211 0.00197368 0 0
Year 17 Pred =  0.00579687 0.0615278 0.38025 0.442871 0.0966905 0.00900855
0.00365357 0.000201954
Year 18 Obs  =  0.000712758 0.0498931 0.35923 0.412687 0.108339 0.0627227
0.00427655 0.00213828
Year 18 Pred =  0.00407982 0.0690898 0.36043 0.338255 0.185229 0.0378691
0.00352946 0.00151825
Year 19 Obs  =  0 0.028169 0.224225 0.510423 0.194366 0.0309859 0.0101408
0.00169014
Year 19 Pred =  0.00461471 0.0493012 0.376692 0.32392 0.150002 0.0776383
0.0157195 0.00211303
Year 20 Obs  =  0 0.0539986 0.278879 0.380041 0.228298 0.0430622 0.0123035
0.00341763
Year 20 Pred =  0.00416101 0.0606265 0.302558 0.37007 0.153001 0.0670424
0.03457 0.00797164
Year 21 Obs  =  0 0.0351423 0.255338 0.459075 0.204626 0.0311388 0.0133452
0.00133452
Year 21 Pred =  0.00396866 0.0500091 0.36134 0.290436 0.175876 0.068985
0.0301775 0.0192073
Year 22 Obs  =  0 0.0262997 0.205505 0.435474 0.221407 0.075841 0.030581
0.00489297
Year 22 Pred =  0.00211204 0.0474674 0.3032 0.366445 0.143538 0.0820769
0.0321095 0.0230515
Year 23 Obs  =  0 0.0106054 0.26867 0.381352 0.198409 0.10517 0.0251878
0.0106054
Year 23 Pred =  0.00328718 0.027767 0.305783 0.327859 0.194411 0.0720895
0.0411028 0.0277005
Year 24 Obs  =  0 0.00888657 0.24621 0.434919 0.203346 0.0747517 0.0230005
0.00888657
Year 24 Pred =  0.00184977 0.0512234 0.205268 0.366144 0.190652 0.107186
0.0396972 0.0379791
Year 25 Obs  =  0 0.00924499 0.223934 0.337956 0.229584 0.132512 0.048793
0.0179764
Year 25 Pred =  0.00459203 0.0270195 0.361408 0.225119 0.193568 0.0955469
0.0537064 0.0390394
 fleet 3
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  0.135354 0.814374 0.0116478 0.0198118 0.0167883 0.00107831
0.000707803 0.000237965
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  0.000394463 0.993954 2.15434e-05 5.71852e-06 2.46674e-07
0.00562354 4.69009e-07 3.3144e-07
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  0.000113801 0.989659 0.00933959 3.74437e-06 2.50601e-08
2.89549e-05 0.000854727 1.29506e-07
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  0.000881663 0.964402 0.0294083 0.00512086 5.16981e-08
9.26004e-06 1.3847e-05 0.000163812
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  0.000567303 0.994601 0.00309078 0.00171399 7.52469e-06
2.0342e-06 4.71659e-07 1.69943e-05
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  5.52216e-05 0.99355 0.00554517 0.000316568 4.45127e-06
0.000525611 1.84467e-07 3.11217e-06
Year 7 Obs  =  0 0 0 0 0 0 0 0
```

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Year 7 Pred =  0.00229042 0.927905 0.0597301 0.00617262 8.9228e-06 0.00337053
0.000516264 6.20622e-06
Year 8 Obs  =  0.310372 0.651982 0.0376452 0 0 0 0 0
Year 8 Pred =  0.000209342 0.997866 0.00082678 0.000947898 2.48599e-06
9.65518e-05 4.74184e-05 3.09243e-06
Year 9 Obs  =  0.338025 0.646259 0.0157166 0 0 0 0 0
Year 9 Pred =  0.000443382 0.98194 0.0167892 0.000261639 7.56678e-06
0.000524537 2.64379e-05 6.93793e-06
Year 10 Obs  =  0.206489 0.793511 0 0 0 0 0 0
Year 10 Pred =  0.000236459 0.987086 0.00844164 0.00317419 1.25706e-06
0.000970098 8.62232e-05 4.09322e-06
Year 11 Obs  =  0.421841 0.563915 0.0131483 0.00109569 0 0 0 0
Year 11 Pred =  0.00200426 0.981212 0.0137136 0.00252176 2.42618e-05
0.000256854 0.000255739 1.14495e-05
Year 12 Obs  =  0.378133 0.556484 0.06502 0.00036324 0 0 0 0
Year 12 Pred =  0.000204483 0.998377 0.000826326 0.000261645 1.23798e-06
0.000323236 4.36624e-06 2.17349e-06
Year 13 Obs  =  0.205618 0.603889 0.17753 0.0129636 0 0 0 0
Year 13 Pred =  0.000387902 0.980015 0.0188471 0.000313482 2.53518e-06
0.000322585 0.000109432 2.08564e-06
Year 14 Obs  =  0.181467 0.525097 0.265122 0.028314 0 0 0 0
Year 14 Pred =  0.000311709 0.990543 0.00681472 0.00209579 9.04353e-07
0.000196413 3.22523e-05 4.82792e-06
Year 15 Obs  =  0.0239334 0.663892 0.248699 0.0634755 0 0 0 0
Year 15 Pred =  0.00016907 0.987785 0.0112208 0.000753428 4.49799e-06
5.09349e-05 1.42705e-05 1.64579e-06
Year 16 Obs  =  0.0126984 0.395238 0.477778 0.114286 0 0 0 0
Year 16 Pred =  0.000221116 0.97318 0.0229479 0.00299962 4.05565e-06
0.000636332 9.29983e-06 1.64804e-06
Year 17 Obs  =  0.047619 0.306878 0.386243 0.259259 0 0 0 0
Year 17 Pred =  0.000285467 0.975337 0.0178167 0.00579522 1.72768e-05
0.000620972 0.000125899 1.39182e-06
Year 18 Obs  =  0.0319893 0.407531 0.416861 0.143619 0 0 0 0
Year 18 Pred =  0.000179465 0.978302 0.0150854 0.00395378 2.9564e-05
0.00233173 0.00010864 9.34648e-06
Year 19 Obs  =  0.0220441 0.164329 0.460922 0.352705 0 0 0 0
Year 19 Pred =  0.000280706 0.965351 0.0218017 0.00523569 3.3107e-05
0.00661056 0.000669097 1.79879e-05
Year 20 Obs  =  0.0226337 0.203704 0.218107 0.555556 0 0 0 0
Year 20 Pred =  0.000207783 0.974529 0.0143753 0.0049105 2.77218e-05
0.00468615 0.00120796 5.57092e-05
Year 21 Obs  =  0.0247148 0.235741 0.418251 0.321293 0 0 0 0
Year 21 Pred =  0.000238446 0.967198 0.0206566 0.00463688 3.83414e-05
0.0058017 0.00126873 0.000161503
Year 22 Obs  =  0.00319489 0.421725 0.408946 0.0894569 0.0399361 0.0159744
0.0159744 0.00479233
Year 22 Pred =  0.000133599 0.966533 0.0182484 0.00615941 3.29444e-05
0.00726735 0.00142127 0.000204064
Year 23 Obs  =  0.00369004 0.143911 0.494465 0.195572 0.0811808 0.0332103
0.0258303 0.0221402
Year 23 Pred =  0.00034771 0.945461 0.0307753 0.00921531 7.46157e-05
0.0106738 0.00304233 0.000410062
Year 24 Obs  =  0.0162602 0.166667 0.390244 0.211382 0.0894309 0.0528455
0.0406504 0.0325203
Year 24 Pred =  0.000109022 0.971812 0.011511 0.00573423 4.0771e-05
0.00884274 0.00163718 0.000313261
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Year 25 Obs  =  0.0114286 0.14 0.517143 0.148571 0.0828571 0.0457143
0.0314286 0.0228571
Year 25 Pred =  0.000494654 0.936901 0.0370417 0.00644374 7.56565e-05
0.0144068 0.00404822 0.000588527
 fleet 4
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  0.146857 0.0126319 0.75343 0.048907 0.0341455 0.00214567
0.00140842 0.000473514
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  0.015046 0.542005 0.0489901 0.000496276 1.76376e-05 0.393389
3.2809e-05 2.31855e-05
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  0.000198711 0.0247048 0.972251 1.48756e-05 8.20274e-08
9.2724e-05 0.00273714 4.14724e-07
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  0.000495337 0.007746 0.98502 0.00654583 5.4447e-08 9.54129e-06
1.42675e-05 0.000168787
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  0.00279457 0.0700437 0.907706 0.0192102 6.94848e-05 1.83776e-
05 4.26111e-06 0.000153532
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  0.000159347 0.0409869 0.953952 0.00207838 2.4078e-05 0.0027816
9.76226e-07 1.647e-05
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  0.000636627 0.00368718 0.989783 0.00390358 4.64914e-06
0.00171816 0.000263171 3.16368e-06
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  0.00316241 0.215504 0.744609 0.0325797 7.03985e-05 0.00267496
0.00131372 8.56757e-05
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  0.000435949 0.0138027 0.984156 0.000585306 1.39467e-05
0.000945865 4.76739e-05 1.25108e-05
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  0.000448867 0.0267879 0.955358 0.0137094 4.47321e-06
0.00337733 0.00030018 1.42503e-05
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  0.00238502 0.0166926 0.972897 0.00682757 5.41209e-05
0.000560559 0.000558126 2.49875e-05
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  0.00314861 0.219775 0.758562 0.00916639 3.57338e-05
0.00912806 0.000123301 6.13784e-05
Year 13 Obs  =  0 0.604376 0.362808 0.0328168 0 0 0 0
Year 13 Pred =  0.000340402 0.0122949 0.986036 0.000625903 4.17043e-06
0.000519171 0.000176121 3.35665e-06
Year 14 Obs  =  0 0.404255 0.524823 0.070922 0 0 0 0
Year 14 Pred =  0.000731795 0.0332457 0.953818 0.0111947 3.97998e-06
0.000845681 0.000138866 2.07873e-05
Year 15 Obs  =  0 0.741611 0.241611 0.0167785 0 0 0 0
Year 15 Pred =  0.000246783 0.0206126 0.976447 0.00250216 1.23075e-05
0.000136352 3.82019e-05 4.40576e-06
Year 16 Obs  =  0 0.220779 0.636364 0.142857 0 0 0 0
Year 16 Pred =  0.000159047 0.0100074 0.984065 0.00490902 5.46849e-06
0.00083943 1.22681e-05 2.17405e-06
Year 17 Obs  =  0.00595238 0.25 0.434524 0.309524 0 0 0 0
Year 17 Pred =  0.000261653 0.0127804 0.973585 0.0120854 2.96847e-05
0.00104385 0.000211635 2.33963e-06
Year 18 Obs  =  0.00208333 0.133333 0.497917 0.366667 0 0 0 0
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Year 18 Pred =  0.000193583 0.0150863 0.970111 0.0097034 5.97796e-05
0.00461278 0.000214919 1.84898e-05
Year 19 Obs  =  0.0111732 0.256983 0.458101 0.273743 0 0 0 0
Year 19 Pred =  0.000209606 0.0103052 0.97055 0.00889506 4.63417e-05
0.00905285 0.000916297 2.46336e-05
Year 20 Obs  =  0 0.0634146 0.243902 0.692683 0 0 0 0
Year 20 Pred =  0.000232602 0.0155962 0.959391 0.0125069 5.81736e-05
0.00962088 0.00248 0.000114373
Year 21 Obs  =  0.00564972 0.169492 0.468927 0.355932 0 0 0 0
Year 21 Pred =  0.000187833 0.0108923 0.970105 0.0083106 5.66178e-05
0.00838174 0.00183295 0.000233323
Year 22 Obs  =  0 0.387387 0.432432 0.117117 0.036036 0.00900901 0.00900901
0.00900901
Year 22 Pred =  0.000117992 0.0122036 0.960843 0.0123769 5.45423e-05
0.0117712 0.00230208 0.000330532
Year 23 Obs  =  0 0.133333 0.609524 0.180952 0.047619 0.0190476 0.00952381 0
Year 23 Pred =  0.000183426 0.00713031 0.967885 0.0110606 7.37864e-05
0.0103267 0.00294338 0.000396724
Year 24 Obs  =  0 0.08 0.52 0.24 0.08 0.04 0.02 0.02
Year 24 Pred =  0.000148697 0.0189493 0.936005 0.0177946 0.000104242
0.0221194 0.00409526 0.000783595
Year 25 Obs  =  0 0.0887097 0.637097 0.169355 0.0564516 0.0241935 0.016129
0.00806452
Year 25 Pred =  0.000217721 0.00589539 0.971999 0.00645297 6.24232e-05
0.0116295 0.00326782 0.000475074
 fleet 5
Year 1 Obs  =  0.177729 0.545789 0.226071 0.0362567 0.0138952 0 0.000258515 0
Year 1 Pred =  0.914206 0.00103718 0.000482371 0.00141776 0.0827949 1.37373e-
05 1.80343e-05 3.03159e-05
Year 2 Obs  =  0.10964 0.553058 0.237093 0.0638217 0.0251476 0.0104782 0
0.00076205
Year 2 Pred =  0.665339 0.316128 0.000222802 0.000102195 0.000303797
0.0178909 2.98424e-06 1.05445e-05
Year 3 Obs  =  0.130587 0.526352 0.276452 0.0579113 0.00841202 0.000286123 0
0
Year 3 Pred =  0.315221 0.516908 0.158622 0.000109889 5.06845e-05 0.000151278
0.00893124 6.76618e-06
Year 4 Obs  =  0.0905476 0.452015 0.395988 0.0427435 0.0133743 0.00533165 0 0
Year 4 Pred =  0.677532 0.139748 0.138568 0.0416944 2.90086e-05 1.34223e-05
4.0142e-05 0.00237443
Year 5 Obs  =  0.100594 0.551416 0.239566 0.0936236 0.0111006 0.00129077
0.00240943 0
Year 5 Pred =  0.711101 0.235085 0.0237548 0.0227631 0.00688699 4.80945e-06
2.23029e-06 0.000401796
Year 6 Obs  =  0.059377 0.595041 0.263954 0.0569612 0.0231405 0.000127146
0.000635728 0.000762873
Year 6 Pred =  0.194288 0.659154 0.119624 0.0118008 0.0114353 0.0034881
2.44835e-06 0.000206532
Year 7 Obs  =  0.0430723 0.576506 0.33243 0.0388554 0.00883534 0.000301205 0
0
Year 7 Pred =  0.786556 0.0600866 0.125769 0.0224591 0.00223738 0.00218322
0.000668809 4.02002e-05
Year 8 Obs  =  0.042516 0.313337 0.552126 0.0786255 0.00931858 0.00116482
0.00291206 0
Year 8 Pred =  0.504619 0.453566 0.0122198 0.024209 0.00437555 0.00043899
0.000431192 0.000140603
Year 9 Obs  =  0.0930416 0.7301 0.139431 0.0311017 0.0060622 0 0.000263574 0
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Year 9 Pred =  0.598355 0.249877 0.138924 0.00374103 0.00745619 0.00133519
0.000134594 0.000176603
Year 10 Obs  =  0.0141727 0.59443 0.371622 0.0130191 0.00659196 0.000164799 0
0
Year 10 Pred =  0.46262 0.364153 0.101266 0.0657976 0.00179576 0.0035799
0.000636369 0.00015105
Year 11 Obs  =  0.0165934 0.639544 0.320472 0.0179928 0 0.00539784 0 0
Year 11 Pred =  0.864104 0.0797693 0.0362518 0.0115192 0.00763768 0.000208874
0.000415936 9.31079e-05
Year 12 Obs  =  0.0121651 0.60502 0.357715 0.0244841 0.000307977 0.000307977
0 0
Year 12 Pred =  0.508472 0.468129 0.0125988 0.00689336 0.00224776 0.00151606
4.09576e-05 0.000101942
Year 13 Obs  =  0.117858 0.596449 0.253319 0.0274504 0.00417723 0.000149187
0.000596748 0
Year 13 Pred =  0.55854 0.266088 0.166397 0.00478248 0.00266542 0.000876118
0.000594422 5.66446e-05
Year 14 Obs  =  0.0694528 0.453999 0.428743 0.0348767 0.0078172 0.00481058
0.000300661 0
Year 14 Pred =  0.0558895 0.389637 0.329018 0.21333 0.00643599 0.00361426
0.00118704 0.00088846
Year 15 Obs  =  0.0165785 0.419465 0.495641 0.0505931 0.017579 0.000142918 0
0
Year 15 Pred =  0.0283026 0.362767 0.505793 0.071602 0.0298865 0.000875072
0.00049037 0.000282769
Year 16 Obs  =  0.000558114 0.160179 0.584345 0.204409 0.0382308 0.0122785 0
0
Year 16 Pred =  0.0211229 0.203953 0.590289 0.162675 0.0153776 0.00623855
0.000182361 0.000161584
Year 17 Obs  =  0 0.110044 0.417682 0.388881 0.0737928 0.00902708 0.000573148
0
Year 17 Pred =  0.0252862 0.189534 0.424957 0.29142 0.0607416 0.00564504
0.00228915 0.000126533
Year 18 Obs  =  0 0.0489408 0.482591 0.3701 0.0791332 0.0146092 0.00462625 0
Year 18 Pred =  0.0178094 0.212984 0.403103 0.222743 0.116447 0.0237474
0.00221301 0.000951951
Year 19 Obs  =  0 0.0740931 0.528266 0.292783 0.0824253 0.0217921 0.000640943
0
Year 19 Pred =  0.0209643 0.158168 0.438438 0.221986 0.0981395 0.0506681
0.0102575 0.00137881
Year 20 Obs  =  0 0.158292 0.373064 0.336419 0.101813 0.0228561 0.00680015
0.000755572
Year 20 Pred =  0.019079 0.196311 0.355427 0.255972 0.101033 0.04416
0.0227679 0.0052501
Year 21 Obs  =  0.00030656 0.0594727 0.406806 0.369099 0.129062 0.0282036
0.00613121 0.000919681
Year 21 Pred =  0.0182043 0.161996 0.42465 0.20097 0.116184 0.0454575
0.0198828 0.0126549
Year 22 Obs  =  0 0.0519851 0.367186 0.384075 0.142136 0.0375082 0.0135995
0.00350954
Year 22 Pred =  0.0101065 0.160405 0.371717 0.26452 0.0989178 0.0564209
0.0220697 0.0158438
Year 23 Obs  =  0.00526662 0.0467413 0.341014 0.377441 0.14944 0.0482774
0.0263331 0.00548607
Year 23 Pred =  0.016524 0.09857 0.393812 0.248616 0.140742 0.0520576
0.0296775 0.0200005
```

```
Year 24 Obs  =  0.000729927 0.0447689 0.291241 0.374453 0.183698 0.0579075
0.0240876 0.0231144
Year 24 Pred =  0.00925537 0.180995 0.263137 0.276362 0.137381 0.0770434
0.0285299 0.027295
Year 25 Obs  =  0.000987167 0.017769 0.34847 0.325518 0.179911 0.078233
0.0333169 0.0157947
Year 25 Pred =  0.0223836 0.0930094 0.451346 0.165535 0.135885 0.0669058
0.0376025 0.0273333
 fleet 6
Year 1 Obs  =  0.212871 0.787129 0 0 0 0 0 0
Year 1 Pred =  0.686457 0.0117566 0.00443128 0.00843459 0.288861 2.62378e-05
1.80851e-05 1.55953e-05
Year 2 Obs  =  0.158085 0.841915 0 0 0 0 0 0
Year 2 Pred =  0.121235 0.869569 0.000496687 0.000147538 0.000257208
0.00829231 7.26225e-07 1.31634e-06
Year 3 Obs  =  0.170732 0.829268 0 0 0 0 0 0
Year 3 Pred =  0.0312955 0.774704 0.192667 8.64395e-05 2.33807e-05 3.82032e-
05 0.00118421 4.60218e-07
Year 4 Obs  =  0.162602 0.837398 0 0 0 0 0 0
Year 4 Pred =  0.140724 0.438166 0.352112 0.0686132 2.79949e-05 7.09123e-06
1.11349e-05 0.000337871
Year 5 Obs  =  0.109729 0.890271 0 0 0 0 0 0
Year 5 Pred =  0.149292 0.74505 0.0610148 0.0378641 0.00671815 2.56836e-06
6.25341e-07 5.77915e-05
Year 6 Obs  =  0.0805471 0.919453 0 0 0 0 0 0
Year 6 Pred =  0.0165156 0.845846 0.124408 0.00794789 0.00451659 0.000754212
2.77954e-07 1.20279e-05
Year 7 Obs  =  0.0763889 0.923611 0 0 0 0 0 0
Year 7 Pred =  0.229509 0.264669 0.448977 0.0519223 0.00303337 0.00162041
0.00026063 8.03622e-06
Year 8 Obs  =  0.135417 0.864583 0 0 0 0 0 0
Year 8 Pred =  0.0654078 0.887485 0.019378 0.0248619 0.0026352 0.000144736
7.46428e-05 1.24857e-05
Year 9 Obs  =  0.113208 0.886792 0 0 0 0 0 0
Year 9 Pred =  0.0974827 0.61454 0.276901 0.00482893 0.00564418 0.00055331
2.9285e-05 1.97115e-05
Year 10 Obs  =  0.023976 0.976024 0 0 0 0 0 0
Year 10 Pred =  0.0597822 0.710373 0.160099 0.0673672 0.00107823 0.00117672
0.000109827 1.33728e-05
Year 11 Obs  =  0.024602 0.975398 0 0 0 0 0 0
Year 11 Pred =  0.327349 0.45618 0.168017 0.0345748 0.0134438 0.000201273
0.000210437 2.41649e-05
Year 12 Obs  =  0.0191657 0.980834 0 0 0 0 0 0
Year 12 Pred =  0.065202 0.90618 0.0197652 0.00700351 0.00133924 0.000494501
7.01423e-06 8.95573e-06
Year 13 Obs  =  0.175182 0.824818 0 0 0 0 0 0
Year 13 Pred =  0.0838092 0.602723 0.305464 0.00568567 0.00185831 0.000334392
0.00011912 5.82303e-06
Year 14 Obs  =  0.139278 0.860722 0 0 0 0 0 0
Year 14 Pred =  0.110493 0.659763 0.187129 0.0421992 0.0003611 5.08835e-05
4.0436e-06 7.25598e-07
Year 15 Obs  =  0.0384911 0.961509 0 0 0 0 0 0
Year 15 Pred =  0.0574625 0.630829 0.295427 0.0145456 0.00172204 1.26519e-05
1.71546e-06 2.37162e-07
Year 16 Obs  =  0.0172786 0.590353 0.37581 0.0165587 0 0 0 0
Year 16 Pred =  0.05524 0.456832 0.444103 0.0425668 0.0011413 0.000116182
8.21735e-07 1.74563e-07
```

```
Year 17 Obs  =  0 0.403892 0.51592 0.0801887 0 0 0 0
Year 17 Pred =  0.0741962 0.476332 0.358725 0.085559 0.00505817 0.000117956
1.15737e-05 1.53376e-07
Year 18 Obs  =  0.0471116 0.32922 0.553561 0.0701066 0 0 0 0
Year 18 Pred =  0.0520802 0.533452 0.339123 0.0651742 0.00966409 0.000494531
1.11508e-05 1.14998e-06
Year 19 Obs  =  0 0.314914 0.588519 0.0965665 0 0 0 0
Year 19 Pred =  0.0680786 0.43992 0.409597 0.072128 0.00904449 0.00117171
5.73947e-05 1.84966e-06
Year 20 Obs  =  0 0.524324 0.369231 0.0993763 0.00706861 0 0 0
Year 20 Pred =  0.0599393 0.528234 0.321237 0.0804633 0.00900801 0.000987963
0.000123248 6.81365e-06
Year 21 Obs  =  0.0533049 0.401564 0.404407 0.140725 0 0 0 0
Year 21 Pred =  0.0601023 0.458086 0.403337 0.0663894 0.0108862 0.00106876
0.000113109 1.72597e-05
Year 22 Obs  =  0.0298598 0.478367 0.365021 0.118221 0.00853138 0 0 0
Year 22 Pred =  0.0355673 0.483497 0.376341 0.0931445 0.00987949 0.00141399
0.000133828 2.30338e-05
Year 23 Obs  =  0.0499706 0.298648 0.466784 0.180482 0.00411523 0 0 0
Year 23 Pred =  0.0678482 0.346652 0.465192 0.102141 0.0164005 0.00152217
0.000209967 3.39251e-05
Year 24 Obs  =  0.109767 0.498271 0.31936 0.0691443 0.00345722 0 0 0
Year 24 Pred =  0.0340098 0.569644 0.278171 0.10161 0.0143268 0.00201605
0.000180639 4.14332e-05
Year 25 Obs  =  0.0883694 0.314709 0.505701 0.0826682 0.00741163 0.00114025 0
0
Year 25 Pred =  0.0885205 0.31504 0.513502 0.0655016 0.0152509 0.00188423
0.00025623 4.4654e-05

Proportions of Discards at age by fleet
 fleet 1
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
```

```
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 2
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
```

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Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 3
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
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Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 4
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
```

```
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 5
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
```

```
 fleet 6
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15

F Reference Points Using Final Year Selectivity and Freport options
 refpt           F       slope to plot on SRR
  F0.1     0.152881     0.319245
  Fmax     0.279128     0.516866
  F30%SPR  0.229528     0.436022
```

```
  F40%SPR  0.158236     0.327007
  Fmsy     0.186241     0.368634    SSBmsy    6.51841e+25     MSY
1.14189e+25
  Fcurrent 0.549344     0.981741

Stock-Recruitment Relationship Parameters
 alpha     = 2.93159e+25
 beta      = 1.43419e+25
 unexpl    = 2.23067e+26
 steepness = 0.805387
Spawning Stock, Obs Recruits(year+1), Pred Recruits(year+1), standardized
residual
init  xxxx  97062.2  15698.8  3.85656
1982  15299.5  103590  31273.5  2.53539
1983  20232.5  29010.2  41356.9  -0.750651
1984  17910.5  56267.3  36610.4  0.909817
1985  12866.4  78406  26299.9  2.3124
1986  14397.4  10996.4  29429.5  -2.08397
1987  12863.5  50266.8  26294  1.37179
1988  7234.02  22469  14786.9  0.885709
1989  7950.32  29309.9  16251.1  1.2485
1990  9597.1  18141.7  19617.2  -0.165538
1991  6721.31  56335.6  13738.9  2.9872
1992  6674.25  32501.5  13642.7  1.83768
1993  11836.1  37381.4  24193.9  0.921021
1994  14637.2  41145.4  29919.6  0.674452
1995  18578.8  29040.8  37976.5  -0.567898
1996  20634.6  27793.1  42178.8  -0.883041
1997  21338.4  34351  43617.4  -0.505576
1998  23304.3  25643.4  47635.8  -1.31102
1999  24300.2  30997  49671.5  -0.998224
2000  25984.9  28222.5  53115.3  -1.33864
2001  30300  30073.3  61935.6  -1.5294
2002  33479  17902  68433.7  -2.83872
2003  35553.7  28339.4  72674.7  -1.9936
2004  31562.3  13577.9  64515.8  -3.29917
2005  27021.8  30243.3  55234.7  -1.27507
2006  24936       xxxx   50971.2

Root Mean Square Error computed from Standardized Residuals
Component                  #resids         RMSE
_Catch_Fleet_1                25           0.725723
_Catch_Fleet_2                25           0.227321
_Catch_Fleet_3                25           3.18695
_Catch_Fleet_4                25           2.11043
_Catch_Fleet_5                25           0.287387
_Catch_Fleet_6                25           0.0438207
Catch_Fleet_Total             150           1.59548
_Discard_Fleet_1              0            0
_Discard_Fleet_2              0            0
_Discard_Fleet_3              0            0
_Discard_Fleet_4              0            0
_Discard_Fleet_5              0            0
_Discard_Fleet_6              0            0
Discard_Fleet_Total           0            0
_Index_1                      15           2.63899
_Index_2                      15           2.75352
```

```
_Index_3                    15          2.90266
_Index_4                    15          2.97054
_Index_5                    14          1.71904
_Index_6                    25          3.77745
_Index_7                    25          4.51911
_Index_8                    24          4.55728
_Index_9                    20          5.06911
_Index_10                   15          1.98099
_Index_11                   24          2.55692
_Index_12                   24          3.02387
_Index_13                   22          2.9767
_Index_14                   25          3.51974
_Index_15                   25          3.28889
_Index_16                   24          3.36338
_Index_17                   22          3.94782
_Index_18                   23          1.51235
_Index_19                   23          2.29602
_Index_20                   22          2.98137
_Index_21                   22          2.14156
_Index_22                   22          1.5502
_Index_23                   22          2.35926
_Index_24                   22          1.48266
_Index_25                   25          3.42895
_Index_26                   20          3.75802
_Index_27                   17          1.62819
_Index_28                   17          1.76583
_Index_29                   19          1.45328
_Index_30                   19          1.77833
_Index_31                   16          1.68215
_Index_32                   15          1.76458
_Index_33                   19          2.02468
_Index_34                   25          1.09348
_Index_35                   25          1.37439
_Index_36                   19          1.49039
_Index_37                   25          1.33349
_Index_38                   21          1.98413
_Index_39                   15          1.64904
Index_Total                 802         2.76882
Nyear1                      7         4.12008
Fmult_Year1                 6         8.9986
_Fmult_devs_Fleet_1         0         0
_Fmult_devs_Fleet_2         0         0
_Fmult_devs_Fleet_3         0         0
_Fmult_devs_Fleet_4         0         0
_Fmult_devs_Fleet_5         0         0
_Fmult_devs_Fleet_6         0         0
Fmult_devs_Total            0         0
Recruit_devs                0         0
Fleet_Sel_params            32          6.12623
Index_Sel_params            0         0
q_year1                     0         0
q_devs                      0         0
SRR_steepness               0         0
SRR_unexpl_S                0         0

Projections not requested
```

```
that's all
```

ASAP ALTERNATIVE RUN (F08_SVAge comp.REP)

```
Age Structured Assessment Program (ASAP) Version 2.0
Start time for run: Fri Mar 28 11:36:11 2008

obj_fun        = 28952.5

Component                 Lambda          obj_fun
__Catch_Fleet_1                10           2064.51
Catch_Fleet_Total              10           2064.51
Discard_Fleet_Total            0            0
__Index_Fit_1                  1            92.1493
__Index_Fit_2                  1            46.612
__Index_Fit_3                  1            35.2325
__Index_Fit_4                  1            114.635
__Index_Fit_5                  1            161.785
__Index_Fit_6                  1            6.96195
__Index_Fit_7                  1            33.4007
__Index_Fit_8                  1            41.3422
__Index_Fit_9                  1            29.1583
__Index_Fit_10                  1           47.2661
__Index_Fit_11                  1           14.3711
__Index_Fit_12                  1           79.8653
__Index_Fit_13                  1           27.0557
Index_Fit_Total                13           729.835
Catch_Age_Comps       see_below             374.972
Discard_Age_Comps     see_below             0
Survey_Age_Comps      see_below             25688.1
__Sel_Param_1                  1            0.865894
__Sel_Param_2                  1            3.68963
__Sel_Param_3                  1            1.0393
__Sel_Param_4                  1            2.34366
Sel_Params_Total               4            7.93848
__Index_Sel_Param_1            1            0.943825
__Index_Sel_Param_2            1            1.1233
__Index_Sel_Param_3            1            0.907767
__Index_Sel_Param_4            1            1.99006
__Index_Sel_Param_5            1            0.199202
__Index_Sel_Param_6            1            6.51157
__Index_Sel_Param_9            1            0.461552
__Index_Sel_Param_10           1            0.168969
__Index_Sel_Param_17           1            0.168969
__Index_Sel_Param_18           1            0.486765
__Index_Sel_Param_25           1            0.696264
__Index_Sel_Param_26           1            0.323948
__Index_Sel_Param_27           1            0.168969
__Index_Sel_Param_31           1            0.889978
__Index_Sel_Param_32           1            3.65449
__Index_Sel_Param_35           1            0.168969
__Index_Sel_Param_36           1            0.668816
__Index_Sel_Param_41           1            0.885887
__Index_Sel_Param_42           1            1.93495
__Index_Sel_Param_43           1            2.55251
Index_Sel_Params_Total        20             24.9068
q_year1_Total                  0            0
q_devs_Total                   130000            0
```

```
__Fmult_year1_fleet_1         1          0.658164
Fmult_year1_fleet_Total       1          0.658164
Fmult_devs_fleet_Total        0          0
N_year_1                      1          61.573
Recruit_devs                  0          0
SRR_steepness                 0          0
SRR_unexpl_stock              0          0
Fmult_Max_penalty          1000          0
F_penalty                     0          0

 Input and Estimated effective sample sizes for fleet 1
1982  31  23.5065
1983  33  24.0389
1984  43  13.3083
1985  379  170.647
1986  39  8.22219
1987  46  22.2347
1988  663  101.747
1989  92  332.309
1990  2270  117.262
1991  58  12.9326
1992  173  79.6955
1993  415  65.9631
1994  106  50.6206
1995  75  39.4668
1996  222  76.4549
1997  267  49.0351
1998  151  177.214
1999  187  281.54
2000  125  223.883
2001  215  203.151
2002  61  54.7536
2003  236  135.97
2004  139  172.464
2005  368  193.59
2006  194  98.8826
 Total  6588  2728.89

 Input and Estimated effective Discard sample sizes for fleet 1
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
```

```
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16

Observed and predicted total fleet catch by year and standardized residual
 fleet 1 total catches
1982  18963  19195.4  -0.122109
1983  26466  25384.5  0.418271
1984  26057  24981.1  0.422708
1985  20432  19975.4  0.226549
1986  20866  21116.4  -0.119568
1987  18312  18546.2  -0.127383
1988  21761  20876.8  0.41585
1989  10314  9091.06  1.26525
1990  7976  7506.94  0.607599
1991  11316  10926.1  0.351494
1992  11805  12213.1  -0.340726
1993  10781  11630.2  -0.760129
1994  12182  11615.4  0.477441
1995  10495  9694.19  0.795698
1996  11643  12176.9  -0.449456
1997  10325  11128.2  -0.750974
1998  11641  12038.1  -0.336266
1999  10851  11082  -0.211188
2000  13756  14265.1  -0.364303
2001  11932  12220.1  -0.239148
2002  11308  11778.5  -0.40871
2003  12927  13369.7  -0.337545
2004  13832  14125  -0.210103
2005  13444  13611.2  -0.123878
2006  12853  12852.4  0.000429028
Observed and predicted total fleet Discards by year and standardized residual
 fleet 1 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
```

```
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0

Index data
index number 1
units = 2
month = 1
starting and ending ages for selectivity = 2  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  12.3  7.54009  3.07796
1993  13.6  7.5266  3.72116
1994  12.05  7.94022  2.62358
1995  10.93  9.75436  0.715749
1996  31.25  15.3005  4.49167
1997  10.28  17.1287  -3.21123
1998  7.76  17.7966  -5.22063
1999  11.06  18.139  -3.11172
2000  15.77  18.2803  -0.929082
2001  18.6  17.2825  0.462099
2002  22.68  19.1877  1.05174
2003  35.64  21.965  3.04432
2004  17.77  23.1879  -1.67382
2005  12.89  24.5117  -4.04237
2006  21.06  24.687  -0.999438
index number 2
units = 2
month = 1
starting and ending ages for selectivity = 2  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  1.91575  0.816747
1983  0.95  1.93498  -3.42444
1984  0.66  1.95525  -5.22789
1985  2.38  1.53323  2.11673
1986  2.14  1.3136  2.34926
1987  0.93  1.40755  -1.99492
1988  1.5  1.4356  0.211244
1989  0.32  0.645859  -3.3805
1990  0.72  0.486179  1.89024
1991  1.08  0.748915  1.76227
1992  1.2  0.763812  2.17463
1993  1.27  0.759139  2.47709
1994  0.93  0.804313  0.698939
1995  1.09  0.983287  0.495969
1996  1.76  1.5628  0.572031
1997  1.06  1.75865  -2.4371
1998  1.19  1.79967  -1.9912
1999  1.6  1.82963  -0.645577
2000  2.14  1.84582  0.71187
2001  2.69  1.73105  2.12197
2002  2.47  1.93159  1.18358
2003  2.91  2.20818  1.32851
```

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2004  3.03  2.33121  1.26204
2005  1.81  2.43755  -1.43288
2006  1.77  2.48776  -1.63861
index number 3
units = 2
month = 1
starting and ending ages for selectivity = 1  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.5  2.83958  -0.42046
1983  2.89  3.134  -0.267579
1984  2.08  3.09466  -1.31161
1985  1.9  2.32043  -0.659919
1986  1.44  2.56687  -1.90826
1987  0.9  2.50345  -3.37727
1988  0.89  1.90144  -2.50611
1989  0.57  0.889314  -1.46844
1990  0.89  1.12052  -0.760373
1991  1.7  1.45783  0.507342
1992  2.32  1.41421  1.6341
1993  1.07  1.41529  -0.923279
1994  1.53  1.52757  0.00525775
1995  2.4  1.8926  0.784102
1996  1.96  2.29038  -0.514251
1997  2.91  2.16618  0.974491
1998  4.51  2.1654  2.42209
1999  3.78  2.10084  1.93911
2000  3.19  2.01919  1.50973
2001  2.89  2.06634  1.10749
2002  2.55  2.28008  0.369349
2003  2.87  2.3916  0.60198
2004  4.07  2.48299  1.6314
2005  2.49  2.54735  -0.0751662
2006  2.77  2.23649  0.706268
index number 4
units = 2
month = 1
starting and ending ages for selectivity = 3  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.726  1.24583  1.56931
1983  1.049  1.38311  -1.33097
1984  0.145  0.930165  -8.94696
1985  1.296  1.15572  0.551437
1986  0.707  0.607022  0.73393
1987  0.653  0.674727  -0.157559
1988  1.128  0.909554  1.03615
1989  0.465  0.563767  -0.927141
1990  0.102  0.19859  -3.20725
1991  0.062  0.306259  -7.68898
1992  0.432  0.404173  0.320513
1993  0.557  0.374742  1.90782
1994  1.265  0.446179  5.01644
1995  1.355  0.503381  4.76661
1996  0.8  1.00688  -1.10716
1997  1.46  1.46212  -0.0069917
1998  1.871  1.50234  1.05636
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1999  1.99  1.36515  1.81417
2000  2.864  1.46892  3.21411
2001  1.756  1.24145  1.66919
2002  1.908  1.35371  1.65211
2003  2.064  1.62709  1.14496
2004  0.606  1.80873  -5.26384
2005  1.38  1.61231  -0.748946
2006  3.415  1.85697  2.93268
index number 5
units = 2
month = 1
starting and ending ages for selectivity = 3  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.682  1.1546  1.81109
1983  0.779  1.11461  -1.72453
1984  0.394  0.783503  -3.30908
1985  1.935  1.05004  2.94253
1986  0.893  0.481363  2.97472
1987  0.674  0.627016  0.347831
1988  0.435  0.811326  -3.00052
1989  0.333  0.490955  -1.86874
1990  0.011  0.147002  -12.4799
1991  0.294  0.288147  0.0968051
1992  0.186  0.371367  -3.32844
1993  0.508  0.334744  2.00789
1994  0.076  0.401853  -8.01658
1995  0.506  0.440068  0.672034
1996  1.396  0.931751  1.9462
1997  1.859  1.26955  1.83583
1998  0.852  1.141  -1.40596
1999  1.319  1.07479  0.985626
2000  2.797  1.15028  4.27722
2001  1.39  0.926286  1.95379
2002  1.48  1.08518  1.49369
2003  1.51  1.25529  0.889314
2004  1.591  1.38718  0.659915
2005  3.399  1.15449  5.19801
2006  4.304  1.51026  5.04126
index number 6
units = 2
month = 1
starting and ending ages for selectivity = 3  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.315  0.418658  -0.738427
1985  0.423  0.494647  -0.406154
1986  0.19  0.253925  -0.752793
1987  0.104  0.291746  -2.67744
1988  0.267  0.377594  -0.89959
1989  0.089  0.237528  -2.54806
1990  0.041  0.0863973  -1.93479
1991  0.246  0.134117  1.5746
1992  0.213  0.167657  0.621342
1993  0.184  0.156116  0.42657
1994  0.357  0.187551  1.6708
1995  0.076  0.21128  -2.65398
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1996  0.375  0.420964  -0.300115
1997  0.6  0.602624  -0.0113271
1998  1.213  0.641634  1.65303
1999  1.117  0.649477  1.40748
2000  1.324  0.680338  1.72827
2001  0.825  0.586594  0.885264
2002  1.962  0.655437  2.84596
2003  1.643  0.749426  2.03755
2004  1.422  0.870724  1.27317
2005  0.447  0.806745  -1.53263
2006  0.493  0.937668  -1.66874
index number 7
units = 2
month = 1
starting and ending ages for selectivity = 1  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.999  2.28158  -2.1437
1985  1.191  1.60968  -0.781933
1986  1.719  1.64716  0.110808
1987  1.401  1.70786  -0.514095
1988  1.42  1.53774  -0.206768
1989  0.14  0.633396  -3.91808
1990  0.87  0.649399  0.759102
1991  1.26  0.952706  0.725654
1992  1.02  0.927476  0.246827
1993  1.109  0.933631  0.446805
1994  0.55  0.97366  -1.48252
1995  0.541  1.2111  -2.09179
1996  2.191  1.71041  0.642762
1997  2.5  1.71748  0.97451
1998  1.719  1.71488  0.00622259
1999  2.68  1.72983  1.13637
2000  1.91  1.68011  0.332875
2001  4.417  1.65216  2.55254
2002  6.121  1.84153  3.11777
2003  3.388  2.05019  1.30384
2004  1.954  2.08166  -0.164273
2005  2.41  2.24897  0.179503
2006  1.316  2.11573  -1.23244
index number 8
units = 2
month = 1
starting and ending ages for selectivity = 3  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.59  0.828087  -0.87993
1983  0.53  0.788703  -1.03182
1984  0.59  0.556906  0.149842
1985  0.3  0.751753  -2.38447
1986  0.64  0.340038  1.64155
1987  0.39  0.44981  -0.370352
1988  0.24  0.579866  -2.28981
1989  0.07  0.350098  -4.17834
1990  0.12  0.103059  0.395037
1991  0.09  0.206938  -2.1612
1992  0.52  0.266142  1.73859
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1993  0.29  0.239277  0.499042
1994  0.03  0.287466  -5.86603
1995  0.2  0.313927  -1.17025
1996  1.04  0.668171  1.14842
1997  0.99  0.905061  0.232841
1998  0.45  0.802239  -1.50073
1999  2.26  0.758655  2.83339
2000  1.69  0.811475  1.90428
2001  0.93  0.64998  0.929889
2002  1.78  0.767453  2.18374
2003  2.57  0.884125  2.76977
2004  2.08  0.976386  1.96303
2005  2.07  0.806251  2.4475
2006  1.57  1.06968  0.996014
index number 9
units = 2
month = 1
starting and ending ages for selectivity = 1  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.29  0.27472  0.140505
1991  0.15  0.397241  -2.52797
1992  0.34  0.402362  -0.437131
1993  0.26  0.399074  -1.11216
1994  0.17  0.428745  -2.40118
1995  0.08  0.524055  -4.87879
1996  0.96  0.773908  0.559322
1997  0.73  0.847535  -0.387505
1998  0.43  0.863277  -1.80907
1999  0.9  0.868505  0.0924629
2000  2.61  0.876343  2.83281
2001  0.98  0.832595  0.423112
2002  2.03  0.928122  2.03146
2003  3.78  1.04224  3.34417
2004  2.17  1.10641  1.74848
2005  2.49  1.14161  2.02424
2006  1.32  1.15027  0.357257
index number 10
units = 2
month = 1
starting and ending ages for selectivity = 1  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  4.26  6.23688  -0.989507
1989  1.69  3.64041  -1.99185
1990  2.86  4.60006  -1.2336
1991  3.97  5.46561  -0.82987
1992  4.75  5.43199  -0.348242
1993  8.46  5.3459  1.19148
1994  2.83  6.04261  -1.96899
1995  8.37  7.37571  0.328257
1996  9.69  8.17946  0.439888
1997  16.35  7.95322  1.87059
1998  9.47  8.05435  0.420285
1999  11.44  7.64338  1.04678
2000  7.35  7.79363  -0.152124
2001  5.68  7.95066  -0.872944
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2002  16.84  8.77206  1.69287
2003  9.84  8.92621  0.252986
2004  10.66  9.91036  0.189271
2005  11.19  9.42065  0.446761
2006  10.65  8.75713  0.507956
index number 11
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1986  0.32  0.321593  -0.0128915
1987  0.26  0.247873  0.123988
1988  0.01  0.0517732  -4.26807
1989  0.14  0.126369  0.265899
1990  0.36  0.188631  1.67763
1991  0.38  0.164607  2.17159
1992  0.37  0.174796  1.94647
1993  0.05  0.16301  -3.06756
1994  0.57  0.214904  2.53196
1995  0.3  0.25164  0.456276
1996  0.08  0.170399  -1.96264
1997  0.22  0.166241  0.727278
1998  0.39  0.172739  2.11384
1999  0.35  0.130116  2.56846
2000  0.21  0.166588  0.601119
2001  0.14  0.179157  -0.640156
2002  0.13  0.194362  -1.04395
2003  0.21  0.143261  0.992688
2004  0.27  0.230624  0.40917
2005  0.01  0.117019  -6.38476
2006  0.17  0.125215  0.793671
index number 12
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  3.408  12.1543  -3.30058
1983  17.699  19.3591  -0.232713
1984  13.31  7.97112  1.33079
1985  12.843  14.1176  -0.245609
1986  59.526  14.3118  3.69972
1987  7.584  11.031  -0.972531
1988  1.763  2.30405  -0.694743
1989  2.855  5.62376  -1.7597
1990  4.733  8.39461  -1.48741
1991  7.337  7.32547  0.00408205
1992  8.487  7.7789  0.226139
1993  4.145  7.2544  -1.45283
1994  22.311  9.56384  2.19879
1995  13.067  11.1987  0.400496
1996  6.493  7.58322  -0.402886
1997  7.997  7.39821  0.202019
1998  14.983  7.68738  1.7322
1999  8.565  5.79051  1.01612
2000  9.874  7.41364  0.743885
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2001  13.543  7.973  1.37522
2002  5.406  8.64963  -1.22
2003  8.18  6.37553  0.64691
2004  6.993  10.2634  -0.995903
2005  2.198  5.20765  -2.239
2006  9.658  5.57243  1.42752
index number 13
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  1.43516  1.19013
1983  5.01  2.28589  2.03679
1984  1.58  0.94122  1.34458
1985  1.26  1.66699  -0.726548
1986  1.26  1.68992  -0.762014
1987  0.39  1.30253  -3.13019
1988  0.54  0.272059  1.77948
1989  1.24  0.664046  1.62105
1990  2.54  0.991224  2.44249
1991  2.64  0.864982  2.89634
1992  0.89  0.918522  -0.0818803
1993  0.5  0.85659  -1.3974
1994  2.41  1.12929  1.96765
1995  0.63  1.32233  -1.92452
1996  0.81  0.895417  -0.260231
1997  0.89  0.873571  0.0483633
1998  0.73  0.907716  -0.565568
1999  0.53  0.683736  -0.66111
2000  0.57  0.875393  -1.11365
2001  0.47  0.941442  -1.80318
2002  0.77  1.02134  -0.733226
2003  0.44  0.752815  -1.394
2004  1.3  1.21189  0.182176
2005  0.35  0.614913  -1.4628
2006  0.8  0.657985  0.507276

Input and Estimated effective sample sizes for index 1
1992  100  118.621
1993  100  21.273
1994  100  8.3919
1995  100  70.7126
1996  100  3.73205
1997  100  17.5172
1998  100  955.085
1999  100  129.711
2000  100  24.3779
2001  100  41.3227
2002  100  33.9329
2003  100  1118.94
2004  100  49.8274
2005  100  230.662
2006  100  718.924
 Total  1500  3543.03
Input and Estimated effective sample sizes for index 2
1982  200  51.6129
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1983  200  492.46
1984  200  5.42513
1985  200  111.26
1986  200  28.2404
1987  200  107.991
1988  200  131.313
1989  200  39.8793
1990  200  5.71901
1991  200  18.3413
1992  200  19.4127
1993  200  225.433
1994  200  19.172
1995  200  9.31537
1996  200  5.83828
1997  200  106.614
1998  200  2745.17
1999  200  39.8192
2000  200  50.9268
2001  200  34.6435
2002  200  27.118
2003  200  176.445
2004  200  88.7468
2005  200  44.076
2006  200  26.6085
 Total  5000  4611.59
Input and Estimated effective sample sizes for index 3
1982  200  22.494
1983  200  39.9825
1984  200  124.415
1985  200  93.8825
1986  200  286.114
1987  200  25.506
1988  200  43.8008
1989  200  4.95657
1990  200  18.8502
1991  200  8.51814
1992  200  14.4996
1993  200  12.6568
1994  200  11.4063
1995  200  37.2978
1996  200  31.7089
1997  200  45.8043
1998  200  25.3096
1999  200  30.619
2000  200  39.2675
2001  200  21.8385
2002  200  21.2653
2003  200  47.0809
2004  200  38.8658
2005  200  401.613
2006  200  222.287
 Total  5000  1670.04
Input and Estimated effective sample sizes for index 4
1982  100  107.977
1983  100  34.2916
1984  100  5.83164
1985  100  8.77213
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1986  100  19.0612
1987  100  12.5322
1988  100  29.2407
1989  100  34607.8
1990  100  2.45753
1991  100  6.54163
1992  100  17.3549
1993  100  39.7699
1994  100  8.7098
1995  100  5.46338
1996  100  132.138
1997  100  16.7582
1998  100  33.3017
1999  100  7.7066
2000  100  284.199
2001  100  108.154
2002  100  10.4753
2003  100  19.1446
2004  100  20.3479
2005  100  4.99488
2006  100  99.5416
 Total  2500  35642.6
Input and Estimated effective sample sizes for index 5
1982  100  26.4813
1983  100  6301.02
1984  100  4.66732
1985  100  22.8855
1986  100  490.263
1987  100  34.8278
1988  100  13.1016
1989  100  20.5499
1990  100  0.433317
1991  100  80.3202
1992  100  14.2691
1993  100  70.9197
1994  100  10.7228
1995  100  7.65234
1996  100  100.16
1997  100  24.4156
1998  100  147.934
1999  100  53.4174
2000  100  52.3684
2001  100  40.2889
2002  100  20.8741
2003  100  27.4651
2004  100  6.28849
2005  100  78.6932
2006  100  39.3887
 Total  2500  7689.41
Input and Estimated effective sample sizes for index 6
1984  100  9.13474
1985  100  20.5963
1986  100  22.8604
1987  100  73.253
1988  100  265.783
1989  100  4.79719
1990  100  58.9697
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1991  100  13.6972
1992  100  759.943
1993  100  25.6803
1994  100  36.2781
1995  100  18.1394
1996  100  4.18949
1997  100  20.8085
1998  100  95.9122
1999  100  132.763
2000  100  37.8285
2001  100  53.1015
2002  100  49.1044
2003  100  38.8114
2004  100  72.3484
2005  100  10.7314
2006  100  12.4136
 Total  2300  1837.14
Input and Estimated effective sample sizes for index 7
1984  100  23.5731
1985  100  24.5881
1986  100  295.131
1987  100  20.4856
1988  100  98.9566
1989  100  17.2652
1990  100  28.0577
1991  100  93.5366
1992  100  44.9739
1993  100  22.3697
1994  100  13.7288
1995  100  47.3238
1996  100  14.6902
1997  100  46.4665
1998  100  6.9553
1999  100  14.1178
2000  100  77.6051
2001  100  10.2087
2002  100  22.811
2003  100  53.259
2004  100  54.7589
2005  100  48.8162
2006  100  132.062
 Total  2300  1211.74
Input and Estimated effective sample sizes for index 8
1982  100  11.0587
1983  100  382.381
1984  100  174.553
1985  100  6823.36
1986  100  33599.3
1987  100  29080.3
1988  100  10.4817
1989  100  8.10245
1990  100  2.53957
1991  100  7.14768
1992  100  2.43217
1993  100  3.2546
1994  100  11.7998
1995  100  8.42092
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1996  100  26.7721
1997  100  14.6238
1998  100  67.447
1999  100  49.8549
2000  100  76.8843
2001  100  80.2997
2002  100  158.454
2003  100  91.7159
2004  100  10.3535
2005  100  1880.05
2006  100  14.2005
 Total  2500  72595.8
Input and Estimated effective sample sizes for index 9
1990  100  61.7963
1991  100  7.81849
1992  100  46.9289
1993  100  25.0137
1994  100  15.7169
1995  100  4.25525
1996  100  42.3328
1997  100  124.66
1998  100  22.7039
1999  100  311.244
2000  100  117.854
2001  100  18.2379
2002  100  21.649
2003  100  21.733
2004  100  79.7948
2005  100  49.0442
2006  100  44.3416
 Total  1700  1015.12
Input and Estimated effective sample sizes for index 10
1988  100  15.9629
1989  100  9.63008
1990  100  27.4182
1991  100  9.8401
1992  100  7.73236
1993  100  8.41824
1994  100  19.669
1995  100  16.654
1996  100  40.1803
1997  100  10.6752
1998  100  4.79342
1999  100  11.8347
2000  100  7.16788
2001  100  6.8386
2002  100  7.87276
2003  100  8.6866
2004  100  3.80159
2005  100  11.1216
2006  100  5.62824
 Total  1900  233.926
Input and Estimated effective sample sizes for index 11
1986  0  0
1987  0  0
1988  0  0
1989  0  0
```

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1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 12
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 13
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
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Survey proportions at age by index
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Year 1992 Obs  =  -1 0.581582 0.385385 0.027027 0.003003 0.001001 0.002002 0
Year 1992 Pred =  -1 0.526066 0.414236 0.0536325 0.00346755 0.00212635
0.000405328 6.63787e-05
Year 1993 Obs  =  -1 0.478 0.493 0.023 0.004 0.001 0.001 0
Year 1993 Pred =  -1 0.56015 0.36281 0.0692043 0.00706614 0.000441028
0.000269053 5.96403e-05
Year 1994 Obs  =  -1 0.311688 0.597403 0.0679321 0.021978 0 0 0.000999001
Year 1994 Pred =  -1 0.499552 0.416628 0.0717824 0.0108515 0.00106977
6.6426e-05 4.94682e-05
Year 1995 Obs  =  -1 0.555 0.42 0.023 0.002 0 0 0
Year 1995 Pred =  -1 0.540384 0.359103 0.0866966 0.0118912 0.00173584
0.000170247 1.84288e-05
Year 1996 Obs  =  -1 0.709 0.267 0.019 0.004 0.001 0 0
Year 1996 Pred =  -1 0.416511 0.515979 0.0592757 0.00718042 0.000908248
0.00013147 1.42758e-05
Year 1997 Obs  =  -1 0.375 0.467 0.101 0.042 0.011 0.004 0
Year 1997 Pred =  -1 0.252928 0.585266 0.151113 0.00947107 0.00106652
0.000133847 2.14578e-05
Year 1998 Obs  =  -1 0.216216 0.419419 0.295295 0.0540541 0.013013 0.001001
0.001001
Year 1998 Pred =  -1 0.23927 0.420389 0.289355 0.0477964 0.0028274
0.000316232 4.60082e-05
Year 1999 Obs  =  -1 0.191191 0.434434 0.262262 0.0760761 0.025025 0.00500501
0.00600601
Year 1999 Pred =  -1 0.244192 0.4109 0.22607 0.101867 0.0159164 0.000935299
0.000119724
Year 2000 Obs  =  -1 0.044044 0.413413 0.315315 0.159159 0.049049 0.011011
0.00800801
Year 2000 Pred =  -1 0.182813 0.432864 0.246545 0.0919479 0.0393207 0.0061045
0.000404293
Year 2001 Obs  =  -1 0.165 0.287 0.345 0.131 0.043 0.02 0.009
Year 2001 Pred =  -1 0.247326 0.341186 0.260826 0.0985928 0.0348261 0.0147959
0.00244707
Year 2002 Obs  =  -1 0.122 0.474 0.246 0.1 0.037 0.014 0.007
Year 2002 Pred =  -1 0.240036 0.402623 0.196528 0.103884 0.0373384 0.0131066
0.00648377
Year 2003 Obs  =  -1 0.229 0.403 0.238 0.075 0.029 0.011 0.015
Year 2003 Pred =  -1 0.22773 0.384238 0.240356 0.0830553 0.0418388 0.0149462
0.00783506
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Year 2004 Obs  =  -1 0.082 0.488 0.257 0.092 0.035 0.023 0.023
Year 2004 Pred =  -1 0.159106 0.398477 0.258511 0.116053 0.0382669 0.0191611
0.0104242
Year 2005 Obs  =  -1 0.22977 0.312687 0.237762 0.103896 0.0539461 0.025974
0.035964
Year 2005 Pred =  -1 0.242318 0.278297 0.268979 0.125439 0.0537445 0.0176153
0.0136072
Year 2006 Obs  =  -1 0.125 0.43 0.204 0.117 0.063 0.027 0.034
Year 2006 Pred =  -1 0.122069 0.444393 0.19618 0.136059 0.0605469 0.0257855
0.0149668
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Year 1982 Obs  =  -1 0.308 0.63 0.053 0.009 0 0 0
Year 1982 Pred =  -1 0.364832 0.543278 0.0557618 0.0216204 0.00698379
0.00620704 0.00131655
Year 1983 Obs  =  -1 0.336327 0.41018 0.199601 0.0319361 0.010978 0 0.010978
Year 1983 Pred =  -1 0.344348 0.438862 0.189591 0.0165956 0.00634841
0.00204836 0.00220647
Year 1984 Obs  =  -1 0.258 0.5 0.136 0.076 0 0.015 0.015
Year 1984 Pred =  -1 0.533872 0.323845 0.100436 0.0366616 0.00316524
0.00120945 0.000810519
Year 1985 Obs  =  -1 0.231231 0.655656 0.0880881 0.017017 0.00800801 0 0
Year 1985 Pred =  -1 0.279052 0.604579 0.0850175 0.0222218 0.00799992
0.000689907 0.000440237
Year 1986 Obs  =  -1 0.692 0.201 0.093 0.009 0.005 0 0
Year 1986 Pred =  -1 0.57459 0.272812 0.13141 0.0155396 0.0040056 0.0014404
0.000203464
Year 1987 Obs  =  -1 0.505 0.462 0.022 0.011 0 0 0
Year 1987 Pred =  -1 0.539631 0.402679 0.0393118 0.0158581 0.00184913
0.000476103 0.00019537
Year 1988 Obs  =  -1 0.4 0.54 0.047 0.013 0 0 0
Year 1988 Pred =  -1 0.413543 0.488949 0.0870301 0.0071714 0.00285325
0.000332326 0.000120666
Year 1989 Obs  =  -1 0.187812 0.718282 0.0629371 0.030969 0 0 0
Year 1989 Pred =  -1 0.188365 0.639815 0.147324 0.0218977 0.00177909
0.000707032 0.00011224
Year 1990 Obs  =  -1 0.875 0.042 0.083 0 0 0 0
Year 1990 Pred =  -1 0.61683 0.201671 0.148156 0.028646 0.00419883
0.000340749 0.0001569
Year 1991 Obs  =  -1 0.731 0.25 0 0.019 0 0 0
Year 1991 Pred =  -1 0.601254 0.352186 0.0265105 0.0164079 0.00312882
0.000458092 5.42881e-05
Year 1992 Obs  =  -1 0.642 0.342 0.008 0 0.008 0 0
Year 1992 Pred =  -1 0.508347 0.434368 0.0516098 0.00325111 0.00198408
0.000377913 6.18817e-05
Year 1993 Obs  =  -1 0.575 0.394 0.031 0 0 0 0
Year 1993 Pred =  -1 0.543641 0.3821 0.0668844 0.00665393 0.000413312
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Year 1994 Obs  =  -1 0.376 0.57 0.043 0.011 0 0 0
Year 1994 Pred =  -1 0.482746 0.436895 0.069078 0.0101745 0.000998238
6.19358e-05 4.61187e-05
Year 1995 Obs  =  -1 0.725 0.248 0.018 0 0 0 0.009
Year 1995 Pred =  -1 0.524749 0.378406 0.0838368 0.0112038 0.00162766
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Year 1996 Obs  =  -1 0.614 0.318 0.068 0 0 0 0
Year 1996 Pred =  -1 0.399172 0.536605 0.056571 0.00667684 0.000840508
0.00012157 1.31992e-05
Year 1997 Obs  =  -1 0.274 0.632 0.085 0.009 0 0 0
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0.00800801 0
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Year 1999 Pred =  -1 0.23698 0.43272 0.218478 0.0959183 0.0149152 0.000875785
0.000112092
Year 2000 Obs  =  -1 0.0890891 0.481481 0.294294 0.0560561 0.0700701
0.00900901 0
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0.00571006 0.000378124
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Year 2001 Pred =  -1 0.241712 0.361834 0.253841 0.0934891 0.0328652 0.0139519
0.00230721
Year 2002 Obs  =  -1 0.138 0.36 0.3 0.126 0.04 0.012 0.024
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0.002997
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0.012922
Year 2006 Obs  =  -1 0.022977 0.587413 0.135864 0.140859 0.0509491 0.033966
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Year 1983 Obs  =  0.332 0.505 0.118 0.042 0.003 -1 -1 -1
Year 1983 Pred =  0.292272 0.420969 0.20433 0.0758797 0.00654963 -1 -1 -1
Year 1984 Obs  =  0.0869131 0.667333 0.206793 0.033966 0.004995 -1 -1 -1
Year 1984 Pred =  0.121873 0.667889 0.154296 0.0411351 0.0148064 -1 -1 -1
Year 1985 Obs  =  0.311 0.421 0.242 0.026 0 -1 -1 -1
Year 1985 Pred =  0.287867 0.365089 0.301244 0.0364146 0.00938562 -1 -1 -1
Year 1986 Obs  =  0.271271 0.576577 0.0760761 0.0760761 0 -1 -1 -1
Year 1986 Pred =  0.263811 0.582232 0.105281 0.0435932 0.00508332 -1 -1 -1
Year 1987 Obs  =  0.0780781 0.644645 0.222222 0.033033 0.022022 -1 -1 -1
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Year 1988 Obs  =  0.067 0.697 0.202 0.034 0 -1 -1 -1
Year 1988 Pred =  0.0573339 0.618228 0.278383 0.0425942 0.003461 -1 -1 -1
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Year 1990 Pred =  0.354471 0.529929 0.0659852 0.0416702 0.00794486 -1 -1 -1
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Year 1991 Pred =  0.237756 0.611592 0.136435 0.00882828 0.005388 -1 -1 -1
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Year 1992 Pred =  0.260259 0.543638 0.176912 0.018069 0.00112241 -1 -1 -1
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Year 1994 Pred =  0.296233 0.503293 0.173472 0.0235774 0.00342441 -1 -1 -1
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Year 1986 Pred =  -1 -1 0.627247 0.372753 -1 -1 -1 -1
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Year 1998 Pred =  -1 -1 0.728562 0.271438 -1 -1 -1 -1
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Year 1985 Pred =  -1 -1 0.832262 0.125621 0.0421177 -1 -1 -1
Year 1986 Obs  =  -1 -1 0.526 0.432 0.042 -1 -1 -1
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Year 1987 Obs  =  -1 -1 0.827 0.135 0.038 -1 -1 -1
Year 1987 Pred =  -1 -1 0.862806 0.0904114 0.0467827 -1 -1 -1
Year 1988 Obs  =  -1 -1 0.835 0.131 0.034 -1 -1 -1
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Year 1990 Pred =  -1 -1 0.504005 0.397427 0.0985677 -1 -1 -1
Year 1991 Obs  =  -1 -1 0.768 0.118 0.114 -1 -1 -1
Year 1991 Pred =  -1 -1 0.873407 0.0705682 0.0560243 -1 -1 -1
Year 1992 Obs  =  -1 -1 0.882118 0.0989011 0.018981 -1 -1 -1
Year 1992 Pred =  -1 -1 0.87886 0.112083 0.00905674 -1 -1 -1
Year 1993 Obs  =  -1 -1 0.82018 0.0819181 0.0979021 -1 -1 -1
Year 1993 Pred =  -1 -1 0.825177 0.155039 0.0197846 -1 -1 -1
Year 1994 Obs  =  -1 -1 0.88 0.07 0.05 -1 -1 -1
Year 1994 Pred =  -1 -1 0.832103 0.141217 0.0266805 -1 -1 -1
Year 1995 Obs  =  -1 -1 0.671 0.263 0.066 -1 -1 -1
Year 1995 Pred =  -1 -1 0.782124 0.185993 0.031883 -1 -1 -1
Year 1996 Obs  =  -1 -1 0.70971 0.229229 0.0610611 -1 -1 -1
Year 1996 Pred =  -1 -1 0.884729 0.100114 0.0151567 -1 -1 -1
Year 1997 Obs  =  -1 -1 0.845 0.095 0.06 -1 -1 -1
Year 1997 Pred =  -1 -1 0.784778 0.199588 0.015634 -1 -1 -1
Year 1998 Obs  =  -1 -1 0.48951 0.414585 0.0959041 -1 -1 -1
Year 1998 Pred =  -1 -1 0.55007 0.372939 0.0769909 -1 -1 -1
Year 1999 Obs  =  -1 -1 0.531 0.345 0.124 -1 -1 -1
Year 1999 Pred =  -1 -1 0.541382 0.293393 0.165225 -1 -1 -1
Year 2000 Obs  =  -1 -1 0.548 0.396 0.056 -1 -1 -1
Year 2000 Pred =  -1 -1 0.54869 0.30783 0.143481 -1 -1 -1
Year 2001 Obs  =  -1 -1 0.412412 0.442442 0.145145 -1 -1 -1
Year 2001 Pred =  -1 -1 0.474216 0.357088 0.168697 -1 -1 -1
Year 2002 Obs  =  -1 -1 0.644 0.237 0.119 -1 -1 -1
Year 2002 Pred =  -1 -1 0.556039 0.267344 0.176617 -1 -1 -1
Year 2003 Obs  =  -1 -1 0.618619 0.24024 0.141141 -1 -1 -1
Year 2003 Pred =  -1 -1 0.531276 0.327352 0.141372 -1 -1 -1
```

```
Year 2004 Obs  =  -1 -1 0.575576 0.288288 0.136136 -1 -1 -1
Year 2004 Pred =  -1 -1 0.500612 0.319902 0.179487 -1 -1 -1
Year 2005 Obs  =  -1 -1 0.59041 0.335664 0.0739261 -1 -1 -1
Year 2005 Pred =  -1 -1 0.398897 0.379761 0.221341 -1 -1 -1
Year 2006 Obs  =  -1 -1 0.73 0.138 0.132 -1 -1 -1
Year 2006 Pred =  -1 -1 0.551953 0.24001 0.208037 -1 -1 -1
 Index number 7
Year 1984 Obs  =  0 0.572 0.331 0.072 0.014 0.004 0.004 0.003
Year 1984 Pred =  0.0314468 0.662808 0.22131 0.0598425 0.0215495 0.0018583
0.000709992 0.0004758
Year 1985 Obs  =  0.201798 0.284715 0.442557 0.0629371 0.000999001 0.00699301
0 0
Year 1985 Pred =  0.0789427 0.385065 0.459214 0.0563022 0.0145179 0.00522029
0.000450148 0.000287241
Year 1986 Obs  =  0.1 0.681 0.173 0.042 0.003 0.001 0 0
Year 1986 Pred =  0.0782077 0.663848 0.173495 0.0728627 0.00850014 0.00218846
0.00078688 0.00011115
Year 1987 Obs  =  0.0539461 0.761239 0.158841 0.023976 0.001998 0 0 0
Year 1987 Pred =  0.0581372 0.644304 0.264646 0.022526 0.00896439 0.00104405
0.000268788 0.000110297
Year 1988 Obs  =  0.010989 0.622378 0.338661 0.025974 0.000999001 0.000999001
0 0
Year 1988 Pred =  0.0134865 0.559311 0.364006 0.0564897 0.0045921 0.00182487
0.000212526 7.71663e-05
Year 1989 Obs  =  0 0.207 0.679 0.107 0.007 0 0 0
Year 1989 Pred =  0.0799177 0.278257 0.52025 0.104445 0.0153151 0.0012428
0.000493855 7.83978e-05
Year 1990 Obs  =  0.037 0.775 0.126 0.048 0.008 0.006 0 0
Year 1990 Pred =  0.116354 0.669011 0.120399 0.0771179 0.0147098 0.00215355
0.00017475 8.04639e-05
Year 1991 Obs  =  0.028971 0.655345 0.26973 0.028971 0.00999001 0.003996
0.002997 0
Year 1991 Pred =  0.0692099 0.684722 0.220771 0.0144891 0.00884678 0.00168498
0.000246674 2.92329e-05
Year 1992 Obs  =  0.012987 0.558442 0.358641 0.044955 0.015984 0.00899101 0 0
Year 1992 Pred =  0.0754931 0.606495 0.285258 0.0295506 0.00183643 0.0011194
0.000213193 3.49092e-05
Year 1993 Obs  =  0.0759241 0.745255 0.136863 0.034965 0.002997 0.000999001
0.001998 0.000999001
Year 1993 Pred =  0.0699388 0.640385 0.247753 0.0378113 0.00371093
0.000230232 0.000140332 3.11029e-05
Year 1994 Obs  =  0.24 0.545 0.155 0.044 0.016 0 0 0
Year 1994 Pred =  0.088413 0.577722 0.287799 0.0396742 0.00576488 0.000564928
3.50475e-05 2.60969e-05
Year 1995 Obs  =  0.042957 0.709291 0.215784 0.021978 0.003996 0.001998 0
0.003996
Year 1995 Pred =  0.0832296 0.617211 0.244993 0.0473243 0.00623909
0.000905326 8.87136e-05 9.6018e-06
Year 1996 Obs  =  0.031031 0.405405 0.542543 0.019019 0.002002 0 0 0
Year 1996 Pred =  0.0399067 0.528381 0.39098 0.0359376 0.0041844 0.000526124
7.60901e-05 8.26124e-06
Year 1997 Obs  =  0.013013 0.272272 0.54955 0.149149 0.00800801 0.00600601
0.002002 0
Year 1997 Pred =  0.0387728 0.357718 0.494426 0.102141 0.00615329 0.000688777
8.63642e-05 1.38438e-05
Year 1998 Obs  =  0 0.156156 0.613614 0.187187 0.031031 0.012012 0 0
```

```
Year 1998 Pred =  0.0403492 0.352131 0.369547 0.203516 0.0323129 0.00190006
0.000212326 3.0887e-05
Year 1999 Obs  =  0.016 0.253 0.554 0.129 0.043 0.004 0.001 0
Year 1999 Pred =  0.0301303 0.363123 0.364974 0.160664 0.0695855 0.0108076
0.000634533 8.12135e-05
Year 2000 Obs  =  0.0588822 0.206587 0.45509 0.178643 0.0648703 0.0229541
0.00598802 0.00698603
Year 2000 Pred =  0.0397177 0.282075 0.398944 0.181805 0.0651723 0.027704
0.00429723 0.000284563
Year 2001 Obs  =  0.005 0.609 0.257 0.099 0.025 0.004 0.001 0
Year 2001 Pred =  0.043437 0.36689 0.302315 0.184913 0.0671853 0.0235903
0.0100135 0.00165591
Year 2002 Obs  =  0.0720721 0.504505 0.315315 0.0780781 0.02002 0.00500501
0.004004 0.001001
Year 2002 Pred =  0.0422777 0.354678 0.355351 0.138782 0.0705129 0.0251928
0.00883545 0.00437027
Year 2003 Obs  =  0 0.430569 0.388611 0.11988 0.025974 0.026973 0.004995
0.002997
Year 2003 Pred =  0.0279908 0.345997 0.348703 0.174525 0.0579672 0.0290265
0.0103601 0.00543023
Year 2004 Obs  =  0.131 0.197 0.386 0.225 0.041 0.012 0.008 0
Year 2004 Pred =  0.0443786 0.251335 0.375986 0.195162 0.0842145 0.0276028
0.0138091 0.00751163
Year 2005 Obs  =  0.028 0.454 0.309 0.147 0.036 0.013 0.005 0.008
Year 2005 Pred =  0.0208425 0.37453 0.256929 0.198688 0.0890633 0.0379315
0.0124214 0.00959386
Year 2006 Obs  =  0.074 0.165 0.45 0.175 0.073 0.033 0.016 0.014
Year 2006 Pred =  0.023707 0.201988 0.43923 0.155141 0.103422 0.0457485
0.0194661 0.0112973
 Index number 8
Year 1982 Obs  =  -1 -1 0.881 0.119 -1 -1 -1 -1
Year 1982 Pred =  -1 -1 0.947854 0.0521459 -1 -1 -1 -1
Year 1983 Obs  =  -1 -1 0.792 0.208 -1 -1 -1 -1
Year 1983 Pred =  -1 -1 0.811981 0.188019 -1 -1 -1 -1
Year 1984 Obs  =  -1 -1 0.831 0.169 -1 -1 -1 -1
Year 1984 Pred =  -1 -1 0.857461 0.142539 -1 -1 -1 -1
Year 1985 Obs  =  -1 -1 0.933 0.067 -1 -1 -1 -1
Year 1985 Pred =  -1 -1 0.929909 0.0700907 -1 -1 -1 -1
Year 1986 Obs  =  -1 -1 0.797 0.203 -1 -1 -1 -1
Year 1986 Pred =  -1 -1 0.794797 0.205203 -1 -1 -1 -1
Year 1987 Obs  =  -1 -1 0.949 0.051 -1 -1 -1 -1
Year 1987 Pred =  -1 -1 0.950275 0.0497253 -1 -1 -1 -1
Year 1988 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1988 Pred =  -1 -1 0.912905 0.0870954 -1 -1 -1 -1
Year 1989 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1989 Pred =  -1 -1 0.890139 0.109861 -1 -1 -1 -1
Year 1990 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1990 Pred =  -1 -1 0.717479 0.282521 -1 -1 -1 -1
Year 1991 Obs  =  -1 -1 0.889 0.111 -1 -1 -1 -1
Year 1991 Pred =  -1 -1 0.961218 0.0387822 -1 -1 -1 -1
Year 1992 Obs  =  -1 -1 0.788 0.212 -1 -1 -1 -1
Year 1992 Pred =  -1 -1 0.940128 0.0598721 -1 -1 -1 -1
Year 1993 Obs  =  -1 -1 0.759 0.241 -1 -1 -1 -1
Year 1993 Pred =  -1 -1 0.914224 0.0857758 -1 -1 -1 -1
Year 1994 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1994 Pred =  -1 -1 0.921873 0.0781265 -1 -1 -1 -1
Year 1995 Obs  =  -1 -1 1 0 -1 -1 -1 -1
```

```
Year 1995 Pred =  -1 -1 0.893853 0.106147 -1 -1 -1 -1
Year 1996 Obs  =  -1 -1 0.99 0.01 -1 -1 -1 -1
Year 1996 Pred =  -1 -1 0.946515 0.0534848 -1 -1 -1 -1
Year 1997 Obs  =  -1 -1 0.97 0.03 -1 -1 -1 -1
Year 1997 Pred =  -1 -1 0.887311 0.112689 -1 -1 -1 -1
Year 1998 Obs  =  -1 -1 0.8 0.2 -1 -1 -1 -1
Year 1998 Pred =  -1 -1 0.74707 0.25293 -1 -1 -1 -1
Year 1999 Obs  =  -1 -1 0.845 0.155 -1 -1 -1 -1
Year 1999 Pred =  -1 -1 0.787016 0.212984 -1 -1 -1 -1
Year 2000 Obs  =  -1 -1 0.734 0.266 -1 -1 -1 -1
Year 2000 Pred =  -1 -1 0.781154 0.218846 -1 -1 -1 -1
Year 2001 Obs  =  -1 -1 0.677 0.323 -1 -1 -1 -1
Year 2001 Pred =  -1 -1 0.726731 0.273269 -1 -1 -1 -1
Year 2002 Obs  =  -1 -1 0.775 0.225 -1 -1 -1 -1
Year 2002 Pred =  -1 -1 0.80639 0.19361 -1 -1 -1 -1
Year 2003 Obs  =  -1 -1 0.809 0.191 -1 -1 -1 -1
Year 2003 Pred =  -1 -1 0.764708 0.235292 -1 -1 -1 -1
Year 2004 Obs  =  -1 -1 0.625 0.375 -1 -1 -1 -1
Year 2004 Pred =  -1 -1 0.75809 0.24191 -1 -1 -1 -1
Year 2005 Obs  =  -1 -1 0.667 0.333 -1 -1 -1 -1
Year 2005 Pred =  -1 -1 0.677778 0.322222 -1 -1 -1 -1
Year 2006 Obs  =  -1 -1 0.72 0.28 -1 -1 -1 -1
Year 2006 Pred =  -1 -1 0.821597 0.178403 -1 -1 -1 -1
 Index number 9
Year 1990 Obs  =  0.07 0.59 0.14 0.17 0.03 0 0 0
Year 1990 Pred =  0.143929 0.554761 0.160515 0.114975 0.0221835 0.0032511
0.000263834 0.000121484
Year 1991 Obs  =  0 0.47 0.53 0 0 0 0 0
Year 1991 Pred =  0.0868601 0.576064 0.29862 0.0219166 0.0135361 0.0025808
0.000377853 4.4779e-05
Year 1992 Obs  =  0.03 0.44 0.38 0.12 0.03 0 0 0
Year 1992 Pred =  0.0910626 0.490415 0.370847 0.0429614 0.0027006 0.00164788
0.000313872 5.13953e-05
Year 1993 Obs  =  0.04 0.42 0.35 0.15 0 0 0.04 0
Year 1993 Pred =  0.0856223 0.52555 0.326898 0.0557916 0.00553867 0.000343986
0.000209687 4.6475e-05
Year 1994 Obs  =  0.237624 0.465347 0.237624 0 0.0594059 0 0 0
Year 1994 Pred =  0.105068 0.460234 0.368612 0.0568254 0.00835218 0.000819323
5.08345e-05 3.78524e-05
Year 1995 Obs  =  0.376238 0.247525 0.247525 0.128713 0 0 0 0
Year 1995 Pred =  0.100653 0.500366 0.319322 0.0689786 0.00919869 0.00133617
0.000130945 1.41727e-05
Year 1996 Obs  =  0.019802 0.425743 0.415842 0.138614 0 0 0 0
Year 1996 Pred =  0.0461533 0.409646 0.487345 0.050094 0.00589991 0.000742596
0.000107407 1.16615e-05
Year 1997 Obs  =  0.0505051 0.232323 0.525253 0.181818 0.010101 0 0 0
Year 1997 Pred =  0.0411157 0.254288 0.565076 0.130545 0.00795505 0.000891386
0.000111779 1.79178e-05
Year 1998 Obs  =  0 0.16 0.56 0.26 0.02 0 0 0
Year 1998 Pred =  0.0419437 0.24538 0.414024 0.254982 0.0409507 0.00241048
0.00026939 3.91884e-05
Year 1999 Obs  =  0.03 0.29 0.41 0.19 0.06 0.02 0 0
Year 1999 Pred =  0.0314039 0.25371 0.409983 0.201825 0.0884204 0.0137472
0.000807198 0.000103314
Year 2000 Obs  =  0.03 0.24 0.47 0.19 0.05 0.02 0 0
Year 2000 Pred =  0.039847 0.189706 0.431369 0.219835 0.079713 0.0339204
0.00526195 0.00034845
```

Year 2001 Obs = 0.01 0.43 0.29 0.15 0.06 0.04 0.02 0
Year 2001 Pred = 0.0451052 0.255391 0.338338 0.231427 0.085054 0.0298956
0.0126911 0.00209871
Year 2002 Obs = 0.0505051 0.40404 0.313131 0.151515 0.0505051 0.020202 0
0.010101
Year 2002 Pred = 0.0438966 0.246864 0.397651 0.173673 0.0892572 0.0319229
0.0111968 0.00553833
Year 2003 Obs = 0.010101 0.393939 0.383838 0.121212 0.0606061 0.020202
0.010101 0
Year 2003 Pred = 0.0288129 0.238753 0.386859 0.216526 0.072746 0.0364648
0.0130161 0.00682246
Year 2004 Obs = 0.049505 0.247525 0.405941 0.207921 0.0594059 0.019802
0.00990099 0
Year 2004 Pred = 0.0436932 0.165881 0.398967 0.231588 0.101084 0.0331665
0.0165941 0.00902661
Year 2005 Obs = 0.02 0.22 0.39 0.21 0.07 0.06 0.01 0.02
Year 2005 Pred = 0.0214864 0.258824 0.285464 0.246868 0.111935 0.0477221
0.015629 0.0120714
Year 2006 Obs = 0 0.178218 0.356436 0.217822 0.168317 0.049505 0.019802
0.00990099
Year 2006 Pred = 0.0228183 0.130327 0.455641 0.179975 0.12136 0.053739
0.0228681 0.0132718
 Index number 10
Year 1988 Obs = 0.04 0.72 0.24 0 0 0 0 0
Year 1988 Pred = 0.10567 0.551345 0.289759 0.0474307 0.00395567 0.00158734
0.000185532 6.74548e-05
Year 1989 Obs = 0.59 0.3 0.11 0 0 0 0 0
Year 1989 Pred = 0.441879 0.193564 0.292246 0.061885 0.00930973 0.000762868
0.000304239 4.83613e-05
Year 1990 Obs = 0.45 0.5 0.04 0.01 0 0 0 0
Year 1990 Pred = 0.521992 0.377602 0.0548761 0.0370746 0.00725516 0.00107257
8.73483e-05 4.02734e-05
Year 1991 Obs = 0.25 0.68 0.07 0 0 0 0 0
Year 1991 Pred = 0.383375 0.477187 0.124244 0.00860076 0.00538763 0.00103619
0.000152242 1.8066e-05
Year 1992 Obs = 0.232323 0.636364 0.121212 0.010101 0 0 0 0
Year 1992 Pred = 0.409624 0.414023 0.157251 0.0171824 0.00109549 0.000674296
0.000128886 2.11326e-05
Year 1993 Obs = 0.30303 0.676768 0.020202 0 0 0 0 0
Year 1993 Pred = 0.388157 0.447146 0.139696 0.0224879 0.00226428 0.000141854
8.67762e-05 1.92586e-05
Year 1994 Obs = 0.584158 0.376238 0.029703 0 0.00990099 0 0 0
Year 1994 Pred = 0.452725 0.372182 0.149722 0.0217703 0.00324537 0.000321142
1.99954e-05 1.49087e-05
Year 1995 Obs = 0.59 0.35 0.03 0.01 0.02 0 0 0
Year 1995 Pred = 0.434301 0.405195 0.12988 0.0264628 0.00357924 0.00052445
5.15772e-05 5.58983e-06
Year 1996 Obs = 0.168317 0.524752 0.277228 0.019802 0.00990099 0 0 0
Year 1996 Pred = 0.265189 0.441749 0.263962 0.0255916 0.00305704 0.000388137
5.6337e-05 6.12476e-06
Year 1997 Obs = 0.10101 0.505051 0.323232 0.0606061 0.010101 0 0 0
Year 1997 Pred = 0.266079 0.308847 0.344716 0.075114 0.00464246 0.000524746
6.60348e-05 1.05992e-05
Year 1998 Obs = 0.0707071 0.616162 0.282828 0.030303 0 0 0 0
Year 1998 Pred = 0.273007 0.299752 0.254031 0.147563 0.0240365 0.00142722
0.000160065 2.33157e-05
Year 1999 Obs = 0.09 0.53 0.3 0.06 0.01 0.01 0 0

```
Year 1999 Pred =  0.2167 0.328569 0.266682 0.123826 0.0550212 0.00862921
0.000508468 6.51653e-05
Year 2000 Obs  =  0.128713 0.524752 0.247525 0.0594059 0.019802 0.00990099
0.00990099 0
Year 2000 Pred =  0.272094 0.243119 0.277666 0.133468 0.0490856 0.0210699
0.00328003 0.000217493
Year 2001 Obs  =  0.11 0.58 0.21 0.07 0.02 0.01 0 0
Year 2001 Pred =  0.286844 0.304817 0.202825 0.130855 0.0487771 0.0172944
0.0073676 0.00121998
Year 2002 Obs  =  0.09 0.54 0.25 0.08 0.03 0.01 0 0
Year 2002 Pred =  0.282048 0.29769 0.24085 0.0992163 0.0517175 0.0186584
0.00656743 0.00325277
Year 2003 Obs  =  0.0594059 0.564356 0.257426 0.0594059 0.019802 0.019802
0.00990099 0.00990099
Year 2003 Pred =  0.204304 0.317726 0.258579 0.136508 0.0465158 0.0235203
0.00842519 0.00442194
Year 2004 Obs  =  0.0808081 0.59596 0.232323 0.0505051 0.020202 0.010101
0.010101 0
Year 2004 Pred =  0.29623 0.21107 0.254979 0.139602 0.0618014 0.0204548
0.0102701 0.005594
Year 2005 Obs  =  0.277228 0.534653 0.108911 0.049505 0.019802 0.00990099 0 0
Year 2005 Pred =  0.15812 0.357473 0.198029 0.161528 0.0742837 0.0319465
0.0104994 0.00812017
Year 2006 Obs  =  0.0792079 0.534653 0.29703 0.049505 0.019802 0.00990099
0.00990099 0
Year 2006 Pred =  0.182016 0.195109 0.342611 0.127644 0.0872978 0.0389939
0.016652 0.00967701
 Index number 11
 N/A
 Index number 12
 N/A
 Index number 13
 N/A

Index Selectivity at Age
 0.0612985 0.308279 0.752582 0.95406 0.993013 0.998989 0.999871 1
 0.0384494 0.319544 0.846508 0.984796 0.998688 0.999889 0.999991 1
 0.340174 0.99113 0.999959 1 1 1 1 1
 0 0 0.696733 0.999999 0 0 0 0
 0 0 0.999999 0.68619 0 0 0 0
 0 0 0.615634 0.768747 1 0 0 0
 0.0603079 0.675801 0.985445 0.999545 0.999986 1 1 1
 0 0 1 0.623561 0 0 0 0
 0.0494111 0.37117 0.870175 0.987033 0.998845 0.999899 0.999992 1
 0.540556 0.762086 0.897378 0.960081 0.98541 0.995068 0.998669 1
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0

Deviations section: only applicable if associated lambda > 0
Nyear1 observed, expected, standardized residual
2  41325.1  26197.7  0.591731
3  23229.6  12015.3  0.855858
4  2049.47  3640.42  -0.745861
5  783.58  1079.1  -0.415446
6  252.807  319.652  -0.304574
7  224.667  94.6859  1.12174
```

```
8  47.6525  39.8523  0.232067

Fleet Obs, Initial, and Stadardized Residual for Fmult
1  1.01667  1  0.0214614

Standardized Residuals for Fmult_devs by fleet and year
N/A

Index Obs, Initial, and Standardized Residual for q_year1
N/A

Standardized Residuals for catchability deviations by index and year
 index 1 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 2 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 3 q_devs standardized residuals
2  0
3  0
4  0
5  0
```

```
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 4 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 5 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
```

```
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 6 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 7 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
```

```
22  0
23  0
 index 8 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 9 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 10 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
```

```
14  0
15  0
16  0
17  0
18  0
19  0
 index 11 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
 index 12 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 13 q_devs standardized residuals
2  0
3  0
4  0
5  0
```

```
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0

Obs, Initial, and Stadardized Residual for SRR steepness
N/A

Obs, Initial, and Stadardized Residual for SRR unexpl S
N/A

End of Deviations Section

Selectivity by age and year for each fleet
 fleet 1 selectivity at age
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0383937 0.569993 0.977781 0.999316 0.999979 0.999999 1 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
 0.0119196 0.149396 0.718876 0.973843 0.998159 0.999874 0.999992 1
```

```
Fmult by year for each fleet
1982   1.01667
1983   1.44772
1984   1.56668
1985   1.66922
1986   1.86084
1987   1.49672
1988   1.994
1989   1.73682
1990   1.58354
1991   1.89415
1992   1.86993
1993   1.6404
1994   1.43306
1995   1.93142
1996   1.60304
1997   0.978431
1998   0.888182
1999   0.751541
2000   0.834523
2001   0.673641
2002   0.581336
2003   0.527712
2004   0.521252
2005   0.52825
2006   0.428633

Directed F by age and year for each fleet
 fleet 1 directed F at age
 0.0390337 0.579494 0.99408 1.01597 1.01665 1.01667 1.01667 1.01667
 0.0555832 0.825188 1.41555 1.44673 1.44769 1.44772 1.44772 1.44772
 0.0601505 0.892994 1.53187 1.5656 1.56664 1.56668 1.56668 1.56668
 0.0640874 0.951441 1.63213 1.66807 1.66918 1.66922 1.66922 1.66922
 0.0714446 1.06067 1.8195 1.85957 1.8608 1.86084 1.86084 1.86084
 0.0574648 0.853122 1.46347 1.4957 1.49669 1.49672 1.49672 1.49672
 0.076557 1.13656 1.94969 1.99263 1.99396 1.994 1.994 1.994
 0.066683 0.989975 1.69823 1.73563 1.73679 1.73682 1.73682 1.73682
 0.0607982 0.902609 1.54836 1.58246 1.58351 1.58354 1.58354 1.58354
 0.0727236 1.07965 1.85207 1.89286 1.89411 1.89415 1.89415 1.89415
 0.0717935 1.06584 1.82838 1.86865 1.86989 1.86993 1.86993 1.86993
 0.0629812 0.935019 1.60396 1.63928 1.64037 1.6404 1.6404 1.6404
 0.0550206 0.816835 1.40122 1.43208 1.43303 1.43306 1.43306 1.43306
 0.0230218 0.288547 1.38845 1.8809 1.92786 1.93118 1.9314 1.93142
 0.0191077 0.239489 1.15239 1.56111 1.60009 1.60284 1.60303 1.60304
 0.0116625 0.146174 0.703371 0.952839 0.97663 0.978308 0.978423 0.978431
 0.0105868 0.132691 0.638492 0.86495 0.886547 0.88807 0.888174 0.888182
 0.00895809 0.112278 0.540265 0.731883 0.750157 0.751446 0.751535 0.751541
 0.00994721 0.124675 0.599919 0.812695 0.832987 0.834418 0.834517 0.834523
 0.00802956 0.10064 0.484265 0.656021 0.672401 0.673556 0.673636 0.673641
 0.00692931 0.0868496 0.417909 0.56613 0.580266 0.581263 0.581331 0.581336
 0.00629014 0.0788384 0.37936 0.513909 0.526741 0.527646 0.527708 0.527712
 0.00621313 0.0778732 0.374716 0.507618 0.520292 0.521186 0.521248 0.521252
 0.00629654 0.0789186 0.379746 0.514432 0.527277 0.528183 0.528245 0.52825
 0.00510914 0.0640362 0.308134 0.417421 0.427844 0.428579 0.428629 0.428633
Discard F by age and year for each fleet
 fleet 1 Discard F at age
 0 0 0 0 0 0 0 0
```

```
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
Total F
 0.0390337 0.579494 0.99408 1.01597 1.01665 1.01667 1.01667 1.01667
 0.0555832 0.825188 1.41555 1.44673 1.44769 1.44772 1.44772 1.44772
 0.0601505 0.892994 1.53187 1.5656 1.56664 1.56668 1.56668 1.56668
 0.0640874 0.951441 1.63213 1.66807 1.66918 1.66922 1.66922 1.66922
 0.0714446 1.06067 1.8195 1.85957 1.8608 1.86084 1.86084 1.86084
 0.0574648 0.853122 1.46347 1.4957 1.49669 1.49672 1.49672 1.49672
 0.076557 1.13656 1.94969 1.99263 1.99396 1.994 1.994 1.994
 0.066683 0.989975 1.69823 1.73563 1.73679 1.73682 1.73682 1.73682
 0.0607982 0.902609 1.54836 1.58246 1.58351 1.58354 1.58354 1.58354
 0.0727236 1.07965 1.85207 1.89286 1.89411 1.89415 1.89415 1.89415
 0.0717935 1.06584 1.82838 1.86865 1.86989 1.86993 1.86993 1.86993
 0.0629812 0.935019 1.60396 1.63928 1.64037 1.6404 1.6404 1.6404
 0.0550206 0.816835 1.40122 1.43208 1.43303 1.43306 1.43306 1.43306
 0.0230218 0.288547 1.38845 1.8809 1.92786 1.93118 1.9314 1.93142
 0.0191077 0.239489 1.15239 1.56111 1.60009 1.60284 1.60303 1.60304
 0.0116625 0.146174 0.703371 0.952839 0.97663 0.978308 0.978423 0.978431
 0.0105868 0.132691 0.638492 0.86495 0.886547 0.88807 0.888174 0.888182
 0.00895809 0.112278 0.540265 0.731883 0.750157 0.751446 0.751535 0.751541
 0.00994721 0.124675 0.599919 0.812695 0.832987 0.834418 0.834517 0.834523
 0.00802956 0.10064 0.484265 0.656021 0.672401 0.673556 0.673636 0.673641
 0.00692931 0.0868496 0.417909 0.56613 0.580266 0.581263 0.581331 0.581336
 0.00629014 0.0788384 0.37936 0.513909 0.526741 0.527646 0.527708 0.527712
 0.00621313 0.0778732 0.374716 0.507618 0.520292 0.521186 0.521248 0.521252
 0.00629654 0.0789186 0.379746 0.514432 0.527277 0.528183 0.528245 0.52825
 0.00510914 0.0640362 0.308134 0.417421 0.427844 0.428579 0.428629 0.428633

Average F for ages 3 to 5
Freport unweighted in .std and MCMC files
year    unweighted   Nweighted    Bweighted
1982  1.0089  0.99648  1.00094
1983  1.43665  1.42453  1.42766
1984  1.5547  1.54092  1.54575
```

```
1985  1.65646  1.6369  1.64029
1986  1.84662  1.83221  1.83712
1987  1.48529  1.46688  1.46951
1988  1.97876  1.9558  1.9592
1989  1.72355  1.70518  1.7078
1990  1.57144  1.56307  1.56709
1991  1.87968  1.85596  1.85952
1992  1.85564  1.83233  1.83471
1993  1.62787  1.60898  1.61237
1994  1.42211  1.40539  1.40842
1995  1.73241  1.47674  1.51053
1996  1.43786  1.19031  1.21094
1997  0.877613  0.747913  0.757708
1998  0.796663  0.727086  0.74853
1999  0.674102  0.615854  0.63962
2000  0.748534  0.682587  0.710033
2001  0.604229  0.563724  0.580894
2002  0.521435  0.474103  0.489852
2003  0.473337  0.43399  0.449618
2004  0.467542  0.43252  0.448102
2005  0.473818  0.452504  0.466889
2006  0.384466  0.349794  0.364892

Population Numbers at the Start of the Year
 50033.9 41325.1 23229.6 2049.47 783.58 252.807 224.667 47.6525
 79692.8 39396.1 18953.3 7038.16 607.506 232.113 74.8854 80.6651
 32813.6 61719.3 14132.5 3767.55 1356.11 116.942 44.6793 29.9418
 58115.9 25297.2 20689 2500.81 644.565 231.767 19.9854 12.7527
 58915.4 44627.6 7998.48 3311.74 386.176 99.4241 35.7488 5.04967
 45409.9 44909.9 12650.4 1061.58 422.277 49.1802 12.6614 5.19556
 9484.77 35102.2 15666.7 2397 194.768 77.3985 9.0139 3.27287
 23150.6 7193.16 9223 1825.48 267.558 21.7118 8.62764 1.36961
 34556.9 17731.4 2188.37 1381.91 263.477 38.573 3.13 1.44122
 30155.8 26623.9 5886.88 380.905 232.47 44.2764 6.48187 0.768155
 32022.3 22957.7 7405 756.281 46.9785 28.6355 5.45373 0.893017
 29863.2 24401.4 6474.08 974.117 95.5611 5.92869 3.61366 0.800927
 39370.1 22957.5 7843 1065.93 154.818 15.1711 0.941199 0.700831
 46100.1 30507.9 8304.6 1581.54 208.413 30.2415 2.96339 0.320738
 31216.8 36884.6 18717.1 1696.15 197.404 24.8202 3.58959 0.389728
 30455.2 25074.4 23767.2 4840.66 291.489 32.6278 4.09113 0.655788
 31645.6 24645.5 17737.4 9630.49 1528.39 89.8708 10.0428 1.46093
 23837 25636.4 17670.6 7668.97 3320.07 515.647 30.2744 3.87481
 30518.7 19342 18760.1 8428.66 3020.13 1283.8 199.134 13.1866
 32821.4 24739.3 13979.7 8430.16 3061.62 1074.99 456.306 75.4582
 35606.7 26657 18315.6 7052.21 3581.54 1279.59 448.77 221.975
 26245.3 28951 20009.4 9873.4 3277.93 1641.36 585.833 307.064
 42249.9 21353.1 21906.2 11210.4 4835.26 1584.82 792.853 431.282
 21437.6 34377.1 16172.7 12330.2 5524.67 2352.88 770.5 595.106
 22939.2 17441.5 26009.7 9057.35 6035.26 2669.65 1135.94 659.252

q by index
 index 1 q over time
1992  0.000560461
1993  0.000560461
1994  0.000560461
1995  0.000560461
1996  0.000560461
```

```
1997  0.000560461
1998  0.000560461
1999  0.000560461
2000  0.000560461
2001  0.000560461
2002  0.000560461
2003  0.000560461
2004  0.000560461
2005  0.000560461
2006  0.000560461
 index 2 q over time
1982  5.29284e-05
1983  5.29284e-05
1984  5.29284e-05
1985  5.29284e-05
1986  5.29284e-05
1987  5.29284e-05
1988  5.29284e-05
1989  5.29284e-05
1990  5.29284e-05
1991  5.29284e-05
1992  5.29284e-05
1993  5.29284e-05
1994  5.29284e-05
1995  5.29284e-05
1996  5.29284e-05
1997  5.29284e-05
1998  5.29284e-05
1999  5.29284e-05
2000  5.29284e-05
2001  5.29284e-05
2002  5.29284e-05
2003  5.29284e-05
2004  5.29284e-05
2005  5.29284e-05
2006  5.29284e-05
 index 3 q over time
1982  3.37882e-05
1983  3.37882e-05
1984  3.37882e-05
1985  3.37882e-05
1986  3.37882e-05
1987  3.37882e-05
1988  3.37882e-05
1989  3.37882e-05
1990  3.37882e-05
1991  3.37882e-05
1992  3.37882e-05
1993  3.37882e-05
1994  3.37882e-05
1995  3.37882e-05
1996  3.37882e-05
1997  3.37882e-05
1998  3.37882e-05
1999  3.37882e-05
2000  3.37882e-05
2001  3.37882e-05
```

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2002  3.37882e-05
2003  3.37882e-05
2004  3.37882e-05
2005  3.37882e-05
2006  3.37882e-05
 index 4 q over time
1982  6.83234e-05
1983  6.83234e-05
1984  6.83234e-05
1985  6.83234e-05
1986  6.83234e-05
1987  6.83234e-05
1988  6.83234e-05
1989  6.83234e-05
1990  6.83234e-05
1991  6.83234e-05
1992  6.83234e-05
1993  6.83234e-05
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1997  6.83234e-05
1998  6.83234e-05
1999  6.83234e-05
2000  6.83234e-05
2001  6.83234e-05
2002  6.83234e-05
2003  6.83234e-05
2004  6.83234e-05
2005  6.83234e-05
2006  6.83234e-05
 index 5 q over time
1982  4.68664e-05
1983  4.68664e-05
1984  4.68664e-05
1985  4.68664e-05
1986  4.68664e-05
1987  4.68664e-05
1988  4.68664e-05
1989  4.68664e-05
1990  4.68664e-05
1991  4.68664e-05
1992  4.68664e-05
1993  4.68664e-05
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1996  4.68664e-05
1997  4.68664e-05
1998  4.68664e-05
1999  4.68664e-05
2000  4.68664e-05
2001  4.68664e-05
2002  4.68664e-05
2003  4.68664e-05
2004  4.68664e-05
2005  4.68664e-05
2006  4.68664e-05
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 index 6 q over time
1984  3.23216e-05
1985  3.23216e-05
1986  3.23216e-05
1987  3.23216e-05
1988  3.23216e-05
1989  3.23216e-05
1990  3.23216e-05
1991  3.23216e-05
1992  3.23216e-05
1993  3.23216e-05
1994  3.23216e-05
1995  3.23216e-05
1996  3.23216e-05
1997  3.23216e-05
1998  3.23216e-05
1999  3.23216e-05
2000  3.23216e-05
2001  3.23216e-05
2002  3.23216e-05
2003  3.23216e-05
2004  3.23216e-05
2005  3.23216e-05
2006  3.23216e-05
 index 7 q over time
1984  3.62562e-05
1985  3.62562e-05
1986  3.62562e-05
1987  3.62562e-05
1988  3.62562e-05
1989  3.62562e-05
1990  3.62562e-05
1991  3.62562e-05
1992  3.62562e-05
1993  3.62562e-05
1994  3.62562e-05
1995  3.62562e-05
1996  3.62562e-05
1997  3.62562e-05
1998  3.62562e-05
1999  3.62562e-05
2000  3.62562e-05
2001  3.62562e-05
2002  3.62562e-05
2003  3.62562e-05
2004  3.62562e-05
2005  3.62562e-05
2006  3.62562e-05
 index 8 q over time
1982  3.37891e-05
1983  3.37891e-05
1984  3.37891e-05
1985  3.37891e-05
1986  3.37891e-05
1987  3.37891e-05
1988  3.37891e-05
1989  3.37891e-05
```

```
1990  3.37891e-05
1991  3.37891e-05
1992  3.37891e-05
1993  3.37891e-05
1994  3.37891e-05
1995  3.37891e-05
1996  3.37891e-05
1997  3.37891e-05
1998  3.37891e-05
1999  3.37891e-05
2000  3.37891e-05
2001  3.37891e-05
2002  3.37891e-05
2003  3.37891e-05
2004  3.37891e-05
2005  3.37891e-05
2006  3.37891e-05
 index 9 q over time
1990  2.31569e-05
1991  2.31569e-05
1992  2.31569e-05
1993  2.31569e-05
1994  2.31569e-05
1995  2.31569e-05
1996  2.31569e-05
1997  2.31569e-05
1998  2.31569e-05
1999  2.31569e-05
2000  2.31569e-05
2001  2.31569e-05
2002  2.31569e-05
2003  2.31569e-05
2004  2.31569e-05
2005  2.31569e-05
2006  2.31569e-05
 index 10 q over time
1988  0.000128544
1989  0.000128544
1990  0.000128544
1991  0.000128544
1992  0.000128544
1993  0.000128544
1994  0.000128544
1995  0.000128544
1996  0.000128544
1997  0.000128544
1998  0.000128544
1999  0.000128544
2000  0.000128544
2001  0.000128544
2002  0.000128544
2003  0.000128544
2004  0.000128544
2005  0.000128544
2006  0.000128544
 index 11 q over time
1986  5.45856e-06
```

```
1987  5.45856e-06
1988  5.45856e-06
1989  5.45856e-06
1990  5.45856e-06
1991  5.45856e-06
1992  5.45856e-06
1993  5.45856e-06
1994  5.45856e-06
1995  5.45856e-06
1996  5.45856e-06
1997  5.45856e-06
1998  5.45856e-06
1999  5.45856e-06
2000  5.45856e-06
2001  5.45856e-06
2002  5.45856e-06
2003  5.45856e-06
2004  5.45856e-06
2005  5.45856e-06
2006  5.45856e-06
 index 12 q over time
1982  0.000242921
1983  0.000242921
1984  0.000242921
1985  0.000242921
1986  0.000242921
1987  0.000242921
1988  0.000242921
1989  0.000242921
1990  0.000242921
1991  0.000242921
1992  0.000242921
1993  0.000242921
1994  0.000242921
1995  0.000242921
1996  0.000242921
1997  0.000242921
1998  0.000242921
1999  0.000242921
2000  0.000242921
2001  0.000242921
2002  0.000242921
2003  0.000242921
2004  0.000242921
2005  0.000242921
2006  0.000242921
 index 13 q over time
1982  2.86838e-05
1983  2.86838e-05
1984  2.86838e-05
1985  2.86838e-05
1986  2.86838e-05
1987  2.86838e-05
1988  2.86838e-05
1989  2.86838e-05
1990  2.86838e-05
1991  2.86838e-05
```

```
1992  2.86838e-05
1993  2.86838e-05
1994  2.86838e-05
1995  2.86838e-05
1996  2.86838e-05
1997  2.86838e-05
1998  2.86838e-05
1999  2.86838e-05
2000  2.86838e-05
2001  2.86838e-05
2002  2.86838e-05
2003  2.86838e-05
2004  2.86838e-05
2005  2.86838e-05
2006  2.86838e-05

Proportions of catch at age by fleet
 fleet 1
Year 1 Obs  =  0.146845 0.533716 0.27888 0.0256925 0.00901297 0.00318751
0.00184106 0.000824357
Year 1 Pred =  0.0513598 0.491732 0.398533 0.0356207 0.0136243 0.00439569
0.0039064 0.00082856
Year 2 Obs  =  0.103612 0.598342 0.229546 0.0458839 0.0145793 0.00679528
0.000336608 0.000904635
Year 2 Pred =  0.0903823 0.4702 0.307665 0.115427 0.00996629 0.00380791
0.00122853 0.00132334
Year 3 Obs  =  0.0942382 0.521666 0.303281 0.0624068 0.0162689 0.00186435
7.84991e-05 0.000196248
Year 3 Pred =  0.0351405 0.677824 0.208033 0.0559939 0.0201605 0.00173852
0.000664228 0.000445131
Year 4 Obs  =  0.0558107 0.392743 0.482878 0.0474579 0.0133215 0.00676819
0.000805737 0.000214863
Year 4 Pred =  0.0918882 0.401264 0.434567 0.0530069 0.0136659 0.0049139
0.000423727 0.000270382
Year 5 Obs  =  0.0563748 0.497562 0.320918 0.109789 0.00917325 0.0040641
0.0016837 0.000435439
Year 5 Pred =  0.0924713 0.674898 0.156781 0.0654444 0.00763323 0.00196525
0.000706623 9.98135e-05
Year 6 Obs  =  0.0361216 0.546812 0.344315 0.0523557 0.0172825 0.000794231
0.000921308 0.00139785
Year 6 Pred =  0.0636797 0.655715 0.249685 0.021163 0.00842079 0.000980731
0.000252487 0.000103608
Year 7 Obs  =  0.0204602 0.529056 0.374768 0.0549979 0.016574 0.00311406
0.000488985 0.000540457
Year 7 Pred =  0.0169801 0.589054 0.336018 0.0517995 0.00420993 0.00167299
0.000194837 7.07438e-05
Year 8 Obs  =  0.063287 0.315776 0.48164 0.111543 0.0232711 0.00362582
0.000593315 0.000263696
Year 8 Pred =  0.0956689 0.293961 0.495269 0.0988857 0.0144974 0.00117644
0.000467484 7.42115e-05
Year 9 Obs  =  0.131557 0.624327 0.155018 0.0705274 0.0156649 0.00212645
0.000567054 0.000212645
Year 9 Pred =  0.12849 0.67366 0.111213 0.0709001 0.0135217 0.0019796
0.000160635 7.39647e-05
Year 10 Obs  =  0.0470108 0.570563 0.335697 0.0348471 0.0101911 0.00150284
0.000140891 4.69638e-05
```

Year 10 Pred = 0.0824055 0.696157 0.198802 0.0129663 0.00791536 0.00150757
0.000220702 2.6155e-05
Year 11 Obs = 0.0686058 0.561535 0.302207 0.0564193 0.00757272 0.00351053
0.000100301 5.01505e-05
Year 11 Pred = 0.0900669 0.620978 0.259357 0.0267036 0.00165917 0.00101135
0.000192614 3.15395e-05
Year 12 Obs = 0.0682494 0.596718 0.297482 0.0300616 0.0038772 0.00239006
0.00106225 0.000159337
Year 12 Pred = 0.079083 0.652267 0.229935 0.0349171 0.00342633 0.000212574
0.000129568 2.87174e-05
Year 13 Obs = 0.0809769 0.51226 0.345857 0.0485466 0.0101345 0.00128535
0.00069211 0.000247182
Year 13 Pred = 0.0954296 0.587489 0.273478 0.0375545 0.00545618 0.000534675
3.31706e-05 2.46993e-05
Year 14 Obs = 0.0383395 0.377437 0.472962 0.0802409 0.0257108 0.00498672
0.000259051 6.47626e-05
Year 14 Pred = 0.0628503 0.460095 0.381638 0.0826585 0.0109896 0.0015956
0.000156361 1.69236e-05
Year 15 Obs = 0.00868307 0.371174 0.497293 0.0956745 0.0223509 0.00380554
0.000857587 0.000160798
Year 15 Pred = 0.0256037 0.341667 0.56519 0.0595162 0.00700105 0.000880909
0.000127407 1.38328e-05
Year 16 Obs = 0.00206925 0.175541 0.554973 0.217202 0.0381432 0.011036
0.000758725 0.0002759
Year 16 Pred = 0.0184486 0.178549 0.634345 0.157775 0.00964452 0.00108068
0.000135514 2.17223e-05
Year 17 Obs = 0.00299222 0.148481 0.42423 0.348627 0.0651639 0.00917614
0.00126338 6.64938e-05
Year 17 Pred = 0.0180279 0.166009 0.457522 0.305855 0.0493113 0.00290272
0.000324395 4.71899e-05
Year 18 Obs = 0.0127178 0.153527 0.439854 0.282322 0.0815767 0.0251546
0.00386453 0.000983699
Year 18 Pred = 0.0129023 0.165534 0.451615 0.244462 0.107641 0.0167375
0.000982765 0.000125784
Year 19 Obs = 0.00135811 0.0949441 0.49182 0.288289 0.0943885 0.0228409
0.00456818 0.00179023
Year 19 Pred = 0.0163637 0.123053 0.462971 0.25739 0.0937349 0.0398898
0.00618787 0.000409764
Year 20 Obs = 0.000832829 0.218655 0.360388 0.282935 0.0978952 0.0274833
0.00931254 0.00249849
Year 20 Pred = 0.0181602 0.164124 0.374195 0.283605 0.104831 0.0368531
0.0156445 0.00258711
Year 21 Obs = 0.0218685 0.0912526 0.435038 0.308651 0.104679 0.0256472
0.0108538 0.00200997
Year 21 Pred = 0.0171921 0.155254 0.440431 0.215136 0.111299 0.0398153
0.013965 0.00690753
Year 22 Obs = 0.019559 0.119544 0.372829 0.30222 0.119242 0.0425162
0.0175955 0.00649449
Year 22 Pred = 0.0108833 0.145323 0.420349 0.264599 0.0895318 0.0448906
0.0160237 0.00839888
Year 23 Obs = 0.00730276 0.0718673 0.386841 0.319956 0.130153 0.0524843
0.020748 0.010647
Year 23 Pred = 0.0159763 0.0977808 0.420512 0.274708 0.120769 0.0396359
0.0198308 0.0107873
Year 24 Obs = 0.0172803 0.13655 0.262167 0.285301 0.155593 0.0739879
0.0359712 0.03315

```
Year 24 Pred =  0.00805196 0.156292 0.30768 0.299232 0.136646 0.0582727
0.0190843 0.0147401
Year 25 Obs  =  0.0148916 0.0835802 0.395291 0.255419 0.140028 0.067753
0.0290036 0.014034
Year 25 Pred =  0.00783156 0.0725494 0.464405 0.208487 0.141728 0.0627791
0.0267152 0.0155045

Proportions of Discards at age by fleet
 fleet 1
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
```

```
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15

F Reference Points Using Final Year Selectivity and Freport options
 refpt           F       slope to plot on SRR
  F0.1     0.150496     0.314039
  Fmax     0.280941     0.506466
  F30%SPR  0.23454     0.436015
  F40%SPR  0.159777     0.327007
  Fmsy     0.280937     0.506459    SSBmsy    65694.7     MSY   16712.6
  Fcurrent 0.384466     0.666036

Stock-Recruitment Relationship Parameters
 alpha     = 33271.7
 beta      = 0.0171332
 unexpl    = 269444
 steepness = 1
Spawning Stock, Obs Recruits(year+1), Pred Recruits(year+1), standardized
residual
init  xxxx  50033.9  33271.7  0.863699
1982  23028.1  79692.8  33271.7  1.84909
1983  20985.5  32813.6  33271.7  -0.0293473
1984  17756.9  58115.9  33271.7  1.18068
1985  14902.8  58915.4  33271.7  1.20961
1986  15047.3  45409.9  33271.7  0.658417
1987  15983.6  9484.77  33271.7  -2.6568
1988  9224.05  23150.6  33271.6  -0.767785
1989  5408.63  34556.9  33271.6  0.0802391
1990  7480.19  30155.8  33271.6  -0.208157
1991  7347.33  32022.3  33271.6  -0.0810195
1992  8459.78  29863.2  33271.6  -0.228796
1993  9320.08  39370.1  33271.6  0.356284
1994  12162.4  46100.1  33271.7  0.690353
1995  18524.2  31216.8  33271.7  -0.134955
1996  20952.1  30455.2  33271.7  -0.187244
1997  21391.5  31645.6  33271.7  -0.106076
1998  23275  23837  33271.7  -0.70593
1999  23246.8  30518.7  33271.7  -0.182834
2000  24171.5  32821.4  33271.7  -0.028848
2001  28086.2  35606.7  33271.7  0.143588
2002  32456.5  26245.3  33271.7  -0.502181
2003  36786.4  42249.9  33271.7  0.505727
2004  37365.9  21437.6  33271.7  -0.930519
2005  37693.1  22939.2  33271.7  -0.7872
2006  39173.3       xxxx   33271.7

Root Mean Square Error computed from Standardized Residuals
Component                 #resids         RMSE
_Catch_Fleet_1               25           0.478577
Catch_Fleet_Total            25           0.478577
_Discard_Fleet_1             0            0
Discard_Fleet_Total          0            0
_Index_1                     15           2.9409
_Index_2                     25           2.08431
_Index_3                     25           1.39818
_Index_4                     25           3.27278
_Index_5                     25           3.85238
```

```
_Index_6                    23          1.61452
_Index_7                    23          1.49045
_Index_8                    25          2.15759
_Index_9                    17          2.05723
_Index_10                   19          1.07253
_Index_11                   21          2.24145
_Index_12                   25          1.50986
_Index_13                   25          1.52569
Index_Total                 293         2.23831
Nyear1                      7           0.677861
Fmult_Year1                 1           0.0214614
_Fmult_devs_Fleet_1         0           0
Fmult_devs_Total            0           0
Recruit_devs                0           0
Fleet_Sel_params            4           1.71411
Index_Sel_params            68          0.728852
q_year1                     0           0
q_devs                      0           0
SRR_steepness               0           0
SRR_unexpl_S                0           0

Projections not requested

that's all
```

ASAP ALTERNATIVE RUN (F08_MULTI_SVAge.REP)

```
Age Structured Assessment Program (ASAP) Version 2.0
Start time for run: Fri Mar 28 13:51:17 2008

obj_fun        = 45830.2

Component                Lambda          obj_fun
__Catch_Fleet_1               10           1976.54
__Catch_Fleet_2               10           1543.55
__Catch_Fleet_3               10           3265.42
__Catch_Fleet_4               10           1171.79
__Catch_Fleet_5               10           1803.36
__Catch_Fleet_6               10           1211.4
Catch_Fleet_Total             60           10972.1
Discard_Fleet_Total           0           0
__Index_Fit_1                 1           99.8189
__Index_Fit_2                 1           76.6323
__Index_Fit_3                 1           38.2846
__Index_Fit_4                 1           674.6
__Index_Fit_5                 1           792.804
__Index_Fit_6                 1           13.0548
__Index_Fit_7                 1           34.4386
__Index_Fit_8                 1           182.317
__Index_Fit_9                 1           32.3718
__Index_Fit_10                 1           48.8763
__Index_Fit_11                 1           36.7619
__Index_Fit_12                 1           92.7366
__Index_Fit_13                 1           20.4368
Index_Fit_Total               13           2143.13
Catch_Age_Comps       see_below           2472.97
Discard_Age_Comps     see_below           0
Survey_Age_Comps      see_below           29484.6
__Sel_Param_1                 1           0.876883
__Sel_Param_2                 1           7.80609
__Sel_Param_3                 1           1.159
__Sel_Param_4                 1           2.78348
__Sel_Param_5                 0           0
__Sel_Param_6                 0           0
__Sel_Param_7                 0           0
__Sel_Param_8                 0           0
__Sel_Param_9                 1           27.1384
__Sel_Param_11                1           22.7558
__Sel_Param_12                1           16.4072
__Sel_Param_13                1           103.468
__Sel_Param_17                1           39.8586
__Sel_Param_18                1           52.679
__Sel_Param_20                1           13.3228
__Sel_Param_21                1           104.359
__Sel_Param_25                1           0.888378
__Sel_Param_26                1           9.53583
__Sel_Param_27                1           0.891698
__Sel_Param_28                1           3.97907
__Sel_Param_29                1           0.901386
__Sel_Param_30                1           4.58442
__Sel_Param_31                1           1.69186
```

```
__Sel_Param_32                1          0.698472
__Sel_Param_33                1          0.862118
__Sel_Param_34                1          3.27088
__Sel_Param_35                1          1.61987
__Sel_Param_36                1          0.424805
Sel_Params_Total             24           421.963
__Index_Sel_Param_1           1          1.31586
__Index_Sel_Param_3           1          0.881503
__Index_Sel_Param_4           1          5.79736
__Index_Sel_Param_5           1          0.289153
__Index_Sel_Param_6           1          5.60516
__Index_Sel_Param_9           1          0.442075
__Index_Sel_Param_10          1          0.168969
__Index_Sel_Param_17          1          0.168969
__Index_Sel_Param_18          1          0.443008
__Index_Sel_Param_25          1          0.728782
__Index_Sel_Param_26          1          0.357856
__Index_Sel_Param_27          1          0.168969
__Index_Sel_Param_31          1          0.867095
__Index_Sel_Param_32          1          3.55618
__Index_Sel_Param_35          1          0.168969
__Index_Sel_Param_36          1          0.760976
__Index_Sel_Param_41          1          0.888247
__Index_Sel_Param_42          1          2.14515
__Index_Sel_Param_43          1          1.40355
Index_Sel_Params_Total       19           26.1578
q_year1_Total                 0          0
q_devs_Total                  130000           0
__Fmult_year1_fleet_1         1          0.442467
__Fmult_year1_fleet_2         1          -0.818903
__Fmult_year1_fleet_3         1          119.098
__Fmult_year1_fleet_4         1          119.098
__Fmult_year1_fleet_5         1          -0.27683
__Fmult_year1_fleet_6         1          -2.15671
Fmult_year1_fleet_Total       6          235.386
Fmult_devs_fleet_Total        0          0
N_year_1                      1          73.9121
Recruit_devs                  0          0
SRR_steepness                 0          0
SRR_unexpl_stock              0          0
Fmult_Max_penalty          1000          0
F_penalty                     0          0

 Input and Estimated effective sample sizes for fleet 1
1982  31  0.241008
1983  33  0.703232
1984  43  1.70392
1985  379  16.22
1986  39  1.71089
1987  46  4.03722
1988  663  73.8028
1989  92  0.68642
1990  2270  30.6753
1991  58  4.62533
1992  173  27.9117
1993  415  0.817513
1994  106  10.4028
```

```
1995  75  11.3122
1996  222  65.9931
1997  267  29.1057
1998  151  44.5803
1999  187  45.0792
2000  125  126.574
2001  215  53.2007
2002  61  52.8198
2003  236  540.394
2004  139  440.712
2005  368  44.8789
2006  194  380.616
 Total  6588  2008.8
 Input and Estimated effective sample sizes for fleet 2
1982  10  0.0957991
1983  10  0.404572
1984  10  2.50319
1985  10  0.599177
1986  10  0.756592
1987  10  3.91203
1988  10  0.611378
1989  10  0.579011
1990  10  0.619397
1991  10  0.766801
1992  10  0.246268
1993  10  0.679388
1994  10  0.753415
1995  10  6.29289
1996  10  25.1849
1997  10  11.9335
1998  10  6.88701
1999  10  22.2499
2000  10  7.01976
2001  10  27.8323
2002  10  7.90409
2003  10  8.73044
2004  10  20.8715
2005  10  25.1157
2006  10  8.37452
 Total  250  190.924
 Input and Estimated effective sample sizes for fleet 3
1982  0  0.27197
1983  0  0.00643108
1984  0  0.011243
1985  0  0.0657306
1986  0  0.0187932
1987  0  0.0216768
1988  0  0.0880965
1989  10  0.0778081
1990  10  0.14547
1991  10  0.363032
1992  10  0.0965035
1993  10  0.0163067
1994  10  0.162001
1995  10  0.0810745
1996  10  0.197019
1997  10  0.138381
```

```
1998  10  0.129164
1999  10  0.145954
2000  10  0.111016
2001  10  0.082808
2002  10  0.100124
2003  10  0.200913
2004  10  0.15029
2005  10  0.0913496
2006  10  0.172197
 Total  180  2.94535
 Input and Estimated effective sample sizes for fleet 4
1982  0  0.301304
1983  0  1.05703
1984  0  0.128103
1985  0  0.0455786
1986  0  0.241491
1987  0  0.0917117
1988  0  0.0573292
1989  0  0.285143
1990  0  0.0652916
1991  0  0.148446
1992  0  0.10273
1993  0  0.436069
1994  10  0.0666308
1995  10  0.378404
1996  10  0.0578331
1997  10  0.314728
1998  10  0.280872
1999  10  0.306507
2000  10  0.289745
2001  10  0.150844
2002  10  0.269742
2003  10  0.276941
2004  10  0.713166
2005  10  0.838495
2006  10  0.591872
 Total  130  7.49601
 Input and Estimated effective sample sizes for fleet 5
1982  10  0.128276
1983  10  0.49279
1984  10  4.03153
1985  10  0.824078
1986  10  1.02304
1987  10  4.90925
1988  10  0.708588
1989  10  0.891267
1990  10  0.855972
1991  10  1.18493
1992  10  0.281373
1993  10  0.977105
1994  10  1.50332
1995  10  34.912
1996  10  772.296
1997  10  31.7885
1998  10  15.5305
1999  10  8.66238
2000  10  24.0074
```

```
2001  10  29.143
2002  10  8.7636
2003  10  9.70986
2004  10  13.9248
2005  10  10.4823
2006  10  8.69858
 Total  250  985.73
 Input and Estimated effective sample sizes for fleet 6
1982  10  0.474685
1983  10  27.8293
1984  10  11.3501
1985  10  2.69443
1986  10  12.7006
1987  10  6.74465
1988  10  1.7653
1989  10  24.0472
1990  10  4.52262
1991  10  4.46393
1992  10  2.09493
1993  10  10.5111
1994  10  4.8728
1995  10  6.83062
1996  10  2.59822
1997  10  23.1824
1998  10  19.6278
1999  10  8.65241
2000  10  13.7124
2001  10  99.7269
2002  10  42.3543
2003  10  348.973
2004  10  58.3459
2005  10  52.3199
2006  10  222.82
 Total  250  1013.22

 Input and Estimated effective Discard sample sizes for fleet 1
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
```

```
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 2
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 3
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
```

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2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 4
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 5
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 6
```

```
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16

Observed and predicted total fleet catch by year and standardized residual
 fleet 1 total catches
1982  7536  5970.07  2.33513
1983  10201  7852.01  2.62369
1984  11455  10788.6  0.600826
1985  10767  10416.3  0.331967
1986  9500  9559.79  -0.0628995
1987  9945  9774.71  0.173149
1988  11616  7893.64  3.87289
1989  6218  5589.29  1.06862
1990  2962  3466.26  -1.57603
1991  4629  4799.79  -0.363218
1992  6361  6927.82  -0.855725
1993  4401  4194.5  0.481776
1994  4969  4676.68  0.60781
1995  4911  4774.55  0.282472
1996  3947  3961.81  -0.037536
1997  3313  3376.72  -0.190968
1998  3730  3744.53  -0.038987
1999  3551  3563.09  -0.0340601
2000  3564  3576.5  -0.0351064
2001  3705  3691.18  0.0374708
2002  4723  4729.67  -0.0141448
2003  4835  4829.28  0.0118693
2004  6036  5986.71  0.0822069
2005  5984  5949.51  0.0579491
2006  4481  4478.2  0.00625614
 fleet 2 total catches
1982  2864  2733.18  0.468694
1983  3201  3131.21  0.220985
```

```
1984  5674  5562.43  0.199092
1985  3907  3894.24  0.032792
1986  2687  2689.71  -0.0100884
1987  2326  2319.01  0.0301855
1988  3071  2830.39  0.817923
1989  1908  1940.74  -0.170582
1990  1237  1270.48  -0.26771
1991  1595  1613.21  -0.113816
1992  1168  1168.03  -0.000228875
1993  1313  1295.96  0.130937
1994  1620  1617.01  0.0185363
1995  2066  2047.66  0.0893968
1996  1913  1919.51  -0.0340733
1997  681  683.504  -0.0367987
1998  1346  1347.61  -0.0120205
1999  1271  1272.21  -0.00955747
2000  1521  1523.05  -0.013485
2001  1265  1263.49  0.0119431
2002  1850  1850.92  -0.00495953
2003  1614  1613.35  0.00403255
2004  2193  2186.47  0.0298806
2005  1841  1837.53  0.0189247
2006  1781  1780.52  0.00267546
 fleet 3 total catches
1982  0  2.17813e-05  -11.5918
1983  0  9.67825e-10  -0.00097019
1984  0  1.11636e-14  -1.11914e-08
1985  0  9.4865e-12  -9.51014e-06
1986  0  3.63228e-17  -3.64171e-11
1987  0  4.08966e-11  -4.09985e-05
1988  0  3.69612e-05  -15.5059
1989  709  214.057  12.006
1990  1214  1253.39  -0.320129
1991  1052  1047.28  0.0451271
1992  690  707.962  -0.257627
1993  846  827.937  0.216359
1994  434  432.886  0.0257655
1995  138  138.233  -0.016891
1996  355  356.58  -0.0445213
1997  239  238.927  0.00306082
1998  254  253.852  0.00586163
1999  1181  1171.09  0.084503
2000  592  591.019  0.0166176
2001  230  230.191  -0.0083295
2002  307  306.917  0.00272334
2003  445  445.298  -0.00671081
2004  170  170.058  -0.00341487
2005  153  152.946  0.00356469
2006  214  213.987  0.000589446
 fleet 4 total catches
1982  0  1.63688e-05  -9.72013
1983  0  8.9278e-08  -0.0891034
1984  0  1.16555e-08  -0.0116777
1985  0  1.92838e-12  -1.93319e-06
1986  0  7.7355e-14  -7.75478e-08
1987  0  4.43064e-20  -5.34235e-14
1988  0  1.1571e-13  -1.15999e-07
```

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1989  0  1.96311e-20  -1.78078e-14
1990  0  4.10018e-18  -4.11361e-12
1991  0  3.59114e-16  -3.60003e-10
1992  0  2.08148e-10  -0.000208665
1993  0  1.39522e-05  -8.75652
1994  472  281.954  5.16521
1995  170  169.563  0.0257992
1996  108  108.092  -0.00851767
1997  86  86.0848  -0.00988289
1998  135  134.961  0.00290376
1999  367  366.883  0.00320173
2000  134  133.929  0.0052939
2001  238  237.673  0.0137981
2002  142  142.142  -0.010045
2003  83  83.02  -0.00241633
2004  74  74.0023  -0.000317263
2005  77  77.0006  -8.14275e-05
2006  74  73.998  0.000273206
 fleet 5 total catches
1982  8267  7254.89  1.30922
1983  12687  11556.8  0.935381
1984  8512  8248.25  0.315544
1985  5665  5634.13  0.0547801
1986  8102  8124.26  -0.0275096
1987  5519  5476.03  0.0783624
1988  6634  5627.63  1.64929
1989  1435  1446.46  -0.0797169
1990  2329  2457.24  -0.537335
1991  3611  3709.92  -0.270917
1992  3242  3243.27  -0.00391181
1993  4006  3854.68  0.386
1994  4231  4198.86  0.0764339
1995  2459  2453.92  0.0207208
1996  4454  4574.9  -0.268497
1997  5382  5568.94  -0.34229
1998  5659  5663  -0.00708688
1999  3795  3791.77  0.00854194
2000  7470  7462.25  0.0104058
2001  5279  5251.1  0.053117
2002  3632  3648.82  -0.0463236
2003  5279  5293.14  -0.0268084
2004  4831  4814.65  0.033981
2005  4724  4705.24  0.039887
2006  4992  4989.97  0.00407941
 fleet 6 total catches
1982  296  290.549  0.186339
1983  376  372.901  0.0829626
1984  415  414.238  0.0184242
1985  92  91.9744  0.00279134
1986  578  578.343  -0.00595467
1987  522  521.655  0.00662919
1988  341  334.757  0.18523
1989  45  45.0033  -0.000724943
1990  234  236.525  -0.107597
1991  429  430.001  -0.0233546
1992  344  345.698  -0.0493633
1993  910  898.999  0.121935
```

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1994  687  682.235  0.0697731
1995  752  754.903  -0.0386219
1996  681  685.599  -0.0674722
1997  556  557.789  -0.0322068
1998  734  733.421  0.00791784
1999  711  709.573  0.0201415
2000  952  949.788  0.0233239
2001  1274  1273.05  0.00744881
2002  777  778.599  -0.0206129
2003  882  883.837  -0.0208526
2004  1034  1035.86  -0.0180007
2005  999  998.876  0.00124593
2006  795  795.002  -2.65654e-05
Observed and predicted total fleet Discards by year and standardized residual
 fleet 1 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 2 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
```

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1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 3 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 4 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
```

```
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 5 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 6 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
```

```
Index data
index number 1
units = 2
month = 1
starting and ending ages for selectivity = 2  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  12.3  5.48081  5.08426
1993  13.6  7.08226  4.10389
1994  12.05  8.96872  1.85748
1995  10.93  11.6494  -0.400916
1996  31.25  16.0097  4.20671
1997  10.28  17.4853  -3.34084
1998  7.76  18.8163  -5.57106
1999  11.06  19.6273  -3.6077
2000  15.77  19.6145  -1.37215
2001  18.6  18.4942  0.035871
2002  22.68  19.9931  0.793115
2003  35.64  22.4528  2.90618
2004  17.77  22.585  -1.50812
2005  12.89  22.6145  -3.53568
2006  21.06  19.9067  0.354241
index number 2
units = 2
month = 1
starting and ending ages for selectivity = 2  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  0.455855  7.72779
1983  0.95  0.861621  0.470048
1984  0.66  1.83504  -4.92245
1985  2.38  1.55713  2.04225
1986  2.14  1.23156  2.6597
1987  0.93  1.50131  -2.30533
1988  1.5  1.12558  1.38233
1989  0.32  0.621465  -3.19516
1990  0.72  0.696578  0.159201
1991  1.08  0.845711  1.17715
1992  1.2  0.62016  3.17755
1993  1.27  0.664527  3.11785
1994  0.93  1.07545  -0.699471
1995  1.09  1.33639  -0.98103
1996  1.76  1.94962  -0.492546
1997  1.06  2.26412  -3.65324
1998  1.19  2.27324  -3.11571
1999  1.6  2.3008  -1.74862
2000  2.14  2.3343  -0.418354
2001  2.69  2.10003  1.19184
2002  2.47  2.32527  0.290656
2003  2.91  2.61708  0.510717
2004  3.03  2.6683  0.611926
2005  1.81  2.48403  -1.52381
2006  1.77  2.39662  -1.45894
index number 3
units = 2
month = 1
starting and ending ages for selectivity = 1  5
```

```
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.5  1.07036  2.80043
1983  2.89  2.915  -0.0284315
1984  2.08  3.46954  -1.68909
1985  1.9  2.25511  -0.565653
1986  1.44  2.58739  -1.93455
1987  0.9  2.33275  -3.14413
1988  0.89  1.46489  -1.64505
1989  0.57  1.22674  -2.53032
1990  0.89  1.23419  -1.07933
1991  1.7  1.42947  0.572184
1992  2.32  1.26798  1.99441
1993  1.07  1.63066  -1.3909
1994  1.53  1.74126  -0.42698
1995  2.4  2.05544  0.511627
1996  1.96  2.54451  -0.8616
1997  2.91  2.4249  0.602023
1998  4.51  2.44389  2.02269
1999  3.78  2.45719  1.42186
2000  3.19  2.27132  1.1213
2001  2.89  2.24543  0.833106
2002  2.55  2.42939  0.159957
2003  2.87  2.54297  0.399379
2004  4.07  2.42853  1.70461
2005  2.49  2.41209  0.104939
2006  2.77  2.01475  1.05096
index number 4
units = 2
month = 1
starting and ending ages for selectivity = 3  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.726  0.020156  21.4215
1983  1.049  0.00928056  22.7578
1984  0.145  0.833704  -8.41994
1985  1.296  1.66026  -1.19232
1986  0.707  0.774766  -0.440605
1987  0.653  1.0141  -2.1189
1988  1.128  1.28137  -0.613691
1989  0.465  0.358562  1.25126
1990  0.102  0.532544  -7.95564
1991  0.062  0.643778  -11.2652
1992  0.432  0.499167  -0.695656
1993  0.557  0.151569  6.26519
1994  1.265  0.905274  1.61063
1995  1.355  1.23149  0.460075
1996  0.8  1.81326  -3.93895
1997  1.46  2.62503  -2.82402
1998  1.871  2.69579  -1.75807
1999  1.99  2.37221  -0.845713
2000  2.864  2.56205  0.536297
2001  1.756  2.12303  -0.913681
2002  1.908  2.30589  -0.911769
2003  2.064  2.76895  -1.41439
2004  0.606  2.97883  -7.66544
2005  1.38  2.41771  -2.69926
```

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2006  3.415  2.55862  1.38978
index number 5
units = 2
month = 1
starting and ending ages for selectivity = 3  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.682  0.0175228  21.9711
1983  0.779  0.00739608  22.4179
1984  0.394  0.817284  -3.51228
1985  1.935  1.52009  1.16175
1986  0.893  0.598128  1.92926
1987  0.674  0.935341  -1.57738
1988  0.435  1.12501  -4.57404
1989  0.333  0.270861  0.994208
1990  0.011  0.495354  -18.3277
1991  0.294  0.523058  -2.77326
1992  0.186  0.433915  -4.07773
1993  0.508  0.130559  6.54021
1994  0.076  0.865006  -11.707
1995  0.506  1.00775  -3.31639
1996  1.396  1.66169  -0.838657
1997  1.859  2.28206  -0.987014
1998  0.852  2.06709  -4.26648
1999  1.319  1.88874  -1.72831
2000  2.797  2.02928  1.54457
2001  1.39  1.6199  -0.736787
2002  1.48  1.87588  -1.14104
2003  1.51  2.16977  -1.74503
2004  1.591  2.31309  -1.80141
2005  3.399  1.76156  3.16397
2006  4.304  2.12704  3.39279
index number 6
units = 2
month = 1
starting and ending ages for selectivity = 3  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.315  0.234541  0.76558
1985  0.423  0.458818  -0.210985
1986  0.19  0.217245  -0.347829
1987  0.104  0.301022  -2.75869
1988  0.267  0.358746  -0.766677
1989  0.089  0.104698  -0.421651
1990  0.041  0.158314  -3.5068
1991  0.246  0.178726  0.829269
1992  0.213  0.149582  0.917444
1993  0.184  0.0437486  3.72865
1994  0.357  0.256317  0.860006
1995  0.076  0.336891  -3.86506
1996  0.375  0.516544  -0.831232
1997  0.6  0.730271  -0.510018
1998  1.213  0.78147  1.14126
1999  1.117  0.768707  0.96999
2000  1.324  0.80793  1.28211
2001  0.825  0.682308  0.492929
2002  1.962  0.752256  2.48835
```

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2003  1.643  0.853245  1.70078
2004  1.422  0.962644  1.01267
2005  0.447  0.811039  -1.54641
2006  0.493  0.852492  -1.42154
index number 7
units = 2
month = 1
starting and ending ages for selectivity = 1  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.999  2.19887  -2.04785
1985  1.191  1.46491  -0.537318
1986  1.719  1.48811  0.37439
1987  1.401  1.59613  -0.338475
1988  1.42  1.00341  0.901358
1989  0.14  0.740873  -4.32491
1990  0.87  0.75219  0.377684
1991  1.26  0.916791  0.825399
1992  1.02  0.700082  0.976918
1993  1.109  0.919455  0.486519
1994  0.55  1.10917  -1.82076
1995  0.541  1.35342  -2.38018
1996  2.191  1.84207  0.450273
1997  2.5  1.90649  0.703505
1998  1.719  1.91252  -0.276911
1999  2.68  1.96056  0.811385
2000  1.91  1.8941  0.0217017
2001  4.417  1.79349  2.33949
2002  6.121  1.96374  2.95099
2003  3.388  2.15956  1.16894
2004  1.954  2.09724  -0.183624
2005  2.41  2.07279  0.391246
2006  1.316  1.83775  -0.866813
index number 8
units = 2
month = 1
starting and ending ages for selectivity = 3  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.59  0.012535  9.99757
1983  0.53  0.00520795  11.9991
1984  0.59  0.596057  -0.0265112
1985  0.3  1.09687  -3.36514
1986  0.64  0.418574  1.10217
1987  0.39  0.675729  -1.42671
1988  0.24  0.806146  -3.14501
1989  0.07  0.188724  -2.57438
1990  0.12  0.358349  -2.83973
1991  0.09  0.369657  -3.66711
1992  0.52  0.310399  1.3393
1993  0.29  0.0932474  2.94514
1994  0.03  0.628407  -7.89608
1995  0.2  0.713151  -3.3001
1996  1.04  1.19922  -0.369755
1997  0.99  1.63248  -1.29825
1998  0.45  1.4446  -3.02747
1999  2.26  1.32972  1.37675
```

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2000  1.69  1.42723  0.438648
2001  0.93  1.13096  -0.507815
2002  1.78  1.32605  0.764205
2003  2.57  1.52287  1.35834
2004  2.08  1.62058  0.647849
2005  2.07  1.21818  1.37621
2006  1.57  1.50959  0.101846
index number 9
units = 2
month = 1
starting and ending ages for selectivity = 1  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.29  0.326862  -0.31059
1991  0.15  0.390696  -2.48484
1992  0.34  0.312163  0.221722
1993  0.26  0.356115  -0.81653
1994  0.17  0.48488  -2.72055
1995  0.08  0.597296  -5.21835
1996  0.96  0.814881  0.42541
1997  0.73  0.899529  -0.542052
1998  0.43  0.919792  -1.97367
1999  0.9  0.929709  -0.084299
2000  2.61  0.929861  2.67894
2001  0.98  0.860493  0.337562
2002  2.03  0.942675  1.99108
2003  3.78  1.0425  3.34351
2004  2.17  1.05416  1.87405
2005  2.49  1.00105  2.36529
2006  1.32  0.927903  0.914878
index number 10
units = 2
month = 1
starting and ending ages for selectivity = 1  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  4.26  5.88488  -0.838714
1989  1.69  4.39393  -2.48018
1990  2.86  4.79774  -1.34281
1991  3.97  5.05149  -0.625349
1992  4.75  5.56706  -0.411994
1993  8.46  5.81988  0.970969
1994  2.83  6.52782  -2.16947
1995  8.37  7.45167  0.301662
1996  9.69  8.26943  0.411494
1997  16.35  8.13913  1.81061
1998  9.47  8.46636  0.29079
1999  11.44  8.15948  0.877178
2000  7.35  8.08929  -0.248772
2001  5.68  7.98697  -0.884769
2002  16.84  8.6326  1.73447
2003  9.84  8.60594  0.347832
2004  10.66  8.94796  0.454436
2005  11.19  8.10941  0.835802
2006  10.65  7.33559  0.967731
index number 11
units = 2
```

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month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1986  0.32  0.38262  -0.463904
1987  0.26  0.119271  2.02278
1988  0.01  0.215559  -7.97047
1989  0.14  0.138853  0.0213615
1990  0.36  0.179477  1.80675
1991  0.38  0.146507  2.47396
1992  0.37  0.261448  0.9014
1993  0.05  0.193841  -3.51721
1994  0.57  0.22229  2.44424
1995  0.3  0.225908  0.736285
1996  0.08  0.157849  -1.76407
1997  0.22  0.152806  0.946018
1998  0.39  0.174819  2.08277
1999  0.35  0.128662  2.59764
2000  0.21  0.153688  0.810333
2001  0.14  0.161208  -0.366126
2002  0.13  0.170931  -0.710506
2003  0.21  0.115053  1.56187
2004  0.27  0.176284  1.10661
2005  0.01  0.0895175  -5.68937
2006  0.17  0.116876  0.972568
index number 12
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  3.408  17.9581  -4.31382
1983  17.699  27.7909  -1.17118
1984  13.31  10.019  0.737262
1985  12.843  15.0264  -0.407546
1986  59.526  16.2027  3.37761
1987  7.584  5.05074  1.05516
1988  1.763  9.12821  -4.26824
1989  2.855  5.87995  -1.87533
1990  4.733  7.60026  -1.22938
1991  7.337  6.20409  0.435355
1992  8.487  11.0715  -0.69003
1993  4.145  8.20855  -1.77357
1994  22.311  9.41328  2.23998
1995  13.067  9.56645  0.809409
1996  6.493  6.6844  -0.0754105
1997  7.997  6.47085  0.549663
1998  14.983  7.40302  1.83004
1999  8.565  5.4484  1.1742
2000  9.874  6.50818  1.082
2001  13.543  6.82662  1.77816
2002  5.406  7.23837  -0.757647
2003  8.18  4.87211  1.345
2004  6.993  7.46506  -0.169559
2005  2.198  3.79078  -1.41471
2006  9.658  4.94932  1.73532
index number 13
```

```
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  2.12047  0.176879
1983  5.01  3.28152  1.09831
1984  1.58  1.18303  0.751049
1985  1.26  1.7743  -0.88849
1986  1.26  1.9132  -1.08413
1987  0.39  0.596386  -1.1025
1988  0.54  1.07785  -1.79403
1989  1.24  0.694299  1.50541
1990  2.54  0.89743  2.70052
1991  2.64  0.732572  3.32761
1992  0.89  1.30731  -0.998054
1993  0.5  0.969257  -1.71815
1994  2.41  1.11151  2.00883
1995  0.63  1.1296  -1.51562
1996  0.81  0.789287  0.0672394
1997  0.89  0.764071  0.396002
1998  0.73  0.87414  -0.467735
1999  0.53  0.643341  -0.50304
2000  0.57  0.768479  -0.775535
2001  0.47  0.80608  -1.40025
2002  0.77  0.854698  -0.270882
2003  0.44  0.575294  -0.695922
2004  1.3  0.881466  1.00851
2005  0.35  0.447611  -0.638517
2006  0.8  0.58441  0.815071

Input and Estimated effective sample sizes for index 1
1992  100  43.808
1993  100  0.557621
1994  100  6.36623
1995  100  18.3641
1996  100  6.53857
1997  100  49.7465
1998  100  103.43
1999  100  28.5752
2000  100  17.5802
2001  100  31.5588
2002  100  17.0236
2003  100  107.507
2004  100  24.811
2005  100  81.0669
2006  100  245.687
 Total  1500  782.621
Input and Estimated effective sample sizes for index 2
1982  200  0.0606725
1983  200  0.293579
1984  200  2.0214
1985  200  332.209
1986  200  33.4284
1987  200  348.478
1988  200  9.62086
1989  200  1.3145
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1990  200  1.41036
1991  200  6.76998
1992  200  8.74047
1993  200  1.9755
1994  200  595.782
1995  200  3.65263
1996  200  3.73875
1997  200  69.8507
1998  200  218.949
1999  200  38.6778
2000  200  51.6254
2001  200  24.5799
2002  200  20.2172
2003  200  431.442
2004  200  231.349
2005  200  78.3861
2006  200  50.5252
 Total  5000  2565.1
Input and Estimated effective sample sizes for index 3
1982  200  0.58047
1983  200  17.0632
1984  200  17.9177
1985  200  165.096
1986  200  270.859
1987  200  69.3924
1988  200  3.98785
1989  200  2.44251
1990  200  7.261
1991  200  5.98254
1992  200  175.091
1993  200  4889.34
1994  200  6.05223
1995  200  13.34
1996  200  73.9536
1997  200  145.684
1998  200  35.8999
1999  200  37.2363
2000  200  96.4518
2001  200  45.0888
2002  200  44.5106
2003  200  92.0734
2004  200  118.987
2005  200  895.183
2006  200  312.214
 Total  5000  7541.69
Input and Estimated effective sample sizes for index 4
1982  100  8.39482
1983  100  75.2588
1984  100  0.007279
1985  100  10.49
1986  100  9.32903
1987  100  10.6897
1988  100  16.5352
1989  100  4.36532
1990  100  0.19391
1991  100  10.3053
1992  100  505.915
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1993  100  11.6449
1994  100  258.151
1995  100  2.61214
1996  100  820.995
1997  100  16.682
1998  100  36.1991
1999  100  6.90336
2000  100  165.083
2001  100  363.932
2002  100  12.9416
2003  100  24.8506
2004  100  17.3341
2005  100  4.5544
2006  100  686.215
 Total  2500  3079.58
Input and Estimated effective sample sizes for index 5
1982  100  8.37857
1983  100  190.175
1984  100  0.00744726
1985  100  26.5766
1986  100  254.536
1987  100  26.7538
1988  100  9.84369
1989  100  3.40125
1990  100  0.0572045
1991  100  4.75626
1992  100  6.86439
1993  100  19.2885
1994  100  36.8234
1995  100  4.0852
1996  100  433.743
1997  100  28.9208
1998  100  199.245
1999  100  53.6636
2000  100  51.8603
2001  100  53.4689
2002  100  23.1804
2003  100  29.8531
2004  100  6.25595
2005  100  76.1243
2006  100  63.2604
 Total  2500  1611.12
Input and Estimated effective sample sizes for index 6
1984  100  0.108932
1985  100  6.42799
1986  100  78.7149
1987  100  126.549
1988  100  75.7512
1989  100  27.3127
1990  100  1.71234
1991  100  9.19794
1992  100  11.7058
1993  100  17.256
1994  100  19.3062
1995  100  115.552
1996  100  6.87779
1997  100  21.1447
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1998  100  93.9813
1999  100  90.5935
2000  100  30.5635
2001  100  34.4762
2002  100  63.1121
2003  100  52.2532
2004  100  91.0283
2005  100  11.7648
2006  100  18.5144
 Total  2300  1003.91
Input and Estimated effective sample sizes for index 7
1984  100  5.23319
1985  100  27.0258
1986  100  241.891
1987  100  21.2738
1988  100  5.41881
1989  100  0.830844
1990  100  7.17044
1991  100  76.0327
1992  100  23.6082
1993  100  17.7015
1994  100  7.57609
1995  100  13.982
1996  100  21.1072
1997  100  76.6199
1998  100  8.20103
1999  100  13.7323
2000  100  77.6332
2001  100  9.21016
2002  100  18.2604
2003  100  45.3026
2004  100  53.5258
2005  100  38.8581
2006  100  132.506
 Total  2300  942.701
Input and Estimated effective sample sizes for index 8
1982  100  1186.22
1983  100  3076.57
1984  100  0.0230121
1985  100  1419.08
1986  100  158.295
1987  100  5931.68
1988  100  8.97249
1989  100  2.81165
1990  100  20.6031
1991  100  31.2626
1992  100  9.41173
1993  100  7.05119
1994  100  43.3997
1995  100  4.81478
1996  100  22.6548
1997  100  15.3148
1998  100  92.5184
1999  100  73.4836
2000  100  48.2867
2001  100  35.6999
2002  100  67.1358
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2003  100  208.097
2004  100  8.4355
2005  100  305.25
2006  100  8.43741
 Total  2500  12785.5
Input and Estimated effective sample sizes for index 9
1990  100  7.26999
1991  100  7.14964
1992  100  23.6592
1993  100  1.66187
1994  100  9.1535
1995  100  5.0661
1996  100  49.8249
1997  100  121.29
1998  100  22.7625
1999  100  635.002
2000  100  141.918
2001  100  20.5765
2002  100  22.1646
2003  100  23.0369
2004  100  72.5359
2005  100  56.2258
2006  100  29.906
 Total  1700  1249.2
Input and Estimated effective sample sizes for index 10
1988  100  1.48793
1989  100  9.08255
1990  100  17.9709
1991  100  8.52108
1992  100  1.88521
1993  100  13.3611
1994  100  14.5023
1995  100  11.6114
1996  100  49.898
1997  100  12.2684
1998  100  4.73133
1999  100  14.0643
2000  100  8.43251
2001  100  7.76601
2002  100  9.02435
2003  100  9.83115
2004  100  4.05491
2005  100  10.1301
2006  100  5.59076
 Total  1900  214.214
Input and Estimated effective sample sizes for index 11
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
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1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 12
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 13
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
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2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0

Survey proportions at age by index
 Index number 1
Year 1992 Obs  =  -1 0.581582 0.385385 0.027027 0.003003 0.001001 0.002002 0
Year 1992 Pred =  -1 0.537365 0.314276 0.0980548 0.0436503 0.00386281
0.0023173 0.000474207
Year 1993 Obs  =  -1 0.478 0.493 0.023 0.004 0.001 0.001 0
Year 1993 Pred =  -1 0.893863 0.0723216 0.0246687 0.00626094 0.00253299
0.000206141 0.000146787
Year 1994 Obs  =  -1 0.311688 0.597403 0.0679321 0.021978 0 0 0.000999001
Year 1994 Pred =  -1 0.538861 0.427038 0.0248372 0.00697561 0.00159757
0.000608286 8.25858e-05
Year 1995 Obs  =  -1 0.555 0.42 0.023 0.002 0 0 0
Year 1995 Pred =  -1 0.506976 0.316061 0.165698 0.00847162 0.00214131
0.000458027 0.000194004
Year 1996 Obs  =  -1 0.709 0.267 0.019 0.004 0.001 0 0
Year 1996 Pred =  -1 0.472151 0.439108 0.0705333 0.017222 0.000752887
0.000179613 5.36199e-05
Year 1997 Obs  =  -1 0.375 0.467 0.101 0.042 0.011 0.004 0
Year 1997 Pred =  -1 0.302847 0.518141 0.161536 0.0142899 0.00302279
0.0001249 3.78952e-05
Year 1998 Obs  =  -1 0.216216 0.419419 0.295295 0.0540541 0.013013 0.001001
0.001001
Year 1998 Pred =  -1 0.273668 0.361564 0.295673 0.0631165 0.00493703
0.000988716 5.21081e-05
Year 1999 Obs  =  -1 0.191191 0.434434 0.262262 0.0760761 0.025025 0.00500501
0.00600601
Year 1999 Pred =  -1 0.299996 0.337169 0.215197 0.122377 0.0231886 0.00171769
0.000355397
Year 2000 Obs  =  -1 0.044044 0.413413 0.315315 0.159159 0.049049 0.011011
0.00800801
Year 2000 Pred =  -1 0.221258 0.359498 0.237782 0.112644 0.0577043 0.0102113
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Year 2002 Pred =  -1 0.271544 0.33982 0.18611 0.118634 0.0513998 0.0207585
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Year 2003 Obs  =  -1 0.229 0.403 0.238 0.075 0.029 0.011 0.015
Year 2003 Pred =  -1 0.257022 0.329992 0.234531 0.0918575 0.0520456 0.0213522
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Year 2005 Obs  =  -1 0.22977 0.312687 0.237762 0.103896 0.0539461 0.025974
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Year 2005 Pred =  -1 0.262937 0.232891 0.259945 0.139669 0.0646131 0.0214249
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Year 2003 Pred =  -1 -1 0.547215 0.317648 0.135137 -1 -1 -1
Year 2004 Obs  =  -1 -1 0.575576 0.288288 0.136136 -1 -1 -1
Year 2004 Pred =  -1 -1 0.509277 0.313773 0.17695 -1 -1 -1
Year 2005 Obs  =  -1 -1 0.59041 0.335664 0.0739261 -1 -1 -1
Year 2005 Pred =  -1 -1 0.409218 0.373058 0.217724 -1 -1 -1
Year 2006 Obs  =  -1 -1 0.73 0.138 0.132 -1 -1 -1
Year 2006 Pred =  -1 -1 0.587727 0.222784 0.189489 -1 -1 -1
```

```
 Index number 7
Year 1984 Obs  =  0 0.572 0.331 0.072 0.014 0.004 0.004 0.003
Year 1984 Pred =  0.0405667 0.773946 0.182091 0.000203409 8.42026e-05
1.70975e-05 0.0030906 1.29679e-06
Year 1985 Obs  =  0.201798 0.284715 0.442557 0.0629371 0.000999001 0.00699301
0 0
Year 1985 Pred =  0.0913242 0.382788 0.472766 0.0522269 5.61752e-05 2.28725e-
05 4.56564e-06 0.000810867
Year 1986 Obs  =  0.1 0.681 0.173 0.042 0.003 0.001 0 0
Year 1986 Pred =  0.0969383 0.673884 0.144299 0.0765815 0.00816342 8.66146e-
06 3.48036e-06 0.000120846
Year 1987 Obs  =  0.0539461 0.761239 0.158841 0.023976 0.001998 0 0 0
Year 1987 Pred =  0.0281728 0.661383 0.26922 0.0262533 0.0135203 0.00142761
1.49741e-06 2.08842e-05
Year 1988 Obs  =  0.010989 0.622378 0.338661 0.025974 0.000999001 0.000999001
0 0
Year 1988 Pred =  0.0809935 0.3268 0.485878 0.0926314 0.00875856 0.0044653
0.000466052 7.11038e-06
Year 1989 Obs  =  0 0.207 0.679 0.107 0.007 0 0 0
Year 1989 Pred =  0.07066 0.709949 0.126303 0.0768416 0.014184 0.0013257
0.00066665 6.94845e-05
Year 1990 Obs  =  0.037 0.775 0.126 0.048 0.008 0.006 0 0
Year 1990 Pred =  0.089959 0.561175 0.305406 0.0253565 0.0149604 0.00274832
0.000253934 0.000140187
Year 1991 Obs  =  0.028971 0.655345 0.26973 0.028971 0.00999001 0.003996
0.002997 0
Year 1991 Pred =  0.0602492 0.622598 0.222334 0.0832933 0.00669308 0.00401785
0.000711644 0.000103111
Year 1992 Obs  =  0.012987 0.558442 0.358641 0.044955 0.015984 0.00899101 0 0
Year 1992 Pred =  0.140799 0.514789 0.265242 0.0560816 0.0202995 0.00164392
0.000952528 0.00019239
Year 1993 Obs  =  0.0759241 0.745255 0.136863 0.034965 0.002997 0.000999001
0.001998 0.000999001
Year 1993 Pred =  0.079484 0.842513 0.0600542 0.0138817 0.00286472 0.00106061
8.33691e-05 5.85929e-05
Year 1994 Obs  =  0.24 0.545 0.155 0.044 0.016 0 0 0
Year 1994 Pred =  0.0755587 0.533177 0.372247 0.014672 0.00335054 0.000702217
0.000258249 3.46061e-05
Year 1995 Obs  =  0.042957 0.709291 0.215784 0.021978 0.003996 0.001998 0
0.003996
Year 1995 Pred =  0.0629305 0.533975 0.293274 0.104194 0.00433149 0.00100191
0.000206995 8.6536e-05
Year 1996 Obs  =  0.031031 0.405405 0.542543 0.019019 0.002002 0 0 0
Year 1996 Pred =  0.0323073 0.502137 0.411418 0.0447845 0.00889123
0.000355704 8.19624e-05 2.41502e-05
Year 1997 Obs  =  0.013013 0.272272 0.54955 0.149149 0.00800801 0.00600601
0.002002 0
Year 1997 Pred =  0.0302183 0.339881 0.512297 0.108234 0.00778519 0.00150705
6.01452e-05 1.80111e-05
Year 1998 Obs  =  0 0.156156 0.613614 0.187187 0.031031 0.012012 0 0
Year 1998 Pred =  0.0344624 0.329471 0.383485 0.212517 0.036887 0.00264043
0.000510739 2.65675e-05
Year 1999 Obs  =  0.016 0.253 0.554 0.129 0.043 0.004 0.001 0
Year 1999 Pred =  0.0247419 0.367503 0.363885 0.157389 0.072775 0.0126194
0.000902875 0.00018438
Year 2000 Obs  =  0.0588822 0.206587 0.45509 0.178643 0.0648703 0.0229541
0.00598802 0.00698603
```

```
Year 2000 Pred =  0.0305915 0.280373 0.401333 0.179891 0.069292 0.0324835
0.00555204 0.000484236
Year 2001 Obs  =  0.005 0.609 0.257 0.099 0.025 0.004 0.001 0
Year 2001 Pred =  0.0338883 0.352914 0.317697 0.181615 0.0709479 0.027612
0.0129119 0.00241421
Year 2002 Obs  =  0.0720721 0.504505 0.315315 0.0780781 0.02002 0.00500501
0.004004 0.001001
Year 2002 Pred =  0.0328172 0.338299 0.372974 0.138427 0.0717475 0.0284472
0.0110966 0.00619147
Year 2003 Obs  =  0 0.430569 0.388611 0.11988 0.025974 0.026973 0.004995
0.002997
Year 2003 Pred =  0.0200861 0.326994 0.369865 0.17814 0.0567313 0.0294152
0.011656 0.00711254
Year 2004 Obs  =  0.131 0.197 0.386 0.225 0.041 0.012 0.008 0
Year 2004 Pred =  0.0316905 0.226666 0.399897 0.204428 0.0862997 0.0275744
0.0142895 0.00915575
Year 2005 Obs  =  0.028 0.454 0.309 0.147 0.036 0.013 0.005 0.008
Year 2005 Pred =  0.0162823 0.351031 0.273915 0.207189 0.0905173 0.0383205
0.0122729 0.0104711
Year 2006 Obs  =  0.074 0.165 0.45 0.175 0.073 0.033 0.016 0.014
Year 2006 Pred =  0.0239775 0.200853 0.466398 0.146688 0.0933964 0.0409419
0.0173874 0.0103585
 Index number 8
Year 1982 Obs  =  -1 -1 0.881 0.119 -1 -1 -1 -1
Year 1982 Pred =  -1 -1 0.890082 0.109918 -1 -1 -1 -1
Year 1983 Obs  =  -1 -1 0.792 0.208 -1 -1 -1 -1
Year 1983 Pred =  -1 -1 0.799222 0.200778 -1 -1 -1 -1
Year 1984 Obs  =  -1 -1 0.831 0.169 -1 -1 -1 -1
Year 1984 Pred =  -1 -1 0.999347 0.00065261 -1 -1 -1 -1
Year 1985 Obs  =  -1 -1 0.933 0.067 -1 -1 -1 -1
Year 1985 Pred =  -1 -1 0.939337 0.0606632 -1 -1 -1 -1
Year 1986 Obs  =  -1 -1 0.797 0.203 -1 -1 -1 -1
Year 1986 Pred =  -1 -1 0.763212 0.236788 -1 -1 -1 -1
Year 1987 Obs  =  -1 -1 0.949 0.051 -1 -1 -1 -1
Year 1987 Pred =  -1 -1 0.946067 0.0539329 -1 -1 -1 -1
Year 1988 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1988 Pred =  -1 -1 0.899724 0.100276 -1 -1 -1 -1
Year 1989 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1989 Pred =  -1 -1 0.737646 0.262354 -1 -1 -1 -1
Year 1990 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1990 Pred =  -1 -1 0.95371 0.0462897 -1 -1 -1 -1
Year 1991 Obs  =  -1 -1 0.889 0.111 -1 -1 -1 -1
Year 1991 Pred =  -1 -1 0.820339 0.179661 -1 -1 -1 -1
Year 1992 Obs  =  -1 -1 0.788 0.212 -1 -1 -1 -1
Year 1992 Pred =  -1 -1 0.889993 0.110007 -1 -1 -1 -1
Year 1993 Obs  =  -1 -1 0.759 0.241 -1 -1 -1 -1
Year 1993 Pred =  -1 -1 0.880955 0.119045 -1 -1 -1 -1
Year 1994 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1994 Pred =  -1 -1 0.977477 0.0225227 -1 -1 -1 -1
Year 1995 Obs  =  -1 -1 1 0 -1 -1 -1 -1
Year 1995 Pred =  -1 -1 0.828024 0.171976 -1 -1 -1 -1
Year 1996 Obs  =  -1 -1 0.99 0.01 -1 -1 -1 -1
Year 1996 Pred =  -1 -1 0.940172 0.0598284 -1 -1 -1 -1
Year 1997 Obs  =  -1 -1 0.97 0.03 -1 -1 -1 -1
Year 1997 Pred =  -1 -1 0.890069 0.109931 -1 -1 -1 -1
Year 1998 Obs  =  -1 -1 0.8 0.2 -1 -1 -1 -1
Year 1998 Pred =  -1 -1 0.755305 0.244695 -1 -1 -1 -1
```

```
Year 1999 Obs  =  -1 -1 0.845 0.155 -1 -1 -1 -1
Year 1999 Pred =  -1 -1 0.798179 0.201821 -1 -1 -1 -1
Year 2000 Obs  =  -1 -1 0.734 0.266 -1 -1 -1 -1
Year 2000 Pred =  -1 -1 0.792371 0.207629 -1 -1 -1 -1
Year 2001 Obs  =  -1 -1 0.677 0.323 -1 -1 -1 -1
Year 2001 Pred =  -1 -1 0.749518 0.250482 -1 -1 -1 -1
Year 2002 Obs  =  -1 -1 0.775 0.225 -1 -1 -1 -1
Year 2002 Pred =  -1 -1 0.821713 0.178287 -1 -1 -1 -1
Year 2003 Obs  =  -1 -1 0.809 0.191 -1 -1 -1 -1
Year 2003 Pred =  -1 -1 0.780298 0.219702 -1 -1 -1 -1
Year 2004 Obs  =  -1 -1 0.625 0.375 -1 -1 -1 -1
Year 2004 Pred =  -1 -1 0.769914 0.230086 -1 -1 -1 -1
Year 2005 Obs  =  -1 -1 0.667 0.333 -1 -1 -1 -1
Year 2005 Pred =  -1 -1 0.693391 0.306609 -1 -1 -1 -1
Year 2006 Obs  =  -1 -1 0.72 0.28 -1 -1 -1 -1
Year 2006 Pred =  -1 -1 0.844693 0.155307 -1 -1 -1 -1
 Index number 9
Year 1990 Obs  =  0.07 0.59 0.14 0.17 0.03 0 0 0
Year 1990 Pred =  0.11547 0.462145 0.364968 0.0333712 0.0198694 0.00365284
0.000337528 0.000186337
Year 1991 Obs  =  0 0.47 0.53 0 0 0 0 0
Year 1991 Pred =  0.0788575 0.522824 0.270926 0.111779 0.00906429 0.00544534
0.000964538 0.000139753
Year 1992 Obs  =  0.03 0.44 0.38 0.12 0.03 0 0 0
Year 1992 Pred =  0.176128 0.413154 0.308902 0.0719293 0.0262741 0.00212934
0.00123387 0.000249215
Year 1993 Obs  =  0.04 0.42 0.35 0.15 0 0 0.04 0
Year 1993 Pred =  0.114467 0.778455 0.0805187 0.0204976 0.00426874 0.0015816
0.000124328 8.73801e-05
Year 1994 Obs  =  0.237624 0.465347 0.237624 0 0.0594059 0 0 0
Year 1994 Pred =  0.0964075 0.436469 0.442191 0.0191944 0.00442341
0.000927762 0.000341216 4.57242e-05
Year 1995 Obs  =  0.376238 0.247525 0.247525 0.128713 0 0 0 0
Year 1995 Pred =  0.0795363 0.432993 0.345089 0.135022 0.00566445 0.00131121
0.000270912 0.000113258
Year 1996 Obs  =  0.019802 0.425743 0.415842 0.138614 0 0 0 0
Year 1996 Pred =  0.0407354 0.406209 0.482955 0.0578972 0.0115998 0.000464407
0.000107016 3.15325e-05
Year 1997 Obs  =  0.0505051 0.232323 0.525253 0.181818 0.010101 0 0 0
Year 1997 Pred =  0.0357231 0.257787 0.563836 0.13119 0.00952279 0.00184479
7.36283e-05 2.20488e-05
Year 1998 Obs  =  0 0.16 0.56 0.26 0.02 0 0 0
Year 1998 Pred =  0.039969 0.24516 0.414074 0.252715 0.0442656 0.00317097
0.000613396 3.19076e-05
Year 1999 Obs  =  0.03 0.29 0.41 0.19 0.06 0.02 0 0
Year 1999 Pred =  0.0291022 0.277338 0.398482 0.189812 0.0885708 0.0153698
0.00109973 0.000224581
Year 2000 Obs  =  0.03 0.24 0.47 0.19 0.05 0.02 0 0
Year 2000 Pred =  0.0347573 0.20438 0.424523 0.209562 0.0814599 0.0382161
0.00653223 0.000569729
Year 2001 Obs  =  0.01 0.43 0.29 0.15 0.06 0.04 0.02 0
Year 2001 Pred =  0.0393969 0.263231 0.343857 0.216482 0.085343 0.0332391
0.0155442 0.00290638
Year 2002 Obs  =  0.0505051 0.40404 0.313131 0.151515 0.0505051 0.020202 0
0.010101
Year 2002 Pred =  0.0381313 0.252196 0.403471 0.164915 0.0862589 0.0342262
0.0133517 0.00744975
```

```
Year 2003 Obs  =  0.010101 0.393939 0.383838 0.121212 0.0606061 0.020202
0.010101 0
Year 2003 Pred =  0.0232083 0.242406 0.397871 0.211041 0.0678243 0.0351931
0.0139463 0.00851017
Year 2004 Obs  =  0.049505 0.247525 0.405941 0.207921 0.0594059 0.019802
0.00990099 0
Year 2004 Pred =  0.0351667 0.161378 0.413145 0.232595 0.0990894 0.0316845
0.0164204 0.0105211
Year 2005 Obs  =  0.02 0.22 0.39 0.21 0.07 0.06 0.01 0.02
Year 2005 Pred =  0.0188051 0.260114 0.29453 0.245351 0.10817 0.0458281
0.0146782 0.0125233
Year 2006 Obs  =  0 0.178218 0.356436 0.217822 0.168317 0.049505 0.019802
0.00990099
Year 2006 Pred =  0.0264878 0.142357 0.47968 0.166148 0.106755 0.0468328
0.0198903 0.0118497
 Index number 10
Year 1988 Obs  =  0.04 0.72 0.24 0 0 0 0 0
Year 1988 Pred =  0.478662 0.221002 0.242844 0.0498092 0.00488706 0.00252723
0.000265172 4.05354e-06
Year 1989 Obs  =  0.59 0.3 0.11 0 0 0 0 0
Year 1989 Pred =  0.412954 0.474778 0.0624256 0.0408599 0.00782641
0.000741974 0.000375094 3.91723e-05
Year 1990 Obs  =  0.45 0.5 0.04 0.01 0 0 0 0
Year 1990 Pred =  0.488847 0.348949 0.140355 0.0125369 0.00767554 0.00143025
0.000132851 7.34852e-05
Year 1991 Obs  =  0.25 0.68 0.07 0 0 0 0 0
Year 1991 Pred =  0.379 0.448158 0.118281 0.0476728 0.00397512 0.00242046
0.000430988 6.25684e-05
Year 1992 Obs  =  0.232323 0.636364 0.121212 0.010101 0 0 0 0
Year 1992 Pred =  0.613706 0.256759 0.0977738 0.0222409 0.00835377
0.000686208 0.000399716 8.08919e-05
Year 1993 Obs  =  0.30303 0.676768 0.020202 0 0 0 0 0
Year 1993 Pred =  0.435244 0.527916 0.0278111 0.00691623 0.00148106
0.000556192 4.39514e-05 3.09501e-05
Year 1994 Obs  =  0.584158 0.376238 0.029703 0 0.00990099 0 0 0
Year 1994 Pred =  0.444993 0.359315 0.185405 0.00786194 0.00186303
0.000396055 0.000146427 1.96601e-05
Year 1995 Obs  =  0.59 0.35 0.03 0.01 0.02 0 0 0
Year 1995 Pred =  0.396167 0.384657 0.156139 0.0596804 0.00257449 0.000604034
0.000125456 5.25506e-05
Year 1996 Obs  =  0.168317 0.524752 0.277228 0.019802 0.00990099 0 0 0
Year 1996 Pred =  0.249441 0.443635 0.26864 0.0314606 0.00648136 0.00026301
6.09251e-05 1.79867e-05
Year 1997 Obs  =  0.10101 0.505051 0.323232 0.0606061 0.010101 0 0 0
Year 1997 Pred =  0.245338 0.315759 0.351751 0.0799521 0.00596759 0.00117176
4.7012e-05 1.41058e-05
Year 1998 Obs  =  0.0707071 0.616162 0.282828 0.030303 0 0 0 0
Year 1998 Pred =  0.269831 0.295189 0.253931 0.151396 0.0272682 0.00197987
0.000385 2.0066e-05
Year 1999 Obs  =  0.09 0.53 0.3 0.06 0.01 0.01 0 0
Year 1999 Pred =  0.206057 0.350228 0.256294 0.119261 0.0572233 0.0100648
0.000723929 0.000148126
Year 2000 Obs  =  0.128713 0.524752 0.247525 0.0594059 0.019802 0.00990099
0.00990099 0
Year 2000 Pred =  0.248273 0.260376 0.275457 0.132834 0.0530944 0.0252469
0.00433807 0.000379096
Year 2001 Obs  =  0.11 0.58 0.21 0.07 0.02 0.01 0 0
```

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Year 2001 Pred =  0.263757 0.314311 0.209117 0.128611 0.0521352 0.0205811
0.0096752 0.00181256
Year 2002 Obs  =  0.09 0.54 0.25 0.08 0.03 0.01 0 0
Year 2002 Pred =  0.25875 0.305221 0.248702 0.0993053 0.0534099 0.0214799
0.00842335 0.00470908
Year 2003 Obs  =  0.0594059 0.564356 0.257426 0.0594059 0.019802 0.019802
0.00990099 0.00990099
Year 2003 Pred =  0.174703 0.325446 0.272062 0.140973 0.0465868 0.0245014
0.00976037 0.00596749
Year 2004 Obs  =  0.0808081 0.59596 0.232323 0.0505051 0.020202 0.010101
0.010101 0
Year 2004 Pred =  0.257448 0.210709 0.274745 0.151103 0.0661921 0.0214527
0.0111761 0.00717493
Year 2005 Obs  =  0.277228 0.534653 0.108911 0.049505 0.019802 0.00990099 0 0
Year 2005 Pred =  0.144251 0.355865 0.20523 0.167011 0.0757133 0.0325126
0.0104681 0.00894871
Year 2006 Obs  =  0.0792079 0.534653 0.29703 0.049505 0.019802 0.00990099
0.00990099 0
Year 2006 Pred =  0.208205 0.199573 0.342503 0.115892 0.0765691 0.0340464
0.0145357 0.00867656
 Index number 11
 N/A
 Index number 12
 N/A
 Index number 13
 N/A

Index Selectivity at Age
 0.106403 0.244817 0.469495 0.708798 0.872376 0.953313 0.987 1
 0.00292969 0.278651 0.980689 0.99985 0.999999 1 1 1
 0.224921 0.970976 0.999741 0.999998 1 1 1 1
 0 0 0.70531 1 0 0 0 0
 0 0 0.999975 0.704889 0 0 0 0
 0 0 0.606629 0.748008 1 0 0 0
 0.042917 0.57808 0.97667 0.999219 0.999974 0.999999 1 1
 0 0 1 0.598093 0 0 0 0
 0.0414441 0.35816 0.87808 0.989357 0.999168 0.999936 0.999995 1
 0.444903 0.685741 0.856259 0.942475 0.978728 0.992777 0.998047 1
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0

Deviations section: only applicable if associated lambda > 0
Nyear1 observed, expected, standardized residual
2  286.252  3503.99  -3.2518
3  164.732  752.269  -1.97172
4  34.0134  117.878  -1.61357
5  6276.04  18.4496  7.56799
6  1.15039  2.87895  -1.1909
7  1.51314  0.445747  1.58669
8  0.0943591  0.0802721  0.209906

Fleet Obs, Initial, and Stadardized Residual for Fmult
1  1.06156  0.5  0.977426
2  0.13451  0.2  -0.514978
3  3.05902e-07  0.05  -15.5843
4  3.05902e-07  0.05  -15.5843
```

```
5  0.489352  0.2  1.16161
6  0.0794867  0.05  0.601818

Standardized Residuals for Fmult_devs by fleet and year
N/A

Index Obs, Initial, and Standardized Residual for q_year1
N/A

Standardized Residuals for catchability deviations by index and year
 index 1 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 2 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 3 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
```

```
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 4 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 5 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
```

```
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 6 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 7 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
```

```
 index 8 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 9 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 10 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
```

```
16  0
17  0
18  0
19  0
 index 11 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
 index 12 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 13 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
```

```
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0

Obs, Initial, and Stadardized Residual for SRR steepness
N/A

Obs, Initial, and Stadardized Residual for SRR unexpl S
N/A

End of Deviations Section

Selectivity by age and year for each fleet
 fleet 1 selectivity at age
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00473742 0.728693 0.999341 0.999999 1 1 1 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 0.00394392 0.0700206 0.58877 0.964571 0.998072 0.999899 0.999995 1
 fleet 2 selectivity at age
 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1
```

```
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
0.00812412 0.0971404 0.585633 0.948891 0.995918 0.99969 0.999978 1
fleet 3 selectivity at age
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
0.000234275 1 0.0417969 0.0677448 0.000549955 0.1 0.05 0.01
fleet 4 selectivity at age
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
```

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0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
0.000117237 0.00789973 1 0.0886656 0.000534175 0.1 0.05 0.01
fleet 5 selectivity at age
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.678419 0.725986 0.773645 0.820996 0.867655 0.913255 0.957467 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
0.0101395 0.289638 0.94196 0.998454 0.999961 0.999999 1 1
fleet 6 selectivity at age
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
```

```
 0.0682426 0.94653 1 0.714298 0.46494 0.282495 0.163687 0.092067
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128
 0.0602832 0.723521 1 0.485206 0.153646 0.0406654 0.0101971 0.00252128

Fmult by year for each fleet
1982   1.06156 0.13451 3.05902e-07 3.05902e-07 0.489352 0.0794867
1983   1.10401 0.101086 1.10676e-13 5.66497e-10 0.535406 0.0376709
1984   0.850568 0.231708 8.29175e-19 4.14465e-12 0.478375 0.0260715
1985   1.20851 0.159363 1.944e-15 4.38751e-16 0.324862 0.00895283
1986   0.965997 0.103539 3.89177e-21 4.45649e-17 0.440393 0.0472397
1987   0.868906 0.12732 4.14138e-15 1.3638e-23 0.411986 0.0395224
1988   1.34936 0.181179 1.30984e-08 4.07259e-17 0.503985 0.0508169
1989   1.07967 0.180533 0.0428189 2.34814e-23 0.187171 0.007232
1990   0.590446 0.0927925 0.314935 1.62888e-21 0.250585 0.0343323
1991   0.828357 0.165015 0.239951 2.16907e-19 0.517872 0.0663759
1992   2.05219 0.0877475 0.288414 1.8756e-13 0.347507 0.0808183
1993   0.610366 0.0778725 0.099393 2.43004e-08 0.327211 0.0994068
1994   0.493778 0.0689036 0.0559511 0.0794384 0.251681 0.0582644
1995   1.19533 0.472093 0.0118411 0.05353 0.319066 0.0590028
1996   0.752209 0.339661 0.0250176 0.0198173 0.445091 0.0418482
1997   0.394007 0.0779335 0.0251413 0.00922708 0.402248 0.0327447
1998   0.350637 0.123973 0.0252166 0.018182 0.367645 0.0440114
1999   0.296355 0.104613 0.137265 0.0523532 0.233745 0.0477804
2000   0.256722 0.108328 0.0666405 0.0160038 0.401518 0.0587105
2001   0.255209 0.0861519 0.020134 0.0321163 0.271399 0.0735773
2002   0.301993 0.116668 0.0275245 0.0153002 0.17261 0.0415398
2003   0.2524 0.0835154 0.0362729 0.00776204 0.209335 0.0410535
2004   0.309646 0.112429 0.019451 0.00695738 0.194407 0.0530746
2005   0.366439 0.112053 0.0144671 0.0113019 0.227147 0.0604569
2006   0.271644 0.107649 0.0359352 0.00752173 0.237537 0.0513892

Directed F by age and year for each fleet
 fleet 1 directed F at age
 0.00502907 0.773553 1.06086 1.06156 1.06156 1.06156 1.06156 1.06156
 0.00523018 0.804487 1.10329 1.10401 1.10401 1.10401 1.10401 1.10401
 0.0040295 0.619803 0.850007 0.850567 0.850568 0.850568 0.850568 0.850568
 0.00572523 0.880634 1.20772 1.20851 1.20851 1.20851 1.20851 1.20851
 0.00457633 0.703915 0.96536 0.965996 0.965997 0.965997 0.965997 0.965997
 0.00411637 0.633166 0.868333 0.868905 0.868906 0.868906 0.868906 0.868906
 0.00639247 0.983266 1.34847 1.34935 1.34936 1.34936 1.34936 1.34936
 0.00511484 0.786746 1.07896 1.07967 1.07967 1.07967 1.07967 1.07967
 0.00279719 0.430253 0.590056 0.590445 0.590446 0.590446 0.590446 0.590446
 0.00392427 0.603618 0.827811 0.828356 0.828357 0.828357 0.828357 0.828357
 0.0097221 1.49542 2.05084 2.05219 2.05219 2.05219 2.05219 2.05219
 0.00289156 0.44477 0.609964 0.610366 0.610366 0.610366 0.610366 0.610366
 0.00233923 0.359813 0.493453 0.493778 0.493778 0.493778 0.493778 0.493778
 0.00471427 0.0836974 0.703772 1.15298 1.19302 1.1952 1.19532 1.19533
```

```
 0.00296665 0.0526701 0.442878 0.725559 0.750759 0.752133 0.752205 0.752209
 0.00155393 0.0275886 0.231979 0.380047 0.393247 0.393967 0.394005 0.394007
 0.00138289 0.0245518 0.206445 0.338215 0.349961 0.350602 0.350636 0.350637
 0.0011688 0.020751 0.174485 0.285855 0.295784 0.296325 0.296353 0.296355
 0.00101249 0.0179758 0.15115 0.247627 0.256227 0.256696 0.256721 0.256722
 0.00100652 0.0178699 0.15026 0.246167 0.254717 0.255183 0.255208 0.255209
 0.00119104 0.0211458 0.177805 0.291294 0.301411 0.301963 0.301992 0.301993
 0.000995445 0.0176732 0.148605 0.243457 0.251913 0.252374 0.252399 0.2524
 0.00122122 0.0216816 0.18231 0.298675 0.309049 0.309614 0.309644 0.309646
 0.00144521 0.0256583 0.215749 0.353457 0.365733 0.366402 0.366438 0.366439
 0.00107134 0.0190207 0.159936 0.26202 0.27112 0.271617 0.271643 0.271644
 fleet 2 directed F at age
 0.13451 0.13451 0.13451 0.13451 0.13451 0.13451 0.13451 0.13451
 0.101086 0.101086 0.101086 0.101086 0.101086 0.101086 0.101086 0.101086
 0.231708 0.231708 0.231708 0.231708 0.231708 0.231708 0.231708 0.231708
 0.159363 0.159363 0.159363 0.159363 0.159363 0.159363 0.159363 0.159363
 0.103539 0.103539 0.103539 0.103539 0.103539 0.103539 0.103539 0.103539
 0.12732 0.12732 0.12732 0.12732 0.12732 0.12732 0.12732 0.12732
 0.181179 0.181179 0.181179 0.181179 0.181179 0.181179 0.181179 0.181179
 0.180533 0.180533 0.180533 0.180533 0.180533 0.180533 0.180533 0.180533
 0.0927925 0.0927925 0.0927925 0.0927925 0.0927925 0.0927925 0.0927925
0.0927925
 0.165015 0.165015 0.165015 0.165015 0.165015 0.165015 0.165015 0.165015
 0.0877475 0.0877475 0.0877475 0.0877475 0.0877475 0.0877475 0.0877475
0.0877475
 0.0778725 0.0778725 0.0778725 0.0778725 0.0778725 0.0778725 0.0778725
0.0778725
 0.0689036 0.0689036 0.0689036 0.0689036 0.0689036 0.0689036 0.0689036
0.0689036
 0.00383534 0.0458592 0.276473 0.447964 0.470166 0.471946 0.472082 0.472093
 0.00275944 0.0329948 0.198917 0.322301 0.338274 0.339555 0.339653 0.339661
 0.000633141 0.00757049 0.0456404 0.0739503 0.0776154 0.0779093 0.0779318
0.0779335
 0.00100717 0.0120428 0.0726025 0.117637 0.123467 0.123934 0.12397 0.123973
 0.000849888 0.0101621 0.0612648 0.0992662 0.104186 0.10458 0.104611 0.104613
 0.000880068 0.010523 0.0634403 0.102791 0.107886 0.108294 0.108325 0.108328
 0.000699909 0.00836883 0.0504534 0.0817487 0.0858003 0.0861252 0.08615
0.0861519
 0.000947829 0.0113332 0.0683249 0.110706 0.116192 0.116632 0.116666 0.116668
 0.000678489 0.00811272 0.0489094 0.079247 0.0831745 0.0834895 0.0835136
0.0835154
 0.000913388 0.0109214 0.0658422 0.106683 0.11197 0.112394 0.112427 0.112429
 0.000910329 0.0108848 0.0656217 0.106326 0.111595 0.112018 0.11205 0.112053
 0.000874555 0.0104571 0.063043 0.102147 0.10721 0.107616 0.107647 0.107649
 fleet 3 directed F at age
 7.16653e-11 3.05902e-07 1.27858e-08 2.07233e-08 1.68232e-10 3.05902e-08
1.52951e-08 3.05902e-09
 2.59287e-17 1.10676e-13 4.62591e-15 7.49773e-15 6.08668e-17 1.10676e-14
5.5338e-15 1.10676e-15
 1.94255e-22 8.29175e-19 3.46569e-20 5.61723e-20 4.56009e-22 8.29175e-20
4.14588e-20 8.29175e-21
 4.55431e-19 1.944e-15 8.12531e-17 1.31696e-16 1.06911e-18 1.944e-16
9.71999e-17 1.944e-17
 9.11746e-25 3.89177e-21 1.62664e-22 2.63647e-22 2.1403e-24 3.89177e-22
1.94589e-22 3.89177e-23
 9.70222e-19 4.14138e-15 1.73097e-16 2.80557e-16 2.27757e-18 4.14138e-16
2.07069e-16 4.14138e-17
```

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 3.06863e-12 1.30984e-08 5.47473e-10 8.87349e-10 7.20353e-12 1.30984e-09
6.54921e-10 1.30984e-10
 1.00314e-05 0.0428189 0.0017897 0.00290076 2.35485e-05 0.00428189 0.00214095
0.000428189
 7.37816e-05 0.314935 0.0131633 0.0213352 0.0001732 0.0314935 0.0157468
0.00314935
 5.62146e-05 0.239951 0.0100292 0.0162555 0.000131962 0.0239951 0.0119976
0.00239951
 6.75682e-05 0.288414 0.0120548 0.0195385 0.000158614 0.0288414 0.0144207
0.00288414
 2.32853e-05 0.099393 0.00415432 0.00673336 5.46616e-05 0.0099393 0.00496965
0.00099393
 1.31079e-05 0.0559511 0.00233858 0.00379039 3.07705e-05 0.00559511
0.00279755 0.000559511
 2.77407e-06 0.0118411 0.000494919 0.00080217 6.51204e-06 0.00118411
0.000592053 0.000118411
 5.861e-06 0.0250176 0.00104566 0.00169481 1.37585e-05 0.00250176 0.00125088
0.000250176
 5.88998e-06 0.0251413 0.00105083 0.00170319 1.38266e-05 0.00251413
0.00125706 0.000251413
 5.90762e-06 0.0252166 0.00105397 0.00170829 1.3868e-05 0.00252166 0.00126083
0.000252166
 3.21578e-05 0.137265 0.00573724 0.00929898 7.54894e-05 0.0137265 0.00686324
0.00137265
 1.56122e-05 0.0666405 0.00278536 0.00451455 3.66492e-05 0.00666405
0.00333203 0.000666405
 4.7169e-06 0.020134 0.000841539 0.00136398 1.10728e-05 0.0020134 0.0010067
0.00020134
 6.4483e-06 0.0275245 0.00115044 0.00186464 1.51372e-05 0.00275245 0.00137622
0.000275245
 8.49783e-06 0.0362729 0.00151609 0.0024573 1.99484e-05 0.00362729 0.00181364
0.000362729
 4.55688e-06 0.019451 0.00081299 0.0013177 1.06972e-05 0.0019451 0.000972549
0.00019451
 3.38929e-06 0.0144671 0.000604681 0.000980073 7.95627e-06 0.00144671
0.000723357 0.000144671
 8.41872e-06 0.0359352 0.00150198 0.00243442 1.97627e-05 0.00359352
0.00179676 0.000359352
 fleet 4 directed F at age
 3.58631e-11 2.41655e-09 3.05902e-07 2.7123e-08 1.63405e-10 3.05902e-08
1.52951e-08 3.05902e-09
 6.64144e-14 4.47517e-12 5.66497e-10 5.02288e-11 3.02609e-13 5.66497e-11
2.83248e-11 5.66497e-12
 4.85907e-16 3.27416e-14 4.14465e-12 3.67488e-13 2.21397e-15 4.14465e-13
2.07233e-13 4.14465e-14
 5.14379e-20 3.46602e-18 4.38751e-16 3.89021e-17 2.3437e-19 4.38751e-17
2.19376e-17 4.38751e-18
 5.22466e-21 3.52051e-19 4.45649e-17 3.95137e-18 2.38054e-20 4.45649e-18
2.22824e-18 4.45649e-19
 1.59888e-27 1.07737e-25 1.3638e-23 1.20922e-24 7.28509e-27 1.3638e-24
6.81901e-25 1.3638e-25
 4.77459e-21 3.21724e-19 4.07259e-17 3.61099e-18 2.17548e-20 4.07259e-18
2.0363e-18 4.07259e-19
 2.75289e-27 1.85497e-25 2.34814e-23 2.08199e-24 1.25432e-26 2.34814e-24
1.17407e-24 2.34814e-25
 1.90965e-25 1.28677e-23 1.62888e-21 1.44426e-22 8.70108e-25 1.62888e-22
8.1444e-23 1.62888e-23
```

2.54296e-23 1.71351e-21 2.16907e-19 1.92322e-20 1.15867e-22 2.16907e-20
1.08454e-20 2.16907e-21
2.1989e-17 1.48168e-15 1.8756e-13 1.66301e-14 1.0019e-16 1.8756e-14
9.37802e-15 1.8756e-15
2.84891e-12 1.91967e-10 2.43004e-08 2.15461e-09 1.29807e-11 2.43004e-09
1.21502e-09 2.43004e-10
9.31313e-06 0.000627542 0.0794384 0.00704345 4.2434e-05 0.00794384
0.00397192 0.000794384
6.2757e-06 0.000422873 0.05353 0.00474627 2.85944e-05 0.005353 0.0026765
0.0005353
2.32333e-06 0.000156552 0.0198173 0.00175711 1.05859e-05 0.00198173
0.000990866 0.000198173
1.08176e-06 7.28915e-05 0.00922708 0.000818124 4.92888e-06 0.000922708
0.000461354 9.22708e-05
2.13161e-06 0.000143633 0.018182 0.00161212 9.71238e-06 0.0018182 0.0009091
0.00018182
6.13773e-06 0.000413576 0.0523532 0.00464192 2.79658e-05 0.00523532
0.00261766 0.000523532
1.87624e-06 0.000126426 0.0160038 0.00141899 8.54885e-06 0.00160038
0.000800191 0.000160038
3.76522e-06 0.00025371 0.0321163 0.00284761 1.71557e-05 0.00321163
0.00160581 0.000321163
1.79375e-06 0.000120868 0.0153002 0.0013566 8.173e-06 0.00153002 0.000765011
0.000153002
9.09999e-07 6.1318e-05 0.00776204 0.000688225 4.14629e-06 0.000776204
0.000388102 7.76204e-05
8.15663e-07 5.49615e-05 0.00695738 0.00061688 3.71646e-06 0.000695738
0.000347869 6.95738e-05
1.32501e-06 8.92823e-05 0.0113019 0.00100209 6.03722e-06 0.00113019
0.000565097 0.000113019
8.81826e-07 5.94197e-05 0.00752173 0.000666918 4.01792e-06 0.000752173
0.000376086 7.52173e-05
fleet 5 directed F at age
0.331986 0.355263 0.378585 0.401756 0.424589 0.446903 0.468538 0.489352
0.36323 0.388698 0.414214 0.439567 0.464548 0.488963 0.512634 0.535406
0.324539 0.347294 0.370092 0.392744 0.415065 0.436879 0.458028 0.478375
0.220393 0.235846 0.251328 0.266711 0.281868 0.296682 0.311045 0.324862
0.298771 0.319719 0.340707 0.361561 0.382109 0.402191 0.421661 0.440393
0.279499 0.299096 0.318731 0.338239 0.357462 0.376249 0.394463 0.411986
0.341913 0.365886 0.389905 0.41377 0.437285 0.460267 0.482549 0.503985
0.12698 0.135884 0.144804 0.153667 0.1624 0.170935 0.17921 0.187171
0.170002 0.181922 0.193864 0.20573 0.217422 0.228849 0.239927 0.250585
0.351334 0.375968 0.400649 0.425171 0.449334 0.47295 0.495845 0.517872
0.235756 0.252286 0.268847 0.285302 0.301517 0.317363 0.332727 0.347507
0.221987 0.237551 0.253145 0.268639 0.283907 0.298828 0.313294 0.327211
0.170745 0.182717 0.194711 0.206629 0.218372 0.229849 0.240976 0.251681
0.00323518 0.0924137 0.300548 0.318573 0.319054 0.319066 0.319066 0.319066
0.00451301 0.128915 0.419258 0.444403 0.445074 0.44509 0.445091 0.445091
0.0040786 0.116506 0.378901 0.401626 0.402232 0.402247 0.402248 0.402248
0.00372775 0.106484 0.346307 0.367077 0.367631 0.367645 0.367645 0.367645
0.00237007 0.0677014 0.220179 0.233384 0.233736 0.233745 0.233745 0.233745
0.00407121 0.116295 0.378214 0.400898 0.401503 0.401518 0.401518 0.401518
0.00275186 0.0786074 0.255647 0.270979 0.271388 0.271399 0.271399 0.271399
0.00175019 0.0499944 0.162592 0.172343 0.172603 0.17261 0.17261 0.17261
0.00212256 0.0606314 0.197185 0.209012 0.209327 0.209335 0.209335 0.209335
0.0019712 0.0563076 0.183124 0.194107 0.194399 0.194407 0.194407 0.194407
0.00230316 0.0657904 0.213963 0.226796 0.227138 0.227147 0.227147 0.227147

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 0.00240851 0.0687997 0.22375 0.23717 0.237528 0.237537 0.237537 0.237537
 fleet 6 directed F at age
 0.00542438 0.0752366 0.0794867 0.0567772 0.0369566 0.0224546 0.0130109
0.00731811
 0.00257076 0.0356566 0.0376709 0.0269082 0.0175147 0.0106418 0.00616624
0.00346825
 0.00177919 0.0246775 0.0260715 0.0186228 0.0121217 0.00736507 0.00426757
0.00240033
 0.000610965 0.00847413 0.00895283 0.00639499 0.00416253 0.00252913
0.00146546 0.000824261
 0.00322376 0.0447138 0.0472397 0.0337432 0.0219636 0.013345 0.00773253
0.00434922
 0.00269711 0.0374091 0.0395224 0.0282308 0.0183755 0.0111649 0.0064693
0.00363871
 0.00346788 0.0480998 0.0508169 0.0362984 0.0236268 0.0143555 0.00831807
0.00467856
 0.000493531 0.00684531 0.007232 0.00516581 0.00336245 0.002043 0.00118378
0.000665829
 0.00234293 0.0324966 0.0343323 0.0245235 0.0159625 0.00969872 0.00561976
0.00316088
 0.00452966 0.0628268 0.0663759 0.0474122 0.0308608 0.0187509 0.0108649
0.00611103
 0.00551525 0.0764969 0.0808183 0.0577283 0.0375757 0.0228308 0.0132289
0.0074407
 0.00678378 0.0940915 0.0994068 0.0710061 0.0462182 0.0280819 0.0162716
0.00915209
 0.00397611 0.055149 0.0582644 0.0416181 0.0270894 0.0164594 0.00953712
0.00536423
 0.00355688 0.0426897 0.0590028 0.0286285 0.00906551 0.00239937 0.000601658
0.000148763
 0.00252274 0.030278 0.0418482 0.020305 0.00642979 0.00170177 0.000426731
0.000105511
 0.00197396 0.0236915 0.0327447 0.0158879 0.00503108 0.00133158 0.000333902
8.25586e-05
 0.00265315 0.0318432 0.0440114 0.0213546 0.00676215 0.00178974 0.00044879
0.000110965
 0.00288036 0.0345701 0.0477804 0.0231833 0.00734125 0.00194301 0.000487223
0.000120468
 0.00353926 0.0424783 0.0587105 0.0284867 0.0090206 0.00238749 0.000598678
0.000148026
 0.00443548 0.0532347 0.0735773 0.0357001 0.0113048 0.00299205 0.000750277
0.000185509
 0.00250416 0.030055 0.0415398 0.0201554 0.00638241 0.00168924 0.000423587
0.000104734
 0.00247483 0.029703 0.0410535 0.0199194 0.00630768 0.00166946 0.000418627
0.000103507
 0.00319951 0.0384006 0.0530746 0.0257521 0.00815468 0.0021583 0.000541208
0.000133816
 0.00364454 0.0437418 0.0604569 0.029334 0.00928893 0.00245851 0.000616486
0.000152429
 0.00309791 0.0371812 0.0513892 0.0249343 0.00789572 0.00208976 0.000524022
0.000129567
Discard F by age and year for each fleet
 fleet 1 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0
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fleet 2 Discard F at age
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fleet 3 Discard F at age
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fleet 4 Discard F at age
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0 0 0 0 0 0 0 0
fleet 5 Discard F at age
0 0 0 0 0 0 0 0
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 fleet 6 Discard F at age
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 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
Total F
 0.47695 1.33856 1.65344 1.65461 1.65762 1.66543 1.67762 1.69274
 0.472117 1.32993 1.65626 1.67157 1.68716 1.7047 1.7239 1.74397
 0.562056 1.22348 1.47788 1.49364 1.50946 1.52652 1.54457 1.56305
 0.386092 1.28432 1.62736 1.64098 1.65391 1.66709 1.68039 1.69356
 0.41011 1.17189 1.45685 1.46484 1.47361 1.48507 1.49893 1.51428
 0.413633 1.09699 1.35391 1.36269 1.37206 1.38364 1.39716 1.41185
 0.532953 1.57843 1.97037 1.9806 1.99145 2.00516 2.0214 2.0392
 0.313132 1.15283 1.41332 1.42193 1.42599 1.43746 1.44274 1.44847
 0.268008 1.0524 0.924209 0.934826 0.916796 0.953279 0.944532 0.940134
 0.52486 1.44738 1.46988 1.48221 1.4737 1.50907 1.51208 1.51975
 0.338808 2.20036 2.50031 2.50251 2.47919 2.50898 2.50032 2.49777
 0.309558 0.953678 1.04454 1.03462 1.01842 1.02509 1.02277 1.0256
 0.245986 0.72316 0.897109 0.821762 0.808216 0.822529 0.819964 0.821081
 0.0153507 0.276924 1.39382 1.95369 1.99134 1.99515 1.99034 1.98729
 0.01277 0.270032 1.12376 1.51602 1.54056 1.54296 1.53962 1.53751
 0.0082466 0.200571 0.699544 0.874033 0.878144 0.878892 0.876236 0.874614
 0.00877899 0.200282 0.688602 0.847603 0.847845 0.848311 0.84487 0.8428
 0.00730741 0.270863 0.561799 0.65563 0.64115 0.655555 0.644677 0.63673
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 0.00952051 0.254039 0.670305 0.785736 0.774681 0.77716 0.771296 0.767543
 0.00890225 0.178469 0.562895 0.638807 0.623239 0.620924 0.61612 0.613468
 0.00640145 0.140174 0.466712 0.59772 0.596613 0.597177 0.593833 0.591805
 0.00628074 0.152454 0.445032 0.554781 0.550746 0.551272 0.547868 0.545794
 0.00731068 0.146817 0.492121 0.627151 0.623587 0.621214 0.618339 0.61688
 0.00830795 0.160632 0.567697 0.717894 0.713769 0.710602 0.70754 0.706049
 0.00746162 0.171453 0.507142 0.629373 0.623778 0.623205 0.619523 0.617394

Average F for ages 3 to 5
Freport unweighted in .std and MCMC files
year    unweighted   Nweighted    Bweighted
1982  1.65522  1.6575  1.65758
1983  1.67166  1.6623  1.66505
1984  1.49366  1.47791  1.47794
1985  1.64075  1.62869  1.62948
1986  1.4651  1.46007  1.46141
1987  1.36289  1.35542  1.35686
1988  1.98081  1.97226  1.97341
1989  1.42041  1.41714  1.41826
1990  0.925277  0.924658  0.924668
1991  1.47526  1.4732  1.4747
1992  2.494  2.49943  2.4984
1993  1.03253  1.04182  1.03989
1994  0.842362  0.893591  0.890187
1995  1.77962  1.54293  1.58347
1996  1.39345  1.16858  1.1937
1997  0.81724  0.731217  0.738249
1998  0.794683  0.750405  0.765123
1999  0.619526  0.595893  0.605792
2000  0.743574  0.712734  0.726137
2001  0.608314  0.594174  0.600351
2002  0.553681  0.5131  0.526045
2003  0.516853  0.486686  0.498406
2004  0.580953  0.547767  0.562355
2005  0.666454  0.644411  0.659251
2006  0.586764  0.54732  0.562267

Population Numbers at the Start of the Year
 79921.3 286.252 164.732 34.0134 6276.04 1.15039 1.51314 0.0943591
 123682 40613.2 61.4552 25.813 5.3236 979.338 0.178115 0.245655
 44589 63155.3 8794.85 9.60277 3.97214 0.806531 145.791 0.0611728
 66874.1 20810 15212.5 1642.61 1.76546 0.71881 0.143484 25.483
 72109.2 37215.3 4716.73 2446.74 260.62 0.276513 0.111109 3.85796
 22478.1 39176.3 9438.83 899.666 462.974 48.8842 0.0512741 0.715114
 40624.6 12169.2 10709 1995.56 188.544 96.1211 10.0323 0.15306
 26168.4 19519.6 2055.41 1222.27 225.446 21.0707 10.5957 1.10438
 33824.5 15664.9 5045.99 409.491 241.419 44.3491 4.09768 2.26216
 27610.9 21182.6 4477.3 1639.49 131.642 79.023 13.9966 2.02798
 49273 13374.5 4078.79 842.941 304.884 24.6898 14.3059 2.88947
 36531.7 28748 1212.87 274.032 56.5084 20.9207 1.64446 1.15575
 41893.3 21946.8 9069.25 349.395 79.7287 16.7094 6.14507 0.823459
 42575 26819.8 8718.64 3027.63 125.768 29.0905 6.0101 2.51258
 29748.6 34326.4 16646.7 1771.17 351.372 14.0567 3.23898 0.954367
 28798.2 24047 21453.4 4430.23 318.422 61.6384 2.45994 0.736653
 32946.7 23384.3 16110 8726.29 1513.49 108.336 20.9553 1.09005
 24247.8 26738.7 15670.5 6624.92 3060.99 530.77 37.9748 7.75499
 28964.3 19707.9 16697.3 7315.41 2815.69 1319.94 225.602 19.6765
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 30381.5 23489.3 12515.6 6993.25 2729.85 1062.4 496.797 92.8886
 32213.9 24653.8 16088 5836.23 3022.66 1198.43 467.481 260.835
 21683.1 26206.3 17544.8 8259.5 2628.37 1362.78 540.01 329.517
 33222.8 17641.4 18422 9204.81 3882.9 1240.63 642.913 411.936
 16870.6 27002.4 12471.4 9220.44 4025.2 1704.03 545.749 465.626
 22026.7 13698.2 18827 5787.71 3682.27 1614.15 685.5 408.386

q by index
 index 1 q over time
1992  0.000899486
1993  0.000899486
1994  0.000899486
1995  0.000899486
1996  0.000899486
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1998  0.000899486
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2001  0.000899486
2002  0.000899486
2003  0.000899486
2004  0.000899486
2005  0.000899486
2006  0.000899486
 index 2 q over time
1982  6.95525e-05
1983  6.95525e-05
1984  6.95525e-05
1985  6.95525e-05
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2002  6.95525e-05
2003  6.95525e-05
2004  6.95525e-05
2005  6.95525e-05
2006  6.95525e-05
 index 3 q over time
1982  4.32841e-05
1983  4.32841e-05
1984  4.32841e-05
1985  4.32841e-05
1986  4.32841e-05
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1988  4.32841e-05
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2003  4.32841e-05
2004  4.32841e-05
2005  4.32841e-05
2006  4.32841e-05
 index 4 q over time
1982  0.000134194
1983  0.000134194
1984  0.000134194
1985  0.000134194
1986  0.000134194
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2003  0.000134194
2004  0.000134194
2005  0.000134194
2006  0.000134194
 index 5 q over time
1982  9.28585e-05
1983  9.28585e-05
1984  9.28585e-05
1985  9.28585e-05
1986  9.28585e-05
1987  9.28585e-05
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2002  9.28585e-05
2003  9.28585e-05
2004  9.28585e-05
2005  9.28585e-05
2006  9.28585e-05
 index 6 q over time
1984  4.38692e-05
1985  4.38692e-05
1986  4.38692e-05
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2006  4.38692e-05
 index 7 q over time
1984  4.66135e-05
1985  4.66135e-05
1986  4.66135e-05
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1988  4.66135e-05
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2002  4.66135e-05
2003  4.66135e-05
2004  4.66135e-05
2005  4.66135e-05
2006  4.66135e-05
 index 8 q over time
1982  6.77292e-05
1983  6.77292e-05
1984  6.77292e-05
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1987  6.77292e-05
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2005  6.77292e-05
2006  6.77292e-05
 index 9 q over time
1990  2.69239e-05
1991  2.69239e-05
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2004  2.69239e-05
2005  2.69239e-05
2006  2.69239e-05
 index 10 q over time
1988  0.000155852
1989  0.000155852
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1991  0.000155852
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1994  0.000155852
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2005  0.000155852
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 index 11 q over time
1986  5.30611e-06
1987  5.30611e-06
1988  5.30611e-06
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2005  5.30611e-06
2006  5.30611e-06
 index 12 q over time
1982  0.000224697
1983  0.000224697
1984  0.000224697
1985  0.000224697
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2006  0.000224697
 index 13 q over time
1982  2.65319e-05
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1984  2.65319e-05
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2003  2.65319e-05
2004  2.65319e-05
2005  2.65319e-05
2006  2.65319e-05

Proportions of catch at age by fleet
 fleet 1
Year 1 Obs  =  0.0999237 0.477013 0.390403 0.0160876 0.00422994 0.0067263
0.00395257 0.00166424
Year 1 Pred =  0.0827446 0.0320251 0.0225304 0.00465316 0.857672 0.000156777
0.000205328 1.27364e-05
Year 2 Obs  =  0.10236 0.634204 0.227746 0.0289916 0.00156994 0.00324454
0.000680308 0.00120362
Year 2 Pred =  0.0265622 0.943565 0.00173806 0.000726579 0.000149028
0.0272473 4.92241e-06 6.7417e-06
Year 3 Obs  =  0.0664268 0.506889 0.31883 0.0766062 0.0272241 0.00340893
0.000142039 0.000473462
Year 3 Pred =  0.00509288 0.845532 0.14676 0.000159426 6.55665e-05 1.32308e-
05 0.00237605 9.9035e-07
Year 4 Obs  =  0.0447546 0.343172 0.536416 0.0509351 0.0140125 0.00900421
0.00133198 0.000372955
Year 4 Pred =  0.0150919 0.497365 0.43949 0.0472574 5.05597e-05 2.04899e-05
4.07094e-06 0.000719667
Year 5 Obs  =  0.0249296 0.431275 0.39042 0.135673 0.00967781 0.00569644
0.00177631 0.000551268
Year 5 Pred =  0.0137248 0.791856 0.123567 0.0639529 0.00679021 7.17411e-06
2.86816e-06 9.9034e-05
Year 6 Obs  =  0.0183903 0.493436 0.413006 0.0517919 0.0186673 0.00127403
0.00132942 0.00210491
Year 6 Pred =  0.0036891 0.741361 0.221885 0.0210933 0.0108168 0.00113718
1.18678e-06 1.64618e-05
```

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Year 7 Obs  =  0.0137816 0.502282 0.406308 0.0578374 0.0147757 0.00356965
0.000813339 0.000632597
Year 7 Pred =  0.0142398 0.432587 0.455982 0.084738 0.00797749 0.00404863
0.000420311 6.37521e-06
Year 8 Obs  =  0.0113879 0.295492 0.572835 0.0997628 0.0180308 0.00189798
0.000355872 0.000237248
Year 8 Pred =  0.0100543 0.808319 0.105708 0.0627009 0.0115477 0.00107471
0.000539383 5.61008e-05
Year 9 Obs  =  0 0.651696 0.210154 0.112033 0.0197706 0.00439346 0.00146449
0.000488162
Year 9 Pred =  0.012688 0.645397 0.300237 0.0242755 0.0144175 0.00260945
0.000241961 0.000133817
Year 10 Obs  =  0 0.519579 0.450533 0.0196485 0.00844057 0.00152207
0.00013837 0.00013837
Year 10 Pred =  0.0086662 0.704666 0.20258 0.0738946 0.00595189 0.00352696
0.000624011 9.01616e-05
Year 11 Obs  =  0.0115983 0.586021 0.36372 0.034388 0.00193306 0.00223827 0
0.00010174
Year 11 Pred =  0.031705 0.648632 0.24738 0.0511248 0.0186207 0.00149457
0.000868227 0.000175496
Year 12 Obs  =  0.0213669 0.609594 0.331116 0.0246215 0.00410358 0.00608462
0.00268855 0.000424508
Year 12 Pred =  0.0100724 0.923292 0.0515034 0.0116904 0.00242637 0.000895901
7.04873e-05 4.94834e-05
Year 13 Obs  =  0.0151246 0.470005 0.469243 0.0345704 0.00813421 0.00152517
0.000762583 0.000635486
Year 13 Pred =  0.00976979 0.637116 0.33579 0.0133544 0.0030646 0.000638454
0.00023505 3.14828e-05
Year 14 Obs  =  0.00640312 0.357183 0.595768 0.0335468 0.00556793 0.00111359
0.000278396 0.000139198
Year 14 Pred =  0.0275874 0.272758 0.468688 0.218893 0.00929184 0.00215045
0.000445033 0.000186239
Year 15 Obs  =  0 0.251933 0.573098 0.143499 0.0280525 0.00269736 0.000539471
0.000179824
Year 15 Pred =  0.0125096 0.226992 0.643153 0.0966573 0.0196654 0.000787474
0.000181689 5.35757e-05
Year 16 Obs  =  0 0.086758 0.557534 0.277169 0.059589 0.0157534 0.00228311
0.000913242
Year 16 Pred =  0.00809008 0.109471 0.657279 0.206685 0.0153454 0.002975
0.000118871 3.56212e-05
Year 17 Obs  =  0 0.0439265 0.385253 0.45316 0.0979381 0.0161363 0.00336172
0.000224115
Year 17 Pred =  0.00838592 0.0964902 0.449404 0.373008 0.0669349 0.00479904
0.000929692 4.84021e-05
Year 18 Obs  =  0 0.0307962 0.39309 0.381072 0.14647 0.0400601 0.00650976
0.002003
Year 18 Pred =  0.00584186 0.100998 0.436765 0.290452 0.139729 0.0241233
0.0017342 0.000355364
Year 19 Obs  =  0 0.0548229 0.500129 0.280062 0.116111 0.0307732 0.0121541
0.00594776
Year 19 Pred =  0.00684379 0.0736553 0.435951 0.297971 0.119224 0.0559337
0.00958461 0.000837271
Year 20 Obs  =  0 0.192057 0.381393 0.272035 0.0900435 0.0421654 0.0160501
0.0062568
Year 20 Pred =  0.00762441 0.096548 0.363464 0.321935 0.130911 0.0510917
0.0239435 0.004482
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Year 21 Obs  =  0 0.0797956 0.53184 0.270244 0.0752752 0.0261399 0.0147406
0.00196541
Year 21 Pred =  0.00727537 0.0927398 0.438147 0.245827 0.131803 0.05234
0.0204484 0.0114195
Year 22 Obs  =  0 0.0960949 0.431814 0.276631 0.108771 0.0521366 0.0224903
0.012063
Year 22 Pred =  0.0042353 0.0847619 0.417243 0.306555 0.10112 0.0525133
0.0208418 0.0127294
Year 23 Obs  =  0 0.048398 0.439966 0.297639 0.126138 0.0507589 0.0202361
0.0168634
Year 23 Pred =  0.00615164 0.0542612 0.406901 0.313987 0.137262 0.043982
0.0228227 0.0146326
Year 24 Obs  =  0 0.084207 0.228491 0.271093 0.181561 0.112332 0.0605758
0.0617407
Year 24 Pred =  0.00353109 0.0933184 0.301347 0.342142 0.154821 0.0657504
0.0210874 0.018003
Year 25 Obs  =  0 0.0787154 0.466205 0.232997 0.121327 0.0579345 0.0277078
0.0151134
Year 25 Pred =  0.0046227 0.0472079 0.468248 0.223569 0.147536 0.0648077
0.0275692 0.0164396
 fleet 2
Year 1 Obs  =  0.172408 0.608612 0.179438 0.0249561 0.00913884 0.00333919
0.00105448 0.00105448
Year 1 Pred =  0.949488 0.00238912 0.00122559 0.000252953 0.0466243 8.52265e-
06 1.1162e-05 6.9237e-07
Year 2 Obs  =  0.0778358 0.59769 0.250119 0.0454042 0.0213574 0.00648632
0.000474608 0.000632811
Year 2 Pred =  0.808884 0.186806 0.000250908 0.000104821 2.14997e-05
0.00393085 7.10135e-07 9.72597e-07
Year 3 Obs  =  0.0814915 0.508356 0.349416 0.049416 0.00961366 0.00161725
8.98473e-05 0
Year 3 Pred =  0.450776 0.486548 0.0615793 6.68496e-05 2.7493e-05 5.54787e-06
0.000996313 4.15268e-07
Year 4 Obs  =  0.0274049 0.415828 0.493428 0.0472595 0.0118848 0.0033557
0.000699105 0.000139821
Year 4 Pred =  0.731322 0.156689 0.100958 0.0108487 1.16068e-05 4.70377e-06
9.34546e-07 0.00016521
Year 5 Obs  =  0.0420725 0.482665 0.369497 0.0932996 0.00564862 0.00623296
0.00019478 0.00038956
Year 5 Pred =  0.693372 0.260078 0.0295931 0.015306 0.00162512 1.717e-06
6.86442e-07 2.3702e-05
Year 6 Obs  =  0.054914 0.570351 0.306151 0.0624558 0.00589206 0.000235682 0
0
Year 6 Pred =  0.379639 0.495996 0.108245 0.0102834 0.0052734 0.0005544
5.78582e-07 8.02547e-06
Year 7 Obs  =  0 0.495499 0.377951 0.0800068 0.0385595 0.00662477 0.000169866
0.00118906
Year 7 Pred =  0.72378 0.142947 0.10987 0.0204044 0.00192093 0.000974885
0.000101208 1.53511e-06
Year 8 Obs  =  0.000823384 0.0201729 0.591601 0.294772 0.076163 0.0152326
0.000411692 0.000823384
Year 8 Pred =  0.621781 0.324987 0.0309899 0.0183697 0.00338317 0.00031486
0.000158025 1.6436e-05
Year 9 Obs  =  0.00140449 0.100421 0.51264 0.293539 0.0821629 0.00842697
0.000702247 0.000702247
Year 9 Pred =  0.685666 0.226748 0.0769153 0.00621485 0.00369108 0.000668054
6.19452e-05 3.42587e-05
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Year 10 Obs  =  0 0.142431 0.611857 0.194258 0.0432513 0.00745712 0.000745712
0
Year 10 Pred =  0.593327 0.31365 0.0657492 0.0239674 0.00193046 0.00114395
0.000202395 2.92435e-05
Year 11 Obs  =  0 0.0214031 0.472652 0.414388 0.0778835 0.0124851 0.00118906
0
Year 11 Pred =  0.846888 0.11264 0.0313249 0.00646951 0.00235632 0.000189128
0.000109868 2.22078e-05
Year 12 Obs  =  0 0.269211 0.575536 0.13173 0.0230005 0.000522739 0 0
Year 12 Pred =  0.614515 0.366215 0.0148958 0.00337888 0.000701292
0.000258941 2.03729e-05 1.43022e-05
Year 13 Obs  =  0.00277649 0.119389 0.583989 0.232763 0.0532161 0.00647848
0.00138825 0
Year 13 Pred =  0.626841 0.265759 0.102134 0.00405918 0.000931512 0.000194063
7.14454e-05 9.56945e-06
Year 14 Obs  =  0 0.0642528 0.493788 0.304934 0.117501 0.0188143 0.000709975
0
Year 14 Pred =  0.050343 0.335222 0.412995 0.190763 0.00821379 0.00190467
0.000394244 0.000164987
Year 15 Obs  =  0 0.164492 0.620533 0.157119 0.0374362 0.015882 0.0036869
0.000850822
Year 15 Pred =  0.0235086 0.28729 0.58362 0.0867466 0.017902 0.000718259
0.000165752 4.88769e-05
Year 16 Obs  =  0 0.0163305 0.600384 0.363112 0.0172911 0.00288184 0 0
Year 16 Pred =  0.0159613 0.145459 0.626176 0.194741 0.0146659 0.00284881
0.000113851 3.41173e-05
Year 17 Obs  =  0.0118421 0.359868 0.456579 0.151316 0.0184211 0.00197368 0 0
Year 17 Pred =  0.0166474 0.129004 0.430788 0.353628 0.0643666 0.00462391
0.000895938 4.66456e-05
Year 18 Obs  =  0.000712758 0.0498931 0.35923 0.412687 0.108339 0.0627227
0.00427655 0.00213828
Year 18 Pred =  0.0115937 0.134993 0.418552 0.275282 0.134329 0.0232363
0.00167076 0.000342369
Year 19 Obs  =  0 0.028169 0.224225 0.510423 0.194366 0.0309859 0.0101408
0.00169014
Year 19 Pred =  0.013709 0.0993663 0.421675 0.285047 0.115687 0.0543806
0.00932026 0.000814193
Year 20 Obs  =  0 0.0539986 0.278879 0.380041 0.228298 0.0430622 0.0123035
0.00341763
Year 20 Pred =  0.0151305 0.129037 0.348289 0.305104 0.125844 0.0492105
0.0230663 0.00431787
Year 21 Obs  =  0 0.0351423 0.255338 0.459075 0.204626 0.0311388 0.0133452
0.00133452
Year 21 Pred =  0.0144518 0.124068 0.420261 0.233202 0.126825 0.0504618
0.0197184 0.011012
Year 22 Obs  =  0 0.0262997 0.205505 0.435474 0.221407 0.075841 0.030581
0.00489297
Year 22 Pred =  0.0084712 0.114179 0.402978 0.292821 0.097974 0.0509789
0.0202367 0.0123601
Year 23 Obs  =  0 0.0106054 0.26867 0.381352 0.198409 0.10517 0.0251878
0.0106054
Year 23 Pred =  0.0124239 0.0738042 0.396814 0.302839 0.134285 0.0431123
0.0223757 0.0143462
Year 24 Obs  =  0 0.00888657 0.24621 0.434919 0.203346 0.0747517 0.0230005
0.00888657
Year 24 Pred =  0.00704566 0.125402 0.290343 0.326026 0.149643 0.0636755
0.0204258 0.0174385
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Year 25 Obs  =  0 0.00924499 0.223934 0.337956 0.229584 0.132512 0.048793
0.0179764
Year 25 Pred =  0.00936574 0.0644149 0.458093 0.216317 0.144796 0.0637285
0.0271153 0.0161692
 fleet 3
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  0.0821733 0.882577 0.0189237 0.00633039 0.00947228 0.00031484
0.00020617 2.55772e-06
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  0.00101118 0.996797 5.59596e-05 3.78912e-05 6.3092e-08
0.0020975 1.89464e-07 5.18977e-08
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  0.000215838 0.994412 0.00526041 9.25583e-06 3.09022e-08
1.13388e-06 0.000101814 8.4873e-09
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  0.00105879 0.968309 0.0260773 0.00454181 3.9447e-08 2.90685e-
06 2.88767e-07 1.02097e-05
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  0.000618783 0.990715 0.00471173 0.00394988 3.40453e-06
6.54056e-07 1.30743e-07 9.02882e-07
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  0.000177396 0.989293 0.00902397 0.00138951 5.78448e-06
0.000110578 5.77008e-08 1.60073e-07
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  0.00113653 0.958124 0.0307801 0.00926503 7.08085e-06
0.000653432 3.39182e-05 1.02893e-07
Year 8 Obs  =  0.310372 0.651982 0.0376452 0 0 0 0 0
Year 8 Pred =  0.000444497 0.991679 0.00395247 0.00379737 5.67748e-06
9.60777e-05 2.41101e-05 5.01536e-07
Year 9 Obs  =  0.338025 0.646259 0.0157166 0 0 0 0 0
Year 9 Pred =  0.000696543 0.983224 0.0139401 0.00182564 8.80215e-06
0.000289681 1.34303e-05 1.48553e-06
Year 10 Obs  =  0.206489 0.793511 0 0 0 0 0 0
Year 10 Pred =  0.000436718 0.985433 0.00863407 0.00510126 3.33557e-06
0.000359408 3.17944e-05 9.18776e-07
Year 11 Obs  =  0.421841 0.563915 0.0131483 0.00109569 0 0 0 0
Year 11 Pred =  0.0017311 0.982795 0.0114236 0.00382399 1.13066e-05
0.000165016 4.79306e-05 1.93765e-06
Year 12 Obs  =  0.378133 0.556484 0.06502 0.00036324 0 0 0 0
Year 12 Pred =  0.000392023 0.997215 0.00169535 0.000623305 1.05022e-06
7.05106e-05 2.7738e-06 3.89452e-07
Year 13 Obs  =  0.205618 0.603889 0.17753 0.0129636 0 0 0 0
Year 13 Pred =  0.000542949 0.98257 0.0157829 0.00101669 1.89405e-06
7.17495e-05 1.32075e-05 3.53803e-07
Year 14 Obs  =  0.181467 0.525097 0.265122 0.028314 0 0 0 0
Year 14 Pred =  0.000415298 0.987195 0.00843205 0.00389604 1.29753e-06
5.45035e-05 5.63917e-06 4.71977e-07
Year 15 Obs  =  0.0239334 0.663892 0.248699 0.0634755 0 0 0 0
Year 15 Pred =  0.000225515 0.983828 0.0138563 0.00206021 3.28854e-06
2.39009e-05 2.75699e-06 1.62593e-07
Year 16 Obs  =  0.0126984 0.395238 0.477778 0.114286 0 0 0 0
Year 16 Pred =  0.000295662 0.961874 0.0287073 0.00893091 5.20222e-06
0.000183053 3.65674e-06 2.19156e-07
Year 17 Obs  =  0.047619 0.306878 0.386243 0.259259 0 0 0 0
Year 17 Pred =  0.000346605 0.958834 0.0221984 0.0182283 2.56628e-05
0.000333952 3.23443e-05 3.36784e-07
Year 18 Obs  =  0.0319893 0.407531 0.416861 0.143619 0 0 0 0
```

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Year 18 Pred =  0.000231848 0.9637 0.0207157 0.0136292 5.14406e-05 0.00161188
5.79328e-05 2.37425e-06
Year 19 Obs  =  0.0220441 0.164329 0.460922 0.352705 0 0 0 0
Year 19 Pred =  0.000366133 0.947377 0.0278728 0.0188478 5.91659e-05
0.00503804 0.000431609 7.54068e-06
Year 20 Obs  =  0.0226337 0.203704 0.218107 0.555556 0 0 0 0
Year 20 Pred =  0.000315801 0.961448 0.0179915 0.0157659 5.02976e-05
0.00356289 0.000834772 3.12521e-05
Year 21 Obs  =  0.0247148 0.235741 0.418251 0.321293 0 0 0 0
Year 21 Pred =  0.000313232 0.959959 0.022544 0.0125137 5.26383e-05
0.00379394 0.000741043 8.27672e-05
Year 22 Obs  =  0.00319489 0.421725 0.408946 0.0894569 0.0399361 0.0159744
0.0159744 0.00479233
Year 22 Pred =  0.000198346 0.954369 0.0233522 0.0169743 4.39281e-05
0.00414052 0.000821578 0.000100358
Year 23 Obs  =  0.00369004 0.143911 0.494465 0.195572 0.0811808 0.0332103
0.0258303 0.0221402
Year 23 Pred =  0.000439204 0.931412 0.0347188 0.0265052 9.0906e-05
0.00528684 0.00137157 0.000175873
Year 24 Obs  =  0.0162602 0.166667 0.390244 0.211382 0.0894309 0.0528455
0.0406504 0.0325203
Year 24 Pred =  0.000151309 0.961387 0.015432 0.0173342 6.15393e-05
0.00474351 0.000760591 0.000129868
Year 25 Obs  =  0.0114286 0.14 0.517143 0.148571 0.0828571 0.0457143
0.0314286 0.0228571
Year 25 Pred =  0.000375376 0.921639 0.0454408 0.0214647 0.000111131
0.00886018 0.00188438 0.000224731
 fleet 4
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  0.0792542 0.0134375 0.872599 0.0159684 0.0177323 0.000606796
0.000397355 4.92953e-06
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  0.042642 0.663574 0.112824 0.00417915 5.16418e-06 0.176755
1.5966e-05 4.37339e-06
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  0.000806441 0.0586522 0.939682 9.04482e-05 2.24105e-07
8.46589e-06 0.000760173 6.33687e-08
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  0.000830425 0.0119888 0.977843 0.00931663 6.00512e-08
4.55589e-06 4.52582e-07 1.60016e-05
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  0.00245679 0.0620944 0.894393 0.0410161 2.62365e-05 5.18927e-
06 1.03732e-06 7.16346e-06
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  0.000393256 0.0346202 0.956415 0.00805624 2.48893e-05
0.000489849 2.55608e-07 7.09103e-07
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  0.00075094 0.00999356 0.972328 0.0160108 9.0809e-06
0.000862754 4.47836e-05 1.35854e-07
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  0.00206502 0.072728 0.877895 0.0461402 5.11953e-05 0.00089195
0.00022383 4.65607e-06
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  0.00101228 0.022557 0.968582 0.0069392 2.48291e-05 0.00084127
3.90033e-05 4.31415e-06
Year 10 Obs  =  0 0 0 0 0 0 0 0
```

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Year 10 Pred =  0.000986002 0.0351218 0.931986 0.0301227 1.46172e-05
0.00162153 0.000143446 4.14522e-06
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  0.00301659 0.0270353 0.951733 0.0174282 3.82423e-05
0.000574619 0.000166905 6.74733e-06
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  0.0039611 0.159062 0.818997 0.016472 2.05969e-05 0.0014237
5.60068e-05 7.86357e-06
Year 13 Obs  =  0 0.604376 0.362808 0.0328168 0 0 0 0
Year 13 Pred =  0.000701969 0.0200538 0.975581 0.00343786 4.753e-06
0.00018537 3.41224e-05 9.14075e-07
Year 14 Obs  =  0 0.404255 0.524823 0.070922 0 0 0 0
Year 14 Pred =  0.000967051 0.0362883 0.938729 0.0237276 5.86442e-06
0.000253615 2.62401e-05 2.1962e-06
Year 15 Obs  =  0 0.741611 0.241611 0.0167785 0 0 0 0
Year 15 Pred =  0.000329858 0.0227167 0.968984 0.00788141 9.33627e-06
6.98599e-05 8.05841e-06 4.75244e-07
Year 16 Obs  =  0 0.220779 0.636364 0.142857 0 0 0 0
Year 16 Pred =  0.000209435 0.0107559 0.972217 0.0165459 7.15254e-06
0.000259114 5.17617e-06 3.10219e-07
Year 17 Obs  =  0.00595238 0.25 0.434524 0.309524 0 0 0 0
Year 17 Pred =  0.000308028 0.0134515 0.943177 0.0423683 4.42666e-05
0.000593062 5.74398e-05 5.9809e-07
Year 18 Obs  =  0.00208333 0.133333 0.497917 0.366667 0 0 0 0
Year 18 Pred =  0.000221875 0.0145587 0.947813 0.0341127 9.55499e-05
0.00308248 0.000110788 4.5404e-06
Year 19 Obs  =  0.0111732 0.256983 0.458101 0.273743 0 0 0 0
Year 19 Pred =  0.000259988 0.0106197 0.946263 0.0350038 8.15464e-05
0.00714887 0.000612444 1.07001e-05
Year 20 Obs  =  0 0.0634146 0.243902 0.692683 0 0 0 0
Year 20 Pred =  0.000341093 0.016393 0.929064 0.0445368 0.000105445
0.00768996 0.00180173 6.7453e-05
Year 21 Obs  =  0.00564972 0.169492 0.468927 0.355932 0 0 0 0
Year 21 Pred =  0.00027589 0.0133474 0.949332 0.0288267 8.99892e-05
0.00667762 0.00130429 0.000145677
Year 22 Obs  =  0 0.387387 0.432432 0.117117 0.036036 0.00900901 0.00900901
0.00900901
Year 22 Pred =  0.000167193 0.0126995 0.941112 0.037422 7.18715e-05
0.00697447 0.0013839 0.000169047
Year 23 Obs  =  0 0.133333 0.609524 0.180952 0.047619 0.0190476 0.00952381 0
Year 23 Pred =  0.000249804 0.00836271 0.944092 0.0394279 0.000100356
0.00600882 0.00155887 0.00019989
Year 24 Obs  =  0 0.08 0.52 0.24 0.08 0.04 0.02 0.02
Year 24 Pred =  0.000186837 0.0187401 0.911042 0.0559815 0.000147493
0.0117047 0.00187677 0.000320451
Year 25 Obs  =  0 0.0887097 0.637097 0.169355 0.0564516 0.0241935 0.016129
0.00806452
Year 25 Pred =  0.000165676 0.00642139 0.958865 0.0247777 9.52022e-05
0.00781445 0.00166197 0.000198207
 fleet 5
Year 1 Obs  =  0.177729 0.545789 0.226071 0.0362567 0.0138952 0 0.000258515 0
Year 1 Pred =  0.936927 0.00252281 0.00137913 0.000302064 0.0588408 1.1321e-
05 1.55447e-05 1.00706e-06
Year 2 Obs  =  0.10964 0.553058 0.237093 0.0638217 0.0251476 0.0104782 0
0.00076205
Year 2 Pred =  0.797305 0.197042 0.000282031 0.000125034 2.71031e-05
0.00521578 9.87882e-07 1.4131e-06
```

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Year 3 Obs  =  0.130587 0.526352 0.276452 0.0579113 0.00841202 0.000286123 0
0
Year 3 Pred =  0.432113 0.499105 0.0673153 7.75493e-05 3.3706e-05 7.15907e-06
0.0013479 5.86768e-07
Year 4 Obs  =  0.0905476 0.452015 0.395988 0.0427435 0.0133743 0.00533165 0 0
Year 4 Pred =  0.711735 0.163184 0.112046 0.012777 1.44467e-05 6.1624e-06
1.28362e-06 0.000237
Year 5 Obs  =  0.100594 0.551416 0.239566 0.0936236 0.0111006 0.00129077
0.00240943 0
Year 5 Pred =  0.675754 0.271241 0.0328895 0.0180521 0.00202561 2.25261e-06
9.44174e-07 3.40494e-05
Year 6 Obs  =  0.059377 0.595041 0.263954 0.0569612 0.0231405 0.000127146
0.000635728 0.000762873
Year 6 Pred =  0.360258 0.503676 0.117137 0.0118093 0.00640004 0.000708207
7.74878e-07 1.12257e-05
Year 7 Obs  =  0.0430723 0.576506 0.33243 0.0388554 0.00883534 0.000301205 0
0
Year 7 Pred =  0.702257 0.148421 0.121566 0.0239583 0.00238369 0.00127332
0.00013859 2.19549e-06
Year 8 Obs  =  0.042516 0.313337 0.552126 0.0786255 0.00931858 0.00116482
0.00291206 0
Year 8 Pred =  0.602429 0.33695 0.0342399 0.0215384 0.0041922 0.000410659
0.000216082 2.3473e-05
Year 9 Obs  =  0.0930416 0.7301 0.139431 0.0311017 0.0060622 0 0.000263574 0
Year 9 Pred =  0.666146 0.235739 0.0852143 0.00730686 0.00458626 0.0008737
8.49357e-05 4.90603e-05
Year 10 Obs  =  0.0141727 0.59443 0.371622 0.0130191 0.00659196 0.000164799 0
0
Year 10 Pred =  0.571998 0.323576 0.0722827 0.0279617 0.00238019 0.00148457
0.000275376 4.15557e-05
Year 11 Obs  =  0.0165934 0.639544 0.320472 0.0179928 0 0.00539784 0 0
Year 11 Pred =  0.834839 0.118823 0.0352136 0.00771776 0.00297071 0.000250972
0.000152853 3.2269e-05
Year 12 Obs  =  0.0121651 0.60502 0.357715 0.0244841 0.000307977 0.000307977
0 0
Year 12 Pred =  0.597325 0.380929 0.0165115 0.0039746 0.000871818 0.000338824
2.79484e-05 2.04919e-05
Year 13 Obs  =  0.117858 0.596449 0.253319 0.0274504 0.00417723 0.000149187
0.000596748 0
Year 13 Pred =  0.606122 0.274993 0.11262 0.0047499 0.00115197 0.000252604
9.74994e-05 1.36393e-05
Year 14 Obs  =  0.0694528 0.453999 0.428743 0.0348767 0.0078172 0.00481058
0.000300661 0
Year 14 Pred =  0.03242 0.515727 0.342755 0.103571 0.00425535 0.000983073
0.000203426 8.513e-05
Year 15 Obs  =  0.0165785 0.419465 0.495641 0.0505931 0.017579 0.000142918 0
0
Year 15 Pred =  0.0151643 0.442721 0.485167 0.0471757 0.00928998 0.000371338
8.56685e-05 2.52614e-05
Year 16 Obs  =  0.000558114 0.160179 0.584345 0.204409 0.0382308 0.0122785 0
0
Year 16 Pred =  0.0118335 0.257632 0.598283 0.121723 0.00874723 0.00169278
6.76316e-05 2.02665e-05
Year 17 Obs  =  0 0.110044 0.417682 0.388881 0.0737928 0.00902708 0.000573148
0
Year 17 Pred =  0.0134863 0.249669 0.449755 0.241526 0.0419494 0.00300227
0.000581558 3.02773e-05
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Year 18 Obs  =  0 0.0489408 0.482591 0.3701 0.0791332 0.0146092 0.00462625 0
Year 18 Pred =  0.00939609 0.261367 0.437161 0.188094 0.0875821 0.0150934
0.00108494 0.00022232
Year 19 Obs  =  0 0.0740931 0.528266 0.292783 0.0824253 0.0217921 0.000640943
0
Year 19 Pred =  0.0116216 0.201239 0.460684 0.203726 0.0788973 0.0369484
0.00633075 0.000553025
Year 20 Obs  =  0 0.158292 0.373064 0.336419 0.101813 0.0228561 0.00680015
0.000755572
Year 20 Pred =  0.0126922 0.258592 0.376522 0.215777 0.0849255 0.0330854
0.0155036 0.00290211
Year 21 Obs  =  0.00030656 0.0594727 0.406806 0.369099 0.129062 0.0282036
0.00613121 0.000919681
Year 21 Pred =  0.0118832 0.243715 0.445342 0.161663 0.0838943 0.0332556
0.0129912 0.00725493
Year 22 Obs  =  0 0.0519851 0.367186 0.384075 0.142136 0.0375082 0.0135995
0.00350954
Year 22 Pred =  0.00709929 0.228597 0.435228 0.206892 0.0660539 0.0342416
0.0135887 0.00829945
Year 23 Obs  =  0.00526662 0.0467413 0.341014 0.377441 0.14944 0.0482774
0.0263331 0.00548607
Year 23 Pred =  0.0110194 0.156385 0.453578 0.226455 0.095818 0.0306475
0.0159018 0.0101952
Year 24 Obs  =  0.000729927 0.0447689 0.291241 0.374453 0.183698 0.0579075
0.0240876 0.0231144
Year 24 Pred =  0.00608732 0.258835 0.323281 0.23748 0.104011 0.044093
0.0141401 0.0120718
Year 25 Obs  =  0.000987167 0.017769 0.34847 0.325518 0.179911 0.078233
0.0333169 0.0157947
Year 25 Pred =  0.00822831 0.135198 0.518666 0.160225 0.10234 0.044874
0.0190876 0.0113819
 fleet 6
Year 1 Obs  =  0.212871 0.787129 0 0 0 0 0 0
Year 1 Pred =  0.718792 0.0250859 0.0135958 0.00200437 0.240474 2.67082e-05
2.02681e-05 7.07132e-07
Year 2 Obs  =  0.158085 0.841915 0 0 0 0 0 0
Year 2 Pred =  0.23644 0.757364 0.00107472 0.000320705 4.28162e-05 0.00475638
4.97891e-07 3.83545e-07
Year 3 Obs  =  0.170732 0.829268 0 0 0 0 0 0
Year 3 Pred =  0.0556179 0.83264 0.111335 8.63328e-05 2.31109e-05 2.83357e-06
0.000294854 6.91242e-08
Year 4 Obs  =  0.162602 0.837398 0 0 0 0 0 0
Year 4 Pred =  0.162592 0.483179 0.328911 0.025246 1.7581e-05 4.32906e-06
4.98369e-07 4.95539e-05
Year 5 Obs  =  0.109729 0.890271 0 0 0 0 0 0
Year 5 Pred =  0.141342 0.735337 0.0883976 0.0326581 0.00225699 1.44887e-06
3.35635e-07 6.51837e-06
Year 6 Obs  =  0.0805471 0.919453 0 0 0 0 0 0
Year 6 Pred =  0.0422235 0.765138 0.176415 0.0119714 0.00399591 0.000255248
1.5435e-07 1.20421e-06
Year 7 Obs  =  0.0763889 0.923611 0 0 0 0 0 0
Year 7 Pred =  0.159164 0.436004 0.354047 0.0469661 0.002878 0.000887454
5.3384e-05 4.55434e-07
Year 8 Obs  =  0.135417 0.864583 0 0 0 0 0 0
Year 8 Pred =  0.107194 0.777102 0.0782884 0.0331481 0.00397373 0.000224701
6.53456e-05 3.82277e-06
Year 9 Obs  =  0.113208 0.886792 0 0 0 0 0 0
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Year 9 Pred =  0.135751 0.622661 0.223144 0.012879 0.00497879 0.000547514
2.94168e-05 9.15059e-06
Year 10 Obs  =  0.023976 0.976024 0 0 0 0 0 0
Year 10 Pred =  0.0960632 0.704348 0.15599 0.0406169 0.00212944 0.0007667
7.85997e-05 6.38763e-06
Year 11 Obs  =  0.024602 0.975398 0 0 0 0 0 0
Year 11 Pred =  0.286781 0.529049 0.155438 0.0229308 0.00543626 0.000265115
8.92392e-05 1.01456e-05
Year 12 Obs  =  0.0191657 0.980834 0 0 0 0 0 0
Year 12 Pred =  0.103219 0.853183 0.0366636 0.0059405 0.000802542 0.000180046
8.20802e-06 3.24099e-06
Year 13 Obs  =  0.175182 0.824818 0 0 0 0 0 0
Year 13 Pred =  0.106981 0.629093 0.255423 0.0072512 0.00108312 0.000137103
2.92469e-05 2.20335e-06
Year 14 Obs  =  0.139278 0.860722 0 0 0 0 0 0
Year 14 Pred =  0.101664 0.679501 0.191922 0.0265466 0.000344863 2.10856e-05
1.0941e-06 1.13208e-07
Year 15 Obs  =  0.0384911 0.961509 0 0 0 0 0 0
Year 15 Pred =  0.0519485 0.637233 0.296777 0.0132096 0.000822477 8.70097e-06
5.03351e-07 3.66988e-08
Year 16 Obs  =  0.0172786 0.590353 0.37581 0.0165587 0 0 0 0
Year 16 Pred =  0.0499096 0.45655 0.450575 0.0419628 0.000953455 4.88338e-05
4.89238e-07 3.62488e-08
Year 17 Obs  =  0 0.403892 0.51592 0.0801887 0 0 0 0
Year 17 Pred =  0.0614286 0.477815 0.365799 0.089921 0.00493812 9.35352e-05
4.54329e-06 5.8484e-08
Year 18 Obs  =  0.0471116 0.32922 0.553561 0.0701066 0 0 0 0
Year 18 Pred =  0.0436996 0.510737 0.363045 0.0715029 0.010527 0.000480135
8.65438e-06 4.38482e-07
Year 19 Obs  =  0 0.314914 0.588519 0.0965665 0 0 0 0
Year 19 Pred =  0.0588762 0.428355 0.416741 0.0843607 0.0103299 0.00128032
5.50084e-05 1.18813e-06
Year 20 Obs  =  0 0.524324 0.369231 0.0993763 0.00706861 0 0 0
Year 20 Pred =  0.060827 0.520703 0.322209 0.0845244 0.0105185 0.00108453
0.000127435 5.89813e-06
Year 21 Obs  =  0.0533049 0.401564 0.404407 0.140725 0 0 0 0
Year 21 Pred =  0.056738 0.488925 0.379686 0.0630918 0.0103522 0.00108606
0.000106387 1.46899e-05
Year 22 Obs  =  0.0298598 0.478367 0.365021 0.118221 0.00853138 0 0 0
Year 22 Pred =  0.0355424 0.480862 0.389079 0.0846631 0.00854652 0.00117255
0.000116683 1.76207e-05
Year 23 Obs  =  0.0499706 0.298648 0.466784 0.180482 0.00411523 0 0 0
Year 23 Pred =  0.0615794 0.367191 0.452606 0.103438 0.0138383 0.00117144
0.000152413 2.41612e-05
Year 24 Obs  =  0.109767 0.498271 0.31936 0.0691443 0.00345722 0 0 0
Year 24 Pred =  0.0312177 0.557719 0.296036 0.0995453 0.0137852 0.00154665
0.000124373 2.62536e-05
Year 25 Obs  =  0.0883694 0.314709 0.505701 0.0826682 0.00741163 0.00114025 0
0
Year 25 Pred =  0.0473619 0.326967 0.533082 0.075382 0.0152237 0.00176669
0.000188438 2.77828e-05

Proportions of Discards at age by fleet
 fleet 1
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
```

```
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 2
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
```

```
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 3
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
```

```
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 4
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
```

```
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 5
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
```

```
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 6
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
```

```
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15

F Reference Points Using Final Year Selectivity and Freport options
 refpt           F       slope to plot on SRR
  F0.1     0.153305     0.318993
  Fmax     0.280737     0.51694
  F30%SPR  0.230649     0.43601
  F40%SPR  0.158871     0.327012
  Fmsy     0.204411     0.395064    SSBmsy    6.35383e+25     MSY
1.21161e+25
  Fcurrent 0.586764     1.03479

Stock-Recruitment Relationship Parameters
 alpha     = 2.91798e+25
 beta      = 1.03225e+25
 unexpl    = 2.25984e+26
 steepness = 0.851259
Spawning Stock, Obs Recruits(year+1), Pred Recruits(year+1), standardized
residual
init  xxxx  79921.3  6895.37  5.1869
1982  7668.5  123682  21677.4  3.68653
1983  13116.5  44589  37077.8  0.390507
1984  12626.9  66874.1  35693.9  1.32908
1985  11034.5  72109.2  31192.5  1.774
1986  12582  22478.1  35566.8  -0.971406
1987  10319.1  40624.6  29170.2  0.701182
1988  6190.88  26168.4  17500.4  0.8517
1989  5943.41  33824.5  16800.9  1.48134
1990  7411.88  27610.9  20952  0.584232
1991  5330.35  49273  15067.9  2.50817
1992  5217.14  36531.7  14747.9  1.92024
1993  8993.8  41893.3  25423.7  1.05729
1994  12864.6  42575  36365.9  0.333704
1995  17270.1  29748.6  48819.3  -1.04861
1996  19359  28798.2  54724.3  -1.35907
1997  19800.3  32946.7  55971.8  -1.12188
1998  21405.5  24247.8  60509.1  -1.93587
1999  21545.2  28964.3  60904.2  -1.57339
2000  21923.9  30381.5  61974.6  -1.50914
2001  25023.3  32213.9  70736.1  -1.66509
2002  28221.5  21683.1  79776.9  -2.75774
```

```
2003  30733.3  33222.8  86877.1  -2.03492
2004  28544.5  16870.6  80689.8  -3.31309
2005  25558.8  22026.7  72249.9  -2.51466
2006  23825.8       xxxx   67350.9

Root Mean Square Error computed from Standardized Residuals
Component                  #resids         RMSE
_Catch_Fleet_1                25           1.15006
_Catch_Fleet_2                25           0.211925
_Catch_Fleet_3                25           4.55708
_Catch_Fleet_4                25           2.81316
_Catch_Fleet_5                25           0.495593
_Catch_Fleet_6                25           0.0692742
Catch_Fleet_Total             150           2.24718
_Discard_Fleet_1              0             0
_Discard_Fleet_2              0             0
_Discard_Fleet_3              0             0
_Discard_Fleet_4              0             0
_Discard_Fleet_5              0             0
_Discard_Fleet_6              0             0
Discard_Fleet_Total           0             0
_Index_1                      15            3.1099
_Index_2                      25            2.5973
_Index_3                      25            1.48293
_Index_4                      25            7.45039
_Index_5                      25            8.08223
_Index_6                      23            1.77101
_Index_7                      23            1.52043
_Index_8                      25            3.99163
_Index_9                      17            2.14715
_Index_10                      19            1.14883
_Index_11                      21            2.67517
_Index_12                      25            1.81917
_Index_13                      25            1.34097
Index_Total                   293            3.82846
Nyear1                        7            3.34493
Fmult_Year1                   6            9.02474
_Fmult_devs_Fleet_1           0            0
_Fmult_devs_Fleet_2           0            0
_Fmult_devs_Fleet_3           0            0
_Fmult_devs_Fleet_4           0            0
_Fmult_devs_Fleet_5           0            0
_Fmult_devs_Fleet_6           0            0
Fmult_devs_Total              0            0
Recruit_devs                  0            0
Fleet_Sel_params              32            7.70217
Index_Sel_params              68            0.756962
q_year1                       0            0
q_devs                        0            0
SRR_steepness                 0            0
SRR_unexpl_S                  0            0

Projections not requested

that's all
```

SS2 ALTERNATIVE RUN (F08_MULTI.REP)

```
Code_version_:__2.00o;_01/31/08;_Stock_Synthesis_2_by_Richard_Methot_(NOAA);_
using_Otter_Research_ADMB_7.0.1

Time: Wed Mar 19 08:48:34 2008

Data_File: F08_MULTI.DAT
Control_File: F08_MULTI_IAN.CTL

Convergence_Level:
Hessian:
Sum_of_months_on_read_was:_ 12 rescaled_to_sum_to: 1

LIKELIHOOD 4950.75
indices 3153.61
discard 0
length_comps 0
age_comps 1769.74
size-at-age 0
mean_body_wt 0
Equil_catch 0
catch 27.4002
Recruitment 0
Parm_priors 0
Parm_devs 0
penalties 0
Forecast_Recruitment 0

Fleet surv_lambda surv_like disc_lambda disc_like length_lambda length_like
age_lambda age_like sizeage_lambda sizeage_like
1 0 0 0 0 0 0 1 193.803 0 0
2 0 0 0 0 0 0 1 722.843 0 0
3 0 0 0 0 0 0 1 286.395 0 0
4 0 0 0 0 0 0 1 175.194 0 0
5 0 0 0 0 0 0 1 213.2 0 0
6 0 0 0 0 0 0 1 178.307 0 0
7 1 154.773 0 0 0 0 0 0 0 0
8 1 44.0208 0 0 0 0 0 0 0 0
9 1 105.618 0 0 0 0 0 0 0 0
10 1 143.636 0 0 0 0 0 0 0 0
11 1 79.8689 0 0 0 0 0 0 0 0
12 1 127.796 0 0 0 0 0 0 0 0
13 1 82.6969 0 0 0 0 0 0 0 0
14 1 175.064 0 0 0 0 0 0 0 0
15 1 41.067 0 0 0 0 0 0 0 0
16 1 33.4215 0 0 0 0 0 0 0 0
17 1 67.72 0 0 0 0 0 0 0 0
18 1 25.9998 0 0 0 0 0 0 0 0
19 1 73.3038 0 0 0 0 0 0 0 0
20 1 48.2303 0 0 0 0 0 0 0 0
21 1 255.747 0 0 0 0 0 0 0 0
22 1 180.776 0 0 0 0 0 0 0 0
23 1 518.654 0 0 0 0 0 0 0 0
24 1 193.801 0 0 0 0 0 0 0 0
25 1 43.3054 0 0 0 0 0 0 0 0
```

```
26 1 40.5962 0 0 0 0 0 0 0 0
27 1 41.73 0 0 0 0 0 0 0 0
28 1 36.0263 0 0 0 0 0 0 0 0
29 1 19.9886 0 0 0 0 0 0 0 0
30 1 13.9444 0 0 0 0 0 0 0 0
31 1 41.9613 0 0 0 0 0 0 0 0
32 1 41.3827 0 0 0 0 0 0 0 0
33 1 45.0029 0 0 0 0 0 0 0 0
34 1 41.8502 0 0 0 0 0 0 0 0
35 1 42.5269 0 0 0 0 0 0 0 0
36 1 24.6281 0 0 0 0 0 0 0 0
37 1 60.3497 0 0 0 0 0 0 0 0
38 1 36.1547 0 0 0 0 0 0 0 0
39 1 29.5795 0 0 0 0 0 0 0 0
40 1 53.5634 0 0 0 0 0 0 0 0
41 1 24.9973 0 0 0 0 0 0 0 0
42 1 23.1701 0 0 0 0 0 0 0 0
43 1 27.2461 0 0 0 0 0 0 0 0
44 1 49.3891 0 0 0 0 0 0 0 0
45 1 64.0237 0 0 0 0 0 0 0 0

Source Lambda Like
mean_body_wt 0 0
Equil_catch 0 0
Catch 10 2.74002
Recruitment 0 0
Parm_priors 0 0
Parm_devs 1 0
penalties 0


Variance_adjustments_to_input_values 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45
Index_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Discard_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
MeanBodyWt_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
effN_mult_Lencomp  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
effN_mult_Agecomp  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
effN_mult_Len-at-age  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

PARAMETERS
Num Value Phase Min Max Init Prior PR_type SD Active_Cnt Prior_Like Bound
M-G_parmsUsing_offset_approach_#:_3
Gender:_1__Pattern:_1
1 0.2 -3
2 0 -3
3 28.1 -2
4 60.2 -2
5 0.2052 -3
6 0.1 -2
```

```
7 0 -3
biology_parms
8 2.44e-006 -3
9 3.34694 -3
10 28.1 -3
11 -0.25 -3
12 1 -3
13 0 -3
recrdist_by_growthpattern:1
14 0 -3
recrdist_by_area:1
15 0 -3
recrdist_by_seas:1
16 4 -3
cohort_growth_dev:2
17 1 -3
MGparm_env_linkages
MG_parm_blockparms
M-G_parm_devs 1
1_YR1982 0 -

MGParm_Block_Assignments
SR_parms
1 11.0006 1  3 31 10.1121 0 -1 99 1 0
2 0.879485 1  0.2 1 0.8 0 -1 99 2 0
3 0.6 -1
4 0 -1
5 -0.47173 1  -5 5 0 0 -1 99 3 0
6 0 -1
Recr_Devs
1982 0.480175 - - - - - - - 4
1983 0.666252 - - - - - - - 5
1984 0.183554 - - - - - - - 6
1985 0.450982 - - - - - - - 7
1986 0.523818 - - - - - - - 8
1987 0.193761 - - - - - - - 9
1988 -0.985401 - - - - - - - 10
1989 0.150743 - - - - - - - 11
1990 0.420276 - - - - - - - 12
1991 0.167928 - - - - - - - 13
1992 0.363846 - - - - - - - 14
1993 0.27197 - - - - - - - 15
1994 0.152032 - - - - - - - 16
1995 0.288818 - - - - - - - 17
1996 -0.133266 - - - - - - - 18
1997 -0.0934432 - - - - - - - 19
1998 -0.0834052 - - - - - - - 20
1999 -0.382198 - - - - - - - 21
2000 -0.216948 - - - - - - - 22
2001 -0.217438 - - - - - - - 23
2002 -0.141447 - - - - - - - 24
2003 -0.53948 - - - - - - - 25
2004 -0.243228 - - - - - - - 26
2005 -0.960752 - - - - - - - 27
2006 -0.317149 - - - - - - - 28
init_F_parms
1 1.2679 1 0 2 1 1 -1 10 29 0
```

```
2 0 -1
3 0 -1
4 0 -1
5 0 -1
6 0 -1
Q_parms
sel_parms
#_size_sel:_1
#_male
#_size_sel:_2
#_male
#_size_sel:_3
#_male
#_size_sel:_4
#_male
#_size_sel:_5
#_male
#_size_sel:_6
#_male
#_size_sel:_7
#_male
#_size_sel:_8
#_male
#_size_sel:_9
#_male
#_size_sel:_10
#_male
#_size_sel:_11
#_male
#_size_sel:_12
#_male
#_size_sel:_13
#_male
#_size_sel:_14
#_male
#_size_sel:_15
#_male
#_size_sel:_16
#_male
#_size_sel:_17
#_male
#_size_sel:_18
#_male
#_size_sel:_19
#_male
#_size_sel:_20
#_male
#_size_sel:_21
#_male
#_size_sel:_22
#_male
#_size_sel:_23
#_male
#_size_sel:_24
#_male
#_size_sel:_25
#_male
```

```
#_size_sel:_26
#_male
#_size_sel:_27
#_male
#_size_sel:_28
#_male
#_size_sel:_29
#_male
#_size_sel:_30
#_male
#_size_sel:_31
#_male
#_size_sel:_32
#_male
#_size_sel:_33
#_male
#_size_sel:_34
#_male
#_size_sel:_35
#_male
#_size_sel:_36
#_male
#_size_sel:_37
#_male
#_size_sel:_38
#_male
#_size_sel:_39
#_male
#_size_sel:_40
#_male
#_size_sel:_41
#_male
#_size_sel:_42
#_male
#_size_sel:_43
#_male
#_size_sel:_44
#_male
#_size_sel:_45
#_male
#_age_sel:_1
1 1.95761 2 0.5 9 4 4 -1 99 30 0
2 -3 -3
3 3.97162e-009 3 0 9 2 2 -1 99 31 0 LO
4 9 -3
5 -999 -2
6 -999 -2
#_male
#_age_sel:_2
7 2.82246 2 0.5 9 4 4 -1 99 32 0
8 -3 -3
9 0.544786 3 0 9 2 2 -1 99 33 0
10 9 -3
11 -999 -2
12 -999 -2
#_male
#_age_sel:_3
```

```
13 1.02748 2 0.5 9 4 4 -1 99 34 0
14 2.99975 3 -9 3 -3 -3 -1 99 35 0 HI
15 3.78419e-008 3 0 9 2 2 -1 99 36 0 LO
16 8.93608 3 0 9 9 9 -1 99 37 0 HI
17 -999 -2
18 -8.13933 3 -10 10 0 5 -1 99 38 0
#_male
#_age_sel:_4
19 1.83597 2 0.5 9 4 4 -1 99 39 0
20 -8.99999 3 -9 3 -3 -3 -1 99 40 0 LO
21 4.49397e-007 3 0 9 2 2 -1 99 41 0 LO
22 1.63644e-007 3 0 9 9 9 -1 99 42 0 LO
23 -999 -2
24 -9.99936 3 -10 10 0 5 -1 99 43 0 LO
#_male
#_age_sel:_5
25 1.72793 2 0.5 9 4 4 -1 99 44 0
26 -3 -3
27 3.70491e-009 3 0 9 2 2 -1 99 45 0 LO
28 9 -3
29 -999 -2
30 -999 -2
#_male
#_age_sel:_6
31 1.60547 2 0.5 9 4 4 -1 99 46 0
32 -9 3 -9 3 -3 -3 -1 99 47 0 LO
33 2.23577e-008 3 0 9 2 2 -1 99 48 0 LO
34 1.65515e-007 3 0 9 9 9 -1 99 49 0 LO
35 -999 -2
36 -9.99912 3 -10 10 0 5 -1 99 50 0 LO
#_male
#_age_sel:_7
37 1 -3
38 1 -3
#_male
#_age_sel:_8
39 2 -3
40 2 -3
#_male
#_age_sel:_9
41 3 -3
42 3 -3
#_male
#_age_sel:_10
43 4 -3
44 4 -3
#_male
#_age_sel:_11
45 5 -3
46 15 -3
#_male
#_age_sel:_12
47 1 -3
48 1 -3
#_male
#_age_sel:_13
49 2 -3
```

```
50 2 -3
#_male
#_age_sel:_14
51 3 -3
52 3 -3
#_male
#_age_sel:_15
53 4 -3
54 4 -3
#_male
#_age_sel:_16
55 5 -3
56 15 -3
#_male
#_age_sel:_17
57 0 -3
58 0 -3
#_male
#_age_sel:_18
59 2 -3
60 2 -3
#_male
#_age_sel:_19
61 3 -3
62 3 -3
#_male
#_age_sel:_20
63 4 -3
64 4 -3
#_male
#_age_sel:_21
65 2 -3
66 2 -3
#_male
#_age_sel:_22
67 3 -3
68 3 -3
#_male
#_age_sel:_23
69 3 -3
70 3 -3
#_male
#_age_sel:_24
71 4 -3
72 4 -3
#_male
#_age_sel:_25
73 2 -3
74 2 -3
#_male
#_age_sel:_26
75 3 -3
76 3 -3
#_male
#_age_sel:_27
77 4 -3
78 4 -3
```

```
#_male
#_age_sel:_28
79 2 -3
80 2 -3
#_male
#_age_sel:_29
81 3 -3
82 3 -3
#_male
#_age_sel:_30
83 4 -3
84 4 -3
#_male
#_age_sel:_31
85 5 -3
86 15 -3
#_male
#_age_sel:_32
87 3 -3
88 3 -3
#_male
#_age_sel:_33
89 4 -3
90 4 -3
#_male
#_age_sel:_34
91 1 -3
92 1 -3
#_male
#_age_sel:_35
93 2 -3
94 15 -3
#_male
#_age_sel:_36
95 1 -3
96 1 -3
#_male
#_age_sel:_37
97 2 -3
98 2 -3
#_male
#_age_sel:_38
99 3 -3
100 3 -3
#_male
#_age_sel:_39
101 4 -3
102 15 -3
#_male
#_age_sel:_40
103 0 -3
104 0 -3
#_male
#_age_sel:_41
105 0 -3
106 0 -3
#_male
```

```
#_age_sel:_42
107 0 -3
108 0 -3
#_male
#_age_sel:_43
109 0 -3
110 0 -3
#_male
#_age_sel:_44
111 0 -3
112 0 -3
#_male
#_age_sel:_45
113 4 -3
114 15 -3
#_male
sel_parm_env_linkages
sel_parm_blockparms
115 2.612 2 0.5 9 4 4 -1 99 51 0
116 0.132447 3 0 9 2 2 -1 99 52 0
117 3.19599 2 0.5 9 4 4 -1 99 53 0
118 0.399783 3 0 9 2 2 -1 99 54 0
119 1.81934 2 0.5 9 4 4 -1 99 55 0
120 0.173406 3 0 9 2 2 -1 99 56 0
121 5.79422 3 0 9 9 9 -1 99 57 0
122 8.37467 3 -10 10 0 5 -1 99 58 0
123 2.12927 2 0.5 9 4 4 -1 99 59 0
124 1.06391e-008 3 0 9 2 2 -1 99 60 0 LO
125 7.11083e-008 3 0 9 9 9 -1 99 61 0 LO
126 0.00212228 3 -10 10 0 5 -1 99 62 0
127 2.89121 2 0.5 9 4 4 -1 99 63 0
128 0.491235 3 0 9 2 2 -1 99 64 0
129 1.55718 2 0.5 9 4 4 -1 99 65 0
130 2.42323e-009 3 0 9 2 2 -1 99 66 0 LO
131 1.11571e-008 3 0 9 9 9 -1 99 67 0 LO
132 -5.75388 3 -10 10 0 5 -1 99 68 0
SEL_parm_devs
1_YR1982 0
Forecast_Recr_Devs
2007 0 - - - - - - - 69

Selex_Block_Assignments Years:
Base_parm#  1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
1  0 0 0 0 0 0 0 0 0 0 0 0 0 115 115 115 115 115 115 115 115 115 115 115 115
3  0 0 0 0 0 0 0 0 0 0 0 0 0 116 116 116 116 116 116 116 116 116 116 116 116
7  0 0 0 0 0 0 0 0 0 0 0 0 0 117 117 117 117 117 117 117 117 117 117 117 117
9  0 0 0 0 0 0 0 0 0 0 0 0 0 118 118 118 118 118 118 118 118 118 118 118 118
13  0 0 0 0 0 0 0 0 0 0 0 0 0 119 119 119 119 119 119 119 119 119 119 119 119
15  0 0 0 0 0 0 0 0 0 0 0 0 0 120 120 120 120 120 120 120 120 120 120 120 120
16  0 0 0 0 0 0 0 0 0 0 0 0 0 121 121 121 121 121 121 121 121 121 121 121 121
18  0 0 0 0 0 0 0 0 0 0 0 0 0 122 122 122 122 122 122 122 122 122 122 122 122
19  0 0 0 0 0 0 0 0 0 0 0 0 0 123 123 123 123 123 123 123 123 123 123 123 123
21  0 0 0 0 0 0 0 0 0 0 0 0 0 124 124 124 124 124 124 124 124 124 124 124 124
22  0 0 0 0 0 0 0 0 0 0 0 0 0 125 125 125 125 125 125 125 125 125 125 125 125
24  0 0 0 0 0 0 0 0 0 0 0 0 0 126 126 126 126 126 126 126 126 126 126 126 126
25  0 0 0 0 0 0 0 0 0 0 0 0 0 127 127 127 127 127 127 127 127 127 127 127 127
```

```
27  0 0 0 0 0 0 0 0 0 0 0 0 0 128 128 128 128 128 128 128 128 128 128 128 128
31  0 0 0 0 0 0 0 0 0 0 0 0 0 129 129 129 129 129 129 129 129 129 129 129 129
33  0 0 0 0 0 0 0 0 0 0 0 0 0 130 130 130 130 130 130 130 130 130 130 130 130
34  0 0 0 0 0 0 0 0 0 0 0 0 0 131 131 131 131 131 131 131 131 131 131 131 131
36  0 0 0 0 0 0 0 0 0 0 0 0 0 132 132 132 132 132 132 132 132 132 132 132 132

RECR_DIST
G_pattern gender Seas Area Value Used?
1 1 1 1 1 1

MOVEMENT
Seas Source Dist  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SUBMORPHDIST 1

MGparm_By_Year_after_adjustments
Year
1982  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1983  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1984  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1985  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1986  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1987  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1988  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1989  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1990  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1991  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1992  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1993  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1994  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1995  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1996  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1997  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1998  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1999  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2000  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2001  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2002  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2003  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2004  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2005  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2006  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1

SELparm(Size)_By_Year_after_adjustments
Fleet/Svy Year

SELparm(Age)_By_Year_after_adjustments
Fleet/Svy Year
1 1982  1.95761 -3 3.97162e-009 9 -999 -999
1 1995  2.612 -3 0.132447 9 -999 -999
2 1982  2.82246 -3 0.544786 9 -999 -999
2 1995  3.19599 -3 0.399783 9 -999 -999
3 1982  1.02748 2.99975 3.78419e-008 8.93608 -999 -8.13933
3 1995  1.81934 2.99975 0.173406 5.79422 -999 8.37467
4 1982  1.83597 -8.99999 4.49397e-007 1.63644e-007 -999 -9.99936
4 1995  2.12927 -8.99999 1.06391e-008 7.11083e-008 -999 0.00212228
5 1982  1.72793 -3 3.70491e-009 9 -999 -999
```

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5 1995  2.89121 -3 0.491235 9 -999 -999
6 1982  1.60547 -9 2.23577e-008 1.65515e-007 -999 -9.99912
6 1995  1.55718 -9 2.42323e-009 1.11571e-008 -999 -5.75388
7 1982  1 1
8 1982  2 2
9 1982  3 3
10 1982  4 4
11 1982  5 15
12 1982  1 1
13 1982  2 2
14 1982  3 3
15 1982  4 4
16 1982  5 15
17 1982  0 0
18 1982  2 2
19 1982  3 3
20 1982  4 4
21 1982  2 2
22 1982  3 3
23 1982  3 3
24 1982  4 4
25 1982  2 2
26 1982  3 3
27 1982  4 4
28 1982  2 2
29 1982  3 3
30 1982  4 4
31 1982  5 15
32 1982  3 3
33 1982  4 4
34 1982  1 1
35 1982  2 15
36 1982  1 1
37 1982  2 2
38 1982  3 3
39 1982  4 15
40 1982  0 0
41 1982  0 0
42 1982  0 0
43 1982  0 0
44 1982  0 0
45 1982  4 15

EXPLOITATION   Hrate_is_Continuous_F  Fleet_in_columns;_year_in_rows
yr seas 1 2 3 4 5 6
init_yr 1  1.2679 0 0 0 0 0
1982 1  0.595402 0.345118 0 0 0.571907 0.0204952
1983 1  0.797626 0.388142 0 0 0.0801778 0.0228562
1984 1  0.725689 0.586247 0 0 0.463563 0.0221396
1985 1  0.802818 0.445766 0 0 0.36574 0.00568771
1986 1  0.818679 0.366873 0 0 0.584079 0.039284
1987 1  0.783304 0.309775 0 0 0.367215 0.0332012
1988 1  1.05521 0.439869 0 0 0.530945 0.0266954
1989 1  0.898225 0.404364 0.074797 0 0.196128 0.00626545
1990 1  0.496874 0.333209 0.113382 0 0.327412 0.0330574
1991 1  0.629675 0.36496 0.0842471 0 0.416467 0.0487067
1992 1  0.884227 0.260421 0.0553676 0 0.382673 0.038694
```

```
1993 1  0.580373 0.282546 0.0611891 0 0.436058 0.0925591
1994 1  0.562156 0.296654 0.0296666 0.0509053 0.407506 0.0631812
1995 1  0.760228 0.525156 0.0122314 0.0200129 0.426889 0.0613531
1996 1  0.475522 0.3635 0.0235728 0.00913772 0.578351 0.042292
1997 1  0.282129 0.0823618 0.0126451 0.00530796 0.513491 0.0292825
1998 1  0.257561 0.118628 0.0118904 0.00748703 0.420086 0.0366528
1999 1  0.197563 0.0910697 0.0471332 0.0177053 0.222714 0.0327238
2000 1  0.173567 0.0918201 0.0219422 0.0059384 0.38613 0.0436747
2001 1  0.175605 0.07105 0.00826828 0.0106197 0.261697 0.0594051
2002 1  0.202588 0.0946733 0.0098913 0.00573971 0.161527 0.0339231
2003 1  0.185697 0.072284 0.0129194 0.00301957 0.211607 0.0350385
2004 1  0.213811 0.0898307 0.00474415 0.00254895 0.176707 0.0421661
2005 1  0.204824 0.0716039 0.00425289 0.00274663 0.166086 0.0422069
2006 1  0.145567 0.0671848 0.00589704 0.00257925 0.168439 0.0367256
2007 1  9.23527e-006 4.26244e-006 3.74129e-007 1.63637e-007 1.06863e-005
2.33e-006

TIME_SERIES    Bio-Smry_age:_1  Hrate_is_Continuous_F
pop year period season bio-all bio-smry SpawnBio recruit-0  enc_catch:_1
dead_catch:_1 ret_catch:_1 obs_cat:_1 Hrate-1 enc_catch:_2 dead_catch:_2
ret_catch:_2 obs_cat:_2 Hrate-2 enc_catch:_3 dead_catch:_3 ret_catch:_3
obs_cat:_3 Hrate-3 enc_catch:_4 dead_catch:_4 ret_catch:_4 obs_cat:_4 Hrate-4
enc_catch:_5 dead_catch:_5 ret_catch:_5 obs_cat:_5 Hrate-5 enc_catch:_6
dead_catch:_6 ret_catch:_6 obs_cat:_6 Hrate-6 SPB_vir_LH
1 1980 VIRG 1 479634 479226 477538 59911.2 0 0 0 0 0  0 0 0 0 0  0 0 0 0 0  0
0 0 0 0  0 0 0 0 0  0 0 0 0 0  0 0 0 0 0  477569
1 1981 INIT 1 23214.8 22960.1 22076.4 37379.9 16827 16827 16827 10000 1.2679
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 22076.4
1 1982 TIME 1 23283 22960.1 22076.4 47391.2 7418.04 7418.04 7418.04 7536
0.595402 2824.76 2824.76 2824.76 2864 0.345118 0 0 0 0 0 0 0 0 0 0 8218.91
8218.91 8218.91 8267 0.571907 296.063 296.063 296.063 296 0.0204952 22102.3
1 1983 TIME 1 23541.5 23153.1 22000.4 56997.8 10632.9 10632.9 10632.9 10201
0.797626 3215.63 3215.63 3215.63 3201 0.388142 0 0 0 0 0 0 0 0 0 0 1274.63
1274.63 1274.63 1268 0.0801778 376.767 376.767 376.767 376 0.0228562 22148
1 1984 TIME 1 30526.1 30259 28798.3 39199.6 11069.2 11069.2 11069.2 11455
0.725689 5491.51 5491.51 5491.51 5674 0.586247 0 0 0 0 0 0 0 0 0 0 8340.76
8340.76 8340.76 8512 0.463563 414.907 414.907 414.907 415 0.0221396 28899.8
1 1985 TIME 1 25406.5 25081.3 24022.7 47705.8 10987 10987 10987 10767
0.802818 3914.39 3914.39 3914.39 3907 0.445766 0 0 0 0 0 0 0 0 0 0 5732.58
5732.58 5732.58 5665 0.36574 92.0256 92.0256 92.0256 92 0.00568771 24146.3
1 1986 TIME 1 24542.7 24199.2 23023.6 50405.6 9670.04 9670.04 9670.04 9500
0.818679 2702.9 2702.9 2702.9 2687 0.366873 0 0 0 0 0 0 0 0 0 0 8222.45
8222.45 8222.45 8102 0.584079 578.55 578.55 578.55 578 0.039284 23154.1
1 1987 TIME 1 23800.7 23557 22328.7 35763.9 9771.98 9771.98 9771.98 9945
0.783304 2311.33 2311.33 2311.33 2326 0.309775 0 0 0 0 0 0 0 0 0 0 5474.22
5474.22 5474.22 5519 0.367215 521.584 521.584 521.584 522 0.0332012 22421.3
1 1988 TIME 1 23069.5 22995 22023.2 10933.3 11486.8 11486.8 11486.8 11616
1.05521 3055.86 3055.86 3055.86 3071 0.439869 0 0 0 0 0 0 0 0 0 0 6593.9
6593.9 6593.9 6634 0.530945 340.93 340.93 340.93 341 0.0266954 22051.5
1 1989 TIME 1 11676 11512.9 11160.3 23928.4 5975.95 5975.95 5975.95 6218
0.898225 1879.73 1879.73 1879.73 1908 0.404364 705.757 705.757 705.757 709
0.074797 0 0 0 0 0 1421.61 1421.61 1421.61 1435 0.196128 44.9871 44.9871
44.9871 45 0.00626545 11222.3
1 1990 TIME 1 10639.2 10440.9 9899.27 29096.3 2804.32 2804.32 2804.32 2962
0.496874 1201.59 1201.59 1201.59 1237 0.333209 1197.79 1197.79 1197.79 1214
0.113382 0 0 0 0 0 2244.76 2244.76 2244.76 2329 0.327412 233.236 233.236
233.236 234 0.0330574 9974.62
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1 1991 TIME 1 13788.5 13607.8 12908.3 26507 4473.92 4473.92 4473.92 4629
0.629675 1562.38 1562.38 1562.38 1595 0.36496 1046.58 1046.58 1046.58 1052
0.0842471 0 0 0 0 0 3528.02 3528.02 3528.02 3611 0.416467 428.241 428.241
428.241 429 0.0487067 12977
1 1992 TIME 1 14108.7 13885.9 13228.7 32693.2 6382.46 6382.46 6382.46 6361
0.884227 1169.98 1169.98 1169.98 1168 0.260421 690.092 690.092 690.092 690
0.0553676 0 0 0 0 0 3248.25 3248.25 3248.25 3242 0.382673 344.367 344.367
344.367 344 0.038694 13313.3
1 1993 TIME 1 14919.9 14710.7 13934.8 30696.7 4491.49 4491.49 4491.49 4401
0.580373 1322.18 1322.18 1322.18 1313 0.282546 846.301 846.301 846.301 846
0.0611891 0 0 0 0 0 4055.18 4055.18 4055.18 4006 0.436058 909.333 909.333
909.333 910 0.0925591 14014.3
1 1994 TIME 1 16141.9 15947.6 15184 28514.4 4958.5 4958.5 4958.5 4969
0.562156 1630.73 1630.73 1630.73 1620 0.296654 433.541 433.541 433.541 434
0.0296666 472.132 472.132 472.132 472 0.0509053 4201.27 4201.27 4201.27 4231
0.407506 677.4 677.4 677.4 678 0.0631812 15257.9
1 1995 TIME 1 16363 16138.4 15414.2 32953.6 4447.27 4447.27 4447.27 4911
0.760228 1943.54 1943.54 1943.54 2066 0.525156 137.847 137.847 137.847 138
0.0122314 169.595 169.595 169.595 170 0.0200129 2324.56 2324.56 2324.56 2450
0.426889 750.203 750.203 750.203 752 0.0613531 15499.6
1 1996 TIME 1 20718.7 20552.7 19654.2 24358.2 3918.19 3918.19 3918.19 3947
0.475522 1867.38 1867.38 1867.38 1913 0.3635 355.946 355.946 355.946 355
0.0235728 108.07 108.07 108.07 108 0.00913772 4388.14 4388.14 4388.14 4454
0.578351 687.134 687.134 687.134 681 0.042292 19717.3
1 1997 TIME 1 23214.8 23032.1 22276.1 26808.5 3484.28 3484.28 3484.28 3313
0.282129 687.09 687.09 687.09 681 0.0823618 239.71 239.71 239.71 239
0.0126451 86.1085 86.1085 86.1085 86 0.00530796 5833.36 5833.36 5833.36 5382
0.513491 559.913 559.913 559.913 556 0.0292825 22345.5
1 1998 TIME 1 26576.2 26380.7 25618.9 28696.3 3850.77 3850.77 3850.77 3730
0.257561 1366 1366 1366 1346 0.118628 254.276 254.276 254.276 254 0.0118904
135.111 135.111 135.111 135 0.00748703 5958.31 5958.31 5958.31 5659 0.420086
735.407 735.407 735.407 734 0.0366528 25693.2
1 1999 TIME 1 29259.8 29109.1 28286.6 22114.6 3539.67 3539.67 3539.67 3551
0.197563 1271.76 1271.76 1271.76 1271 0.0910697 1177.61 1177.61 1177.61 1181
0.0471332 366.676 366.676 366.676 367 0.0177053 3785.77 3785.77 3785.77 3795
0.222714 708.711 708.711 708.711 711 0.0327238 28343.9
1 2000 TIME 1 32517.2 32332 31637.6 27166 3590 3590 3590 3564 0.173567
1529.87 1529.87 1529.87 1521 0.0918201 591.85 591.85 591.85 592 0.0219422
133.992 133.992 133.992 134 0.0059384 7604.64 7604.64 7604.64 7470 0.38613
948.278 948.278 948.278 952 0.0436747 31708
1 2001 TIME 1 32786.7 32601.2 31846.6 27215 3752.61 3752.61 3752.61 3705
0.175605 1274.81 1274.81 1274.81 1265 0.07105 230.053 230.053 230.053 230
0.00826828 238.013 238.013 238.013 238 0.0106197 5395.49 5395.49 5395.49 5279
0.261697 1268.49 1268.49 1268.49 1274 0.0594051 31917
1 2002 TIME 1 35532.8 35327.1 34532.3 30178.7 4845.25 4845.25 4845.25 4723
0.202588 1871.1 1871.1 1871.1 1850 0.0946733 307.344 307.344 307.344 307
0.0098913 142.064 142.064 142.064 142 0.00573971 3704.72 3704.72 3704.72 3632
0.161527 776.721 776.721 776.721 777 0.0339231 34610.5
1 2003 TIME 1 39940.8 39797.3 38930.3 21051.9 5006.81 5006.81 5006.81 4835
0.185697 1635.26 1635.26 1635.26 1614 0.072284 446.213 446.213 446.213 445
0.0129194 83.0403 83.0403 83.0403 83 0.00301957 5493.05 5493.05 5493.05 5279
0.211607 885.684 885.684 885.684 882 0.0350385 38984.8
1 2004 TIME 1 41141.6 40946.7 40257.4 28596.6 6255.46 6255.46 6255.46 6036
0.213811 2221.22 2221.22 2221.22 2193 0.0898307 170.135 170.135 170.135 170
0.00474415 74.0298 74.0298 74.0298 74 0.00254895 4968.13 4968.13 4968.13 4831
0.176707 1038.15 1038.15 1038.15 1034 0.0421661 40331.4
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1 2005 TIME 1 41755.1 41659.5 40874.8 14016.7 6009.79 6009.79 6009.79 5984
0.204824 1846.92 1846.92 1846.92 1841 0.0716039 152.99 152.99 152.99 153
0.00425289 76.9977 76.9977 76.9977 77 0.00274663 4745.78 4745.78 4745.78 4724
0.166086 996.952 996.952 996.952 999 0.0422069 40911.1
1 2006 TIME 1 40233.3 40053.2 39529 26414.8 4482.71 4482.71 4482.71 4481
0.145567 1781.85 1781.85 1781.85 1781 0.0671848 213.998 213.998 213.998 214
0.00589704 73.9991 73.9991 73.9991 74 0.00257925 4995.37 4995.37 4995.37 4992
0.168439 794.683 794.683 794.683 795 0.0367256 39597.5
1 2007 FORE 1 41381 41082.8 40510.7 43744.6 0.332017 0.332017 0.332017
0.332017 9.23527e-006 0.140433 0.140433 0.140433 0.140433 4.26244e-006
0.0157942 0.0157942 0.0157942 0.0157942 3.74129e-007 0.00517644 0.00517644
0.00517644 0.00517644 1.63637e-007 0.378088 0.378088 0.378088 0.378088
1.06863e-005 0.0564658 0.0564658 0.0564658 0.0564658 2.33e-006 40510.8

SPR_series  uses_R0= 59911.2   ###note_Y/R_unit_is_Dead_Biomass
Year Bio_all Bio_Smry SPBzero SPBfished SPBfished/R SPR Y/R GenTime Actual:
Bio_all Bio_Smry Enc_Catch Dead_Catch Retain_Catch SPB Recruits Tot_Exploit
More_F(by_morph):  aveF-1 maxF-1
1982 32229.7 31821.4  477538 30470.5 0.508594 0.0638075 0.427594 0.184806 +
23283 22960.1 18757.8 18757.8 18757.8 22076.4 47391.2 0.805642 +  1.44249
1.52969
1983 39727.3 39319  477538 37881.2 0.632289 0.0793261 0.461154 0.23543 +
23541.5 23153.1 15499.9 15499.9 15499.9 22000.4 56997.8 0.658408 +  1.19978
1.28519
1984 30604.9 30196.6  477538 28851.5 0.481571 0.0604172 0.422874 0.142576 +
30526.1 30259 25316.4 25316.4 25316.4 28798.3 39199.6 0.829334 +  1.68367
1.79396
1985 32604.1 32195.8  477538 30827 0.514545 0.064554 0.431829 0.167119 +
25406.5 25081.3 20726 20726 20726 24022.7 47705.8 0.815777 +  1.53083  1.6188
1986 28732.3 28324  477538 27010.1 0.450836 0.0565612 0.412432 0.143482 +
24542.7 24199.2 21173.9 21173.9 21173.9 23023.6 50405.6 0.862739 +  1.69089
1.80298
1987 33418.6 33010.3  477538 31640.1 0.528117 0.0662567 0.433782 0.194523 +
23800.7 23557 18079.1 18079.1 18079.1 22328.7 35763.9 0.759603 +  1.39378
1.48847
1988 27011.5 26603.2  477538 25306.4 0.422399 0.0529936 0.405091 0.11147 +
23069.5 22995 21477.5 21477.5 21477.5 22023.2 10933.3 0.930991 +  1.93015
2.04851
1989 32058.6 31650.3  477538 30312.3 0.505953 0.0634762 0.42636 0.187241 +
11676 11512.9 10028 10028 10028 11160.3 23928.4 0.858859 +  1.48977  1.57852
1990 34595 34186.7  477538 32858.3 0.54845 0.0688077 0.431163 0.261998 +
10639.2 10440.9 7681.7 7681.7 7681.7 9899.27 29096.3 0.722017 +  1.20894
1.29892
1991 30934.6 30526.3  477538 29218.7 0.487701 0.0611863 0.41836 0.204142 +
13788.5 13607.8 11039.1 11039.1 11039.1 12908.3 26507 0.800607 +  1.42673
1.53678
1992 30034.8 29626.5  477538 28314.4 0.472607 0.0592925 0.416204 0.182126 +
14108.7 13885.9 11835.1 11835.1 11835.1 13228.7 32693.2 0.838854 +  1.51252
1.61562
1993 31873.8 31465.5  477538 30146.8 0.503191 0.0631296 0.421973 0.227998 +
14919.9 14710.7 11624.5 11624.5 11624.5 13934.8 30696.7 0.779124 +  1.30933
1.43927
1994 33590.3 33182  477538 31831.6 0.531313 0.0666577 0.431053 0.235435 +
16141.9 15947.6 12373.6 12373.6 12373.6 15184 28514.4 0.766549 +  1.25185
1.39954
```

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1995 45868.1 45459.8  477538 43913.8 0.732982 0.0919589 0.50213 0.147926 +
16363 16138.4 9773.01 9773.01 9773.01 15414.2 32953.6 0.597262 +  1.58823
1.78146
1996 50498 50089.7  477538 48530 0.810033 0.101626 0.515467 0.196694 +
20718.7 20552.7 11324.9 11324.9 11324.9 19654.2 24358.2 0.546602 +  1.32259
1.47529
1997 65799 65390.7  477538 63802.4 1.06495 0.133607 0.547171 0.339197 +
23214.8 23032.1 10890.5 10890.5 10890.5 22276.1 26808.5 0.469116 +  0.820735
0.917455
1998 69644.3 69236  477538 67645.2 1.12909 0.141654 0.552455 0.367515 +
26576.2 26380.7 12299.9 12299.9 12299.9 25618.9 28696.3 0.462815 +  0.747176
0.842448
1999 85958 85549.7  477538 83955.7 1.40134 0.17581 0.563683 0.467508 +
29259.8 29109.1 10850.2 10850.2 10850.2 28286.6 22114.6 0.370822 +  0.527044
0.600614
2000 77141.1 76732.8  477538 75141.9 1.25422 0.157353 0.55861 0.419976 +
32517.2 32332 14398.6 14398.6 14398.6 31637.6 27166 0.442801 +  0.625467
0.712707
2001 89674.1 89265.8  477538 87670.4 1.46334 0.183589 0.564543 0.48916 +
32786.7 32601.2 12159.5 12159.5 12159.5 31846.6 27215 0.370866 +  0.487686
0.574126
2002 101010 100601  477538 98989.1 1.65227 0.207291 0.575609 0.514129 +
35532.8 35327.1 11647.2 11647.2 11647.2 34532.3 30178.7 0.327787 +  0.436351
0.49981
2003 98627.6 98219.3  477538 96610.2 1.61256 0.202309 0.573842 0.507836 +
39940.8 39797.3 13550.1 13550.1 13550.1 38930.3 21051.9 0.339254 +  0.44817
0.51235
2004 97930.7 97522.4  477538 95913.4 1.60093 0.20085 0.573505 0.506709 +
41141.6 40946.7 14727.1 14727.1 14727.1 40257.4 28596.6 0.357962 +  0.450859
0.519928
2005 103328 102920  477538 101309 1.69099 0.212149 0.573883 0.526184 +
41755.1 41659.5 13829.4 13829.4 13829.4 40874.8 14016.7 0.331204 +  0.416358
0.482293
2006 115502 115093  477538 113478 1.8941 0.237631 0.57513 0.558108 +  40233.3
40053.2 12342.6 12342.6 12342.6 39529 26414.8 0.306776 +  0.360707  0.418063
2007 479522 479114  477538 477457 7.96942 0.999831 0.000185743 0.818711 +
41381 41082.8 0.927974 0.927974 0.927974 40510.7 43744.6 2.24251e-005 +
2.28845e-005  2.65233e-005

SPAWN_RECRUIT Function: 3 - - - - -
11.0006 Ln(R0) 59911.2
0.879485 steep
0.6 stddev_recr
0 env_link_
-0.47173 init-eq 37379.9
1982 2006 recdev:start_end 1957 first_year_with_full_bias_adjustment
year spawn_bio exp-recr with-env bias-adj pred-recr dev
S/Rcurve 477538 59911.2
Virg 477538 59911.2 59911.2 50042 59911.2
Init 22076.4 37379.9 37379.9 31222.3 37379.9
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N_est r.m.s.e.
25 0.419648

INDEX_2
index year vuln_bio obs exp eff_Q SE Dev Like Like+log(s)
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41 1988 10933.3 0.54 0.360041 3.29307e-005 0.4 0.405351 0.513467 -0.402823
41 1989 23928.4 1.24 0.787978 3.29307e-005 0.4 0.453397 0.642402 -0.273889
41 1990 29096.3 2.54 0.958161 3.29307e-005 0.4 0.974903 2.97011 2.05382
41 1991 26507 2.64 0.872895 3.29307e-005 0.4 1.10672 3.82758 2.91129
41 1992 32693.2 0.89 1.07661 3.29307e-005 0.4 -0.19035 0.113229 -0.803062
41 1993 30696.7 0.5 1.01086 3.29307e-005 0.4 -0.703953 1.54859 0.632303
41 1994 28514.4 2.41 0.938998 3.29307e-005 0.4 0.942569 2.77636 1.86007
41 1995 32953.6 0.63 1.08519 3.29307e-005 0.4 -0.543787 0.924075 0.00778411
41 1996 24358.2 0.81 0.802134 3.29307e-005 0.4 0.00975834 0.000297579 -
0.915993
41 1997 26808.5 0.89 0.882821 3.29307e-005 0.4 0.00809883 0.000204972 -
0.916086
41 1998 28696.3 0.73 0.94499 3.29307e-005 0.4 -0.25813 0.208222 -0.708069
41 1999 22114.6 0.53 0.728248 3.29307e-005 0.4 -0.317765 0.315546 -0.600745
```

```
41 2000 27166 0.57 0.894596 3.29307e-005 0.4 -0.450736 0.634885 -0.281406
41 2001 27215 0.47 0.896209 3.29307e-005 0.4 -0.64544 1.30185 0.385564
41 2002 30178.7 0.77 0.993805 3.29307e-005 0.4 -0.25515 0.203443 -0.712848
41 2003 21051.9 0.44 0.693253 3.29307e-005 0.4 -0.45462 0.645874 -0.270416
41 2004 28596.6 1.3 0.941705 3.29307e-005 0.4 0.322427 0.324873 -0.591418
41 2005 14016.7 0.35 0.461578 3.29307e-005 0.4 -0.276719 0.239292 -0.676999
41 2006 26414.8 0.8 0.869857 3.29307e-005 0.4 -0.0837176 0.021902 -0.894389
42 1982 47391.2 -0.001 2.14688 4.53013e-005 0.4
42 1983 56997.8 -0.001 2.58208 4.53013e-005 0.4
42 1984 39199.6 -0.001 1.77579 4.53013e-005 0.4
42 1985 47705.8 -0.001 2.16114 4.53013e-005 0.4
42 1986 50405.6 -0.001 2.28344 4.53013e-005 0.4
42 1987 35763.9 -0.001 1.62015 4.53013e-005 0.4
42 1988 10933.3 0.17 0.495293 4.53013e-005 0.4 -1.06935 3.57347 2.65718
42 1989 23928.4 1 1.08399 4.53013e-005 0.4 -0.0806457 0.0203241 -0.895967
42 1990 29096.3 1.28 1.3181 4.53013e-005 0.4 -0.0293317 0.0026886 -0.913602
42 1991 26507 1 1.2008 4.53013e-005 0.4 -0.182991 0.104643 -0.811648
42 1992 32693.2 1.1 1.48104 4.53013e-005 0.4 -0.297437 0.276465 -0.639825
42 1993 30696.7 2.55 1.3906 4.53013e-005 0.4 0.606356 1.14896 0.232672
42 1994 28514.4 1.66 1.29174 4.53013e-005 0.4 0.250829 0.196609 -0.719682
42 1995 32953.6 4.95 1.49284 4.53013e-005 0.4 1.19871 4.4903 3.574
42 1996 24358.2 1.66 1.10346 4.53013e-005 0.4 0.408366 0.521134 -0.395157
42 1997 26808.5 1.65 1.21446 4.53013e-005 0.4 0.306477 0.293525 -0.622765
42 1998 28696.3 0.67 1.29998 4.53013e-005 0.4 -0.662828 1.37294 0.456649
42 1999 22114.6 1.03 1.00182 4.53013e-005 0.4 0.027741 0.00240488 -0.913886
42 2000 27166 0.95 1.23066 4.53013e-005 0.4 -0.258842 0.209372 -0.706919
42 2001 27215 0.62 1.23288 4.53013e-005 0.4 -0.687385 1.47656 0.560265
42 2002 30178.7 1.51 1.36713 4.53013e-005 0.4 0.099393 0.0308718 -0.885419
42 2003 21051.9 0.6 0.953678 4.53013e-005 0.4 -0.463397 0.671051 -0.245239
42 2004 28596.6 0.9 1.29546 4.53013e-005 0.4 -0.364229 0.41457 -0.501721
42 2005 14016.7 3.11 0.634973 4.53013e-005 0.4 1.5888 7.88834 6.97205
42 2006 26414.8 0.81 1.19662 4.53013e-005 0.4 -0.390226 0.475864 -0.440427
43 1982 47391.2 3.408 13.2168 0.000278888 0.4 -1.35536 5.74066 4.82437
43 1983 56997.8 17.699 15.896 0.000278888 0.4 0.107441 0.0360734 -0.880217
43 1984 39199.6 13.31 10.9323 0.000278888 0.4 0.196796 0.121027 -0.795264
43 1985 47705.8 12.843 13.3046 0.000278888 0.4 -0.0353086 0.00389592 -
0.912395
43 1986 50405.6 59.526 14.0575 0.000278888 0.4 1.44326 6.50935 5.59306
43 1987 35763.9 7.584 9.97411 0.000278888 0.4 -0.273952 0.23453 -0.68176
43 1988 10933.3 1.763 3.04916 0.000278888 0.4 -0.54785 0.937935 0.0216446
43 1989 23928.4 2.855 6.67333 0.000278888 0.4 -0.849047 2.25275 1.33646
43 1990 29096.3 4.733 8.1146 0.000278888 0.4 -0.539105 0.908233 -0.00805724
43 1991 26507 7.337 7.39249 0.000278888 0.4 -0.00753417 0.000177387 -0.916113
43 1992 32693.2 8.487 9.11773 0.000278888 0.4 -0.0716848 0.0160585 -0.900232
43 1993 30696.7 4.145 8.56094 0.000278888 0.4 -0.725307 1.64397 0.727679
43 1994 28514.4 22.311 7.95231 0.000278888 0.4 1.03162 3.32574 2.40944
43 1995 32953.6 13.067 9.19036 0.000278888 0.4 0.351935 0.387057 -0.529234
43 1996 24358.2 6.493 6.79322 0.000278888 0.4 -0.0451999 0.00638447 -0.909906
43 1997 26808.5 7.997 7.47655 0.000278888 0.4 0.0672952 0.014152 -0.902139
43 1998 28696.3 14.983 8.00305 0.000278888 0.4 0.627093 1.22889 0.312602
43 1999 22114.6 8.565 6.16748 0.000278888 0.4 0.328393 0.337007 -0.579284
43 2000 27166 9.874 7.57627 0.000278888 0.4 0.264884 0.219261 -0.69703
43 2001 27215 13.543 7.58993 0.000278888 0.4 0.579048 1.0478 0.131511
43 2002 30178.7 5.406 8.41646 0.000278888 0.4 -0.44268 0.612393 -0.303898
43 2003 21051.9 8.18 5.87111 0.000278888 0.4 0.331648 0.343721 -0.57257
43 2004 28596.6 6.993 7.97523 0.000278888 0.4 -0.131431 0.0539818 -0.862309
43 2005 14016.7 2.198 3.90907 0.000278888 0.4 -0.575753 1.03591 0.119619
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44 1983 56997.8 -0.001 0.359637 6.30965e-006 0.4
44 1984 39199.6 -0.001 0.247336 6.30965e-006 0.4
44 1985 47705.8 -0.001 0.301007 6.30965e-006 0.4
44 1986 50405.6 0.32 0.318042 6.30965e-006 0.4 0.00613831 0.000117746 -
0.916173
44 1987 35763.9 0.26 0.225658 6.30965e-006 0.4 0.141662 0.0627127 -0.853578
44 1988 10933.3 0.01 0.0689853 6.30965e-006 0.4 -1.93131 11.6561 10.7398
44 1989 23928.4 0.14 0.15098 6.30965e-006 0.4 -0.0755031 0.0178148 -0.898476
44 1990 29096.3 0.36 0.183588 6.30965e-006 0.4 0.673412 1.41714 0.500847
44 1991 26507 0.38 0.16725 6.30965e-006 0.4 0.82068 2.10474 1.18845
44 1992 32693.2 0.37 0.206283 6.30965e-006 0.4 0.584256 1.06673 0.150443
44 1993 30696.7 0.05 0.193686 6.30965e-006 0.4 -1.35421 5.73092 4.81463
44 1994 28514.4 0.57 0.179916 6.30965e-006 0.4 1.15315 4.15547 3.23917
44 1995 32953.6 0.3 0.207926 6.30965e-006 0.4 0.3666 0.419987 -0.496304
44 1996 24358.2 0.08 0.153692 6.30965e-006 0.4 -0.652925 1.33222 0.415931
44 1997 26808.5 0.22 0.169152 6.30965e-006 0.4 0.262829 0.215873 -0.700418
44 1998 28696.3 0.39 0.181064 6.30965e-006 0.4 0.767297 1.83983 0.923534
44 1999 22114.6 0.35 0.139535 6.30965e-006 0.4 0.919615 2.64279 1.7265
44 2000 27166 0.21 0.171408 6.30965e-006 0.4 0.203059 0.128853 -0.787437
44 2001 27215 0.14 0.171717 6.30965e-006 0.4 -0.204206 0.130313 -0.785978
44 2002 30178.7 0.13 0.190417 6.30965e-006 0.4 -0.381682 0.455254 -0.461037
44 2003 21051.9 0.21 0.13283 6.30965e-006 0.4 0.458037 0.655618 -0.260673
44 2004 28596.6 0.27 0.180435 6.30965e-006 0.4 0.403054 0.507664 -0.408626
44 2005 14016.7 0.01 0.0884403 6.30965e-006 0.4 -2.17974 14.8477 13.9315
44 2006 26414.8 0.17 0.166668 6.30965e-006 0.4 0.0197935 0.00122432 -0.915066
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45 1983 782.996 -0.001 0.0145372 1.85661e-005 0.4
45 1984 838.424 -0.001 0.0155663 1.85661e-005 0.4
45 1985 564.515 -0.001 0.0104809 1.85661e-005 0.4
45 1986 612.891 -0.001 0.011379 1.85661e-005 0.4
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45 1990 422.799 0.02 0.00784974 1.85661e-005 0.4 0.935251 2.73342 1.81713
45 1991 533.68 -0.001 0.00990836 1.85661e-005 0.4
45 1992 261.258 0.01 0.00485054 1.85661e-005 0.4 0.723495 1.63577 0.719475
45 1993 315.937 0.01 0.00586572 1.85661e-005 0.4 0.533459 0.889309 -0.0269816
45 1994 383.774 0.04 0.00712519 1.85661e-005 0.4 1.72524 9.30146 8.38517
45 1995 433.463 0.03 0.00804772 1.85661e-005 0.4 1.31581 5.41048 4.49419
45 1996 386.407 0.02 0.00717407 1.85661e-005 0.4 1.02526 3.28486 2.36857
45 1997 607.581 0.04 0.0112804 1.85661e-005 0.4 1.26581 5.00712 4.09083
45 1998 1792.76 -0.001 0.0332847 1.85661e-005 0.4
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45 2001 5412.56 0.01 0.10049 1.85661e-005 0.4 -2.30748 16.6389 15.7226
45 2002 6673.66 0.11 0.123904 1.85661e-005 0.4 -0.119026 0.0442725 -0.872018
45 2003 7011.68 0.05 0.13018 1.85661e-005 0.4 -0.956892 2.86138 1.94509
45 2004 8235.4 0.1 0.152899 1.85661e-005 0.4 -0.42461 0.563418 -0.352873
45 2005 8883.53 0.04 0.164933 1.85661e-005 0.4 -1.41666 6.27162 5.35533
45 2006 10069.7 0.04 0.186955 1.85661e-005 0.4 -1.54199 7.43039 6.5141

INDEX_1
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Err_type N Npos r.m.s.e. mean_input_SE mean_(Input+extra)_SE pen_mean_Qdev
rmse_Qdev
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4 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
5 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
6 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
7 0  1.0 0  0.00  0.0 0 0.000168716  0 0 25 15 0.726836 0.16 0.16 0 0
8 0  1.0 0  0.00  0.0 0 0.000457075  0 0 25 15 0.387631 0.16 0.16 0 0
9 0  1.0 0  0.00  0.0 0 0.00035905  0 0 25 15 0.600424 0.16 0.16 0 0
10 0  1.0 0  0.00  0.0 0 0.000380449  0 0 25 15 0.700198 0.16 0.16 0 0
11 0  1.0 0  0.00  0.0 0 0.000549826  0 0 25 14 0.540455 0.16 0.16 0 0
12 0  1.0 0  0.00  0.0 0 1.64656e-005  0 0 25 25 0.671465 0.21 0.21 0 0
13 0  1.0 0  0.00  0.0 0 4.16651e-005  0 0 25 25 0.540143 0.21 0.21 0 0
14 0  1.0 0  0.00  0.0 0 3.43403e-005  0 0 25 24 0.802098 0.21 0.21 0 0
15 0  1.0 0  0.00  0.0 0 4.35677e-005  0 0 25 20 0.425565 0.21 0.21 0 0
16 0  1.0 0  0.00  0.0 0 7.78219e-005  0 0 25 15 0.443304 0.21 0.21 0 0
17 0  1.0 0  0.00  0.0 0 9.55652e-006  0 0 25 25 0.721548 0.31 0.31 0 0
18 0  1.0 0  0.00  0.0 0 7.38611e-005  0 0 25 25 0.447087 0.31 0.31 0 0
19 0  1.0 0  0.00  0.0 0 9.18233e-005  0 0 25 25 0.750706 0.31 0.31 0 0
20 0  1.0 0  0.00  0.0 0 0.000101415  0 0 25 23 0.634852 0.31 0.31 0 0
21 0  1.0 0  0.00  0.0 0 4.51905e-005  0 0 25 25 0.949882 0.21 0.21 0 0
22 0  1.0 0  0.00  0.0 0 4.50405e-005  0 0 25 25 0.798611 0.21 0.21 0 0
23 0  1.0 0  0.00  0.0 0 0.000129624  0 0 25 24 1.3806 0.21 0.21 0 0
24 0  1.0 0  0.00  0.0 0 0.000762365  0 0 25 24 0.843931 0.21 0.21 0 0
25 0  1.0 0  0.00  0.0 0 1.91489e-005  0 0 25 23 0.776215 0.4 0.4 0 0
26 0  1.0 0  0.00  0.0 0 1.94099e-005  0 0 25 23 0.751543 0.4 0.4 0 0
27 0  1.0 0  0.00  0.0 0 3.3982e-005  0 0 25 22 0.779091 0.4 0.4 0 0
28 0  1.0 0  0.00  0.0 0 4.8757e-005  0 0 25 22 0.723892 0.4 0.4 0 0
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38 0  1.0 0  0.00  0.0 0 4.52769e-005  0 0 25 16 0.850349 0.4 0.4 0 0
39 0  1.0 0  0.00  0.0 0 6.54363e-005  0 0 25 15 0.794374 0.4 0.4 0 0
40 0  1.0 0  0.00  0.0 0 2.10772e-006  0 0 25 19 0.9498 0.4 0.4 0 0
41 0  1.0 0  0.00  0.0 0 3.29307e-005  0 0 25 25 0.565655 0.4 0.4 0 0
42 0  1.0 0  0.00  0.0 0 4.53013e-005  0 0 25 19 0.624686 0.4 0.4 0 0
43 0  1.0 0  0.00  0.0 0 0.000278888  0 0 25 25 0.590551 0.4 0.4 0 0
44 0  1.0 0  0.00  0.0 0 6.30965e-006  0 0 25 21 0.867523 0.4 0.4 0 0
45 0  1.0 0  0.00  0.0 0 1.85661e-005  0 0 25 15 1.16869 0.4 0.4 0 0
rmse_Qdev_not_in_logL
pen_mean_Qdev_not_in_logL_in_randwalk_approach

INDEX_3
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7 0 -- 0 --  0 0
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12 0 -- 0 --  0 0
13 0 -- 0 --  0 0
14 0 -- 0 --  0 0
15 0 -- 0 --  0 0
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22 0 -- 0 --  0 0
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24 0 -- 0 --  0 0
25 0 -- 0 --  0 0
26 0 -- 0 --  0 0
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37 0 -- 0 --  0 0
38 0 -- 0 --  0 0
39 0 -- 0 --  0 0
40 0 -- 0 --  0 0
41 0 -- 0 --  0 0
42 0 -- 0 --  0 0
43 0 -- 0 --  0 0
44 0 -- 0 --  0 0
45 0 -- 0 --  0 0

DISCARD  log(L)_based_on_T-distribution_with_DF=_30
as_fraction
index year seas obs exp cv Dev Like Like+log(s)


MEAN_BODY_WT log(L)_based_on_T-distribution_with_DF=_30
 year seas index Mkt obs exp cv Dev Like Like+log(s)
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 1983 1 1 0 0.521 0.626652 0.1 -0.105652 1.99113 1.99113
 1984 1 1 0 0.518 0.628874 0.1 -0.110874 2.20286 2.20286
 1985 1 1 0 0.575 0.660544 0.1 -0.0855437 1.10332 1.10332
 1986 1 1 0 0.613 0.620202 0.1 -0.007202 0.0071301 0.0071301
 1987 1 1 0 0.581 0.615069 0.1 -0.0340691 0.176646 0.176646
 1988 1 1 0 0.588 0.66533 0.1 -0.0773298 0.868804 0.868804
 1989 1 1 0 0.668 0.734795 0.1 -0.0667948 0.508164 0.508164
 1990 1 1 0 0.54 0.622326 0.1 -0.0823259 1.15662 1.15662
 1991 1 1 0 0.537 0.618015 0.1 -0.0810151 1.13349 1.13349
 1992 1 1 0 0.595 0.629482 0.1 -0.0344819 0.17256 0.17256
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 1993 1 1 0 0.571 0.612088 0.1 -0.0410875 0.265239 0.265239
 1994 1 1 0 0.605 0.641615 0.1 -0.0366146 0.188092 0.188092
 1995 1 1 0 0.675 0.778673 0.1 -0.103673 1.17327 1.17327
 1996 1 1 0 0.621 0.788782 0.1 -0.167782 3.37572 3.37572
 1997 1 1 0 0.697 0.866739 0.1 -0.169739 2.79607 2.79607
 1998 1 1 0 0.759 0.959393 0.1 -0.200393 3.23841 3.23841
 1999 1 1 0 0.755 1.00132 0.1 -0.246317 4.70655 4.70655
 2000 1 1 0 0.85 1.0595 0.1 -0.209497 2.85806 2.85806
 2001 1 1 0 0.903 1.11397 0.1 -0.21097 2.59103 2.59103
 2002 1 1 0 0.898 1.12294 0.1 -0.224944 2.94383 2.94383
 2003 1 1 0 0.999 1.14422 0.1 -0.145224 1.0551 1.0551
 2004 1 1 0 0.983 1.17684 0.1 -0.193843 1.88916 1.88916
 2005 1 1 0 0.949 1.23621 0.1 -0.28721 4.12987 4.12987
 2006 1 1 0 0.947 1.25562 0.1 -0.308624 4.69781 4.69781

FIT_LEN_COMPS
Index Year Seas Gender Mkt Nsamp effN Like

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
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2 0 0 0 0 0 0 -1.#IND
3 0 0 0 0 0 0 -1.#IND
4 0 0 0 0 0 0 -1.#IND
5 0 0 0 0 0 0 -1.#IND
6 0 0 0 0 0 0 -1.#IND
7 0 0 0 0 0 0 -1.#IND
8 0 0 0 0 0 0 -1.#IND
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10 0 0 0 0 0 0 -1.#IND
11 0 0 0 0 0 0 -1.#IND
12 0 0 0 0 0 0 -1.#IND
13 0 0 0 0 0 0 -1.#IND
14 0 0 0 0 0 0 -1.#IND
15 0 0 0 0 0 0 -1.#IND
16 0 0 0 0 0 0 -1.#IND
17 0 0 0 0 0 0 -1.#IND
18 0 0 0 0 0 0 -1.#IND
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0.999791 0.999348 0.998658 0.997722 0.996541 0.995116 0.993447 0.991537
0.989386 0.986996
3 1982 1 1982-3 0.347973 0.999523 0.999966 0.999996 0.999997 0.999998
0.999998 0.999998 0.999998 0.999998 0.999997 0.999996 0.999991 0.999959
0.997971 0.000471197
3 1994 1 1994-3 0.347973 0.999523 0.999966 0.999996 0.999997 0.999998
0.999998 0.999998 0.999998 0.999998 0.999997 0.999996 0.999991 0.999959
0.997971 0.000471197
3 1995 1 1995-3 0.0618538 0.568734 0.998788 0.999986 0.999999 1 1 1 1 1 1 1 1
1 1 0.999769
3 2006 1 2006-3 0.0618538 0.568734 0.998788 0.999986 0.999999 1 1 1 1 1 1 1 1
1 1 0.999769
3 2007 1 2007-3 0.0618538 0.568734 0.998788 0.999986 0.999999 1 1 1 1 1 1 1 1
1 1 0.999769
4 1982 1 1982-4 0.034365 0.497215 0.998452 0.97541 0.258896 0.00935664
9.09988e-005 4.55558e-005 4.54797e-005 4.54604e-005 4.54507e-005 4.5445e-005
4.54415e-005 4.54391e-005 4.54374e-005 4.54362e-005
4 1994 1 1994-4 0.034365 0.497215 0.998452 0.97541 0.258896 0.00935664
9.09988e-005 4.55558e-005 4.54797e-005 4.54604e-005 4.54507e-005 4.5445e-005
4.54415e-005 4.54391e-005 4.54374e-005 4.54362e-005
4 1995 1 1995-4 0.0107409 0.279376 0.984951 0.999189 0.735157 0.515702
0.500663 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531
0.500531 0.500531
4 2006 1 2006-4 0.0107409 0.279376 0.984951 0.999189 0.735157 0.515702
0.500663 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531
0.500531 0.500531
4 2007 1 2007-4 0.0107409 0.279376 0.984951 0.999189 0.735157 0.515702
0.500663 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531
0.500531 0.500531
5 1982 1 1982-5 0.0505048 0.588763 0.999024 0.999989 0.999939 0.999644
0.999103 0.998314 0.997281 0.996002 0.99448 0.992715 0.990709 0.988462
0.985978 0.983256
```

```
5 1994 1 1994-5 0.0505048 0.588763 0.999024 0.999989 0.999939 0.999644
0.999103 0.998314 0.997281 0.996002 0.99448 0.992715 0.990709 0.988462
0.985978 0.983256
5 1995 1 1995-5 0.00600833 0.112092 0.615127 0.999111 0.999986 0.999956
0.999688 0.999173 0.998412 0.997404 0.996152 0.994656 0.992918 0.990937
0.988717 0.986258
5 2006 1 2006-5 0.00600833 0.112092 0.615127 0.999111 0.999986 0.999956
0.999688 0.999173 0.998412 0.997404 0.996152 0.994656 0.992918 0.990937
0.988717 0.986258
5 2007 1 2007-5 0.00600833 0.112092 0.615127 0.999111 0.999986 0.999956
0.999688 0.999173 0.998412 0.997404 0.996152 0.994656 0.992918 0.990937
0.988717 0.986258
6 1982 1 1982-6 0.0759641 0.69325 0.999338 0.857383 0.14368 0.00330444
5.56366e-005 4.55259e-005 4.54848e-005 4.54685e-005 4.546e-005 4.5455e-005
4.54518e-005 4.54496e-005 4.5448e-005 4.54469e-005
6 1994 1 1994-6 0.0759641 0.69325 0.999338 0.857383 0.14368 0.00330444
5.56366e-005 4.55259e-005 4.54848e-005 4.54685e-005 4.546e-005 4.5455e-005
4.54518e-005 4.54496e-005 4.5448e-005 4.54469e-005
6 1995 1 1995-6 0.0884999 0.733326 0.999411 0.823981 0.128032 0.00573296
0.00316778 0.00316051 0.00316047 0.00316046 0.00316045 0.00316044 0.00316044
0.00316044 0.00316044 0.00316043
6 2006 1 2006-6 0.0884999 0.733326 0.999411 0.823981 0.128032 0.00573296
0.00316778 0.00316051 0.00316047 0.00316046 0.00316045 0.00316044 0.00316044
0.00316044 0.00316044 0.00316043
6 2007 1 2007-6 0.0884999 0.733326 0.999411 0.823981 0.128032 0.00573296
0.00316778 0.00316051 0.00316047 0.00316046 0.00316045 0.00316044 0.00316044
0.00316044 0.00316044 0.00316043
7 1982 1 1982-7 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
7 2006 1 2006-7 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
8 1982 1 1982-8 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
8 2006 1 2006-8 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
9 1982 1 1982-9 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
9 2006 1 2006-9 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
10 1982 1 1982-10 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
10 2006 1 2006-10 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
11 1982 1 1982-11 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1
11 2006 1 2006-11 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1
12 1982 1 1982-12 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
12 2006 1 2006-12 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
13 1982 1 1982-13 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
13 2006 1 2006-13 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
14 1982 1 1982-14 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
14 2006 1 2006-14 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
15 1982 1 1982-15 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
15 2006 1 2006-15 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
16 1982 1 1982-16 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1
16 2006 1 2006-16 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1
17 1982 1 1982-17 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
17 2006 1 2006-17 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
18 1982 1 1982-18 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
18 2006 1 2006-18 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
19 1982 1 1982-19 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
19 2006 1 2006-19 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
20 1982 1 1982-20 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
20 2006 1 2006-20 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
21 1982 1 1982-21 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
21 2006 1 2006-21 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
```

```
22 1982 1 1982-22 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
22 2006 1 2006-22 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
23 1982 1 1982-23 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
23 2006 1 2006-23 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
24 1982 1 1982-24 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
24 2006 1 2006-24 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
25 1982 1 1982-25 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
25 2006 1 2006-25 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
26 1982 1 1982-26 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
26 2006 1 2006-26 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
27 1982 1 1982-27 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
27 2006 1 2006-27 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
28 1982 1 1982-28 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
28 2006 1 2006-28 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
29 1982 1 1982-29 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
29 2006 1 2006-29 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
30 1982 1 1982-30 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
30 2006 1 2006-30 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
31 1982 1 1982-31 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1
31 2006 1 2006-31 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1
32 1982 1 1982-32 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
32 2006 1 2006-32 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
33 1982 1 1982-33 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
33 2006 1 2006-33 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
34 1982 1 1982-34 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
34 2006 1 2006-34 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
35 1982 1 1982-35 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1
35 2006 1 2006-35 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1
36 1982 1 1982-36 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
36 2006 1 2006-36 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
37 1982 1 1982-37 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
37 2006 1 2006-37 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
38 1982 1 1982-38 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
38 2006 1 2006-38 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
39 1982 1 1982-39 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1
39 2006 1 2006-39 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1
40 1982 1 1982-40 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
40 2006 1 2006-40 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
41 1982 1 1982-41 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
41 2006 1 2006-41 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
42 1982 1 1982-42 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
42 2006 1 2006-42 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
43 1982 1 1982-43 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
43 2006 1 2006-43 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
44 1982 1 1982-44 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
44 2006 1 2006-44 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
45 1982 1 1982-45 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1
45 2006 1 2006-45 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX_from_size_selex_in_endyear
fleet year morph season 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

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7 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
11 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
12 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
13 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
14 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
15 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
16 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
17 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
18 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
19 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
20 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
21 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
22 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
23 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
24 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
25 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
26 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
27 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
28 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
29 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
30 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
31 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
32 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
33 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
34 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
35 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
36 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
37 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
38 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
39 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
40 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
41 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
42 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
43 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
44 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
45 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX_mortality_in_endyear
fleet year morph season label 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2006 1 1 sel*wt  0.000454671 0.0457677 0.581737 1.22398 1.6606 2.08797
2.48737 2.84598 3.15601 3.41517 3.62609 3.79437 3.92666 4.02941 4.10827
4.16792
1 2006 1 1 sel*ret*wt  0.000454671 0.0457677 0.581737 1.22398 1.6606 2.08797
2.48737 2.84598 3.15601 3.41517 3.62609 3.79437 3.92666 4.02941 4.10827
4.16792
1 2006 1 1 sel_nums  0.00253893 0.102677 0.720443 0.999541 0.999993 0.999909
0.999575 0.998994 0.998168 0.997095 0.995778 0.994218 0.992414 0.99037
0.988086 0.985564
1 2006 1 1 sel*ret_nums  0.00253893 0.102677 0.720443 0.999541 0.999993
0.999909 0.999575 0.998994 0.998168 0.997095 0.995778 0.994218 0.992414
0.99037 0.988086 0.985564
1 2006 1 1 dead_nums  0.00253893 0.102677 0.720443 0.999541 0.999993 0.999909
0.999575 0.998994 0.998168 0.997095 0.995778 0.994218 0.992414 0.99037
0.988086 0.985564
```

```
1 2006 1 1 dead*wt  0.000454671 0.0457677 0.581737 1.22398 1.6606 2.08797
2.48737 2.84598 3.15601 3.41517 3.62609 3.79437 3.92666 4.02941 4.10827
4.16792
2 2006 1 1 sel*wt  0.000190083 0.0175762 0.309487 1.19454 1.66053 2.08813
2.48791 2.84698 3.15756 3.41732 3.62887 3.79779 3.93075 4.03416 4.11368
4.17397
2 2006 1 1 sel*ret*wt  0.000190083 0.0175762 0.309487 1.19454 1.66053 2.08813
2.48791 2.84698 3.15756 3.41732 3.62887 3.79779 3.93075 4.03416 4.11368
4.17397
2 2006 1 1 sel_nums  0.00106144 0.0394312 0.383279 0.9755 0.999953 0.999987
0.999791 0.999348 0.998658 0.997722 0.996541 0.995116 0.993447 0.991537
0.989386 0.986996
2 2006 1 1 sel*ret_nums  0.00106144 0.0394312 0.383279 0.9755 0.999953
0.999987 0.999791 0.999348 0.998658 0.997722 0.996541 0.995116 0.993447
0.991537 0.989386 0.986996
2 2006 1 1 dead_nums  0.00106144 0.0394312 0.383279 0.9755 0.999953 0.999987
0.999791 0.999348 0.998658 0.997722 0.996541 0.995116 0.993447 0.991537
0.989386 0.986996
2 2006 1 1 dead*wt  0.000190083 0.0175762 0.309487 1.19454 1.66053 2.08813
2.48791 2.84698 3.15756 3.41732 3.62887 3.79779 3.93075 4.03416 4.11368
4.17397
3 2006 1 1 sel*wt  0.0110768 0.253509 0.806493 1.22452 1.66061 2.08816
2.48843 2.84884 3.1618 3.42512 3.64146 3.81643 3.95667 4.06859 4.15781
4.22799
3 2006 1 1 sel*ret*wt  0.0110768 0.253509 0.806493 1.22452 1.66061 2.08816
2.48843 2.84884 3.1618 3.42512 3.64146 3.81643 3.95667 4.06859 4.15781
4.22799
3 2006 1 1 sel_nums  0.0618538 0.568734 0.998788 0.999986 0.999999 1 1 1 1 1
1 1 1 1 1 0.999769
3 2006 1 1 sel*ret_nums  0.0618538 0.568734 0.998788 0.999986 0.999999 1 1 1
1 1 1 1 1 1 1 0.999769
3 2006 1 1 dead_nums  0.0618538 0.568734 0.998788 0.999986 0.999999 1 1 1 1 1
1 1 1 1 1 0.999769
3 2006 1 1 dead*wt  0.0110768 0.253509 0.806493 1.22452 1.66061 2.08816
2.48843 2.84884 3.1618 3.42512 3.64146 3.81643 3.95667 4.06859 4.15781
4.22799
4 2006 1 1 sel*wt  0.00192348 0.12453 0.79532 1.22355 1.22081 1.07687 1.24587
1.42593 1.58258 1.71438 1.82266 1.91024 1.98044 2.03646 2.08111 2.11673
4 2006 1 1 sel*ret*wt  0.00192348 0.12453 0.79532 1.22355 1.22081 1.07687
1.24587 1.42593 1.58258 1.71438 1.82266 1.91024 1.98044 2.03646 2.08111
2.11673
4 2006 1 1 sel_nums  0.0107409 0.279376 0.984951 0.999189 0.735157 0.515702
0.500663 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531
0.500531 0.500531
4 2006 1 1 sel*ret_nums  0.0107409 0.279376 0.984951 0.999189 0.735157
0.515702 0.500663 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531
0.500531 0.500531 0.500531
4 2006 1 1 dead_nums  0.0107409 0.279376 0.984951 0.999189 0.735157 0.515702
0.500663 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531 0.500531
0.500531 0.500531
4 2006 1 1 dead*wt  0.00192348 0.12453 0.79532 1.22355 1.22081 1.07687
1.24587 1.42593 1.58258 1.71438 1.82266 1.91024 1.98044 2.03646 2.08111
2.11673
5 2006 1 1 sel*wt  0.00107597 0.0499642 0.496698 1.22345 1.66058 2.08807
2.48765 2.84649 3.15678 3.41623 3.62745 3.79604 3.92865 4.03172 4.11089
4.17085
```

```
5 2006 1 1 sel*ret*wt  0.00107597 0.0499642 0.496698 1.22345 1.66058 2.08807
2.48765 2.84649 3.15678 3.41623 3.62745 3.79604 3.92865 4.03172 4.11089
4.17085
5 2006 1 1 sel_nums  0.00600833 0.112092 0.615127 0.999111 0.999986 0.999956
0.999688 0.999173 0.998412 0.997404 0.996152 0.994656 0.992918 0.990937
0.988717 0.986258
5 2006 1 1 sel*ret_nums  0.00600833 0.112092 0.615127 0.999111 0.999986
0.999956 0.999688 0.999173 0.998412 0.997404 0.996152 0.994656 0.992918
0.990937 0.988717 0.986258
5 2006 1 1 dead_nums  0.00600833 0.112092 0.615127 0.999111 0.999986 0.999956
0.999688 0.999173 0.998412 0.997404 0.996152 0.994656 0.992918 0.990937
0.988717 0.986258
5 2006 1 1 dead*wt  0.00107597 0.0499642 0.496698 1.22345 1.66058 2.08807
2.48765 2.84649 3.15678 3.41623 3.62745 3.79604 3.92865 4.03172 4.11089
4.17085
6 2006 1 1 sel*wt  0.0158485 0.326875 0.806996 1.009 0.212611 0.0119713
0.0078828 0.00900379 0.00999278 0.0108249 0.0115086 0.0120616 0.0125048
0.0128585 0.0131405 0.0133654
6 2006 1 1 sel*ret*wt  0.0158485 0.326875 0.806996 1.009 0.212611 0.0119713
0.0078828 0.00900379 0.00999278 0.0108249 0.0115086 0.0120616 0.0125048
0.0128585 0.0131405 0.0133654
6 2006 1 1 sel_nums  0.0884999 0.733326 0.999411 0.823981 0.128032 0.00573296
0.00316778 0.00316051 0.00316047 0.00316046 0.00316045 0.00316044 0.00316044
0.00316044 0.00316044 0.00316043
6 2006 1 1 sel*ret_nums  0.0884999 0.733326 0.999411 0.823981 0.128032
0.00573296 0.00316778 0.00316051 0.00316047 0.00316046 0.00316045 0.00316044
0.00316044 0.00316044 0.00316044 0.00316043
6 2006 1 1 dead_nums  0.0884999 0.733326 0.999411 0.823981 0.128032
0.00573296 0.00316778 0.00316051 0.00316047 0.00316046 0.00316045 0.00316044
0.00316044 0.00316044 0.00316044 0.00316043
6 2006 1 1 dead*wt  0.0158485 0.326875 0.806996 1.009 0.212611 0.0119713
0.0078828 0.00900379 0.00999278 0.0108249 0.0115086 0.0120616 0.0125048
0.0128585 0.0131405 0.0133654

ENVIRONMENTAL_DATA Begins_in_startyr-1

NUMBERS_AT_AGE
Population 1 gmorph 1 gender: 1 GrowPattern: 1 birthseason: 1
Year Per Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1980 VIRG 1  59911.2 49051.1 40159.7 32879.9 26919.8 22040.1 18044.9 14773.9
12095.9 9903.25 8108.09 6638.35 5435.02 4449.82 3643.2 16421.7
1981 INIT 1  37379.9 29774.9 14685 3385.93 780.172 179.765 41.4336 9.55585
2.20592 0.509859 0.118028 0.0273734 0.00636232 0.00148244 0.000346376
0.000106143
1982 TIME 1  47391.2 29774.9 14685 3385.93 780.172 179.765 41.4336 9.55585
2.20592 0.509859 0.118028 0.0273734 0.00636232 0.00148244 0.000346376
0.000106143
1983 TIME 1  56997.8 37028.8 12864.2 2906.03 600.461 140.358 32.4448 7.48385
1.72785 0.399442 0.0924915 0.0214578 0.00498926 0.00116302 0.000271879
8.33728e-005
1984 TIME 1  39199.6 45427.8 19555.4 3294.06 658.095 138.172 32.4092 7.49623
1.73059 0.400021 0.0926128 0.021483 0.00499444 0.00116407 0.000272087
8.34256e-005
1985 TIME 1  47705.8 30632.9 19150.8 3211.37 448.502 90.9878 19.1695 4.50013
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1987 TIME 1 35763.9 39105.7 14476.6 2071.15 484.227 72.2723 10.1911 2.07174
0.437349 0.102958 0.0239298 0.00555834 0.0012943 0.000302251 7.08074e-005
2.17844e-005
1988 TIME 1 10933.3 28102.3 17615.8 2945.75 382.75 91.6098 13.7412 1.93914
0.394613 0.0834193 0.0196724 0.00458195 0.0010669 0.000249133 5.83632e-005
1.79582e-005
1989 TIME 1 23928.4 8463.62 10163.9 2138.1 310.943 41.165 9.89392 1.48556
0.20994 0.0428049 0.0090707 0.00214535 0.000501385 0.000117202 2.74885e-005
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1991 TIME 1 26507 22155 8491.22 930.556 436.938 82.5632 12.1159 1.60688
0.386782 0.0581976 0.00824729 0.0016873 0.000359009 8.53115e-005 2.0045e-005
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0.295496 0.0712218 0.0107345 0.00152428 0.000312589 6.66902e-005 1.5896e-005
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1993 TIME 1 30696.7 25126.3 8225.58 1638.88 272.141 27.4072 13.3975 2.55181
0.375178 0.0498801 0.0120444 0.00181935 0.000259013 5.32737e-005 1.14036e-005
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1994 TIME 1 28514.4 23534.2 10683.3 1728.08 318.144 56.4245 5.75841 2.81742
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3.26945e-006
1995 TIME 1 32953.6 22150.4 10504.7 2353.02 349.054 69.7074 12.636 1.29119
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1998 TIME 1 28696.3 21788.8 14333.2 8255.47 1590.05 177.898 20.8106 3.21969
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1.1711 0.23709 0.0431136 0.00442264 0.00217679 0.000418092 6.20972e-005
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0.000254433
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138.456 27.5625 3.10806 0.36442 0.0565396 0.0114799 0.00209474 0.000346542
2004 TIME 1 28596.6 17137 18584.9 9761.98 4706.94 1814.09 1040.86 429.768
158.122 69.9091 13.9235 1.57101 0.184332 0.0286225 0.00581701 0.00123853
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216.407 79.6514 35.2328 7.02145 0.792817 0.0931021 0.0144705 0.0035716

2006 TIME 1 26414.8 11411.5 17653.4 7654.51 5438.5 2470.41 1231.56 477.515
274.123 113.253 41.7031 18.4572 3.68075 0.41593 0.0488867 0.00948512
2007 FORE 1 43744.6 21516.7 8733.29 10930.5 4125.69 3003.64 1371.33 683.804
265.186 152.278 62.9374 23.1866 10.268 2.04902 0.231717 0.032552

CATCH_AT_AGE
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1989 1 410.027 2080.48 4471.41 897.434 130.708 17.3072 4.15873 0.624201
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0.0656484 0.00928387 0.00189464 0.000401951 9.51976e-005 2.22839e-005
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1991 1 316.679 3727.58 2641.08 277.962 132.16 25.0318 3.67262 0.4869 0.11714
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1992 1 550.591 4712.22 3900 681.864 67.4703 32.8518 6.25086 0.91771 0.121776
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10.2662 4.53564 0.902518 0.10172 0.0119195 0.00184806 0.000374948 7.96814e-
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2005 1  0.962926 57.4187 276.475 544.744 249.722 124.098 48.1001 27.5966
11.3914 4.18965 1.85151 0.368565 0.0415606 0.00487309 0.000756097 0.00018626
2006 1  1.7031 26.5257 361.135 374.193 275.533 125.45 62.5347 24.2381 13.9064
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2001 1  12.5664 89.5672 82.008 50.6957 20.3267 7.43442 3.28408 0.653431
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1987 1  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1988 1  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1989 1  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1990 1  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1991 1  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1992 1  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1993 1  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1994 1  44.0814 408.846 279.845 42.8083 2.15663 0.0139383 1.3841e-005
3.39134e-006 6.45757e-007 9.50739e-008 1.26659e-008 3.06625e-009 4.64575e-010
6.63713e-011 1.37054e-011 3.99751e-012
1995 1  6.38478 101.876 115.652 20.4726 2.26123 0.318092 0.0559977 0.00572231
0.00280354 0.000535449 7.90002e-005 1.05481e-005 2.55993e-006 3.88939e-007
5.57371e-008 1.4987e-008
1996 1  2.15598 56.7828 80.2986 12.62 1.06591 0.115109 0.0225911 0.00409895
0.000419389 0.000205757 3.93679e-005 5.82108e-006 7.79247e-007 1.89681e-007
2.89165e-008 5.2811e-009
1997 1  1.38038 25.0485 66.0365 15.524 1.2635 0.103391 0.0155259 0.00313961
0.000570231 5.84052e-005 2.86934e-005 5.49912e-006 8.14725e-007 1.09313e-007
2.66772e-008 4.82516e-009
1998 1  2.08414 39.115 74.513 38.3552 5.49003 0.431985 0.049069 0.00759096
0.00153625 0.000279227 2.86266e-005 1.408e-005 2.70212e-006 4.00963e-007
5.38933e-008 1.55651e-008
1999 1  3.79711 99.4488 207.672 82.8128 26.3569 3.66055 0.400149 0.0468228
0.00724842 0.00146779 0.000266985 2.73968e-005 1.34898e-005 2.59211e-006
3.85186e-007 6.68489e-008
2000 1  1.56431 25.6135 73.3392 33.6074 8.85541 2.73305 0.527759 0.0594338
0.00695895 0.00107783 0.000218398 3.97569e-005 4.08345e-006 2.01276e-006
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2001 1  2.80274 56.5102 103.871 65.0612 19.1931 4.92429 2.11182 0.420076
0.047337 0.00554543 0.000859465 0.000174292 3.17582e-005 3.26547e-006
1.61157e-006 3.6474e-007
2002 1  1.68198 30.9934 71.5842 30.0125 12.4495 3.59405 1.28325 0.566916
0.112834 0.0127203 0.00149097 0.000231235 4.69294e-005 8.55885e-006 8.80947e-
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0.151606 0.0301866 0.00340487 0.000399347 6.1981e-005 1.259e-005 2.29836e-006
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2004 1  0.707625 10.6458 35.9456 17.7237 6.36468 1.72511 0.961066 0.396761
0.146003 0.0645648 0.0128626 0.00145177 0.000170405 2.64712e-005 5.38236e-006
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2005 1  0.373766 15.605 27.2533 21.4031 7.0424 2.4549 0.923943 0.530192
0.219004 0.0806236 0.0356718 0.00711106 0.000803214 9.43603e-005 1.46725e-005
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2006 1  0.661617 7.21502 35.6281 14.7143 7.77672 2.4837 1.20221 0.466052
0.267579 0.110568 0.0407234 0.0180283 0.0035963 0.000406526 4.77998e-005
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 fleet 5 fleetarea 1 gmorph 1
Year Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1981 E  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1982 1  1213.05 6785.06 4154.17 920.983 213.309 49.1928 11.3354 2.61323
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005 3.4745e-006
1984 1 813.347 8302.77 4189.79 661.537 132.857 27.9193 6.54701 1.51376
0.349305 0.0806953 0.0186703 0.00432758 0.00100523 0.00023407 5.46534e-005
1.67382e-005
1985 1 783.176 4530.38 3395.59 541.006 75.6535 15.3494 3.23295 0.758653
0.175601 0.0405819 0.00939327 0.00217843 0.000506346 0.000117994 2.75748e-005
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1986 1 1313.19 8318.4 3590.49 905.255 132.668 18.6298 3.78284 0.797281
0.18729 0.0434142 0.0100519 0.00233193 0.000542254 0.000126426 2.95634e-005
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1987 1 589.382 5826.13 2656.86 367.194 86.5854 12.9429 1.8246 0.370771
0.0782295 0.0184045 0.00427441 0.00099198 0.000230761 5.38291e-005 1.2595e-
005 3.86975e-006
1988 1 258.655 5513.77 3892.96 622.156 81.3313 19.4873 2.92241 0.412275
0.0838639 0.0177198 0.0041764 0.000972098 0.000226184 5.27731e-005 1.23516e-
005 3.79678e-006
1989 1 208.728 669.077 975.922 195.958 28.5393 3.77872 0.907937 0.136268
0.0192473 0.00392181 0.000830428 0.000196236 4.58162e-005 1.0698e-005
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1990 1 421.138 2473.99 662.287 331.832 61.7993 9.03894 1.19768 0.287916
0.0432479 0.00611571 0.00124802 0.000264754 6.27008e-005 1.46763e-005
3.43704e-006 1.12541e-006
1991 1 488.311 3631.19 1746.07 183.846 87.4082 16.5546 2.42873 0.321973
0.0774576 0.011647 0.00164921 0.000337102 7.16514e-005 1.70069e-005 3.99112e-
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1992 1 555.528 3003.64 1687.12 295.099 29.1987 14.2163 2.70485 0.397087
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1993 1 593.675 4335.69 1814.16 351.323 59.7802 6.04865 2.95616 0.562808
0.0826992 0.0109872 0.00265087 0.00040004 5.68904e-005 1.16871e-005 2.49846e-
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0.113355 0.0166748 0.00221852 0.000536187 8.10812e-005 1.1558e-005 2.38077e-
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2004 1  27.4416 296.111 1556.29 1228.61 600.182 231.896 133.035 54.9075
20.1898 8.91927 1.77466 0.200002 0.0234345 0.00363314 0.000737067 0.000156625
2005 1  12.6429 378.602 1029.2 1294.12 579.25 287.838 111.557 63.9992 26.4158
9.71482 4.29291 0.854494 0.0963486 0.0112963 0.00175258 0.000431708
2006 1  24.1695 189.048 1453.08 960.844 690.808 314.506 156.764 60.7565
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 fleet 6 fleetarea 1 gmorph 1
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1981 E  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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1986 1  132.846 658.768 241.565 52.2028 1.28213 0.00414193 1.41681e-005
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1987 1  80.1506 620.244 240.292 28.4648 1.12487 0.00386828 9.18656e-006
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1988 1  19.5607 326.426 195.796 26.8205 0.587581 0.00323885 8.18237e-006
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1989 1  10.0293 25.1673 31.1863 5.36729 0.131002 0.000399033 1.61517e-006
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1990 1  63.9551 294.118 66.8893 28.7257 0.896562 0.00301678 6.73388e-006
1.32566e-006 1.99153e-007 2.81884e-008 5.76008e-009 1.22398e-009 2.90437e-010
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1991 1  85.8975 500.041 204.27 18.435 1.46887 0.00639999 1.58175e-005
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1992 1  84.4885 357.612 170.646 25.5836 0.42423 0.00475175 1.52303e-005
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1993 1  189.539 1083.63 385.2 63.9382 1.82329 0.0042441 3.49424e-005
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1994 1  120.941 707.506 347.638 46.7025 1.48549 0.00610957 1.05031e-005
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1995 1  161.278 819.795 359.759 51.7569 1.20728 0.0108408 0.00108619
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1996 1  82.218 689.834 377.101 48.167 0.859167 0.00592258 0.000661555
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1997 1  62.7453 362.719 369.653 70.6241 1.21393 0.0063408 0.000541933
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0.00167199 0.000195869 3.03568e-005 6.1561e-006 1.12172e-006 1.15338e-007
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2002 1  81.9086 480.821 429.292 146.277 12.8143 0.23614 0.0479871 0.0211568
0.00421081 0.000474704 5.56409e-005 8.62931e-006 1.75133e-006 3.19402e-007
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2003 1  59.0019 550.953 453.894 198.166 11.715 0.300148 0.0684682 0.0251299
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2004 1  96.4511 462.26 603.362 241.784 18.3365 0.317249 0.100592 0.0414436
0.0152505 0.00674399 0.00134353 0.000151641 1.77992e-005 2.76498e-006
5.62201e-007 1.19764e-007
2005 1  47.3244 629.442 424.945 271.224 18.847 0.41937 0.0898334 0.0514449
0.0212499 0.00782284 0.0034612 0.000689978 7.79347e-005 9.15565e-006
1.42366e-006 3.51559e-007
2006 1  77.6218 269.663 514.751 172.776 19.2845 0.393146 0.108309 0.0419021
0.0240574 0.00994089 0.00366132 0.00162087 0.000323332 3.65494e-005 4.29752e-
006 8.34171e-007

BIOLOGY 1 70 15 1 N_Used_morphs;_lengths;_ages;_season;_by_season_in_endyr
bin low Mean_Size Wt_len-F mat_len spawn Wt_len-M
1 10 10.5 0.0063863 1 0.0063863
2 11 11.5 0.00865928 1 0.00865928
3 12 12.5 0.0114467 1 0.0114467
4 13 13.5 0.0148098 1 0.0148098
5 14 14.5 0.0188113 1 0.0188113
6 15 15.5 0.0235157 1 0.0235157
7 16 16.5 0.0289892 1 0.0289892
8 17 17.5 0.0352991 1 0.0352991
9 18 18.5 0.0425145 1 0.0425145
10 19 19.5 0.0507059 1 0.0507059
11 20 20.5 0.0599448 1 0.0599448
12 21 21.5 0.0703042 1 0.0703042
13 22 22.5 0.0818585 1 0.0818585
14 23 23.5 0.0946829 1 0.0946829
15 24 24.5 0.108854 1 0.108854
16 25 25.5 0.12445 1 0.12445
17 26 26.5 0.14155 1 0.14155
18 27 27.5 0.160232 1 0.160232
19 28 28.5 0.180579 1 0.180579
20 29 29.5 0.202673 1 0.202673
21 30 30.5 0.226596 1 0.226596
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22 31 31.5 0.252433 1 0.252433
23 32 32.5 0.280267 1 0.280267
24 33 33.5 0.310187 1 0.310187
25 34 34.5 0.342277 1 0.342277
26 35 35.5 0.376627 1 0.376627
27 36 36.5 0.413324 1 0.413324
28 37 37.5 0.452458 1 0.452458
29 38 38.5 0.494119 1 0.494119
30 39 39.5 0.538399 1 0.538399
31 40 40.5 0.58539 1 0.58539
32 41 41.5 0.635184 1 0.635184
33 42 42.5 0.687876 1 0.687876
34 43 43.5 0.743558 1 0.743558
35 44 44.5 0.802328 1 0.802328
36 45 45.5 0.86428 1 0.86428
37 46 46.5 0.929512 1 0.929512
38 47 47.5 0.99812 1 0.99812
39 48 48.5 1.0702 1 1.0702
40 49 49.5 1.14586 1 1.14586
41 50 50.5 1.22519 1 1.22519
42 51 51.5 1.3083 1 1.3083
43 52 52.5 1.39527 1 1.39527
44 53 53.5 1.48623 1 1.48623
45 54 54.5 1.58127 1 1.58127
46 55 55.5 1.68048 1 1.68048
47 56 56.5 1.78398 1 1.78398
48 57 57.5 1.89188 1 1.89188
49 58 58.5 2.00426 1 2.00426
50 59 59.5 2.12125 1 2.12125
51 60 60.5 2.24294 1 2.24294
52 61 61.5 2.36945 1 2.36945
53 62 62.5 2.50088 1 2.50088
54 63 63.5 2.63734 1 2.63734
55 64 64.5 2.77893 1 2.77893
56 65 65.5 2.92577 1 2.92577
57 66 66.5 3.07797 1 3.07797
58 67 67.5 3.23564 1 3.23564
59 68 68.5 3.39888 1 3.39888
60 69 69.5 3.56782 1 3.56782
61 70 70.5 3.74255 1 3.74255
62 71 71.5 3.9232 1 3.9232
63 72 72.5 4.10988 1 4.10988
64 73 73.5 4.30271 1 4.30271
65 74 74.5 4.50178 1 4.50178
66 75 75.5 4.70723 1 4.70723
67 76 76.5 4.91917 1 4.91917
68 77 77.5 5.13771 1 5.13771
69 78 78.5 5.36296 1 5.36296
70 79 79.5 5.59506 1 5.59506

Growth_Parameters
 Count Yr Morph A1 A2 L-at-A1 L-at-A2 K A-at-L0 Linf CVmin CVmax natM_amin
natM_max M_young M_old
 1 1982 1 0.5 6 28.1 60.2 0.2052 -1.76669 75.5491 0.1 0.1 0 2 0.2 0.2

Season gmorph GrowPattern Sex BirthSeas age age_Beg age_Mid M Len_Beg Len_Mid
SD_Beg SD_Mid Wt_Beg Wt_Mid Len_Mat Age_Mat Mat*Fecund Len:_1 SelWt:_1
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RetWt:_1 Len:_2 SelWt:_2 RetWt:_2 Len:_3 SelWt:_3 RetWt:_3 Len:_4 SelWt:_4
RetWt:_4 Len:_5 SelWt:_5 RetWt:_5 Len:_6 SelWt:_6 RetWt:_6 Len:_7 SelWt:_7
RetWt:_7 Len:_8 SelWt:_8 RetWt:_8 Len:_9 SelWt:_9 RetWt:_9 Len:_10 SelWt:_10
RetWt:_10 Len:_11 SelWt:_11 RetWt:_11 Len:_12 SelWt:_12 RetWt:_12 Len:_13
SelWt:_13 RetWt:_13 Len:_14 SelWt:_14 RetWt:_14 Len:_15 SelWt:_15 RetWt:_15
Len:_16 SelWt:_16 RetWt:_16 Len:_17 SelWt:_17 RetWt:_17 Len:_18 SelWt:_18
RetWt:_18 Len:_19 SelWt:_19 RetWt:_19 Len:_20 SelWt:_20 RetWt:_20 Len:_21
SelWt:_21 RetWt:_21 Len:_22 SelWt:_22 RetWt:_22 Len:_23 SelWt:_23 RetWt:_23
Len:_24 SelWt:_24 RetWt:_24 Len:_25 SelWt:_25 RetWt:_25 Len:_26 SelWt:_26
RetWt:_26 Len:_27 SelWt:_27 RetWt:_27 Len:_28 SelWt:_28 RetWt:_28 Len:_29
SelWt:_29 RetWt:_29 Len:_30 SelWt:_30 RetWt:_30 Len:_31 SelWt:_31 RetWt:_31
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RetWt:_42 Len:_43 SelWt:_43 RetWt:_43 Len:_44 SelWt:_44 RetWt:_44 Len:_45
SelWt:_45 RetWt:_45
1 1 1 1 1 0 0 0.5 0.2 10 28.1 1 2.81 0.006815 0.17908 1 0.38 0.0025897 28.1
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1 1 1 1 1 15 15 15.5 0.2 73.1279 73.364 7.31279 7.3364 4.19539 4.22897 1 1
4.19539 72.5389 4.22897 4.22897 72.5389 4.22897 4.22897 72.5389 4.22897
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4.22897
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MEAN_BODY_WT(begin)
morph year season 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 1982 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1983 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1984 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1985 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1986 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1987 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1988 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1989 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1990 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1991 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1992 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1993 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1994 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1995 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1996 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1997 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1998 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1999 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2000 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2001 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2002 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2003 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2004 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2005 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2006 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2007 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539

MEAN_SIZE_TIMESERIES
morph year season beg/mid 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
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1 1982 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1982 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1983 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1983 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1984 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1984 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1985 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1985 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1986 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1986 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1987 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1987 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1988 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1988 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1989 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1989 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1990 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1990 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1991 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1991 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1992 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1992 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1993 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1993 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1994 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1994 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1995 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1995 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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1 1996 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1996 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1997 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1997 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1998 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1998 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1999 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1999 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2000 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2000 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2001 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2001 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2002 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2002 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2003 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2003 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2004 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2004 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2005 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2005 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2006 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2006 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2007 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2007 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364

 mean_size_Jan_1_for_gender: 1
1 1982 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1983 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1984 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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1 1985 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1986 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1987 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1988 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1989 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1990 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1991 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1992 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1993 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1994 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1995 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1996 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1997 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1998 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1999 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2000 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2001 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2002 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2003 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2004 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2005 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2006 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2007 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279

AGE_LENGTH_KEY
 sdratio 1000
 sdwithin 1
 sdbetween 1e-006

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0.0109369 0.0284014 0.0540658 0.0846271 0.116561 0.147279 0.175291 0.199958
0.221178
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45 2006 L 1 23 1
45 2006 L 1 24 1
45 2006 L 1 25 1
45 2006 L 1 26 1
45 2006 L 1 27 1
45 2006 L 1 28 1
45 2006 L 1 29 1
45 2006 L 1 30 1
45 2006 L 1 31 1
45 2006 L 1 32 1
45 2006 L 1 33 1
45 2006 L 1 34 1
45 2006 L 1 35 1
45 2006 L 1 36 1
45 2006 L 1 37 1
45 2006 L 1 38 1
45 2006 L 1 39 1
45 2006 L 1 40 1
45 2006 L 1 41 1
45 2006 L 1 42 1
45 2006 L 1 43 1
45 2006 L 1 44 1
45 2006 L 1 45 1
45 2006 L 1 46 1
45 2006 L 1 47 1
45 2006 L 1 48 1
45 2006 L 1 49 1
45 2006 L 1 50 1
45 2006 L 1 51 1
45 2006 L 1 52 1
45 2006 L 1 53 1
45 2006 L 1 54 1
```

```
45 2006 L 1 55 1
45 2006 L 1 56 1
45 2006 L 1 57 1
45 2006 L 1 58 1
45 2006 L 1 59 1
45 2006 L 1 60 1
45 2006 L 1 61 1
45 2006 L 1 62 1
45 2006 L 1 63 1
45 2006 L 1 64 1
45 2006 L 1 65 1
45 2006 L 1 66 1
45 2006 L 1 67 1
45 2006 L 1 68 1
45 2006 L 1 69 1
45 2006 L 1 70 1
45 2006 L 1 71 1
45 2006 L 1 72 1
45 2006 L 1 73 1
45 2006 L 1 74 1
45 2006 L 1 75 1
45 2006 L 1 76 1
45 2006 L 1 77 1
45 2006 L 1 78 1
45 2006 L 1 79 1
```

SS2 ALTERNATIVE RUN (F08_SVAge comp.REP)

```
Code_version_:__2.00o;_01/31/08;_Stock_Synthesis_2_by_Richard_Methot_(NOAA);_
using_Otter_Research_ADMB_7.0.1

Time: Mon Mar 24 10:22:43 2008

Data_File: F08_MULTI_SVAGE.DAT
Control_File: F08_MULTI_SVAGE.CTL

Convergence_Level:
Hessian:
Sum_of_months_on_read_was:_ 12 rescaled_to_sum_to: 1

LIKELIHOOD 4856.09
indices 846.218
discard 0
length_comps 0
age_comps 3994.71
size-at-age 0
mean_body_wt 0
Equil_catch 0
catch 15.1549
Recruitment 0
Parm_priors 0
Parm_devs 0
penalties 0
Forecast_Recruitment 0

Fleet surv_lambda surv_like disc_lambda disc_like length_lambda length_like
age_lambda age_like sizeage_lambda sizeage_like
1 0 0 0 0 0 0 1 227.475 0 0
2 0 0 0 0 0 0 1 669.724 0 0
3 0 0 0 0 0 0 1 306.226 0 0
4 0 0 0 0 0 0 1 167.667 0 0
5 0 0 0 0 0 0 1 210.481 0 0
6 0 0 0 0 0 0 1 165.856 0 0
7 1 51.8476 0 0 0 0 1 95.0189 0 0
8 1 46.9423 0 0 0 0 1 215.315 0 0
9 1 26.899 0 0 0 0 1 223.489 0 0
10 1 172.422 0 0 0 0 1 164.952 0 0
11 1 259.163 0 0 0 0 1 464.187 0 0
12 1 38.1829 0 0 0 0 1 139.974 0 0
13 1 27.8704 0 0 0 0 1 173.175 0 0
14 1 59.5867 0 0 0 0 1 354.729 0 0
15 1 38.0936 0 0 0 0 1 132.604 0 0
16 1 12.1586 0 0 0 0 1 283.841 0 0
17 1 27.6408 0 0 0 0 1 0 0 0
18 1 29.2281 0 0 0 0 1 0 0 0
19 1 56.1833 0 0 0 0 1 0 0 0

Source Lambda Like
mean_body_wt 0 0
Equil_catch 0 0
Catch 10 1.51549
```

```
Recruitment 0 0
Parm_priors 0 0
Parm_devs 1 0
penalties 0


Variance_adjustments_to_input_values 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19
Index_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Discard_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
MeanBodyWt_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
effN_mult_Lencomp  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
effN_mult_Agecomp  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
effN_mult_Len-at-age  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

PARAMETERS
Num Value Phase Min Max Init Prior PR_type SD Active_Cnt Prior_Like Bound
M-G_parmsUsing_offset_approach_#:_3
Gender:_1__Pattern:_1
1 0.2 -3
2 0 -3
3 28.1 -2
4 60.2 -2
5 0.2052 -3
6 0.1 -2
7 0 -3
biology_parms
8 2.44e-006 -3
9 3.34694 -3
10 28.1 -3
11 -0.25 -3
12 1 -3
13 0 -3
recrdist_by_growthpattern:1
14 0 -3
recrdist_by_area:1
15 0 -3
recrdist_by_seas:1
16 4 -3
cohort_growth_dev:2
17 1 -3
MGparm_env_linkages
MG_parm_blockparms
M-G_parm_devs 1
1_YR1982 0 -

MGParm_Block_Assignments
SR_parms
1 10.7263 1  3 31 10.1121 0 -1 99 1 0
2 0.941285 1  0.2 1 0.8 0 -1 99 2 0
3 0.6 -1
4 0 -1
5 -0.0527826 1  -5 5 0 0 -1 99 3 0
6 0 -1
Recr_Devs
1982 0.379281 - - - - - - - 4
1983 0.735238 - - - - - - - 5
```

```
1984 0.1173 - - - - - - - 6
1985 0.435202 - - - - - - - 7
1986 0.535303 - - - - - - - 8
1987 0.241006 - - - - - - - 9
1988 -1.05693 - - - - - - - 10
1989 -0.0828879 - - - - - - - - 11
1990 0.13574 - - - - - - - 12
1991 -0.0155899 - - - - - - - 13
1992 0.188584 - - - - - - - 14
1993 0.0376144 - - - - - - - 15
1994 0.0357273 - - - - - - - 16
1995 0.219397 - - - - - - - 17
1996 -0.159491 - - - - - - - 18
1997 -0.167965 - - - - - - - 19
1998 -0.132378 - - - - - - - 20
1999 -0.402027 - - - - - - - 21
2000 -0.178327 - - - - - - - 22
2001 -0.0985194 - - - - - - - 23
2002 0.0246805 - - - - - - - 24
2003 -0.299759 - - - - - - - 25
2004 0.177235 - - - - - - - 26
2005 -0.381848 - - - - - - - 27
2006 -0.286584 - - - - - - - 28
init_F_parms
1 1.69633 1 0 2 1 1 -1 10 29 0
2 0 -1
3 0 -1
4 0 -1
5 0 -1
6 0 -1
Q_parms
sel_parms
#_size_sel:_1
#_male
#_size_sel:_2
#_male
#_size_sel:_3
#_male
#_size_sel:_4
#_male
#_size_sel:_5
#_male
#_size_sel:_6
#_male
#_size_sel:_7
#_male
#_size_sel:_8
#_male
#_size_sel:_9
#_male
#_size_sel:_10
#_male
#_size_sel:_11
#_male
#_size_sel:_12
#_male
#_size_sel:_13
```

```
#_male
#_size_sel:_14
#_male
#_size_sel:_15
#_male
#_size_sel:_16
#_male
#_size_sel:_17
#_male
#_size_sel:_18
#_male
#_size_sel:_19
#_male
#_age_sel:_1
1 1.97374 2 0.5 9 4 4 -1 99 30 0
2 -3 -3
3 5.3772e-009 3 0 9 2 2 -1 99 31 0 LO
4 9 -3
5 -999 -2
6 -999 -2
#_male
#_age_sel:_2
7 3.10267 2 0.5 9 4 4 -1 99 32 0
8 -3 -3
9 0.695128 3 0 9 2 2 -1 99 33 0
10 9 -3
11 -999 -2
12 -999 -2
#_male
#_age_sel:_3
13 1.02044 2 0.5 9 4 4 -1 99 34 0
14 2.99968 3 -9 3 -3 -3 -1 99 35 0 HI
15 5.34279e-008 3 0 9 2 2 -1 99 36 0 LO
16 8.92362 3 0 9 9 9 -1 99 37 0 HI
17 -999 -2
18 -9.31547 3 -10 10 0 5 -1 99 38 0
#_male
#_age_sel:_4
19 2.07057 2 0.5 9 4 4 -1 99 39 0
20 -8.99997 3 -9 3 -3 -3 -1 99 40 0 LO
21 0.433328 3 0 9 2 2 -1 99 41 0
22 3.14884e-007 3 0 9 9 9 -1 99 42 0 LO
23 -999 -2
24 -9.99843 3 -10 10 0 5 -1 99 43 0 LO
#_male
#_age_sel:_5
25 1.75411 2 0.5 9 4 4 -1 99 44 0
26 -3 -3
27 1.0821e-008 3 0 9 2 2 -1 99 45 0 LO
28 9 -3
29 -999 -2
30 -999 -2
#_male
#_age_sel:_6
31 1.61042 2 0.5 9 4 4 -1 99 46 0
32 -9 3 -9 3 -3 -3 -1 99 47 0 LO
33 2.06662e-008 3 0 9 2 2 -1 99 48 0 LO
```

```
34 1.21969e-007 3 0 9 9 9 -1 99 49 0 LO
35 -999 -2
36 -9.99952 3 -10 10 0 5 -1 99 50 0 LO
#_male
#_age_sel:_7
37 2.62984 2 0.5 9 4 4 -1 99 51 0
38 -3 -3
39 0.799193 3 0 9 2 2 -1 99 52 0
40 9 -3
41 -999 -2
42 -999 -2
#_male
#_age_sel:_8
43 2.63079 2 0.5 9 4 4 -1 99 53 0
44 -3 -3
45 0.813735 3 0 9 2 2 -1 99 54 0
46 9 -3
47 -999 -2
48 -999 -2
#_male
#_age_sel:_9
49 1.00677 2 0.5 9 4 4 -1 99 55 0
50 -3 -3
51 2.3011e-007 3 0 9 2 2 -1 99 56 0 LO
52 9 -3
53 -999 -2
54 -999 -2
#_male
#_age_sel:_10
55 2.57629 2 0.5 9 4 4 -1 99 57 0
56 -3 -3
57 4.2168e-009 3 0 9 2 2 -1 99 58 0 LO
58 9 -3
59 -999 -2
60 -999 -2
#_male
#_age_sel:_11
61 2.39289 2 0.5 9 4 4 -1 99 59 0
62 -3 -3
63 9.51338e-010 3 0 9 2 2 -1 99 60 0 LO
64 9 -3
65 -999 -2
66 -999 -2
#_male
#_age_sel:_12
67 2.63304 2 0.5 9 4 4 -1 99 61 0
68 -3 -3
69 1.35641e-008 3 0 9 2 2 -1 99 62 0 LO
70 9 -3
71 -999 -2
72 -999 -2
#_male
#_age_sel:_13
73 1.55873 2 0.5 9 4 4 -1 99 63 0
74 -3 -3
75 4.80854e-009 3 0 9 2 2 -1 99 64 0 LO
76 9 -3
```

```
77 -999 -2
78 -999 -2
#_male
#_age_sel:_14
79 2.37479 2 0.5 9 4 4 -1 99 65 0
80 -3 -3
81 8.68399e-010 3 0 9 2 2 -1 99 66 0 LO
82 9 -3
83 -999 -2
84 -999 -2
#_male
#_age_sel:_15
85 2.23303 2 0.5 9 4 4 -1 99 67 0
86 -3 -3
87 0.656754 3 0 9 2 2 -1 99 68 0
88 9 -3
89 -999 -2
90 -999 -2
#_male
#_age_sel:_16
91 0.999921 2 0.5 9 4 4 -1 99 69 0
92 -3 -3
93 0.206175 3 0 9 2 2 -1 99 70 0
94 9 -3
95 -999 -2
96 -999 -2
#_male
#_age_sel:_17
97 0 -3
98 0 -3
#_male
#_age_sel:_18
99 0 -3
100 0 -3
#_male
#_age_sel:_19
101 0 -3
102 0 -3
#_male
sel_parm_env_linkages
sel_parm_blockparms
103 2.65148 2 0.5 9 4 4 -1 99 71 0
104 0.0988482 3 0 9 2 2 -1 99 72 0
105 3.38705 2 0.5 9 4 4 -1 99 73 0
106 0.463316 3 0 9 2 2 -1 99 74 0
107 1.96104 2 0.5 9 4 4 -1 99 75 0
108 0.270113 3 0 9 2 2 -1 99 76 0
109 8.60703 3 0 9 9 9 -1 99 77 0
110 -9.92206 3 -10 10 0 5 -1 99 78 0 LO
111 2.18987 2 0.5 9 4 4 -1 99 79 0
112 6.69745e-008 3 0 9 2 2 -1 99 80 0 LO
113 1.68701e-007 3 0 9 9 9 -1 99 81 0 LO
114 1.10433 3 -10 10 0 5 -1 99 82 0
115 2.86846 2 0.5 9 4 4 -1 99 83 0
116 0.407388 3 0 9 2 2 -1 99 84 0
117 1.60548 2 0.5 9 4 4 -1 99 85 0
118 3.58325e-009 3 0 9 2 2 -1 99 86 0 LO
```

```
119 1.68123e-008 3 0 9 9 9 -1 99 87 0 LO
120 -5.64085 3 -10 10 0 5 -1 99 88 0
SEL_parm_devs
1_YR1982 0
Forecast_Recr_Devs
2007 0 - - - - - - - 89

Selex_Block_Assignments Years:
Base_parm#  1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
1  0 0 0 0 0 0 0 0 0 0 0 0 0 103 103 103 103 103 103 103 103 103 103 103 103
3  0 0 0 0 0 0 0 0 0 0 0 0 0 104 104 104 104 104 104 104 104 104 104 104 104
7  0 0 0 0 0 0 0 0 0 0 0 0 0 105 105 105 105 105 105 105 105 105 105 105 105
9  0 0 0 0 0 0 0 0 0 0 0 0 0 106 106 106 106 106 106 106 106 106 106 106 106
13  0 0 0 0 0 0 0 0 0 0 0 0 0 107 107 107 107 107 107 107 107 107 107 107 107
15  0 0 0 0 0 0 0 0 0 0 0 0 0 108 108 108 108 108 108 108 108 108 108 108 108
16  0 0 0 0 0 0 0 0 0 0 0 0 0 109 109 109 109 109 109 109 109 109 109 109 109
18  0 0 0 0 0 0 0 0 0 0 0 0 0 110 110 110 110 110 110 110 110 110 110 110 110
19  0 0 0 0 0 0 0 0 0 0 0 0 0 111 111 111 111 111 111 111 111 111 111 111 111
21  0 0 0 0 0 0 0 0 0 0 0 0 0 112 112 112 112 112 112 112 112 112 112 112 112
22  0 0 0 0 0 0 0 0 0 0 0 0 0 113 113 113 113 113 113 113 113 113 113 113 113
24  0 0 0 0 0 0 0 0 0 0 0 0 0 114 114 114 114 114 114 114 114 114 114 114 114
25  0 0 0 0 0 0 0 0 0 0 0 0 0 115 115 115 115 115 115 115 115 115 115 115 115
27  0 0 0 0 0 0 0 0 0 0 0 0 0 116 116 116 116 116 116 116 116 116 116 116 116
31  0 0 0 0 0 0 0 0 0 0 0 0 0 117 117 117 117 117 117 117 117 117 117 117 117
33  0 0 0 0 0 0 0 0 0 0 0 0 0 118 118 118 118 118 118 118 118 118 118 118 118
34  0 0 0 0 0 0 0 0 0 0 0 0 0 119 119 119 119 119 119 119 119 119 119 119 119
36  0 0 0 0 0 0 0 0 0 0 0 0 0 120 120 120 120 120 120 120 120 120 120 120 120

RECR_DIST
G_pattern gender Seas Area Value Used?
1 1 1 1 1 1

MOVEMENT
Seas Source Dist  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SUBMORPHDIST 1

MGparm_By_Year_after_adjustments
Year
1982  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1983  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1984  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1985  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1986  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1987  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1988  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1989  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1990  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1991  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1992  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1993  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1994  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1995  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1996  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1997  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1998  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
```

```
1999  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2000  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2001  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2002  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2003  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2004  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2005  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2006  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1

SELparm(Size)_By_Year_after_adjustments
Fleet/Svy Year

SELparm(Age)_By_Year_after_adjustments
Fleet/Svy Year
1 1982  1.97374 -3 5.3772e-009 9 -999 -999
1 1995  2.65148 -3 0.0988482 9 -999 -999
2 1982  3.10267 -3 0.695128 9 -999 -999
2 1995  3.38705 -3 0.463316 9 -999 -999
3 1982  1.02044 2.99968 5.34279e-008 8.92362 -999 -9.31547
3 1995  1.96104 2.99968 0.270113 8.60703 -999 -9.92206
4 1982  2.07057 -8.99997 0.433328 3.14884e-007 -999 -9.99843
4 1995  2.18987 -8.99997 6.69745e-008 1.68701e-007 -999 1.10433
5 1982  1.75411 -3 1.0821e-008 9 -999 -999
5 1995  2.86846 -3 0.407388 9 -999 -999
6 1982  1.61042 -9 2.06662e-008 1.21969e-007 -999 -9.99952
6 1995  1.60548 -9 3.58325e-009 1.68123e-008 -999 -5.64085
7 1982  2.62984 -3 0.799193 9 -999 -999
8 1982  2.63079 -3 0.813735 9 -999 -999
9 1982  1.00677 -3 2.3011e-007 9 -999 -999
10 1982  2.57629 -3 4.2168e-009 9 -999 -999
11 1982  2.39289 -3 9.51338e-010 9 -999 -999
12 1982  2.63304 -3 1.35641e-008 9 -999 -999
13 1982  1.55873 -3 4.80854e-009 9 -999 -999
14 1982  2.37479 -3 8.68399e-010 9 -999 -999
15 1982  2.23303 -3 0.656754 9 -999 -999
16 1982  0.999921 -3 0.206175 9 -999 -999
17 1982  0 0
18 1982  0 0
19 1982  0 0

EXPLOITATION   Hrate_is_Continuous_F  Fleet_in_columns;_year_in_rows
yr seas 1 2 3 4 5 6
init_yr 1  1.69633 0 0 0 0 0
1982 1  0.696923 0.520672 0 0 0.651114 0.0215592
1983 1  0.848389 0.517252 0 0 0.0885099 0.0241223
1984 1  0.817659 0.813321 0 0 0.505292 0.0228049
1985 1  0.829448 0.570227 0 0 0.38806 0.00596932
1986 1  0.902398 0.481583 0 0 0.643524 0.0420524
1987 1  0.87767 0.423746 0 0 0.40364 0.0348759
1988 1  1.09054 0.559255 0 0 0.54739 0.0267095
1989 1  0.860061 0.456393 0.072753 0 0.190601 0.00596043
1990 1  0.500825 0.366903 0.112288 0 0.331257 0.0323731
1991 1  0.634453 0.432054 0.0850217 0 0.426588 0.0492399
1992 1  0.923679 0.316181 0.0563009 0 0.400297 0.0396348
1993 1  0.600873 0.349938 0.0630537 0 0.456399 0.0955669
1994 1  0.593916 0.372075 0.0316709 0.0540191 0.436667 0.0675514
1995 1  1.03891 0.818268 0.0149126 0.0249021 0.555775 0.0706187
```

```
1996 1  0.626286 0.589045 0.0277906 0.0110119 0.746611 0.0466988
1997 1  0.329654 0.116107 0.0139905 0.00589162 0.583565 0.030762
1998 1  0.289486 0.149022 0.0130693 0.00803391 0.464551 0.0381168
1999 1  0.229564 0.113352 0.0530287 0.0190647 0.254777 0.0348294
2000 1  0.20546 0.117052 0.0251532 0.00648873 0.454832 0.0476486
2001 1  0.212397 0.0927343 0.00969099 0.0117605 0.312372 0.0647091
2002 1  0.241676 0.123545 0.0113368 0.00616481 0.190803 0.0351759
2003 1  0.20731 0.0896376 0.0140383 0.00305609 0.233258 0.0339814
2004 1  0.220803 0.102171 0.00480198 0.00238279 0.181646 0.0380037
2005 1  0.199172 0.0740993 0.00392251 0.00232279 0.159754 0.0341463
2006 1  0.121588 0.0609425 0.0047057 0.00185252 0.139819 0.0255747
2007 1  0.0544083 0.0272707 0.00210571 0.000828969 0.0625663 0.0114442

TIME_SERIES    Bio-Smry_age:_1  Hrate_is_Continuous_F
pop year period season bio-all bio-smry SpawnBio recruit-0  enc_catch:_1
dead_catch:_1 ret_catch:_1 obs_cat:_1 Hrate-1 enc_catch:_2 dead_catch:_2
ret_catch:_2 obs_cat:_2 Hrate-2 enc_catch:_3 dead_catch:_3 ret_catch:_3
obs_cat:_3 Hrate-3 enc_catch:_4 dead_catch:_4 ret_catch:_4 obs_cat:_4 Hrate-4
enc_catch:_5 dead_catch:_5 ret_catch:_5 obs_cat:_5 Hrate-5 enc_catch:_6
dead_catch:_6 ret_catch:_6 obs_cat:_6 Hrate-6 SPB_vir_LH
1 1980 VIRG 1 364568 364258 362975 45538.3 0 0 0 0 0  0 0 0 0 0  0 0 0 0 0  0
0 0 0 0  0 0 0 0 0  0 0 0 0 0  362998
1 1981 INIT 1 22218.4 21924 20939.8 43197 18393.4 18393.4 18393.4 10000
1.69633 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 20939.8
1 1982 TIME 1 22225.9 21924 20939.8 44297.1 7487.62 7487.62 7487.62 7536
0.696923 2842.42 2842.42 2842.42 2864 0.520672 0 0 0 0 0 0 0 0 0 0 8274.41
8274.41 8274.41 8267 0.651114 296.102 296.102 296.102 296 0.0215592 20942.7
1 1983 TIME 1 21981.5 21552.7 20457.2 62916.4 10244.7 10244.7 10244.7 10201
0.848389 3178.31 3178.31 3178.31 3201 0.517252 0 0 0 0 0 0 0 0 0 0 1270.16
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1 1984 TIME 1 30300 30053.6 28486.6 36151.1 11409 11409 11409 11455 0.817659
5646.89 5646.89 5646.89 5674 0.813321 0 0 0 0 0 0 0 0 0 0 8449.2 8449.2
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1 1985 TIME 1 24233.9 23908.6 22902.2 47725.9 10630.9 10630.9 10630.9 10767
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1 1986 TIME 1 23502.6 23146.1 21983.1 52311.7 9551 9551 9551 9500 0.902398
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6566.64 6634 0.54739 340.946 340.946 340.946 341 0.0267095 21791.7
1 1989 TIME 1 11840.9 11680.2 11322.3 23587 5937.23 5937.23 5937.23 6218
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1 1990 TIME 1 10872.7 10680.2 10143 28244.9 2874.63 2874.63 2874.63 2962
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795.14 795 0.0255747 48379.7
1 2007 FORE 1 53899 53614.6 52970.8 41729.8 2447.68 2447.68 2447.68 2447.68
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52970.8

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Year Bio_all Bio_Smry SPBzero SPBfished SPBfished/R SPR Y/R GenTime Actual:
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1.88487
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21981.5 21552.7 15069.5 15069.5 15069.5 20457.2 62916.4 0.685554 + 1.36853
1.47254
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30300 30053.6 25920 25920 25920 28486.6 36151.1 0.855446 + 2.01001 2.15218
1985 24377.7 24067.4 362975 23026.6 0.505654 0.0634386 0.430905 0.140805 +
24233.9 23908.6 20248.4 20248.4 20248.4 22902.2 47725.9 0.835542 + 1.6846
1.79026
1986 20866 20555.6 362975 19565.6 0.429653 0.0539036 0.407294 0.111259 +
23502.6 23146.1 20980.1 20980.1 20980.1 21983.1 52311.7 0.89267 + 1.92717
2.06148
1987 23909.1 23598.7 362975 22567.1 0.495562 0.0621725 0.426955 0.152803 +
23165 22900.3 18324.4 18324.4 18324.4 21641.1 38847.8 0.791036 + 1.61809
1.73312
1988 20463 20152.6 362975 19164 0.420833 0.0527971 0.405597 0.0941261 +
22870.9 22798.5 21306.9 21306.9 21306.9 21764.2 10621.7 0.931618 + 2.08152
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11840.9 11680.2 9979.7 9979.7 9979.7 11322.3 23587 0.842814 + 1.48775
1.58284
1990 26672 26361.7 362975 25345.8 0.556582 0.0698279 0.434153 0.251431 +
10872.7 10680.2 7811.03 7811.03 7811.03 10143 28244.9 0.718409 + 1.24128
1.33745
1991 23613.7 23303.4 362975 22305.3 0.489815 0.0614514 0.419944 0.188231 +
13738.1 13558.9 11007.2 11007.2 11007.2 12874.7 26297 0.801216 + 1.49757
1.61851
1992 22521.6 22211.3 362975 21214 0.46585 0.0584449 0.415346 0.162926 +
13982.4 13761.4 11877.8 11877.8 11877.8 13109.2 32432.6 0.849486 + 1.61466
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Virg 362975 45538.3 45538.3 38036.8 45538.3
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2007 52970.8 41729.8 41729.8 41729.8 41729.8 0 forecast

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18 1987 38847.8 7.584 10.4036 0.000267804 0.4 -0.316111 0.31227 -0.604021
18 1988 10621.7 1.763 2.84454 0.000267804 0.4 -0.478383 0.715158 -0.201132
18 1989 23587 2.855 6.31671 0.000267804 0.4 -0.794126 1.97074 1.05445
18 1990 28244.9 4.733 7.56409 0.000267804 0.4 -0.468853 0.686946 -0.229345
```

```
18 1991 26297 7.337 7.04244 0.000267804 0.4 0.0409754 0.00524682 -0.911044
18 1992 32432.6 8.487 8.68559 0.000267804 0.4 -0.02313 0.00167187 -0.914619
18 1993 28239.9 4.145 7.56276 0.000267804 0.4 -0.601333 1.13 0.213713
18 1994 28620.9 22.311 7.66479 0.000267804 0.4 1.06844 3.56741 2.65112
18 1995 34451 13.067 9.22612 0.000267804 0.4 0.348051 0.378562 -0.537729
18 1996 25144.7 6.493 6.73387 0.000267804 0.4 -0.0364248 0.00414615 -0.912145
18 1997 25677 7.997 6.8764 0.000267804 0.4 0.150972 0.0712265 -0.845064
18 1998 27386.1 14.983 7.33412 0.000267804 0.4 0.714379 1.5948 0.678513
18 1999 21247.3 8.565 5.69013 0.000267804 0.4 0.408951 0.522629 -0.393662
18 2000 26996.8 9.874 7.22986 0.000267804 0.4 0.311685 0.303586 -0.612705
18 2001 29162.3 13.543 7.80979 0.000267804 0.4 0.550492 0.947003 0.0307125
18 2002 33483.4 5.406 8.96699 0.000267804 0.4 -0.50604 0.80024 -0.11605
18 2003 24764.3 8.18 6.63197 0.000267804 0.4 0.20979 0.137538 -0.778753
18 2004 40333.2 6.993 10.8014 0.000267804 0.4 -0.434766 0.590692 -0.325599
18 2005 23368.8 2.198 6.25826 0.000267804 0.4 -1.04635 3.42143 2.50514
18 2006 25925.7 9.658 6.94301 0.000267804 0.4 0.330051 0.340418 -0.575873
19 1986 52311.7 0.32 0.313775 5.99819e-006 0.4 0.0196445 0.00120595 -0.915085
19 1987 38847.8 0.26 0.233016 5.99819e-006 0.4 0.109573 0.0375193 -0.878771
19 1988 10621.7 0.01 0.063711 5.99819e-006 0.4 -1.85177 10.7158 9.79952
19 1989 23587 0.14 0.14148 5.99819e-006 0.4 -0.0105125 0.000345351 -0.915945
19 1990 28244.9 0.36 0.169418 5.99819e-006 0.4 0.753735 1.77537 0.859075
19 1991 26297 0.38 0.157734 5.99819e-006 0.4 0.87926 2.41593 1.49964
19 1992 32432.6 0.37 0.194537 5.99819e-006 0.4 0.642881 1.29155 0.375258
19 1993 28239.9 0.05 0.169388 5.99819e-006 0.4 -1.22017 4.65254 3.73625
19 1994 28620.9 0.57 0.171673 5.99819e-006 0.4 1.20004 4.50032 3.58403
19 1995 34451 0.3 0.206644 5.99819e-006 0.4 0.372787 0.434282 -0.482009
19 1996 25144.7 0.08 0.150823 5.99819e-006 0.4 -0.63408 1.25643 0.340137
19 1997 25677 0.22 0.154015 5.99819e-006 0.4 0.356576 0.397333 -0.518958
19 1998 27386.1 0.39 0.164267 5.99819e-006 0.4 0.864653 2.33633 1.42004
19 1999 21247.3 0.35 0.127446 5.99819e-006 0.4 1.01024 3.18935 2.27306
19 2000 26996.8 0.21 0.161932 5.99819e-006 0.4 0.259931 0.211138 -0.705153
19 2001 29162.3 0.14 0.174921 5.99819e-006 0.4 -0.222692 0.154975 -0.761316
19 2002 33483.4 0.13 0.20084 5.99819e-006 0.4 -0.434972 0.591252 -0.325038
19 2003 24764.3 0.21 0.148541 5.99819e-006 0.4 0.346249 0.374651 -0.541639
19 2004 40333.2 0.27 0.241926 5.99819e-006 0.4 0.10979 0.0376681 -0.878623
19 2005 23368.8 0.01 0.14017 5.99819e-006 0.4 -2.64027 21.7845 20.8682
19 2006 25925.7 0.17 0.155507 5.99819e-006 0.4 0.0891063 0.0248123 -0.891478

INDEX_1
Index Do_Power Power Do_Env_var Env_Link Do_ExtraVar Qtype  Q Num=0/Bio=1
Err_type N Npos r.m.s.e. mean_input_SE mean_(Input+extra)_SE pen_mean_Qdev
rmse_Qdev
1 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
2 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
3 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
4 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
5 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
6 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
7 0  1.0 0  0.00  0.0 0 0.000540955  0 0 15 15 0.420682 0.16 0.16 0 0
8 0  1.0 0  0.00  0.0 0 5.29245e-005  0 0 25 25 0.406955 0.21 0.21 0 0
9 0  1.0 0  0.00  0.0 0 3.57563e-005  0 0 25 25 0.454752 0.31 0.31 0 0
10 0  1.0 0  0.00  0.0 0 5.08453e-005  0 0 25 25 0.779939 0.21 0.21 0 0
11 0  1.0 0  0.00  0.0 0 3.51898e-005  0 0 25 25 0.956204 0.21 0.21 0 0
12 0  1.0 0  0.00  0.0 0 2.2917e-005  0 0 23 23 0.728863 0.4 0.4 0 0
13 0  1.0 0  0.00  0.0 0 3.57884e-005  0 0 23 23 0.622706 0.4 0.4 0 0
14 0  1.0 0  0.00  0.0 0 2.45492e-005  0 0 25 25 0.873332 0.4 0.4 0 0
15 0  1.0 0  0.00  0.0 0 2.12204e-005  0 0 17 17 0.846791 0.4 0.4 0 0
```

```
16 0  1.0 0  0.00  0.0 0 0.000128238  0 0 19 19 0.452521 0.4 0.4 0 0
17 0  1.0 0  0.00  0.0 0 3.1622e-005  0 0 25 25 0.594813 0.4 0.4 0 0
18 0  1.0 0  0.00  0.0 0 0.000267804  0 0 25 25 0.611653 0.4 0.4 0 0
19 0  1.0 0  0.00  0.0 0 5.99819e-006  0 0 21 21 0.925271 0.4 0.4 0 0
rmse_Qdev_not_in_logL
pen_mean_Qdev_not_in_logL_in_randwalk_approach

INDEX_3
Index  Q_parm_assignments
1 0 -- 0 --  0 0
2 0 -- 0 --  0 0
3 0 -- 0 --  0 0
4 0 -- 0 --  0 0
5 0 -- 0 --  0 0
6 0 -- 0 --  0 0
7 0 -- 0 --  0 0
8 0 -- 0 --  0 0
9 0 -- 0 --  0 0
10 0 -- 0 --  0 0
11 0 -- 0 --  0 0
12 0 -- 0 --  0 0
13 0 -- 0 --  0 0
14 0 -- 0 --  0 0
15 0 -- 0 --  0 0
16 0 -- 0 --  0 0
17 0 -- 0 --  0 0
18 0 -- 0 --  0 0
19 0 -- 0 --  0 0

DISCARD  log(L)_based_on_T-distribution_with_DF=_30
as_fraction
index year seas obs exp cv Dev Like Like+log(s)


MEAN_BODY_WT log(L)_based_on_T-distribution_with_DF=_30
 year seas index Mkt obs exp cv Dev Like Like+log(s)
 1982 1 1 0 0.504 0.612363 0.1 -0.108363 2.22137 2.22137
 1983 1 1 0 0.521 0.610247 0.1 -0.0892473 1.44645 1.44645
 1984 1 1 0 0.518 0.599941 0.1 -0.0819413 1.24178 1.24178
 1985 1 1 0 0.575 0.655972 0.1 -0.0809724 0.992146 0.992146
 1986 1 1 0 0.613 0.602498 0.1 0.010502 0.0151573 0.0151573
 1987 1 1 0 0.581 0.592906 0.1 -0.0119064 0.0216828 0.0216828
 1988 1 1 0 0.588 0.64301 0.1 -0.05501 0.445738 0.445738
 1989 1 1 0 0.668 0.735088 0.1 -0.0670882 0.512566 0.512566
 1990 1 1 0 0.54 0.63509 0.1 -0.0950898 1.5246 1.5246
 1991 1 1 0 0.537 0.624971 0.1 -0.0879709 1.32801 1.32801
 1992 1 1 0 0.595 0.629074 0.1 -0.0340744 0.168527 0.168527
 1993 1 1 0 0.571 0.609911 0.1 -0.0389107 0.238088 0.238088
 1994 1 1 0 0.605 0.643092 0.1 -0.038092 0.203476 0.203476
 1995 1 1 0 0.675 0.758197 0.1 -0.0831971 0.765681 0.765681
 1996 1 1 0 0.621 0.755434 0.1 -0.134434 2.24981 2.24981
 1997 1 1 0 0.697 0.840488 0.1 -0.143488 2.04817 2.04817
 1998 1 1 0 0.759 0.945693 0.1 -0.186693 2.84759 2.84759
 1999 1 1 0 0.755 0.996752 0.1 -0.241752 4.55675 4.55675
 2000 1 1 0 0.85 1.04868 0.1 -0.198685 2.59336 2.59336
 2001 1 1 0 0.903 1.09022 0.1 -0.187221 2.07559 2.07559
 2002 1 1 0 0.898 1.08023 0.1 -0.182231 1.99375 1.99375
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 2003 1 1 0 0.999 1.09046 0.1 -0.0914585 0.427101 0.427101
 2004 1 1 0 0.983 1.12325 0.1 -0.14025 1.01759 1.01759
 2005 1 1 0 0.949 1.17917 0.1 -0.230173 2.77539 2.77539
 2006 1 1 0 0.947 1.18552 0.1 -0.238523 2.97338 2.97338

FIT_LEN_COMPS
Index Year Seas Gender Mkt Nsamp effN Like

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
1 0 0 0 0 0 0 -1.#IND
2 0 0 0 0 0 0 -1.#IND
3 0 0 0 0 0 0 -1.#IND
4 0 0 0 0 0 0 -1.#IND
5 0 0 0 0 0 0 -1.#IND
6 0 0 0 0 0 0 -1.#IND
7 0 0 0 0 0 0 -1.#IND
8 0 0 0 0 0 0 -1.#IND
9 0 0 0 0 0 0 -1.#IND
10 0 0 0 0 0 0 -1.#IND
11 0 0 0 0 0 0 -1.#IND
12 0 0 0 0 0 0 -1.#IND
13 0 0 0 0 0 0 -1.#IND
14 0 0 0 0 0 0 -1.#IND
15 0 0 0 0 0 0 -1.#IND
16 0 0 0 0 0 0 -1.#IND
17 0 0 0 0 0 0 -1.#IND
18 0 0 0 0 0 0 -1.#IND
19 0 0 0 0 0 0 -1.#IND

FIT_AGE_COMPS
Index Year Seas Gender Mkt Ageerr Lbin_lo Lbin_hi Nsamp effN Like
1 1982 1 0 0 1 1 70 200 81.2288 10.9277
1 1983 1 0 0 1 1 70 200 18.1541 12.7422
1 1984 1 0 0 1 1 70 200 54.4502 9.94839
1 1985 1 0 0 1 1 70 200 73.3926 5.38873
1 1986 1 0 0 1 1 70 200 17.2752 15.2438
1 1987 1 0 0 1 1 70 200 32.8046 7.88321
1 1988 1 0 0 1 1 70 200 1405 1.92141
1 1989 1 0 0 1 1 70 200 167.564 5.4684
1 1990 1 0 0 1 1 70 200 576.416 0.872547
1 1991 1 0 0 1 1 70 200 52.38 4.20233
1 1992 1 0 0 1 1 70 200 53.1101 9.20428
1 1993 1 0 0 1 1 70 200 144.595 6.31613
1 1994 1 0 0 1 1 70 200 119.826 4.70352
1 1995 1 0 0 1 1 70 200 51.9234 10.1064
1 1996 1 0 0 1 1 70 200 48.1564 8.60539
1 1997 1 0 0 1 1 70 200 13.4072 29.1135
1 1998 1 0 0 1 1 70 200 16.7415 21.6081
1 1999 1 0 0 1 1 70 200 24.2913 19.1481
1 2000 1 0 0 1 1 70 200 438.556 4.00258
1 2001 1 0 0 1 1 70 200 62.9992 7.98905
1 2002 1 0 0 1 1 70 200 79.9802 5.41049
1 2003 1 0 0 1 1 70 200 1422.43 0.431303
1 2004 1 0 0 1 1 70 200 1592.84 0.86772
1 2005 1 0 0 1 1 70 200 32.9787 22.7301
1 2006 1 0 0 1 1 70 200 301.77 2.63987
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2 1983 1 0 0 1 1 70 200 5.76288 34.4103
2 1984 1 0 0 1 1 70 200 28.5027 14.5649
2 1985 1 0 0 1 1 70 200 16.4207 15.0521
2 1986 1 0 0 1 1 70 200 39.3618 8.93881
2 1987 1 0 0 1 1 70 200 14.0057 12.9091
2 1988 1 0 0 1 1 70 200 12.4771 16.5247
2 1989 1 0 0 1 1 70 200 17.8017 41.3146
2 1990 1 0 0 1 1 70 200 5.57055 55.7759
2 1991 1 0 0 1 1 70 200 6.52591 34.8442
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2 1993 1 0 0 1 1 70 200 13.3532 11.7807
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2 1998 1 0 0 1 1 70 200 2.77729 112.221
2 1999 1 0 0 1 1 70 200 120.838 8.27681
2 2000 1 0 0 1 1 70 200 31.7068 8.72331
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2 2002 1 0 0 1 1 70 200 40.9014 9.8555
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2 2005 1 0 0 1 1 70 200 176.566 6.59189
2 2006 1 0 0 1 1 70 200 109.828 4.67639
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3 1990 1 0 0 1 1 70 200 19.072 19.4039
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3 1993 1 0 0 1 1 70 200 55.2122 10.1551
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3 1997 1 0 0 1 1 70 200 35.5644 7.10751
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3 2000 1 0 0 1 1 70 200 23.4723 12.4819
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4 1995 1 0 0 1 1 70 200 38.6227 3.13426
4 1996 1 0 0 1 1 70 200 2.95615 41.9267
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4 1998 1 0 0 1 1 70 200 84.1527 2.26935
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4 2002 1 0 0 1 1 70 200 141.822 1.8854
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10 1989 1 0 0 1 1 70 100 918.89 0.0534227
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KEEPERS equals_sel*retain
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20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1982 1 1982-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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3 2007 1 2007-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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4 2007 1 2007-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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5 2007 1 2007-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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6 1982 1 1982-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2007 1 2007-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

DEADFISH equals_sel*(retain+(1-retain)*discmort)
fleet year gender label  10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5 19.5
20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1982 1 1982-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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1 2007 1 2007-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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4 2007 1 2007-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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5 2007 1 2007-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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6 2007 1 2007-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX
fleet year gender label  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
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0.983915
1 1994 1 1994-1 0.0203317 0.38748 0.999742 0.999974 0.999972 0.999736
0.999252 0.998521 0.997545 0.996324 0.994858 0.99315 0.9912 0.98901 0.986581
0.983915
1 1995 1 1995-1 0.00171496 0.0845306 0.680925 0.99941 0.999992 0.999917
0.999592 0.999021 0.998203 0.99714 0.995832 0.994281 0.992487 0.990451
0.988176 0.985663
1 2006 1 2006-1 0.00171496 0.0845306 0.680925 0.99941 0.999992 0.999917
0.999592 0.999021 0.998203 0.99714 0.995832 0.994281 0.992487 0.990451
0.988176 0.985663
1 2007 1 2007-1 0.00171496 0.0845306 0.680925 0.99941 0.999992 0.999917
0.999592 0.999021 0.998203 0.99714 0.995832 0.994281 0.992487 0.990451
0.988176 0.985663
2 1982 1 1982-2 0.00819924 0.110116 0.545141 0.995459 0.999974 0.99998
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0.989183 0.986772
2 1994 1 1994-2 0.00819924 0.110116 0.545141 0.995459 0.999974 0.99998
0.999762 0.999297 0.998585 0.997627 0.996424 0.994977 0.993287 0.991355
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2 1995 1 1995-2 0.000733328 0.0277331 0.29805 0.910385 0.999895 0.999995
0.999846 0.999447 0.998802 0.997911 0.996774 0.995393 0.993769 0.991903
0.989795 0.987449
2 2006 1 2006-2 0.000733328 0.0277331 0.29805 0.910385 0.999895 0.999995
0.999846 0.999447 0.998802 0.997911 0.996774 0.995393 0.993769 0.991903
0.989795 0.987449
2 2007 1 2007-2 0.000733328 0.0277331 0.29805 0.910385 0.999895 0.999995
0.999846 0.999447 0.998802 0.997911 0.996774 0.995393 0.993769 0.991903
0.989795 0.987449
3 1982 1 1982-3 0.353021 0.999749 0.999967 0.999996 0.999997 0.999998
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3 1994 1 1994-3 0.353021 0.999749 0.999967 0.999996 0.999997 0.999998
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4 1994 1 1994-4 0.0620616 0.475659 0.997452 0.998901 0.422747 0.0243512
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4 1995 1 1995-4 0.00826784 0.24275 0.965991 0.999591 0.88052 0.760519
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4 2006 1 2006-4 0.00826784 0.24275 0.965991 0.999591 0.88052 0.760519
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0.751071 0.751071
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5 1994 1 1994-5 0.0461053 0.566355 0.998889 0.999988 0.999943 0.999655
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0.986042 0.983327
5 1995 1 1995-5 0.00419129 0.0979857 0.605447 0.99898 0.999986 0.999953
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5 2006 1 2006-5 0.00419129 0.0979857 0.605447 0.99898 0.999986 0.999953
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0.988666 0.986202
5 2007 1 2007-5 0.00419129 0.0979857 0.605447 0.99898 0.999986 0.999953
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0.988666 0.986202
6 1982 1 1982-6 0.0747662 0.689093 0.999328 0.860711 0.145668 0.00338233
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6 1994 1 1994-6 0.0747662 0.689093 0.999328 0.860711 0.145668 0.00338233
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6 1995 1 1995-6 0.075963 0.693246 0.999339 0.857884 0.146672 0.00678497
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0.0035373 0.00353729 0.00353729
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0.0035373 0.00353729 0.00353729
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0.0035373 0.00353729 0.00353729
7 1982 1 1982-7 0.0445974 0.302843 0.836687 0.999732 0.999994 0.999913
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8 1982 1 1982-8 0.0465421 0.307688 0.838398 0.999735 0.999994 0.999913
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9 1982 1 1982-9 0.362942 0.999976 0.999971 0.99998 0.999763 0.999299 0.998588
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9 2006 1 2006-9 0.362942 0.999976 0.999971 0.99998 0.999763 0.999299 0.998588
0.997631 0.996429 0.994983 0.993294 0.991363 0.989191 0.986781 0.984134
0.981251
10 1982 1 1982-10 0.00131115 0.0833559 0.717597 0.999574 0.999993 0.999902
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10 2006 1 2006-10 0.00131115 0.0833559 0.717597 0.999574 0.999993 0.999902
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0.985474
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0.987579 0.985007
11 2006 1 2006-11 0.00326107 0.14369 0.857466 0.999839 0.999996 0.99986
0.999474 0.998842 0.997964 0.996841 0.995473 0.993861 0.992008 0.989913
0.987579 0.985007
12 1982 1 1982-12 0.00097569 0.0694773 0.669969 0.999416 0.999992 0.999913
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0.988134 0.985616
12 2006 1 2006-12 0.00097569 0.0694773 0.669969 0.999416 0.999992 0.999913
0.999584 0.999009 0.998187 0.997119 0.995807 0.994251 0.992453 0.990413
0.988134 0.985616
13 1982 1 1982-13 0.0880745 0.73206 0.999613 0.999993 0.999908 0.999574
0.998992 0.998164 0.997091 0.995773 0.994212 0.992408 0.990363 0.988078
0.985555 0.982796
13 2006 1 2006-13 0.0880745 0.73206 0.999613 0.999993 0.999908 0.999574
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14 1982 1 1982-14 0.00355502 0.151074 0.869513 0.999853 0.999995 0.999855
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14 2006 1 2006-14 0.00355502 0.151074 0.869513 0.999853 0.999995 0.999855
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15 1982 1 1982-15 0.0753511 0.454602 0.972856 0.999955 0.999992 0.999817
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15 2006 1 2006-15 0.0753511 0.454602 0.972856 0.999955 0.999992 0.999817
0.999394 0.998724 0.997809 0.996648 0.995243 0.993595 0.991704 0.989573
0.987203 0.984595
16 1982 1 1982-16 0.443301 1 0.999975 0.99998 0.999761 0.999295 0.998582
0.997624 0.99642 0.994973 0.993282 0.991349 0.989176 0.986764 0.984115
0.981231
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0.997624 0.99642 0.994973 0.993282 0.991349 0.989176 0.986764 0.984115
0.981231
17 1982 1 1982-17 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
17 2006 1 2006-17 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
18 1982 1 1982-18 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
18 2006 1 2006-18 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
19 1982 1 1982-19 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
19 2006 1 2006-19 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

AGE_SELEX_from_size_selex_in_endyear
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1 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
11 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
12 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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```
13 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
14 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
15 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
16 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
17 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
18 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
19 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX_mortality_in_endyear
fleet year morph season label 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2006 1 1 sel*wt  0.000307115 0.0376789 0.549828 1.22382 1.66059 2.08799
2.48742 2.84605 3.15612 3.41532 3.62629 3.79461 3.92695 4.02974 4.10865
4.16834
1 2006 1 1 sel*ret*wt  0.000307115 0.0376789 0.549828 1.22382 1.66059 2.08799
2.48742 2.84605 3.15612 3.41532 3.62629 3.79461 3.92695 4.02974 4.10865
4.16834
1 2006 1 1 sel_nums  0.00171496 0.0845306 0.680925 0.99941 0.999992 0.999917
0.999592 0.999021 0.998203 0.99714 0.995832 0.994281 0.992487 0.990451
0.988176 0.985663
1 2006 1 1 sel*ret_nums  0.00171496 0.0845306 0.680925 0.99941 0.999992
0.999917 0.999592 0.999021 0.998203 0.99714 0.995832 0.994281 0.992487
0.990451 0.988176 0.985663
1 2006 1 1 dead_nums  0.00171496 0.0845306 0.680925 0.99941 0.999992 0.999917
0.999592 0.999021 0.998203 0.99714 0.995832 0.994281 0.992487 0.990451
0.988176 0.985663
1 2006 1 1 dead*wt  0.000307115 0.0376789 0.549828 1.22382 1.66059 2.08799
2.48742 2.84605 3.15612 3.41532 3.62629 3.79461 3.92695 4.02974 4.10865
4.16834
2 2006 1 1 sel*wt  0.000131324 0.0123618 0.240667 1.1148 1.66043 2.08815
2.48805 2.84727 3.15801 3.41796 3.62972 3.79885 3.93202 4.03565 4.11538
4.17589
2 2006 1 1 sel*ret*wt  0.000131324 0.0123618 0.240667 1.1148 1.66043 2.08815
2.48805 2.84727 3.15801 3.41796 3.62972 3.79885 3.93202 4.03565 4.11538
4.17589
2 2006 1 1 sel_nums  0.000733328 0.0277331 0.29805 0.910385 0.999895 0.999995
0.999846 0.999447 0.998802 0.997911 0.996774 0.995393 0.993769 0.991903
0.989795 0.987449
2 2006 1 1 sel*ret_nums  0.000733328 0.0277331 0.29805 0.910385 0.999895
0.999995 0.999846 0.999447 0.998802 0.997911 0.996774 0.995393 0.993769
0.991903 0.989795 0.987449
2 2006 1 1 dead_nums  0.000733328 0.0277331 0.29805 0.910385 0.999895
0.999995 0.999846 0.999447 0.998802 0.997911 0.996774 0.995393 0.993769
0.991903 0.989795 0.987449
2 2006 1 1 dead*wt  0.000131324 0.0123618 0.240667 1.1148 1.66043 2.08815
2.48805 2.84727 3.15801 3.41796 3.62972 3.79885 3.93202 4.03565 4.11538
4.17589
3 2006 1 1 sel*wt  0.00951124 0.220262 0.80717 1.22451 1.6606 2.08816 2.48842
2.84884 3.16179 3.42511 3.64145 3.81642 3.95664 4.06842 4.15009 0.00122562
3 2006 1 1 sel*ret*wt  0.00951124 0.220262 0.80717 1.22451 1.6606 2.08816
2.48842 2.84884 3.16179 3.42511 3.64145 3.81642 3.95664 4.06842 4.15009
0.00122562
3 2006 1 1 sel_nums  0.0531117 0.494146 0.999627 0.999976 0.999996 0.999997
0.999998 0.999998 0.999997 0.999997 0.999997 0.999995 0.999991 0.999958
0.998144 0.000289815
3 2006 1 1 sel*ret_nums  0.0531117 0.494146 0.999627 0.999976 0.999996
0.999997 0.999998 0.999998 0.999997 0.999997 0.999997 0.999995 0.999991
0.999958 0.998144 0.000289815
```

3 2006 1 1 dead_nums 0.0531117 0.494146 0.999627 0.999976 0.999996 0.999997
0.999998 0.999998 0.999997 0.999997 0.999997 0.999995 0.999991 0.999958
0.998144 0.000289815
3 2006 1 1 dead*wt 0.00951124 0.220262 0.80717 1.22451 1.6606 2.08816
2.48842 2.84884 3.16179 3.42511 3.64145 3.81642 3.95664 4.06842 4.15009
0.00122562
4 2006 1 1 sel*wt 0.0014806 0.108204 0.780011 1.22404 1.4622 1.58809 1.86922
2.13968 2.37474 2.57251 2.735 2.86641 2.97174 3.0558 3.12281 3.17626
4 2006 1 1 sel*ret*wt 0.0014806 0.108204 0.780011 1.22404 1.4622 1.58809
1.86922 2.13968 2.37474 2.57251 2.735 2.86641 2.97174 3.0558 3.12281 3.17626
4 2006 1 1 sel_nums 0.00826784 0.24275 0.965991 0.999591 0.88052 0.760519
0.751165 0.751071 0.751071 0.751071 0.751071 0.751071 0.751071 0.751071
0.751071 0.751071
4 2006 1 1 sel*ret_nums 0.00826784 0.24275 0.965991 0.999591 0.88052
0.760519 0.751165 0.751071 0.751071 0.751071 0.751071 0.751071 0.751071
0.751071 0.751071 0.751071
4 2006 1 1 dead_nums 0.00826784 0.24275 0.965991 0.999591 0.88052 0.760519
0.751165 0.751071 0.751071 0.751071 0.751071 0.751071 0.751071 0.751071
0.751071 0.751071
4 2006 1 1 dead*wt 0.0014806 0.108204 0.780011 1.22404 1.4622 1.58809
1.86922 2.13968 2.37474 2.57251 2.735 2.86641 2.97174 3.0558 3.12281 3.17626
5 2006 1 1 sel*wt 0.000750575 0.0436764 0.488882 1.22329 1.66058 2.08806
2.48763 2.84645 3.15672 3.41615 3.62734 3.79591 3.92849 4.03154 4.11068
4.17061
5 2006 1 1 sel*ret*wt 0.000750575 0.0436764 0.488882 1.22329 1.66058 2.08806
2.48763 2.84645 3.15672 3.41615 3.62734 3.79591 3.92849 4.03154 4.11068
4.17061
5 2006 1 1 sel_nums 0.00419129 0.0979857 0.605447 0.99898 0.999986 0.999953
0.99968 0.999159 0.998392 0.99738 0.996123 0.994621 0.992877 0.990892
0.988666 0.986202
5 2006 1 1 sel*ret_nums 0.00419129 0.0979857 0.605447 0.99898 0.999986
0.999953 0.99968 0.999159 0.998392 0.99738 0.996123 0.994621 0.992877
0.990892 0.988666 0.986202
5 2006 1 1 dead_nums 0.00419129 0.0979857 0.605447 0.99898 0.999986 0.999953
0.99968 0.999159 0.998392 0.99738 0.996123 0.994621 0.992877 0.990892
0.988666 0.986202
5 2006 1 1 dead*wt 0.000750575 0.0436764 0.488882 1.22329 1.66058 2.08806
2.48763 2.84645 3.15672 3.41615 3.62734 3.79591 3.92849 4.03154 4.11068
4.17061
6 2006 1 1 sel*wt 0.0136034 0.309009 0.806938 1.05051 0.243565 0.0141681
0.00882758 0.0100774 0.0111843 0.0121157 0.012881 0.0134999 0.0139959
0.0143918 0.0147074 0.0149591
6 2006 1 1 sel*ret*wt 0.0136034 0.309009 0.806938 1.05051 0.243565 0.0141681
0.00882758 0.0100774 0.0111843 0.0121157 0.012881 0.0134999 0.0139959
0.0143918 0.0147074 0.0149591
6 2006 1 1 sel_nums 0.075963 0.693246 0.999339 0.857884 0.146672 0.00678497
0.00354745 0.00353737 0.00353733 0.00353732 0.00353731 0.0035373 0.0035373
0.0035373 0.00353729 0.00353729
6 2006 1 1 sel*ret_nums 0.075963 0.693246 0.999339 0.857884 0.146672
0.00678497 0.00354745 0.00353737 0.00353733 0.00353732 0.00353731 0.0035373
0.0035373 0.0035373 0.00353729 0.00353729
6 2006 1 1 dead_nums 0.075963 0.693246 0.999339 0.857884 0.146672 0.00678497
0.00354745 0.00353737 0.00353733 0.00353732 0.00353731 0.0035373 0.0035373
0.0035373 0.00353729 0.00353729
6 2006 1 1 dead*wt 0.0136034 0.309009 0.806938 1.05051 0.243565 0.0141681
0.00882758 0.0100774 0.0111843 0.0121157 0.012881 0.0134999 0.0139959
0.0143918 0.0147074 0.0149591

ENVIRONMENTAL_DATA Begins_in_startyr-1

NUMBERS_AT_AGE
Population 1 gmorph 1 gender: 1 GrowPattern: 1 birthseason: 1
Year Per Seas 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1980 VIRG 1 45538.3 37283.6 30525.2 24991.9 20461.7 16752.6 13715.9 11229.6
9194.02 7527.43 6162.94 5045.79 4131.14 3382.29 2769.19 12482.1
1981 INIT 1 43197 34167.7 14497.7 2177.33 326.874 49.0723 7.36998 1.10778
0.166717 0.0251318 0.00379636 0.000574899 8.73119e-005 1.33043e-005 2.03481e-
006 3.69501e-007
1982 TIME 1 44297.1 34167.7 14497.7 2177.33 326.874 49.0723 7.36998 1.10778
0.166717 0.0251318 0.00379636 0.000574899 8.73119e-005 1.33043e-005 2.03481e-
006 3.69501e-007
1983 TIME 1 62916.4 34496.2 13739.7 2273.85 270.692 41.1735 6.20238 0.932324
0.140314 0.0211531 0.00319569 0.000484008 7.35221e-005 1.12057e-005 1.71431e-
006 3.11418e-007
1984 TIME 1 36151.1 50120.6 17964.7 3246.65 426.958 51.5916 7.87606 1.18722
0.178626 0.0269177 0.00406467 0.000615296 9.34102e-005 1.42277e-005 2.17511e-
006 3.94779e-007
1985 TIME 1 47725.9 28202.5 20209.6 2459.76 308.956 41.1475 4.9899 0.762467
0.115091 0.0173491 0.00262072 0.000396904 6.02903e-005 9.18939e-006 1.40598e-
006 2.55447e-007
1986 TIME 1 52311.7 37547.1 12570.3 3569.68 336.151 42.2943 5.63938 0.684394
0.1047 0.0158294 0.00239108 0.000362093 5.49989e-005 8.38252e-006 1.2825e-006
2.3302e-007
1987 TIME 1 38847.8 40532.7 13866.3 1618.99 371.946 36.0175 4.5607 0.608732
0.0739782 0.0113387 0.00171837 0.000260312 3.95534e-005 6.03107e-006
9.23217e-007 1.6786e-007
1988 TIME 1 10621.7 30481.4 17509.3 2418.08 234.261 55.0735 5.36132 0.679452
0.0907935 0.0110514 0.00169722 0.000257833 3.91689e-005 5.97085e-006
9.13757e-007 1.66092e-007
1989 TIME 1 23587 8239.23 11073.4 2001.96 215.537 21.2305 5.01224 0.488437
0.0619927 0.00830073 0.00101296 0.000156049 2.37924e-005 3.62954e-006
5.55886e-007 1.0115e-007
1990 TIME 1 28244.9 18257.1 3821.36 2286.03 336.65 36.3249 3.58197 0.846196
0.0825425 0.0104906 0.00140711 0.000172073 2.65737e-005 4.06313e-006
6.21814e-007 1.14363e-007
1991 TIME 1 26297 21550.2 8566.97 964.998 491.33 73.9284 8.01547 0.790881
0.186984 0.0182594 0.00232386 0.000312223 3.82566e-005 5.92144e-006 9.07702e-
007 1.68093e-007
1992 TIME 1 32432.6 20078.5 9174.63 1678.26 156.587 82.4243 12.4926 1.35555
0.133885 0.0316971 0.00310064 0.000395445 5.3261e-005 6.54448e-006 1.0162e-
006 1.87993e-007
1993 TIME 1 28239.9 24940.6 8138.58 1529.41 243.813 23.3696 12.375 1.87723
0.203926 0.0201724 0.00478505 0.000469176 6.00011e-005 8.10672e-006 9.99645e-
007 1.86477e-007
1994 TIME 1 28620.9 21654.3 10567.3 1633.44 265.529 45.2531 4.39811 2.33111
0.353958 0.0385012 0.00381482 0.000906713 8.91114e-005 1.14267e-005 1.54851e-
006 2.29819e-007
1995 TIME 1 34451 22182.3 9515.15 2163.93 285.351 50.1376 8.81728 0.858771
0.455607 0.0692695 0.00754701 0.000749264 0.0001785 1.75897e-005 2.26228e-006
3.54915e-007
1996 TIME 1 25144.7 27895.5 14468.2 1926.21 154.602 19.9589 3.55233 0.62539
0.0609846 0.0324128 0.00493979 0.000539807 5.37839e-005 1.28666e-005
1.27392e-006 1.91109e-007

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1997 TIME 1  25677 20387 18863.9 3791.7 216.248 17.0245 2.21519 0.394562
0.069531 0.00679023 0.00361598 0.000552423 6.05431e-005 6.05267e-006
1.45356e-006 1.66951e-007
1998 TIME 1  27386.1 20892.1 14834.6 7960.09 1070.81 61.7709 4.8876 0.636245
0.113387 0.0199972 0.00195492 0.0010424 0.000159497 1.75116e-005 1.75427e-006
4.71578e-007
1999 TIME 1  21247.3 22283.1 15339.2 6788.65 2538.52 346.333 20.1053 1.59153
0.207274 0.0369643 0.00652508 0.000638611 0.00034098 5.22552e-005 5.74752e-
006 7.34422e-007
2000 TIME 1  26996.8 17271.7 16466.7 8003.09 2790.3 1060.76 145.762 8.46559
0.670341 0.0873426 0.0155856 0.0027533 0.000269707 0.000144157 2.21184e-005
2.76496e-006
2001 TIME 1  29162.3 21941.2 12639.8 7941.81 2832.17 1011.03 387.231 53.2332
3.09293 0.245056 0.0319548 0.00570765 0.00100947 9.90189e-005 5.30068e-005
9.19373e-006
2002 TIME 1  33483.4 23703.2 16195.4 6617.68 3275.38 1214.12 437.983 167.832
23.0796 1.34159 0.106362 0.0138802 0.00248153 0.00043936 4.31499e-005
2.71883e-005
2003 TIME 1  24764.3 27287.2 18021.6 9164.91 2996.53 1504.56 560.885 202.399
77.5804 10.6731 0.620762 0.0492486 0.00643225 0.00115108 0.000204027
3.28655e-005
2004 TIME 1  40333.2 20179.2 20745.2 10293.6 4251.72 1412.77 713.005 265.876
95.9696 36.8005 5.06551 0.294814 0.023408 0.00306009 0.000548195 0.000113196
2005 TIME 1  23368.8 32877.8 15426 12139.4 4936.17 2075.59 693.563 350.13
130.596 47.1577 18.0923 2.49195 0.145142 0.0115342 0.00150936 0.000326933
2006 TIME 1  25925.7 19058.5 25332.3 9405.91 6263.98 2592.44 1095.62 366.197
184.909 68.9926 24.9239 9.5674 1.31863 0.0768607 0.00611328 0.000975072
2007 FORE 1  41729.8 21161.6 14899.7 16683.5 5453.01 3678.07 1528.03 645.902
215.92 109.054 40.7031 14.7101 5.64942 0.779069 0.0454397 0.00419682

CATCH_AT_AGE
 fleet 1 fleetarea 1 gmorph 1
Year Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1981 E  1328.04 15081.2 11020.7 1655.29 248.502 37.303 5.60131 0.841681
0.126619 0.0190778 0.00288014 0.000435845 6.61403e-005 1.00691e-005 1.53846e-
006 2.79058e-007
1982 1  555.344 6055.43 4597.46 637.327 96.1036 14.4409 2.16842 0.325836
0.0490177 0.00738561 0.00111501 0.000168738 2.56073e-005 3.89862e-006
5.95704e-007 1.08061e-007
1983 1  970.72 8329.43 6169.05 936.801 112.135 17.0751 2.57157 0.386401
0.0581238 0.00875704 0.00132199 0.000200054 3.03594e-005 4.62213e-006
7.06272e-007 1.2813e-007
1984 1  532.188 10433.6 6374.38 1021.17 134.836 16.3079 2.48911 0.375095
0.0564149 0.00849755 0.00128248 0.000194021 2.94348e-005 4.47992e-006
6.84306e-007 1.24086e-007
1985 1  715.596 6217.37 7959 885 111.225 14.8156 1.79626 0.274383 0.0413992
0.00623741 0.000941635 0.000142508 2.16297e-005 3.2938e-006 5.03448e-007
9.13692e-008
1986 1  847.131 8312.39 4820.55 1275.96 121.256 15.2847 2.03771 0.247228
0.0378078 0.00571358 0.000862597 0.000130548 1.98153e-005 3.01775e-006
4.61309e-007 8.37363e-008
1987 1  615.558 9328.1 5751.65 628.676 145.597 14.1217 1.78782 0.238548
0.028978 0.00443912 0.000672324 0.000101775 1.54514e-005 2.35383e-006
3.59945e-007 6.53709e-008
1988 1  207.98 8099.26 7796.26 993.506 96.7564 22.7719 2.21646 0.280824
0.0375132 0.00456422 0.000700612 0.000106373 1.61495e-005 2.46004e-006
3.76176e-007 6.83173e-008
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1989 1  363.866 1916.28 4788.99 803.344 86.5586 8.52743 2.0127 0.196062
0.0248721 0.00332832 0.000405871 6.24736e-005 9.5162e-006 1.45016e-006
2.2185e-007 4.13929e-008
1990 1  251.987 2485.28 1039.19 584.607 86.7932 9.37995 0.924716 0.218359
0.0212878 0.00270365 0.000362338 4.42667e-005 6.82867e-006 1.04281e-006
1.59382e-007 3.05562e-008
1991 1  297.308 3562.75 2680.37 282.035 145.316 21.9171 2.37583 0.234334
0.0553756 0.00540427 0.000687304 9.2266e-005 1.12946e-005 1.74634e-006
2.67397e-007 5.10036e-008
1992 1  535.657 4732.24 3940.64 686.81 64.6874 34.1134 5.16945 0.560741
0.0553589 0.013099 0.00128053 0.00016319 2.19606e-005 2.69581e-006 4.18159e-
007 7.88199e-008
1993 1  302.994 3896.99 2433.33 433.723 70.8413 6.82315 3.61257 0.547802
0.0594788 0.00588 0.00139375 0.00013654 1.74445e-005 2.35432e-006 2.89971e-
007 5.5294e-008
1994 1  305.083 3397.2 3146.35 458.887 76.7394 13.2273 1.28594 0.681326
0.103402 0.0112404 0.00111291 0.000264291 2.59489e-005 3.32374e-006 4.49886e-
007 6.74678e-008
1995 1  55.3359 1585.26 3360.96 790.609 103.651 18.2814 3.21499 0.313064
0.166046 0.0252365 0.00274843 0.000272732 6.49386e-005 6.3952e-006 8.21955e-
007 1.29438e-007
1996 1  24.3626 1222.18 3399.97 489.414 39.0544 5.05459 0.899561 0.158329
0.0154342 0.00819968 0.00124901 0.000136407 1.35816e-005 3.24659e-006
3.21172e-007 4.85813e-008
1997 1  13.1173 486.648 2836.75 708.972 40.6415 3.20576 0.417066 0.0742597
0.0130797 0.0012765 0.000679233 0.000103671 1.13495e-005 1.13324e-006
2.71776e-007 3.13421e-008
1998 1  12.2858 439.804 2028.89 1372.47 185.799 10.7449 0.850062 0.110615
0.0197024 0.00347236 0.000339168 0.000180669 2.76119e-005 3.02758e-006
3.02851e-007 8.17139e-008
1999 1  7.55535 373.132 1762.65 1031.75 388.768 53.1994 3.08792 0.244331
0.031801 0.00566665 0.000999308 9.76877e-005 5.20885e-005 7.97025e-006
8.75165e-007 1.14193e-007
2000 1  8.59107 257.657 1635.57 1022.15 360.1 137.312 18.8657 1.09524
0.0866762 0.0112852 0.00201194 0.00035504 3.47358e-005 1.854e-005 2.8402e-006
3.58176e-007
2001 1  9.59387 339.746 1345.92 1118.37 405.732 145.483 55.7145 7.65586
0.444543 0.0351936 0.00458468 0.000817951 0.00014447 1.41496e-005 7.56169e-
006 1.31454e-006
2002 1  12.5499 423.55 2032.09 1103.92 550.125 204.41 73.7256 28.2386 3.88079
0.225401 0.0178519 0.00232688 0.000415428 7.3437e-005 7.19969e-006 4.55007e-
006
2003 1  7.96154 418.245 1947.88 1325.36 436.66 219.725 81.8947 29.539 11.3151
1.55538 0.0903711 0.00716099 0.000933971 0.000166873 2.95255e-005 4.77603e-
006
2004 1  13.8133 330.295 2414.61 1608.64 670.07 223.187 112.617 41.9751
15.1414 5.80122 0.797702 0.0463697 0.00367648 0.000479848 8.5807e-005
1.77203e-005
2005 1  7.22101 487.259 1650.34 1767.62 724.858 305.461 102.049 51.4929
19.1936 6.92471 2.65386 0.365067 0.0212319 0.00168446 0.000220017 4.76414e-
005
2006 1  4.89249 173.633 1714.44 881.083 590.525 244.804 103.435 34.5546
17.4358 6.49962 2.34537 0.899099 0.123726 0.00719913 0.000571472 9.11465e-005
 fleet 2 fleetarea 1 gmorph 1
Year Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1981 E  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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1982 1 167.318 1285.66 1872.92 473.998 71.7992 10.7915 1.62086 0.243622
0.0366593 0.00552501 0.000834337 0.000126296 1.91715e-005 2.91957e-006
4.46225e-007 8.09668e-008
1983 1 238.672 1443.19 2050.91 568.576 68.3673 10.413 1.56865 0.235767
0.0354743 0.00534604 0.000807269 0.000122195 1.85487e-005 2.82473e-006
4.3174e-007 7.8346e-008
1984 1 213.479 2949.36 3457.4 1011.16 134.121 16.2253 2.47717 0.373395
0.0561741 0.00846353 0.00127769 0.000193346 2.93403e-005 4.46672e-006
6.82471e-007 1.23786e-007
1985 1 198.393 1214.7 2983.58 605.671 76.4647 10.1879 1.23552 0.188779
0.0284907 0.00429369 0.000648372 9.81512e-005 1.49013e-005 2.26979e-006
3.47022e-007 6.29967e-008
1986 1 182.316 1260.67 1402.78 677.866 64.711 8.15899 1.08802 0.132041
0.0201979 0.00305316 0.000461067 6.97976e-005 1.05971e-005 1.61431e-006
2.46836e-007 4.48174e-008
1987 1 119.852 1279.88 1514.22 302.159 70.2955 6.81972 0.863613 0.115262
0.0140054 0.00214605 0.000325114 4.9228e-005 7.47579e-006 1.13914e-006
1.74242e-007 3.16532e-008
1988 1 43.0122 1180.37 2180.1 507.194 49.6192 11.6808 1.13724 0.144125
0.0192577 0.00234371 0.000359857 5.46513e-005 8.29929e-006 1.26456e-006
1.93421e-007 3.51365e-008
1989 1 77.8667 288.983 1385.72 424.372 45.9326 4.52621 1.06859 0.104122
0.0132122 0.00176849 0.000215716 3.32128e-005 5.06043e-006 7.71355e-007
1.18036e-007 2.20291e-008
1990 1 74.4466 517.42 415.127 426.348 63.5847 6.87341 0.67779 0.160093
0.0156117 0.00198328 0.000265866 3.24894e-005 5.0132e-006 7.65769e-007
1.17071e-007 2.24504e-008
1991 1 81.6481 689.487 995.302 191.195 98.9588 14.9289 1.61873 0.159702
0.0377493 0.00368505 0.000468781 6.29475e-005 7.70766e-006 1.19205e-006
1.82574e-007 3.48336e-008
1992 1 73.9438 460.345 735.534 234.038 22.1429 11.6801 1.77044 0.192094
0.0189694 0.00448974 0.000439022 5.59638e-005 7.53306e-006 9.24979e-007
1.43516e-007 2.70589e-008
1993 1 71.1611 644.972 772.735 251.452 41.2568 3.97466 2.10497 0.319278
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1.55251e-009 1.99998e-010 3.15753e-011
1996 1 80.4645 747.381 372.068 31.3253 0.427124 0.00255743 0.000238044
4.18022e-005 4.07825e-006 2.16894e-006 3.30816e-007 3.61855e-008 3.60938e-009
8.64568e-010 8.57252e-011 1.3e-011
1997 1 54.2187 372.43 388.5 56.7898 0.55626 0.00202989 0.000138119 2.45367e-
005 4.32526e-006 4.22568e-007 2.25145e-007 3.44172e-008 3.77467e-009
3.77673e-010 9.07831e-011 1.04961e-011
1998 1 71.6539 474.921 392.067 155.123 3.58825 0.00960009 0.000397221
5.15715e-005 9.19315e-006 1.62193e-006 1.58632e-007 8.46321e-008 1.29578e-008
1.42371e-009 1.42743e-010 3.86125e-011
1999 1 50.7743 464.278 392.484 134.37 8.65134 0.0547688 0.00166265
0.000131258 1.70978e-005 3.0499e-006 5.38552e-007 5.27284e-008 2.81664e-008
4.31869e-009 4.75301e-010 6.21764e-011
2000 1 88.2502 490.046 556.679 203.479 12.2489 0.216079 0.015527 0.000899368
7.12325e-005 9.28429e-006 1.65738e-006 2.92929e-007 2.87109e-008 1.53557e-008
2.3578e-009 2.98099e-010
2001 1 129.467 848.88 601.8 292.475 18.1305 0.300756 0.0602393 0.00825882
0.000479942 3.80364e-005 4.96151e-006 8.86561e-007 1.56871e-007 1.53957e-008
8.24658e-009 1.43726e-009
2002 1 80.9093 505.581 434.078 137.923 11.7442 0.201883 0.0380823 0.0145533
0.00200166 0.000116382 9.22962e-006 1.20489e-006 2.15504e-007 3.81738e-008
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2003 1 57.8051 562.246 468.594 186.483 10.4982 0.244392 0.0476399 0.0171445
0.00657263 0.000904433 5.26184e-005 4.17598e-006 5.45636e-007 9.76893e-008
1.73243e-008 2.80952e-009

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2004 1  105.309 466.225 609.93 237.664 16.9158 0.260659 0.0687886 0.025581
0.00923511 0.00354207 0.000487694 2.83934e-005 2.25528e-006 2.94959e-007
5.28664e-008 1.09454e-008
2005 1  54.8353 685.092 415.244 260.129 18.2272 0.355349 0.0620892 0.0312586
0.0116608 0.00421148 0.00161615 0.000222665 1.29733e-005 1.03137e-006
1.35023e-007 2.93118e-008
2006 1  45.5824 299.521 529.244 159.083 18.2184 0.349401 0.0772115 0.0257355
0.0129963 0.00484983 0.00175234 0.000672809 9.27536e-005 5.40803e-006
4.30282e-007 6.88024e-008

BIOLOGY 1 70 15 1 N_Used_morphs;_lengths;_ages;_season;_by_season_in_endyr
bin low Mean_Size Wt_len-F mat_len spawn Wt_len-M
1 10 10.5 0.0063863 1 0.0063863
2 11 11.5 0.00865928 1 0.00865928
3 12 12.5 0.0114467 1 0.0114467
4 13 13.5 0.0148098 1 0.0148098
5 14 14.5 0.0188113 1 0.0188113
6 15 15.5 0.0235157 1 0.0235157
7 16 16.5 0.0289892 1 0.0289892
8 17 17.5 0.0352991 1 0.0352991
9 18 18.5 0.0425145 1 0.0425145
10 19 19.5 0.0507059 1 0.0507059
11 20 20.5 0.0599448 1 0.0599448
12 21 21.5 0.0703042 1 0.0703042
13 22 22.5 0.0818585 1 0.0818585
14 23 23.5 0.0946829 1 0.0946829
15 24 24.5 0.108854 1 0.108854
16 25 25.5 0.12445 1 0.12445
17 26 26.5 0.14155 1 0.14155
18 27 27.5 0.160232 1 0.160232
19 28 28.5 0.180579 1 0.180579
20 29 29.5 0.202673 1 0.202673
21 30 30.5 0.226596 1 0.226596
22 31 31.5 0.252433 1 0.252433
23 32 32.5 0.280267 1 0.280267
24 33 33.5 0.310187 1 0.310187
25 34 34.5 0.342277 1 0.342277
26 35 35.5 0.376627 1 0.376627
27 36 36.5 0.413324 1 0.413324
28 37 37.5 0.452458 1 0.452458
29 38 38.5 0.494119 1 0.494119
30 39 39.5 0.538399 1 0.538399
31 40 40.5 0.58539 1 0.58539
32 41 41.5 0.635184 1 0.635184
33 42 42.5 0.687876 1 0.687876
34 43 43.5 0.743558 1 0.743558
35 44 44.5 0.802328 1 0.802328
36 45 45.5 0.86428 1 0.86428
37 46 46.5 0.929512 1 0.929512
38 47 47.5 0.99812 1 0.99812
39 48 48.5 1.0702 1 1.0702
40 49 49.5 1.14586 1 1.14586
41 50 50.5 1.22519 1 1.22519
42 51 51.5 1.3083 1 1.3083
43 52 52.5 1.39527 1 1.39527
44 53 53.5 1.48623 1 1.48623
45 54 54.5 1.58127 1 1.58127
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48 57 57.5 1.89188 1 1.89188
49 58 58.5 2.00426 1 2.00426
50 59 59.5 2.12125 1 2.12125
51 60 60.5 2.24294 1 2.24294
52 61 61.5 2.36945 1 2.36945
53 62 62.5 2.50088 1 2.50088
54 63 63.5 2.63734 1 2.63734
55 64 64.5 2.77893 1 2.77893
56 65 65.5 2.92577 1 2.92577
57 66 66.5 3.07797 1 3.07797
58 67 67.5 3.23564 1 3.23564
59 68 68.5 3.39888 1 3.39888
60 69 69.5 3.56782 1 3.56782
61 70 70.5 3.74255 1 3.74255
62 71 71.5 3.9232 1 3.9232
63 72 72.5 4.10988 1 4.10988
64 73 73.5 4.30271 1 4.30271
65 74 74.5 4.50178 1 4.50178
66 75 75.5 4.70723 1 4.70723
67 76 76.5 4.91917 1 4.91917
68 77 77.5 5.13771 1 5.13771
69 78 78.5 5.36296 1 5.36296
70 79 79.5 5.59506 1 5.59506

Growth_Parameters
 Count Yr Morph A1 A2 L-at-A1 L-at-A2 K A-at-L0 Linf CVmin CVmax natM_amin
natM_max M_young M_old
 1 1982 1 0.5 6 28.1 60.2 0.2052 -1.76669 75.5491 0.1 0.1 0 2 0.2 0.2

Season gmorph GrowPattern Sex BirthSeas age age_Beg age_Mid M Len_Beg Len_Mid
SD_Beg SD_Mid Wt_Beg Wt_Mid Len_Mat Age_Mat Mat*Fecund Len:_1 SelWt:_1
RetWt:_1 Len:_2 SelWt:_2 RetWt:_2 Len:_3 SelWt:_3 RetWt:_3 Len:_4 SelWt:_4
RetWt:_4 Len:_5 SelWt:_5 RetWt:_5 Len:_6 SelWt:_6 RetWt:_6 Len:_7 SelWt:_7
RetWt:_7 Len:_8 SelWt:_8 RetWt:_8 Len:_9 SelWt:_9 RetWt:_9 Len:_10 SelWt:_10
RetWt:_10 Len:_11 SelWt:_11 RetWt:_11 Len:_12 SelWt:_12 RetWt:_12 Len:_13
SelWt:_13 RetWt:_13 Len:_14 SelWt:_14 RetWt:_14 Len:_15 SelWt:_15 RetWt:_15
Len:_16 SelWt:_16 RetWt:_16 Len:_17 SelWt:_17 RetWt:_17 Len:_18 SelWt:_18
RetWt:_18 Len:_19 SelWt:_19 RetWt:_19
1 1 1 1 1 0 0 0.5 0.2 10 28.1 1 2.81 0.006815 0.17908 1 0.38 0.0025897 28.1
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1 1 1 1 1 1 1 1.5 0.2 32.7269 36.9026 3.27269 3.69026 0.298237 0.445742 1
0.91 0.271396 36.9026 0.445742 0.445742 36.9026 0.445742 0.445742 36.9026
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1 1 1 1 1 2 2 2.5 0.2 40.6711 44.0721 4.06711 4.40721 0.61717 0.807472 1 0.98
0.604826 44.0721 0.807472 0.807472 44.0721 0.807472 0.807472 44.0721 0.807472
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1 1 1 1 1 3 3 3.5 0.2 47.1415 49.9116 4.71415 4.99116 1.01154 1.22454 1 1
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1 1 1 1 1 4 4 4.5 0.2 52.4115 54.6677 5.24115 5.46677 1.44214 1.66061 1 1
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1 1 1 1 1 5 5 5.5 0.2 56.7039 58.5416 5.67039 5.85416 1.8768 2.08816 1 1
1.8768 58.5413 2.08816 2.08816 58.5413 2.08816 2.08816 58.5413 2.08816
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1 1 1 1 1 6 6 6.5 0.2 60.2 61.6967 6.02 6.16967 2.29261 2.48843 1 1 2.29261
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1 1 1 1 1 7 7 7.5 0.2 63.0475 64.2666 6.30475 6.42666 2.67421 2.84884 1 1
2.67421 64.2476 2.84884 2.84884 64.2476 2.84884 2.84884 64.2476 2.84884
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1 1 1 1 1 8 8 8.5 0.2 65.3667 66.3596 6.53667 6.63596 3.01152 3.1618 1 1
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1 1 1 1 1 9 9 9.5 0.2 67.2557 68.0644 6.72557 6.80644 3.29959 3.42512 1 1
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1 1 1 1 1 12 12 12.5 0.2 71.0681 71.505 7.10681 7.1505 3.89048 3.95667 1 1
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1 1 1 1 1 13 13 13.5 0.2 71.8994 72.2553 7.18994 7.22553 4.0158 4.06859 1 1
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1 1 1 1 1 15 15 15.5 0.2 73.1279 73.364 7.31279 7.3364 4.19539 4.22897 1 1
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MEAN_BODY_WT(begin)
morph year season 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
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1 1982 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1983 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1984 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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1 1986 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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1 1987 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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1 1993 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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1 1994 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1995 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1996 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1997 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1998 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1999 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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1 2000 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2001 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
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3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2003 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2004 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
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1 2006 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2007 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539

MEAN_SIZE_TIMESERIES
morph year season beg/mid 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 1982 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279

1 1982 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1983 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1983 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1984 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1984 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1985 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1985 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1986 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1986 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1987 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1987 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1988 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1988 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1989 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1989 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1990 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1990 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1991 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1991 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1992 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1992 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1993 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1995 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1996 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279

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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1997 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1997 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1998 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1998 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1999 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1999 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2000 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2000 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2001 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2001 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2002 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2002 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2003 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2003 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2004 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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1 2007 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2007 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1984 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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1 1987 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1988 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1991 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1992 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1993 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1994 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1995 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1996 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1997 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1998 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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AGE_LENGTH_KEY
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 sdwithin 1
 sdbetween 1e-006

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18 1982 L 1 58 1
18 1982 L 1 59 1
18 1982 L 1 60 1
18 1982 L 1 61 1
18 1982 L 1 62 1
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18 1982 L 1 63 1
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18 1982 L 1 65 1
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18 1982 L 1 69 1
18 1982 L 1 70 1
18 1982 L 1 71 1
18 1982 L 1 72 1
18 1982 L 1 73 1
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18 1982 L 1 75 1
18 1982 L 1 76 1
18 1982 L 1 77 1
18 1982 L 1 78 1
18 1982 L 1 79 1
18 1982 A 1 0 1
18 1982 A 1 1 0
18 1982 A 1 2 0
18 1982 A 1 3 0
18 1982 A 1 4 0
18 1982 A 1 5 0
18 1982 A 1 6 0
18 1982 A 1 7 0
18 1982 A 1 8 0
18 1982 A 1 9 0
18 1982 A 1 10 0
18 1982 A 1 11 0
18 1982 A 1 12 0
18 1982 A 1 13 0
18 1982 A 1 14 0
18 1982 A 1 15 0
18 2006 L 1 10 1
18 2006 L 1 11 1
18 2006 L 1 12 1
18 2006 L 1 13 1
18 2006 L 1 14 1
18 2006 L 1 15 1
18 2006 L 1 16 1
18 2006 L 1 17 1
18 2006 L 1 18 1
18 2006 L 1 19 1
18 2006 L 1 20 1
18 2006 L 1 21 1
18 2006 L 1 22 1
18 2006 L 1 23 1
18 2006 L 1 24 1
18 2006 L 1 25 1
18 2006 L 1 26 1
18 2006 L 1 27 1
18 2006 L 1 28 1
18 2006 L 1 29 1
18 2006 L 1 30 1
18 2006 L 1 31 1
18 2006 L 1 32 1
18 2006 L 1 33 1
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18 2006 L 1 34 1
18 2006 L 1 35 1
18 2006 L 1 36 1
18 2006 L 1 37 1
18 2006 L 1 38 1
18 2006 L 1 39 1
18 2006 L 1 40 1
18 2006 L 1 41 1
18 2006 L 1 42 1
18 2006 L 1 43 1
18 2006 L 1 44 1
18 2006 L 1 45 1
18 2006 L 1 46 1
18 2006 L 1 47 1
18 2006 L 1 48 1
18 2006 L 1 49 1
18 2006 L 1 50 1
18 2006 L 1 51 1
18 2006 L 1 52 1
18 2006 L 1 53 1
18 2006 L 1 54 1
18 2006 L 1 55 1
18 2006 L 1 56 1
18 2006 L 1 57 1
18 2006 L 1 58 1
18 2006 L 1 59 1
18 2006 L 1 60 1
18 2006 L 1 61 1
18 2006 L 1 62 1
18 2006 L 1 63 1
18 2006 L 1 64 1
18 2006 L 1 65 1
18 2006 L 1 66 1
18 2006 L 1 67 1
18 2006 L 1 68 1
18 2006 L 1 69 1
18 2006 L 1 70 1
18 2006 L 1 71 1
18 2006 L 1 72 1
18 2006 L 1 73 1
18 2006 L 1 74 1
18 2006 L 1 75 1
18 2006 L 1 76 1
18 2006 L 1 77 1
18 2006 L 1 78 1
18 2006 L 1 79 1
19 1982 L 1 10 1
19 1982 L 1 11 1
19 1982 L 1 12 1
19 1982 L 1 13 1
19 1982 L 1 14 1
19 1982 L 1 15 1
19 1982 L 1 16 1
19 1982 L 1 17 1
19 1982 L 1 18 1
19 1982 L 1 19 1
19 1982 L 1 20 1
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19 1982 L 1 21 1
19 1982 L 1 22 1
19 1982 L 1 23 1
19 1982 L 1 24 1
19 1982 L 1 25 1
19 1982 L 1 26 1
19 1982 L 1 27 1
19 1982 L 1 28 1
19 1982 L 1 29 1
19 1982 L 1 30 1
19 1982 L 1 31 1
19 1982 L 1 32 1
19 1982 L 1 33 1
19 1982 L 1 34 1
19 1982 L 1 35 1
19 1982 L 1 36 1
19 1982 L 1 37 1
19 1982 L 1 38 1
19 1982 L 1 39 1
19 1982 L 1 40 1
19 1982 L 1 41 1
19 1982 L 1 42 1
19 1982 L 1 43 1
19 1982 L 1 44 1
19 1982 L 1 45 1
19 1982 L 1 46 1
19 1982 L 1 47 1
19 1982 L 1 48 1
19 1982 L 1 49 1
19 1982 L 1 50 1
19 1982 L 1 51 1
19 1982 L 1 52 1
19 1982 L 1 53 1
19 1982 L 1 54 1
19 1982 L 1 55 1
19 1982 L 1 56 1
19 1982 L 1 57 1
19 1982 L 1 58 1
19 1982 L 1 59 1
19 1982 L 1 60 1
19 1982 L 1 61 1
19 1982 L 1 62 1
19 1982 L 1 63 1
19 1982 L 1 64 1
19 1982 L 1 65 1
19 1982 L 1 66 1
19 1982 L 1 67 1
19 1982 L 1 68 1
19 1982 L 1 69 1
19 1982 L 1 70 1
19 1982 L 1 71 1
19 1982 L 1 72 1
19 1982 L 1 73 1
19 1982 L 1 74 1
19 1982 L 1 75 1
19 1982 L 1 76 1
19 1982 L 1 77 1
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19 1982 L 1 78 1
19 1982 L 1 79 1
19 1982 A 1 0 1
19 1982 A 1 1 0
19 1982 A 1 2 0
19 1982 A 1 3 0
19 1982 A 1 4 0
19 1982 A 1 5 0
19 1982 A 1 6 0
19 1982 A 1 7 0
19 1982 A 1 8 0
19 1982 A 1 9 0
19 1982 A 1 10 0
19 1982 A 1 11 0
19 1982 A 1 12 0
19 1982 A 1 13 0
19 1982 A 1 14 0
19 1982 A 1 15 0
19 2006 L 1 10 1
19 2006 L 1 11 1
19 2006 L 1 12 1
19 2006 L 1 13 1
19 2006 L 1 14 1
19 2006 L 1 15 1
19 2006 L 1 16 1
19 2006 L 1 17 1
19 2006 L 1 18 1
19 2006 L 1 19 1
19 2006 L 1 20 1
19 2006 L 1 21 1
19 2006 L 1 22 1
19 2006 L 1 23 1
19 2006 L 1 24 1
19 2006 L 1 25 1
19 2006 L 1 26 1
19 2006 L 1 27 1
19 2006 L 1 28 1
19 2006 L 1 29 1
19 2006 L 1 30 1
19 2006 L 1 31 1
19 2006 L 1 32 1
19 2006 L 1 33 1
19 2006 L 1 34 1
19 2006 L 1 35 1
19 2006 L 1 36 1
19 2006 L 1 37 1
19 2006 L 1 38 1
19 2006 L 1 39 1
19 2006 L 1 40 1
19 2006 L 1 41 1
19 2006 L 1 42 1
19 2006 L 1 43 1
19 2006 L 1 44 1
19 2006 L 1 45 1
19 2006 L 1 46 1
19 2006 L 1 47 1
19 2006 L 1 48 1
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19 2006 L 1 49 1
19 2006 L 1 50 1
19 2006 L 1 51 1
19 2006 L 1 52 1
19 2006 L 1 53 1
19 2006 L 1 54 1
19 2006 L 1 55 1
19 2006 L 1 56 1
19 2006 L 1 57 1
19 2006 L 1 58 1
19 2006 L 1 59 1
19 2006 L 1 60 1
19 2006 L 1 61 1
19 2006 L 1 62 1
19 2006 L 1 63 1
19 2006 L 1 64 1
19 2006 L 1 65 1
19 2006 L 1 66 1
19 2006 L 1 67 1
19 2006 L 1 68 1
19 2006 L 1 69 1
19 2006 L 1 70 1
19 2006 L 1 71 1
19 2006 L 1 72 1
19 2006 L 1 73 1
19 2006 L 1 74 1
19 2006 L 1 75 1
19 2006 L 1 76 1
19 2006 L 1 77 1
19 2006 L 1 78 1
19 2006 L 1 79 1
```

SS2 ALTERNATIVE RUN (F08_MULTI_SVAge_FLAT6.REP)

```
Code_version_:__2.00o;_01/31/08;_Stock_Synthesis_2_by_Richard_Methot_(NOAA);_
using_Otter_Research_ADMB_7.0.1

Time: Thu Mar 20 15:25:00 2008

Data_File: F08_SVAgecomp6.DAT
Control_File: F08_SVAgecomp_FLAT6.CTL

Convergence_Level:
Hessian:
Sum_of_months_on_read_was:_ 12 rescaled_to_sum_to: 1

LIKELIHOOD 2882.75
indices 780.521
discard 0
length_comps 0
age_comps 2072.58
size-at-age 0
mean_body_wt 0
Equil_catch 0
catch 29.6505
Recruitment 0
Parm_priors 0
Parm_devs 0
penalties 0
Forecast_Recruitment 0

Fleet surv_lambda surv_like disc_lambda disc_like length_lambda length_like
age_lambda age_like sizeage_lambda sizeage_like
1 0 0 0 0 0 0 1 132.902 0 0
2 1 56.3759 0 0 0 0 1 94.4645 0 0
3 1 50.2471 0 0 0 0 1 170.465 0 0
4 1 28.0924 0 0 0 0 1 184.24 0 0
5 1 147.366 0 0 0 0 1 118.582 0 0
6 1 227.645 0 0 0 0 1 384.394 0 0
7 1 33.8026 0 0 0 0 1 132.792 0 0
8 1 26.9844 0 0 0 0 1 138.996 0 0
9 1 56.0583 0 0 0 0 1 336.231 0 0
10 1 35.6475 0 0 0 0 1 156.394 0 0
11 1 11.8535 0 0 0 0 1 223.12 0 0
12 1 28.2231 0 0 0 0 1 0 0 0
13 1 27.6765 0 0 0 0 1 0 0 0
14 1 50.548 0 0 0 0 1 0 0 0

Source Lambda Like
mean_body_wt 0 0
Equil_catch 0 0
Catch 10 2.96505
Recruitment 0 0
Parm_priors 0 0
Parm_devs 1 0
penalties 0
```

```
Variance_adjustments_to_input_values 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Index_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0
Discard_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0
MeanBodyWt_extra_CV  0 0 0 0 0 0 0 0 0 0 0 0 0 0
effN_mult_Lencomp  1 1 1 1 1 1 1 1 1 1 1 1 1 1
effN_mult_Agecomp  1 1 1 1 1 1 1 1 1 1 1 1 1 1
effN_mult_Len-at-age  1 1 1 1 1 1 1 1 1 1 1 1 1 1

PARAMETERS
Num Value Phase Min Max Init Prior PR_type SD Active_Cnt Prior_Like Bound
M-G_parmsUsing_offset_approach_#:_3
Gender:_1__Pattern:_1
1 0.2 -3
2 0 -3
3 28.1 -2
4 60.2 -2
5 0.2052 -3
6 0.1 -2
7 0 -3
biology_parms
8 2.44e-006 -3
9 3.34694 -3
10 28.1 -3
11 -0.25 -3
12 1 -3
13 0 -3
recrdist_by_growthpattern:1
14 0 -3
recrdist_by_area:1
15 0 -3
recrdist_by_seas:1
16 4 -3
cohort_growth_dev:2
17 1 -3
MGparm_env_linkages
MG_parm_blockparms
M-G_parm_devs 1
1_YR1982 0 -

MGParm_Block_Assignments
SR_parms
1 10.7104 1  3 31 10.1121 0 -1 99 1 0
2 0.951334 1  0.2 1 0.8 0 -1 99 2 0
3 0.6 -1
4 0 -1
5 0.261235 1  -5 5 0 0 -1 99 3 0
6 0 -1
Recr_Devs
1982 0.325619 - - - - - - - 4
1983 0.804456 - - - - - - - 5
1984 -0.0671377 - - - - - - - 6
1985 0.55384 - - - - - - - 7
1986 0.626122 - - - - - - - 8
1987 0.364245 - - - - - - - 9
1988 -1.35316 - - - - - - - 10
1989 -0.156547 - - - - - - - 11
1990 0.310527 - - - - - - - 12
```

```
1991 0.012096 - - - - - - - 13
1992 0.254122 - - - - - - - 14
1993 0.0991567 - - - - - - - 15
1994 0.158374 - - - - - - - 16
1995 0.246814 - - - - - - - 17
1996 -0.184163 - - - - - - - 18
1997 -0.226493 - - - - - - - 19
1998 -0.145966 - - - - - - - 20
1999 -0.416833 - - - - - - - 21
2000 -0.156891 - - - - - - - 22
2001 -0.0633979 - - - - - - - 23
2002 -0.0230323 - - - - - - - 24
2003 -0.351293 - - - - - - - 25
2004 0.188345 - - - - - - - 26
2005 -0.452512 - - - - - - - 27
2006 -0.346291 - - - - - - - 28
init_F_parms
1 1.6927 1 0 2 1 1 -1 10 29 0
Q_parms
sel_parms
#_size_sel:_1
#_male
#_size_sel:_2
#_male
#_size_sel:_3
#_male
#_size_sel:_4
#_male
#_size_sel:_5
#_male
#_size_sel:_6
#_male
#_size_sel:_7
#_male
#_size_sel:_8
#_male
#_size_sel:_9
#_male
#_size_sel:_10
#_male
#_size_sel:_11
#_male
#_size_sel:_12
#_male
#_size_sel:_13
#_male
#_size_sel:_14
#_male
#_age_sel:_1
1 1.94887 2 0.5 9 4 4 -1 99 30 0
2 -3 -3
3 0.195781 3 0 9 2 2 -1 99 31 0
4 9 -3
5 -999 -2
6 -999 -2
#_male
#_age_sel:_2
```

```
7 3.48574 2 0.5 9 4 4 -1 99 32 0
8 -3 -3
9 1.27732 3 0 9 2 2 -1 99 33 0
10 9 -3
11 -999 -2
12 -999 -2
#_male
#_age_sel:_3
13 3.15264 2 0.5 9 4 4 -1 99 34 0
14 -3 -3
15 1.0745 3 0 9 2 2 -1 99 35 0
16 9 -3
17 -999 -2
18 -999 -2
#_male
#_age_sel:_4
19 1.04469 2 0.5 9 4 4 -1 99 36 0
20 -3 -3
21 6.14273e-008 3 0 9 2 2 -1 99 37 0 LO
22 9 -3
23 -999 -2
24 -999 -2
#_male
#_age_sel:_5
25 2.72982 2 0.5 9 4 4 -1 99 38 0
26 -3 -3
27 3.25786e-009 3 0 9 2 2 -1 99 39 0 LO
28 9 -3
29 -999 -2
30 -999 -2
#_male
#_age_sel:_6
31 2.5354 2 0.5 9 4 4 -1 99 40 0
32 -3 -3
33 7.49481e-010 3 0 9 2 2 -1 99 41 0 LO
34 9 -3
35 -999 -2
36 -999 -2
#_male
#_age_sel:_7
37 2.79823 2 0.5 9 4 4 -1 99 42 0
38 -3 -3
39 1.58835e-008 3 0 9 2 2 -1 99 43 0 LO
40 9 -3
41 -999 -2
42 -999 -2
#_male
#_age_sel:_8
43 1.67615 2 0.5 9 4 4 -1 99 44 0
44 -3 -3
45 0.021067 3 0 9 2 2 -1 99 45 0 LO
46 9 -3
47 -999 -2
48 -999 -2
#_male
#_age_sel:_9
49 2.5068 2 0.5 9 4 4 -1 99 46 0
```

```
50 -3 -3
51 7.19415e-010 3 0 9 2 2 -1 99 47 0 LO
52 9 -3
53 -999 -2
54 -999 -2
#_male
#_age_sel:_10
55 2.96626 2 0.5 9 4 4 -1 99 48 0
56 -3 -3
57 1.08417 3 0 9 2 2 -1 99 49 0
58 9 -3
59 -999 -2
60 -999 -2
#_male
#_age_sel:_11
61 0.999988 2 0.5 9 4 4 -1 99 50 0
62 -3 -3
63 0.0984456 3 0 9 2 2 -1 99 51 0
64 9 -3
65 -999 -2
66 -999 -2
#_male
#_age_sel:_12
67 0 -3
68 0 -3
#_male
#_age_sel:_13
69 0 -3
70 0 -3
#_male
#_age_sel:_14
71 0 -3
72 0 -3
#_male
sel_parm_env_linkages
sel_parm_blockparms
73 2.42671 2 0.5 9 4 4 -1 99 52 0
74 0.0967715 3 0 9 2 2 -1 99 53 0
SEL_parm_devs
1_YR1982 0
Forecast_Recr_Devs
2007 0 - - - - - - - 54

Selex_Block_Assignments Years:
Base_parm#  1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
1  0 0 0 0 0 0 0 0 0 0 0 0 0 73 73 73 73 73 73 73 73 73 73 73 73
3  0 0 0 0 0 0 0 0 0 0 0 0 0 74 74 74 74 74 74 74 74 74 74 74 74

RECR_DIST
G_pattern gender Seas Area Value Used?
1 1 1 1 1 1

MOVEMENT
Seas Source Dist  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SUBMORPHDIST 1
```

```
MGparm_By_Year_after_adjustments
Year
1982  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1983  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1984  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1985  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1986  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1987  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1988  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1989  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1990  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1991  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1992  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1993  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1994  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1995  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1996  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1997  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1998  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
1999  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2000  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2001  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2002  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2003  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2004  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2005  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1
2006  0.2 0 28.1 60.2 0.2052 0.1 0 2.44e-006 3.34694 28.1 -0.25 1 0 0 0 4 1

SELparm(Size)_By_Year_after_adjustments
Fleet/Svy Year

SELparm(Age)_By_Year_after_adjustments
Fleet/Svy Year
1 1982  1.94887 -3 0.195781 9 -999 -999
1 1995  2.42671 -3 0.0967715 9 -999 -999
2 1982  3.48574 -3 1.27732 9 -999 -999
3 1982  3.15264 -3 1.0745 9 -999 -999
4 1982  1.04469 -3 6.14273e-008 9 -999 -999
5 1982  2.72982 -3 3.25786e-009 9 -999 -999
6 1982  2.5354 -3 7.49481e-010 9 -999 -999
7 1982  2.79823 -3 1.58835e-008 9 -999 -999
8 1982  1.67615 -3 0.021067 9 -999 -999
9 1982  2.5068 -3 7.19415e-010 9 -999 -999
10 1982  2.96626 -3 1.08417 9 -999 -999
11 1982  0.999988 -3 0.0984456 9 -999 -999
12 1982  0 0
13 1982  0 0
14 1982  0 0

EXPLOITATION   Hrate_is_Continuous_F  Fleet_in_columns;_year_in_rows
yr seas 1
init_yr 1  1.6927
1982 1  1.18484
1983 1  1.71053
1984 1  1.78559
1985 1  1.71667
```

```
1986 1  2.25341
1987 1  1.72794
1988 1  2.13806
1989 1  1.68657
1990 1  1.78713
1991 1  1.90442
1992 1  2.11489
1993 1  1.86887
1994 1  1.6676
1995 1  2.12497
1996 1  1.70532
1997 1  1.01498
1998 1  0.950804
1999 1  0.781728
2000 1  0.94831
2001 1  0.86898
2002 1  0.733562
2003 1  0.695106
2004 1  0.675384
2005 1  0.605025
2006 1  0.442444
2007 1  0.0328236

TIME_SERIES    Bio-Smry_age:_1  Hrate_is_Continuous_F
pop year period season bio-all bio-smry SpawnBio recruit-0  enc_catch:_1
dead_catch:_1 ret_catch:_1 obs_cat:_1 Hrate-1 SPB_vir_LH
1 1980 VIRG 1 358829 358524 357261 44821.4 0 0 0 0 0  357284
1 1981 INIT 1 26674.7 26278.1 25042.3 58202 23449 23449 23449 10000 1.6927
25042.3
1 1982 TIME 1 26580.2 26278.1 25042.3 44326.9 18908.3 18908.3 18908.3 18963
1.18484 25006.3
1 1983 TIME 1 28649.5 28156.3 26977.7 72362.1 26121.7 26121.7 26121.7 26466
1.71053 27165.1
1 1984 TIME 1 28444.7 28238.8 26610.1 30206.8 24933.7 24933.7 24933.7 26057
1.78559 26688.3
1 1985 TIME 1 21556.7 21190.4 20339.8 53752.2 20000.1 20000.1 20000.1 20432
1.71667 20479
1 1986 TIME 1 21024.9 20634.5 19437.3 57288.3 20918 20918 20918 20866 2.25341
19585.7
1 1987 TIME 1 21131 20830.2 19549.4 44138.1 18364 18364 18364 18312 1.72794
19663.7
1 1988 TIME 1 21358.9 21304.6 20217.4 7974.63 20975.3 20975.3 20975.3 21761
2.13806 20238.1
1 1989 TIME 1 9772.24 9624.45 9342.89 21685.5 9244.97 9244.97 9244.97 10314
1.68657 9399.05
1 1990 TIME 1 8369.74 8149.75 7680.44 32280.6 7391.75 7391.75 7391.75 7976
1.78713 7764.04
1 1991 TIME 1 11684.4 11501.4 10774.7 26851 10640.9 10640.9 10640.9 11316
1.90442 10844.2
1 1992 TIME 1 12060.8 11825.1 11183 34582.9 11944.4 11944.4 11944.4 11805
2.11489 11272.6
1 1993 TIME 1 12542.2 12338.4 11571.5 29912.3 11341.2 11341.2 11341.2 10781
1.86887 11648.9
1 1994 TIME 1 13227.5 13007.5 12295.2 32280 11561.9 11561.9 11561.9 12182
1.6676 12378.8
1 1995 TIME 1 14270.9 14025.7 13263.7 35983.4 9681.58 9681.58 9681.58 10495
2.12497 13356.8
```

```
1 1996 TIME 1 19099.3 18928.4 17968 25083.5 12296.1 12296.1 12296.1 11643
1.70532 18033
1 1997 TIME 1 20593.3 20426.5 19654.4 24474 11242.1 11242.1 11242.1 10325
1.01498 19717.8
1 1998 TIME 1 22588.8 22404.7 21694.1 27010.3 12186.6 12186.6 12186.6 11641
0.950804 21764
1 1999 TIME 1 24050.3 23908.3 23143.9 20830.7 11199.3 11199.3 11199.3 10851
0.781728 23197.9
1 2000 TIME 1 25541.2 25355.2 24702.4 27301.4 14451.5 14451.5 14451.5 13756
0.94831 24773.1
1 2001 TIME 1 24643.4 24440.5 23695.4 29777.3 12337.4 12337.4 12337.4 11932
0.86898 23772.5
1 2002 TIME 1 26850 26635.9 25788.1 31420.5 11882 11882 11882 11308 0.733562
25869.5
1 2003 TIME 1 30852.1 30694.7 29788 23100.3 13460.1 13460.1 13460.1 12927
0.695106 29847.9
1 2004 TIME 1 32334.8 32063 31324.8 39889 14687.2 14687.2 14687.2 14306
0.675384 31428.1
1 2005 TIME 1 35545.6 35400.7 34355.7 21256.6 13651.5 13651.5 13651.5 13446
0.605025 34410.7
1 2006 TIME 1 37454.6 37292.4 36527.5 23806.8 12564 12564 12564 12574
0.442444 36589.2
1 2007 FORE 1 39972.6 39695.9 39115.4 40598.4 1187.77 1187.77 1187.77 1187.77
0.0328236 39115.4

SPR_series  uses_R0= 44821.4   ###note_Y/R_unit_is_Dead_Biomass
Year Bio_all Bio_Smry SPBzero SPBfished SPBfished/R SPR Y/R GenTime Actual:
Bio_all Bio_Smry Enc_Catch Dead_Catch Retain_Catch SPB Recruits Tot_Exploit
More_F(by_morph):  aveF-1 maxF-1
1982 26950.5 26645  357261 25626.1 0.571739 0.0717295 0.438324 0.255201 +
26580.2 26278.1 18908.3 18908.3 18908.3 25042.3 44326.9 0.71137 +  1.13793
1.18482
1983 20388.4 20082.9  357261 19133.4 0.42688 0.0535557 0.401905 0.152148 +
28649.5 28156.3 26121.7 26121.7 26121.7 26977.7 72362.1 0.911771 +  1.64279
1.71049
1984 19774.5 19469  357261 18528.3 0.413381 0.0518622 0.397902 0.141317 +
28444.7 28238.8 24933.7 24933.7 24933.7 26610.1 30206.8 0.876569 +  1.71489
1.78555
1985 20336.1 20030.6  357261 19081.8 0.42573 0.0534115 0.401569 0.151232 +
21556.7 21190.4 20000.1 20000.1 20000.1 20339.8 53752.2 0.927791 +  1.64869
1.71663
1986 16867.6 16562.1  357261 15671.6 0.349646 0.0438661 0.377277 0.0891874 +
21024.9 20634.5 20918 20918 20918 19437.3 57288.3 0.994919 +  2.16418
2.25336
1987 20241.2 19935.7  357261 18988.2 0.423642 0.0531495 0.400956 0.149564 +
21131 20830.2 18364 18364 18364 19549.4 44138.1 0.869056 +  1.65952  1.7279
1988 17468.1 17162.7  357261 16260.5 0.362785 0.0455145 0.381776 0.0999061 +
21358.9 21304.6 20975.3 20975.3 20975.3 20217.4 7974.63 0.982037 +  2.0534
2.13801
1989 20595.9 20290.5  357261 19338.1 0.431447 0.0541287 0.403232 0.155777 +
9772.24 9624.45 9244.97 9244.97 9244.97 9342.89 21685.5 0.946044 +  1.61979
1.68653
1990 19762.4 19457  357261 18516.5 0.413116 0.051829 0.397823 0.141103 +
8369.74 8149.75 7391.75 7391.75 7391.75 7680.44 32280.6 0.883151 +  1.71637
1.78709
```

```
1991 18902.2 18596.8  357261 17669.6 0.394223 0.0494586 0.392011 0.125725 +
11684.4 11501.4 10640.9 10640.9 10640.9 10774.7 26851 0.910696 +  1.82901
1.90438
1992 17596.4 17290.9  357261 16386.4 0.365594 0.0458668 0.38272 0.102209 +
12060.8 11825.1 11944.4 11944.4 11944.4 11183 34582.9 0.990345 +  2.03115
2.11485
1993 19151.5 18846.1  357261 17914.9 0.399696 0.0501452 0.39372 0.1302 +
12542.2 12338.4 11341.2 11341.2 11341.2 11571.5 29912.3 0.904242 +  1.79487
1.86883
1994 20764.6 20459.1  357261 19504.4 0.435159 0.0545944 0.404301 0.158712 +
13227.5 13007.5 11561.9 11561.9 11561.9 12295.2 32280 0.87408 +  1.60157
1.66756
1995 27642.3 27336.9  357261 26215.3 0.584883 0.0733785 0.468291 0.100934 +
14270.9 14025.7 9681.58 9681.58 9681.58 13263.7 35983.4 0.678413 +  1.9752
2.12496
1996 30826.1 30520.7  357261 29378.6 0.655459 0.0822329 0.484012 0.152606 +
19099.3 18928.4 12296.1 12296.1 12296.1 17968 25083.5 0.643796 +  1.58513
1.70531
1997 41880.4 41574.9  357261 40396.3 0.901272 0.113072 0.524221 0.301241 +
20593.3 20426.5 11242.1 11242.1 11242.1 19654.4 24474 0.545911 +  0.943439
1.01497
1998 43747.9 43442.4  357261 42260.2 0.942857 0.118289 0.529331 0.320898 +
22588.8 22404.7 12186.6 12186.6 12186.6 21694.1 27010.3 0.539495 +  0.883791
0.9508
1999 50165.6 49860.1  357261 48668.2 1.08583 0.136226 0.544062 0.379054 +
24050.3 23908.3 11199.3 11199.3 11199.3 23143.9 20830.7 0.465661 +  0.726632
0.781725
2000 43825.7 43520.3  357261 42337.9 0.94459 0.118507 0.529535 0.321688 +
25541.2 25355.2 14451.5 14451.5 14451.5 24702.4 27301.4 0.56581 +  0.881473
0.948306
2001 46537.9 46232.5  357261 45045.6 1.005 0.126086 0.536243 0.347835 +
24643.4 24440.5 12337.4 12337.4 12337.4 23695.4 29777.3 0.500638 +  0.807734
0.868976
2002 52539.3 52233.9  357261 51039.2 1.13872 0.142863 0.548534 0.397473 +
26850 26635.9 11882 11882 11882 25788.1 31420.5 0.442532 +  0.68186  0.733559
2003 54669.2 54363.7  357261 53166.8 1.18619 0.148818 0.552148 0.41282 +
30852.1 30694.7 13460.1 13460.1 13460.1 29788 23100.3 0.436277 +  0.646115
0.695103
2004 55854.3 55548.8  357261 54350.7 1.21261 0.152132 0.554006 0.420918 +
32334.8 32063 14687.2 14687.2 14687.2 31324.8 39889 0.454221 +  0.627782
0.675381
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35545.6 35400.7 13651.5 13651.5 13651.5 34355.7 21256.6 0.384055 +  0.562383
0.605022
2006 77364.3 77058.8  357261 75846.8 1.6922 0.212301 0.572455 0.529486 +
37454.6 37292.4 12564 12564 12564 36527.5 23806.8 0.335445 +  0.41126
0.442442
2007 291073 290767  357261 289529 6.45963 0.810415 0.198007 0.792681 +
39972.6 39695.9 1187.77 1187.77 1187.77 39115.4 40598.4 0.0297146 +
0.0305102  0.0328234

SPAWN_RECRUIT Function: 3 - - - - -
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0.6 stddev_recr
0 env_link_
0.261235 init-eq 58202
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Virg 357261 44821.4 44821.4 37438 44821.4
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2006 36527.5 40296.4 40296.4 33658.4 23806.8 -0.346291
2007 39115.4 40598.4 40598.4 40598.4 40598.4 0 forecast

N_est r.m.s.e.
25 0.424012

INDEX_2
index year vuln_bio obs exp eff_Q SE Dev Like Like+log(s)
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7 0  1.0 0  0.00  0.0 0 3.44968e-005  0 0 23 23 0.685782 0.4 0.4 0 0
8 0  1.0 0  0.00  0.0 0 4.2525e-005  0 0 23 23 0.612727 0.4 0.4 0 0
9 0  1.0 0  0.00  0.0 0 3.25614e-005  0 0 25 25 0.847081 0.4 0.4 0 0
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13 0  1.0 0  0.00  0.0 0 0.000267896  0 0 25 25 0.595197 0.4 0.4 0 0
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pen_mean_Qdev_not_in_logL_in_randwalk_approach

INDEX_3
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12 0 -- 0 --  0 0
13 0 -- 0 --  0 0
14 0 -- 0 --  0 0

DISCARD  log(L)_based_on_T-distribution_with_DF=_30
as_fraction
index year seas obs exp cv Dev Like Like+log(s)


MEAN_BODY_WT log(L)_based_on_T-distribution_with_DF=_30
 year seas index Mkt obs exp cv Dev Like Like+log(s)
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 1985 1 1 0 0.575 0.617058 0.1 -0.0420578 0.273983 0.273983
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 1999 1 1 0 0.755 0.903129 0.1 -0.148129 1.8712 1.8712
 2000 1 1 0 0.85 0.942084 0.1 -0.0920844 0.594819 0.594819
 2001 1 1 0 0.903 0.942133 0.1 -0.0391327 0.0967294 0.0967294
```

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 2002 1 1 0 0.898 0.918153 0.1 -0.0201526 0.025999 0.025999
 2003 1 1 0 0.999 0.938836 0.1 0.0601637 0.186267 0.186267
 2004 1 1 0 0.983 0.989492 0.1 -0.00649183 0.00225323 0.00225323
 2005 1 1 0 0.949 1.005 0.1 -0.0560018 0.178885 0.178885
 2006 1 1 0 0.947 1.025 0.1 -0.0779964 0.346574 0.346574

FIT_LEN_COMPS
Index Year Seas Gender Mkt Nsamp effN Like

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
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2 0 0 0 0 0 0 -1.#IND
3 0 0 0 0 0 0 -1.#IND
4 0 0 0 0 0 0 -1.#IND
5 0 0 0 0 0 0 -1.#IND
6 0 0 0 0 0 0 -1.#IND
7 0 0 0 0 0 0 -1.#IND
8 0 0 0 0 0 0 -1.#IND
9 0 0 0 0 0 0 -1.#IND
10 0 0 0 0 0 0 -1.#IND
11 0 0 0 0 0 0 -1.#IND
12 0 0 0 0 0 0 -1.#IND
13 0 0 0 0 0 0 -1.#IND
14 0 0 0 0 0 0 -1.#IND

FIT_AGE_COMPS
Index Year Seas Gender Mkt Ageerr Lbin_lo Lbin_hi Nsamp effN Like
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1 1983 1 0 0 1 1 70 69 16.1371 4.31202
1 1984 1 0 0 1 1 70 53 12.7667 3.16884
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1 1986 1 0 0 1 1 70 78 8.64958 11.653
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1 1988 1 0 0 1 1 70 90 60.3402 2.99848
1 1989 1 0 0 1 1 70 84 45.7634 3.85335
1 1990 1 0 0 1 1 70 34 156.495 0.488038
1 1991 1 0 0 1 1 70 46 15.2244 3.77918
1 1992 1 0 0 1 1 70 34 81.0315 1.70277
1 1993 1 0 0 1 1 70 36 32.5246 1.36151
1 1994 1 0 0 1 1 70 40 84.5481 0.963621
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1 1997 1 0 0 1 1 70 89 18.3428 9.56086
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1 2000 1 0 0 1 1 70 110 63.8735 3.59989
1 2001 1 0 0 1 1 70 103 77.432 2.22418
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1 2003 1 0 0 1 1 70 87 21.5935 7.52746
1 2004 1 0 0 1 1 70 140 26.2485 9.53913
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11 2006 1 0 0 1 1 70 100 8.65758 17.1867

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
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2 0 15 147.655 100 21.9047 1.47655 1.47655
3 0 25 71.9399 100 18.6871 0.719399 0.719399
4 0 25 52.1643 100 19.9406 0.521643 0.521643
5 0 25 180.32 100 11.3793 1.8032 1.8032
6 0 25 1448.23 100 5.74022 14.4823 14.4823
7 0 23 95.0143 100 17.3944 0.950143 0.950143
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8 0 23 59.3106 100 24.0829 0.593106 0.593106
9 0 25 90.3048 100 6.93846 0.903048 0.903048
10 0 17 44.8152 100 20.6869 0.448152 0.448152
11 0 19 75.8133 100 11.6669 0.758133 0.758133
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13 0 0 0 0 0 0 -1.#IND
14 0 0 0 0 0 0 -1.#IND

LEN_SELEX
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20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
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1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1

RETENTION
fleet year gender label  10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5 19.5
20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1982 1 1982-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

DISCARD_MORT
fleet year gender label  10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5 19.5
20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1982 1 1982-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

KEEPERS equals_sel*retain
fleet year gender label  10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5 19.5
20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1982 1 1982-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2007 1 2007-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

DEADFISH equals_sel*(retain+(1-retain)*discmort)
fleet year gender label 10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5 18.5 19.5
20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1982 1 1982-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2007 1 2007-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX
fleet year gender label 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 1982 1 1982-1 0.0440365 0.477016 0.999411 0.999979 0.999969 0.999727
0.999237 0.998501 0.997519 0.996292 0.994821 0.993107 0.991151 0.988955
0.98652 0.983849
1 1994 1 1994-1 0.0440365 0.477016 0.999411 0.999979 0.999969 0.999727
0.999237 0.998501 0.997519 0.996292 0.994821 0.993107 0.991151 0.988955
0.98652 0.983849
1 1995 1 1995-1 0.00476902 0.157596 0.848032 0.999824 0.999996 0.999868
0.999491 0.998866 0.997996 0.996881 0.99552 0.993917 0.992071 0.989984
0.987658 0.985094
1 2006 1 2006-1 0.00476902 0.157596 0.848032 0.999824 0.999996 0.999868
0.999491 0.998866 0.997996 0.996881 0.99552 0.993917 0.992071 0.989984
0.987658 0.985094
1 2007 1 2007-1 0.00476902 0.157596 0.848032 0.999824 0.999996 0.999868
0.999491 0.998866 0.997996 0.996881 0.99552 0.993917 0.992071 0.989984
0.987658 0.985094
2 1982 1 1982-2 0.0337993 0.178606 0.540432 0.936431 0.99992 0.999997 0.99987
0.999495 0.998873 0.998005 0.996891 0.995534 0.993932 0.992088 0.990004
0.987679
2 2006 1 2006-2 0.0337993 0.178606 0.540432 0.936431 0.99992 0.999997 0.99987
0.999495 0.998873 0.998005 0.996891 0.995534 0.993932 0.992088 0.990004
0.987679
3 1982 1 1982-3 0.0335775 0.205499 0.6353 0.992599 0.999977 0.999984 0.999778
0.999324 0.998624 0.997678 0.996487 0.995052 0.993373 0.991453 0.989292
0.986892
3 2006 1 2006-3 0.0335775 0.205499 0.6353 0.992599 0.999977 0.999984 0.999778
0.999324 0.998624 0.997678 0.996487 0.995052 0.993373 0.991453 0.989292
0.986892
4 1982 1 1982-4 0.335777 0.9986 0.999966 0.999983 0.999775 0.99932 0.998618
0.99767 0.996477 0.995039 0.993359 0.991437 0.989274 0.986872 0.984233
0.981359
4 2006 1 2006-4 0.335777 0.9986 0.999966 0.999983 0.999775 0.99932 0.998618
0.99767 0.996477 0.995039 0.993359 0.991437 0.989274 0.986872 0.984233
0.981359
5 1982 1 1982-5 0.000580775 0.0501765 0.587146 0.999014 0.999989 0.999931
0.999625 0.999072 0.998273 0.997228 0.995938 0.994405 0.992629 0.990611
0.988354 0.985858
5 2006 1 2006-5 0.000580775 0.0501765 0.587146 0.999014 0.999989 0.999931
0.999625 0.999072 0.998273 0.997228 0.995938 0.994405 0.992629 0.990611
0.988354 0.985858
6 1982 1 1982-6 0.00161586 0.0946661 0.751006 0.99966 0.999994 0.999893
0.999541 0.998942 0.998098 0.997007 0.995673 0.994094 0.992273 0.990211
0.98791 0.98537

```
6 2006 1 2006-6 0.00161586 0.0946661 0.751006 0.99966 0.999994 0.999893
0.999541 0.998942 0.998098 0.997007 0.995673 0.994094 0.992273 0.990211
0.98791 0.98537
7 1982 1 1982-7 0.000397994 0.039417 0.528854 0.998658 0.999986 0.999942
0.999652 0.999115 0.998332 0.997303 0.99603 0.994512 0.992752 0.99075
0.988508 0.986028
7 2006 1 2006-7 0.000397994 0.039417 0.528854 0.998658 0.999986 0.999942
0.999652 0.999115 0.998332 0.997303 0.99603 0.994512 0.992752 0.99075
0.988508 0.986028
8 1982 1 1982-8 0.063872 0.639238 0.999273 0.999991 0.99993 0.999623 0.999069
0.998269 0.997224 0.995933 0.994399 0.992622 0.990603 0.988345 0.985849
0.983116
8 2006 1 2006-8 0.063872 0.639238 0.999273 0.999991 0.99993 0.999623 0.999069
0.998269 0.997224 0.995933 0.994399 0.992622 0.990603 0.988345 0.985849
0.983116
9 1982 1 1982-9 0.0018665 0.103273 0.773762 0.999708 0.999994 0.999887
0.999528 0.998923 0.998071 0.996974 0.995633 0.994048 0.99222 0.990152
0.987844 0.985298
9 2006 1 2006-9 0.0018665 0.103273 0.773762 0.999708 0.999994 0.999887
0.999528 0.998923 0.998071 0.996974 0.995633 0.994048 0.99222 0.990152
0.987844 0.985298
10 1982 1 1982-10 0.0510192 0.270505 0.729261 0.999868 0.999988 0.999966
0.999716 0.999218 0.998474 0.997485 0.99625 0.994771 0.99305 0.991087
0.988883 0.986441
10 2006 1 2006-10 0.0510192 0.270505 0.729261 0.999868 0.999988 0.999966
0.999716 0.999218 0.998474 0.997485 0.99625 0.994771 0.99305 0.991087
0.988883 0.986441
11 1982 1 1982-11 0.404074 1 0.999973 0.99998 0.999761 0.999295 0.998582
0.997624 0.99642 0.994973 0.993282 0.991349 0.989176 0.986765 0.984116
0.981232
11 2006 1 2006-11 0.404074 1 0.999973 0.99998 0.999761 0.999295 0.998582
0.997624 0.99642 0.994973 0.993282 0.991349 0.989176 0.986765 0.984116
0.981232
12 1982 1 1982-12 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
12 2006 1 2006-12 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
13 1982 1 1982-13 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
13 2006 1 2006-13 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
14 1982 1 1982-14 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
14 2006 1 2006-14 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

AGE_SELEX_from_size_selex_in_endyear
fleet year morph season 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
10 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
11 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
12 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
13 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
14 2006 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

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AGE_SELEX_mortality_in_endyear
fleet year morph season label 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2006 1 1 sel*wt  0.000854034 0.0702472 0.684762 1.22432 1.6606 2.08789
2.48716 2.84561 3.15546 3.41444 3.62515 3.79322 3.9253 4.02784 4.10649
4.16593
1 2006 1 1 sel*ret*wt  0.000854034 0.0702472 0.684762 1.22432 1.6606 2.08789
2.48716 2.84561 3.15546 3.41444 3.62515 3.79322 3.9253 4.02784 4.10649
4.16593
1 2006 1 1 sel_nums  0.00476902 0.157596 0.848032 0.999824 0.999996 0.999868
0.999491 0.998866 0.997996 0.996881 0.99552 0.993917 0.992071 0.989984
0.987658 0.985094
1 2006 1 1 sel*ret_nums  0.00476902 0.157596 0.848032 0.999824 0.999996
0.999868 0.999491 0.998866 0.997996 0.996881 0.99552 0.993917 0.992071
0.989984 0.987658 0.985094
1 2006 1 1 dead_nums  0.00476902 0.157596 0.848032 0.999824 0.999996 0.999868
0.999491 0.998866 0.997996 0.996881 0.99552 0.993917 0.992071 0.989984
0.987658 0.985094
1 2006 1 1 dead*wt  0.000854034 0.0702472 0.684762 1.22432 1.6606 2.08789
2.48716 2.84561 3.15546 3.41444 3.62515 3.79322 3.9253 4.02784 4.10649
4.16593

ENVIRONMENTAL_DATA Begins_in_startyr-1

NUMBERS_AT_AGE
Population 1 gmorph 1 gender: 1 GrowPattern: 1 birthseason: 1
Year Per Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1980 VIRG 1  44821.4 36696.6 30044.7 24598.5 20139.5 16488.9 13499.9 11052.8
9049.28 7408.93 6065.92 4966.35 4066.1 3329.04 2725.59 12285.6
1981 INIT 1  58202 44228.9 16150.2 2435.68 366.981 55.2936 8.3346 1.25734
0.189918 0.0287341 0.00435645 0.000662139 0.000100931 1.54362e-005 2.36956e-
006 4.32162e-007
1982 TIME 1  44326.9 44228.9 16150.2 2435.68 366.981 55.2936 8.3346 1.25734
0.189918 0.0287341 0.00435645 0.000662139 0.000100931 1.54362e-005 2.36956e-
006 4.32162e-007
1983 TIME 1  72362.1 34446.8 20577.4 4046.24 609.82 91.8821 13.848 2.08857
0.315353 0.0476884 0.00722566 0.00109741 0.000167135 2.55358e-005 3.91556e-
006 7.13091e-007
1984 TIME 1  30206.8 54946.3 12471.8 3048.57 598.876 90.2596 13.6051 2.05221
0.309907 0.0468716 0.00710292 0.00107893 0.000164346 2.51137e-005 3.85145e-
006 7.01526e-007
1985 TIME 1  53752.2 22861.1 19194.1 1714.17 418.583 82.2298 12.3986 1.87052
0.282523 0.042739 0.00647819 0.000984287 0.000149971 2.2924e-005 3.51677e-006
6.40821e-007
1986 TIME 1  57288.3 40804.4 8252.85 2826.23 252.157 61.5752 12.1014 1.82618
0.275856 0.0417355 0.00632689 0.000961428 0.000146509 2.23979e-005 3.43658e-
006 6.26327e-007
1987 TIME 1  44138.1 42472.8 11403 710.685 243.067 21.6869 5.29871 1.0425
0.157583 0.0238565 0.00361936 0.000550498 8.39769e-005 1.28535e-005 1.97476e-
006 3.6052e-007
1988 TIME 1  7974.63 33489.5 15250.5 1660.23 103.371 35.3554 3.1558 0.771702
0.152023 0.0230185 0.00349219 0.00053116 8.10282e-005 1.24025e-005 1.90553e-
006 3.47914e-007
1989 TIME 1  21685.5 5942.39 9888.21 1473.75 160.244 9.97754 3.41432 0.305079
0.07472 0.0147506 0.00223932 0.000340802 5.20261e-005 7.96981e-006 1.22563e-
006 2.24049e-007
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1990 TIME 1  32280.6 16483.7 2176.23 1500.45 223.416 24.2929 1.5132 0.518247
0.0463644 0.0113744 0.00225009 0.000342439 5.22667e-005 8.00528e-006
1.23087e-006 2.24968e-007
1991 TIME 1  26851 24428.9 5753.92 298.648 205.702 30.6293 3.33189 0.207725
0.071236 0.00638425 0.00156966 0.000311328 4.75262e-005 7.27934e-006
1.11931e-006 2.04595e-007
1992 TIME 1  34582.9 20215.3 8063.36 702.287 36.4118 25.08 3.73617 0.406804
0.0253976 0.00872601 0.000783864 0.000193265 3.84577e-005 5.89272e-006
9.0634e-007 1.65734e-007
1993 TIME 1  29912.3 25796.2 6035.16 797.466 69.3727 3.59687 2.47876 0.369643
0.0403104 0.00252189 0.000868713 7.82804e-005 1.93704e-005 3.87049e-006
5.95821e-007 1.09054e-007
1994 TIME 1  32280 22555.3 8660.28 763.252 100.747 8.76425 0.454619 0.313584
0.0468275 0.00511602 0.000320802 0.000110811 1.00173e-005 2.48784e-006
4.99151e-007 9.13882e-008
1995 TIME 1  35983.4 24557.4 8335.31 1339.28 117.922 15.5656 1.35464
0.0703254 0.0485682 0.00726458 0.000795298 4.9992e-005 1.73175e-005 1.57062e-
006 3.91502e-007 9.33735e-008
1996 TIME 1  25083.5 29163.7 14384.1 1125.76 131.013 11.5313 1.52253 0.13261
0.00689349 0.0047696 0.000715104 7.85135e-005 4.95217e-006 1.7222e-006
1.56889e-007 4.87256e-008
1997 TIME 1  24474 20370.3 18250.1 2773.09 167.536 19.4916 1.71597 0.226712
0.0197672 0.00102909 0.000713384 0.000107206 1.18027e-005 7.4679e-007
2.60635e-007 3.12736e-008
1998 TIME 1  27010.3 19940.8 14212.5 6318.24 822.972 49.7112 5.78428 0.50942
0.0673469 0.00587722 0.000306318 0.000212638 3.20068e-005 3.53036e-006
2.2385e-007 8.77307e-008
1999 TIME 1  20830.7 22014.1 14054.3 5195.58 1999.31 260.375 15.7297 1.83093
0.161345 0.021348 0.00186497 9.73271e-005 6.76651e-005 1.0203e-005 1.12763e-
006 9.98107e-008
2000 TIME 1  27301.4 16991.2 15934.5 5929.83 1946.86 749.072 97.5628 5.89569
0.68659 0.0605449 0.00801784 0.000701187 3.66387e-005 2.55092e-005 3.85274e-
006 4.64411e-007
2001 TIME 1  29777.3 22251.6 11980.1 5837.42 1881.09 617.493 237.615 30.9592
1.87196 0.218182 0.0192601 0.00255386 0.000223684 1.17085e-005 8.16804e-006
1.38576e-006
2002 TIME 1  31420.5 24278.8 15886.5 4694.19 2004.64 645.892 212.046 81.6231
10.6406 0.643874 0.0751179 0.0066389 0.000881538 7.73348e-005 4.05535e-006
3.31683e-006
2003 TIME 1  23100.3 25635.1 17707.6 6982.34 1845.76 788.127 253.958 83.3971
32.1169 4.18951 0.25372 0.0296299 0.00262176 0.000348599 3.06285e-005
2.92722e-006
2004 TIME 1  39889 18850.3 18810.5 8040.77 2853.08 754.116 322.03 103.795
34.0999 13.1401 1.7154 0.103984 0.012157 0.00107708 0.00014342 1.38299e-005
2005 TIME 1  21256.6 32553.4 13875.1 8685.64 3351 1188.89 314.269 134.237
43.2846 14.2288 5.48706 0.716976 0.0435087 0.00509305 0.000451867 6.6085e-005
2006 TIME 1  23806.8 17353.3 24228.5 6800.61 3883.56 1498.16 531.567 140.546
60.0553 19.375 6.37337 2.45979 0.321725 0.0195453 0.00229082 0.000233346
2007 FORE 1  40598.4 19450.3 13250.7 13630.7 3577.43 2042.78 788.086 279.67
73.965 31.6174 10.2054 3.35907 1.29735 0.169824 0.0103266 0.00133514

CATCH_AT_AGE
 fleet 1 fleetarea 1 gmorph 1
Year Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1981 E  3793.85 22504.5 12264.6 1850.09 278.751 41.9957 6.3289 0.954482
0.144114 0.0217931 0.00330212 0.000501538 7.63888e-005 1.16721e-005 1.78994e-
006 3.26086e-007
```

1982 1 2044.24 17469.7 10355 1562.16 235.368 35.4586 5.34338 0.805773
0.121645 0.0183923 0.00278627 0.000423091 6.44236e-005 9.84092e-006 1.50862e-
006 2.74737e-007
1983 1 4764.73 17649 15692.8 3086.48 465.17 70.0807 10.5601 1.59221 0.240313
0.0363227 0.00550027 0.000834782 0.000127035 1.93917e-005 2.97047e-006
5.40376e-007
1984 1 2073 28953.7 9673.46 2365.08 464.605 70.0165 10.5518 1.5912 0.240197
0.0363111 0.00549945 0.000834807 0.000127063 1.93997e-005 2.9723e-006
5.40819e-007
1985 1 3551.6 11740.7 14659 1309.45 319.753 62.8089 9.46848 1.42804 0.215606
0.0325999 0.00493841 0.000749815 0.000114155 1.74336e-005 2.67182e-006
4.8632e-007
1986 1 4913.17 24789.1 6927 2372.58 211.682 51.6877 10.1567 1.53239 0.23141
0.0349983 0.00530326 0.000805466 0.00012267 1.87412e-005 2.87341e-006
5.23262e-007
1987 1 2934.81 21906.8 8731.54 544.311 186.163 16.6083 4.05706 0.79798
0.120574 0.0182448 0.00276634 0.000420465 6.40901e-005 9.80086e-006 1.50427e-
006 2.74326e-007
1988 1 650.478 19731.8 12597.6 1371.67 85.4046 29.2081 2.6067 0.63728
0.125504 0.0189957 0.00288053 0.000437888 6.67579e-005 1.0211e-005 1.5676e-
006 2.85966e-007
1989 1 1408.6 3016.32 7498.08 1117.78 121.538 7.56679 2.58884 0.231251
0.0566152 0.0111709 0.00169485 0.000257757 3.93168e-005 6.0174e-006 9.24439e-
007 1.68801e-007
1990 1 2217.16 8690.84 1688.5 1164.44 173.383 18.8508 1.17399 0.401959
0.0359473 0.0088146 0.00174271 0.000265045 4.04231e-005 6.18597e-006
9.50224e-007 1.7349e-007
1991 1 1960.43 13412.6 4571.27 237.314 163.456 24.3366 2.6469 0.164976
0.0565558 0.00506635 0.00124497 0.000246774 3.76447e-005 5.76121e-006
8.85075e-007 1.61621e-007
1992 1 2791.67 11834.1 6637.8 578.231 29.9797 20.6481 3.07547 0.334786
0.0208948 0.00717614 0.000644334 0.000158775 3.15746e-005 4.8346e-006
7.43002e-007 1.35746e-007
1993 1 2144.78 13996 4761.99 629.365 54.7492 2.83841 1.95572 0.291567
0.0317844 0.00198759 0.000684291 6.16227e-005 1.52374e-005 3.04215e-006
4.67876e-007 8.55495e-008
1994 1 2074.03 11363.1 6536.59 576.22 76.0588 6.61593 0.343112 0.236598
0.0353168 0.00385648 0.000241675 8.3419e-005 7.5349e-006 1.86961e-006
3.74726e-007 6.85299e-008
1995 1 328.891 6369.35 6489.33 1104.31 97.2387 12.8349 1.11686 0.0579697
0.040024 0.00598446 0.000654871 4.11438e-005 1.4244e-005 1.29099e-006
3.21558e-007 7.66277e-008
1996 1 184.166 6257.1 10200.4 857.627 99.8148 8.78494 1.15974 0.100985
0.00524771 0.00362924 0.000543831 5.96699e-005 3.76078e-006 1.30676e-006
1.18929e-007 3.68971e-008
1997 1 107.119 2736.38 9682.14 1629.06 98.4297 11.4507 1.00785 0.133107
0.0115997 0.000603486 0.000418007 6.2757e-005 6.90152e-006 4.36132e-007
1.52e-007 1.82101e-008
1998 1 110.762 2521.3 7224.83 3568.22 464.822 28.0751 3.266 0.287526
0.0379914 0.00331315 0.000172535 0.000119651 1.79895e-005 1.98167e-006
1.2547e-007 4.90948e-008
1999 1 70.2586 2317.44 6241.45 2586.79 995.539 129.64 7.8298 0.911002
0.0802323 0.0106078 0.000925847 4.82647e-005 3.35132e-005 5.04618e-006
5.56815e-007 4.91992e-008
2000 1 111.663 2143.12 8086.1 3343.47 1097.83 422.367 54.9985 3.32226
0.386691 0.0340757 0.00450879 0.000393917 2.05595e-005 1.42957e-005 2.15599e-
006 2.59466e-007

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2001 1  111.622 2587.03 5730.64 3115.59 1004.1 329.582 126.794 16.5136
0.997944 0.116229 0.0102512 0.00135789 0.00011879 6.20952e-006 4.3253e-006
7.32587e-007
2002 1  99.4579 2407 6737.9 2238.11 955.891 307.96 101.077 38.8909 5.06686
0.306365 0.0357085 0.0031524 0.00041805 3.66209e-005 1.91724e-006 1.56526e-
006
2003 1  69.294 2415.17 7217.93 3206.5 847.733 361.943 116.598 38.2726 14.7301
1.91996 0.116162 0.0135502 0.00119741 0.000158975 1.39446e-005 1.33026e-006
2004 1  116.266 1728.11 7504.41 3618.14 1283.97 339.344 144.871 46.6732
15.3242 5.90033 0.769521 0.0465933 0.00544011 0.000481256 6.3975e-005
6.15762e-006
2005 1  55.5117 2687.56 5090.25 3608.89 1392.52 494.001 130.547 55.7361
17.9605 5.89922 2.27263 0.296604 0.0179743 0.00210076 0.00018606 2.71587e-005
2006 1  45.482 1060.55 6912.96 2219.64 1267.73 489 173.451 45.8373 19.5726
6.30884 2.073 0.799039 0.104353 0.00632888 0.00074038 7.52585e-005

BIOLOGY 1 70 15 1 N_Used_morphs;_lengths;_ages;_season;_by_season_in_endyr
bin low Mean_Size Wt_len-F mat_len spawn Wt_len-M
1 10 10.5 0.0063863 1 0.0063863
2 11 11.5 0.00865928 1 0.00865928
3 12 12.5 0.0114467 1 0.0114467
4 13 13.5 0.0148098 1 0.0148098
5 14 14.5 0.0188113 1 0.0188113
6 15 15.5 0.0235157 1 0.0235157
7 16 16.5 0.0289892 1 0.0289892
8 17 17.5 0.0352991 1 0.0352991
9 18 18.5 0.0425145 1 0.0425145
10 19 19.5 0.0507059 1 0.0507059
11 20 20.5 0.0599448 1 0.0599448
12 21 21.5 0.0703042 1 0.0703042
13 22 22.5 0.0818585 1 0.0818585
14 23 23.5 0.0946829 1 0.0946829
15 24 24.5 0.108854 1 0.108854
16 25 25.5 0.12445 1 0.12445
17 26 26.5 0.14155 1 0.14155
18 27 27.5 0.160232 1 0.160232
19 28 28.5 0.180579 1 0.180579
20 29 29.5 0.202673 1 0.202673
21 30 30.5 0.226596 1 0.226596
22 31 31.5 0.252433 1 0.252433
23 32 32.5 0.280267 1 0.280267
24 33 33.5 0.310187 1 0.310187
25 34 34.5 0.342277 1 0.342277
26 35 35.5 0.376627 1 0.376627
27 36 36.5 0.413324 1 0.413324
28 37 37.5 0.452458 1 0.452458
29 38 38.5 0.494119 1 0.494119
30 39 39.5 0.538399 1 0.538399
31 40 40.5 0.58539 1 0.58539
32 41 41.5 0.635184 1 0.635184
33 42 42.5 0.687876 1 0.687876
34 43 43.5 0.743558 1 0.743558
35 44 44.5 0.802328 1 0.802328
36 45 45.5 0.86428 1 0.86428
37 46 46.5 0.929512 1 0.929512
38 47 47.5 0.99812 1 0.99812
39 48 48.5 1.0702 1 1.0702
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40 49 49.5 1.14586 1 1.14586
41 50 50.5 1.22519 1 1.22519
42 51 51.5 1.3083 1 1.3083
43 52 52.5 1.39527 1 1.39527
44 53 53.5 1.48623 1 1.48623
45 54 54.5 1.58127 1 1.58127
46 55 55.5 1.68048 1 1.68048
47 56 56.5 1.78398 1 1.78398
48 57 57.5 1.89188 1 1.89188
49 58 58.5 2.00426 1 2.00426
50 59 59.5 2.12125 1 2.12125
51 60 60.5 2.24294 1 2.24294
52 61 61.5 2.36945 1 2.36945
53 62 62.5 2.50088 1 2.50088
54 63 63.5 2.63734 1 2.63734
55 64 64.5 2.77893 1 2.77893
56 65 65.5 2.92577 1 2.92577
57 66 66.5 3.07797 1 3.07797
58 67 67.5 3.23564 1 3.23564
59 68 68.5 3.39888 1 3.39888
60 69 69.5 3.56782 1 3.56782
61 70 70.5 3.74255 1 3.74255
62 71 71.5 3.9232 1 3.9232
63 72 72.5 4.10988 1 4.10988
64 73 73.5 4.30271 1 4.30271
65 74 74.5 4.50178 1 4.50178
66 75 75.5 4.70723 1 4.70723
67 76 76.5 4.91917 1 4.91917
68 77 77.5 5.13771 1 5.13771
69 78 78.5 5.36296 1 5.36296
70 79 79.5 5.59506 1 5.59506

Growth_Parameters
 Count Yr Morph A1 A2 L-at-A1 L-at-A2 K A-at-L0 Linf CVmin CVmax natM_amin
natM_max M_young M_old
 1 1982 1 0.5 6 28.1 60.2 0.2052 -1.76669 75.5491 0.1 0.1 0 2 0.2 0.2

Season gmorph GrowPattern Sex BirthSeas age age_Beg age_Mid M Len_Beg Len_Mid
SD_Beg SD_Mid Wt_Beg Wt_Mid Len_Mat Age_Mat Mat*Fecund Len:_1 SelWt:_1
RetWt:_1 Len:_2 SelWt:_2 RetWt:_2 Len:_3 SelWt:_3 RetWt:_3 Len:_4 SelWt:_4
RetWt:_4 Len:_5 SelWt:_5 RetWt:_5 Len:_6 SelWt:_6 RetWt:_6 Len:_7 SelWt:_7
RetWt:_7 Len:_8 SelWt:_8 RetWt:_8 Len:_9 SelWt:_9 RetWt:_9 Len:_10 SelWt:_10
RetWt:_10 Len:_11 SelWt:_11 RetWt:_11 Len:_12 SelWt:_12 RetWt:_12 Len:_13
SelWt:_13 RetWt:_13 Len:_14 SelWt:_14 RetWt:_14
1 1 1 1 1 0 0 0.5 0.2 10 28.1 1 2.81 0.006815 0.17908 1 0.38 0.0025897 28.1
0.17908 0.17908 28.1 0.17908 0.17908 28.1 0.17908 0.17908 28.1 0.17908
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1 1 1 1 1 1 1 1.5 0.2 32.7269 36.9026 3.27269 3.69026 0.298237 0.445742 1
0.91 0.271396 36.9026 0.445742 0.445742 36.9026 0.445742 0.445742 36.9026
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1 1 1 1 1 2 2 2.5 0.2 40.6711 44.0721 4.06711 4.40721 0.61717 0.807472 1 0.98
0.604826 44.0721 0.807472 0.807472 44.0721 0.807472 0.807472 44.0721 0.807472
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0.807472 44.0721 0.807472 0.807472 44.0721 0.807472 0.807472 44.0721 0.807472
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1 1 1 1 1 3 3 3.5 0.2 47.1415 49.9116 4.71415 4.99116 1.01154 1.22454 1 1
1.01154 49.9116 1.22454 1.22454 49.9116 1.22454 1.22454 49.9116 1.22454
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1 1 1 1 1 4 4 4.5 0.2 52.4115 54.6677 5.24115 5.46677 1.44214 1.66061 1 1
1.44214 54.6677 1.66061 1.66061 54.6677 1.66061 1.66061 54.6677 1.66061
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1 1 1 1 1 5 5 5.5 0.2 56.7039 58.5416 5.67039 5.85416 1.8768 2.08816 1 1
1.8768 58.5413 2.08816 2.08816 58.5413 2.08816 2.08816 58.5413 2.08816
2.08816 58.5413 2.08816 2.08816 58.5413 2.08816 2.08816 58.5413 2.08816
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1 1 1 1 1 6 6 6.5 0.2 60.2 61.6967 6.02 6.16967 2.29261 2.48843 1 1 2.29261
61.6933 2.48843 2.48843 61.6933 2.48843 2.48843 61.6933 2.48843 2.48843
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1 1 1 1 1 7 7 7.5 0.2 63.0475 64.2666 6.30475 6.42666 2.67421 2.84884 1 1
2.67421 64.2476 2.84884 2.84884 64.2476 2.84884 2.84884 64.2476 2.84884
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1 1 1 1 1 8 8 8.5 0.2 65.3667 66.3596 6.53667 6.63596 3.01152 3.1618 1 1
3.01152 66.3006 3.1618 3.1618 66.3006 3.1618 3.1618 66.3006 3.1618 3.1618
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1 1 1 1 1 9 9 9.5 0.2 67.2557 68.0644 6.72557 6.80644 3.29959 3.42512 1 1
3.29959 67.9344 3.42512 3.42512 67.9344 3.42512 3.42512 67.9344 3.42512
3.42512 67.9344 3.42512 3.42512 67.9344 3.42512 3.42512 67.9344 3.42512
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1 1 1 1 1 10 10 10.5 0.2 68.7943 69.453 6.87943 6.9453 3.53886 3.64146 1 1
3.53886 69.2242 3.64146 3.64146 69.2242 3.64146 3.64146 69.2242 3.64146
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1 1 1 1 1 11 11 11.5 0.2 70.0474 70.5839 7.00474 7.05839 3.73371 3.81643 1 1
3.73371 70.2376 3.81643 3.81643 70.2376 3.81643 3.81643 70.2376 3.81643
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1 1 1 1 1 12 12 12.5 0.2 71.0681 71.505 7.10681 7.1505 3.89048 3.95667 1 1
3.89048 71.0329 3.95667 3.95667 71.0329 3.95667 3.95667 71.0329 3.95667
3.95667 71.0329 3.95667 3.95667 71.0329 3.95667 3.95667 71.0329 3.95667
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1 1 1 1 1 13 13 13.5 0.2 71.8994 72.2553 7.18994 7.22553 4.0158 4.06859 1 1
4.0158 71.6577 4.06859 4.06859 71.6577 4.06859 4.06859 71.6577 4.06859
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1 1 1 1 1 14 14 14.5 0.2 72.5765 72.8663 7.25765 7.28663 4.11573 4.15781 1 1
4.11573 72.1499 4.15781 4.15781 72.1499 4.15781 4.15781 72.1499 4.15781
4.15781 72.1499 4.15781 4.15781 72.1499 4.15781 4.15781 72.1499 4.15781
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1 1 1 1 1 15 15 15.5 0.2 73.1279 73.364 7.31279 7.3364 4.19539 4.22897 1 1
4.19539 72.5389 4.22897 4.22897 72.5389 4.22897 4.22897 72.5389 4.22897
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MEAN_BODY_WT(begin)
morph year season 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 1982 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1983 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1984 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1985 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1986 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1987 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1988 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1989 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1990 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1991 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1992 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1993 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1994 1  0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
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1 1995 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1996 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1997 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1998 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 1999 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2000 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2001 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2002 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2003 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2004 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
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3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
1 2006 1 0.006815 0.298237 0.61717 1.01154 1.44214 1.8768 2.29261 2.67421
3.01152 3.29959 3.53886 3.73371 3.89048 4.0158 4.11573 4.19539
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MEAN_SIZE_TIMESERIES
morph year season beg/mid 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 1982 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1982 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1983 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1983 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1984 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1984 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1985 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1985 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1986 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1986 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1987 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1987 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1988 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1988 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364

1 1989 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1989 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1990 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1990 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1991 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1991 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1992 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1992 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1993 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1993 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1994 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1995 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1995 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1996 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1996 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1997 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1997 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 1998 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1999 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2000 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2000 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2001 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2001 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2002 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2002 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364

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1 2003 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2003 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2004 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
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67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2006 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364
1 2007 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 2007 1 1 28.1 36.9026 44.0721 49.9116 54.6677 58.5416 61.6967 64.2666
66.3596 68.0644 69.453 70.5839 71.505 72.2553 72.8663 73.364

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1 1983 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1984 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1985 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1986 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1987 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1988 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1989 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1990 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1991 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1992 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1993 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1994 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1995 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1996 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
67.2557 68.7943 70.0474 71.0681 71.8994 72.5765 73.1279
1 1997 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 1998 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 2000 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 2001 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 2002 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 2003 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 2005 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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1 2006 1 0 10 32.7269 40.6711 47.1415 52.4115 56.7039 60.2 63.0475 65.3667
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AGE_LENGTH_KEY
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 sdwithin 1
 sdbetween 1e-006

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SS2 ALTERNATIVE RUN (F08_SEXStructured.REP)

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Code_version_:__2.00o;_01/31/08;_Stock_Synthesis_2_by_Richard_Methot_(NOAA);_
using_Otter_Research_ADMB_7.0.1

Time: Sat May 17 12:47:08 2008

Data_File: maunder.DAT
Control_File: maunder.CTL

Convergence_Level:
Hessian:
Sum_of_months_on_read_was:_ 12 rescaled_to_sum_to: 1

LIKELIHOOD 2744.38
indices 187.449
discard 0
length_comps 0
age_comps 2476.08
size-at-age 0
mean_body_wt 0
Equil_catch 0
catch 33.771
Recruitment 9.09625
Parm_priors 0
Parm_devs 37.977
penalties 0
Forecast_Recruitment 1.09564e-030

Fleet surv_lambda surv_like disc_lambda disc_like length_lambda length_like
age_lambda age_like sizeage_lambda sizeage_like
1 0 0 0 0 0 0 1 73.1485 0 0
2 0 0 0 0 0 0 1 120.7 0 0
3 0 0 0 0 0 0 1 277.383 0 0
4 0 0 0 0 0 0 1 183.812 0 0
5 0 0 0 0 0 0 1 66.8626 0 0
6 0 0 0 0 0 0 1 153.008 0 0
7 1 54.4921 0 0 0 0 1 219.146 0 0
8 1 80.7492 0 0 0 0 1 751.994 0 0
9 1 52.2079 0 0 0 0 1 630.03 0 0

Source Lambda Like
mean_body_wt 0 0
Equil_catch 0 0
Catch 1 33.771
Recruitment 1 9.09625
Parm_priors 0 0
Parm_devs 1 37.977
penalties 0


Variance_adjustments_to_input_values 1 2 3 4 5 6 7 8 9
Index_extra_CV  0 0 0 0 0 0 0 0 0
Discard_extra_CV  0 0 0 0 0 0 0 0 0
MeanBodyWt_extra_CV  0 0 0 0 0 0 0 0 0
effN_mult_Lencomp  1 1 1 1 1 1 1 1 1
```

```
effN_mult_Agecomp  1 1 1 1 1 1 1 1 1
effN_mult_Len-at-age  1 1 1 1 1 1 1 1 1

PARAMETERS
Num Value Phase Min Max Init Prior PR_type SD Active_Cnt Prior_Like Bound
M-G_parmsUsing_offset_approach_#:_3
Gender:_1__Pattern:_1
1 0.287429 3 0.05 0.8 0.2 0.2 0 0.8 1 0
2 0 -3
3 29.61 -2
4 62.12 -2
5 0.200667 -3
6 0.001 -2
7 0 -3
Gender:_2__Pattern:_1
8 0.631743 3 -3 3 0.154151 0 0 0.8 2 0
9 0 -3
10 -0.0243857 -2
11 -0.155104 -3
12 0.0619715 -3
13 0 -3
14 0 -3
biology_parms
15 2.44e-006 -3
16 3.34694 -3
17 28.1 -3
18 -0.25 -3
19 1 -3
20 0 -3
21 2.44e-006 -3
22 3.34694 -3
recrdist_by_growthpattern:1
23 0 -3
recrdist_by_area:1
24 0 -3
recrdist_by_seas:1
25 4 -3
cohort_growth_dev:2
26 1 -3
MGparm_env_linkages
MG_parm_blockparms
M-G_parm_devs 1
1_YR1976 0 -

MGParm_Block_Assignments
SR_parms
1 11.1586 1  3 31 10.1121 0 -1 99 3 0
2 1 -1
3 0.6 -1
4 0 -1
5 -0.0396692 1  -5 5 0 0 -1 99 4 0
6 0 -1
Recr_Devs
1970 -0.475066 - - - - - - - 5
1971 -0.14295 - - - - - - - 6
1972 -0.0159156 - - - - - - - 7
1973 -0.0537484 - - - - - - - 8
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1975 0.291379 - - - - - - - 10
1976 0.289242 - - - - - - - 11
1977 0.138823 - - - - - - - 12
1978 -0.0294581 - - - - - - - - 13
1979 -0.377302 - - - - - - - 14
1980 0.348669 - - - - - - - 15
1981 0.384042 - - - - - - - 16
1982 0.604651 - - - - - - - 17
1983 0.588443 - - - - - - - 18
1984 0.0216812 - - - - - - - 19
1985 0.315039 - - - - - - - 20
1986 0.301765 - - - - - - - 21
1987 -0.0104133 - - - - - - - - 22
1988 -1.26072 - - - - - - - 23
1989 -0.325978 - - - - - - - 24
1990 -0.158674 - - - - - - - 25
1991 -0.0293285 - - - - - - - - 26
1992 0.0707161 - - - - - - - 27
1993 -0.178915 - - - - - - - 28
1994 0.0449586 - - - - - - - 29
1995 0.384236 - - - - - - - 30
1996 0.116184 - - - - - - - 31
1997 0.168637 - - - - - - - 32
1998 0.293698 - - - - - - - 33
1999 0.0526087 - - - - - - - 34
2000 0.209601 - - - - - - - 35
2001 0.203928 - - - - - - - 36
2002 0.222126 - - - - - - - 37
2003 -0.127249 - - - - - - - 38
2004 0.187304 - - - - - - - 39
2005 -0.627414 - - - - - - - 40
2006 -0.871828 - - - - - - - 41
2007 -1.06734 - - - - - - - 42
init_F_parms
1 0.723782 1 0 2 1 1 -1 10 43 0
2 0 -1
3 0 -1
4 0 -1
5 0 -1
6 0 -1
Q_parms
sel_parms
#_size_sel:_1
1 50.6893 2 0.5 90 60 4 -1 99 44 0
2 -9 -3
3 3.19152 3 -9 9 5 2 -1 99 45 0
4 5.72156 3 -9 9 5 9 -1 99 46 0
5 -5.35014 3 -10 10 -2 5 -1 99 47 0
6 -999 -3
#_male
#_size_sel:_2
7 44.7042 2 0.5 90 60 4 -1 99 48 0
8 -9 -3
9 4.18341 3 -9 9 5 2 -1 99 49 0
10 4.55032 3 -9 9 5 9 -1 99 50 0
11 -10 -3
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12 -999 -3
#_male
#_size_sel:_3
13 29.6876 2 0.5 70 60 4 -1 99 51 0
14 -9 -3
15 -4.31897 3 -9 9 5 2 -1 99 52 0
16 4.50078 3 -9 9 5 9 -1 99 53 0
17 -2.37533 3 -10 10 -2 5 -1 99 54 0
18 -15 -3
#_male
#_size_sel:_4
19 40.9342 2 0.5 90 60 4 -1 99 55 0
20 -0.4361 3 -9 3 -3 -3 -1 99 56 0
21 1.58879 3 -9 9 5 2 -1 99 57 0
22 -6.36985 3 -9 9 5 9 -1 99 58 0
23 -7.66248 3 -10 10 -2 5 -1 99 59 0
24 -15 -3
#_male
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25 42.5643 2 0.5 90 60 4 -1 99 60 0
26 -9 -3
27 3.80939 3 -9 9 5 2 -1 99 61 0
28 4.89772 3 -9 9 5 9 -1 99 62 0
29 -4.63763 3 -10 10 -2 5 -1 99 63 0
30 -999 -3
#_male
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31 29.9673 2 0.5 70 60 4 -1 99 64 0
32 -9 -3
33 -4.82493 3 -9 9 5 2 -1 99 65 0
34 2.84761 3 -9 9 5 9 -1 99 66 0
35 -4.70611 3 -10 10 -2 5 -1 99 67 0
36 -15 -3
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#_male
#_size_sel:_8
#_male
#_size_sel:_9
#_male
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38 15 -2
#_male
#_age_sel:_2
39 0 -2
40 15 -2
#_male
#_age_sel:_3
41 0 -2
42 15 -2
#_male
#_age_sel:_4
43 0 -2
44 15 -2
#_male
#_age_sel:_5
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45 0 -2
46 15 -2
#_male
#_age_sel:_6
47 0 -2
48 15 -2
#_male
#_age_sel:_7
49 2.41518 2 0 15 4 4 -1 99 68 0
50 -3 -3
51 0.672538 3 -9 9 2 2 -1 99 69 0
52 2 -3
53 -15 -2
54 15 -2
#_male
55 2 -5
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57 0 -4
58 0 -4
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62 3.87354 3 -9 9 2 9 -1 99 72 0
63 -15 -2
64 -999 -3
#_male
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66 0 -4
67 0 -4
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70 -9 -3
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72 2.97285 3 -9 9 2 9 -1 99 75 0
73 -15 -3
74 -999 -3
#_male
75 0 -5
76 0 -4
77 0 -4
78 0 -4
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sel_parm_blockparms
79 47.1667 2 0.5 90 60 4 -1 99 76 0
80 3.8142 3 -9 9 5 2 -1 99 77 0
81 -10 -3
82 51.6208 2 0.5 90 60 4 -1 99 78 0
83 3.53032 3 -9 9 5 2 -1 99 79 0
84 -10 -3
85 49.4883 2 0.5 90 60 4 -1 99 80 0
86 5.11851 3 -9 9 5 2 -1 99 81 0
87 -6.37802 3 -10 10 -2 5 -1 99 82 0
88 48.8969 2 0.5 90 60 4 -1 99 83 0
89 3.43883 3 -9 9 5 2 -1 99 84 0
90 -8.08323 3 -10 10 -2 5 -1 99 85 0
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RECR_DIST
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1977  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1978  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1979  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1980  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1981  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1982  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
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0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1984  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1985  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1986  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1987  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1988  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
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0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1990  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1991  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
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0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1993  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
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0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1995  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1996  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1997  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
1998  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
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2000  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
2001  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
2002  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
2003  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
2004  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
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2006  0.287429 0 29.61 62.12 0.200667 0.001 0 0.631743 0 -0.0243857 -0.155104
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0.0619715 0 0 2.44e-006 3.34694 28.1 -0.25 1 0 2.44e-006 3.34694 0 0 4 1
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3 2003  49.4883 -9 5.31366 4.50078 -7.26424 -15
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3 2005  49.4883 -9 4.55052 4.50078 -3.73115 -15
3 2006  49.4883 -9 5.11851 4.50078 -6.37802 -15
3 2008  29.6876 -9 -4.31897 4.50078 -2.37533 -15
4 1976  40.9342 -0.4361 1.58879 -6.36985 -7.66248 -15
4 1994  40.9342 -0.4361 2.92433 -6.36985 -9.08311 -15
4 1995  40.9342 -0.4361 1.64381 -6.36985 -9.44956 -15
4 1996  40.9342 -0.4361 3.35385 -6.36985 -8.5459 -15
4 1997  40.9342 -0.4361 1.91633 -6.36985 -8.55451 -15
4 1998  40.9342 -0.4361 2.09417 -6.36985 -5.85181 -15
4 1999  40.9342 -0.4361 1.40095 -6.36985 -6.74758 -15
4 2000  40.9342 -0.4361 2.5748 -6.36985 -4.88967 -15
4 2001  40.9342 -0.4361 1.05933 -6.36985 -8.55953 -15
4 2002  40.9342 -0.4361 1.76618 -6.36985 -5.7487 -15
4 2003  40.9342 -0.4361 3.16369 -6.36985 -8.25137 -15
4 2004  40.9342 -0.4361 1.87009 -6.36985 -8.43195 -15
4 2005  40.9342 -0.4361 1.14112 -6.36985 -8.17888 -15
4 2006  40.9342 -0.4361 1.58879 -6.36985 -7.66248 -15
5 1976  42.5643 -9 3.80939 4.89772 -4.63763 -999
5 1982  42.5643 -9 4.44364 4.89772 -4.69098 -999
5 1983  42.5643 -9 3.99322 4.89772 -3.79009 -999
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5 1984  42.5643 -9 3.24175 4.89772 -2.41575 -999
5 1985  42.5643 -9 4.01911 4.89772 -4.66292 -999
5 1986  42.5643 -9 4.04195 4.89772 -4.44883 -999
5 1987  42.5643 -9 3.93746 4.89772 -4.48726 -999
5 1988  42.5643 -9 4.13871 4.89772 -3.92087 -999
5 1989  42.5643 -9 3.31822 4.89772 -4.93937 -999
5 1990  42.5643 -9 4.03864 4.89772 -6.05754 -999
5 1991  42.5643 -9 3.45317 4.89772 -6.63433 -999
5 1992  42.5643 -9 3.53276 4.89772 -6.72944 -999
5 1993  42.5643 -9 3.23539 4.89772 -5.66957 -999
5 1994  42.5643 -9 3.97209 4.89772 -4.13083 -999
5 1995  48.8969 -9 4.5178 4.89772 -7.82098 -999
5 1996  48.8969 -9 4.50918 4.89772 -8.72458 -999
5 1997  48.8969 -9 4.02865 4.89772 -9.09116 -999
5 1998  48.8969 -9 3.78429 4.89772 -9.18418 -999
5 1999  48.8969 -9 3.54701 4.89772 -9.00449 -999
5 2000  48.8969 -9 3.85084 4.89772 -9.0112 -999
5 2001  48.8969 -9 4.11739 4.89772 -8.93501 -999
5 2002  48.8969 -9 3.72922 4.89772 -8.63216 -999
5 2003  48.8969 -9 3.65321 4.89772 -8.71784 -999
5 2004  48.8969 -9 3.70642 4.89772 -6.12511 -999
5 2005  48.8969 -9 3.56851 4.89772 -7.53864 -999
5 2006  48.8969 -9 3.43883 4.89772 -8.08323 -999
5 2008  42.5643 -9 3.80939 4.89772 -4.63763 -999
6 1976  29.9673 -9 -4.82493 2.84761 -4.70611 -15
6 1982  29.9673 -9 -4.82493 2.84761 -3.93873 -15
6 1983  29.9673 -9 -4.82493 2.84761 -4.23117 -15
6 1984  29.9673 -9 -4.82493 2.84761 -3.40391 -15
6 1985  29.9673 -9 -4.82493 2.84761 -4.38992 -15
6 1986  29.9673 -9 -4.82493 2.84761 -4.56843 -15
6 1987  29.9673 -9 -4.82493 2.84761 -4.57319 -15
6 1988  29.9673 -9 -4.82493 2.84761 -3.77136 -15
6 1989  29.9673 -9 -4.82493 2.84761 -5.36906 -15
6 1990  29.9673 -9 -4.82493 2.84761 -4.7281 -15
6 1991  29.9673 -9 -4.82493 2.84761 -6.67592 -15
6 1992  29.9673 -9 -4.82493 2.84761 -6.57424 -15
6 1993  29.9673 -9 -4.82493 2.84761 -6.38603 -15
6 1994  29.9673 -9 -4.82493 2.84761 -4.22382 -15
6 1995  41.7491 -9 4.22227 2.84761 -6.25233 -15
6 1996  41.7491 -9 4.17597 2.84761 -6.49621 -15
6 1997  41.7491 -9 3.75226 2.84761 -6.54798 -15
6 1998  41.7491 -9 2.89289 2.84761 -7.56326 -15
6 1999  41.7491 -9 2.51219 2.84761 -3.56132 -15
6 2000  41.7491 -9 2.82443 2.84761 -7.43189 -15
6 2001  41.7491 -9 3.357 2.84761 -7.33845 -15
6 2002  41.7491 -9 3.03385 2.84761 -3.45369 -15
6 2003  41.7491 -9 3.58152 2.84761 -3.99071 -15
6 2004  41.7491 -9 2.91114 2.84761 -3.61157 -15
6 2005  41.7491 -9 4.89448 2.84761 -4.56464 -15
6 2006  41.7491 -9 4.24017 2.84761 -5.09092 -15
6 2008  29.9673 -9 -4.82493 2.84761 -4.70611 -15

SELparm(Age)_By_Year_after_adjustments
Fleet/Svy Year
1 1976  0 15
2 1976  0 15
3 1976  0 15
```

```
4 1976  0 15
5 1976  0 15
6 1976  0 15
7 1976  2.41518 -3 0.672538 2 -15 15 2 0 0 0
8 1976  2.43197 -9 0.649506 3.87354 -15 -999 2 0 0 0
9 1976  2.78635 -9 0.480917 2.97285 -15 -999 0 0 0 0

EXPLOITATION   Hrate_is_Continuous_F  Fleet_in_columns;_year_in_rows
yr seas 1 2 3 4 5 6
init_yr 1  0.723782 0 0 0 0 0
1976 1  0.595971 0.120504 0 0 0.182746 0.102763
1977 1  0.452968 0.138043 0 0 0.198743 0.105532
1978 1  0.395394 0.164894 0 0 0.237205 0.129656
1979 1  0.677546 0.309978 0 0 0.307296 0.162542
1980 1  0.797017 0.407128 0 0 0.487191 0.240901
1981 1  1.19887 0.256098 0 0 0.544173 0.12646
1982 1  0.424346 0.132745 0 0 0.378628 0.105932
1983 1  0.326181 0.154116 0 0 0.531414 0.127548
1984 1  0.693828 0.279954 0 0 0.45092 0.125526
1985 1  0.678355 0.261015 0 0 0.314138 0.0492914
1986 1  0.774488 0.220651 0 0 0.509996 0.246336
1987 1  0.719672 0.160732 0 0 0.344301 0.218477
1988 1  1.07617 0.31822 0 0 0.516052 0.217432
1989 1  1.0867 1.09132 0.255945 0 0.281522 0.0906378
1990 1  0.515997 1.01208 0.227523 0 0.359813 0.190948
1991 1  0.858567 0.984552 0.177143 0 0.543683 0.320465
1992 1  1.10926 1.19904 0.0821956 0 0.446145 0.220269
1993 1  0.66306 0.53421 0.0903016 0 0.608194 0.516314
1994 1  1.08322 0.675482 0.0586221 0.0508671 0.445836 0.454459
1995 1  0.648218 0.922569 0.0100902 0.0230672 0.319993 0.0571902
1996 1  0.301136 0.3308 0.0238882 0.00497588 0.346589 0.0330267
1997 1  0.296031 0.0876328 0.0108111 0.00358307 0.386893 0.0245901
1998 1  0.2913 0.0577801 0.00926402 0.00475925 0.359291 0.0387428
1999 1  0.201478 0.0738002 0.0337539 0.0125848 0.191532 0.0356813
2000 1  0.124894 0.0817649 0.0198297 0.00363208 0.29149 0.0442511
2001 1  0.102031 0.0523412 0.00643927 0.00760591 0.174506 0.0547021
2002 1  0.140309 0.0731754 0.0081662 0.00413942 0.122098 0.0344671
2003 1  0.123994 0.0630334 0.0104415 0.00198174 0.170471 0.0343858
2004 1  0.158974 0.0813588 0.00487777 0.00207774 0.150939 0.0505257
2005 1  0.169467 0.0725086 0.00457958 0.00259278 0.164474 0.0372862
2006 1  0.119758 0.0771549 0.00614518 0.00237909 0.17651 0.0384431
2007 1  0.105255 0.0547262 0.0077552 0.00349481 0.178589 0.0899916
2008 1  0.146586 0.076877 0.0490183 0.00559261 0.279572 1.78441
2009 1  0.102961 0.0539981 0.0344302 0.00392823 0.19637 1.25336

TIME_SERIES    Bio-Smry_age:_1  Hrate_is_Continuous_F
pop year period season bio-all bio-smry SpawnBio recruit-0  enc_catch:_1
dead_catch:_1 ret_catch:_1 obs_cat:_1 Hrate-1 enc_catch:_2 dead_catch:_2
ret_catch:_2 obs_cat:_2 Hrate-2 enc_catch:_3 dead_catch:_3 ret_catch:_3
obs_cat:_3 Hrate-3 enc_catch:_4 dead_catch:_4 ret_catch:_4 obs_cat:_4 Hrate-4
enc_catch:_5 dead_catch:_5 ret_catch:_5 obs_cat:_5 Hrate-5 enc_catch:_6
dead_catch:_6 ret_catch:_6 obs_cat:_6 Hrate-6 SPB_vir_LH
1 1974 VIRG 1 169294 160562 125895 70165.5 0 0 0 0 0  0 0 0 0 0  0 0 0 0 0  0
0 0 0 0  0 0 0 0 0  0 0 0 0 0  125895
1 1975 INIT 1 70507.6 62115.1 38034.2 67436.6 15955.4 15955.4 15955.4 10000
0.723782 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 38034.2
```

1 1976 TIME 1 73637.2 63897.1 38600.2 78264.9 11175.1 11175.1 11175.1 10769.5
0.595971 4459.51 4459.51 4459.51 4367.04 0.120504 0 0 0 0 0 0 0 0 0 0 7075.59
7075.59 7075.59 6850.4 0.182746 273.052 273.052 273.052 276.45 0.102763 38805
1 1977 TIME 1 68514.9 60135.1 35362.7 67335 9016.7 9016.7 9016.7 8889.22
0.452968 4594.56 4594.56 4594.56 4686.84 0.138043 0 0 0 0 0 0 0 0 0 0 6889.46
6889.46 6889.46 7086.62 0.198743 285.311 285.311 285.311 285.983 0.105532
36636.5
1 1978 TIME 1 63147.1 56065.1 33530.6 56905.9 7489.51 7489.51 7489.51 8059.54
0.395394 4888.77 4888.77 4888.77 4908.21 0.164894 0 0 0 0 0 0 0 0 0 0 7342.06
7342.06 7342.06 7339.71 0.237205 297.802 297.802 297.802 296.197 0.129656
34607.1
1 1979 TIME 1 54855.8 49854.5 30479.3 40187.4 10221.8 10221.8 10221.8 10650.2
0.677546 7032.37 7032.37 7032.37 7296.09 0.309978 0 0 0 0 0 0 0 0 0 0 7306.71
7306.71 7306.71 7611.56 0.307296 302.38 302.38 302.38 307.167 0.162542
31239.5
1 1980 TIME 1 45530.2 35193.8 21425.8 83056.9 7359.24 7359.24 7359.24 7972.9
0.797017 5916.5 5916.5 5916.5 6188.79 0.407128 0 0 0 0 0 0 0 0 0 0 7490.68
7490.68 7490.68 7904.31 0.487191 318.945 318.945 318.945 318.981 0.240901
22997
1 1981 TIME 1 42952.7 32244.1 17936.1 86047.5 5730.28 5730.28 5730.28 6168.38
1.19887 3334.65 3334.65 3334.65 3383.58 0.256098 0 0 0 0 0 0 0 0 0 0 8030.7
8030.7 8030.7 8220.48 0.544173 334.222 334.222 334.222 331.74 0.12646 19563.8
1 1982 TIME 1 48837.1 35485.2 18602.4 107287 7904.02 7904.02 7904.02 7536
0.424346 2905.74 2905.74 2905.74 2864 0.132745 0 0 0 0 0 0 0 0 0 0 8637.11
8637.11 8637.11 8267 0.378628 297.044 297.044 297.044 296 0.105932 20631.8
1 1983 TIME 1 54094.4 40957.1 21664.9 105562 9740.43 9740.43 9740.43 10201
0.326181 3159.47 3159.47 3159.47 3201 0.154116 0 0 0 0 0 0 0 0 0 0 11804.4
11804.4 11804.4 12687 0.531414 379.477 379.477 379.477 376 0.127548 23661.8
1 1984 TIME 1 48928.3 41474.8 22439.4 59891.7 11287.9 11287.9 11287.9 11455
0.693828 5459.4 5459.4 5459.4 5674 0.279954 0 0 0 0 0 0 0 0 0 0 8124.75
8124.75 8124.75 8512 0.45092 415.59 415.59 415.59 415 0.125526 23572.3
1 1985 TIME 1 42851.1 32856.5 17557.3 80310.1 10762.2 10762.2 10762.2 10767
0.678355 3868.25 3868.25 3868.25 3907 0.261015 0 0 0 0 0 0 0 0 0 0 5556.91
5556.91 5556.91 5665 0.314138 92.1642 92.1642 92.1642 92 0.0492914 19076.4
1 1986 TIME 1 41503 31640.1 16551.5 79251.2 9112.71 9112.71 9112.71 9500
0.774488 2634.47 2634.47 2634.47 2687 0.220651 0 0 0 0 0 0 0 0 0 0 8088.58
8088.58 8088.58 8102 0.509996 594.386 594.386 594.386 578 0.246336 18050.6
1 1987 TIME 1 37931.4 30713.3 15734.3 58000 10107.3 10107.3 10107.3 9945
0.719672 2311.57 2311.57 2311.57 2326 0.160732 0 0 0 0 0 0 0 0 0 0 5509.26
5509.26 5509.26 5519 0.344301 528.127 528.127 528.127 522 0.218477 16831.5
1 1988 TIME 1 29650.4 27583 14181.1 16612.2 12067.3 12067.3 12067.3 11616
1.07617 3060.85 3060.85 3060.85 3071 0.31822 0 0 0 0 0 0 0 0 0 0 6534.14
6534.14 6534.14 6634 0.516052 344.025 344.025 344.025 341 0.217432 14495.4
1 1989 TIME 1 17405.3 12140.6 6192.17 42303.9 5649.64 5649.64 5649.64 6218
1.0867 1787.57 1787.57 1787.57 1908 1.09132 718.894 718.894 718.894 709
0.255945 0 0 0 0 0 1393.07 1393.07 1393.07 1435 0.281522 45.2256 45.2256
45.2256 45 0.0906378 6992.41
1 1990 TIME 1 18307.5 12084 5787.36 50008 2659.89 2659.89 2659.89 2962
0.515997 962.18 962.18 962.18 1237 1.01208 1349.21 1349.21 1349.21 1214
0.227523 0 0 0 0 0 2311.96 2311.96 2311.96 2329 0.359813 241.63 241.63 241.63
234 0.190948 6733.33
1 1991 TIME 1 23405.4 16322.6 7973.46 56913.3 4564.8 4564.8 4564.8 4629
0.858567 1351.05 1351.05 1351.05 1595 0.984552 1147.33 1147.33 1147.33 1052
0.177143 0 0 0 0 0 3617.09 3617.09 3617.09 3611 0.543683 457.311 457.311
457.311 429 0.320465 9050.05
1 1992 TIME 1 26815 18986.9 9121.77 62901.7 7857.21 7857.21 7857.21 6361
1.10926 1017.97 1017.97 1017.97 1168 1.19904 721.802 721.802 721.802 690

0.0821956 0 0 0 0 0 3511.1 3511.1 3511.1 3242 0.446145 360.771 360.771
360.771 344 0.220269 10311.6
1 1993 TIME 1 26974.2 20875.4 9838.36 49006 5580.8 5580.8 5580.8 4401 0.66306
1332.53 1332.53 1332.53 1313 0.53421 865.506 865.506 865.506 846 0.0903016 0
0 0 0 0 4951.42 4951.42 4951.42 4006 0.608194 947.107 947.107 947.107 910
0.516314 10765.4
1 1994 TIME 1 27644.6 20015.5 9723.95 61302.2 6639.75 6639.75 6639.75 4969
1.08322 1627.02 1627.02 1627.02 1620 0.675482 434.959 434.959 434.959 434
0.0586221 475.364 475.364 475.364 472 0.0508671 4570.43 4570.43 4570.43 4231
0.445836 703.221 703.221 703.221 687 0.454459 10883.6
1 1995 TIME 1 31163.1 20452.4 9985.89 86064.1 3968.62 3968.62 3968.62 4911
0.648218 1630.38 1630.38 1630.38 2066 0.922569 138.145 138.145 138.145 138
0.0100902 168.186 168.186 168.186 170 0.0230672 2249.22 2249.22 2249.22 2459
0.319993 769.961 769.961 769.961 752 0.0571902 11613.9
1 1996 TIME 1 40070.9 31878.6 15857.5 65827.7 3915.07 3915.07 3915.07 3947
0.301136 1692.48 1692.48 1692.48 1913 0.3308 355.796 355.796 355.796 355
0.0238882 108.313 108.313 108.313 108 0.00497588 4333.67 4333.67 4333.67 4454
0.346589 706.866 706.866 706.866 681 0.0330267 17102.8
1 1997 TIME 1 47258.2 38624.7 20363.8 69372.8 3374.12 3374.12 3374.12 3313
0.296031 673.962 673.962 673.962 681 0.0876328 240.434 240.434 240.434 239
0.0108111 86.2928 86.2928 86.2928 86 0.00358307 6154.74 6154.74 6154.74 5382
0.386893 570.02 570.02 570.02 556 0.0245901 21676.1
1 1998 TIME 1 55123.8 45340.2 24546.4 78614.4 4127.67 4127.67 4127.67 3730
0.2913 1380.56 1380.56 1380.56 1346 0.0577801 255.138 255.138 255.138 254
0.00926402 135.447 135.447 135.447 135 0.00475925 6787.05 6787.05 6787.05
5659 0.359291 741.571 741.571 741.571 734 0.0387428 26033.5
1 1999 TIME 1 59112.3 51424.7 28441.7 61773 3763.53 3763.53 3763.53 3551
0.201478 1297.52 1297.52 1297.52 1271 0.0738002 1182.3 1182.3 1182.3 1181
0.0337539 367.901 367.901 367.901 367 0.0125848 4020.34 4020.34 4020.34 3795
0.191532 707.321 707.321 707.321 711 0.0356813 29610.2
1 2000 TIME 1 65313.7 56319.2 32751.1 72273.6 3657.11 3657.11 3657.11 3564
0.124894 1560.75 1560.75 1560.75 1521 0.0817649 593.524 593.524 593.524 592
0.0198297 134.001 134.001 134.001 134 0.00363208 7939.37 7939.37 7939.37 7470
0.29149 939.293 939.293 939.293 952 0.0442511 34118.3
1 2001 TIME 1 67734 58790.4 34849.3 71864.7 3699.76 3699.76 3699.76 3705
0.102031 1290.86 1290.86 1290.86 1265 0.0523412 229.794 229.794 229.794 230
0.00643927 237.006 237.006 237.006 238 0.00760591 5364.32 5364.32 5364.32
5279 0.174506 1207.48 1207.48 1207.48 1274 0.0547021 36208.7
1 2002 TIME 1 72871.3 63763.5 39099.3 73184.4 4625.61 4625.61 4625.61 4723
0.140309 1868.09 1868.09 1868.09 1850 0.0731754 306.511 306.511 306.511 307
0.0081662 141.793 141.793 141.793 142 0.00413942 3634.43 3634.43 3634.43 3632
0.122098 768.918 768.918 768.918 777 0.0344671 40483.7
1 2003 TIME 1 75635 69212.8 43582.6 51604.4 4820.88 4820.88 4820.88 4835
0.123994 1609.67 1609.67 1609.67 1614 0.0630334 444.34 444.34 444.34 445
0.0104415 82.9877 82.9877 82.9877 83 0.00198174 5254.48 5254.48 5254.48 5279
0.170471 879.156 879.156 879.156 882 0.0343858 44558.8
1 2004 TIME 1 77075.7 68279.6 44377.6 70679.9 6062.31 6062.31 6062.31 6036
0.158974 2163.8 2163.8 2163.8 2193 0.0813588 169.967 169.967 169.967 170
0.00487777 74.017 74.017 74.017 74 0.00207774 4793.74 4793.74 4793.74 4831
0.150939 1044.07 1044.07 1044.07 1034 0.0505257 45714.6
1 2005 TIME 1 72282.6 68388 44595.1 31294.5 5838.54 5838.54 5838.54 5984
0.169467 1829 1829 1829 1841 0.0725086 152.922 152.922 152.922 153 0.00457958
76.9755 76.9755 76.9755 77 0.00259278 4675.1 4675.1 4675.1 4724 0.164474
988.022 988.022 988.022 999 0.0372862 45187.1
1 2006 TIME 1 64881.1 61831 41537.1 24508.7 4323.21 4323.21 4323.21 4481
0.119758 1761.93 1761.93 1761.93 1781 0.0771549 213.499 213.499 213.499 214

0.00614518 73.9008 73.9008 73.9008 74 0.00237909 4810.2 4810.2 4810.2 4992
0.17651 784.395 784.395 784.395 795 0.0384431 42000.8
1 2007 TIME 1 55966 53457.5 37275.3 20156.4 3227.7 3227.7 3227.7 3279
0.105255 1200.54 1200.54 1200.54 1211 0.0547262 219.77 219.77 219.77 220
0.0077552 83.9611 83.9611 83.9611 84 0.00349481 4330.67 4330.67 4330.67 4445
0.178589 1131.91 1131.91 1131.91 1130 0.0899916 37656.6
1 2008 TIME 1 52398 45104.3 32757 58607.2 3279 3279 3279 3279 0.146586 1211
1211 1211 1211 0.076877 220 220 220 220 0.0490183 84 84 84 84 0.00559261 4445
4445 4445 4445 0.279572 1130 1130 1130 1130 1.78441 33865.6
1 2009 FORE 1 52385.1 43653 32588.8 70165.5 1686.62 1686.62 1686.62 1686.62
0.102961 623.303 623.303 623.303 623.303 0.0539981 514.627 514.627 514.627
514.627 0.0344302 35.6132 35.6132 35.6132 35.6132 0.00392823 2297.71 2297.71
2297.71 2297.71 0.19637 11587.2 11587.2 11587.2 11587.2 1.25336 32588.8

SPR_series uses_R0= 70165.5   ###note_Y/R_unit_is_Dead_Biomass
Year Bio_all Bio_Smry SPBzero SPBfished SPBfished/R SPR Y/R GenTime Actual:
Bio_all Bio_Smry Enc_Catch Dead_Catch Retain_Catch SPB Recruits Tot_Exploit
More_F(by_morph): aveF-1 aveF-2 maxF-1 maxF-2
1976 57645.9 48913.8 125895 29699.3 0.423275 0.235906 0.244023 0.380641 +
73637.2 63897.1 22983.3 22983.3 22983.3 38600.2 78264.9 0.312115 + 0.29812
0.522346 0.794787 0.804949
1977 59599.1 50867 125895 31751.4 0.452522 0.252207 0.238633 0.418809 +
68514.9 60135.1 20786 20786 20786 35362.7 67335 0.30338 + 0.246158 0.435314
0.674094 0.697938
1978 57726.5 48994.4 125895 30729.8 0.437962 0.244092 0.238203 0.43384 +
63147.1 56065.1 20018.1 20018.1 20018.1 33530.6 56905.9 0.317008 + 0.234818
0.419158 0.659411 0.69658
1979 45272 36539.9 125895 21031 0.299735 0.167053 0.250179 0.353537 +
54855.8 49854.5 24863.3 24863.3 24863.3 30479.3 40187.4 0.453247 + 0.388711
0.69124 1.08718 1.14079
1980 38767.2 30035.1 125895 16681.3 0.237742 0.132502 0.250605 0.320266 +
45530.2 35193.8 21085.4 21085.4 21085.4 21425.8 83056.9 0.463107 + 0.488424
0.874038 1.3873 1.47545
1981 39166.6 30434.5 125895 16564.3 0.236075 0.131573 0.251742 0.244391 +
42952.7 32244.1 17429.8 17429.8 17429.8 17936.1 86047.5 0.405792 + 0.634833
1.11707 1.71882 1.76717
1982 41473.6 32741.5 125895 20111.8 0.286634 0.159751 0.235419 0.505582 +
48837.1 35485.2 19743.9 19743.9 19743.9 18602.4 107287 0.404281 + 0.211494
0.410864 0.919041 0.919041
1983 37586.6 28854.5 125895 17607.2 0.250939 0.139857 0.238694 0.486154 +
54094.4 40957.1 25083.8 25083.8 25083.8 21664.9 105562 0.463704 + 0.257458
0.457168 0.96694 0.973983
1984 35566.7 26834.6 125895 14824.5 0.211278 0.117753 0.245292 0.356653 +
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0.783557 1.35485 1.35485
1985 38046.3 29314.2 125895 16283.6 0.232074 0.129343 0.248405 0.402099 +
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0.658032 1.24314 1.24314
1986 34967.7 26235.6 125895 14323.3 0.204136 0.113772 0.249112 0.327682 +
41503 31640.1 20430.1 20430.1 20430.1 16551.5 79251.2 0.492257 + 0.548153
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1987 37190.7 28458.6 125895 15733.9 0.22424 0.124977 0.248963 0.343297 +
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0.919914 1.7444 1.7444
1992 33101.4 24369.3 125895 12734.8 0.181496 0.101154 0.248914 0.368044 +
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0.221455 0.362297 0.364519
2004 84715.7 75983.6 125895 52055.9 0.741901 0.413488 0.199336 0.501159 +
77075.7 68279.6 14307.9 14307.9 14307.9 44377.6 70679.9 0.185634 + 0.113706
0.236167 0.385848 0.390276
2005 82653 73920.9 125895 49400.5 0.704057 0.392396 0.208511 0.461895 +
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0.273112 0.39839 0.398926
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64881.1 61831 11967.1 11967.1 11967.1 41537.1 24508.7 0.184447 + 0.106859
0.224993 0.374696 0.374267
2007 85594 76861.9 125895 53561.8 0.763363 0.425449 0.19134 0.511678 +
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0.213252 0.343648 0.348872

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2008 26736.1 18004  125895 10039.8 0.143088 0.079748 0.232392 0.477942 +
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1.59044 1.94559
2009 33726.1 24994  125895 15154.4 0.215981 0.120374 0.231781 0.506898 +
52385.1 43653 16745 16745 16745 32588.8 70165.5 0.319653 +  0.229961 0.412901
1.11712 1.36657

SPAWN_RECRUIT Function: 3 - - - - -
11.1586 Ln(R0) 70165.5
1 steep
0.6 stddev_recr
0 env_link_
-0.0396692 init-eq 67436.6
1970 2007 recdev:start_end 1957 first_year_with_full_bias_adjustment
year spawn_bio exp-recr with-env bias-adj pred-recr dev
S/Rcurve 125895 70165.5
Virg 125895 70165.5 70165.5 58607.2 70165.5
Init 38034.2 67436.6 67436.6 56327.8 67436.6
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2008 32757 70165.5 70165.5 58607.2 58607.2 8.88178e-016 forecast
2009 32588.8 70165.5 70165.5 70165.5 70165.5 0 forecast

N_est r.m.s.e.
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7 1998 55003.3 7.75628 17.7361 0.000322456 0.206629 -0.827101 8.01134 6.43451
7 1999 60239.4 11.0546 19.4246 0.000322456 0.133137 -0.563692 8.96307 6.94669
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9 2007 37594.1 2.09713 1.30544 3.47246e-005 0.197404 0.47403 2.88317 1.26066
9 2008 27605.4 2.21 0.958586 3.47246e-005 0.302095 0.835289 3.82257 2.62556

INDEX_1
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2 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
3 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
4 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
5 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
6 0  1.0 0  0.00  0.0 0  --  1 0 0 0 0 0 0 0 0
7 0  1.0 0  0.00  0.0 0 0.000322456  0 0 16 16 0.45585 0.160359 0.160359 0 0
8 0  1.0 0  0.00  0.0 0 3.66556e-005  0 0 32 32 0.463306 0.19294 0.19294 0 0
9 0  1.0 0  0.00  0.0 0 3.47246e-005  0 0 32 32 0.58456 0.320599 0.320599 0 0
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pen_mean_Qdev_not_in_logL_in_randwalk_approach

INDEX_3
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3 0 -- 0 --  0 0
4 0 -- 0 --  0 0
5 0 -- 0 --  0 0
6 0 -- 0 --  0 0
7 0 -- 0 --  0 0
8 0 -- 0 --  0 0
9 0 -- 0 --  0 0

DISCARD  log(L)_based_on_T-distribution_with_DF=_30
as_fraction
index year seas obs exp cv Dev Like Like+log(s)


MEAN_BODY_WT log(L)_based_on_T-distribution_with_DF=_30
 year seas index Mkt obs exp cv Dev Like Like+log(s)
 1982 1 1 0 0.504 0.584366 0.1 -0.0803661 1.26098 1.26098
 1983 1 1 0 0.521 0.510163 0.1 0.010837 0.0223376 0.0223376
 1984 1 1 0 0.518 0.66308 0.1 -0.14508 3.60042 3.60042
```

```
 1985 1 1 0 0.575 0.693915 0.1 -0.118915 2.06578 2.06578
 1986 1 1 0 0.613 0.700616 0.1 -0.0876163 1.02112 1.02112
 1987 1 1 0 0.581 0.652126 0.1 -0.0711255 0.755581 0.755581
 1988 1 1 0 0.588 0.660922 0.1 -0.0729225 0.774955 0.774955
 1989 1 1 0 0.668 0.712032 0.1 -0.044032 0.222879 0.222879
 1990 1 1 0 0.54 0.562826 0.1 -0.0228264 0.0920465 0.0920465
 1991 1 1 0 0.537 0.590777 0.1 -0.0537771 0.509679 0.509679
 1992 1 1 0 0.595 0.554206 0.1 0.040794 0.240984 0.240984
 1993 1 1 0 0.571 0.575056 0.1 -0.00405563 0.00260626 0.00260626
 1994 1 1 0 0.605 0.636079 0.1 -0.0310787 0.135745 0.135745
 1995 1 1 0 0.675 0.636646 0.1 0.038354 0.16592 0.16592
 1996 1 1 0 0.621 0.701931 0.1 -0.0809313 0.853586 0.853586
 1997 1 1 0 0.697 0.8833 0.1 -0.1863 3.31099 3.31099
 1998 1 1 0 0.759 1.03133 0.1 -0.272325 5.53432 5.53432
 1999 1 1 0 0.755 1.08782 0.1 -0.332816 7.74066 7.74066
 2000 1 1 0 0.85 1.01957 0.1 -0.169574 1.93089 1.93089
 2001 1 1 0 0.903 0.975038 0.1 -0.0720384 0.325384 0.325384
 2002 1 1 0 0.898 0.963027 0.1 -0.065027 0.268582 0.268582
 2003 1 1 0 0.999 1.05069 0.1 -0.0516921 0.13772 0.13772
 2004 1 1 0 0.983 1.07207 0.1 -0.0890714 0.418508 0.418508
 2005 1 1 0 0.949 1.36764 0.1 -0.41864 7.74957 7.74957
 2006 1 1 0 0.947 1.08413 0.1 -0.137135 1.04725 1.04725

FIT_LEN_COMPS
Index Year Seas Gender Mkt Nsamp effN Like

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
1 0 0 0 0 0 0 -1.#IND
2 0 0 0 0 0 0 -1.#IND
3 0 0 0 0 0 0 -1.#IND
4 0 0 0 0 0 0 -1.#IND
5 0 0 0 0 0 0 -1.#IND
6 0 0 0 0 0 0 -1.#IND
7 0 0 0 0 0 0 -1.#IND
8 0 0 0 0 0 0 -1.#IND
9 0 0 0 0 0 0 -1.#IND

FIT_AGE_COMPS
Index Year Seas Gender Mkt Ageerr Lbin_lo Lbin_hi Nsamp effN Like
1 1982 1 0 0 1 1 55 200 678.832 3.73748
1 1983 1 0 0 1 1 55 200 142.913 2.97809
1 1984 1 0 0 1 1 55 200 513.809 1.7752
1 1985 1 0 0 1 1 55 200 286.356 2.18121
1 1986 1 0 0 1 1 55 200 104.001 3.92782
1 1987 1 0 0 1 1 55 200 4753.23 0.697715
1 1988 1 0 0 1 1 55 200 440.994 1.74849
1 1989 1 0 0 1 1 55 200 1522.02 0.988077
1 1990 1 0 0 1 1 55 200 42.705 7.42745
1 1991 1 0 0 1 1 55 200 127.636 2.24531
1 1992 1 0 0 1 1 55 200 119.563 2.35414
1 1993 1 0 0 1 1 55 200 484.346 4.41191
1 1994 1 0 0 1 1 55 200 35.1191 5.53968
1 1995 1 0 0 1 1 55 200 132.572 1.80091
1 1996 1 0 0 1 1 55 200 41.408 10.594
1 1997 1 0 0 1 1 55 200 64.4139 5.97107
1 1998 1 0 0 1 1 55 200 1676.86 0.959758
```

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1 1999 1 0 0 1 1 55 200 389.541 2.03139
1 2000 1 0 0 1 1 55 200 384.548 2.15074
1 2001 1 0 0 1 1 55 200 510.157 2.00466
1 2002 1 0 0 1 1 55 200 250.604 2.39995
1 2003 1 0 0 1 1 55 200 12434.5 0.135202
1 2004 1 0 0 1 1 55 200 2333.25 0.41005
1 2005 1 0 0 1 1 55 200 402.36 1.70737
1 2006 1 0 0 1 1 55 200 948.285 1.44493
1 2007 1 0 0 1 1 55 200 271.367 1.52587
2 1982 1 0 0 1 1 55 200 28.3912 7.41697
2 1983 1 0 0 1 1 55 200 68.3539 6.5871
2 1984 1 0 0 1 1 55 200 35.6905 4.91642
2 1985 1 0 0 1 1 55 200 306.175 1.70836
2 1986 1 0 0 1 1 55 200 54.315 3.99331
2 1987 1 0 0 1 1 55 200 829.349 1.28283
2 1988 1 0 0 1 1 55 200 88.1069 9.1314
2 1989 1 0 0 1 1 55 200 415.652 2.01452
2 1990 1 0 0 1 1 55 200 33.2601 6.86815
2 1991 1 0 0 1 1 55 200 111.386 2.92482
2 1992 1 0 0 1 1 55 200 54.3118 4.77538
2 1993 1 0 0 1 1 55 200 601.718 1.12501
2 1994 1 0 0 1 1 55 200 2248.77 0.465538
2 1995 1 0 0 1 1 55 200 117.225 3.29432
2 1996 1 0 0 1 1 55 200 761.748 3.37674
2 1997 1 0 0 1 1 55 200 352.515 2.85688
2 1998 1 0 0 1 1 55 200 32.4378 12.9899
2 1999 1 0 0 1 1 55 200 77.1594 8.97917
2 2000 1 0 0 1 1 55 200 42.329 9.19115
2 2001 1 0 0 1 1 55 200 202.461 2.09687
2 2002 1 0 0 1 1 55 200 37.7301 9.4257
2 2003 1 0 0 1 1 55 200 107.771 4.26627
2 2004 1 0 0 1 1 55 200 561.879 1.92213
2 2005 1 0 0 1 1 55 200 270.949 2.45901
2 2006 1 0 0 1 1 55 200 265.096 3.032
2 2007 1 0 0 1 1 55 200 150.512 3.59969
3 1989 1 0 0 1 1 55 200 50.2686 8.19638
3 1990 1 0 0 1 1 55 200 4212.21 0.465286
3 1991 1 0 0 1 1 55 200 121.327 8.35856
3 1992 1 0 0 1 1 55 200 1081.25 1.34015
3 1993 1 0 0 1 1 55 200 220.956 2.243
3 1994 1 0 0 1 1 55 200 3269.74 0.434391
3 1995 1 0 0 1 1 55 200 67.047 5.40299
3 1996 1 0 0 1 1 55 200 25.6089 10.4776
3 1997 1 0 0 1 1 55 200 31.9363 10.9085
3 1998 1 0 0 1 1 55 200 400.139 6.60129
3 1999 1 0 0 1 1 55 200 36.1686 19.8439
3 2000 1 0 0 1 1 55 200 35.6986 26.2608
3 2001 1 0 0 1 1 55 200 11.0483 41.9141
3 2002 1 0 0 1 1 55 200 31.9905 32.4814
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3 2004 1 0 0 1 1 55 200 92.8791 15.6937
3 2005 1 0 0 1 1 55 200 65.6491 25.4092
3 2006 1 0 0 1 1 55 200 103.338 17.7059
3 2007 1 0 0 1 1 55 200 42.3714 19.4305
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4 1995 1 0 0 1 1 55 200 4410.89 1.12589
4 1996 1 0 0 1 1 55 200 30.2827 6.84107
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4 2000 1 0 0 1 1 55 200 88.1996 11.9892
4 2001 1 0 0 1 1 55 200 2.75308 66.6972
4 2002 1 0 0 1 1 55 200 27.6085 23.3548
4 2003 1 0 0 1 1 55 200 86.9763 9.25673
4 2004 1 0 0 1 1 55 200 46.6208 4.30947
4 2005 1 0 0 1 1 55 200 65.2421 16.0965
4 2006 1 0 0 1 1 55 200 102.527 6.75513
4 2007 1 0 0 1 1 55 200 46.5877 7.26324
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5 1983 1 0 0 1 1 55 200 410.084 6.42999
5 1984 1 0 0 1 1 55 200 591.521 0.623278
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5 1990 1 0 0 1 1 55 200 947.531 0.698914
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5 1993 1 0 0 1 1 55 200 1016.05 0.744972
5 1994 1 0 0 1 1 55 200 408.977 0.65477
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5 1996 1 0 0 1 1 55 200 82.6752 3.47678
5 1997 1 0 0 1 1 55 200 140.562 5.43875
5 1998 1 0 0 1 1 55 200 129.112 2.17951
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5 2000 1 0 0 1 1 55 200 150.506 2.51135
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5 2003 1 0 0 1 1 55 200 170.675 2.79702
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5 2006 1 0 0 1 1 55 200 155.743 2.30276
5 2007 1 0 0 1 1 55 200 190.076 2.63295
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6 1983 1 0 0 1 1 55 200 85579 0.171198
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6 1988 1 0 0 1 1 55 200 28742.6 0.243322
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6 1990 1 0 0 1 1 55 200 89925 0.0618105
6 1991 1 0 0 1 1 55 200 6690.15 0.133705
6 1992 1 0 0 1 1 55 200 6646.98 0.143788
6 1993 1 0 0 1 1 55 200 5341.49 0.16042
6 1994 1 0 0 1 1 55 200 56932.4 0.167146
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6 2001 1 0 0 1 1 55 200 165.636 2.37047
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9 2000 1 3 0 1 1 55 200 62.9462 13.5814
9 2001 1 3 0 1 1 55 200 60.9564 19.9349
9 2002 1 3 0 1 1 55 200 65.6298 19.6583
9 2003 1 3 0 1 1 55 200 62.1285 21.4097
9 2004 1 3 0 1 1 55 200 17.3578 35.6415
9 2005 1 3 0 1 1 55 200 144.749 8.78122
9 2006 1 3 0 1 1 55 200 48.3591 24.098
9 2007 1 3 0 1 1 55 200 60.0188 19.727
9 2008 1 3 0 1 1 55 200 81.6291 16.0489

index N Npos mean_effN mean(inputN) HarMean(effN) Mean(effN/inputN)
MeaneffN/MeaninputN
1 0 26 1118.9 200 159.042 5.5945 5.5945
2 0 26 302.126 200 83.6621 1.51063 1.51063
3 0 19 522.189 200 47.0152 2.61094 2.61094
4 0 14 438.546 200 23.6974 2.19273 2.19273
5 0 26 1790.41 200 170.529 8.95205 8.95205
6 0 26 22771.9 200 47.5152 113.86 113.86
7 0 16 169.288 200 52.3018 0.846441 0.846441
8 0 32 57.1863 200 29.4331 0.285931 0.285931
9 0 31 57.5456 200 39.9614 0.287728 0.287728

LEN_SELEX
fleet year gender label  25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5 41.5 42.5 43.5 44.5 45.5 46.5 47.5 48.5 49.5
50.5 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5
65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5
1 1976 1 1976-1 0.00472505 0.00472505 0.00472505 0.00472506 0.00472506
0.00472511 0.00472532 0.00472629 0.00473034 0.00474588 0.00480072 0.00497822
0.00550524 0.00693966 0.0105151 0.0186684 0.0356525 0.0679098 0.123623
0.210801 0.333709 0.488468 0.659886 0.82201 0.943783 0.998594 0.999992
0.997868 0.98936 0.974521 0.953639 0.927113 0.89544 0.859205 0.819053
0.775682 0.729811 0.682171 0.633478 0.584421 0.535643 0.487732 0.441207
0.396515 0.354023 0.314022 0.276722 0.242261 0.210707 0.182067 0.156292
0.133291 0.112932 0.0950588 0.0794918
1 1976 2 1976-1 0.00472505 0.00472505 0.00472505 0.00472506 0.00472506
0.00472511 0.00472532 0.00472629 0.00473034 0.00474588 0.00480072 0.00497822
0.00550524 0.00693966 0.0105151 0.0186684 0.0356525 0.0679098 0.123623
```

0.210801 0.333709 0.488468 0.659886 0.82201 0.943783 0.998594 0.999992
0.997868 0.98936 0.974521 0.953639 0.927113 0.89544 0.859205 0.819053
0.775682 0.729811 0.682171 0.633478 0.584421 0.535643 0.487732 0.441207
0.396515 0.354023 0.314022 0.276722 0.242261 0.210707 0.182067 0.156292
0.133291 0.112932 0.0950588 0.0794918
1 1981 1 1981-1 0.00472505 0.00472505 0.00472505 0.00472506 0.00472506
0.00472511 0.00472532 0.00472629 0.00473034 0.00474588 0.00480072 0.00497822
0.00550524 0.00693966 0.0105151 0.0186684 0.0356525 0.0679098 0.123623
0.210801 0.333709 0.488468 0.659886 0.82201 0.943783 0.998594 0.999992
0.997868 0.98936 0.974521 0.953639 0.927113 0.89544 0.859205 0.819053
0.775682 0.729811 0.682171 0.633478 0.584421 0.535643 0.487732 0.441207
0.396515 0.354023 0.314022 0.276722 0.242261 0.210707 0.182067 0.156292
0.133291 0.112932 0.0950588 0.0794918
1 1981 2 1981-1 0.00472505 0.00472505 0.00472505 0.00472506 0.00472506
0.00472511 0.00472532 0.00472629 0.00473034 0.00474588 0.00480072 0.00497822
0.00550524 0.00693966 0.0105151 0.0186684 0.0356525 0.0679098 0.123623
0.210801 0.333709 0.488468 0.659886 0.82201 0.943783 0.998594 0.999992
0.997868 0.98936 0.974521 0.953639 0.927113 0.89544 0.859205 0.819053
0.775682 0.729811 0.682171 0.633478 0.584421 0.535643 0.487732 0.441207
0.396515 0.354023 0.314022 0.276722 0.242261 0.210707 0.182067 0.156292
0.133291 0.112932 0.0950588 0.0794918
1 1982 1 1982-1 0.0313759 0.0316043 0.0321774 0.0335242 0.0364867 0.0425817
0.0542995 0.0753266 0.110492 0.165189 0.2441 0.349267 0.477976 0.621243
0.763849 0.886514 0.969997 0.999998 0.999998 0.996333 0.985202 0.966854
0.941699 0.910288 0.873295 0.831492 0.785726 0.736884 0.685872 0.633581
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0.00976874 0.00746935
1 1982 2 1982-1 0.0313759 0.0316043 0.0321774 0.0335242 0.0364867 0.0425817
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0.763849 0.886514 0.969997 0.999998 0.999998 0.996333 0.985202 0.966854
0.941699 0.910288 0.873295 0.831492 0.785726 0.736884 0.685872 0.633581
0.580867 0.528526 0.477278 0.427752 0.380477 0.335876 0.29427 0.255875
0.220814 0.189121 0.160756 0.135616 0.113546 0.0943507 0.07781 0.0636855
0.0517323 0.0417059 0.0333695 0.0264982 0.0208833 0.0163342 0.0126797
0.00976874 0.00746935
1 1983 1 1983-1 0.00531785 0.00966146 0.0208528 0.046344 0.0975033 0.187531
0.325396 0.506804 0.707087 0.882956 0.986469 0.999982 0.999664 0.996981
0.991637 0.983675 0.973158 0.960169 0.944812 0.927205 0.907485 0.8858
0.862313 0.837196 0.81063 0.7828 0.753897 0.724112 0.693638 0.662663 0.631372
0.599945 0.568552 0.537356 0.506508 0.47615 0.446411 0.417405 0.389237
0.361996 0.335758 0.310585 0.286529 0.263627 0.241905 0.221376 0.202046
0.183909 0.166951 0.15115 0.136477 0.122898 0.110373 0.0988583 0.0883073
1 1983 2 1983-1 0.00531785 0.00966146 0.0208528 0.046344 0.0975033 0.187531
0.325396 0.506804 0.707087 0.882956 0.986469 0.999982 0.999664 0.996981
0.991637 0.983675 0.973158 0.960169 0.944812 0.927205 0.907485 0.8858
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0.599945 0.568552 0.537356 0.506508 0.47615 0.446411 0.417405 0.389237
0.361996 0.335758 0.310585 0.286529 0.263627 0.241905 0.221376 0.202046
0.183909 0.166951 0.15115 0.136477 0.122898 0.110373 0.0988583 0.0883073
1 1984 1 1984-1 0.015748 0.0183969 0.0223597 0.0281555 0.0364404 0.0480129
0.0638038 0.0848447 0.112212 0.14694 0.189908 0.241707 0.30249 0.371837
0.448637 0.531031 0.616416 0.701534 0.782654 0.855821 0.917173 0.963271
0.991424 0.999988 0.999988 0.997007 0.988886 0.975749 0.957798 0.935305
0.908608 0.878099 0.844217 0.807437 0.768258 0.727192 0.684754 0.641452
0.597775 0.554185 0.511111 0.468943 0.428024 0.388651 0.351072 0.315483

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5 1976 2 1976-5 0.00958784 0.0112815 0.0145165 0.0204044 0.0306091 0.0474395
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DEADFISH equals_sel*(retain+(1-retain)*discmort)
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1 1976 2 1976-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2008 1 2008-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2008 2 2008-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2009 1 2009-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 2009 2 2009-1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 1976 1 1976-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 1976 2 1976-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2008 1 2008-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2008 2 2008-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2009 1 2009-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
2 2009 2 2009-2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 1976 1 1976-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 1976 2 1976-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2008 1 2008-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2008 2 2008-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2009 1 2009-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3 2009 2 2009-3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 1976 1 1976-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 1976 2 1976-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2008 1 2008-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2008 2 2008-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2009 1 2009-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
4 2009 2 2009-4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 1976 1 1976-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 1976 2 1976-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2008 1 2008-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2008 2 2008-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2009 1 2009-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
5 2009 2 2009-5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
6 1976 1 1976-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 1976 2 1976-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2008 1 2008-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2008 2 2008-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2009 1 2009-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
6 2009 2 2009-6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 1976 1 1976-7 1.02606e-006 0.325447 0.911509 0.999895 0.999996 0.999999 1 1
1 1 1 1 1 1 1 1
7 1976 2 1976-7 1.02606e-006 0.325447 0.911509 0.999895 0.999996 0.999999 1 1
1 1 1 1 1 1 1 1
7 2008 1 2008-7 1.02606e-006 0.325447 0.911509 0.999895 0.999996 0.999999 1 1
1 1 1 1 1 1 1 1
7 2008 2 2008-7 1.02606e-006 0.325447 0.911509 0.999895 0.999996 0.999999 1 1
1 1 1 1 1 1 1 1
8 1976 1 1976-8 1.00572e-006 0.311306 0.90294 0.999875 0.99335 0.950267
0.87204 0.767668 0.648272 0.525155 0.408099 0.304221 0.21755 0.149237
0.0982065 0.0619941
8 1976 2 1976-8 1.00572e-006 0.311306 0.90294 0.999875 0.99335 0.950267
0.87204 0.767668 0.648272 0.525155 0.408099 0.304221 0.21755 0.149237
0.0982065 0.0619941
8 2008 1 2008-8 1.00572e-006 0.311306 0.90294 0.999875 0.99335 0.950267
0.87204 0.767668 0.648272 0.525155 0.408099 0.304221 0.21755 0.149237
0.0982065 0.0619941
8 2008 2 2008-8 1.00572e-006 0.311306 0.90294 0.999875 0.99335 0.950267
0.87204 0.767668 0.648272 0.525155 0.408099 0.304221 0.21755 0.149237
0.0982065 0.0619941
9 1976 1 1976-9 7.11512e-007 0.131928 0.679718 0.99919 0.997754 0.927575
0.77851 0.589854 0.403451 0.249116 0.13886 0.0698746 0.0317414 0.0130166
0.00481877 0.00161042
9 1976 2 1976-9 7.11512e-007 0.131928 0.679718 0.99919 0.997754 0.927575
0.77851 0.589854 0.403451 0.249116 0.13886 0.0698746 0.0317414 0.0130166
0.00481877 0.00161042
9 2008 1 2008-9 7.11512e-007 0.131928 0.679718 0.99919 0.997754 0.927575
0.77851 0.589854 0.403451 0.249116 0.13886 0.0698746 0.0317414 0.0130166
0.00481877 0.00161042
9 2008 2 2008-9 7.11512e-007 0.131928 0.679718 0.99919 0.997754 0.927575
0.77851 0.589854 0.403451 0.249116 0.13886 0.0698746 0.0317414 0.0130166
0.00481877 0.00161042

AGE_SELEX_from_size_selex_in_endyear
fleet year morph season 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2008 1 1  0.00472506 0.00693966 0.333709 0.999992 0.927113 0.775682
0.633478 0.487732 0.396515 0.314026 0.276721 0.239441 0.209419 0.182067
0.156293 0.155656
1 2008 2 1  0.00472506 0.00480072 0.0356183 0.333709 0.940156 0.999385
0.974521 0.92714 0.89544 0.856173 0.8166 0.775682 0.729811 0.728896 0.682171
0.682171
2 2008 1 1  0.0259914 0.554481 0.999985 0.701623 0.292209 0.0991298 0.0352974
0.0103921 0.00413805 0.00151433 0.000887392 0.000489243 0.000280272
0.000157352 8.47454e-005 8.36364e-005
2 2008 2 1  0.0147404 0.272226 0.854403 0.999985 0.860933 0.676665 0.441962
0.292281 0.230189 0.17426 0.132096 0.0991297 0.0717617 0.0713604 0.0508635
0.0508634
3 2008 1 1  0.184837 0.508408 0.0877251 0.00818539 0.000616143 5.24375e-005
6.78928e-006 9.69258e-007 4.38309e-007 3.3252e-007 3.18891e-007 3.13009e-007
3.10851e-007 3.09952e-007 3.09567e-007 3.09562e-007
```

```
3 2008 2 1  0.0851085 0.773797 0.273683 0.0877251 0.0200171 0.00730381
0.00185304 0.000616616 0.000343731 0.000181017 9.7521e-005 5.24375e-005
2.69089e-005 2.66531e-005 1.35845e-005 1.35845e-005
4 2008 1 1  0.000469929 0.298601 1 1 0.0950864 4.07823e-007 3.30052e-007
3.18342e-007 3.15362e-007 3.13636e-007 3.13028e-007 3.12493e-007 3.12101e-007
3.11768e-007 3.11471e-007 3.11464e-007
4 2008 2 1  0.000469928 0.00287614 0.999878 1 1 1 0.999998 0.0960082 2.5293e-
005 1.46784e-006 5.59107e-007 4.07823e-007 3.59825e-007 3.59444e-007
3.40011e-007 3.40011e-007
5 2008 1 1  0.0306091 0.695913 0.972542 0.625307 0.287059 0.117702 0.0515613
0.0197478 0.00966575 0.00445701 0.00295927 0.00187434 0.00122712 0.000792134
0.000495497 0.000490233
5 2008 2 1  0.0204062 0.336264 0.97528 0.972542 0.770999 0.604174 0.409891
0.287119 0.234908 0.186442 0.148569 0.117702 0.090736 0.0903169 0.0689118
0.0689117
6 2008 1 1  0.010653 0.0374467 5.16652e-006 3.11191e-007 3.10321e-007
3.09906e-007 3.09678e-007 3.09497e-007 3.09397e-007 3.09308e-007 3.09268e-007
3.09227e-007 3.09193e-007 3.09161e-007 3.09129e-007 3.09128e-007
6 2008 2 1  0.00896599 0.304782 0.00162766 5.16652e-006 3.14454e-007
3.11124e-007 3.10601e-007 3.10321e-007 3.10202e-007 3.10086e-007 3.0999e-007
3.09906e-007 3.09823e-007 3.09822e-007 3.09748e-007 3.09748e-007
7 2008 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
7 2008 2 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 2008 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8 2008 2 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 2008 1 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9 2008 2 1  1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

AGE_SELEX_mortality_in_endyear
fleet year morph season label 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1 2008 1 1 sel*wt  0.000210331 0.0942739 0.812916 1.26166 1.42142 1.36342
1.22172 1.02439 0.878171 0.731276 0.660107 0.585769 0.523639 0.465042
0.407908 0.406451
1 2008 1 1 sel*ret*wt  0.000210331 0.0942739 0.812916 1.26166 1.42142 1.36342
1.22172 1.02439 0.878171 0.731276 0.660107 0.585769 0.523639 0.465042
0.407908 0.406451
1 2008 1 1 sel_nums  0.00103779 0.190792 0.94057 0.96435 0.796766 0.607869
0.463239 0.332813 0.258371 0.195396 0.168257 0.142014 0.121485 0.103302
0.0866557 0.0862561
1 2008 1 1 sel*ret_nums  0.00103779 0.190792 0.94057 0.96435 0.796766
0.607869 0.463239 0.332813 0.258371 0.195396 0.168257 0.142014 0.121485
0.103302 0.0866557 0.0862561
1 2008 1 1 dead_nums  0.00103779 0.190792 0.94057 0.96435 0.796766 0.607869
0.463239 0.332813 0.258371 0.195396 0.168257 0.142014 0.121485 0.103302
0.0866557 0.0862561
1 2008 1 1 dead*wt  0.000210331 0.0942739 0.812916 1.26166 1.42142 1.36342
1.22172 1.02439 0.878171 0.731276 0.660107 0.585769 0.523639 0.465042
0.407908 0.406451
1 2008 2 1 sel*wt  8.54612e-005 0.0187182 0.312652 0.812916 1.13718 1.2761
1.38685 1.42141 1.42269 1.41173 1.39162 1.36342 1.32424 1.32333 1.27666
1.27666
1 2008 2 1 sel*ret*wt  8.54612e-005 0.0187182 0.312652 0.812916 1.13718
1.2761 1.38685 1.42141 1.42269 1.41173 1.39162 1.36342 1.32424 1.32333
1.27666 1.27666
1 2008 2 1 sel_nums  0.000473239 0.0496997 0.492282 0.94057 0.99439 0.957524
0.877052 0.796809 0.751999 0.701469 0.654066 0.607869 0.558881 0.557952
0.510487 0.510486
```

1 2008 2 1 sel*ret_nums 0.000473239 0.0496997 0.492282 0.94057 0.99439
0.957524 0.877052 0.796809 0.751999 0.701469 0.654066 0.607869 0.558881
0.557952 0.510487 0.510486
1 2008 2 1 dead_nums 0.000473239 0.0496997 0.492282 0.94057 0.99439 0.957524
0.877052 0.796809 0.751999 0.701469 0.654066 0.607869 0.558881 0.557952
0.510487 0.510486
1 2008 2 1 dead*wt 8.54612e-005 0.0187182 0.312652 0.812916 1.13718 1.2761
1.38685 1.42141 1.42269 1.41173 1.39162 1.36342 1.32424 1.32333 1.27666
1.27666
2 2008 1 1 sel*wt 9.32202e-006 0.0032103 0.288431 1.30779 1.52218 1.16475
0.755939 0.402638 0.237134 0.127982 0.0909887 0.0614917 0.0424393 0.0286978
0.0187033 0.0185158
2 2008 1 1 sel*ret*wt 9.32202e-006 0.0032103 0.288431 1.30779 1.52218
1.16475 0.755939 0.402638 0.237134 0.127982 0.0909887 0.0614917 0.0424393
0.0286978 0.0187033 0.0185158
2 2008 1 1 sel_nums 4.59954e-005 0.00649702 0.333724 0.999617 0.85325
0.519294 0.28663 0.130813 0.0697681 0.0341966 0.0231924 0.0149199 0.00985012
0.00637475 0.00397332 0.00393045
2 2008 1 1 sel*ret_nums 4.59954e-005 0.00649702 0.333724 0.999617 0.85325
0.519294 0.28663 0.130813 0.0697681 0.0341966 0.0231924 0.0149199 0.00985012
0.00637475 0.00397332 0.00393045
2 2008 1 1 dead_nums 4.59954e-005 0.00649702 0.333724 0.999617 0.85325
0.519294 0.28663 0.130813 0.0697681 0.0341966 0.0231924 0.0149199 0.00985012
0.00637475 0.00397332 0.00393045
2 2008 1 1 dead*wt 9.32202e-006 0.0032103 0.288431 1.30779 1.52218 1.16475
0.755939 0.402638 0.237134 0.127982 0.0909887 0.0614917 0.0424393 0.0286978
0.0187033 0.0185158
2 2008 2 1 sel*wt 8.22712e-006 0.00020308 0.0315954 0.288431 0.998455
1.33279 1.52356 1.5222 1.47169 1.38383 1.28038 1.16475 1.03087 1.02822
0.892525 0.892525
2 2008 2 1 sel*ret*wt 8.22712e-006 0.00020308 0.0315954 0.288431 0.998455
1.33279 1.52356 1.5222 1.47169 1.38383 1.28038 1.16475 1.03087 1.02822
0.892525 0.892525
2 2008 2 1 sel_nums 4.55586e-005 0.000539208 0.0497463 0.333724 0.872837
0.999721 0.963505 0.853314 0.7779 0.687771 0.601911 0.519294 0.435069
0.433568 0.356885 0.356885
2 2008 2 1 sel*ret_nums 4.55586e-005 0.000539208 0.0497463 0.333724 0.872837
0.999721 0.963505 0.853314 0.7779 0.687771 0.601911 0.519294 0.435069
0.433568 0.356885 0.356885
2 2008 2 1 dead_nums 4.55586e-005 0.000539208 0.0497463 0.333724 0.872837
0.999721 0.963505 0.853314 0.7779 0.687771 0.601911 0.519294 0.435069
0.433568 0.356885 0.356885
2 2008 2 1 dead*wt 8.22712e-006 0.00020308 0.0315954 0.288431 0.998455
1.33279 1.52356 1.5222 1.47169 1.38383 1.28038 1.16475 1.03087 1.02822
0.892525 0.892525
3 2008 1 1 sel*wt 0.0127971 0.231939 0.783345 1.29362 1.19494 0.737677
0.402909 0.178753 0.0926004 0.0436591 0.0289006 0.0180235 0.0114881
0.00710055 0.00413622 0.00408449
3 2008 1 1 sel*ret*wt 0.0127971 0.231939 0.783345 1.29362 1.19494 0.737677
0.402909 0.178753 0.0926004 0.0436591 0.0289006 0.0180235 0.0114881
0.00710055 0.00413622 0.00408449
3 2008 1 1 sel_nums 0.0631418 0.469398 0.906356 0.988779 0.669816 0.328888
0.152771 0.0580749 0.0272444 0.0116657 0.00736656 0.00437401 0.00266668
0.00157727 0.000878695 0.00086713
3 2008 1 1 sel*ret_nums 0.0631418 0.469398 0.906356 0.988779 0.669816
0.328888 0.152771 0.0580749 0.0272444 0.0116657 0.00736656 0.00437401
0.00266668 0.00157727 0.000878695 0.00086713

```
3 2008 1 1 dead_nums  0.0631418 0.469398 0.906356 0.988779 0.669816 0.328888
0.152771 0.0580749 0.0272444 0.0116657 0.00736656 0.00437401 0.00266668
0.00157727 0.000878695 0.00086713
3 2008 1 1 dead*wt  0.0127971 0.231939 0.783345 1.29362 1.19494 0.737677
0.402909 0.178753 0.0926004 0.0436591 0.0289006 0.0180235 0.0114881
0.00710055 0.00413622 0.00408449
3 2008 2 1 sel*wt  0.0076963 0.108648 0.427101 0.783345 1.14341 1.30521
1.32296 1.19502 1.0967 0.974247 0.854646 0.737677 0.61709 0.614927 0.504422
0.504421
3 2008 2 1 sel*ret*wt  0.0076963 0.108648 0.427101 0.783345 1.14341 1.30521
1.32296 1.19502 1.0967 0.974247 0.854646 0.737677 0.61709 0.614927 0.504422
0.504421
3 2008 2 1 sel_nums  0.0426187 0.288476 0.6725 0.906356 0.99982 0.979473
0.836646 0.669905 0.579691 0.484298 0.40183 0.328888 0.260436 0.259308
0.201698 0.201698
3 2008 2 1 sel*ret_nums  0.0426187 0.288476 0.6725 0.906356 0.99982 0.979473
0.836646 0.669905 0.579691 0.484298 0.40183 0.328888 0.260436 0.259308
0.201698 0.201698
3 2008 2 1 dead_nums  0.0426187 0.288476 0.6725 0.906356 0.99982 0.979473
0.836646 0.669905 0.579691 0.484298 0.40183 0.328888 0.260436 0.259308
0.201698 0.201698
3 2008 2 1 dead*wt  0.0076963 0.108648 0.427101 0.783345 1.14341 1.30521
1.32296 1.19502 1.0967 0.974247 0.854646 0.737677 0.61709 0.614927 0.504422
0.504421
4 2008 1 1 sel*wt  9.52419e-005 0.147545 0.86428 1.3083 0.169633 9.14725e-007
8.70459e-007 9.79846e-007 1.07188e-006 1.17379e-006 1.22807e-006 1.28969e-006
1.34567e-006 1.40351e-006 1.46617e-006 1.46796e-006
4 2008 1 1 sel*ret*wt  9.52419e-005 0.147545 0.86428 1.3083 0.169633
9.14725e-007 8.70459e-007 9.79846e-007 1.07188e-006 1.17379e-006 1.22807e-006
1.28969e-006 1.34567e-006 1.40351e-006 1.46617e-006 1.46796e-006
4 2008 1 1 sel_nums  0.000469929 0.298601 1 1 0.0950864 4.07823e-007
3.30052e-007 3.18342e-007 3.15362e-007 3.13636e-007 3.13028e-007 3.12493e-007
3.12101e-007 3.11768e-007 3.11471e-007 3.11464e-007
4 2008 1 1 sel*ret_nums  0.000469929 0.298601 1 1 0.0950864 4.07823e-007
3.30052e-007 3.18342e-007 3.15362e-007 3.13636e-007 3.13028e-007 3.12493e-007
3.12101e-007 3.11768e-007 3.11471e-007 3.11464e-007
4 2008 1 1 dead_nums  0.000469929 0.298601 1 1 0.0950864 4.07823e-007
3.30052e-007 3.18342e-007 3.15362e-007 3.13636e-007 3.13028e-007 3.12493e-007
3.12101e-007 3.11768e-007 3.11471e-007 3.11464e-007
4 2008 1 1 dead*wt  9.52419e-005 0.147545 0.86428 1.3083 0.169633 9.14725e-
007 8.70459e-007 9.79846e-007 1.07188e-006 1.17379e-006 1.22807e-006
1.28969e-006 1.34567e-006 1.40351e-006 1.46617e-006 1.46796e-006
4 2008 2 1 sel*wt  8.48611e-005 0.00108323 0.635011 0.86428 1.14361 1.33315
1.58126 0.171172 4.78513e-005 2.94696e-006 1.18881e-006 9.14725e-007
8.52586e-007 8.52543e-007 8.50327e-007 8.50327e-007
4 2008 2 1 sel*ret*wt  8.48611e-005 0.00108323 0.635011 0.86428 1.14361
1.33315 1.58126 0.171172 4.78513e-005 2.94696e-006 1.18881e-006 9.14725e-007
8.52586e-007 8.52543e-007 8.50327e-007 8.50327e-007
4 2008 2 1 sel_nums  0.000469928 0.00287614 0.999878 1 1 1 0.999998 0.0960082
2.5293e-005 1.46784e-006 5.59107e-007 4.07823e-007 3.59825e-007 3.59444e-007
3.40011e-007 3.40011e-007
4 2008 2 1 sel*ret_nums  0.000469928 0.00287614 0.999878 1 1 1 0.999998
0.0960082 2.5293e-005 1.46784e-006 5.59107e-007 4.07823e-007 3.59825e-007
3.59444e-007 3.40011e-007 3.40011e-007
4 2008 2 1 dead_nums  0.000469928 0.00287614 0.999878 1 1 1 0.999998
0.0960082 2.5293e-005 1.46784e-006 5.59107e-007 4.07823e-007 3.59825e-007
3.59444e-007 3.40011e-007 3.40011e-007
```

4 2008 2 1 dead*wt 8.48611e-005 0.00108323 0.635011 0.86428 1.14361 1.33315
1.58126 0.171172 4.78513e-005 2.94696e-006 1.18881e-006 9.14725e-007
8.52586e-007 8.52543e-007 8.50327e-007 8.50327e-007
5 2008 1 1 sel*wt 6.36883e-005 0.0155219 0.596821 1.28355 1.28888 0.969716
0.663247 0.393652 0.257037 0.15766 0.120613 0.0887503 0.0665544 0.0491918
0.035364 0.035078
5 2008 1 1 sel*ret*wt 6.36883e-005 0.0155219 0.596821 1.28355 1.28888
0.969716 0.663247 0.393652 0.257037 0.15766 0.120613 0.0887503 0.0665544
0.0491918 0.035364 0.035078
5 2008 1 1 sel_nums 0.000314242 0.0314132 0.690541 0.981084 0.722475
0.432341 0.251484 0.127893 0.0756241 0.0421267 0.0307435 0.0215287 0.0154453
0.0109272 0.0075127 0.0074456
5 2008 1 1 sel*ret_nums 0.000314242 0.0314132 0.690541 0.981084 0.722475
0.432341 0.251484 0.127893 0.0756241 0.0421267 0.0307435 0.0215287 0.0154453
0.0109272 0.0075127 0.0074456
5 2008 1 1 dead_nums 0.000314242 0.0314132 0.690541 0.981084 0.722475
0.432341 0.251484 0.127893 0.0756241 0.0421267 0.0307435 0.0215287 0.0154453
0.0109272 0.0075127 0.0074456
5 2008 1 1 dead*wt 6.36883e-005 0.0155219 0.596821 1.28355 1.28888 0.969716
0.663247 0.393652 0.257037 0.15766 0.120613 0.0887503 0.0665544 0.0491918
0.035364 0.035078
5 2008 2 1 sel*wt 5.6007e-005 0.00130076 0.109735 0.596821 1.14344 1.29586
1.3503 1.28893 1.22939 1.14748 1.06086 0.969716 0.867996 0.866014 0.764758
0.764758
5 2008 2 1 sel*ret*wt 5.6007e-005 0.00130076 0.109735 0.596821 1.14344
1.29586 1.3503 1.28893 1.22939 1.14748 1.06086 0.969716 0.867996 0.866014
0.764758 0.764758
5 2008 2 1 sel_nums 0.000310145 0.0034537 0.172777 0.690541 0.99984 0.972433
0.853935 0.722545 0.649827 0.570303 0.498709 0.432341 0.366328 0.365166
0.305796 0.305796
5 2008 2 1 sel*ret_nums 0.000310145 0.0034537 0.172777 0.690541 0.99984
0.972433 0.853935 0.722545 0.649827 0.570303 0.498709 0.432341 0.366328
0.365166 0.305796 0.305796
5 2008 2 1 dead_nums 0.000310145 0.0034537 0.172777 0.690541 0.99984
0.972433 0.853935 0.722545 0.649827 0.570303 0.498709 0.432341 0.366328
0.365166 0.305796 0.305796
5 2008 2 1 dead*wt 5.6007e-005 0.00130076 0.109735 0.596821 1.14344 1.29586
1.3503 1.28893 1.22939 1.14748 1.06086 0.969716 0.867996 0.866014 0.764758
0.764758
6 2008 1 1 sel*wt 0.0203739 0.423259 0.5581 0.0154998 3.16756e-005 7.25746e-
007 8.20239e-007 9.55567e-007 1.05429e-006 1.16007e-006 1.2157e-006 1.2785e-
006 1.33535e-006 1.39392e-006 1.45722e-006 1.45902e-006
6 2008 1 1 sel*ret*wt 0.0203739 0.423259 0.5581 0.0154998 3.16756e-005
7.25746e-007 8.20239e-007 9.55567e-007 1.05429e-006 1.16007e-006 1.2157e-006
1.2785e-006 1.33535e-006 1.39392e-006 1.45722e-006 1.45902e-006
6 2008 1 1 sel_nums 0.100526 0.856592 0.64574 0.0118473 1.77555e-005
3.23569e-007 3.11011e-007 3.10454e-007 3.10186e-007 3.09968e-007 3.09874e-007
3.09781e-007 3.09706e-007 3.09637e-007 3.0957e-007 3.09568e-007
6 2008 1 1 sel*ret_nums 0.100526 0.856592 0.64574 0.0118473 1.77555e-005
3.23569e-007 3.11011e-007 3.10454e-007 3.10186e-007 3.09968e-007 3.09874e-007
3.09781e-007 3.09706e-007 3.09637e-007 3.0957e-007 3.09568e-007
6 2008 1 1 dead_nums 0.100526 0.856592 0.64574 0.0118473 1.77555e-005
3.23569e-007 3.11011e-007 3.10454e-007 3.10186e-007 3.09968e-007 3.09874e-007
3.09781e-007 3.09706e-007 3.09637e-007 3.0957e-007 3.09568e-007
6 2008 1 1 dead*wt 0.0203739 0.423259 0.5581 0.0154998 3.16756e-005
7.25746e-007 8.20239e-007 9.55567e-007 1.05429e-006 1.16007e-006 1.2157e-006
1.2785e-006 1.33535e-006 1.39392e-006 1.45722e-006 1.45902e-006

6 2008 2 1 sel*wt 0.0116556 0.211905 0.634492 0.5581 0.0841087 0.012687
0.000530757 3.17826e-005 6.91661e-006 1.70038e-006 8.39409e-007 7.25746e-007
7.41453e-007 7.42169e-007 7.78733e-007 7.78733e-007
6 2008 2 1 sel*ret*wt 0.0116556 0.211905 0.634492 0.5581 0.0841087 0.012687
0.000530757 3.17826e-005 6.91661e-006 1.70038e-006 8.39409e-007 7.25746e-007
7.41453e-007 7.42169e-007 7.78733e-007 7.78733e-007
6 2008 2 1 sel_nums 0.0645435 0.562639 0.999064 0.64574 0.073692 0.00962032
0.000335654 1.78203e-005 3.65595e-006 8.46625e-007 3.94665e-007 3.23569e-007
3.12922e-007 3.12892e-007 3.11384e-007 3.11384e-007
6 2008 2 1 sel*ret_nums 0.0645435 0.562639 0.999064 0.64574 0.073692
0.00962032 0.000335654 1.78203e-005 3.65595e-006 8.46625e-007 3.94665e-007
3.23569e-007 3.12922e-007 3.12892e-007 3.11384e-007 3.11384e-007
6 2008 2 1 dead_nums 0.0645435 0.562639 0.999064 0.64574 0.073692 0.00962032
0.000335654 1.78203e-005 3.65595e-006 8.46625e-007 3.94665e-007 3.23569e-007
3.12922e-007 3.12892e-007 3.11384e-007 3.11384e-007
6 2008 2 1 dead*wt 0.0116556 0.211905 0.634492 0.5581 0.0841087 0.012687
0.000530757 3.17826e-005 6.91661e-006 1.70038e-006 8.39409e-007 7.25746e-007
7.41453e-007 7.42169e-007 7.78733e-007 7.78733e-007

ENVIRONMENTAL_DATA Begins_in_startyr-1

NUMBERS_AT_AGE
Population 1 gmorph 1 gender: 1 GrowPattern: 1 birthseason: 1
Year Per Seas 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1974 VIRG 1 28066.2 21055 15795.2 11849.4 8889.33 6668.69 5002.78 3753.04
2815.49 2112.15 1584.52 1188.69 891.742 668.976 501.859 1506.9
1975 INIT 1 26974.6 20167 15053.3 8869.65 3226.6 1237.35 529.469 251.124
132.357 74.5214 44.5393 27.3484 17.2519 11.122 7.31347 14.8591
1976 TIME 1 31306 22543.1 21034.4 7020.87 2652.53 895.855 275.01 251.124
132.357 74.5214 44.5393 27.3484 17.2519 11.122 7.31347 14.8591
1977 TIME 1 26934 23190.5 13818.7 9598.64 2378.98 1049.05 409.367 139.515
140.188 78.2181 46.3171 28.3146 17.7809 11.4207 7.48442 15.1566
1978 TIME 1 22762.4 19945.9 13934.5 6398.77 3669.66 1063.86 533.668 227.038
83.4673 87.6589 50.8425 30.6314 19.0497 12.1285 7.88808 15.8255
1979 TIME 1 16075 16825.3 11490.2 6168.22 2482.5 1698.62 561.866 306.072
139.553 53.3712 58.0064 34.1595 20.8927 13.1508 8.46487 16.7242
1980 TIME 1 33222.8 11792.2 8490.42 3740.16 1560.18 831.009 704.641 267.157
163.472 79.6869 32.3054 36.0335 21.7726 13.5938 8.71809 16.9997
1981 TIME 1 34419 24142.7 4956.36 2023.04 700.749 431.549 304.685 306.702
133.998 88.8357 46.4141 19.4035 22.3108 13.8129 8.8165 17.0346
1982 TIME 1 42914.8 25049.5 10620.6 1136.37 272.082 137.302 116.813 103.058
126.509 62.0975 45.6073 24.9428 10.9115 13.0115 8.32637 16.083
1983 TIME 1 42224.9 29814 9567.43 3178.24 439.155 140.741 84.3103 77.8849
72.3459 90.7978 45.2573 33.4299 18.3751 8.06763 9.64886 18.1472
1984 TIME 1 23956.7 29441.1 9849.83 2729.16 1200.29 222.328 83.6259 53.9077
52.1644 49.5145 63.2057 31.7319 23.6049 13.0482 5.75854 19.9405
1985 TIME 1 32124.1 16568.9 11058.7 1906.32 638.946 396.389 92.8841 40.0865
28.866 29.7193 29.7703 38.9275 20.0189 15.1842 8.54466 17.1236
1986 TIME 1 31700.5 23361.1 6177.62 2393.26 532.274 247.312 189.325 49.8384
23.5056 17.751 19.0237 19.3945 25.8051 13.4569 10.3375 17.6903
1987 TIME 1 23200 22848.7 8038.89 1044.37 529.034 165.607 95.8023 83.0177
24.1476 12.0634 9.59776 10.539 11.0182 14.972 7.96568 16.9298
1988 TIME 1 6644.89 16899.9 8134.14 1795.88 288.281 187.646 68.8276 43.5524
40.605 12.3308 6.41142 5.19909 5.82463 6.19427 8.55742 14.474
1989 TIME 1 16921.6 4652.15 4147.99 916.104 274.258 63.9359 52.1876 21.6368
15.1034 14.9277 4.79148 2.55946 2.13639 2.45408 2.67499 10.2067

1990 TIME 1 20003.2 12326.9 1502.37 512.519 70.9539 31.2315 12.4893 14.817
8.12624 6.48666 7.09761 2.37515 1.32038 1.13735 1.34431 7.25534
1991 TIME 1 22765.3 14030.1 4406.96 312.567 70.8522 13.8865 9.76622 5.33293
7.87164 4.75052 4.04899 4.54014 1.5529 0.877357 0.766255 5.86775
1992 TIME 1 25160.7 16714.9 4518.78 577.735 50.7105 19.2011 5.85018 5.37144
3.47965 5.4843 3.43746 2.96416 3.35288 1.15295 0.653785 4.95619
1993 TIME 1 19602.4 18147.2 4876.58 597.619 75.3311 11.7466 7.32225 3.0412
3.4144 2.39058 3.94114 2.50472 2.18243 2.48441 0.858046 4.18782
1994 TIME 1 24520.9 14037.4 6172.89 797.662 117.64 24.2506 5.61817 4.34285
2.05513 2.42294 1.74473 2.90144 1.85607 1.6238 1.85366 3.77233
1995 TIME 1 34425.6 17622.9 4616.77 838.122 185.641 42.9854 12.1499 3.3938
2.95629 1.46444 1.77263 1.28683 2.15301 1.38242 1.2125 4.20841
1996 TIME 1 26331.1 25514.1 9398.06 1036.46 156.002 49.2895 17.3206 6.44543
2.16479 2.02925 1.05011 1.28882 0.945593 1.59262 1.02738 4.04226
1997 TIME 1 27749.1 19583.3 15156.7 3109.43 297.322 54.7167 22.5323 9.44987
3.99171 1.41915 1.384 0.7269 0.903954 0.669639 1.137 3.64559
1998 TIME 1 31445.8 20781.3 13313.3 6552.8 1071.69 117.37 25.8491 12.0733
5.59177 2.48421 0.919064 0.911317 0.486335 0.612417 0.458803 3.31221
1999 TIME 1 24709.2 23535.2 14325 6069.83 2402.53 449.566 59.3623 14.9374
7.7392 3.76917 1.7371 0.651746 0.654346 0.352353 0.446974 2.76969
2000 TIME 1 28909.4 18458.9 16763.9 7618.57 2735.63 1197.16 254.046 36.617
9.86423 5.28649 2.64186 1.23024 0.466033 0.471314 0.255396 2.34499
2001 TIME 1 28745.9 21677 12898.8 8348.74 3415.89 1370.11 687.304 159.648
24.5797 6.82689 3.74 1.88493 0.884529 0.337 0.342493 1.8981
2002 TIME 1 29273.8 21535.2 14720.9 7062.46 4464.44 1963.08 855.949 454
109.936 17.2657 4.86707 2.68219 1.3593 0.640584 0.244974 1.63451
2003 TIME 1 20641.8 21928.9 15261.9 8182.49 3836.01 2648.62 1278.8 591.116
326.309 80.3655 12.7605 3.61067 1.99597 1.01364 0.478445 1.40552
2004 TIME 1 28272 15452.5 15444.4 8455.43 4272.8 2165.64 1645.61 847.187
410.668 231.811 58.0216 9.27032 2.63791 1.46432 0.746269 1.3914
2005 TIME 1 12517.8 21172.3 10902.9 8216.73 4312.56 2371.96 1332.67 1085.2
588.026 291.929 167.631 42.232 6.78692 1.93948 1.08043 1.58216
2006 TIME 1 9803.48 9306.84 14971.5 6317.95 4138.58 2272.93 1355.87 807.611
689.049 382.549 193.749 112.23 28.5228 4.61673 1.32823 1.83581
2007 TIME 1 8062.55 7321.92 6539.76 8378.54 3258.51 2315.92 1408.39 899.513
563.276 491.786 277.517 141.419 82.3628 21.0148 3.41254 2.34537
2008 TIME 1 23442.9 5990.02 4931.42 3601.14 4457.54 1875.22 1462.6 945.987
632.035 404.08 358.011 203.146 104.027 60.8006 15.5586 4.27371
2009 FORE 1 28066.2 16908.5 3225.39 2461.1 1845.01 2632.64 1205.71 982.945
656.541 446.023 289.104 257.669 147.059 75.6534 44.4004 14.5392
Population 1 gmorph 2 gender: 2 GrowPattern: 2 birthseason: 1
Year Per Seas 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1974 VIRG 1 42099.3 24518.1 14279 8315.9 4843.07 2820.54 1642.64 956.653
557.142 324.472 188.968 110.053 64.0931 37.327 21.7387 30.316
1975 INIT 1 40462 23484.1 13629.4 7735.54 3538.39 1043.5 294.824 84.8103
25.2481 7.6908 2.41023 0.77729 0.258209 0.0886702 0.0304699 0.0168034
1976 TIME 1 46958.9 26250.9 19044.7 6123.15 2908.85 755.506 153.134 84.8103
25.2481 7.6908 2.41023 0.77729 0.258209 0.0886702 0.0304699 0.0168034
1977 TIME 1 40401 27096.7 13445.5 8195.52 2169.17 757.438 200.179 43.8924
26.038 8.03498 2.54487 0.826431 0.275739 0.0949141 0.0326158 0.0179942
1978 TIME 1 34143.5 23314.1 13736.3 5640.33 2946.09 628.629 226.591 65.0197
15.2373 9.34525 2.98696 0.976092 0.326379 0.112203 0.0386437 0.0211959
1979 TIME 1 24112.5 19680.9 11500.2 5435.22 1938.26 854.942 191.116 75.7245
23.3637 5.67117 3.60659 1.18974 0.400203 0.137761 0.0473847 0.0259608
1980 TIME 1 49834.2 13826.8 9011.67 3716.58 1373.47 360.73 170.353 44.213
19.6774 6.42579 1.65428 1.10767 0.383143 0.135198 0.0465797 0.0259304

1981 TIME 1 51628.5 28394.9 5663.74 2239.2 687.478 182.915 53.5784 31.2154
9.49318 4.55855 1.60887 0.442968 0.315279 0.115896 0.0409407 0.0232225
1982 TIME 1 64372.2 29422.9 12287.6 1493.35 398.558 68.3909 19.4568 6.93069
4.74775 1.56776 0.821894 0.313874 0.0930832 0.0715309 0.0263323 0.0156809
1983 TIME 1 63337.3 35452.3 11387.8 2887.9 346.928 106.696 20.8748 6.99262
2.78299 2.00375 0.694408 0.378729 0.149623 0.0457925 0.0352083 0.0212411
1984 TIME 1 35935 35281.5 10976.7 2504.12 639.524 90.1453 31.8449 7.35837
2.7481 1.147 0.864115 0.310591 0.174699 0.070995 0.0217383 0.0274431
1985 TIME 1 48186.1 19523.9 14265.9 2111.59 376.239 103.296 16.7002 7.11894
1.88637 0.751398 0.334707 0.266583 0.100734 0.0595214 0.0242099 0.0175407
1986 TIME 1 47550.7 27441.1 8328.81 2672.89 354.76 72.2959 22.8142 4.41848
2.139 0.601083 0.253854 0.118795 0.0988457 0.0389681 0.0230424 0.0167879
1987 TIME 1 34800 26969 10327.4 1420.82 350.795 53.6166 12.6534 4.82551
1.06716 0.549184 0.164017 0.0729244 0.0357246 0.0310832 0.0122637 0.0130517
1988 TIME 1 9967.33 19841.5 11093.5 1843.91 246.412 68.3013 11.6588 3.16327
1.32867 0.307147 0.165181 0.051199 0.0235287 0.0119042 0.0103635 0.00869071
1989 TIME 1 25382.3 5535.26 6262.1 1201.72 161.218 25.3256 8.27694 1.74057
0.544597 0.243967 0.0600761 0.0340536 0.0110543 0.00531127 0.00268931
0.00447959
1990 TIME 1 30004.8 14542.7 2134.23 853.527 115.27 10.0728 1.54168 0.591995
0.153856 0.0546849 0.0283482 0.00799919 0.00516412 0.00191497 0.000922305
0.00140772
1991 TIME 1 34148 16961.4 5285.56 451.132 137.855 12.7379 1.09362 0.193958
0.0899351 0.0261495 0.0105569 0.00615653 0.00194187 0.00140296 0.000521293
0.00070269
1992 TIME 1 37741 19651.5 6494.72 678.261 45.9127 14.7982 1.65239 0.185678
0.040801 0.0211663 0.00694619 0.00312476 0.00201351 0.000700832 0.000507206
0.000483002
1993 TIME 1 29403.6 21710.4 7356.56 825.385 69.6369 4.18365 1.5504 0.23464
0.0333857 0.00831251 0.00494164 0.00183404 0.000925072 0.000667958
0.000232957 0.00036444
1994 TIME 1 36781.3 16779.8 8376.89 1095.51 104.809 9.27755 0.655868
0.313817 0.0586331 0.00927545 0.00257816 0.00168547 0.000680974 0.000372578
0.000269396 0.000258524
1995 TIME 1 51638.5 20737 6520.63 926.606 115.471 15.5209 1.72168 0.15215
0.0890081 0.0180922 0.00311677 0.000934842 0.000655558 0.000283834 0.00015548
0.000234267
1996 TIME 1 39496.6 29839.8 11076.9 1457.82 161.491 16.489 2.27535 0.2939
0.0313577 0.0202964 0.00461741 0.000883071 0.000292429 0.000226619 9.82923e-
005 0.000147758
1997 TIME 1 41623.7 22882.9 16078.5 3586.26 374.444 36.0251 3.69359 0.553839
0.0800205 0.00910209 0.0063303 0.00153894 0.000313391 0.000110594 8.58033e-
005 9.87367e-005
1998 TIME 1 47168.6 24217.7 12913 7344.01 1203.66 101.171 9.67407 1.04917
0.169721 0.0256007 0.00305659 0.00222375 0.000564402 0.000120144 4.24326e-005
7.37942e-005
1999 TIME 1 37063.8 27428.7 13766.6 6056.03 2599.34 347.028 28.8917 2.91502
0.341658 0.0577758 0.00916451 0.00114698 0.000873134 0.000232232 4.94775e-005
5.0008e-005
2000 TIME 1 43364.1 21516 15712.7 6937.28 2500.39 914.004 121.698 10.5134
1.12758 0.136288 0.0238363 0.00390148 0.000503172 0.000395054 0.000105134
4.63535e-005
2001 TIME 1 43118.8 25245.5 12345.1 7557.72 2682.11 870.143 319.181 44.5327
4.08757 0.453312 0.0568597 0.0102885 0.00173887 0.000231654 0.000181984
7.18864e-005

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2002 TIME 1  43910.7 25093.5 14207.5 5879.92 3212.47 1109 361.966 136.613
19.8675 1.86184 0.211173 0.0270417 0.00498985 0.000860288 0.00011465
0.000127967
2003 TIME 1  30962.7 25539.3 14445.9 6956.8 2537.25 1341.32 469.136 159.268
62.9178 9.36897 0.900667 0.104534 0.0136753 0.00257775 0.00044459 0.00012781
2004 TIME 1  42407.9 18004.6 14553.1 7258.84 2992.11 1026.28 545.08 197.151
69.8017 28.2265 4.31377 0.424721 0.05042 0.00674908 0.0012727 0.00028863
2005 TIME 1  18776.7 24655.7 10357.8 7119.19 2998.02 1179.49 407.491 224.542
84.9619 30.8453 12.8265 2.01128 0.202899 0.0246895 0.00330634 0.000782475
2006 TIME 1  14705.2 10865.8 13887.4 5364.47 3202.61 1201.14 460.95 161.287
91.8711 35.4327 13.1474 5.58047 0.89253 0.0919017 0.0111872 0.0018886
2007 TIME 1  12093.8 8539.67 6140.98 7043.83 2330.61 1282.84 482.118 191.528
70.0648 40.9121 16.2209 6.17394 2.6844 0.439959 0.0453214 0.00659462
2008 TIME 1  35164.3 6999.41 4689.59 2975.32 3011.11 957.562 531.176 206.44
85.565 32.0254 19.1773 7.78126 3.02695 1.34549 0.220606 0.0265643
2009 FORE 1  42099.3 19919.6 2029.44 1895.05 1152.74 1145.18 383.904 229.836
94.6489 40.2057 15.4078 9.40939 3.88399 1.53583 0.682873 0.127267

CATCH_AT_AGE
 fleet 1 fleetarea 1 gmorph 1
Year Seas  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1975 E  80.0468 87.8272 2823.56 4039.05 1392.7 468.188 171.091 65.4643
28.8959 13.2395 7.05966 3.79774 2.11648 1.1972 0.681696 1.37969
1976 1  76.1605 73.7273 2898.98 2556.25 955.095 287.162 75.3778 55.3143
24.3224 11.0991 5.90679 3.17113 1.76433 0.996462 0.566556 1.14661
1977 1  49.7948 57.1205 1456.77 2793.09 686.269 267.928 88.7513 24.1036
20.0938 9.0397 4.75503 2.53544 1.40155 0.787239 0.445322 0.898264
1978 1  36.7011 42.0677 1257.41 1635.4 938.012 241.169 102.539 34.6663
10.5515 8.91688 4.58987 2.40965 1.31809 0.733351 0.411419 0.822147
1979 1  44.2543 57.3 1561.26 2271.29 947.937 593.711 170.148 75.136 28.703
8.92787 8.653 4.46183 2.40968 1.33018 0.741051 1.45844
1980 1  107.11 43.621 1199.26 1446.46 648.917 324.3 241.541 75.0176 38.6769
15.4073 5.58188 5.46293 2.91959 1.60105 0.889969 1.72872
1981 1  167.034 136.998 1037.65 1046.31 384.221 223.971 141.264 118.98
44.4397 24.4099 11.4702 4.2348 4.32971 2.36592 1.31498 2.53126
1982 1  556.886 4240.48 2578.94 244.51 44.6869 15.4872 8.99884 4.99508
4.31074 1.43867 0.860613 0.373562 0.132127 0.12646 0.0638533 0.122597
1983 1  1127.43 5861.96 1613.68 499.496 62.3344 17.0402 8.63081 6.50065
5.17751 5.50024 2.51061 1.67968 0.843731 0.337638 0.365468 0.685506
1984 1  506.585 4843.35 3078 987.742 442.068 74.8284 24.5583 13.0445 10.758
8.49501 9.80164 4.37946 2.92277 1.4416 0.561494 1.93777
1985 1  288.44 3487.07 3830.71 655.672 204.361 108.909 21.4153 7.37589
4.45033 3.76138 3.38809 3.92544 1.80577 1.21973 0.605166 1.20866
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8.53491e-007 5.41862e-007 3.51621e-007 6.94845e-007
1980 1  72.9902 71.1445 0.00561194 0.000136053 6.56505e-005 3.91619e-005
3.56894e-005 1.43883e-005 9.12175e-006 4.58693e-006 1.88557e-006 2.13244e-006
1.30289e-006 8.21728e-007 5.32043e-007 1.03769e-006
1981 1  39.7237 77.9771 0.00169457 3.43454e-005 1.35656e-005 9.43878e-006
7.28429e-006 7.96391e-006 3.65768e-006 2.53611e-006 1.3522e-006 5.76888e-007
6.74297e-007 4.23773e-007 2.74346e-007 5.30258e-007
1982 1  79.1662 63.8079 0.0033762 2.41786e-005 6.5508e-006 3.56769e-006
3.15087e-006 2.84607e-006 3.52922e-006 1.74445e-006 1.28452e-006 7.0409e-007
3.08509e-007 3.68363e-007 2.3598e-007 4.55825e-007
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1983 1 72.3993 86.0966 0.0035925 8.06308e-005 1.26089e-005 4.33717e-006
2.6853e-006 2.53324e-006 2.37623e-006 3.00524e-006 1.50282e-006 1.11361e-006
6.13675e-007 2.70065e-007 3.2372e-007 6.08873e-007
1984 1 85.0794 88.2445 0.00313696 5.62558e-005 2.82733e-005 5.77104e-006
2.30236e-006 1.55797e-006 1.54981e-006 1.50718e-006 1.94502e-006 9.87228e-007
7.40938e-007 4.12935e-007 1.8367e-007 6.36132e-007
1985 1 18.9006 19.4409 0.00144182 1.65215e-005 6.31159e-006 4.28074e-006
1.05546e-006 4.73885e-007 3.4864e-007 3.65545e-007 3.69122e-007 4.86518e-007
2.51802e-007 1.92109e-007 1.08706e-007 2.17878e-007
1986 1 79.643 132.491 0.00367541 9.46826e-005 2.40075e-005 1.21964e-005
9.83704e-006 2.70316e-006 1.30735e-006 1.01028e-006 1.09449e-006 1.12844e-006
1.51567e-006 7.97565e-007 6.18223e-007 1.0582e-006
1987 1 51.7455 116.557 0.00470171 3.99352e-005 2.23308e-005 7.46318e-006
4.4844e-006 4.01015e-006 1.18851e-006 6.04256e-007 4.84814e-007 5.37116e-007
5.65818e-007 7.74558e-007 4.15199e-007 8.82618e-007
1988 1 29.3787 73.9151 0.00371327 5.48002e-005 1.00529e-005 7.13378e-006
2.7463e-006 1.80801e-006 1.72648e-006 5.36487e-007 2.82114e-007 2.31572e-007
2.62197e-007 2.81779e-007 3.93537e-007 6.65825e-007
1989 1 8.33204 9.45834 0.000814147 9.31799e-006 3.14601e-006 8.84878e-007
8.33064e-007 3.86994e-007 2.85892e-007 2.95249e-007 9.65119e-008 5.24673e-008
4.44093e-008 5.16658e-008 5.70076e-008 2.17587e-007
1990 1 33.6364 55.056 0.000747644 1.32632e-005 2.07315e-006 1.09267e-006
4.97281e-007 6.48934e-007 3.71491e-007 3.05493e-007 3.38024e-007 1.14254e-007
6.39884e-008 5.54691e-008 6.59383e-008 3.55923e-007
1991 1 18.6189 100.744 0.00312032 1.43569e-005 3.93375e-006 9.23185e-007
7.29471e-007 4.30471e-007 6.54958e-007 4.02271e-007 3.44718e-007 3.88086e-007
1.33063e-007 7.5301e-008 6.58377e-008 5.04174e-007
1992 1 14.6604 79.2678 0.00220575 1.69021e-005 1.82081e-006 8.41039e-007
2.92853e-007 2.94431e-007 1.97696e-007 3.18167e-007 2.00707e-007 1.73905e-007
1.97285e-007 6.7974e-008 3.85961e-008 2.92595e-007
1993 1 29.1578 214.693 0.00600967 4.74429e-005 7.21994e-006 1.3294e-006
9.11848e-007 4.02024e-007 4.61689e-007 3.27476e-007 5.42037e-007 3.45508e-007
3.01597e-007 3.4375e-007 1.18821e-007 5.7993e-007
1994 1 152.944 144.169 0.00627316 5.93755e-005 1.04584e-005 2.4661e-006
6.211e-007 5.07122e-007 2.45114e-007 2.92522e-007 2.11425e-007 3.52563e-007
2.2591e-007 1.97858e-007 2.26031e-007 4.59994e-007
1995 1 159.244 638.802 88.5079 0.274889 0.000104409 5.22461e-007 1.60043e-
007 4.85293e-008 4.37046e-008 2.2084e-008 2.68989e-008 1.96197e-008 3.29214e-
008 2.11806e-008 1.86024e-008 6.4568e-008
1996 1 64.2078 556.93 121.255 0.231598 5.66901e-005 3.65286e-007 1.33431e-
007 5.25069e-008 1.80898e-008 1.72611e-008 8.99197e-009 1.11011e-008
8.17981e-009 1.38264e-008 8.94728e-009 3.5206e-008
1997 1 17.1776 311.805 162.924 0.557308 8.45286e-005 3.06346e-007 1.28226e-
007 5.61453e-008 2.425e-008 8.77536e-009 8.62167e-009 4.56063e-009 5.70336e-
009 4.24632e-009 7.24413e-009 2.32298e-008
1998 1 0.807271 374.704 230.721 1.89857 0.000492633 1.06696e-006 2.3981e-007
1.17254e-007 5.55423e-008 2.50857e-008 9.3394e-009 9.31239e-009 4.98961e-009
6.30364e-009 4.73531e-009 3.41874e-008
1999 1 21.1234 313.855 244.721 1.76852 0.0010963 3.95755e-006 5.22789e-007
1.35517e-007 7.12658e-008 3.51049e-008 1.62528e-008 6.12373e-009 6.1678e-009
3.33037e-009 4.23505e-009 2.62441e-008
2000 1 0.808523 367.093 344.935 2.74672 0.00155159 1.31577e-005 2.79735e-006
4.14981e-007 1.13302e-007 6.13089e-008 3.07516e-008 1.43678e-008 5.45618e-009
5.52956e-009 3.00192e-009 2.75641e-008
2001 1 8.07592 680.85 342.263 4.02147 0.00254738 1.93486e-005 9.57414e-006
2.26347e-006 3.51449e-007 9.82276e-008 5.39465e-008 2.72515e-008 1.28107e-008
4.88832e-009 4.97505e-009 2.75728e-008

2002 1 27.4852 385.469 247.796 2.15855 0.0021284 1.78185e-005 7.67426e-006
4.1401e-006 1.00969e-006 1.59282e-007 4.49667e-008 2.48094e-008 1.25824e-008
5.93264e-009 2.26959e-009 1.51432e-008
2003 1 20.095 476.954 255.918 2.45137 0.00178379 2.34595e-005 1.1216e-005
5.29136e-006 2.94916e-006 7.3137e-007 1.16434e-007 3.30236e-008 1.82869e-008
9.30025e-009 4.39525e-009 1.29122e-008
2004 1 32.9663 378.69 373.67 3.68332 0.00289739 2.80651e-005 2.11655e-005
1.11397e-005 5.45605e-006 3.10252e-006 7.78709e-007 1.24721e-007 3.55527e-008
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2005 1 90.7806 608.919 202.321 2.62676 0.00210838 2.18976e-005 1.21373e-005
1.00785e-005 5.51821e-006 2.76329e-006 1.59276e-006 4.02803e-007 6.49359e-008
1.86114e-008 1.03984e-008 1.52283e-008
2006 1 32.8579 258.241 281.951 2.10446 0.002143 2.24686e-005 1.32969e-005
8.09327e-006 6.97445e-006 3.8993e-006 1.98002e-006 1.14954e-006 2.92627e-007
4.74274e-008 1.36599e-008 1.88805e-008
2007 1 63.0997 466.227 286.209 6.62424 0.00400021 5.4064e-005 3.25194e-005
2.11751e-005 1.33787e-005 1.17538e-005 6.64808e-006 3.39461e-006 1.97987e-006
5.0575e-007 8.22074e-008 5.65005e-008
2008 1 380.152 298.419 0.032768 0.00145816 0.00191892 0.000838294 0.00066694
0.000437661 0.000294616 0.000189529 0.00016837 9.57879e-005 4.91526e-005
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 fleet 6 fleetarea 1 gmorph 2
Year Seas 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1975 E 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1976 1 33.2819 599.454 2.15211 0.00202294 5.16666e-005 1.33679e-005
2.79039e-006 1.58716e-006 4.79241e-007 1.48268e-007 4.71361e-008 1.54124e-008
5.19489e-009 1.78444e-009 6.21909e-010 3.42967e-010
1977 1 29.4064 632.536 1.54332 0.00279751 4.1276e-005 1.44428e-005 3.93971e-
006 8.86979e-007 5.3329e-007 1.66936e-007 5.35551e-008 1.7603e-008 5.94678e-
009 2.04746e-009 7.1195e-010 3.92784e-010
1978 1 30.5174 660.61 1.88949 0.00232168 6.89122e-005 1.48228e-005 5.5432e-
006 1.63754e-006 3.8928e-007 2.42327e-007 7.84708e-008 2.59537e-008 8.7844e-
009 3.02059e-009 1.05218e-009 5.77119e-010
1979 1 26.9542 676.652 1.82306 0.00247969 4.7954e-005 2.1461e-005 5.06638e-
006 2.09777e-006 6.61589e-007 1.6433e-007 1.06659e-007 3.58582e-008 1.22973e-
008 4.23458e-009 1.48327e-009 8.12641e-010
1980 1 82.3248 671.523 1.90714 0.00223408 4.47342e-005 1.20719e-005
6.13499e-006 1.68712e-006 7.72529e-007 2.59841e-007 6.86517e-008 4.70787e-008
1.66816e-008 5.88894e-009 2.07496e-009 1.15511e-009
1981 1 44.7759 741.17 0.643933 0.000696745 1.06676e-005 2.87001e-006
8.95884e-007 5.51535e-007 1.72633e-007 8.55308e-008 3.10627e-008 8.78983e-009
6.43828e-009 2.36798e-009 8.60014e-010 4.8782e-010
1982 1 98.1375 613.43 1.11923 0.000429858 7.37849e-006 1.31987e-006 4.0081e-
007 1.49454e-007 1.0454e-007 3.52331e-008 1.87851e-008 7.2791e-009 2.18825e-
009 1.68197e-009 6.26411e-010 3.73029e-010
1983 1 87.6655 811.554 1.21768 0.000982812 7.64272e-006 2.45685e-006
5.13585e-007 1.79898e-007 7.3032e-008 5.35947e-008 1.88628e-008 1.04237e-008
4.16814e-009 1.27592e-009 9.91095e-010 5.97927e-010
1984 1 108.662 887.935 1.09884 0.000728074 1.16145e-005 1.70189e-006
6.43708e-007 1.56643e-007 5.99757e-008 2.56786e-008 1.97768e-008 7.25231e-009
4.16133e-009 1.69171e-009 5.27568e-010 6.66017e-010
1985 1 22.2603 197.42 0.555379 0.000250822 2.85631e-006 8.17309e-007
1.41425e-007 6.33534e-008 1.71843e-008 7.00815e-009 3.18504e-009 2.58274e-009
9.93224e-010 5.87053e-010 2.4259e-010 1.75763e-010
1986 1 91.8579 1314.8 1.56618 0.00145532 1.23454e-005 2.62282e-006 8.86007e-
007 1.80315e-007 8.93504e-008 2.57061e-008 1.10767e-008 5.27795e-009 4.4704e-
009 1.76293e-009 1.05949e-009 7.71902e-010

1987 1 59.4852 1190.01 1.75098 0.000756648 1.18611e-005 1.86923e-006
4.64542e-007 1.83823e-007 4.13578e-008 2.16544e-008 6.56285e-009 2.95659e-009
1.46723e-009 1.2769e-009 5.09763e-010 5.42518e-010
1988 1 36.88 780.307 1.57507 0.00077571 6.64549e-006 1.92442e-006 3.52264e-
007 1.00451e-007 4.31731e-008 1.02108e-008 5.59794e-009 1.76498e-009
8.24669e-010 4.17359e-010 3.68825e-010 3.09291e-010
1989 1 8.19198 98.5828 0.400378 0.000217027 1.55343e-006 2.39608e-007
8.20154e-008 1.83955e-008 5.99253e-009 2.81525e-009 7.25654e-010 4.30197e-010
1.46387e-010 7.03958e-011 3.72734e-011 6.20863e-011
1990 1 38.3048 532.296 0.336595 0.000387257 2.79498e-006 2.40249e-007
3.85586e-008 1.57872e-008 4.26837e-009 1.58853e-009 8.60199e-010 2.53196e-010
1.70748e-010 6.33669e-011 3.17831e-011 4.85107e-011
1991 1 10.6478 1064.95 1.17046 0.000293613 5.55586e-006 5.4111e-007
5.09597e-008 9.76912e-009 4.72498e-009 1.43937e-009 6.06398e-010 3.68117e-010
1.20894e-010 8.74057e-011 3.36862e-011 4.54081e-011
1992 1 8.94671 840.058 0.985305 0.000304283 1.20638e-006 4.02383e-007
4.96873e-008 6.06609e-009 1.39517e-009 7.61713e-010 2.62099e-010 1.23346e-010
8.32129e-011 2.89871e-011 2.1877e-011 2.0833e-011
1993 1 19.6278 2203.27 2.76294 0.000931405 4.86111e-006 3.05793e-007
1.24127e-007 2.03335e-008 3.01475e-009 7.84149e-010 4.84459e-010 1.86205e-010
9.71739e-011 7.02063e-011 2.5229e-011 3.94684e-011
1994 1 183.706 1503.39 2.50306 0.00102274 6.68138e-006 6.34353e-007
4.86679e-008 2.51625e-008 4.86098e-009 7.95869e-010 2.28225e-010 1.53617e-010
6.39009e-011 3.49797e-011 2.59642e-011 2.49163e-011
1995 1 132.725 489.495 193.098 16.1731 0.21433 0.0037955 1.55037e-005
7.7944e-008 9.71834e-009 4.7773e-010 3.99747e-011 1.02285e-011 7.22632e-012
3.13074e-012 1.77234e-012 2.67044e-012
1996 1 52.724 398.101 219.149 16.9981 0.203541 0.00271737 1.35058e-005
9.67578e-008 2.17244e-009 3.35165e-010 3.6519e-011 5.8764e-012 1.93263e-012
1.49828e-012 6.62811e-013 9.96372e-013
1997 1 12.3796 171.231 273.686 34.6535 0.378408 0.0047413 1.73418e-005
1.42316e-007 4.29272e-009 1.15339e-010 3.80986e-011 7.73149e-012 1.55128e-012
5.47576e-013 4.30253e-013 4.95106e-013
1998 1 0.815497 82.6638 349.615 114.286 1.96646 0.0214959 7.32724e-005
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9.6581e-013 3.45906e-013 6.01561e-013
1999 1 28.1721 51.4712 353.777 92.6115 4.23991 0.0738148 0.000217734
1.19661e-006 2.91512e-008 1.15825e-009 8.68312e-011 9.02707e-012 6.73551e-012
1.79175e-012 3.84691e-013 3.88816e-013
2000 1 0.921085 72.3648 491.192 127.948 5.03642 0.240688 0.00114007
5.36378e-006 1.19705e-007 3.40399e-009 2.81638e-010 3.83243e-011 4.84812e-012
3.807e-012 1.02144e-012 4.50355e-013
2001 1 5.01931 269.856 475.754 179.408 7.18043 0.304899 0.00395014 2.97887e-
005 5.66021e-007 1.46798e-008 8.66252e-010 1.2963e-010 2.13757e-011 2.84788e-
012 2.24462e-012 8.8666e-013
2002 1 36.0617 118.721 348.95 88.5191 5.44161 0.246615 0.00285642 5.83818e-
005 1.76001e-006 3.86319e-008 2.0641e-009 2.18799e-010 3.94181e-011 6.79648e-
012 9.09136e-013 1.01474e-012
2003 1 20.4978 234.326 358.478 104.336 4.22998 0.292509 0.00362105 6.64563e-
005 5.44082e-006 1.89771e-007 8.59554e-009 8.26158e-010 1.05589e-010 1.9905e-
011 3.44855e-012 9.91381e-013
2004 1 43.6091 99.6482 523.54 157.209 7.25 0.32563 0.00612946 0.000120002
8.8116e-006 8.3535e-007 6.02008e-008 4.91222e-009 5.70147e-010 7.6326e-011
1.44684e-011 3.28121e-012
2005 1 86.1916 495.738 282.821 118.048 5.39782 0.274328 0.00332456 9.86435e-
005 7.72026e-006 6.55086e-007 1.28054e-007 1.65964e-008 1.63314e-009
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2006 1  28.1488 179.091 387.198 90.3397 5.94455 0.291311 0.00395842 7.49534e-
005 8.85345e-006 8.00278e-007 1.39971e-007 4.92257e-008 7.69643e-009
7.92562e-010 9.6971e-011 1.63705e-011
2007 1  54.1085 325.238 392.773 275.752 10.2368 0.738033 0.00981765
0.000210896 1.59858e-005 2.18551e-006 4.08051e-007 1.2856e-007 5.45884e-008
8.94748e-009 9.25538e-010 1.34673e-010
2008 1  429.155 2183.21 8.95761 0.0177205 0.00108302 0.000348447 0.000199367
7.938e-005 3.32434e-005 1.25672e-005 7.58846e-006 3.10164e-006 1.21501e-006
5.40144e-007 8.91096e-008 1.07301e-008

BIOLOGY 2 55 15 1 N_Used_morphs;_lengths;_ages;_season;_by_season_in_endyr
bin low Mean_Size Wt_len-F mat_len spawn Wt_len-M
1 25 25.5 0.12445 1 0.12445 0.12445
2 26 26.5 0.14155 1 0.14155 0.14155
3 27 27.5 0.160232 1 0.160232 0.160232
4 28 28.5 0.180579 1 0.180579 0.180579
5 29 29.5 0.202673 1 0.202673 0.202673
6 30 30.5 0.226596 1 0.226596 0.226596
7 31 31.5 0.252433 1 0.252433 0.252433
8 32 32.5 0.280267 1 0.280267 0.280267
9 33 33.5 0.310187 1 0.310187 0.310187
10 34 34.5 0.342277 1 0.342277 0.342277
11 35 35.5 0.376627 1 0.376627 0.376627
12 36 36.5 0.413324 1 0.413324 0.413324
13 37 37.5 0.452458 1 0.452458 0.452458
14 38 38.5 0.494119 1 0.494119 0.494119
15 39 39.5 0.538399 1 0.538399 0.538399
16 40 40.5 0.58539 1 0.58539 0.58539
17 41 41.5 0.635184 1 0.635184 0.635184
18 42 42.5 0.687876 1 0.687876 0.687876
19 43 43.5 0.743558 1 0.743558 0.743558
20 44 44.5 0.802328 1 0.802328 0.802328
21 45 45.5 0.86428 1 0.86428 0.86428
22 46 46.5 0.929512 1 0.929512 0.929512
23 47 47.5 0.99812 1 0.99812 0.99812
24 48 48.5 1.0702 1 1.0702 1.0702
25 49 49.5 1.14586 1 1.14586 1.14586
26 50 50.5 1.22519 1 1.22519 1.22519
27 51 51.5 1.3083 1 1.3083 1.3083
28 52 52.5 1.39527 1 1.39527 1.39527
29 53 53.5 1.48623 1 1.48623 1.48623
30 54 54.5 1.58127 1 1.58127 1.58127
31 55 55.5 1.68048 1 1.68048 1.68048
32 56 56.5 1.78398 1 1.78398 1.78398
33 57 57.5 1.89188 1 1.89188 1.89188
34 58 58.5 2.00426 1 2.00426 2.00426
35 59 59.5 2.12125 1 2.12125 2.12125
36 60 60.5 2.24294 1 2.24294 2.24294
37 61 61.5 2.36945 1 2.36945 2.36945
38 62 62.5 2.50088 1 2.50088 2.50088
39 63 63.5 2.63734 1 2.63734 2.63734
40 64 64.5 2.77893 1 2.77893 2.77893
41 65 65.5 2.92577 1 2.92577 2.92577
42 66 66.5 3.07797 1 3.07797 3.07797
43 67 67.5 3.23564 1 3.23564 3.23564
44 68 68.5 3.39888 1 3.39888 3.39888
45 69 69.5 3.56782 1 3.56782 3.56782
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46 70 70.5 3.74255 1 3.74255 3.74255
47 71 71.5 3.9232 1 3.9232 3.9232
48 72 72.5 4.10988 1 4.10988 4.10988
49 73 73.5 4.30271 1 4.30271 4.30271
50 74 74.5 4.50178 1 4.50178 4.50178
51 75 75.5 4.70723 1 4.70723 4.70723
52 76 76.5 4.91917 1 4.91917 4.91917
53 77 77.5 5.13771 1 5.13771 5.13771
54 78 78.5 5.36296 1 5.36296 5.36296
55 79 79.5 5.59506 1 5.59506 5.59506

Growth_Parameters
 Count Yr Morph A1 A2 L-at-A1 L-at-A2 K A-at-L0 Linf CVmin CVmax natM_amin
natM_max M_young M_old
 1 1976 1 0 0 0 0 0 0 0 0 0 2 0.287429 0.287429
 2 1976 2 0 0 0 0 0 0 0 0 0 2 0.540621 0.540621
 3 1976 1 0.5 6 29.61 62.12 0.200667 -1.86932 78.2523 0.001 0.001 0 2
0.287429 0.287429
 4 1976 2 0.5 6 28.8967 53.195 0.213497 -2.30928 64.0635 0.001 0.001 0 2
0.540621 0.540621

Season gmorph GrowPattern Sex BirthSeas age age_Beg age_Mid M Len_Beg Len_Mid
SD_Beg SD_Mid Wt_Beg Wt_Mid Len_Mat Age_Mat Mat*Fecund Len:_1 SelWt:_1
RetWt:_1 Len:_2 SelWt:_2 RetWt:_2 Len:_3 SelWt:_3 RetWt:_3 Len:_4 SelWt:_4
RetWt:_4 Len:_5 SelWt:_5 RetWt:_5 Len:_6 SelWt:_6 RetWt:_6 Len:_7 SelWt:_7
RetWt:_7 Len:_8 SelWt:_8 RetWt:_8 Len:_9 SelWt:_9 RetWt:_9
1 1 1 1 1 0 0 0.5 0.287429 25 29.61 0.025 0.02961 0.12445 0.202673 1 0.38
0.0472911 29.5 0.202673 0.202673 29.5 0.202673 0.202673 29.5 0.202673
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1 1 1 1 1 1 1 1.5 0.287429 34.2536 38.4539 0.0342536 0.0384539 0.342277
0.494119 1 0.91 0.311472 38.5 0.494119 0.494119 38.5 0.494119 0.494119 38.5
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1 1 1 1 1 2 2 2.5 0.287429 42.2533 45.6899 0.0422533 0.0456899 0.687876
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1 1 1 1 1 3 3 3.5 0.287429 48.7984 51.6102 0.0487984 0.0516102 1.0702 1.3083
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1 1 1 1 1 4 4 4.5 0.287429 54.1536 56.4542 0.0541536 0.0564542 1.58105
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1 1 1 1 1 5 5 5.5 0.287429 58.5351 60.4174 0.0585351 0.0604174 2.00426
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1 1 1 1 1 6 6 6.5 0.287429 62.12 63.6601 0.06212 0.0636601 2.49737 2.63734 1
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1 1 1 1 1 7 7 7.5 0.287429 65.0531 66.3132 0.0650531 0.0663132 2.89535
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1 2 1 2 1 13 13 13.5 0.540621 61.625 61.8719 0.061625 0.0618719 2.36945
2.37197 1 -1 0 61.518 2.37181 2.37181 61.5137 2.37125 2.37125 61.5098 2.37074
2.37074 61.5182 2.37184 2.37184 61.5147 2.37138 2.37138 61.5192 2.37197
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1 2 1 2 1 14 14 14.5 0.540621 62.0938 62.2932 0.0620938 0.0622932 2.49228
2.50088 1 -1 0 62.5 2.50088 2.50088 62.5 2.50088 2.50088 62.5 2.50088 2.50088
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1 2 1 2 1 15 15 15.5 0.540621 62.4725 62.6336 0.0624725 0.0626336 2.50088
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MEAN_BODY_WT(begin)
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1 1976 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723

1 1977 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1978 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1979 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1980 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1981 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1982 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1983 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1984 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1985 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1986 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1987 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1988 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1989 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1990 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1991 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1992 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1993 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1994 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1995 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1996 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1997 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 1998 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 1999 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2000 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2001 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2002 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2003 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2004 1 0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723

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1 2005 1  0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2006 1  0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2007 1  0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
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1 2008 1  0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
1 2009 1  0.12445 0.342277 0.687876 1.0702 1.58105 2.00426 2.49737 2.89535
3.23564 3.56782 3.85572 4.10988 4.30271 4.50177 4.61818 4.70723
2 1976 1  0.12445 0.280267 0.494119 0.743558 0.99812 1.22519 1.48622 1.68048
1.8177 2.00426 2.12125 2.24294 2.34005 2.36945 2.49228 2.50088
2 1977 1  0.12445 0.280267 0.494119 0.743558 0.99812 1.22519 1.48622 1.68048
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2 1978 1  0.12445 0.280267 0.494119 0.743558 0.99812 1.22519 1.48622 1.68048
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2 2007 1 0 25 32.4573 38.5334 43.4414 47.4059 50.6083 53.195 55.2844 56.9722
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2 2008 1 0 25 32.4573 38.5334 43.4414 47.4059 50.6083 53.195 55.2844 56.9722
58.3354 59.4366 60.3261 61.0446 61.625 62.0938 62.4725
2 2009 1 0 25 32.4573 38.5334 43.4414 47.4059 50.6083 53.195 55.2844 56.9722
58.3354 59.4366 60.3261 61.0446 61.625 62.0938 62.4725

AGE_LENGTH_KEY
 sdratio 1000
 sdwithin 1
 sdbetween 1e-006

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78 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
77 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
76 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.0276667
75 0 0 0 0 0 0 0 0 0 0 0 0 0 5.15664e-006 0.99999 0.972333
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73 0 0 0 0 0 0 0 0 0 0 0 0 0.0893952 0.955004 1.35546e-019 3.20638e-069
2.78116e-132
72 0 0 0 0 0 0 0 0 0 0 3.15074e-005 0.910605 1.23412e-032 3.8891e-111
6.73625e-209 3.5943e-310
71 0 0 0 0 0 0 0 0 0 0 0.999968 1.90069e-035 2.4841e-142 2.17405e-280 0 0
70 0 0 0 0 0 0 0 0 0 0 0.999892 1.37735e-023 2.66169e-150 0 0 0 0
69 0 0 0 0 0 0 0 0 0 2.43139e-014 0.0001081 2.27033e-126 0 0 0 0 0
68 0 0 0 0 0 0 0 0 0 1 3.52652e-072 1.96337e-313 0 0 0 0 0
67 0 0 0 0 0 0 0 0 0 8.05867e-013 3.09817e-227 0 0 0 0 0 0
66 0 0 0 0 0 0 0 0 0.999999 2.26793e-104 0 0 0 0 0 0 0
65 0 0 0 0 0 0 0 0 1.1673e-006 2.84184e-288 0 0 0 0 0 0 0
64 0 0 0 0 0 0 0 4.65912e-008 1.53469e-087 0 0 0 0 0 0 0 0
63 0 0 0 0 0 0 0 1 7.95851e-267 0 0 0 0 0 0 0 0
62 0 0 0 0 0 0 0 1.76185e-025 0 0 0 0 0 0 0 0 0
61 0 0 0 0 0 0 0 3.70519e-150 0 0 0 0 0 0 0 0 0
60 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
59 0 0 0 0 0 0 2.46157e-012 0 0 0 0 0 0 0 0 0 0
58 0 0 0 0 0 0 5.72053e-122 0 0 0 0 0 0 0 0 0 0
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56 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
55 0 0 0 0 0 4.3608e-016 0 0 0 0 0 0 0 0 0 0 0
54 0 0 0 0 0 1.44262e-146 0 0 0 0 0 0 0 0 0 0 0
53 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
52 0 0 0 2.15383e-014 0 0 0 0 0 0 0 0 0 0 0 0
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44 0 0 8.60398e-052 0 0 0 0 0 0 0 0 0 0 0 0 0
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37 0 1.90961e-032 0 0 0 0 0 0 0 0 0 0 0 0 0 0
36 0 4.61743e-313 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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28 1.45166e-094 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
27 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
26 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
25 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
mean  29.61 38.4539 45.6899 51.6102 56.4542 60.4174 63.6601 66.3132 68.4839
70.2599 71.7131 72.902 73.8747 74.6707 75.3218 75.8546
sdsize  0.02961 0.0384539 0.0456899 0.0516102 0.0564542 0.0604174 0.0636601
0.0663132 0.0684839 0.0702599 0.0717131 0.072902 0.0738747 0.0746707
0.0753218 0.0758546
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76 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
75 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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70 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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68 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
67 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
66 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
65 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
64 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
63 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2.45753e-009
62 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.0192031 0.999999 1
61 0 0 0 0 0 0 0 0 0 0 0 5.66625e-007 1 0.980797 1.25723e-006 2.41036e-024
60 0 0 0 0 0 0 0 0 0 0 0.0565738 0.999999 5.6779e-009 2.22172e-045 5.36366e-
096 3.31475e-150
59 0 0 0 0 0 0 0 0 0 0.075493 0.943426 1.9761e-031 1.27542e-107 2.58835e-201
6.52616e-297 0
58 0 0 0 0 0 0 0 0 3.92182e-008 0.924507 7.43177e-052 9.86104e-174 2.49503e-
321 0 0 0
57 0 0 0 0 0 0 0 0 1 1.0189e-054 3.46612e-222 0 0 0 0 0
56 0 0 0 0 0 0 0 0 0.998981 2.86503e-033 4.26688e-232 0 0 0 0 0 0
55 0 0 0 0 0 0 0 0 0.00101878 6.41057e-189 0 0 0 0 0 0 0
54 0 0 0 0 0 0 0 1 3.83098e-097 0 0 0 0 0 0 0 0
53 0 0 0 0 0 0 0 2.6599e-008 0 0 0 0 0 0 0 0 0
52 0 0 0 0 0 0 0 0.285783 4.55572e-126 0 0 0 0 0 0 0 0 0
51 0 0 0 0 0 0 0 0.714217 0 0 0 0 0 0 0 0 0 0
50 0 0 0 0 0 0 0 4.16796e-078 0 0 0 0 0 0 0 0 0 0
49 0 0 0 0 0 0 0.970215 7.68703e-315 0 0 0 0 0 0 0 0 0 0
48 0 0 0 0 0 0 0.0297847 0 0 0 0 0 0 0 0 0 0 0
47 0 0 0 0 0 5.67649e-110 0 0 0 0 0 0 0 0 0 0 0
46 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
45 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
44 0 0 0 1.53722e-031 0 0 0 0 0 0 0 0 0 0 0 0 0
43 0 0 0 1.28821e-247 0 0 0 0 0 0 0 0 0 0 0 0 0
42 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
41 0 0 0.99799 0 0 0 0 0 0 0 0 0 0 0 0 0
40 0 0 0.00201011 0 0 0 0 0 0 0 0 0 0 0 0 0
39 0 0 3.97683e-163 0 0 0 0 0 0 0 0 0 0 0 0 0
38 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
37 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
36 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
35 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
34 0 3.71303e-076 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
33 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
32 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
31 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
30 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
29 0.000174638 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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28 0.999825 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
27 1.19527e-211 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
26 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
25 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
mean  28.8967 35.6573 41.1183 45.5294 49.0925 51.9706 54.2954 56.1733 57.6901
58.9154 59.9051 60.7045 61.3503 61.8719 62.2932 62.6336
sdsize  0.0288967 0.0356573 0.0411183 0.0455294 0.0490925 0.0519706 0.0542954
0.0561733 0.0576901 0.0589154 0.0599051 0.0607045 0.0613503 0.0618719
0.0622932 0.0626336

AGE_AGE_KEY
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SD  0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001
11 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1
10 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0
9 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
8 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0
7 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
6 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
5 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
4 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
3 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
2 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
11 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1
10 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0
9 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0
8 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0
7 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0
6 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0
5 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
4 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
3 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0
2 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Composition_Database
year season fleet rep pick_gender kind mkt ageerr gender Lbin_lo Lbin_hi bin
obs exp Pearson N effN Like Used
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47.7287 -8.65474e-005 1
1976 1 8 1 3 AGE 0 1 1 1 55 1 0.0279566 0.0967632 -3.29146 200 47.7287 -
6.94226 1
1976 1 8 1 3 AGE 0 1 1 1 55 2 0.225453 0.261708 -1.16643 200 47.7287 -6.72377
1
1976 1 8 1 3 AGE 0 1 1 1 55 3 0.147989 0.0967934 2.44869 200 47.7287 12.5661
1
1976 1 8 1 3 AGE 0 1 1 1 55 4 0.0505773 0.0363929 1.0712 200 47.7287 3.3293 1
1976 1 8 1 3 AGE 0 1 1 1 55 5 0.0212131 0.0118256 1.2281 200 47.7287 2.47918
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0.706277 1
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9 2008 L 2 63 1
```

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9 2008 L 2 64 1
9 2008 L 2 65 1
9 2008 L 2 66 1
9 2008 L 2 67 1
9 2008 L 2 68 1
9 2008 L 2 69 1
9 2008 L 2 70 1
9 2008 L 2 71 1
9 2008 L 2 72 1
9 2008 L 2 73 1
9 2008 L 2 74 1
9 2008 L 2 75 1
9 2008 L 2 76 1
9 2008 L 2 77 1
9 2008 L 2 78 1
9 2008 L 2 79 1
```

ASAP FINAL TERMINAL YEAR 2006 RUN (F08_FINAL_T2006.REP)

```
Age Structured Assessment Program (ASAP) Version 2.0
Start time for run: Tue Apr 22 14:04:08 2008

obj_fun        = 4129.13

Component                 Lambda          obj_fun
__Catch_Fleet_1                10           2021.06
__Catch_Fleet_2                10           1350
Catch_Fleet_Total              20           3371.06
Discard_Fleet_Total            0           0
__Index_Fit_1                  1           62.4538
__Index_Fit_2                  1           41.8752
__Index_Fit_3                  1           29.8409
__Index_Fit_4                  1           28.0347
__Index_Fit_5                  1           4.29183
__Index_Fit_6                  1           17.9629
__Index_Fit_7                  1           4.6618
__Index_Fit_8                  1           -6.56081
__Index_Fit_9                  1           -50.6321
__Index_Fit_10                  1           -35.3013
__Index_Fit_11                  1           11.0003
__Index_Fit_12                  1           -6.62937
__Index_Fit_13                  1           -36.7012
__Index_Fit_14                  1           28.4984
__Index_Fit_15                  1           -14.2225
__Index_Fit_16                  1           11.9055
__Index_Fit_17                  1           -21.0681
__Index_Fit_18                  1           -5.35967
__Index_Fit_19                  1           -33.838
__Index_Fit_20                  1           -46.6582
__Index_Fit_21                  1           15.7057
__Index_Fit_22                  1           -0.124791
__Index_Fit_23                  1           -36.9599
__Index_Fit_24                  1           -52.4357
__Index_Fit_25                  1           9.62513
__Index_Fit_26                  1           -12.6381
__Index_Fit_27                  1           1.78529
__Index_Fit_28                  1           10.0115
__Index_Fit_29                  1           42.0813
__Index_Fit_30                  1           29.3935
__Index_Fit_31                  1           -4.67064
__Index_Fit_32                  1           -10.4854
__Index_Fit_33                  1           -21.3929
__Index_Fit_34                  1           21.0149
__Index_Fit_35                  1           74.6825
__Index_Fit_36                  1           19.6284
__Index_Fit_37                  1           -1.9789
__Index_Fit_38                  1           -4.88607
__Index_Fit_39                  1           -32.1625
Index_Fit_Total                39           29.7474
Catch_Age_Comps       see_below           643.015
Discard_Age_Comps     see_below           0
Survey_Age_Comps      see_below           0
__Sel_Param_1                  1           0.867088
```

```
__Sel_Param_2                 1          3.65536
__Sel_Param_3                 1          1.13592
__Sel_Param_4                 1          2.72343
__Sel_Param_5                 1          0.934309
__Sel_Param_6                 1          4.19713
__Sel_Param_7                 1          1.65259
__Sel_Param_8                 1          3.72219
__Sel_Param_9                 1          1.22391
__Sel_Param_10                1          3.43685
__Sel_Param_11                1          1.35292
__Sel_Param_12                1          0.207853
Sel_Params_Total              12          25.1096
Index_Sel_Params_Total        0          0
q_year1_Total                 0          0
q_devs_Total                  390000          0
__Fmult_year1_fleet_1         1          0.609516
__Fmult_year1_fleet_2         1          0.783656
Fmult_year1_fleet_Total       2          1.39317
Fmult_devs_fleet_Total        0          0
N_year_1                      1          58.6486
Recruit_devs                  0          0
SRR_steepness                 0.01          0.0040846
SRR_unexpl_stock              0.01          0.149231
Fmult_Max_penalty          1000          0
F_penalty                     0          0

 Input and Estimated effective sample sizes for fleet 1
1982  200  27.7271
1983  200  30.8431
1984  200  90.0871
1985  200  331.302
1986  200  114.463
1987  200  164.466
1988  200  397.268
1989  200  163.779
1990  200  134.133
1991  200  21.4239
1992  200  196.706
1993  200  107.51
1994  200  115.255
1995  200  172.335
1996  200  34.3169
1997  200  119.736
1998  200  220.678
1999  200  54.8965
2000  200  190.279
2001  200  177.764
2002  200  92.9021
2003  200  504.807
2004  200  230.483
2005  200  349.825
2006  200  180.447
 Total  5000  4223.43
 Input and Estimated effective sample sizes for fleet 2
1982  90  498.805
1983  90  57.8055
1984  90  57.5958
```

```
1985  90  37.0952
1986  90  14.8764
1987  90  22.4456
1988  90  163.255
1989  90  90.3434
1990  90  26.1162
1991  90  456.218
1992  90  13.0192
1993  90  68.463
1994  90  16.8605
1995  90  17.3074
1996  90  4.79142
1997  90  46.4164
1998  90  35.6569
1999  90  38.242
2000  90  15.9088
2001  90  118.048
2002  90  56.1465
2003  90  653.953
2004  90  122.253
2005  90  61.1901
2006  90  493.346
 Total  2250  3186.16

 Input and Estimated effective Discard sample sizes for fleet 1
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16
 Input and Estimated effective Discard sample sizes for fleet 2
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
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1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
 Total  0  2.5e+16

Observed and predicted total fleet catch by year and standardized residual
 fleet 1 total catches
1982  18667  18799.4  -0.0708363
1983  26089  25452.3  0.247711
1984  25641  25416.1  0.0883032
1985  20339  20672  -0.162801
1986  20289  20698.2  -0.200192
1987  17790  17773.7  0.00919516
1988  21320  20895.1  0.201815
1989  9561  9387.99  0.183072
1990  6528  6264.06  0.413753
1991  9835  9648.9  0.191509
1992  10771  10808.8  -0.0351513
1993  9720  10029.8  -0.31453
1994  10819  10981.9  -0.14982
1995  9436  8755.08  0.750847
1996  10314  10064.2  0.245801
1997  9376  9628.44  -0.266338
1998  10735  10930.2  -0.180642
1999  8616  8648.19  -0.0373878
2000  12555  12736.9  -0.144187
2001  10249  10372  -0.119601
2002  10205  10377.6  -0.168168
2003  11729  12000.3  -0.229279
2004  13060  13315.4  -0.194118
2005  12549  12573.5  -0.0195378
2006  11254  11254.8  -0.000685572
 fleet 2 total catches
1982  296  296.893  -0.0302043
1983  376  376.201  -0.00536497
1984  415  414.996  0.000106675
1985  92  92.0124  -0.00135211
1986  578  578.089  -0.00153822
1987  522  521.864  0.00261906
1988  341  340.894  0.00310713
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1989  754  751.933  0.0275133
1990  1448  1446.44  0.010797
1991  1481  1481.45  -0.00303367
1992  1034  1035.8  -0.0174387
1993  1756  1757.17  -0.0066898
1994  1593  1586.2  0.0429103
1995  1060  1058.23  0.0167191
1996  1144  1147.45  -0.030229
1997  881  882.872  -0.021276
1998  1123  1122.52  0.00426382
1999  2259  2250.9  0.0360075
2000  1678  1674.85  0.0188583
2001  1742  1738.98  0.0173966
2002  1226  1226.33  -0.00267698
2003  1410  1411.96  -0.0139309
2004  1278  1279.35  -0.0105886
2005  1229  1228.35  0.0052756
2006  1083  1082.98  0.000198962
Observed and predicted total fleet Discards by year and standardized residual
 fleet 1 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
 fleet 2 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
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1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0

Index data
index number 1
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  7.15  2.90895  3.0635
1993  6.5  3.33213  2.27616
1994  3.76  3.51397  0.230519
1995  6.07  4.04061  1.3863
1996  22.17  4.84885  5.1778
1997  3.86  3.6201  0.218579
1998  1.68  3.65433  -2.64722
1999  2.11  4.00743  -2.18511
2000  0.7  3.19827  -5.17537
2001  3.07  3.94221  -0.851832
2002  2.77  3.7132  -0.998249
2003  8.17  4.18494  2.27884
2004  1.45  2.87026  -2.32606
2005  2.96  4.15399  -1.15438
2006  2.64  2.14549  0.706529
index number 2
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  4.74  3.42474  1.10714
1993  6.7  3.07508  2.65287
1994  7.2  3.67237  2.29337
1995  4.59  4.21159  0.293087
1996  8.33  7.64783  0.291053
1997  4.8  9.47655  -2.31708
1998  3.25  7.47334  -2.83651
1999  4.8  7.5415  -1.53906
2000  6.52  8.08791  -0.734076
2001  5.33  6.56992  -0.712459
2002  10.74  8.24646  0.899954
2003  14.36  7.9233  2.02561
2004  8.68  8.9371  -0.0994342
2005  4.03  6.11793  -1.42205
```

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2006  9.06  8.80414  0.0975854
index number 3
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.33  0.470967  -1.21166
1993  0.31  0.500816  -1.63396
1994  0.82  0.560742  1.2946
1995  0.25  0.727502  -3.63863
1996  0.6  0.87877  -1.29988
1997  1.04  1.9528  -2.14621
1998  2.29  3.41843  -1.36472
1999  2.9  2.80203  0.117068
2000  4.96  3.08944  1.61267
2001  6.42  3.20424  2.36729
2002  5.58  2.92339  2.20208
2003  8.48  3.8897  2.65491
2004  4.56  3.78015  0.638913
2005  3.07  4.17359  -1.04612
2006  4.29  2.79982  1.45364
index number 4
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.04  0.0460303  -0.478334
1993  0.05  0.0840443  -1.76904
1994  0.26  0.112987  2.83897
1995  0.02  0.137356  -6.5637
1996  0.12  0.110345  0.285741
1997  0.43  0.181169  2.94438
1998  0.42  0.680801  -1.64537
1999  0.84  1.27824  -1.43015
2000  2.51  1.27744  2.3008
2001  2.44  1.28587  2.18206
2002  2.26  1.59193  1.19368
2003  2.67  1.55779  1.83543
2004  1.64  2.11267  -0.862713
2005  1.34  1.98228  -1.3339
2006  2.47  2.13146  0.502149
index number 5
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.04  0.0495524  -0.729499
1993  0.04  0.0197719  2.40024
1994  0.01  0.0305303  -3.80206
1996  0.03  0.03455  -0.481025
1997  0.15  0.037565  4.71645
1998  0.12  0.0990428  0.653833
1999  0.41  0.386608  0.200116
2000  1.08  1.00236  0.254144
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2001  1.34  1.14543  0.534429
2002  1.33  1.44753  -0.288465
2003  1.96  1.92354  0.0639604
2004  1.44  2.18629  -1.4224
2005  1.49  2.64488  -1.9548
2006  2.6  2.713  -0.14492
index number 6
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.7  0.591094  0.438947
1983  0.32  0.713157  -2.08014
1984  0.17  0.783466  -3.96604
1985  0.55  0.445233  0.548524
1986  1.48  0.536548  2.6337
1987  0.47  0.586939  -0.576732
1988  0.6  0.449166  0.751549
1989  0.06  0.120622  -1.81261
1990  0.63  0.269849  2.20078
1991  0.79  0.341251  2.17887
1992  0.77  0.290155  2.53334
1993  0.73  0.332365  2.04232
1994  0.35  0.350504  -0.00373204
1995  0.79  0.403033  1.74694
1996  1.08  0.483652  2.08525
1997  0.29  0.361089  -0.569089
1998  0.27  0.364504  -0.779006
1999  0.22  0.399723  -1.55001
2000  0.19  0.319013  -1.34511
2001  0.48  0.393218  0.517636
2002  0.34  0.370375  -0.222117
2003  0.54  0.41743  0.668271
2004  0.3  0.286296  0.121368
2005  0.26  0.414343  -1.20963
2006  0.04  0.214004  -4.35328
index number 7
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.43  0.728323  1.75128
1983  0.39  0.762549  -1.74047
1984  0.33  0.804476  -2.31302
1985  1.56  0.834799  1.62296
1986  0.43  0.501237  -0.397902
1987  0.43  0.536724  -0.575463
1988  0.81  0.661191  0.526904
1989  0.23  0.397224  -1.41834
1990  0.03  0.110109  -3.37511
1991  0.27  0.292389  -0.20678
1992  0.41  0.320567  0.638714
1993  0.5  0.287837  1.43338
1994  0.53  0.343746  1.12387
1995  0.27  0.394219  -0.982431
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1996  0.56  0.715862  -0.637374
1997  0.67  0.887036  -0.728372
1998  0.52  0.699529  -0.769829
1999  0.74  0.705909  0.122421
2000  1.03  0.757055  0.79916
2001  0.89  0.614966  0.959512
2002  0.89  0.771896  0.369554
2003  1.29  0.741647  1.43678
2004  1.45  0.836542  1.42774
2005  0.65  0.572659  0.32883
2006  1.04  0.824096  0.603989
index number 8
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.12  0.094435  0.621876
1983  0.19  0.156945  0.49611
1984  0.09  0.121319  -0.775115
1985  0.21  0.113027  1.60798
1986  0.2  0.128393  1.15047
1987  0.02  0.063304  -2.9908
1988  0.07  0.0877675  -0.587137
1989  0.02  0.061687  -2.92364
1990  0.06  0.0588926  0.0483577
1992  0.01  0.0455997  -3.93849
1993  0.04  0.0484897  -0.499601
1994  0.04  0.0542919  -0.792975
1995  0.02  0.0704379  -3.26798
1996  0.12  0.0850838  0.892543
1997  0.09  0.189073  -1.92684
1998  0.32  0.330977  -0.0875491
1999  0.48  0.271297  1.48103
2000  0.63  0.299124  1.93343
2001  1.02  0.31024  3.08943
2002  0.74  0.283047  2.49456
2003  0.59  0.376607  1.16526
2004  0.85  0.366  2.18714
2005  0.58  0.404093  0.938039
2006  0.24  0.271083  -0.316116
index number 9
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.02  0.0256118  -0.64197
1983  0.03  0.0278189  0.195926
1984  0.05  0.0337121  1.02313
1985  0.04  0.0228999  1.44774
1986  0.02  0.0234121  -0.408878
1987  0.01  0.0217195  -2.01328
1988  0.02  0.0140079  0.924357
1989  0.01  0.0108226  -0.20519
1991  0.02  0.0178671  0.29272
1994  0.01  0.0126056  -0.601053
```

```
1997  0.01  0.0202125  -1.82663
1998  0.06  0.075955  -0.612056
1999  0.13  0.142609  -0.240295
2000  0.12  0.14252  -0.44644
2001  0.2  0.14346  0.862444
2002  0.31  0.177607  1.4458
2003  0.29  0.173798  1.32896
2004  0.27  0.235705  0.352604
2005  0.15  0.221157  -1.00775
2006  0.25  0.237801  0.129858
index number 10
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.02  0.0157397  0.621786
1984  0.02  0.0113545  1.46947
1985  0.02  0.0108902  1.57784
1986  0.01  0.00865949  0.373596
1992  0.01  0.00659288  1.08136
1995  0.01  0.00605114  1.30392
1998  0.02  0.0131775  1.08298
1999  0.03  0.0514376  -1.39953
2000  0.17  0.133362  0.630055
2001  0.1  0.152398  -1.09363
2002  0.19  0.192592  -0.0351721
2003  0.2  0.255924  -0.640006
2004  0.16  0.290882  -1.55156
2005  0.17  0.351898  -1.88848
2006  0.2  0.36096  -1.53263
index number 11
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  1.52  1.38509  0.16761
1984  1.46  1.46125  -0.00154469
1985  1.39  1.51633  -0.156874
1986  0.8  0.910447  -0.23322
1987  0.83  0.974906  -0.290192
1988  0.58  1.20099  -1.31263
1989  0.62  0.721517  -0.273459
1990  0.21  0.200002  0.0879699
1991  0.38  0.531095  -0.603719
1992  0.84  0.582278  0.660858
1993  1.04  0.522828  1.24023
1994  0.8  0.62438  0.446973
1995  0.67  0.71606  -0.1199
1996  1.16  1.30029  -0.20589
1997  1.24  1.61121  -0.472263
1998  1.29  1.27063  0.0272904
1999  2.13  1.28221  0.915278
2000  1.73  1.37511  0.414029
2001  1.2  1.11702  0.129219
2002  1.36  1.40207  -0.0549427
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2003  1.17  1.34713  -0.254225
2004  1.31  1.5195  -0.267534
2005  1.49  1.04018  0.648109
2006  1.14  1.49689  -0.491171
index number 12
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.4  0.39768  0.0104919
1984  0.34  0.307408  0.181727
1985  0.43  0.286396  0.732911
1986  0.46  0.325331  0.62466
1987  0.11  0.160405  -0.680271
1988  0.2  0.222392  -0.191383
1989  0.18  0.156307  0.254519
1990  0.05  0.149226  -1.9719
1991  0.03  0.0609517  -1.27839
1992  0.09  0.115544  -0.450561
1993  0.25  0.122867  1.28105
1994  0.03  0.137569  -2.74642
1995  0.09  0.178481  -1.23473
1996  0.28  0.215592  0.471409
1997  0.57  0.479087  0.313345
1998  1.14  0.838655  0.553609
1999  1.63  0.687433  1.55699
2000  1.49  0.757944  1.21895
2001  1.22  0.786109  0.792606
2002  0.93  0.717207  0.468556
2003  0.86  0.954275  -0.187588
2004  1.03  0.927398  0.189232
2005  1.37  1.02392  0.525092
2006  0.54  0.68689  -0.433903
index number 13
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.03  0.058497  -1.20426
1984  0.12  0.0708891  0.949256
1985  0.07  0.0481534  0.674653
1986  0.05  0.0492305  0.02797
1987  0.11  0.0456712  1.5852
1988  0.03  0.0294555  0.033033
1989  0.03  0.0227575  0.49828
1991  0.04  0.0375705  0.112998
1993  0.03  0.0197169  0.756923
1994  0.01  0.0265068  -1.75797
1995  0.01  0.0322238  -2.11017
1996  0.02  0.025887  -0.465286
1997  0.04  0.0425024  -0.109432
1998  0.29  0.159716  1.07568
1999  0.33  0.299876  0.172628
2000  0.31  0.299688  0.0610064
2001  0.4  0.301665  0.50882
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2002  0.37  0.373468  -0.0168259
2003  0.35  0.365459  -0.0779425
2004  0.25  0.495635  -1.2342
2005  0.66  0.465045  0.631376
2006  0.47  0.500042  -0.111737
index number 14
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.584  0.789948  1.25469
1983  0.599  0.82707  -0.581821
1984  0.078  0.872545  -4.35464
1985  1.26  0.905433  0.595935
1986  0.522  0.543647  -0.0732771
1987  0.64  0.582137  0.170892
1988  1.005  0.717136  0.608602
1989  0.363  0.430834  -0.308954
1990  0.021  0.119425  -3.13459
1991  0.05  0.317128  -3.33136
1992  0.342  0.347691  -0.02976
1993  0.492  0.312192  0.82029
1994  1.217  0.372831  2.13344
1995  1.302  0.427575  2.00812
1996  0.686  0.776432  -0.223317
1997  1.279  0.96209  0.51347
1998  1.212  0.758718  0.8447
1999  0.878  0.765638  0.24695
2000  1.659  0.821111  1.26834
2001  1.026  0.666999  0.776599
2002  1.511  0.837207  1.06482
2003  1.44  0.804399  1.05012
2004  0.283  0.907324  -2.10104
2005  0.351  0.621112  -1.02924
2006  2.44  0.893825  1.81104
index number 15
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.142  0.125276  0.225984
1983  0.45  0.2082  1.38995
1984  0.067  0.16094  -1.58037
1985  0.036  0.149939  -2.57291
1986  0.185  0.170323  0.149063
1987  0.013  0.0839778  -3.3644
1988  0.123  0.116431  0.0989854
1989  0.102  0.0818327  0.397279
1990  0.081  0.0781257  0.0651571
1991  0.012  0.0319105  -1.76376
1992  0.09  0.0604916  0.716493
1993  0.065  0.0643255  0.018811
1994  0.048  0.0720226  -0.731774
1995  0.053  0.0934414  -1.0226
1996  0.114  0.11287  0.0179577
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1997  0.181  0.25082  -0.588334
1998  0.659  0.439068  0.7323
1999  1.112  0.359897  2.03439
2000  1.205  0.396812  2.00315
2001  0.73  0.411558  1.03351
2002  0.397  0.375485  0.100482
2003  0.624  0.499599  0.400972
2004  0.323  0.485528  -0.73503
2005  1.029  0.536062  1.17597
2006  0.975  0.359613  1.79871
index number 16
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.405  0.474024  -0.283799
1983  1.662  0.787798  1.34629
1984  0.625  0.608971  0.0468543
1985  0.267  0.567347  -1.35925
1986  1.895  0.644477  1.94501
1987  0.679  0.317759  1.36936
1988  0.663  0.440556  0.737112
1989  0.429  0.309642  0.587974
1990  0.317  0.295616  0.125952
1992  0.288  0.228891  0.414263
1993  0.186  0.243398  -0.485021
1994  0.478  0.272522  1.0133
1995  0.076  0.353568  -2.77242
1996  0.506  0.427084  0.305773
1997  1.282  0.949065  0.542277
1998  1.508  1.66136  -0.174667
1999  0.59  1.36179  -1.50842
2000  0.94  1.50148  -0.844568
2001  2.303  1.55727  0.705624
2002  1.083  1.42078  -0.489562
2003  1.302  1.89041  -0.672464
2004  1.254  1.83716  -0.688683
2005  1.455  2.02838  -0.599137
2006  2.049  1.36072  0.738194
index number 17
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.012  0.0460514  -2.42528
1983  0.02  0.0500199  -1.65314
1984  0.154  0.0606162  1.68146
1985  0.127  0.0411752  2.03124
1986  0.04  0.0420962  -0.0921146
1987  0.214  0.0390527  3.06767
1988  0.011  0.0251869  -1.49398
1989  0.006  0.0194596  -2.12183
1990  0.016  0.0224764  -0.612926
1991  0.011  0.032126  -1.93281
1992  0.006  0.00923383  -0.777465
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1994  0.03  0.0226656  0.50558
1997  0.114  0.0363432  2.06162
1998  0.351  0.136571  1.70229
1999  0.262  0.256419  0.0388295
2000  0.379  0.256259  0.70575
2001  0.494  0.257949  1.17179
2002  0.307  0.319347  -0.0711082
2003  0.178  0.312498  -1.01497
2004  0.256  0.42381  -0.909099
2005  0.136  0.397653  -1.93489
2006  1.35  0.427578  2.07339
index number 18
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.271  0.378296  -0.601533
1985  0.325  0.392555  -0.340571
1986  0.1  0.235701  -1.54621
1987  0.086  0.252388  -1.94156
1988  0.223  0.310918  -0.599366
1989  0.049  0.18679  -2.41322
1990  0.022  0.0517775  -1.54354
1991  0.189  0.137493  0.573796
1992  0.188  0.150743  0.398307
1993  0.151  0.135352  0.19729
1994  0.314  0.161643  1.19746
1995  0.051  0.185377  -2.32739
1996  0.266  0.336626  -0.424654
1997  0.507  0.417119  0.351913
1998  0.594  0.328946  1.06578
1999  0.593  0.331946  1.04636
2000  0.726  0.355996  1.28514
2001  0.34  0.289181  0.291957
2002  1.264  0.362975  2.25009
2003  1.016  0.348751  1.9283
2004  0.818  0.393374  1.32026
2005  0.264  0.269286  -0.0357535
2006  0.36  0.387522  -0.132852
index number 19
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.044  0.0701673  -0.841625
1985  0.04  0.0653713  -0.885828
1986  0.082  0.0742584  0.178839
1987  0.014  0.0366131  -1.73368
1988  0.035  0.050762  -0.670498
1989  0.024  0.0356778  -0.714997
1990  0.013  0.0340616  -1.73706
1991  0.029  0.0139125  1.3246
1992  0.021  0.0263734  -0.410874
1993  0.015  0.028045  -1.12848
1994  0.025  0.0314008  -0.411093
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1995  0.02  0.0407391  -1.28303
1996  0.086  0.0492098  1.00675
1997  0.057  0.109354  -1.17497
1998  0.503  0.191427  1.74222
1999  0.385  0.15691  1.61867
2000  0.524  0.173004  1.99847
2001  0.365  0.179433  1.28058
2002  0.465  0.163706  1.88267
2003  0.395  0.217818  1.07342
2004  0.41  0.211683  1.19216
2005  0.15  0.233715  -0.799741
2006  0.068  0.156786  -1.5065
index number 20
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.058  0.0185776  2.05313
1986  0.008  0.0189931  -1.55927
1987  0.004  0.01762  -2.67395
1988  0.009  0.0113639  -0.420585
1989  0.016  0.00877985  1.08226
1990  0.006  0.010141  -0.94646
1991  0.028  0.0144947  1.18738
1992  0.004  0.00416616  -0.0733963
1993  0.018  0.00760677  1.55332
1994  0.018  0.0102263  1.01964
1995  0.005  0.0124319  -1.64258
1996  0.023  0.00998719  1.50437
1997  0.036  0.0163974  1.41817
1998  0.116  0.0616187  1.14087
1999  0.139  0.115692  0.330996
2000  0.074  0.11562  -0.804747
2001  0.12  0.116382  0.0552014
2002  0.233  0.144084  0.86678
2003  0.232  0.140994  0.898121
2004  0.194  0.191216  0.0260666
2005  0.033  0.179414  -3.05347
2006  0.065  0.192916  -1.96185
index number 21
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.571  0.999988  -1.01053
1986  0.339  0.600421  -1.03087
1987  1.17  0.64293  1.07973
1988  1.067  0.792026  0.537429
1989  0.884  0.475826  1.11703
1990  0.029  0.131897  -2.73163
1991  0.674  0.350246  1.18048
1992  0.826  0.384  1.38131
1993  0.57  0.344794  0.906542
1994  0.827  0.411766  1.25759
1995  0.3  0.472226  -0.818153
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1996  0.384  0.857515  -1.44883
1997  0.887  1.06256  -0.325678
1998  0.681  0.837951  -0.374017
1999  0.269  0.845594  -2.06547
2000  0.679  0.906859  -0.521838
2001  0.395  0.736654  -1.12393
2002  2.689  0.924637  1.92515
2003  3.087  0.888403  2.24617
2004  1.459  1.00208  0.677491
2005  0.385  0.685975  -1.04163
2006  1.093  0.987167  0.183661
index number 22
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.331  0.399583  -0.339581
1986  0.528  0.453905  0.272686
1987  0.298  0.223798  0.516399
1988  0.223  0.310283  -0.595683
1989  0.481  0.218081  1.42648
1990  0.095  0.208202  -1.41499
1991  0.11  0.0850404  0.464108
1992  0.34  0.161208  1.34578
1993  0.366  0.171425  1.36784
1994  0.152  0.191937  -0.42071
1995  0.085  0.249018  -1.93841
1996  0.117  0.300796  -1.70286
1997  1.188  0.668426  1.03713
1998  1.373  1.1701  0.288378
1999  1.054  0.959112  0.170131
2000  1.484  1.05749  0.611065
2001  0.871  1.09679  -0.415675
2002  1.137  1.00065  0.230365
2003  1.93  1.33141  0.669559
2004  1.319  1.29391  0.0346299
2005  0.755  1.42859  -1.15006
2006  0.744  0.958355  -0.456575
index number 23
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.072  0.0572415  0.413673
1986  0.075  0.0585219  0.447396
1987  0.072  0.0542908  0.509115
1988  0.033  0.0350147  -0.106869
1989  0.037  0.0270526  0.564704
1990  0.015  0.0312465  -1.32343
1991  0.042  0.0446613  -0.110797
1992  0.036  0.0128368  1.85965
1993  0.046  0.0234381  1.21599
1994  0.039  0.0315095  0.384611
1995  0.024  0.0383055  -0.843151
1996  0.012  0.0307727  -1.69828
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1997  0.042  0.050524  -0.333227
1998  0.373  0.18986  1.21781
1999  0.321  0.356472  -0.189021
2000  0.346  0.356249  -0.0526451
2001  0.341  0.358599  -0.090751
2002  0.436  0.443954  -0.0326028
2003  0.479  0.434433  0.176118
2004  0.407  0.589177  -0.667097
2005  0.44  0.552814  -0.411616
2006  0.355  0.594416  -0.929576
index number 24
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.025  0.012063  1.31418
1986  0.009  0.00959207  -0.114897
1987  0.007  0.00762591  -0.154444
1988  0.003  0.00902544  -1.98631
1989  0.003  0.00365762  -0.357432
1990  0.001  0.00409602  -2.5428
1991  0.012  0.0070545  0.958032
1992  0.022  0.00730289  1.98872
1993  0.025  0.00291393  3.87615
1994  0.007  0.00449946  0.79701
1995  0.009  0.00670281  0.531454
1996  0.005  0.00509187  -0.0328352
1997  0.005  0.00553622  -0.183718
1998  0.04  0.0145966  1.81797
1999  0.075  0.0569771  0.49564
2000  0.127  0.147724  -0.272601
2001  0.191  0.16881  0.222713
2002  0.134  0.213333  -0.8386
2003  0.183  0.283486  -0.789297
2004  0.203  0.322208  -0.833149
2005  0.119  0.389795  -2.13971
2006  0.151  0.399833  -1.75608
index number 25
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.74  0.329949  2.99849
1983  0.52  0.548355  -0.0957497
1984  0.42  0.423881  -0.0165866
1985  0.49  0.394908  0.389084
1986  0.28  0.448595  -0.849992
1987  0.51  0.22118  1.50661
1988  0.37  0.306654  0.338647
1989  0.24  0.21553  0.193935
1990  0.07  0.205766  -1.94449
1991  0.12  0.0840456  0.642244
1992  0.08  0.159322  -1.24235
1993  0.41  0.16942  1.59379
1994  0.22  0.189692  0.267307
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1995  0.03  0.246105  -3.79533
1996  0.2  0.297277  -0.714765
1997  1.03  0.660607  0.800982
1998  0.96  1.15641  -0.335688
1999  0.36  0.947892  -1.74592
2000  1.91  1.04512  1.08739
2001  1.24  1.08396  0.242545
2002  0.63  0.988947  -0.813183
2003  1.38  1.31584  0.0858589
2004  2.08  1.27878  0.877282
2005  1.3  1.41187  -0.148875
2006  1.38  0.947144  0.678772
index number 26
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.2  0.0594143  2.18892
1983  0.07  0.0645343  0.146612
1984  0.11  0.0782054  0.61521
1985  0.1  0.0531232  1.14074
1986  0.02  0.0543114  -1.80159
1987  0.13  0.0503848  1.70933
1988  0.02  0.0324955  -0.875307
1992  0.01  0.0119132  -0.31571
1993  0.11  0.0217518  2.9229
1994  0.07  0.0292425  1.57412
1997  0.01  0.046889  -2.78658
1998  0.03  0.1762  -3.19276
1999  0.09  0.330825  -2.34761
2000  0.35  0.330618  0.102736
2001  0.45  0.332799  0.544097
2002  0.3  0.412013  -0.572164
2003  0.4  0.403177  -0.0142652
2004  0.49  0.546788  -0.197751
2005  0.78  0.513041  0.755508
2006  0.69  0.55165  0.403558
index number 27
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.17  0.196469  -0.260964
1991  0.07  0.248455  -2.28447
1992  0.15  0.211253  -0.61752
1993  0.11  0.241986  -1.42178
1994  0.08  0.255192  -2.0919
1995  0.2  0.293437  -0.691318
1996  0.41  0.352133  0.274381
1997  0.17  0.262898  -0.78622
1998  0.07  0.265385  -2.40334
1999  0.26  0.291027  -0.203304
2000  0.63  0.232264  1.79949
2001  0.42  0.286291  0.69114
2002  0.81  0.26966  1.98349
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2003  1.48  0.303918  2.85483
2004  0.54  0.208444  1.71664
2005  0.55  0.301671  1.08308
2006  0.19  0.15581  0.357768
index number 28
units = 2
month = 1
starting and ending ages for selectivity = 3  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.1  0.0950919  0.0907569
1991  0.08  0.252512  -2.07287
1992  0.18  0.276847  -0.776371
1993  0.14  0.248581  -1.03537
1994  0.05  0.296865  -3.21228
1995  0.22  0.340454  -0.787453
1996  0.53  0.61823  -0.277693
1997  0.52  0.766059  -0.698687
1998  0.36  0.604125  -0.933572
1999  0.61  0.609635  0.00107831
2000  1.89  0.653805  1.91433
2001  0.55  0.531095  0.0630783
2002  1.11  0.666622  0.919531
2003  2.25  0.640499  2.26584
2004  1.53  0.722452  1.35321
2005  1.89  0.494558  2.41774
2006  1.09  0.711703  0.768732
index number 29
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  3.06  5.01494  -0.890885
1989  0.51  1.34674  -1.75114
1990  1.44  3.01287  -1.33135
1991  2.69  3.81007  -0.627769
1992  3  3.23958  -0.138556
1993  5.69  3.71086  0.77085
1994  1.07  3.91337  -2.33852
1995  2.93  4.49987  -0.773734
1996  5.1  5.39998  -0.103071
1997  8.25  4.03156  1.29133
1998  5.8  4.06968  0.638925
1999  6.12  4.46291  0.569437
2000  3.91  3.56179  0.168211
2001  3.32  4.39028  -0.503918
2002  9.11  4.13524  1.42436
2003  5.61  4.6606  0.334358
2004  6.27  3.19649  1.21498
2005  5.99  4.62614  0.465938
2006  5.74  2.38935  1.58055
index number 30
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
```

```
 year, obs index, pred index, standardized residual
1988  1.03  1.22293  -0.30963
1989  0.18  0.734702  -2.53647
1990  0.11  0.203657  -1.1108
1991  0.27  0.5408  -1.25268
1992  0.57  0.592918  -0.0710883
1993  0.2  0.532381  -1.76559
1994  0.08  0.63579  -3.73813
1995  0.28  0.729144  -1.72599
1996  2.7  1.32405  1.28501
1997  5.25  1.64065  2.09758
1998  2.67  1.29384  1.30648
1999  3.46  1.30564  1.75753
2000  1.82  1.40024  0.472832
2001  1.18  1.13744  0.066253
2002  4.13  1.42769  1.91559
2003  2.55  1.37174  1.11812
2004  2.49  1.54726  0.858043
2005  1.24  1.05918  0.284235
2006  3.22  1.52424  1.34872
index number 31
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.03  0.0783445  -1.7311
1991  0.02  0.0319999  -0.847593
1992  0.06  0.0606611  -0.0197615
1993  0.01  0.0645057  -3.36181
1995  0.05  0.0937032  -1.13272
1996  0.18  0.113187  0.836624
1997  1.02  0.251523  2.52478
1998  0.29  0.440298  -0.753039
1999  0.65  0.360905  1.06103
2000  0.45  0.397924  0.221794
2001  0.41  0.412711  -0.0118832
2002  1.28  0.376537  2.20662
2003  0.57  0.500999  0.232696
2004  0.57  0.486888  0.284218
2005  0.53  0.537564  -0.0255538
2006  0.48  0.36062  0.515697
index number 32
units = 2
month = 1
starting and ending ages for selectivity = 5  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.02  0.0114097  1.01218
1993  0.01  0.0208324  -1.32355
1994  0.02  0.0280065  -0.607208
1995  0.16  0.0340469  2.79062
1996  0.05  0.0273516  1.08789
1997  0.18  0.0449071  2.50375
1998  0.04  0.168753  -2.59607
1999  0.18  0.316842  -1.01972
2000  0.22  0.316644  -0.656704
```

```
2001  0.15  0.318733  -1.35924
2002  0.81  0.394598  1.29693
2003  0.51  0.386136  0.501742
2004  0.43  0.523677  -0.355428
2005  0.32  0.491356  -0.773377
2006  0.4  0.528333  -0.501815
index number 33
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.24  0.0875388  1.81882
1986  0.172  0.0966126  1.04017
1987  0.075  0.0734421  0.0378544
1988  0.015  0.0199672  -0.515841
1990  0.032  0.0566985  -1.03156
1991  0.036  0.0485499  -0.539344
1992  0.013  0.0551377  -2.60568
1993  0.084  0.0582901  0.658928
1994  0.132  0.0664654  1.23734
1995  0.023  0.0771955  -2.18362
1996  0.069  0.0575173  0.328255
1997  0.033  0.0578618  -1.01269
1999  0.044  0.0507513  -0.257428
2000  0.012  0.0624614  -2.97494
2001  0.021  0.0587661  -1.85576
2002  0.442  0.0661368  3.42568
2004  0.255  0.0656517  2.44701
2005  0.067  0.033922  1.22744
2006  0.098  0.0644636  0.755378
index number 34
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  1.80339  0.414979
1983  5.01  1.99535  1.66023
1984  1.58  1.13756  0.592481
1985  1.26  1.36516  -0.144557
1986  1.26  1.50666  -0.32242
1987  0.39  1.14532  -1.94278
1988  0.54  0.311386  0.992825
1989  1.24  0.705588  1.01681
1990  2.54  0.884208  1.90298
1991  2.64  0.757131  2.25242
1992  0.89  0.859867  0.0621154
1993  0.5  0.909029  -1.07801
1994  2.41  1.03652  1.52162
1995  0.63  1.20386  -1.16781
1996  0.81  0.896976  -0.183936
1997  0.89  0.902348  -0.0248493
1998  0.73  0.989671  -0.548821
1999  0.53  0.791461  -0.723164
2000  0.57  0.97408  -0.966356
2001  0.47  0.916452  -1.20426
```

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2002  0.77  1.0314  -0.527092
2003  0.44  0.707365  -0.856197
2004  1.3  1.02383  0.430669
2005  0.35  0.52901  -0.744932
2006  0.8  1.0053  -0.411952
index number 35
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  3.408  15.2728  -2.70498
1983  17.699  16.8985  0.0834698
1984  13.31  9.63392  0.582899
1985  12.843  11.5614  0.18958
1986  59.526  12.7598  2.77741
1987  7.584  9.69965  -0.443722
1988  1.763  2.63711  -0.726163
1989  2.855  5.97557  -1.33199
1990  4.733  7.48829  -0.827359
1991  7.337  6.41209  0.242997
1992  8.487  7.28215  0.276115
1993  4.145  7.6985  -1.11652
1994  22.311  8.77823  1.68221
1995  13.067  10.1954  0.447521
1996  6.493  7.59643  -0.283047
1997  7.997  7.64192  0.0819045
1998  14.983  8.38146  1.04758
1999  8.565  6.70283  0.442108
2000  9.874  8.24941  0.324182
2001  13.543  7.76136  1.00397
2002  5.406  8.73483  -0.865281
2003  8.18  5.99062  0.561748
2004  6.993  8.67076  -0.387812
2005  2.198  4.48015  -1.28421
2006  9.658  8.51384  0.227395
index number 36
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  0.17  0.42419  -1.64899
1989  1  0.961196  0.0713718
1990  1.28  1.20452  0.109601
1991  1  1.03141  -0.0557768
1992  1.1  1.17137  -0.113361
1993  2.55  1.23834  1.30263
1994  1.66  1.41202  0.291786
1995  4.95  1.63997  1.99222
1996  1.66  1.22192  0.55255
1997  1.65  1.22924  0.530884
1998  0.67  1.34819  -1.261
1999  1.03  1.07818  -0.0824413
2000  0.95  1.32695  -0.602653
2001  0.62  1.24845  -1.26226
2002  1.51  1.40504  0.129928
```

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2003  0.6  0.963618  -0.85438
2004  0.9  1.39473  -0.789992
2005  3.11  0.720652  2.63695
2006  0.81  1.36949  -0.947062
index number 37
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.55  0.523346  0.0895843
1983  0.96  0.579053  0.911683
1984  0.18  0.330121  -1.09376
1985  0.59  0.39617  0.718248
1986  0.39  0.437235  -0.206172
1987  0.07  0.332374  -2.80925
1988  0.06  0.0903647  -0.738502
1989  0.31  0.204762  0.747904
1990  0.44  0.256598  0.9725
1991  0.76  0.21972  2.23793
1992  0.99  0.249534  2.48526
1993  0.23  0.263801  -0.247273
1994  0.75  0.3008  1.64762
1995  0.93  0.34936  1.76566
1996  0.11  0.260303  -1.55338
1997  0.17  0.261862  -0.7791
1998  0.38  0.287204  0.504911
1999  0.21  0.229683  -0.161569
2000  0.22  0.282679  -0.452081
2001  0.12  0.265955  -1.4352
2002  0.06  0.299313  -2.8983
2003  0.18  0.205278  -0.236981
2004  0.36  0.297117  0.346209
2005  0.16  0.153519  0.0745648
2006  0.31  0.29174  0.109481
index number 38
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1986  0.32  0.287844  0.190984
1987  0.26  0.218811  0.311039
1988  0.01  0.0594895  -3.21582
1989  0.14  0.1348  0.068252
1990  0.36  0.168925  1.36453
1991  0.38  0.144648  1.74183
1992  0.37  0.164275  1.46428
1993  0.05  0.173667  -2.24543
1994  0.57  0.198024  1.90662
1995  0.3  0.229993  0.479218
1996  0.08  0.171365  -1.37376
1997  0.22  0.172391  0.439777
1998  0.39  0.189074  1.30567
1999  0.35  0.151206  1.51356
2000  0.21  0.186095  0.217938
2001  0.14  0.175085  -0.403294
```

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2002  0.13  0.197046  -0.750029
2003  0.21  0.13514  0.794924
2004  0.27  0.1956  0.581319
2005  0.01  0.101066  -4.17157
2006  0.17  0.19206  -0.220033
index number 39
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.02  0.0319418  -0.844316
1992  0.01  0.0310625  -2.04399
1993  0.01  0.0328385  -2.14425
1994  0.04  0.0374441  0.119076
1995  0.03  0.0434891  -0.669618
1996  0.02  0.0324031  -0.870171
1997  0.04  0.0325972  0.36907
1999  0.03  0.0285914  0.0867281
2000  0.09  0.0351884  1.69354
2001  0.01  0.0331066  -2.15892
2002  0.11  0.037259  1.95232
2003  0.05  0.0255534  1.21052
2004  0.1  0.0369857  1.79371
2005  0.04  0.0191104  1.33206
2006  0.04  0.0363164  0.174226

Input and Estimated effective sample sizes for index 1
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 2
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
```

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2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 3
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 4
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 5
1992  0  0
1993  0  0
1994  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 6
1982  0  0
1983  0  0
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1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 7
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 8
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
```

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1987  0  0
1988  0  0
1989  0  0
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 9
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1991  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 10
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1992  0  0
1995  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
```

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2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 11
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 12
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 13
1983  0  0
1984  0  0
```

```
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1991  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 14
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 15
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
```

```
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 16
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1992  0  0
1993  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 17
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1994  0  0
```

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1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 18
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 19
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
```

```
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 20
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
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1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 21
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 22
1985  0  0
1986  0  0
1987  0  0
1988  0  0
```

```
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 23
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 24
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
```

1998 0 0
1999 0 0
2000 0 0
2001 0 0
2002 0 0
2003 0 0
2004 0 0
2005 0 0
2006 0 0
 Total 0 0
Input and Estimated effective sample sizes for index 25
1982 0 0
1983 0 0
1984 0 0
1985 0 0
1986 0 0
1987 0 0
1988 0 0
1989 0 0
1990 0 0
1991 0 0
1992 0 0
1993 0 0
1994 0 0
1995 0 0
1996 0 0
1997 0 0
1998 0 0
1999 0 0
2000 0 0
2001 0 0
2002 0 0
2003 0 0
2004 0 0
2005 0 0
2006 0 0
 Total 0 0
Input and Estimated effective sample sizes for index 26
1982 0 0
1983 0 0
1984 0 0
1985 0 0
1986 0 0
1987 0 0
1988 0 0
1992 0 0
1993 0 0
1994 0 0
1997 0 0
1998 0 0
1999 0 0
2000 0 0
2001 0 0
2002 0 0
2003 0 0
2004 0 0
2005 0 0

```
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 27
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 28
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 29
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
```

```
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 30
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 31
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 32
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
```

```
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 33
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 34
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 35
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
```

```
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 36
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 37
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
```

```
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 38
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 39
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0

Survey proportions at age by index
 Index number 1
 N/A
 Index number 2
```

N/A
Index number 3
N/A
Index number 4
N/A
Index number 5
N/A
Index number 6
N/A
Index number 7
N/A
Index number 8
N/A
Index number 9
N/A
Index number 10
N/A
Index number 11
N/A
Index number 12
N/A
Index number 13
N/A
Index number 14
N/A
Index number 15
N/A
Index number 16
N/A
Index number 17
N/A
Index number 18
N/A
Index number 19
N/A
Index number 20
N/A
Index number 21
N/A
Index number 22
N/A
Index number 23
N/A
Index number 24
N/A
Index number 25
N/A
Index number 26
N/A
Index number 27
N/A
Index number 28
N/A
Index number 29
N/A
Index number 30
N/A

```
 Index number 31
 N/A
 Index number 32
 N/A
 Index number 33
 N/A
 Index number 34
 N/A
 Index number 35
 N/A
 Index number 36
 N/A
 Index number 37
 N/A
 Index number 38
 N/A
 Index number 39
 N/A

Index Selectivity at Age
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
```

```
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0

Deviations section: only applicable if associated lambda > 0
Nyear1 observed, expected, standardized residual
2  46097.5  29432.6  0.582463
3  20491.6  13698.4  0.522845
4  3100.5  3444.62  -0.136638
5  692.968  836.223  -0.243953
6  234.633  202.709  0.189872
7  62.2202  49.1364  0.306488
8  17.4489  15.7722  0.131159

Fleet Obs, Initial, and Stadardized Residual for Fmult
1  1.16717  0.9  0.337468
2  0.0183138  0.1  -2.20377

Standardized Residuals for Fmult_devs by fleet and year
N/A

Index Obs, Initial, and Standardized Residual for q_year1
N/A

Standardized Residuals for catchability deviations by index and year
 index 1 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 2 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 3 q_devs standardized residuals
2  0
3  0
```

```
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 4 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 5 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
 index 6 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
```

```
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 7 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 8 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
```

```
24  0
 index 9 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
 index 10 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 11 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
```

```
22  0
23  0
24  0
 index 12 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 13 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 14 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
```

```
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 15 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 16 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
```

```
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 17 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 18 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 19 q_devs standardized residuals
2  0
3  0
```

```
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 20 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 21 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
```

```
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 22 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 23 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 24 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
```

```
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 25 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 26 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
```

```
17  0
18  0
19  0
20  0
 index 27 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 28 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
 index 29 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
```

```
 index 30 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 31 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 32 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
 index 33 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
```

```
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 34 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 35 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
```

```
21  0
22  0
23  0
24  0
25  0
 index 36 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 37 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 38 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
```

```
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
 index 39 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0

Obs, Initial, and Stadardized Residual for SRR steepness
0.999992  0.7  0.463037

Obs, Initial, and Stadardized Residual for SRR unexpl S
208922  22026.5  2.92066

End of Deviations Section

Selectivity by age and year for each fleet
 fleet 1 selectivity at age
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.0215206 0.416827 0.958726 0.998677 0.999959 0.999999 1 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
```

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 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 0.00475839 0.0805912 0.616423 0.967173 0.998152 0.999899 0.999995 1
 fleet 2 selectivity at age
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.133702 1 0.0802054 0.00245455 7.25202e-05 2.14053e-06 6.31787e-08
1.86475e-09
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573
 0.0518731 0.678162 1 0.611287 0.268835 0.0975971 0.0326055 0.010573

Fmult by year for each fleet
1982   1.16717 0.0183138
1983   1.48343 0.020692
1984   1.61285 0.0237742
1985   1.51984 0.00752327
1986   1.72254 0.0411853
1987   1.45364 0.0344747
1988   2.03915 0.0324351
1989   1.54132 0.20824
1990   1.13723 0.205264
```

```
1991   1.48912 0.201339
1992   1.52686 0.131097
1993   1.29194 0.187333
1994   1.20967 0.137756
1995   1.70026 0.0708106
1996   1.38945 0.0604837
1997   0.857348 0.0429645
1998   0.778703 0.0528017
1999   0.534662 0.114668
2000   0.654278 0.0743959
2001   0.474666 0.0689756
2002   0.416379 0.0465999
2003   0.39584 0.0478539
2004   0.433208 0.0462099
2005   0.457068 0.0517367
2006   0.383415 0.047729

Directed F by age and year for each fleet
 fleet 1 directed F at age
 0.0251183 0.486509 1.119 1.16563 1.16712 1.16717 1.16717 1.16717
 0.0319243 0.618333 1.4222 1.48146 1.48337 1.48343 1.48343 1.48343
 0.0347094 0.672278 1.54628 1.61071 1.61278 1.61284 1.61285 1.61285
 0.0327079 0.633511 1.45711 1.51783 1.51978 1.51984 1.51984 1.51984
 0.0370702 0.718002 1.65144 1.72026 1.72247 1.72254 1.72254 1.72254
 0.0312833 0.605918 1.39365 1.45172 1.45358 1.45364 1.45364 1.45364
 0.0438838 0.849974 1.95499 2.03645 2.03907 2.03915 2.03915 2.03915
 0.0331701 0.642463 1.4777 1.53928 1.54125 1.54132 1.54132 1.54132
 0.0244739 0.474029 1.09029 1.13573 1.13718 1.13723 1.13723 1.13723
 0.0320467 0.620704 1.42765 1.48715 1.48905 1.48911 1.48912 1.48912
 0.032859 0.636437 1.46384 1.52484 1.5268 1.52686 1.52686 1.52686
 0.0278033 0.538514 1.23861 1.29023 1.29188 1.29193 1.29194 1.29194
 0.0260328 0.504223 1.15974 1.20807 1.20962 1.20967 1.20967 1.20967
 0.00809047 0.137026 1.04808 1.64444 1.69711 1.70008 1.70025 1.70026
 0.00661154 0.111977 0.85649 1.34384 1.38688 1.38931 1.38944 1.38945
 0.00407959 0.0690947 0.52849 0.829205 0.855764 0.857262 0.857344 0.857348
 0.00370537 0.0627566 0.480011 0.753141 0.777264 0.778625 0.778699 0.778703
 0.00254413 0.0430891 0.329578 0.517111 0.533674 0.534609 0.53466 0.534662
 0.00311331 0.0527291 0.403312 0.6328 0.653069 0.654212 0.654275 0.654278
 0.00225864 0.0382539 0.292595 0.459084 0.473789 0.474618 0.474664 0.474666
 0.00198129 0.0335565 0.256666 0.402711 0.41561 0.416337 0.416377 0.416379
 0.00188356 0.0319012 0.244005 0.382846 0.395109 0.395801 0.395838 0.39584
 0.00206137 0.0349128 0.26704 0.418987 0.432408 0.433164 0.433206 0.433208
 0.0021749 0.0368356 0.281747 0.442064 0.456223 0.457022 0.457065 0.457068
 0.00182444 0.0308999 0.236346 0.370829 0.382707 0.383377 0.383413 0.383415
 fleet 2 directed F at age
 0.0024486 0.0183138 0.00146887 4.49522e-05 1.32812e-06 3.92012e-08 1.15704e-
09 3.41506e-11
 0.00276657 0.020692 0.00165961 5.07896e-05 1.50059e-06 4.42918e-08 1.30729e-
09 3.85854e-11
 0.00317867 0.0237742 0.00190682 5.83551e-05 1.72411e-06 5.08894e-08
1.50202e-09 4.43329e-11
 0.00100588 0.00752327 0.000603407 1.84663e-05 5.45589e-07 1.61038e-08
4.7531e-10 1.4029e-11
 0.00550657 0.0411853 0.00330328 0.000101091 2.98676e-06 8.81582e-08
2.60203e-09 7.68001e-11
 0.00460934 0.0344747 0.00276505 8.46199e-05 2.50011e-06 7.37939e-08
2.17806e-09 6.42865e-11
```

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 0.00433664 0.0324351 0.00260147 7.96136e-05 2.3522e-06 6.94281e-08 2.0492e-
09 6.04832e-11
 0.0278422 0.20824 0.016702 0.000511137 1.51016e-05 4.45744e-07 1.31563e-08
3.88316e-10
 0.0274443 0.205264 0.0164633 0.000503832 1.48858e-05 4.39374e-07 1.29683e-08
3.82766e-10
 0.0269195 0.201339 0.0161485 0.000494197 1.46011e-05 4.30971e-07 1.27203e-08
3.75446e-10
 0.017528 0.131097 0.0105147 0.000321785 9.50719e-06 2.80617e-07 8.28254e-09
2.44463e-10
 0.0250469 0.187333 0.0150251 0.000459819 1.35854e-05 4.00991e-07 1.18355e-08
3.49329e-10
 0.0184183 0.137756 0.0110488 0.00033813 9.99011e-06 2.94871e-07 8.70326e-09
2.56881e-10
 0.00367317 0.0480211 0.0708106 0.0432856 0.0190363 0.00691091 0.00230881
0.000748679
 0.00313748 0.0410178 0.0604837 0.0369729 0.0162601 0.00590303 0.0019721
0.000639493
 0.0022287 0.0291369 0.0429645 0.0262636 0.0115503 0.00419321 0.00140088
0.000454262
 0.00273899 0.0358081 0.0528017 0.032277 0.0141949 0.00515329 0.00172162
0.000558271
 0.00594819 0.0777635 0.114668 0.0700951 0.0308267 0.0111913 0.0037388
0.00121238
 0.00385915 0.0504525 0.0743959 0.0454773 0.0200002 0.00726082 0.00242571
0.000786587
 0.00357798 0.0467767 0.0689756 0.0421639 0.018543 0.00673182 0.00224898
0.000729278
 0.00241729 0.0316023 0.0465999 0.0284859 0.0125277 0.00454802 0.00151941
0.0004927
 0.00248233 0.0324527 0.0478539 0.0292525 0.0128648 0.0046704 0.0015603
0.000505959
 0.00239705 0.0313378 0.0462099 0.0282475 0.0124228 0.00450995 0.00150669
0.000488576
 0.00268375 0.0350859 0.0517367 0.031626 0.0139086 0.00504936 0.0016869
0.000547012
 0.00247586 0.032368 0.047729 0.0291762 0.0128312 0.00465822 0.00155623
0.000504638
Discard F by age and year for each fleet
 fleet 1 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
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 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 fleet 2 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
Total F
 0.0275669 0.504823 1.12047 1.16567 1.16713 1.16717 1.16717 1.16717
 0.0346909 0.639025 1.42386 1.48152 1.48337 1.48343 1.48343 1.48343
 0.0378881 0.696052 1.54818 1.61077 1.61278 1.61284 1.61285 1.61285
 0.0337138 0.641034 1.45771 1.51785 1.51978 1.51984 1.51984 1.51984
 0.0425767 0.759187 1.65475 1.72036 1.72247 1.72254 1.72254 1.72254
 0.0358927 0.640393 1.39641 1.45181 1.45359 1.45364 1.45364 1.45364
 0.0482205 0.882409 1.95759 2.03653 2.03907 2.03915 2.03915 2.03915
 0.0610123 0.850703 1.4944 1.53979 1.54127 1.54132 1.54132 1.54132
 0.0519182 0.679293 1.10676 1.13623 1.1372 1.13723 1.13723 1.13723
 0.0589662 0.822043 1.4438 1.48764 1.48907 1.48911 1.48912 1.48912
 0.050387 0.767535 1.47436 1.52516 1.52681 1.52686 1.52686 1.52686
 0.0528501 0.725847 1.25364 1.29069 1.2919 1.29193 1.29194 1.29194
 0.0444512 0.641979 1.17079 1.20841 1.20963 1.20967 1.20967 1.20967
 0.0117636 0.185047 1.11889 1.68773 1.71615 1.707 1.70256 1.701
 0.00974902 0.152995 0.916973 1.38081 1.40314 1.39521 1.39142 1.39009
 0.00630829 0.0982316 0.571454 0.855468 0.867315 0.861455 0.858745 0.857803
 0.00644436 0.0985647 0.532812 0.785418 0.791459 0.783778 0.780421 0.779261
 0.00849232 0.120853 0.444246 0.587206 0.564501 0.5458 0.538398 0.535875
 0.00697246 0.103182 0.477708 0.678278 0.673069 0.661473 0.6567 0.655065
 0.00583663 0.0850306 0.361571 0.501248 0.492332 0.48135 0.476913 0.475395
 0.00439858 0.0651588 0.303266 0.431197 0.428137 0.420885 0.417896 0.416872
 0.00436589 0.064354 0.291859 0.412099 0.407974 0.400471 0.397399 0.396346
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 0.00445842 0.0662505 0.313249 0.447235 0.44483 0.437674 0.434712 0.433697
 0.00485865 0.0719215 0.333484 0.47369 0.470132 0.462071 0.458752 0.457615
 0.00430029 0.0632679 0.284075 0.400005 0.395538 0.388035 0.38497 0.38392

Average F for ages 4 to 8
Freport unweighted in .std and MCMC files
year    unweighted   Nweighted    Bweighted
1982  1.16686  1.16603  1.16616
1983  1.48303  1.48182  1.48201
1984  1.61242  1.6112  1.61138
1985  1.51943  1.51819  1.51838
1986  1.72209  1.72069  1.72089
1987  1.45326  1.45225  1.45249
1988  2.03861  2.03691  2.03718
1989  1.541  1.54001  1.54013
1990  1.13702  1.1364  1.13646
1991  1.48881  1.48825  1.48842
1992  1.52651  1.5254  1.52555
1993  1.29168  1.29088  1.29094
1994  1.20941  1.20863  1.20877
1995  1.70289  1.69252  1.69571
1996  1.39213  1.38344  1.38466
1997  0.860157  0.856479  0.857079
1998  0.784067  0.786331  0.786586
1999  0.554356  0.57827  0.574694
2000  0.664917  0.674681  0.672329
2001  0.485448  0.49604  0.493032
2002  0.422997  0.428309  0.426433
2003  0.402858  0.408729  0.40649
2004  0.43963  0.444377  0.442453
2005  0.464452  0.469907  0.467607
2006  0.390494  0.39498  0.392482

Population Numbers at the Start of the Year
 74147.3 46097.5 20491.6 3100.5 692.968 234.633 62.2202 17.4489
 82039.7 55616.9 21454.6 5152.84 752.685 167.982 56.8748 19.3542
 46771.4 61100.1 22634.2 3983.17 912.135 132.991 29.6788 13.5023
 56129.1 34722.3 23487.3 3710.91 619.593 141.6 20.6442 6.72408
 61947.2 41843.7 14102.4 4215.41 633.452 105.56 24.123 4.67397
 47090.5 45773.5 15100.9 2078.41 587.654 88.121 14.6838 4.01228
 12802.8 35029.1 18602.8 2881.59 379.006 106.97 16.0397 3.41038
 29010.6 9406.9 11176 2025.31 292.822 38.4163 10.8417 1.97479
 36354.6 21044.7 3097.95 1933.57 338.218 48.8276 6.40555 2.14034
 31129.8 26613.1 8226.45 789.768 483.423 84.4779 12.1955 2.13984
 35353.8 22628.3 9019.25 1497.13 138.948 84.9296 14.8407 2.52215
 37375.2 25920.1 8098.39 1592.02 253.698 23.5068 14.3674 2.94154
 42617.1 27334.7 9671.4 1782.52 341.065 54.285 5.02968 3.70986
 49497.1 31431.3 11091.5 2312.62 414.625 79.237 12.6111 2.03897
 36879.6 37718.5 20141 2793.48 333.089 58.0453 11.1948 2.08237
 37100.5 28160.2 24957 6207.66 546.881 63.769 11.2011 2.57645
 40690.8 28426.5 19681.5 10866.7 2055.08 178.916 20.9851 4.55557
 32541.3 31173.2 19861 8907.25 3858.52 725.319 63.6335 9.1326
 40049.8 24878.9 21300 9820.88 3856.11 1708.79 327.279 33.1297
 37680.4 30665.9 17302.3 10185.8 3881.54 1532.02 686.815 145.709
 42406.4 28884.4 21717.5 9293.04 4805.44 1847.63 737.3 403.257
 29083.7 32554 20866.5 12364.8 4702.38 2439.06 944.609 587.154
 42095.4 22327.3 23536.4 12016.5 6377.37 2435.36 1272.7 805.149
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 21750.5 32313.3 16111.9 13267.2 5983.76 3183.32 1224.36 1052.22
 41333.5 16689.5 23186.2 8900.22 6434.07 2912.23 1561.82 1126.47

q by index
 index 1 q over time
1992  0.000128554
1993  0.000128554
1994  0.000128554
1995  0.000128554
1996  0.000128554
1997  0.000128554
1998  0.000128554
1999  0.000128554
2000  0.000128554
2001  0.000128554
2002  0.000128554
2003  0.000128554
2004  0.000128554
2005  0.000128554
2006  0.000128554
 index 2 q over time
1992  0.000379715
1993  0.000379715
1994  0.000379715
1995  0.000379715
1996  0.000379715
1997  0.000379715
1998  0.000379715
1999  0.000379715
2000  0.000379715
2001  0.000379715
2002  0.000379715
2003  0.000379715
2004  0.000379715
2005  0.000379715
2006  0.000379715
 index 3 q over time
1992  0.000314579
1993  0.000314579
1994  0.000314579
1995  0.000314579
1996  0.000314579
1997  0.000314579
1998  0.000314579
1999  0.000314579
2000  0.000314579
2001  0.000314579
2002  0.000314579
2003  0.000314579
2004  0.000314579
2005  0.000314579
2006  0.000314579
 index 4 q over time
1992  0.000331277
1993  0.000331277
1994  0.000331277
1995  0.000331277
```

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1996  0.000331277
1997  0.000331277
1998  0.000331277
1999  0.000331277
2000  0.000331277
2001  0.000331277
2002  0.000331277
2003  0.000331277
2004  0.000331277
2005  0.000331277
2006  0.000331277
 index 5 q over time
1992  0.000484419
1993  0.000484419
1994  0.000484419
1996  0.000484419
1997  0.000484419
1998  0.000484419
1999  0.000484419
2000  0.000484419
2001  0.000484419
2002  0.000484419
2003  0.000484419
2004  0.000484419
2005  0.000484419
2006  0.000484419
 index 6 q over time
1982  1.28227e-05
1983  1.28227e-05
1984  1.28227e-05
1985  1.28227e-05
1986  1.28227e-05
1987  1.28227e-05
1988  1.28227e-05
1989  1.28227e-05
1990  1.28227e-05
1991  1.28227e-05
1992  1.28227e-05
1993  1.28227e-05
1994  1.28227e-05
1995  1.28227e-05
1996  1.28227e-05
1997  1.28227e-05
1998  1.28227e-05
1999  1.28227e-05
2000  1.28227e-05
2001  1.28227e-05
2002  1.28227e-05
2003  1.28227e-05
2004  1.28227e-05
2005  1.28227e-05
2006  1.28227e-05
 index 7 q over time
1982  3.55425e-05
1983  3.55425e-05
1984  3.55425e-05
1985  3.55425e-05
```

```
1986  3.55425e-05
1987  3.55425e-05
1988  3.55425e-05
1989  3.55425e-05
1990  3.55425e-05
1991  3.55425e-05
1992  3.55425e-05
1993  3.55425e-05
1994  3.55425e-05
1995  3.55425e-05
1996  3.55425e-05
1997  3.55425e-05
1998  3.55425e-05
1999  3.55425e-05
2000  3.55425e-05
2001  3.55425e-05
2002  3.55425e-05
2003  3.55425e-05
2004  3.55425e-05
2005  3.55425e-05
2006  3.55425e-05
 index 8 q over time
1982  3.0458e-05
1983  3.0458e-05
1984  3.0458e-05
1985  3.0458e-05
1986  3.0458e-05
1987  3.0458e-05
1988  3.0458e-05
1989  3.0458e-05
1990  3.0458e-05
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 fleet 1
Year 1 Obs  =  0.145346 0.527962 0.285212 0.0262759 0.00921763 0.00325989
0.00188287 0.000843076
Year 1 Pred =  0.0501276 0.485472 0.385065 0.0598691 0.0133905 0.00453402
0.00120234 0.000338484
Year 2 Obs  =  0.102313 0.592534 0.235019 0.046978 0.014927 0.00695731
0.000344634 0.000926205
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Year 2 Pred =  0.0515077 0.515091 0.335066 0.0823855 0.0120416 0.00268746
0.00090991 0.000310762
Year 3 Obs  =  0.0923461 0.514057 0.310783 0.0639504 0.0166714 0.00191047
8.04408e-05 0.000201102
Year 3 Pred =  0.0294064 0.553985 0.338951 0.0609848 0.0139734 0.00203737
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Year 4 Obs  =  0.0551004 0.389786 0.48609 0.0477735 0.0134101 0.0068132
0.000811096 0.000216292
Year 4 Pred =  0.0446351 0.406774 0.458692 0.0741354 0.0123853 0.00283055
0.000412673 0.000134898
Year 5 Obs  =  0.0541701 0.481455 0.33418 0.114325 0.00955231 0.00423204
0.00175327 0.000332517
Year 5 Pred =  0.0567177 0.539261 0.296841 0.0906581 0.0136308 0.00227152
0.000519095 0.000100926
Year 6 Obs  =  0.0342164 0.530752 0.359106 0.0546401 0.0180365 0.000828885
0.000961507 0.00145884
Year 6 Pred =  0.0401321 0.575437 0.323553 0.045623 0.0129078 0.0019356
0.000322534 8.84532e-05
Year 7 Obs  =  0.019327 0.520696 0.382537 0.0562958 0.0169045 0.00318606
0.00050029 0.000552952
Year 7 Pred =  0.0135986 0.499142 0.411034 0.0648465 0.00853295 0.00240837
0.000361125 7.70321e-05
Year 8 Obs  =  0.0135973 0.244752 0.573632 0.134542 0.0280693 0.00437341
0.000715649 0.000318066
Year 8 Pred =  0.0589844 0.261508 0.557855 0.103976 0.0150443 0.00197375
0.000557027 0.000101825
Year 9 Obs  =  0.0381106 0.599356 0.22759 0.106817 0.0237252 0.00322061
0.00085883 0.000322061
Year 9 Pred =  0.0727537 0.615739 0.175262 0.113088 0.0197991 0.00285842
0.000374988 0.000125786
Year 10 Obs  =  0.0053826 0.484685 0.447632 0.0464406 0.0135817 0.00200283
0.000187765 8.76238e-05
Year 10 Pred =  0.0486606 0.574966 0.32123 0.0317319 0.0194382 0.0033969
0.000490386 8.63564e-05
Year 11 Obs  =  0.01193 0.544721 0.361714 0.068128 0.00908374 0.00423908
0.000121116 6.2375e-05
Year 11 Pred =  0.0570444 0.514044 0.358065 0.0610084 0.00566607 0.00346336
0.000605194 0.000103222
Year 12 Obs  =  0.0148636 0.565594 0.372496 0.0378054 0.00484684 0.00297273
0.00122787 0.000193874
Year 12 Pred =  0.0551557 0.548635 0.319465 0.0647546 0.0103276 0.000956943
0.000584885 0.0001202
Year 13 Obs  =  0.0546856 0.475376 0.397561 0.0573153 0.0123715 0.00161367
0.000776954 0.000299127
Year 13 Pred =  0.0549959 0.522105 0.342966 0.0651516 0.0124762 0.0019858
0.000183991 0.000136231
Year 14 Obs  =  0.0207846 0.319422 0.53252 0.091242 0.0297887 0.00577766
0.000375173 9.00414e-05
Year 14 Pred =  0.0287613 0.285124 0.517332 0.137791 0.0252455 0.00484831
0.000772906 0.000125466
Year 15 Obs  =  0.00721218 0.305647 0.549804 0.106069 0.0255535 0.00447653
0.000994784 0.000242479
Year 15 Pred =  0.0134081 0.217083 0.636136 0.116147 0.0141755 0.00248183
0.000479369 8.95431e-05
Year 16 Obs  =  0.000317763 0.122736 0.576343 0.24285 0.0439307 0.0127105
0.000794407 0.000317763
```

```
Year 16 Pred =  0.00938324 0.115482 0.632443 0.219956 0.0199016 0.00233026
0.000409806 9.46869e-05
Year 17 Obs  =  0.00138878 0.116581 0.411079 0.383149 0.0756114 0.0106473
0.00146594 7.71545e-05
Year 17 Pred =  0.00922745 0.104514 0.454772 0.355379 0.0691876 0.0060533
0.000711051 0.000155079
Year 18 Obs  =  0.000105218 0.0414558 0.426763 0.380993 0.111741 0.0324071
0.00536611 0.00116792
Year 18 Pred =  0.00677865 0.104288 0.438672 0.291278 0.131503 0.0249647
0.00219746 0.000317104
Year 19 Obs  =  0 0.0624861 0.480027 0.317861 0.106896 0.0255895 0.00520717
0.00193409
Year 19 Pred =  0.00789122 0.0793243 0.438166 0.291966 0.118572 0.0528955
0.0101525 0.00103283
Year 20 Obs  =  0 0.155561 0.362784 0.319844 0.115401 0.0324924 0.0108308
0.0030863
Year 20 Pred =  0.0073125 0.0970759 0.368907 0.321716 0.12702 0.0504645
0.0226699 0.00483395
Year 21 Obs  =  9.43556e-05 0.0640675 0.434696 0.340718 0.119266 0.0278349
0.0117945 0.00152856
Year 21 Pred =  0.00721366 0.0808479 0.416407 0.265168 0.141703 0.0547542
0.0218809 0.0120265
Year 22 Obs  =  0 0.0676562 0.371839 0.344235 0.139101 0.0496146 0.0200262
0.00752842
Year 22 Pred =  0.0044455 0.0819061 0.361364 0.319725 0.125718 0.0655412
0.0254204 0.0158792
Year 23 Obs  =  0.00188235 0.041098 0.374195 0.341019 0.147294 0.0595293
0.0232941 0.0116878
Year 23 Pred =  0.00607367 0.0529814 0.381056 0.288777 0.158336 0.0607626
0.0317988 0.0202156
Year 24 Obs  =  0.000249326 0.0587578 0.252733 0.332435 0.185748 0.0877627
0.0421361 0.0401781
Year 24 Pred =  0.00335535 0.0817784 0.276415 0.336998 0.157107 0.084024
0.0323676 0.0279542
Year 25 Obs  =  0.000371652 0.0432045 0.378063 0.286822 0.162969 0.0790689
0.0336345 0.0158658
Year 25 Pred =  0.00627273 0.0417106 0.400065 0.229721 0.171729 0.0781265
0.0419607 0.0304145
 fleet 2
Year 1 Obs  =  0.212871 0.787129 0 0 0 0 0 0
Year 1 Pred =  0.206453 0.772093 0.0213553 9.75463e-05 6.43776e-07 6.43377e-
09 5.03567e-11 4.18427e-13
Year 2 Obs  =  0.158085 0.841915 0 0 0 0 0 0
Year 2 Pred =  0.202025 0.78015 0.0176966 0.000127834 5.51327e-07 3.63172e-09
3.62926e-11 3.65846e-13
Year 3 Obs  =  0.170732 0.829268 0 0 0 0 0 0
Year 3 Pred =  0.118613 0.862879 0.01841 9.73144e-05 6.57939e-07 2.83139e-09
1.86498e-11 2.51317e-13
Year 4 Obs  =  0.162602 0.837398 0 0 0 0 0 0
Year 4 Pred =  0.214676 0.755476 0.0297066 0.000141057 6.95354e-07 4.69046e-
09 2.01836e-11 1.94737e-13
Year 5 Obs  =  0.109729 0.890271 0 0 0 0 0 0
Year 5 Pred =  0.210855 0.774151 0.0148599 0.000133333 5.91535e-07 2.90951e-
09 1.96246e-11 1.12617e-13
Year 6 Obs  =  0.0805471 0.919453 0 0 0 0 0 0
Year 6 Pred =  0.150469 0.833128 0.0163352 6.76708e-05 5.64933e-07 2.50039e-
09 1.22975e-11 9.95412e-14
```

```
Year 7 Obs  =  0.0763889 0.923611 0 0 0 0 0 0
Year 7 Pred =  0.0641732 0.909586 0.0261194 0.000121063 4.70059e-07 3.9158e-
09 1.73302e-11 1.09111e-13
Year 8 Obs  =  0.303895 0.659853 0.0362514 0 0 0 0 0
Year 8 Pred =  0.352104 0.602808 0.0448416 0.000245544 1.04833e-06 4.05941e-
09 3.3814e-11 1.82442e-13
Year 9 Obs  =  0.313165 0.672856 0.0139787 0 0 0 0 0
Year 9 Pred =  0.232493 0.759821 0.00754166 0.000142966 7.38573e-07 3.14716e-
09 1.21859e-11 1.20648e-13
Year 10 Obs  =  0.172122 0.827878 0 0 0 0 0 0
Year 10 Pred =  0.176932 0.807293 0.0157279 4.56445e-05 8.25045e-07 4.25548e-
09 1.81323e-11 9.42453e-14
Year 11 Obs  =  0.341791 0.646836 0.0104987 0.000874891 0 0 0 0
Year 11 Pred =  0.219073 0.762318 0.0185167 9.2689e-05 2.54009e-07 4.58258e-
09 2.3635e-11 1.18982e-13
Year 12 Obs  =  0.237464 0.722774 0.0395405 0.000220897 0 0 0 0
Year 12 Pred =  0.203271 0.78078 0.0158538 9.44102e-05 4.443e-07 1.21509e-09
2.19201e-11 1.32961e-13
Year 13 Obs  =  0.196259 0.67182 0.122943 0.00897756 0 0 0 0
Year 13 Pred =  0.210509 0.771715 0.0176773 9.8657e-05 5.5746e-07 2.61886e-09
7.1618e-12 1.56513e-13
Year 14 Obs  =  0.154639 0.738519 0.0965323 0.0103093 0 0 0 0
Year 14 Pred =  0.0859848 0.657975 0.230155 0.0238832 0.00186467 0.000129778
6.91113e-06 3.63794e-07
Year 15 Obs  =  0.0323009 0.834956 0.105752 0.0269912 0 0 0 0
Year 15 Pred =  0.0474209 0.592638 0.334802 0.0238159 0.00123864 7.85907e-05
5.07085e-06 3.07148e-07
Year 16 Obs  =  0.0158494 0.52947 0.407628 0.047053 0 0 0 0
Year 16 Pred =  0.0455706 0.432921 0.45708 0.0619334 0.00238795 0.000101329
5.95278e-06 4.46002e-07
Year 17 Obs  =  0.0119311 0.379585 0.483429 0.125055 0 0 0 0
Year 17 Pred =  0.0512786 0.448323 0.376086 0.1145 0.00949923 0.000301193
1.18186e-05 8.35836e-07
Year 18 Obs  =  0.0376254 0.378344 0.467809 0.116221 0 0 0 0
Year 18 Pred =  0.0391998 0.465521 0.377501 0.0976577 0.0187881 0.0012926
3.80077e-05 1.77851e-06
Year 19 Obs  =  0.00768693 0.262404 0.544025 0.185884 0 0 0 0
Year 19 Pred =  0.0510138 0.395833 0.421521 0.109429 0.0189379 0.00306168
0.000196302 6.47567e-06
Year 20 Obs  =  0.00380491 0.470425 0.343826 0.176064 0.00588032 0 0 0
Year 20 Pred =  0.0458584 0.469924 0.344277 0.116973 0.0196802 0.00283359
0.000425218 2.94015e-05
Year 21 Obs  =  0.0455251 0.356441 0.408174 0.18986 0 0 0 0
Year 21 Pred =  0.0477635 0.413211 0.410295 0.101793 0.0231805 0.00324605
0.000433327 7.72312e-05
Year 22 Obs  =  0.0224967 0.462726 0.37715 0.110278 0.0172034 0.00441112
0.00441112 0.00132333
Year 22 Pred =  0.0309219 0.439769 0.374049 0.128938 0.0216047 0.00408185
0.000528855 0.000107125
Year 23 Obs  =  0.0436105 0.277383 0.470588 0.182556 0.0147059 0.00456389
0.0035497 0.0030426
Year 23 Pred =  0.0485937 0.327201 0.453685 0.133952 0.0312977 0.00435274
0.000760936 0.000156866
Year 24 Obs  =  0.100781 0.466406 0.326172 0.0828125 0.0117188 0.00507813
0.00390625 0.003125
Year 24 Pred =  0.0254366 0.478545 0.311832 0.148118 0.0294253 0.00570324
0.000733907 0.000205534
```

```
Year 25 Obs  =  0.0755703 0.285646 0.507605 0.0936312 0.019962 0.00855513
0.00522814 0.00380228
Year 25 Pred =  0.0538803 0.276556 0.511379 0.114402 0.0364437 0.00600855
0.00107802 0.000253378

Proportions of Discards at age by fleet
 fleet 1
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
```

```
 fleet 2
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15

F Reference Points Using Final Year Selectivity and Freport options
 refpt           F       slope to plot on SRR
  F0.1     0.201379     0.481665
  Fmax     0.434226     0.851622
  F30%SPR  0.318992     0.668277
```

```
  F40%SPR  0.213929     0.501212
  Fmsy     0.434207     0.851591    SSBmsy    46077.8     MSY   15064.7
  Fcurrent 0.390494     0.78256

Stock-Recruitment Relationship Parameters
 alpha     = 39239.8
 beta      = 0.416052
 unexpl    = 208922
 steepness = 0.999992
Spawning Stock, Obs Recruits(year+1), Pred Recruits(year+1), standardized
residual
init  xxxx  74147.3  39238.9  1.34719
1982  24658  82039.7  39239.2  1.5613
1983  24675.5  46771.4  39239.2  0.371725
1984  21059.6  56129.1  39239  0.757827
1985  18833.3  61947.2  39239  0.96662
1986  17757.8  47090.5  39238.9  0.386134
1987  18269.3  12802.8  39238.9  -2.37098
1988  10878.2  29010.6  39238.3  -0.639301
1989  7056.54  36354.6  39237.5  -0.161547
1990  9642.29  31129.8  39238.1  -0.490035
1991  9199.32  35353.8  39238  -0.220669
1992  10534.5  37375.2  39238.3  -0.102981
1993  12114.1  42617.1  39238.5  0.174854
1994  15155.3  49497.1  39238.7  0.491658
1995  20765.1  36879.6  39239  -0.131279
1996  23449.2  37100.5  39239.1  -0.118642
1997  24551.8  40690.8  39239.2  0.0769026
1998  27186  32541.3  39239.2  -0.396219
1999  28089.3  40049.8  39239.2  0.0432819
2000  30541.4  37680.4  39239.3  -0.0858197
2001  36127.8  42406.4  39239.4  0.164315
2002  40610.9  29083.7  39239.4  -0.634034
2003  44582.7  42095.4  39239.5  0.148725
2004  42488.8  21750.5  39239.4  -1.24909
2005  39688.9  41333.5  39239.4  0.110065
2006  40198.1       xxxx   39239.4

Root Mean Square Error computed from Standardized Residuals
Component                  #resids         RMSE
_Catch_Fleet_1                25           0.239059
_Catch_Fleet_2                25           0.0178829
Catch_Fleet_Total             50           0.169512
_Discard_Fleet_1              0            0
_Discard_Fleet_2              0            0
Discard_Fleet_Total           0            0
_Index_1                      15           2.53144
_Index_2                      15           1.58068
_Index_3                      15           1.84289
_Index_4                      15           2.38926
_Index_5                      14           1.88974
_Index_6                      25           1.85024
_Index_7                      25           1.2775
_Index_8                      24           1.86402
_Index_9                      20           0.971662
_Index_10                      15           1.19729
_Index_11                      24           0.526106
```

```
_Index_12                      24           0.997466
_Index_13                      22           0.887212
_Index_14                      25             1.6273
_Index_15                      25            1.31531
_Index_16                      24            1.02876
_Index_17                      22               1.59
_Index_18                      23            1.27512
_Index_19                      23             1.2551
_Index_20                      22              1.425
_Index_21                      22            1.29857
_Index_22                      22            0.93778
_Index_23                      22           0.813408
_Index_24                      22            1.45399
_Index_25                      25            1.30423
_Index_26                      20            1.57201
_Index_27                      17            1.51662
_Index_28                      17            1.46069
_Index_29                      19            1.06949
_Index_30                      19            1.59007
_Index_31                      16            1.37813
_Index_32                      15            1.44575
_Index_33                      19            1.66748
_Index_34                      25            1.05645
_Index_35                      25            1.06615
_Index_36                      19            1.07275
_Index_37                      25            1.32323
_Index_38                      21            1.56898
_Index_39                      15            1.38275
Index_Total                   802            1.41176
Nyear1                          7           0.345998
Fmult_Year1                     2            1.57647
_Fmult_devs_Fleet_1             0                  0
_Fmult_devs_Fleet_2             0                  0
Fmult_devs_Total                0                  0
Recruit_devs                    0                  0
Fleet_Sel_params               12             1.8027
Index_Sel_params                0                  0
q_year1                         0                  0
q_devs                          0                  0
SRR_steepness                   1          -0.463037
SRR_unexpl_S                    1           -2.92066

Projections not requested

that's all
```

APPENDIX 5

Full report of the 2008 assessment final model ASAP F08_T2007_T2 run.

```
Age Structured Assessment Program (ASAP) Version 2.0
Start time for run: Tue May 13 11:50:16 2008

obj_fun        = 4313

Component                Lambda          obj_fun
__Catch_Fleet_1               10          2098.46
__Catch_Fleet_2               10          1408.82
Catch_Fleet_Total             20          3507.28
Discard_Fleet_Total           0           0
__Index_Fit_1                 1           64.0763
__Index_Fit_2                 1           44.2648
__Index_Fit_3                 1           30.9745
__Index_Fit_4                 1           27.8193
__Index_Fit_5                 1           9.71092
__Index_Fit_6                 1           18.0658
__Index_Fit_7                 1           3.70982
__Index_Fit_8                 1           -2.52673
__Index_Fit_9                 1           -47.8742
__Index_Fit_10                 1          -36.6491
__Index_Fit_11                 1          11.1087
__Index_Fit_12                 1          -6.15912
__Index_Fit_13                 1          -37.2882
__Index_Fit_14                 1          27.5961
__Index_Fit_15                 1          -14.232
__Index_Fit_16                 1          13.7773
__Index_Fit_17                 1          -21.2778
__Index_Fit_18                 1          -6.5077
__Index_Fit_19                 1          -33.2446
__Index_Fit_20                 1          -47.0116
__Index_Fit_21                 1          16.1494
__Index_Fit_22                 1          1.6832
__Index_Fit_23                 1          -37.15
__Index_Fit_24                 1          -52.7859
__Index_Fit_25                 1          10.3506
__Index_Fit_26                 1          -13.1098
__Index_Fit_27                 1          0.801612
__Index_Fit_28                 1          12.5251
__Index_Fit_29                 1          43.4257
__Index_Fit_30                 1          31.987
__Index_Fit_31                 1          -3.62967
__Index_Fit_32                 1          -10.7252
__Index_Fit_33                 1          -22.4509
__Index_Fit_34                 1          21.096
__Index_Fit_35                 1          79.0436
__Index_Fit_36                 1          19.1408
__Index_Fit_37                 1          -2.44679
__Index_Fit_38                 1          -5.73109
__Index_Fit_39                 1          -32.9443
Index_Fit_Total               39          53.5617
Catch_Age_Comps       see_below           666.288
Discard_Age_Comps     see_below           0
Survey_Age_Comps      see_below           0
__Sel_Param_1                 1           0.866845
__Sel_Param_2                 1           3.66947
__Sel_Param_3                 1           1.15382
__Sel_Param_4                 1           2.65425
__Sel_Param_5                 1           0.926282
__Sel_Param_6                 1           4.2666
__Sel_Param_7                 1           1.66344
__Sel_Param_8                 1           3.69603
__Sel_Param_9                 1           1.25195
__Sel_Param_10                1           3.36641
__Sel_Param_11                1           1.34415
__Sel_Param_12                1           0.173468
Sel_Params_Total              12          25.0327
Index_Sel_Params_Total        0           0
q_year1_Total                 0           0
q_devs_Total                  390000            0
__Fmult_year1_fleet_1         1           0.608193
__Fmult_year1_fleet_2         1           0.783259
Fmult_year1_fleet_Total       2           1.39145
Fmult_devs_fleet_Total        0           0
N_year_1                      1           58.6859
Recruit_devs                  0           0
```

```
SRR_steepness                  0.05          0.0204231
SRR_unexpl_stock               0.05          0.745703
Fmult_Max_penalty          1000          0
F_penalty                     0          0

 Input and Estimated effective sample sizes for fleet 1
1982  173  26.6801
1983  173  30.217
1984  173  90.0055
1985  173  302.546
1986  173  99.2317
1987  173  142.346
1988  173  435.377
1989  173  159.708
1990  173  130.282
1991  173  19.4867
1992  173  190.144
1993  173  103.484
1994  173  122.286
1995  173  140.589
1996  173  33.5065
1997  173  131.041
1998  173  291.569
1999  173  63.2269
2000  173  183.738
2001  173  154.811
2002  173  96.6285
2003  173  545.974
2004  173  245.475
2005  173  195.693
2006  173  154.771
2007  173  113.851
 Total  4498  4202.67
 Input and Estimated effective sample sizes for fleet 2
1982  101  507.719
1983  101  57.6236
1984  101  57.7075
1985  101  36.809
1986  101  14.8722
1987  101  22.6396
1988  101  166.708
1989  101  96.0275
1990  101  28.1179
1991  101  565.73
1992  101  13.3874
1993  101  61.784
1994  101  16.7393
1995  101  16.4124
1996  101  4.6383
1997  101  39.9822
1998  101  39.6751
1999  101  43.9303
2000  101  17.919
2001  101  130.124
2002  101  64.1021
2003  101  402.233
2004  101  85.0967
2005  101  64.3133
2006  101  157.817
2007  101  126.039
 Total  2626  2838.15

 Input and Estimated effective Discard sample sizes for fleet 1
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
```

```
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
2007  0  1e+15
 Total  0  2.6e+16
 Input and Estimated effective Discard sample sizes for fleet 2
1982  0  1e+15
1983  0  1e+15
1984  0  1e+15
1985  0  1e+15
1986  0  1e+15
1987  0  1e+15
1988  0  1e+15
1989  0  1e+15
1990  0  1e+15
1991  0  1e+15
1992  0  1e+15
1993  0  1e+15
1994  0  1e+15
1995  0  1e+15
1996  0  1e+15
1997  0  1e+15
1998  0  1e+15
1999  0  1e+15
2000  0  1e+15
2001  0  1e+15
2002  0  1e+15
2003  0  1e+15
2004  0  1e+15
2005  0  1e+15
2006  0  1e+15
2007  0  1e+15
 Total  0  2.6e+16

Observed and predicted total fleet catch by year and standardized residual
 fleet 1 total catches
1982  18667  18828.6  -0.0863912
1983  26089  25464.7  0.242808
1984  25641  25371  0.106119
1985  20339  20655.7  -0.154916
1986  20289  20699.5  -0.20081
1987  17790  17787.5  0.00141991
1988  21320  20904.8  0.197175
1989  9561  9375.39  0.196527
1990  6528  6258.7  0.422331
1991  9835  9638.19  0.202643
1992  10771  10813.3  -0.0392901
1993  9720  10033  -0.317771
1994  10819  10979.1  -0.147287
1995  9436  8756.92  0.748737
1996  10314  10043.2  0.266711
1997  9376  9636.12  -0.274335
1998  10735  10947.8  -0.196812
1999  8616  8651.32  -0.0410168
2000  12555  12737.4  -0.144596
2001  10249  10378.2  -0.125586
2002  10205  10383.9  -0.17419
2003  11729  12016.2  -0.242518
2004  13060  13342.9  -0.214802
2005  12549  12585.2  -0.0288801
2006  11254  11204.9  0.0438227
2007  8934  8919.28  0.0165293
 fleet 2 total catches
1982  296  296.889  -0.0300794
1983  376  376.18  -0.00480431
1984  415  414.984  0.000388468
1985  92  92.0122  -0.00132393
1986  578  578.088  -0.00152913
1987  522  521.855  0.00279191
1988  341  340.881  0.0035083
1989  754  751.981  0.0268817
1990  1448  1446.74  0.00870732
1991  1481  1481.99  -0.00672032
1992  1034  1035.91  -0.0185398
1993  1756  1757.47  -0.00840307
1994  1593  1586.56  0.0405876
1995  1060  1058.27  0.0164158
```

```
1996  1144  1147.56  -0.0311187
1997  881  883.006  -0.022806
1998  1123  1122.81  0.00171425
1999  2259  2251.84  0.0318083
2000  1678  1675.4  0.015565
2001  1742  1739.51  0.0143322
2002  1226  1226.57  -0.00468948
2003  1410  1412.3  -0.0163075
2004  1278  1279.45  -0.0113804
2005  1229  1227.75  0.0101849
2006  1083  1081.79  0.0111654
2007  1434  1434.04  -0.000280138
Observed and predicted total fleet Discards by year and standardized residual
 fleet 1 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
2007  0  0  0
 fleet 2 total Discards
1982  0  0  0
1983  0  0  0
1984  0  0  0
1985  0  0  0
1986  0  0  0
1987  0  0  0
1988  0  0  0
1989  0  0  0
1990  0  0  0
1991  0  0  0
1992  0  0  0
1993  0  0  0
1994  0  0  0
1995  0  0  0
1996  0  0  0
1997  0  0  0
1998  0  0  0
1999  0  0  0
2000  0  0  0
2001  0  0  0
2002  0  0  0
2003  0  0  0
2004  0  0  0
2005  0  0  0
2006  0  0  0
2007  0  0  0

Index data
index number 1
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  7.15  2.84957  3.13375
1993  6.5  3.29769  2.31155
1994  3.76  3.43684  0.306125
1995  6.07  3.93633  1.47537
1996  22.17  4.76141  5.2398
1997  3.86  3.54155  0.293305
```

```
1998  1.68  3.57544  -2.57287
1999  2.11  3.92204  -2.11174
2000  0.7  3.09799  -5.06686
2001  3.07  3.80517  -0.731307
2002  2.77  3.59521  -0.888247
2003  8.17  4.08072  2.36475
2004  1.45  3.069  -2.55412
2005  2.96  4.74534  -1.60776
2006  2.64  2.32244  0.436574
2007  2.77  2.79312  -0.0283147
index number 2
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  4.74  3.45418  1.07798
1993  6.7  3.05469  2.67553
1994  7.2  3.69645  2.27112
1995  4.59  4.16197  0.333466
1996  8.33  7.64029  0.294414
1997  4.8  9.49679  -2.32435
1998  3.25  7.45934  -2.83012
1999  4.8  7.54208  -1.53931
2000  6.52  8.0889  -0.734493
2001  5.33  6.49764  -0.674779
2002  10.74  8.11799  0.953443
2003  14.36  7.81897  2.07076
2004  8.68  8.87894  -0.0771934
2005  4.03  6.67258  -1.71767
2006  9.06  10.2968  -0.435894
2007  6.18  5.0958  0.657108
index number 3
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.33  0.461835  -1.14496
1993  0.31  0.501473  -1.63843
1994  0.82  0.555506  1.32656
1995  0.25  0.722483  -3.61504
1996  0.6  0.893556  -1.35672
1997  1.04  1.94817  -2.13813
1998  2.29  3.42231  -1.36859
1999  2.9  2.81456  0.101873
2000  4.96  3.09555  1.60594
2001  6.42  3.21006  2.36111
2002  5.58  2.88469  2.24748
2003  8.48  3.81161  2.724
2004  4.56  3.70443  0.707836
2005  3.07  4.12654  -1.0075
2006  4.29  3.07693  1.13215
2007  5.15  5.05648  0.06243
index number 4
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.04  0.0455408  -0.441913
1993  0.05  0.0830297  -1.72767
1994  0.26  0.114488  2.79402
1995  0.02  0.136193  -6.53474
1996  0.12  0.110174  0.291029
1997  0.43  0.178478  2.99536
1998  0.42  0.669946  -1.59062
1999  0.84  1.27852  -1.4309
2000  2.51  1.28225  2.28801
2001  2.44  1.28395  2.18715
2002  2.26  1.58984  1.19816
2003  2.67  1.53023  1.89624
2004  1.64  2.05439  -0.767412
2005  1.34  1.92911  -1.24128
2006  2.47  2.12562  0.511497
2007  1.54  1.74562  -0.426922
index number 5
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
```

```
 year, obs index, pred index, standardized residual
1992  0.04  0.0471203  -0.558063
1993  0.04  0.0188264  2.56717
1994  0.01  0.029193  -3.64948
1996  0.03  0.0327319  -0.296878
1997  0.15  0.0343817  5.01809
1998  0.12  0.0911681  0.936047
1999  0.41  0.360765  0.435794
2000  1.08  0.948949  0.440665
2001  1.34  1.08311  0.724995
2002  1.33  1.36496  -0.088385
2003  1.96  1.81001  0.271197
2004  1.44  2.0274  -1.16539
2005  1.49  2.42386  -1.65752
2006  2.6  2.50733  0.123636
2007  1.19  2.95807  -3.10187
index number 6
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.7  0.580534  0.485738
1983  0.32  0.695198  -2.01394
1984  0.17  0.766471  -3.90911
1985  0.55  0.436905  0.597534
1986  1.48  0.528792  2.6715
1987  0.47  0.578572  -0.539466
1988  0.6  0.442844  0.788342
1989  0.06  0.118849  -1.77419
1990  0.63  0.264453  2.25321
1991  0.79  0.339911  2.18908
1992  0.77  0.284686  2.58273
1993  0.73  0.329455  2.06514
1994  0.35  0.343358  0.0497359
1995  0.79  0.393259  1.81067
1996  1.08  0.475688  2.12835
1997  0.29  0.353818  -0.516292
1998  0.27  0.357204  -0.726496
1999  0.22  0.391831  -1.49825
2000  0.19  0.309505  -1.26657
2001  0.48  0.380155  0.605332
2002  0.34  0.359179  -0.14244
2003  0.54  0.407684  0.729591
2004  0.3  0.306608  -0.0565571
2005  0.26  0.474083  -1.55924
2006  0.04  0.232023  -4.56312
2007  0.24  0.279047  -0.391275
index number 7
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.43  0.734744  1.72849
1983  0.39  0.758975  -1.72827
1984  0.33  0.793682  -2.27796
1985  1.56  0.825328  1.65258
1986  0.43  0.495326  -0.367113
1987  0.43  0.53146  -0.549882
1988  0.81  0.659388  0.533992
1989  0.23  0.395088  -1.40434
1990  0.03  0.109479  -3.36023
1991  0.27  0.288689  -0.173721
1992  0.41  0.322568  0.622562
1993  0.5  0.285261  1.45671
1994  0.53  0.345191  1.11298
1995  0.27  0.388664  -0.945594
1996  0.56  0.713486  -0.628744
1997  0.67  0.886855  -0.727842
1998  0.52  0.696588  -0.758891
1999  0.74  0.704315  0.128292
2000  1.03  0.755379  0.804911
2001  0.89  0.60678  0.994293
2002  0.89  0.758096  0.416381
2003  1.29  0.730172  1.47726
2004  1.45  0.829157  1.45076
2005  0.65  0.623117  0.109637
2006  1.04  0.961561  0.20355
2007  0.52  0.47587  0.230197
index number 8
```

```
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.12  0.0974708  0.539746
1983  0.19  0.165977  0.350876
1984  0.09  0.126363  -0.880844
1985  0.21  0.116343  1.53293
1986  0.2  0.131329  1.09177
1987  0.02  0.064429  -3.03653
1988  0.07  0.0907741  -0.674566
1989  0.02  0.0640305  -3.02042
1990  0.06  0.0610398  -0.0445978
1992  0.01  0.0469204  -4.0126
1993  0.04  0.0509474  -0.627937
1994  0.04  0.0564369  -0.893554
1995  0.02  0.073401  -3.37494
1996  0.12  0.0907812  0.724301
1997  0.09  0.197925  -2.04562
1998  0.32  0.347691  -0.215428
1999  0.48  0.285946  1.34452
2000  0.63  0.314494  1.80337
2001  1.02  0.326128  2.95979
2002  0.74  0.293072  2.40422
2003  0.59  0.387242  1.09298
2004  0.85  0.376354  2.11473
2005  0.58  0.419238  0.842535
2006  0.24  0.312602  -0.686019
2007  1.46  0.513715  2.71126
index number 9
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.02  0.0262072  -0.70162
1983  0.03  0.0294298  0.0498095
1984  0.05  0.0364831  0.818092
1985  0.04  0.0243334  1.29013
1986  0.02  0.0243703  -0.512997
1987  0.01  0.0223625  -2.08902
1988  0.02  0.0145594  0.824114
1989  0.01  0.0113938  -0.338687
1991  0.02  0.0187979  0.160902
1994  0.01  0.0135824  -0.794776
1997  0.01  0.021174  -1.94726
1998  0.06  0.0794799  -0.729804
1999  0.13  0.151679  -0.400332
2000  0.12  0.152121  -0.615657
2001  0.2  0.152322  0.706855
2002  0.31  0.188613  1.28974
2003  0.29  0.181541  1.21583
2004  0.27  0.243725  0.265754
2005  0.15  0.228863  -1.09665
2006  0.25  0.252175  -0.0224881
2007  0.57  0.207094  2.62805
index number 10
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.02  0.0158499  0.603673
1984  0.02  0.0115939  1.41532
1985  0.02  0.0113393  1.47294
1986  0.01  0.00883552  0.32136
1992  0.01  0.00668783  1.04424
1995  0.01  0.00624098  1.22374
1998  0.02  0.0129396  1.13028
1999  0.03  0.0512036  -1.38769
2000  0.17  0.134685  0.604433
2001  0.1  0.153727  -1.11617
2002  0.19  0.19373  -0.0504622
2003  0.2  0.256896  -0.649842
2004  0.16  0.287751  -1.52347
2005  0.17  0.34402  -1.82971
2006  0.2  0.355867  -1.49574
2007  0.46  0.419842  0.237114
index number 11
units = 2
```

```
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  1.52  1.36419  0.195029
1984  1.46  1.42658  0.0417643
1985  1.39  1.48346  -0.117351
1986  0.8  0.890308  -0.192882
1987  0.83  0.955256  -0.253472
1988  0.58  1.1852  -1.28876
1989  0.62  0.710137  -0.244789
1990  0.21  0.19678  0.117256
1991  0.38  0.518894  -0.561805
1992  0.84  0.579789  0.668583
1993  1.04  0.512733  1.27539
1994  0.8  0.620453  0.458352
1995  0.67  0.698591  -0.0753595
1996  1.16  1.28243  -0.180948
1997  1.24  1.59405  -0.452947
1998  1.29  1.25206  0.0538363
1999  2.13  1.26595  0.938304
2000  1.73  1.35773  0.436971
2001  1.2  1.09064  0.17233
2002  1.36  1.36261  -0.00346277
2003  1.17  1.31242  -0.207158
2004  1.31  1.49034  -0.232597
2005  1.49  1.12  0.51477
2006  1.14  1.72833  -0.750433
2007  0.72  0.855337  -0.310623
index number 12
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.4  0.402302  -0.0103492
1984  0.34  0.306284  0.188332
1985  0.43  0.281997  0.760829
1986  0.46  0.318322  0.663938
1987  0.11  0.156166  -0.631975
1988  0.2  0.220022  -0.172064
1989  0.18  0.1552  0.267338
1990  0.05  0.147951  -1.95642
1991  0.03  0.0602119  -1.25637
1992  0.09  0.113728  -0.421987
1993  0.25  0.123489  1.27195
1994  0.03  0.136794  -2.73624
1995  0.09  0.177913  -1.22898
1996  0.28  0.22004  0.434583
1997  0.57  0.47974  0.310888
1998  1.14  0.84275  0.544826
1999  1.63  0.693089  1.54221
2000  1.49  0.762285  1.20865
2001  1.22  0.790484  0.782598
2002  0.93  0.710361  0.485853
2003  0.86  0.938614  -0.157746
2004  1.03  0.912223  0.218985
2005  1.37  1.01617  0.538801
2006  0.54  0.757698  -0.610835
2007  1.22  1.24517  -0.0368212
index number 13
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1983  0.03  0.0583056  -1.19835
1984  0.12  0.0722795  0.914228
1985  0.07  0.0482088  0.672579
1986  0.05  0.0482819  0.0630587
1987  0.11  0.044304  1.64001
1988  0.03  0.0288448  0.070814
1989  0.03  0.022573  0.512958
1991  0.04  0.0372419  0.128843
1993  0.03  0.0195152  0.775459
1994  0.01  0.0269091  -1.78513
1995  0.01  0.0320107  -2.09821
1996  0.02  0.0258951  -0.465853
1997  0.04  0.0419494  -0.0858115
1998  0.29  0.157464  1.1013
1999  0.33  0.300502  0.168867
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2000  0.31  0.301378  0.050867
2001  0.4  0.301777  0.508148
2002  0.37  0.373675  -0.0178218
2003  0.35  0.359664  -0.0491171
2004  0.25  0.482861  -1.18711
2005  0.66  0.453417  0.677041
2006  0.47  0.499603  -0.110154
2007  0.35  0.410289  -0.286609
index number 14
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.584  0.785839  1.26409
1983  0.599  0.811756  -0.548116
1984  0.078  0.848876  -4.30505
1985  1.26  0.882723  0.641744
1986  0.522  0.529772  -0.026653
1987  0.64  0.568419  0.213897
1988  1.005  0.705243  0.638759
1989  0.363  0.422563  -0.273997
1990  0.021  0.117093  -3.09902
1991  0.05  0.308765  -3.28316
1992  0.342  0.345  -0.0157488
1993  0.492  0.305099  0.861736
1994  1.217  0.369197  2.1511
1995  1.302  0.415692  2.05894
1996  0.686  0.763103  -0.192088
1997  1.279  0.948528  0.539072
1998  1.212  0.74503  0.877532
1999  0.878  0.753294  0.276262
2000  1.659  0.80791  1.29757
2001  1.026  0.648977  0.825996
2002  1.511  0.810815  1.12258
2003  1.44  0.78095  1.10347
2004  0.283  0.886819  -2.05981
2005  0.351  0.66645  -1.15629
2006  2.44  1.02843  1.55806
2007  0.392  0.508963  -0.470888
index number 15
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.142  0.125939  0.216453
1983  0.45  0.214454  1.33658
1984  0.067  0.16327  -1.6063
1985  0.036  0.150323  -2.57752
1986  0.185  0.169687  0.15581
1987  0.013  0.083247  -3.34864
1988  0.123  0.117287  0.0857731
1989  0.102  0.082732  0.377567
1990  0.081  0.0788679  0.0481053
1991  0.012  0.032097  -1.77427
1992  0.09  0.0606245  0.712535
1993  0.065  0.0658278  -0.022822
1994  0.048  0.0729207  -0.754123
1995  0.053  0.0948395  -1.04938
1996  0.114  0.117296  -0.0514
1997  0.181  0.255734  -0.623323
1998  0.659  0.449243  0.690985
1999  1.112  0.369463  1.98708
2000  1.205  0.406349  1.96032
2001  0.73  0.421381  0.990972
2002  0.397  0.37867  0.0852473
2003  0.624  0.500345  0.398282
2004  0.323  0.486276  -0.737809
2005  1.029  0.541686  1.15715
2006  0.975  0.403904  1.58925
2007  1.008  0.663757  0.753466
index number 16
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.405  0.476298  -0.29243
1983  1.662  0.811057  1.29382
1984  0.625  0.617481  0.0218269
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1985  0.267  0.568517  -1.36297
1986  1.895  0.641751  1.95266
1987  0.679  0.314837  1.38602
1988  0.663  0.443574  0.724799
1989  0.429  0.312889  0.569161
1990  0.317  0.298275  0.109799
1992  0.288  0.22928  0.411204
1993  0.186  0.248958  -0.525756
1994  0.478  0.275783  0.991854
1995  0.076  0.358679  -2.7983
1996  0.506  0.443609  0.237314
1997  1.282  0.967176  0.508187
1998  1.508  1.69902  -0.215083
1999  0.59  1.3973  -1.55483
2000  0.94  1.5368  -0.8865
2001  2.303  1.59365  0.663983
2002  1.083  1.43212  -0.503898
2003  1.302  1.89228  -0.674255
2004  1.254  1.83908  -0.690563
2005  1.455  2.04864  -0.617061
2006  2.049  1.52755  0.52963
2007  3.745  2.5103  0.721385
index number 17
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.012  0.0456839  -2.41084
1983  0.02  0.0513015  -1.69877
1984  0.154  0.0635968  1.59489
1985  0.127  0.0424176  1.97763
1986  0.04  0.0424819  -0.108562
1987  0.214  0.0389819  3.07094
1988  0.011  0.0253798  -1.50773
1989  0.006  0.0198614  -2.15868
1990  0.016  0.0230425  -0.657791
1991  0.011  0.0327682  -1.96851
1992  0.006  0.00941804  -0.813087
1994  0.03  0.0236766  0.426878
1997  0.114  0.0369101  2.0337
1998  0.351  0.138548  1.67637
1999  0.262  0.264404  -0.0164685
2000  0.379  0.265175  0.644075
2001  0.494  0.265526  1.11958
2002  0.307  0.328786  -0.12364
2003  0.178  0.316458  -1.03768
2004  0.256  0.424857  -0.913549
2005  0.136  0.398949  -1.94077
2006  1.35  0.439588  2.02344
2007  0.559  0.361002  0.788557
index number 18
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.271  0.370923  -0.56604
1985  0.325  0.385713  -0.308864
1986  0.1  0.231488  -1.51369
1987  0.086  0.248376  -1.91266
1988  0.223  0.308162  -0.583311
1989  0.049  0.184642  -2.39237
1990  0.022  0.0511647  -1.52207
1991  0.189  0.134917  0.607894
1992  0.188  0.150751  0.398215
1993  0.151  0.133315  0.224633
1994  0.314  0.161324  1.20102
1995  0.051  0.18164  -2.29066
1996  0.266  0.333444  -0.407528
1997  0.507  0.414467  0.363412
1998  0.594  0.325547  1.08451
1999  0.593  0.329158  1.06157
2000  0.726  0.353023  1.30027
2001  0.34  0.283576  0.327252
2002  1.264  0.354292  2.29375
2003  1.016  0.341243  1.96756
2004  0.818  0.387503  1.34738
2005  0.264  0.291211  -0.176909
2006  0.36  0.449381  -0.399931
2007  0.21  0.222396  -0.103425
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index number 19
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1984  0.044  0.0720104  -0.888384
1985  0.04  0.0663002  -0.911273
1986  0.082  0.0748407  0.164754
1987  0.014  0.0367161  -1.73875
1988  0.035  0.0517294  -0.704543
1989  0.024  0.036489  -0.755541
1990  0.013  0.0347847  -1.77494
1991  0.029  0.0141564  1.29326
1992  0.021  0.0267385  -0.435664
1993  0.015  0.0290334  -1.19095
1994  0.025  0.0321617  -0.454273
1995  0.02  0.041829  -1.33064
1996  0.086  0.0517335  0.916557
1997  0.057  0.112792  -1.23079
1998  0.503  0.198139  1.68007
1999  0.385  0.162952  1.55053
2000  0.524  0.179221  1.9348
2001  0.365  0.18585  1.2172
2002  0.465  0.167013  1.84661
2003  0.395  0.220677  1.0499
2004  0.41  0.214472  1.16855
2005  0.15  0.238911  -0.839395
2006  0.068  0.178142  -1.73679
2007  0.56  0.292751  1.1697
index number 20
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.058  0.0193235  1.98214
1986  0.008  0.0193527  -1.5931
1987  0.004  0.0177583  -2.68805
1988  0.009  0.0115618  -0.451718
1989  0.016  0.00904791  1.02803
1990  0.006  0.0104971  -1.0087
1991  0.028  0.0149276  1.13431
1992  0.004  0.00429041  -0.126395
1993  0.018  0.00782226  1.50294
1994  0.018  0.0107859  0.923564
1995  0.005  0.0128308  -1.69953
1996  0.023  0.0103795  1.43489
1997  0.036  0.0168145  1.37288
1998  0.116  0.0631159  1.09757
1999  0.139  0.12045  0.25832
2000  0.074  0.120801  -0.883801
2001  0.12  0.120961  -0.0143838
2002  0.233  0.149779  0.79687
2003  0.232  0.144163  0.858032
2004  0.194  0.193545  0.00423858
2005  0.033  0.181742  -3.07672
2006  0.065  0.200255  -2.02918
2007  0.316  0.164455  1.17779
index number 21
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.571  0.943953  -0.906537
1986  0.339  0.566519  -0.926058
1987  1.17  0.607847  1.18092
1988  1.067  0.754162  0.625773
1989  0.884  0.451874  1.21017
1990  0.029  0.125215  -2.63787
1991  0.674  0.330182  1.28687
1992  0.826  0.36893  1.4535
1993  0.57  0.326262  1.00617
1994  0.827  0.394806  1.33344
1995  0.3  0.444527  -0.70914
1996  0.384  0.816035  -1.35942
1997  0.887  1.01432  -0.24189
1998  0.681  0.796709  -0.282999
1999  0.269  0.805546  -1.97797
2000  0.679  0.86395  -0.434424
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2001  0.395  0.693993  -1.01634
2002  2.689  0.867057  2.04111
2003  3.087  0.83512  2.35771
2004  1.459  0.948332  0.776901
2005  0.385  0.712678  -1.1105
2006  1.093  1.09977  -0.0111293
2007  0.217  0.544267  -1.65829
index number 22
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.331  0.375915  -0.229471
1986  0.528  0.424339  0.394155
1987  0.298  0.208177  0.646886
1988  0.223  0.2933  -0.494173
1989  0.481  0.206889  1.52149
1990  0.095  0.197226  -1.31732
1991  0.11  0.0802653  0.568324
1992  0.34  0.151604  1.45654
1993  0.366  0.164616  1.44093
1994  0.152  0.182353  -0.328336
1995  0.085  0.237166  -1.85047
1996  0.117  0.293323  -1.65749
1997  1.188  0.639517  1.11686
1998  1.373  1.12343  0.361786
1999  1.054  0.923921  0.237543
2000  1.484  1.01616  0.682957
2001  0.871  1.05375  -0.343492
2002  1.137  0.946945  0.329853
2003  1.93  1.25122  0.781592
2004  1.319  1.21604  0.146574
2005  0.755  1.3546  -1.05416
2006  0.744  1.01005  -0.551316
2007  0.592  1.65987  -1.85926
index number 23
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.072  0.055919  0.455827
1986  0.075  0.0560038  0.526713
1987  0.072  0.0513897  0.608152
1988  0.033  0.0334581  -0.0248605
1989  0.037  0.0261832  0.623609
1990  0.015  0.0303769  -1.27253
1991  0.042  0.0431981  -0.0507254
1992  0.036  0.0124158  1.9198
1993  0.046  0.0226364  1.27875
1994  0.039  0.0312128  0.401674
1995  0.024  0.0371303  -0.786958
1996  0.012  0.0300366  -1.65462
1997  0.042  0.0486585  -0.265379
1998  0.373  0.182647  1.28765
1999  0.321  0.348562  -0.148555
2000  0.346  0.349579  -0.0185568
2001  0.341  0.350042  -0.0471946
2002  0.436  0.433438  0.0106289
2003  0.479  0.417186  0.249171
2004  0.407  0.560087  -0.575783
2005  0.44  0.525933  -0.321724
2006  0.355  0.579507  -0.883766
2007  0.23  0.475908  -1.31132
index number 24
units = 2
month = 1
starting and ending ages for selectivity = 6  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.025  0.0119964  1.32417
1986  0.009  0.00934748  -0.0683157
1987  0.007  0.00724286  -0.0615059
1988  0.003  0.0085802  -1.89508
1989  0.003  0.003491  -0.273349
1990  0.001  0.00396183  -2.48273
1991  0.012  0.00683811  1.01422
1992  0.022  0.00707534  2.04581
1993  0.025  0.00282687  3.93085
1994  0.007  0.00438346  0.844111
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1995  0.009  0.0066026  0.558619
1996  0.005  0.00491484  0.030979
1997  0.005  0.00516257  -0.0577029
1998  0.04  0.0136893  1.9337
1999  0.075  0.0541705  0.586735
2000  0.127  0.142489  -0.20753
2001  0.191  0.162635  0.289926
2002  0.134  0.204955  -0.766351
2003  0.183  0.271781  -0.713259
2004  0.203  0.304424  -0.73076
2005  0.119  0.363953  -2.01601
2006  0.151  0.376487  -1.64758
2007  0.179  0.444169  -1.63895
index number 25
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  1.74  0.320978  3.0482
1983  0.52  0.546572  -0.0898761
1984  0.42  0.416121  0.0167333
1985  0.49  0.383124  0.443717
1986  0.28  0.432476  -0.783999
1987  0.51  0.212169  1.58162
1988  0.37  0.298925  0.384681
1989  0.24  0.210856  0.233469
1990  0.07  0.201008  -1.9023
1991  0.12  0.0818045  0.690984
1992  0.08  0.154512  -1.18707
1993  0.41  0.167773  1.6114
1994  0.22  0.18585  0.304205
1995  0.03  0.241714  -3.76287
1996  0.2  0.298948  -0.724876
1997  1.03  0.65178  0.82524
1998  0.96  1.14497  -0.317757
1999  0.36  0.941639  -1.73399
2000  1.91  1.03565  1.10381
2001  1.24  1.07396  0.259252
2002  0.63  0.965104  -0.769172
2003  1.38  1.27521  0.142415
2004  2.08  1.23936  0.933749
2005  1.3  1.38058  -0.108451
2006  1.38  1.02942  0.528555
2007  1.13  1.6917  -0.727691
index number 26
units = 2
month = 1
starting and ending ages for selectivity = 5  5
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.2  0.0576979  2.24178
1983  0.07  0.0647929  0.139401
1984  0.11  0.0803215  0.567061
1985  0.1  0.0535726  1.12555
1986  0.02  0.0536538  -1.77962
1987  0.13  0.0492334  1.75102
1988  0.02  0.0320542  -0.850647
1992  0.01  0.0118948  -0.312916
1993  0.11  0.0216865  2.92831
1994  0.07  0.0299031  1.53384
1997  0.01  0.0466168  -2.77608
1998  0.03  0.174983  -3.18026
1999  0.09  0.333937  -2.36449
2000  0.35  0.33491  0.0794755
2001  0.45  0.335354  0.530305
2002  0.3  0.415251  -0.58628
2003  0.4  0.399681  0.00143956
2004  0.49  0.536586  -0.163786
2005  0.78  0.503865  0.788052
2006  0.69  0.555191  0.392019
2007  0.44  0.455939  -0.0641716
index number 27
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.17  0.19741  -0.269579
1991  0.07  0.253738  -2.32241
1992  0.15  0.212514  -0.628247
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1993  0.11  0.245933  -1.45097
1994  0.08  0.256311  -2.0998
1995  0.2  0.293561  -0.692082
1996  0.41  0.355094  0.259282
1997  0.17  0.26412  -0.794579
1998  0.07  0.266647  -2.4119
1999  0.26  0.292496  -0.212382
2000  0.63  0.231041  1.80902
2001  0.42  0.28378  0.707027
2002  0.81  0.268121  1.99381
2003  1.48  0.304329  2.85239
2004  0.54  0.228878  1.54799
2005  0.55  0.353895  0.795142
2006  0.24  0.173202  0.588232
2007  0.25  0.208304  0.329051
index number 28
units = 2
month = 1
starting and ending ages for selectivity = 3  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.1  0.100368  -0.00662966
1991  0.08  0.264663  -2.15763
1992  0.18  0.295723  -0.895318
1993  0.14  0.261521  -1.12688
1994  0.05  0.316464  -3.32758
1995  0.22  0.356318  -0.869586
1996  0.53  0.654108  -0.379423
1997  0.52  0.813048  -0.806044
1998  0.36  0.638616  -1.0337
1999  0.61  0.6457  -0.102569
2000  1.89  0.692515  1.8106
2001  0.55  0.556283  -0.0204832
2002  1.11  0.695005  0.844338
2003  2.25  0.669405  2.18623
2004  1.53  0.760153  1.26147
2005  1.9  0.57126  2.16724
2006  1.08  0.881537  0.366175
2007  1.39  0.436267  2.08977
index number 29
units = 2
month = 1
starting and ending ages for selectivity = 2  2
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  3.06  5.02211  -0.89346
1989  0.51  1.34782  -1.75259
1990  1.44  2.99905  -1.32306
1991  2.69  3.85479  -0.648811
1992  3  3.22851  -0.132381
1993  5.69  3.73621  0.758571
1994  1.07  3.89387  -2.32951
1995  2.93  4.45978  -0.757596
1996  5.1  5.39458  -0.101268
1997  8.25  4.01251  1.29987
1998  5.8  4.0509  0.647269
1999  6.12  4.44359  0.577261
2000  3.91  3.50997  0.194641
2001  3.32  4.31118  -0.471129
2002  9.11  4.0733  1.45158
2003  5.61  4.62337  0.348823
2004  6.27  3.47712  1.06323
2005  5.99  5.37638  0.194904
2006  5.74  2.63128  1.40662
2007  4.1  3.16455  0.467034
index number 30
units = 2
month = 1
starting and ending ages for selectivity = 3  3
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  1.03  1.27629  -0.386641
1989  0.18  0.764718  -2.60869
1990  0.11  0.211905  -1.1824
1991  0.27  0.558776  -1.31165
1992  0.57  0.624351  -0.164246
1993  0.2  0.552141  -1.83131
1994  0.08  0.668141  -3.82763
1995  0.28  0.752284  -1.78233
1996  2.7  1.381  1.20907
1997  5.25  1.71657  2.01601
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1998  2.67  1.34829  1.23214
1999  3.46  1.36325  1.67967
2000  1.82  1.46209  0.394892
2001  1.18  1.17446  0.00848167
2002  4.13  1.46734  1.86618
2003  2.55  1.4133  1.0643
2004  2.49  1.60489  0.792098
2005  1.24  1.20608  0.050013
2006  3.22  1.86116  0.988578
2007  2.49  0.921078  1.79345
index number 31
units = 2
month = 1
starting and ending ages for selectivity = 4  4
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.03  0.0802986  -1.77553
1991  0.02  0.0326792  -0.885476
1992  0.06  0.0617243  -0.0510951
1993  0.01  0.0670219  -3.43082
1995  0.05  0.0965599  -1.18688
1996  0.18  0.119424  0.73989
1997  1.02  0.260373  2.46242
1998  0.29  0.457392  -0.821731
1999  0.65  0.376166  0.986348
2000  0.45  0.413721  0.151587
2001  0.41  0.429025  -0.0817988
2002  1.28  0.385539  2.16401
2003  0.57  0.509421  0.20263
2004  0.57  0.495098  0.254064
2005  0.53  0.551513  -0.0717522
2006  0.48  0.411231  0.278858
2007  1.22  0.675798  1.06528
index number 32
units = 2
month = 1
starting and ending ages for selectivity = 5  8
selectivity choice = -1
 year, obs index, pred index, standardized residual
1992  0.02  0.0115223  0.994474
1993  0.01  0.0210074  -1.33863
1994  0.02  0.0289666  -0.667996
1995  0.16  0.0344582  2.76896
1996  0.05  0.0278751  1.0537
1997  0.18  0.0451569  2.49375
1998  0.04  0.169503  -2.60408
1999  0.18  0.323479  -1.0571
2000  0.22  0.324422  -0.700466
2001  0.15  0.324852  -1.39354
2002  0.81  0.402246  1.26231
2003  0.51  0.387164  0.496945
2004  0.43  0.519782  -0.341964
2005  0.32  0.488086  -0.761335
2006  0.4  0.537804  -0.533855
2007  0.53  0.44166  0.328822
index number 33
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1985  0.24  0.0917319  1.73444
1986  0.172  0.101269  0.955278
1987  0.075  0.0769689  -0.046731
1988  0.015  0.0209152  -0.599493
1990  0.032  0.0600539  -1.13524
1991  0.036  0.0506361  -0.615218
1992  0.013  0.0581052  -2.70022
1993  0.084  0.060694  0.58605
1994  0.132  0.068971  1.17061
1995  0.023  0.0807101  -2.26391
1996  0.069  0.0599258  0.254275
1997  0.033  0.0602847  -1.08667
1999  0.044  0.0523443  -0.313165
2000  0.012  0.0641977  -3.02438
2001  0.021  0.0605887  -1.91084
2002  0.442  0.0686721  3.35784
2004  0.255  0.0798565  2.09379
2005  0.067  0.0390885  0.971779
2006  0.098  0.0469753  1.32611
2007  0.13  0.0651553  1.24571
```

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index number 34
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  2.27  1.79398  0.424417
1983  5.01  1.99211  1.66315
1984  1.58  1.13925  0.589811
1985  1.26  1.37337  -0.155374
1986  1.26  1.51616  -0.333746
1987  0.39  1.15235  -1.9538
1988  0.54  0.313134  0.982735
1989  1.24  0.705756  1.01638
1990  2.54  0.899102  1.87286
1991  2.64  0.758103  2.25011
1992  0.89  0.869926  0.0411421
1993  0.5  0.908684  -1.07732
1994  2.41  1.0326  1.52845
1995  0.63  1.20836  -1.17454
1996  0.81  0.897184  -0.184354
1997  0.89  0.902557  -0.025267
1998  0.73  0.990054  -0.549517
1999  0.53  0.783677  -0.705339
2000  0.57  0.96114  -0.942239
2001  0.47  0.907108  -1.18578
2002  0.77  1.02813  -0.52137
2003  0.44  0.77322  -1.01673
2004  1.3  1.19558  0.151007
2005  0.35  0.585217  -0.927027
2006  0.8  0.703295  0.23234
index number 35
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  3.408  15.5629  -2.73891
1983  17.699  17.2817  0.0430296
1984  13.31  9.88303  0.536861
1985  12.843  11.9141  0.135395
1986  59.526  13.1527  2.72272
1987  7.584  9.99666  -0.498114
1988  1.763  2.71645  -0.779621
1989  2.855  6.12248  -1.37579
1990  4.733  7.79976  -0.900852
1991  7.337  6.57659  0.197316
1992  8.487  7.54666  0.211773
1993  4.145  7.88289  -1.1592
1994  22.311  8.9579  1.64567
1995  13.067  10.4826  0.397423
1996  6.493  7.78313  -0.326833
1997  7.997  7.82974  0.0381183
1998  14.983  8.58877  1.00351
1999  8.565  6.79844  0.416564
2000  9.874  8.33795  0.304931
2001  13.543  7.86922  0.979077
2002  5.406  8.91909  -0.902926
2003  8.18  6.70773  0.357849
2004  6.993  10.3717  -0.710842
2005  2.198  5.07679  -1.50967
2006  9.658  6.10113  0.828318
2007  15.438  8.46232  1.08421
index number 36
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1988  0.17  0.426863  -1.66031
1989  1  0.962085  0.0697049
1990  1.28  1.22565  0.0782423
1991  1  1.03344  -0.0593244
1992  1.1  1.18588  -0.135569
1993  2.55  1.23872  1.30208
1994  1.66  1.40764  0.29738
1995  4.95  1.64723  1.98425
1996  1.66  1.22304  0.550896
1997  1.65  1.23036  0.529231
1998  0.67  1.34964  -1.26294
1999  1.03  1.06831  -0.0658515
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2000  0.95  1.31022  -0.579771
2001  0.62  1.23657  -1.24501
2002  1.51  1.40154  0.134416
2003  0.6  1.05405  -1.01615
2004  0.9  1.62981  -1.07089
2005  3.11  0.797765  2.45362
2006  0.81  0.95873  -0.304005
index number 37
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1982  0.55  0.503709  0.158551
1983  0.96  0.559341  0.97414
1984  0.18  0.319875  -1.0369
1985  0.59  0.385612  0.766961
1986  0.39  0.425703  -0.157969
1987  0.07  0.323553  -2.76074
1988  0.06  0.087921  -0.689063
1989  0.31  0.198161  0.807002
1990  0.44  0.252448  1.00191
1991  0.76  0.212859  2.29515
1992  0.99  0.244256  2.52381
1993  0.23  0.255139  -0.18706
1994  0.75  0.289933  1.71398
1995  0.93  0.33928  1.81846
1996  0.11  0.25191  -1.49427
1997  0.17  0.253418  -0.719988
1998  0.38  0.277985  0.563744
1999  0.21  0.220039  -0.084215
2000  0.22  0.269867  -0.368434
2001  0.12  0.254696  -1.35719
2002  0.06  0.288676  -2.83305
2003  0.18  0.217103  -0.337982
2004  0.36  0.335692  0.126076
2005  0.16  0.164316  -0.0480009
2006  0.31  0.19747  0.813303
2007  0.12  0.273892  -1.48823
index number 38
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1986  0.32  0.288458  0.187139
1987  0.26  0.219241  0.307497
1988  0.01  0.0595756  -3.21843
1989  0.14  0.134275  0.0753021
1990  0.36  0.17106  1.34188
1991  0.38  0.144234  1.747
1992  0.37  0.165509  1.45078
1993  0.05  0.172883  -2.23726
1994  0.57  0.196459  1.92093
1995  0.3  0.229897  0.47997
1996  0.08  0.170695  -1.3667
1997  0.22  0.171717  0.446841
1998  0.39  0.188364  1.31245
1999  0.35  0.149099  1.53886
2000  0.21  0.182863  0.249537
2001  0.14  0.172583  -0.377332
2002  0.13  0.195608  -0.736824
2003  0.21  0.14711  0.641875
2004  0.27  0.227466  0.309139
2005  0.01  0.111341  -4.34618
2006  0.17  0.133806  0.431741
2007  0.17  0.18559  -0.158236
index number 39
units = 2
month = 1
starting and ending ages for selectivity = 1  1
selectivity choice = -1
 year, obs index, pred index, standardized residual
1990  0.02  0.0318227  -0.837575
1992  0.01  0.03079  -2.02809
1993  0.01  0.0321618  -2.1067
1994  0.04  0.0365478  0.16277
1995  0.03  0.0427684  -0.639483
1996  0.02  0.0317548  -0.833724
1997  0.04  0.031945  0.405518
1999  0.03  0.0277373  0.141418
```

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2000  0.09  0.0340184  1.75453
2001  0.01  0.032106  -2.10357
2002  0.11  0.0363895  1.99491
2003  0.05  0.0273672  1.08686
2004  0.1  0.042316  1.55092
2005  0.04  0.0207131  1.18683
2007  0.04  0.0345259  0.265406

Input and Estimated effective sample sizes for index 1
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 2
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 3
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 4
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 5
```

```
1992  0  0
1993  0  0
1994  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 6
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 7
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 8
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
```

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1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 9
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1991  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 10
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1992  0  0
1995  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 11
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
```

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2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 12
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 13
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1991  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 14
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
```

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2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 15
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 16
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 17
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
```

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2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 18
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 19
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 20
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 21
```

1985 0 0
1986 0 0
1987 0 0
1988 0 0
1989 0 0
1990 0 0
1991 0 0
1992 0 0
1993 0 0
1994 0 0
1995 0 0
1996 0 0
1997 0 0
1998 0 0
1999 0 0
2000 0 0
2001 0 0
2002 0 0
2003 0 0
2004 0 0
2005 0 0
2006 0 0
2007 0 0
Total 0 0
Input and Estimated effective sample sizes for index 22
1985 0 0
1986 0 0
1987 0 0
1988 0 0
1989 0 0
1990 0 0
1991 0 0
1992 0 0
1993 0 0
1994 0 0
1995 0 0
1996 0 0
1997 0 0
1998 0 0
1999 0 0
2000 0 0
2001 0 0
2002 0 0
2003 0 0
2004 0 0
2005 0 0
2006 0 0
2007 0 0
Total 0 0
Input and Estimated effective sample sizes for index 23
1985 0 0
1986 0 0
1987 0 0
1988 0 0
1989 0 0
1990 0 0
1991 0 0
1992 0 0
1993 0 0
1994 0 0
1995 0 0
1996 0 0
1997 0 0
1998 0 0
1999 0 0
2000 0 0
2001 0 0
2002 0 0
2003 0 0
2004 0 0
2005 0 0
2006 0 0
2007 0 0
Total 0 0
Input and Estimated effective sample sizes for index 24
1985 0 0
1986 0 0
1987 0 0
1988 0 0
1989 0 0
1990 0 0

```
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 25
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 26
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1992  0  0
1993  0  0
1994  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 27
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
```

```
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 28
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 29
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 30
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 31
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
```

```
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 32
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 33
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 34
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 35
1982  0  0
1983  0  0
1984  0  0
```

```
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 36
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 37
1982  0  0
1983  0  0
1984  0  0
1985  0  0
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 38
1986  0  0
1987  0  0
1988  0  0
1989  0  0
1990  0  0
1991  0  0
1992  0  0
```

```
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1998  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2006  0  0
2007  0  0
 Total  0  0
Input and Estimated effective sample sizes for index 39
1990  0  0
1992  0  0
1993  0  0
1994  0  0
1995  0  0
1996  0  0
1997  0  0
1999  0  0
2000  0  0
2001  0  0
2002  0  0
2003  0  0
2004  0  0
2005  0  0
2007  0  0
 Total  0  0

Survey proportions at age by index
 Index number 1
 N/A
 Index number 2
 N/A
 Index number 3
 N/A
 Index number 4
 N/A
 Index number 5
 N/A
 Index number 6
 N/A
 Index number 7
 N/A
 Index number 8
 N/A
 Index number 9
 N/A
 Index number 10
 N/A
 Index number 11
 N/A
 Index number 12
 N/A
 Index number 13
 N/A
 Index number 14
 N/A
 Index number 15
 N/A
 Index number 16
 N/A
 Index number 17
 N/A
 Index number 18
 N/A
 Index number 19
 N/A
 Index number 20
 N/A
 Index number 21
 N/A
 Index number 22
 N/A
 Index number 23
 N/A
```

```
 Index number 24
 N/A
 Index number 25
 N/A
 Index number 26
 N/A
 Index number 27
 N/A
 Index number 28
 N/A
 Index number 29
 N/A
 Index number 30
 N/A
 Index number 31
 N/A
 Index number 32
 N/A
 Index number 33
 N/A
 Index number 34
 N/A
 Index number 35
 N/A
 Index number 36
 N/A
 Index number 37
 N/A
 Index number 38
 N/A
 Index number 39
 N/A

Index Selectivity at Age
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 0 0 0 0 1 1 1
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 1 0 0 0 0 0 0
 0 0 1 0 0 0 0 0
 0 0 0 1 0 0 0 0
 0 0 0 0 1 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0

Deviations section: only applicable if associated lambda > 0
Nyear1 observed, expected, standardized residual
2  46050.8  29361.5  0.584285
3  20734.2  13655.9  0.542161
4  3070.01  3443.07  -0.148883
5  665.997  838.774  -0.299445
6  236.86  204.047  0.193589
```

```
7  61.3409  49.6362  0.27487
8  17.4905  16.0075  0.115024

Fleet Obs, Initial, and Stadardized Residual for Fmult
1  1.16363  0.9  0.333526
2  0.0183163  0.1  -2.20359

Standardized Residuals for Fmult_devs by fleet and year
N/A

Index Obs, Initial, and Standardized Residual for q_year1
N/A

Standardized Residuals for catchability deviations by index and year
 index 1 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 2 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 3 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 4 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 5 q_devs standardized residuals
2  0
3  0
```

4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
 index 6 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
21 0
22 0
23 0
24 0
25 0
26 0
 index 7 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
21 0
22 0
23 0
24 0
25 0
26 0
 index 8 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0

```
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 9 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
 index 10 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
 index 11 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 12 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
```

```
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 13 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 14 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
26  0
 index 15 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
```

```
19  0
20  0
21  0
22  0
23  0
24  0
25  0
26  0
 index 16 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 17 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 18 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
 index 19 q_devs standardized residuals
```

2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
21 0
22 0
23 0
24 0
 index 20 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
21 0
22 0
23 0
 index 21 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
21 0
22 0
23 0
 index 22 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0

```
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 23 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 24 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
 index 25 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
```

```
25  0
26  0
 index 26 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
 index 27 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
 index 28 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
 index 29 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
 index 30 q_devs standardized residuals
2  0
```

3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
 index 31 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
 index 32 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
 index 33 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
 index 34 q_devs standardized residuals
2 0
3 0
4 0
5 0
6 0
7 0
8 0
9 0
10 0

```
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
 index 35 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
23  0
24  0
25  0
26  0
 index 36 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
 index 37 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
```

```
22  0
23  0
24  0
25  0
26  0
 index 38 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0
16  0
17  0
18  0
19  0
20  0
21  0
22  0
 index 39 q_devs standardized residuals
2  0
3  0
4  0
5  0
6  0
7  0
8  0
9  0
10  0
11  0
12  0
13  0
14  0
15  0

Obs, Initial, and Stadardized Residual for SRR steepness
0.999995  0.7  0.463041

Obs, Initial, and Stadardized Residual for SRR unexpl S
208427  22026.5  2.91758

End of Deviations Section

Selectivity by age and year for each fleet
 fleet 1 selectivity at age
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.0214966 0.418687 0.959371 0.99871 0.999961 0.999999 1 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 0.00468904 0.0764826 0.592806 0.962395 0.997783 0.999874 0.999993 1
 fleet 2 selectivity at age
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
```

```
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.133219 1 0.0793395 0.00246479 7.40189e-05 2.22072e-06 6.66242e-08 1.99881e-09
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063
 0.0521548 0.664116 1 0.632226 0.300182 0.120253 0.0444427 0.0159063

Fmult by year for each fleet
1982   1.16363 0.0183163
1983   1.48149 0.0207686
1984   1.61396 0.0238062
1985   1.52976 0.00754346
1986   1.7371 0.0412011
1987   1.45375 0.0341215
1988   2.0425 0.0324795
1989   1.54384 0.20927
1990   1.14338 0.207133
1991   1.49166 0.201367
1992   1.52722 0.132089
1993   1.28785 0.187671
1994   1.2166 0.140217
1995   1.70968 0.0708892
1996   1.43542 0.0614838
1997   0.883005 0.0430502
1998   0.791504 0.051317
1999   0.544342 0.113706
2000   0.66781 0.0741836
2001   0.486655 0.0693924
2002   0.430056 0.0469552
2003   0.412642 0.0482699
2004   0.4505 0.045047
2005   0.460634 0.046873
2006   0.364006 0.0412391
2007   0.275869 0.0646689

Directed F by age and year for each fleet
 fleet 1 directed F at age
 0.0250141 0.487198 1.11636 1.16213 1.16359 1.16363 1.16363 1.16363
 0.031847 0.620281 1.4213 1.47958 1.48143 1.48149 1.48149 1.48149
 0.0346947 0.675745 1.54839 1.61188 1.6139 1.61396 1.61396 1.61396
 0.0328846 0.640491 1.46761 1.52779 1.5297 1.52976 1.52976 1.52976
 0.0373416 0.727299 1.66652 1.73485 1.73703 1.73709 1.7371 1.7371
 0.0312506 0.608665 1.39468 1.45187 1.45369 1.45375 1.45375 1.45375
 0.0439067 0.855166 1.95951 2.03986 2.04241 2.04249 2.0425 2.0425
 0.0331872 0.646385 1.48111 1.54185 1.54378 1.54384 1.54384 1.54384
 0.0245787 0.478718 1.09692 1.1419 1.14333 1.14338 1.14338 1.14338
 0.0320656 0.624539 1.43106 1.48974 1.4916 1.49166 1.49166 1.49166
 0.0328301 0.639429 1.46517 1.52525 1.52716 1.52722 1.52722 1.52722
 0.0276844 0.539206 1.23553 1.28619 1.2878 1.28785 1.28785 1.28785
 0.0261528 0.509375 1.16717 1.21503 1.21655 1.2166 1.2166 1.2166
 0.00801676 0.130761 1.01351 1.64539 1.70589 1.70947 1.70967 1.70968
 0.00673073 0.109785 0.850924 1.38144 1.43224 1.43524 1.43541 1.43542
 0.00414045 0.0675346 0.523451 0.8498 0.881047 0.882894 0.882999 0.883005
 0.00371139 0.0605363 0.469208 0.76174 0.789749 0.791404 0.791499 0.791504
 0.00255244 0.0416327 0.322689 0.523872 0.543135 0.544273 0.544338 0.544342
 0.00313139 0.0510758 0.395881 0.642697 0.666329 0.667726 0.667805 0.66781
 0.00228195 0.0372207 0.288492 0.468355 0.485576 0.486594 0.486652 0.486655
 0.00201655 0.0328918 0.25494 0.413884 0.429103 0.430002 0.430053 0.430056
 0.00193489 0.0315599 0.244616 0.397124 0.411727 0.41259 0.412639 0.412642
 0.00211241 0.0344555 0.267059 0.433559 0.449501 0.450444 0.450497 0.4505
 0.00215993 0.0352305 0.273066 0.443312 0.459612 0.460576 0.460631 0.460634
 0.00170684 0.0278402 0.215785 0.350318 0.363199 0.363961 0.364004 0.364006
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 0.00129356 0.0210992 0.163537 0.265495 0.275257 0.275834 0.275867 0.275869
 fleet 2 directed F at age
 0.00244008 0.0183163 0.00145321 4.51459e-05 1.35575e-06 4.06754e-08 1.22031e-09 3.66108e-11
 0.00276677 0.0207686 0.00164777 5.11903e-05 1.53727e-06 4.61212e-08 1.38369e-09 4.15125e-11
 0.00317143 0.0238062 0.00188877 5.86772e-05 1.76211e-06 5.28667e-08 1.58607e-09 4.75839e-11
 0.00100493 0.00754346 0.000598494 1.8593e-05 5.58359e-07 1.67519e-08 5.02577e-10 1.50779e-11
 0.00548877 0.0412011 0.00326887 0.000101552 3.04966e-06 9.1496e-08 2.74499e-09 8.23531e-11
 0.00454564 0.0341215 0.00270719 8.41024e-05 2.52564e-06 7.57743e-08 2.27332e-09 6.82024e-11
 0.00432688 0.0324795 0.0025769 8.0055e-05 2.40409e-06 7.21277e-08 2.16392e-09 6.49202e-11
 0.0278787 0.20927 0.0166034 0.000515807 1.54899e-05 4.64729e-07 1.39425e-08 4.1829e-10
 0.0275941 0.207133 0.0164338 0.00051054 1.53318e-05 4.59984e-07 1.38001e-08 4.1402e-10
 0.0268259 0.201367 0.0159763 0.000496327 1.49049e-05 4.47178e-07 1.34159e-08 4.02493e-10
 0.0175968 0.132089 0.0104799 0.000325572 9.7771e-06 2.93333e-07 8.80035e-09 2.64021e-10
 0.0250013 0.187671 0.0148897 0.000462569 1.38912e-05 4.16764e-07 1.25034e-08 3.75118e-10
 0.0186796 0.140217 0.0111248 0.000345606 1.03787e-05 3.11383e-07 9.34187e-09 2.80267e-10
 0.00369721 0.0470787 0.0708892 0.044818 0.0212797 0.00852464 0.00315051 0.00112758
 0.00320668 0.0408324 0.0614838 0.0388717 0.0184563 0.00739361 0.00273251 0.000977978
 0.00224527 0.0285903 0.0430502 0.0272174 0.0129229 0.00517691 0.00191326 0.000684767
 0.00267643 0.0340805 0.051317 0.032444 0.0154044 0.00617103 0.00228067 0.000816263
 0.00593032 0.075514 0.113706 0.071888 0.0341325 0.0136735 0.00505341 0.00180864
 0.00386903 0.0492665 0.0741836 0.0469008 0.0222686 0.00892079 0.00329692 0.00117998
 0.00361915 0.0460846 0.0693924 0.0438717 0.0208303 0.00834464 0.00308398 0.00110377
 0.00244894 0.0311837 0.0469552 0.0296863 0.0140951 0.0056465 0.00208682 0.000746882
 0.00251751 0.0320568 0.0482699 0.0305175 0.0144897 0.0058046 0.00214524 0.000767794
 0.00234942 0.0299164 0.045047 0.0284799 0.0135223 0.00541704 0.00200201 0.00071653
 0.00244465 0.0311291 0.046873 0.0296343 0.0140704 0.00563661 0.00208316 0.000745574
 0.00215082 0.0273875 0.0412391 0.0260724 0.0123792 0.00495912 0.00183278 0.00065596
 0.00337279 0.0429476 0.0646689 0.0408854 0.0194124 0.00777663 0.00287406 0.00102864
Discard F by age and year for each fleet
 fleet 1 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 fleet 2 Discard F at age
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
```

```
 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0
Total F
 0.0274542 0.505514 1.11781 1.16218 1.16359 1.16363 1.16363 1.16363
 0.0346137 0.641049 1.42295 1.47963 1.48143 1.48149 1.48149 1.48149
 0.0378661 0.699551 1.55028 1.61194 1.6139 1.61396 1.61396 1.61396
 0.0338896 0.648035 1.46821 1.52781 1.5297 1.52976 1.52976 1.52976
 0.0428304 0.768501 1.66979 1.73496 1.73703 1.73709 1.7371 1.7371
 0.0357962 0.642787 1.39739 1.45196 1.45369 1.45375 1.45375 1.45375
 0.0482335 0.887646 1.96209 2.03994 2.04242 2.04249 2.0425 2.0425
 0.061066 0.855655 1.49772 1.54236 1.54379 1.54384 1.54384 1.54384
 0.0521728 0.685851 1.11336 1.14241 1.14335 1.14338 1.14338 1.14338
 0.0588915 0.825906 1.44703 1.49023 1.49162 1.49166 1.49166 1.49166
 0.0504269 0.771518 1.47565 1.52558 1.52717 1.52722 1.52722 1.52722
 0.0526857 0.726877 1.25042 1.28665 1.28781 1.28785 1.28785 1.28785
 0.0448323 0.649592 1.1783 1.21538 1.21656 1.2166 1.2166 1.2166
 0.011714 0.17784 1.0844 1.69021 1.72717 1.71799 1.71282 1.71081
 0.00993741 0.150617 0.912408 1.42031 1.45069 1.44263 1.43814 1.4364
 0.00638572 0.0961248 0.566501 0.877017 0.89397 0.888071 0.884913 0.88369
 0.00638782 0.0946168 0.520525 0.794184 0.805153 0.797575 0.793779 0.79232
 0.00848276 0.117147 0.436395 0.59576 0.577267 0.557947 0.549392 0.546151
 0.00700041 0.100342 0.470065 0.689597 0.688597 0.676646 0.671102 0.66899
 0.00590109 0.0833053 0.357885 0.512226 0.506407 0.494939 0.489736 0.487759
 0.00446549 0.0640755 0.301895 0.44357 0.443198 0.435649 0.43214 0.430803
 0.0044524 0.0636167 0.292886 0.427642 0.426217 0.418394 0.414784 0.41341
 0.00446183 0.0643719 0.312106 0.462039 0.463024 0.455861 0.452499 0.451217
 0.00460458 0.0663596 0.319939 0.472946 0.473683 0.466212 0.462714 0.461379
 0.00385766 0.0552277 0.257024 0.37639 0.375579 0.36892 0.365837 0.364662
 0.00466635 0.0640468 0.228205 0.30638 0.294669 0.283611 0.278741 0.276897

Average F for ages 4 to 8
Freport unweighted in .std and MCMC files
year    unweighted   Nweighted    Bweighted
1982  1.16333  1.16252  1.16265
1983  1.48111  1.47992  1.4801
1984  1.61354  1.61237  1.61254
1985  1.52936  1.52814  1.52834
1986  1.73665  1.73528  1.73547
1987  1.45338  1.45239  1.45262
1988  2.04197  2.04031  2.04056
1989  1.54353  1.54257  1.54269
1990  1.14318  1.14257  1.14263
1991  1.49137  1.49082  1.49098
1992  1.52688  1.5258  1.52595
1993  1.2876  1.28683  1.28689
1994  1.21635  1.2156  1.21574
1995  1.7118  1.69649  1.70048
1996  1.43763  1.42387  1.42552
1997  0.885532  0.878462  0.879351
1998  0.796603  0.79591  0.796504
1999  0.565303  0.588346  0.585278
2000  0.678987  0.687564  0.685809
2001  0.498213  0.508154  0.505515
2002  0.437072  0.441841  0.440267
2003  0.420089  0.425298  0.423423
2004  0.456928  0.460772  0.45932
2005  0.467387  0.471316  0.469727
2006  0.370278  0.373876  0.37208
2007  0.28806  0.298373  0.29348

Population Numbers at the Start of the Year
 73512 46050.8 20734.2 3070.01 665.997 236.86 61.3409 17.4905
 81631 55146.6 21418 5227.72 747.893 162.016 57.6182 19.2191
 46683 60800.3 22397.4 3980.02 927.138 132.4 28.6803 13.636
 56276.8 34657.5 23290.5 3664.41 618.38 143.768 20.5296 6.58269
 62127.7 41946.4 13977.9 4136.45 619.317 104.314 24.2506 4.58442
 47219.8 45895.3 14997.6 2029.3 568.293 84.9096 14.3007 3.9594
 12831.3 35128.6 18607.7 2859.09 369.996 103.435 15.4536 3.33059
 28919.9 9427.72 11149.2 2016.75 289.547 37.3777 10.4484 1.90085
 36842.6 20977.8 3089.47 1922.55 335.923 48.1598 6.21669 2.05712
 31064.9 26963.4 8146.69 782.425 477.706 83.3903 11.955 2.05898
 35647 22582.7 9102.75 1477.84 137.3 83.7118 14.6124 2.45928
 37235.3 26134.1 8049.96 1604.68 250.324 23.2195 14.1563 2.89113
 42313.1 27236.8 9741.18 1777.58 345.166 53.7822 4.98854 3.66875
 49515 31195.2 10968 2311.89 410.604 79.6358 12.408 2.00582
 36764 37734 20134.3 2859.31 332.159 56.8526 11.1281 2.028
 36984.2 28066.6 25026.7 6234 538.089 60.6381 10.4628 2.4365
 40569.5 28335.2 19657.5 10951.1 2019.8 171.409 19.4307 4.15534
 32112.8 31082 19875.5 9006.37 3854.57 703.172 60.1282 8.32199
 39384.7 24551.5 21316.5 9905.53 3865.81 1685.38 313.455 30.8252
 37170.7 30155.8 17123.1 10272 3870.93 1512.21 667.208 137.201
```

```
 42129.8 28491.9 21393.2 9230.8 4793.17 1816.82 717.944 384.685
 31684.3 32339.5 20605.2 12196.8 4613.45 2396.46 915.248 559.633
 48991.3 24321.7 23398.5 11853.9 6193.72 2346.11 1228.26 761.949
 23980.5 37606.6 17584.1 13204.6 5816.03 3035.91 1158.24 990.124
 28819 18405.2 27134.9 9845.93 6408.47 2820.56 1483.34 1058.9
 39972.2 22135.4 13428.9 16180.3 5262.82 3428.22 1518.94 1379.72

q by index
 index 1 q over time
1992  0.000126184
1993  0.000126184
1994  0.000126184
1995  0.000126184
1996  0.000126184
1997  0.000126184
1998  0.000126184
1999  0.000126184
2000  0.000126184
2001  0.000126184
2002  0.000126184
2003  0.000126184
2004  0.000126184
2005  0.000126184
2006  0.000126184
2007  0.000126184
 index 2 q over time
1992  0.000379466
1993  0.000379466
1994  0.000379466
1995  0.000379466
1996  0.000379466
1997  0.000379466
1998  0.000379466
1999  0.000379466
2000  0.000379466
2001  0.000379466
2002  0.000379466
2003  0.000379466
2004  0.000379466
2005  0.000379466
2006  0.000379466
2007  0.000379466
 index 3 q over time
1992  0.000312507
1993  0.000312507
1994  0.000312507
1995  0.000312507
1996  0.000312507
1997  0.000312507
1998  0.000312507
1999  0.000312507
2000  0.000312507
2001  0.000312507
2002  0.000312507
2003  0.000312507
2004  0.000312507
2005  0.000312507
2006  0.000312507
2007  0.000312507
 index 4 q over time
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1987  4.64299e-06
1988  4.64299e-06
1989  4.64299e-06
1990  4.64299e-06
1991  4.64299e-06
1992  4.64299e-06
1993  4.64299e-06
1994  4.64299e-06
1995  4.64299e-06
1996  4.64299e-06
1997  4.64299e-06
1998  4.64299e-06
1999  4.64299e-06
2000  4.64299e-06
2001  4.64299e-06
2002  4.64299e-06
2003  4.64299e-06
2004  4.64299e-06
2005  4.64299e-06
2006  4.64299e-06
2007  4.64299e-06
 index 39 q over time
1990  8.63746e-07
1992  8.63746e-07
1993  8.63746e-07
1994  8.63746e-07
1995  8.63746e-07
1996  8.63746e-07
1997  8.63746e-07
1999  8.63746e-07
2000  8.63746e-07
2001  8.63746e-07
2002  8.63746e-07
2003  8.63746e-07
2004  8.63746e-07
2005  8.63746e-07
2007  8.63746e-07

Proportions of catch at age by fleet
 fleet 1
Year 1 Obs  =  0.145346 0.527962 0.285212 0.0262759 0.00921763 0.00325989 0.00188287 0.000843076
Year 1 Pred =  0.049384 0.484434 0.388235 0.0590498 0.0128191 0.00455918 0.00118072 0.000337968
Year 2 Obs  =  0.102313 0.592534 0.235019 0.046978 0.014927 0.00695731 0.000344634 0.000926205
```

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Year 2 Pred =  0.0512962 0.513578 0.335489 0.0838069 0.0119968 0.00259892 0.000924261 0.000309417
Year 3 Obs  =  0.0923461 0.514057 0.310783 0.0639504 0.0166714 0.00191047 8.04408e-05 0.000201102
Year 3 Pred =  0.029454 0.555468 0.336931 0.0611951 0.0142633 0.0020369 0.000441231 0.000210525
Year 4 Obs  =  0.0551004 0.389786 0.48609 0.0477735 0.0134101 0.0068132 0.000811096 0.000216292
Year 4 Pred =  0.0449956 0.409313 0.456434 0.0734316 0.0123989 0.00288268 0.000411637 0.000132464
Year 5 Obs  =  0.0541701 0.481455 0.33418 0.114325 0.00955231 0.00423204 0.00175327 0.000332517
Year 5 Pred =  0.0570858 0.543498 0.294286 0.0889418 0.0133237 0.00224419 0.000521726 9.89693e-05
Year 6 Obs  =  0.0342164 0.530752 0.359106 0.0546401 0.0180365 0.000828885 0.000961507 0.00145884
Year 6 Pred =  0.0402038 0.579018 0.321478 0.0445493 0.0124835 0.00186521 0.000314144 8.72942e-05
Year 7 Obs  =  0.019327 0.520696 0.382537 0.0562958 0.0169045 0.00318606 0.00050029 0.000552952
Year 7 Pred =  0.0135933 0.500978 0.4102 0.0641755 0.00830871 0.0023228 0.000347035 7.50363e-05
Year 8 Obs  =  0.0135973 0.244752 0.573632 0.134542 0.0280693 0.00437341 0.000715649 0.000318066
Year 8 Pred =  0.0588184 0.263107 0.557039 0.103595 0.0148843 0.00192146 0.000537117 9.80668e-05
Year 9 Obs  =  0.0381106 0.599356 0.22759 0.106817 0.0237252 0.00322061 0.00085883 0.000322061
Year 9 Pred =  0.0737869 0.616048 0.174801 0.112403 0.0196574 0.00281827 0.000363796 0.000120849
Year 10 Obs  =  0.0053826 0.484685 0.447632 0.0464406 0.0135817 0.00200283 0.000187765 8.76238e-
05
Year 10 Pred =  0.0482566 0.581195 0.316317 0.0312466 0.0190918 0.00333282 0.000477798 8.25889e-
05
Year 11 Obs  =  0.01193 0.544721 0.361714 0.068128 0.00908374 0.00423908 0.000121116 6.2375e-05
Year 11 Pred =  0.0572646 0.512767 0.360273 0.0600185 0.00557985 0.00340211 0.000593862
0.000100307
Year 12 Obs  =  0.0148636 0.565594 0.372496 0.0378054 0.00484684 0.00297273 0.00122787
0.000193874
Year 12 Pred =  0.0545833 0.552266 0.316366 0.0650029 0.0101485 0.000941374 0.00057393
0.000117656
Year 13 Obs  =  0.0546856 0.475376 0.397561 0.0573153 0.0123715 0.00161367 0.000776954
0.000299127
Year 13 Pred =  0.0545465 0.520998 0.344764 0.0648166 0.012596 0.0019627 0.000182049 0.000134398
Year 14 Obs  =  0.0207846 0.319422 0.53252 0.091242 0.0297887 0.00577766 0.000375173 9.00414e-05
Year 14 Pred =  0.0294113 0.279512 0.517242 0.14206 0.0258257 0.00503527 0.000786042 0.000127598
Year 15 Obs  =  0.00721218 0.305647 0.549804 0.106069 0.0255535 0.00447653 0.000994784
0.000242479
Year 15 Pred =  0.0136392 0.213678 0.634513 0.120741 0.0143812 0.00247393 0.00048509 8.87848e-05
Year 16 Obs  =  0.000317763 0.122736 0.576343 0.24285 0.0439307 0.0127105 0.000794407 0.000317763
Year 16 Pred =  0.00950554 0.112759 0.630338 0.224686 0.0199686 0.00226042 0.000390575 9.13718e-
05
Year 17 Obs  =  0.00138878 0.116581 0.411079 0.383149 0.0756114 0.0106473 0.00146594 7.71545e-05
Year 17 Pred =  0.00928427 0.101434 0.449723 0.363622 0.0692166 0.00590483 0.000670494
0.000144073
Year 18 Obs  =  0.000105218 0.0414558 0.426763 0.380993 0.111741 0.0324071 0.00536611 0.00116792
Year 18 Pred =  0.00673953 0.101067 0.433126 0.298525 0.133522 0.0246137 0.00211279 0.000294108
Year 19 Obs  =  0 0.0624861 0.480027 0.317861 0.106896 0.0255895 0.00520717 0.00193409
Year 19 Pred =  0.0078247 0.0761177 0.432957 0.298404 0.120791 0.0530394 0.0098889 0.0009775
Year 20 Obs  =  0 0.155561 0.362784 0.319844 0.115401 0.0324924 0.0108308 0.0030863
Year 20 Pred =  0.007309 0.0932291 0.361614 0.330361 0.129402 0.0509129 0.0225174 0.00465481
Year 21 Obs  =  9.43556e-05 0.0640675 0.434696 0.340718 0.119266 0.0278349 0.0117945 0.00152856
Year 21 Pred =  0.00732134 0.0785039 0.409216 0.270232 0.145504 0.055453 0.0219498 0.0118205
Year 22 Obs  =  0 0.0676562 0.371839 0.344235 0.139101 0.0496146 0.0200262 0.00752842
Year 22 Pred =  0.00495905 0.080269 0.356434 0.323863 0.127086 0.0663836 0.0253968 0.015608
Year 23 Obs  =  0.00188235 0.041098 0.374195 0.341019 0.147294 0.0595293 0.0232941 0.0116878
Year 23 Pred =  0.00719677 0.0566396 0.376594 0.290958 0.157549 0.0599921 0.0314581 0.0196128
Year 24 Obs  =  0.000249326 0.0587578 0.252733 0.332435 0.185748 0.0877627 0.0421361 0.0401781
Year 24 Pred =  0.00361273 0.0897368 0.289239 0.330823 0.151021 0.0792574 0.0302879 0.0260219
Year 25 Obs  =  0.000371652 0.0432045 0.378063 0.286822 0.162969 0.0790689 0.0336345 0.0158658
Year 25 Pred =  0.00400102 0.0406719 0.423098 0.237199 0.160122 0.0708334 0.0373076 0.0267667
Year 26 Obs  =  0.000251762 0.0304632 0.183661 0.454431 0.194361 0.0813192 0.0342397 0.0212739
Year 26 Pred =  0.00571511 0.0501845 0.218591 0.414476 0.140515 0.0921871 0.040941 0.0373903
 fleet 2
Year 1 Obs  =  0.212871 0.787129 0 0 0 0 0 0
Year 1 Pred =  0.204666 0.773764 0.0214714 9.74591e-05 6.34572e-07 6.77087e-09 5.26067e-11
4.51762e-13
Year 2 Obs  =  0.158085 0.841915 0 0 0 0 0 0
Year 2 Pred =  0.20216 0.780064 0.0176439 0.000131533 5.64727e-07 3.67029e-09 3.91598e-11
3.93304e-13
Year 3 Obs  =  0.170732 0.829268 0 0 0 0 0 0
Year 3 Pred =  0.118741 0.863034 0.018126 9.82463e-05 6.86811e-07 2.94254e-09 1.9123e-11
2.73737e-13
Year 4 Obs  =  0.162602 0.837398 0 0 0 0 0 0
Year 4 Pred =  0.215428 0.755269 0.0291619 0.00014001 7.0905e-07 4.94568e-09 2.11876e-11
2.04552e-13
Year 5 Obs  =  0.109729 0.890271 0 0 0 0 0 0
Year 5 Pred =  0.211027 0.774324 0.0145173 0.000130937 5.883e-07 2.97281e-09 2.07343e-11
1.18001e-13
Year 6 Obs  =  0.0805471 0.919453 0 0 0 0 0 0
Year 6 Pred =  0.150201 0.833705 0.0160274 6.62812e-05 5.57063e-07 2.49707e-09 1.26174e-11
1.05188e-13
Year 7 Obs  =  0.0763889 0.923611 0 0 0 0 0 0
Year 7 Pred =  0.0640677 0.910012 0.0257998 0.000120456 4.67747e-07 3.92304e-09 1.75842e-11
1.14067e-13
Year 8 Obs  =  0.303895 0.659853 0.0362514 0 0 0 0 0
```

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Year 8 Pred =  0.350746 0.604679 0.0443273 0.000246016 1.06016e-06 4.10589e-09 3.44338e-11
1.88615e-13
Year 9 Obs  =  0.313165 0.672856 0.0139787 0 0 0 0 0
Year 9 Pred =  0.235297 0.757121 0.00743854 0.000142744 7.4873e-07 3.22045e-09 1.24718e-11
1.24295e-13
Year 10 Obs  =  0.172122 0.827878 0 0 0 0 0 0
Year 10 Pred =  0.174537 0.81015 0.0152672 4.50066e-05 8.24783e-07 4.31955e-09 1.85785e-11
9.63442e-14
Year 11 Obs  =  0.341791 0.646836 0.0104987 0.000874891 0 0 0 0
Year 11 Pred =  0.220488 0.760909 0.0185113 9.20295e-05 2.56616e-07 4.69401e-09 2.45821e-11
1.24568e-13
Year 12 Obs  =  0.237464 0.722774 0.0395405 0.000220897 0 0 0 0
Year 12 Pred =  0.200914 0.783451 0.0155398 9.52854e-05 4.46184e-07 1.24168e-09 2.27114e-11
1.39681e-13
Year 13 Obs  =  0.196259 0.67182 0.122943 0.00897756 0 0 0 0
Year 13 Pred =  0.209821 0.772382 0.0176974 9.92915e-05 5.78732e-07 2.70541e-09 7.52846e-12
1.66744e-13
Year 14 Obs  =  0.154639 0.738519 0.0965323 0.0103093 0 0 0 0
Year 14 Pred =  0.0877395 0.650955 0.234019 0.0250301 0.00208387 0.000162421 9.36956e-06
5.44356e-07
Year 15 Obs  =  0.0323009 0.834956 0.105752 0.0269912 0 0 0 0
Year 15 Pred =  0.0479861 0.586889 0.338566 0.0250893 0.00136855 9.41135e-05 6.81931e-06
4.46706e-07
Year 16 Obs  =  0.0158494 0.52947 0.407628 0.047053 0 0 0 0
Year 16 Pred =  0.0459273 0.425322 0.461897 0.0641178 0.00260963 0.000118093 7.54035e-06
6.31342e-07
Year 17 Obs  =  0.0119311 0.379585 0.483429 0.125055 0 0 0 0
Year 17 Pred =  0.0515527 0.439702 0.378727 0.119251 0.0103957 0.000354529 1.48762e-05 1.14405e-
06
Year 18 Obs  =  0.0376254 0.378344 0.467809 0.116221 0 0 0 0
Year 18 Pred =  0.0389912 0.456477 0.38004 0.102006 0.0208943 0.00153976 4.88412e-05 2.43334e-06
Year 19 Obs  =  0.00768693 0.262404 0.544025 0.185884 0 0 0 0
Year 19 Pred =  0.0506725 0.384823 0.425233 0.114135 0.0211581 0.00371401 0.000255885 9.05273e-06
Year 20 Obs  =  0.00380491 0.470425 0.343826 0.176064 0.00588032 0 0 0
Year 20 Pred =  0.0460866 0.458922 0.345811 0.123031 0.0220696 0.00347124 0.00056732 4.19736e-05
Year 21 Obs  =  0.0455251 0.356441 0.408174 0.18986 0 0 0 0
Year 21 Pred =  0.0483991 0.405143 0.410276 0.105509 0.0260171 0.0039638 0.000579789 0.000111748
Year 22 Obs  =  0.0224967 0.462726 0.37715 0.110278 0.0172034 0.00441112 0.00441112 0.00132333
Year 22 Pred =  0.0341796 0.431904 0.372586 0.131838 0.0236921 0.00494732 0.000699424 0.000153842
Year 23 Obs  =  0.0436105 0.277383 0.470588 0.182556 0.0147059 0.00456389 0.0035497 0.0030426
Year 23 Pred =  0.0550307 0.33811 0.436735 0.131403 0.0325852 0.00496022 0.000961154 0.000214469
Year 24 Obs  =  0.100781 0.466406 0.326172 0.0828125 0.0117188 0.00507813 0.00390625 0.003125
Year 24 Pred =  0.0254107 0.492744 0.308542 0.137431 0.0287314 0.00602782 0.000851221 0.000261744
Year 25 Obs  =  0.0755703 0.285646 0.507605 0.0936312 0.019962 0.00855513 0.00522814 0.00380228
Year 25 Pred =  0.0335615 0.26634 0.538258 0.117515 0.0363296 0.00642465 0.00125044 0.000321088
Year 26 Obs  =  0.0476397 0.301429 0.326548 0.263317 0.044175 0.0103941 0.00476397 0.00173235
Year 26 Pred =  0.0531444 0.364312 0.308278 0.227636 0.0353423 0.00926922 0.00152119 0.000497222

Proportions of Discards at age by fleet
 fleet 1
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
```

```
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 26 Obs  =  0 0 0 0 0 0 0 0
Year 26 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
 fleet 2
Year 1 Obs  =  0 0 0 0 0 0 0 0
Year 1 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 2 Obs  =  0 0 0 0 0 0 0 0
Year 2 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 3 Obs  =  0 0 0 0 0 0 0 0
Year 3 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 4 Obs  =  0 0 0 0 0 0 0 0
Year 4 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 5 Obs  =  0 0 0 0 0 0 0 0
Year 5 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 6 Obs  =  0 0 0 0 0 0 0 0
Year 6 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 7 Obs  =  0 0 0 0 0 0 0 0
Year 7 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 8 Obs  =  0 0 0 0 0 0 0 0
Year 8 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 9 Obs  =  0 0 0 0 0 0 0 0
Year 9 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 10 Obs  =  0 0 0 0 0 0 0 0
Year 10 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 11 Obs  =  0 0 0 0 0 0 0 0
Year 11 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 12 Obs  =  0 0 0 0 0 0 0 0
Year 12 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 13 Obs  =  0 0 0 0 0 0 0 0
Year 13 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 14 Obs  =  0 0 0 0 0 0 0 0
Year 14 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 15 Obs  =  0 0 0 0 0 0 0 0
Year 15 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 16 Obs  =  0 0 0 0 0 0 0 0
Year 16 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 17 Obs  =  0 0 0 0 0 0 0 0
Year 17 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 18 Obs  =  0 0 0 0 0 0 0 0
Year 18 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 19 Obs  =  0 0 0 0 0 0 0 0
Year 19 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 20 Obs  =  0 0 0 0 0 0 0 0
Year 20 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 21 Obs  =  0 0 0 0 0 0 0 0
Year 21 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 22 Obs  =  0 0 0 0 0 0 0 0
Year 22 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 23 Obs  =  0 0 0 0 0 0 0 0
Year 23 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 24 Obs  =  0 0 0 0 0 0 0 0
Year 24 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 25 Obs  =  0 0 0 0 0 0 0 0
Year 25 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15
Year 26 Obs  =  0 0 0 0 0 0 0 0
Year 26 Pred =  1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15 1e-15

F Reference Points Using Final Year Selectivity and Freport options
 refpt           F       slope to plot on SRR
  F0.1     0.201454     0.506501
  Fmax     0.419999     0.891641
  F30%SPR  0.305528     0.687652
  F40%SPR  0.206915     0.515744
```

```
  Fmsy     0.419984     0.891614    SSBmsy    43898.1     MSY   14686.3
  Fcurrent 0.28806     0.656698

Stock-Recruitment Relationship Parameters
 alpha     = 39140.3
 beta      = 0.260441
 unexpl    = 208427
 steepness = 0.999995
Spawning Stock, Obs Recruits(year+1), Pred Recruits(year+1), standardized residual
init  xxxx  73512  39139.8  1.33433
1982  24674.1  81631  39139.9  1.55609
1983  24637.2  46683  39139.9  0.373083
1984  20983.9  56276.8  39139.9  0.768746
1985  18724.4  62127.7  39139.8  0.978135
1986  17691.4  47219.8  39139.8  0.397293
1987  18338.1  12831.3  39139.8  -2.36092
1988  10860.9  28919.9  39139.4  -0.640588
1989  7016.68  36842.6  39138.9  -0.127994
1990  9576.14  31064.9  39139.3  -0.489117
1991  9151.69  35647  39139.2  -0.197847
1992  10535.6  37235.3  39139.4  -0.105578
1993  12098.5  42313.1  39139.5  0.165048
1994  15053.4  49515  39139.7  0.497774
1995  20670.9  36764  39139.9  -0.132567
1996  23326.5  36984.2  39139.9  -0.119928
1997  24649.9  40569.5  39139.9  0.0759434
1998  27654.2  32112.8  39140  -0.418919
1999  28054.4  39384.7  39140  0.0131966
2000  30320.6  37170.7  39140  -0.109287
2001  35650.5  42129.8  39140.1  0.155825
2002  40412  31684.3  39140.1  -0.447363
2003  43672.8  48991.3  39140.1  0.475241
2004  43932.2  23980.5  39140.1  -1.0371
2005  42080.6  28819  39140.1  -0.648022
2006  41671.3  39972.2  39140.1  0.044534
2007  43363.2       xxxx   39140.1

Root Mean Square Error computed from Standardized Residuals
Component                 #resids         RMSE
_Catch_Fleet_1               26           0.239034
_Catch_Fleet_2               26           0.0172357
Catch_Fleet_Total            52           0.169462
_Discard_Fleet_1             0            0
_Discard_Fleet_2             0            0
Discard_Fleet_Total          0            0
_Index_1                     16           2.47416
_Index_2                     16           1.56581
_Index_3                     16           1.7774
_Index_4                     16           2.30417
_Index_5                     15           2.01824
_Index_6                     26           1.84718
_Index_7                     26           1.24458
_Index_8                     25           1.90547
_Index_9                     21           1.10394
_Index_10                     16           1.12998
_Index_11                     25           0.52376
_Index_12                     25           0.974942
_Index_13                     23           0.874376
_Index_14                     26           1.58857
_Index_15                     26           1.27939
_Index_16                     25           1.01676
_Index_17                     23           1.55624
_Index_18                     24           1.25105
_Index_19                     24           1.25697
_Index_20                     23           1.40824
_Index_21                     23           1.32506
_Index_22                     23           1.00765
_Index_23                     23           0.845876
_Index_24                     23           1.45351
_Index_25                     26           1.28712
_Index_26                     21           1.53474
_Index_27                     18           1.46784
_Index_28                     18           1.49051
_Index_29                     20           1.02325
_Index_30                     20           1.59283
_Index_31                     17           1.35936
_Index_32                     16           1.40278
_Index_33                     20           1.64523
_Index_34                     25           1.05951
_Index_35                     26           1.09205
_Index_36                     19           1.04855
```

```
_Index_37                      26           1.33618
_Index_38                      22           1.55052
_Index_39                      15           1.34453
Index_Total                   838           1.4048
Nyear1                          7          0.353234
Fmult_Year1                     2           1.57592
_Fmult_devs_Fleet_1             0          0
_Fmult_devs_Fleet_2             0          0
Fmult_devs_Total                0          0
Recruit_devs                    0          0
Fleet_Sel_params               12           1.79915
Index_Sel_params                0          0
q_year1                         0          0
q_devs                          0          0
SRR_steepness                   1          -0.463041
SRR_unexpl_S                    1          -2.91758

Projections not requested

that's all
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APPENDIX 6

SAW 47 Working Paper 11 (TOR 6) – Modeling Environmental Factors

September 5, 2007

Modeling environmental factors and summer flounder recruitment success

by
Mark Terceiro
NOAA Fisheries NEFSC
166 Water St.
Woods Hole, MA 02543

A Report to the Northeast Regional (NER) Stock Assessment Workshop (SAW)
Southern Demersal Working Group (SDWG)

INTRODUCTION

There is interest among scientists, managers, and fishermen in exploring the relationship between environmental processes and summer flounder recruitment. Such processes might include the influence of physical parameters such as water temperature and salinity, and biological ones such as the density of prey (e.g., zooplankton and small fish) or the density of predators (e.g., spiny dogfish, bluefish, or striped bass). The most recent stock assessments for summer flounder (Terceiro 2006a, b; SDWG 2007) indicate that over the last 25 years recruitment has varied annually by a factor of about seven (Table 1, Figure 1). The weak year class that recruited to the stock in 2005, which was spawned by the largest spawning stock biomass (SSB) of summer flounder since the 1970s, brought increased focus to the influence of environmental factors on the success of summer flounder recruitment.

Evidence from several studies suggests that low water temperatures could negatively impact summer flounder recruitment. Summer flounder spawning occurs during an annual offshore migration from coastal areas to the continental shelf from August through December, and is generally considered to peak around November 1 (O'Brien et al. 1993). Summer flounder eggs have been collected as early as September in the northern Mid-Atlantic Bight and as late as January off Cape Hatteras, NC, with peak egg concentrations in October and November (Smith 1973, Able et al. 1990). Summer flounder eggs in the wild are tolerant to a wide range of temperatures between about 9 and 22^{o}C, with most occurring in temperatures of about 13-17^{o}C (Smith 1973). Summer flounder larvae have been collected over an even wider range of temperatures (0-23^{o}C; Smith 1973). Laboratory studies suggest that summer flounder eggs and larvae are tolerant to relatively high temperatures (Johns and Howell 1980, Johns at al. 1981),

but that both eggs and larvae are susceptible to shock exposure to low temperatures of about 0°C (Hoss et al. 1974).

Summer flounder larvae undergo metamorphosis during the late autumn and early winter months as they enter the estuarine zone along the mid-Atlantic coast (Able et al. 1990). Szedlmayer et al. (1992) investigated the first year growth and effects of water temperature on survival for summer flounder juveniles migrating into New Jersey estuaries in the winter of 1988-1989, and found that the survival of metamorphosing larvae decreased drastically when water temperatures dropped below 2°C. Keefe and Able (1992) found that the survival of metamorphosing larvae was lower at laboratory water temperatures of 4°C than at 10°C, and concluded that estuarine summer flounder larvae suffer increased mortality based on both the duration and severity of cold water temperatures. Malloy and Targett (1991) conducted laboratory experiments on juvenile summer flounder and found 100% survival above 3°C, suggesting that the juveniles were able to survive most winter water temperatures encountered in the Mid-Atlantic Bight. However, Malloy and Targett (1994) found 42% mortality of juveniles at 2°C and concluded that mortality in the wild from acute exposure to low water temperatures probably occurred during one 2 to 4 week period each winter, and that summer flounder recruitment success in the north/central Mid-Atlantic Bight may be lower in years with late winter cold periods due to increased exposure to lethal temperatures.

Over the last decade, persistent significant relationships have been found between environmental factors and recruitment success for a variety of fish species around the world. Daskalov (1999) used General Additive Modeling (GAM; Hastie and Tibshirani 1990) to document significant correlations between the recruitment success of Black Sea anchovy, whiting, sprat, and horse mackerel and environmental factors including sea surface temperature, wind speed, wind stress, mixing, atmospheric pressure, and river run-off. Williams and Quinn (2000) used correlation analyses to identify significant environmental factors affecting Pacific herring recruitment success. Beentjes and Renwick (2001) used correlation analysis to identify a significant relationship between New Zealand red cod recruitment success and sea surface temperature. Chen and Ware (1999), Chen at al. (2000), Chen (2001), and Dreyfus-Leon and Chen (2007) used neural network, fuzzy logic, and genetic algorithm models to explore the relationships between environmental factors and recruitment success of Pacific herring stocks. Megrey et al. (2005) examined the utility of linear and non-linear regression, Generalized Additive Models (GAMs), and Artificial Neural Network (ANN) models in identifying relationships between recruitment and the environment for both simulated and real Norwegian herring stock-recruit data. Brodziak and O'Brien (2005) used randomization methods and the GAM approach to evaluate the response of New England groundfish recruit-spawner ratios to environmental variables such as the North Atlantic Oscillation (NAO) index, water temperature, windstress, and shelf water volume anomalies. This work explores the relationships between water temperature anomalies, NAO indices and metrics of summer flounder recruitment success by applying some of the approaches of Brodziak and O'Brien (2005) and Megrey et al. (2005) to summer flounder spawner-recruit data and relevant environmental data.

DATA AND MODELING APPROACH

Data

Spawning stock biomass (SSB) and recruitment estimates (VPA0) for summer flounder were taken from a version of the 2007 assessment update Virtual Population Analysis (VPA)

F07_ALL sensitivity run (includes all available survey indices; SDWG 2007), which has historically exhibited a milder retrospective pattern and more precise estimates of stock size (a "degrees of freedom" phenomenon) than the F07_1 final run used to determine the official status of the stock. Because no accepted parametric stock-recruit relationship was available (Terceiro 2006b), the RSAs were computed as the difference between the observed annual RS ratio values and the mean RS ratio value for the 1983-2006 year classes (Table 1, Figure 1).

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 (http://www.nefsc.noaa.gov/epd/ocean/MainPage/ioos) following the methods developed by Mountain (2004). Seasonal temperatures anomalies were computed for the two regions for winter/spring (season 1; January-June) and fall (July-December) for both surface and bottom water temperatures (Figure 2). Fall season anomalies are forward lagged to the next calendar year for correspondence with summer flounder age-0 year class designation (because summer flounder are born during September-March, and appear in fishery and research survey catches from 9-16 months after birth, a fish spawned in fall 1990 by the 1990 SSB may not appear in fishery and catches until late fall/early winter 1991 – but it is classified as a age 0 fish even though it may be up to 15 months old, since the abundance of the year class is estimated as of January 1, 1991).

North Atlantic Oscillation (NAO) climate index monthly values were obtained from the University of East Anglia database (http://www.cru.uea.ac.uk/cru/climon/monthly) and winter (December-March) and fall (September- November) indices were computed as per Jones et al. (1997)(Figure 3). NAO indices were also forward lagged one and two years because the NAO can produce both contemporary local and time-lagged broad-scale physical changes in the climate that could influence recruitment success (Brodziak and O'Brien 2005).

Modeling Approach

The works cited in the Introduction set the foundation for 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. Aspects of the current work follow the general approach of Brodziak and O'Brien (2005), who examined relationships between environmental indices and summer flounder Recruit-Spawner Anomalies (RSAs), considered a measure of summer flounder recruitment success that is independent of the size of the Spawning Stock Biomass (SSB). Brodziak and O'Brien (2005) found that the NAO2 index (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). This work also follows aspects of the work of Megrey et al. (2005), by considering the absolute estimates of recruitment (VPA0) as another measure of recruitment success, which may or may not be subject to strong influence of the magnitude of SSB.

Correlation analyses among the environmental factors and RSAs and absolute estimates of recruitment (VPA0) were performed first to identify potentially significant relationships. The GAM approach to modeling (Hastie and Tibshirani 1990), 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, was then used to model relationships for environmental (predictive) factors initially identified by the correlation analysis as 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. 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.

RESULTS AND DISCUSSION

The most prominent features of the summer flounder absolute recruitment series (VPA0) are the strong year class that recruited in 1983, and the two weak year classes that recruited in 1988 and 2005 (Table 1, Figure 1). The most prominent features of the summer flounder recruit-spawner anomaly (RSA) series are the 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 SSB_{MSY} (Terceiro 2006b).

Visual inspection of the temperature anomaly and climate index series indicates a few instances of prominent environmental factors that correspond with the metrics of recruitment success. For example, a) the relatively high MAS_ST2 and MAS_BT2 (Mid-Atlantic South region Fall surface and bottom) temperature anomalies in 1983 correlate with the strong 1983 year class (VPA0) and positive 1983 RSA, b) the negative MAS_BT2 anomaly correlates with the weak 2005 year class and negative 2005 RSA, and c) the slightly negative MAS_ST1 anomaly in 1988 is the strongest correlate with the weak 1998 year class/negative 1988 RSA (Figure 2). For the NAO climate indices, the unlagged positive NAO_WIN climate indices in the early 1990s correlate with the positive RSAs during that period; the positive 1983 NAO_FAL index correlates with the strong 1983 year class and positive 1983 RSA (Figure 3). The lagged NAO indices likewise have a positive correspondence with positive RSAs in the early 1990s (Figures 3-4), but do not appear to correlate strongly with any of the prominent recruitment success features (i.e., 1983, 1998, or 2005 year classes or RSAs).

Several of the regional, seasonal temperature anomalies exhibit significant statistical correlation over the time series. The strongest positive correlations were between annual values of the Mid-Atlantic North region winter-spring surface (MAN_ST1) and bottom (MAN_BT1) anomalies ($r = 0.50$) and the MAN_BT1 and MAS_BT2 ($r = 0.57$) anomalies, both significant at the $p = 0.01$ level. None of the correlations between NAO indices were significant at the $p = 0.10$ level. The strongest relationships between temperature anomalies and NAO indices were negative correlations between the MAN_BT1 anomaly and NAO_WIN index ($r = -0.42$; $p = 0.03$) and the MAS_ST1 anomaly and the NAO_FAL index ($r = -0.41$; $p = 0.04$).

The strongest statistical correlations between the metrics of recruitment success and environmental factors (Table 2) were between the RSA and the NAO_WIN index ($r = 0.59$; $p < 0.01$), the RSA and the MAN_BT1 anomaly ($r = -0.43$; $p = 0.04$), the VPA0 and the MAS_BT2 anomaly ($r = 0.38$; $p = 0.08$), the VPA0 and the NAO_FAL_1 index ($r = 0.35$; $p = 0.09$), and the VPA0 and the NAO_FAL index ($r = 0.34$; $p = 0.09$). Correlations of this magnitude are of about

the same statistical significance as the highest correlations between the F07_ALL absolute recruitment estimates (VPA0) and research survey VPA calibration indices (e.g., MDDNR r = 0.53, $p < 0.01$; CTDEP r = 0.45, p = 0.03; RIDFW r = 0.35, p = 0.09; VIMS r = 0.34, p = 0.09; NEFSC r = 0.33, p = 0.10; SDWG 2007).

Based on the combined results of the correlation analyses, the initial GAMs related either absolute recruitment (VPA0) or recruitment survival rate (RSA) to the MAN_BT1 and MAS_BT2 temperature anomalies and the NAO_FAL, NAO_FAL_1, and NAO_WIN climate indices. The final GAM relating RSA to the predictive factors included only the NAO_WIN index (i.e., $p <= 0.20$). The estimated effect of the NAO_WIN index (predictive factor; x-axis) on summer flounder recruit-spawner anomaly (RSA; y-axis) is presented in Table 3 and Figure 4 (GAM 1). Comparison of the observed NAO_WIN index and estimated RSA indicates a positive and fairly strong predicative relationship, in line with the results of the correlation analysis (Figure 4, bottom panel).

The final GAM relating VPA0 to the predictive environmental factors included the MAS_BT2 temperature anomaly and the NAO_WIN and NAO_FAL_1 climate indices (i.e., $p <= 0.20$). Note that 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). Also, 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). The estimated combined effects of these predictive factors (x-axis) on the absolute magnitude of summer flounder recruitment (VPA0; y-axis) are presented in Table 3 and in the first panel of Figure 5 (GAM2). The combined predictive fit characterizes the strong 1983 year class and the weak 1988 and 2005 year classes relatively well. However, the subsequent panels of Figure 5 demonstrate that 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 the 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). Summary diagnostics for runs F07_ALL (all available survey indices included), F07_ALL_GAM2 (same as F07_ALL, but including environmental factors MAS_BT2, NAO_WIN, and NAO_FAL_1 as recruitment calibration indices), F07_GAM2_ONLY (including only the environmental factors MAS_BT2, NAO_WIN, and NAO_FAL_1 as recruitment calibration indices), and F07_MD0_MAS_BT2 (including only the MD DNR age 0 survey index [the best correlated trawl survey index with estimates from run F07_ALL] and the environmental factor MAS_BT2 [the best correlated environmental factor with estimates from run F07_ALL] as recruitment calibration indices) are presented in Table 4.

The inclusion of the environmental factors as recruitment calibration indices degraded the overall fit of the VPA, as diagnosed by 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). 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. Estimates of the weak 2005 year class increased by up to 30% in the alternative runs; 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.

Finally, it should be noted that a value of the NAO_WIN index for the 2006-2007 winter season (Dec. 2006-Mar 2007: NAO_WIN = 1.83) is available to use in the GAM1 model to predict the RSA for 2007 = 0.78; given the estimate of the SSB that will produce the 2007 year class (44.451 kmt), this predicted RSA equates to predicted recruitment in 2007 of 34.7 million fish – about 2% below the F07_ALL VPA time series average of 35.4 million fish. Since the fall NAO and temperature anomaly data are lagged forward, environmental factor data are also available to fit the GAM2 model to predict the 2007 VPA0 (NAO_FAL_1 = -0.43; MAS_BT2 = 1.205). The GAM2 model predicted 2007 value for VPA0 in 2007 is 50.4 million fish – about 42% above the F07_ALL VPA time series average of 35.4 million fish.

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Table 1. Summer flounder Spawning Stock Biomass (SSB; 000s metric tons), recruitment at age 0 (VPA0; million of fish), Recruit-Spawner ratios (RS), and Recruit-Spawner Anomalies (RSA), from the SDWG (2007) F07_ALL VPA run configuration. Note that estimates differ from the SDWG (2007) F07_1 VPA run used for official status determination.

Year	SSB	VPA0	RS	RSA
1983	22.582	80.3	3.556	1.552
1984	24.435	48.4	1.981	-0.025
1985	21.870	48.6	2.222	0.216
1986	19.853	53.4	2.690	0.687
1987	18.391	43.9	2.387	0.383
1988	19.082	13.0	0.681	-1.322
1989	10.883	27.3	2.508	0.501
1990	7.025	30.4	4.327	2.316
1991	9.940	28.7	2.887	0.881
1992	8.743	32.3	3.694	1.691
1993	9.905	33.2	3.352	1.343
1994	12.287	35.3	2.873	0.864
1995	15.099	38.7	2.563	0.557
1996	18.972	28.3	1.492	-0.515
1997	20.065	28.0	1.395	-0.560
1998	20.381	31.3	1.536	-0.469
1999	22.141	30.0	1.355	-0.650
2000	22.491	33.7	1.498	-0.505
2001	25.940	36.8	1.419	-0.585
2002	32.145	39.6	1.232	-0.774
2003	38.879	28.0	0.720	-1.284
2004	45.873	36.1	0.787	-1.218
2005	46.451	12.2	0.263	-1.742
2006	47.956	32.2	0.671	-1.334
Mean	22.558	35.4	2.004	0.000

Table 2. Significant correlations of environmental factors with metrics of summer flounder recruitment success. See text for meaning of acronyms; Spearman *r* is a correlation coefficient; *p* level indicates probability that correlation (*r*) is due to random chance.

Recruitment metric	Environmental Factor	Spearman *r*	*p*
RSA (Recruit-Spawner Anomaly)	NAO_WIN	0.59	<0.01
	MAN_BT1	-0.43	0.04
VPA0 (age 0 stock size)	NAO_FAL	0.34	0.09
	NAO_FAL_1	0.35	0.09
	MAS_BT2	0.38	0.08

Table 3. Summary General Additive Model (GAM) results for relationship between environmental factors and summer flounder recruitment metrics with significant linear model component fits ($p < 0.20$).

Regression model using NAO_WIN and RSA

Parameter Estimates

Parameter	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	-0.36404	0.21224	-1.72	0.1018
Linear(NAO_WIN)	0.52255	0.15453	3.38	0.0030

Fit Summary for Smoothing Components

Component	Smoothing Parameter	DF	GCV	Num Unique Obs
Spline(NAO_WIN)	0.990281	3.000000	0.959966	24

Regression model using NAO_WIN, NAO_FAL_1, MAS_BT2 and VPA0

Parameter Estimates

Parameter	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	32.30060	3.15681	10.23	<.0001
Linear(NAO_WIN)	5.56656	1.91828	2.90	0.0124
Linear(NAO_FAL_1)	4.57488	2.82983	1.62	0.1299
Linear(MAS_BT2)	4.02419	1.87632	2.14	0.0514

Fit Summary for Smoothing Components

Component	Smoothing Parameter	DF	GCV	Num Unique Obs
Spline(NAO_WIN)	0.988675	3.000000	99.148877	23
Spline(NAO_FAL_1)	0.978174	3.000000	99.276403	19
Spline(MAS_BT2)	0.989486	3.000000	99.148669	23

Table 4. Summary diagnostics for summer flounder ADAPT VPA runs F07_ALL (all available survey indices included), F07_ALL_GAM2 (same as F07_ALL, but including environmental factors MAS_BT2, NAO_WIN, and NAO_FAL_1 as age 0 calibration indices), F07_GAM2_ONLY (including only the environmental factors MAS_BT2, NAO_WIN, and NAO_FAL_1 as age 0 calibration indices), and F07_MD0_MAS_BT2 (including only the MD DNR age 0 survey index and the environmental factor MAS_BT2 as age 0 calibration indices). MSR = Mean Squared Residual. Age 0 (recruitment) stock sizes (VPA0) in thousands of fish.

Run ID	MSR	Age 0 1983 N	Age 0 1988 N	Age 0 2005 N	Age 0 2006 N
F07_ALL	0.846	80,323	13,033	12,209	33,167
F07_ALL_GAM2	0.943	80,323	13,033	13,432	34,419
F07_GAM2_ONLY	1.017	80,323	13,033	15,912	35,185
F07_MD0_MAS_BT2	0.924	80,323	13,033	13,479	36,225

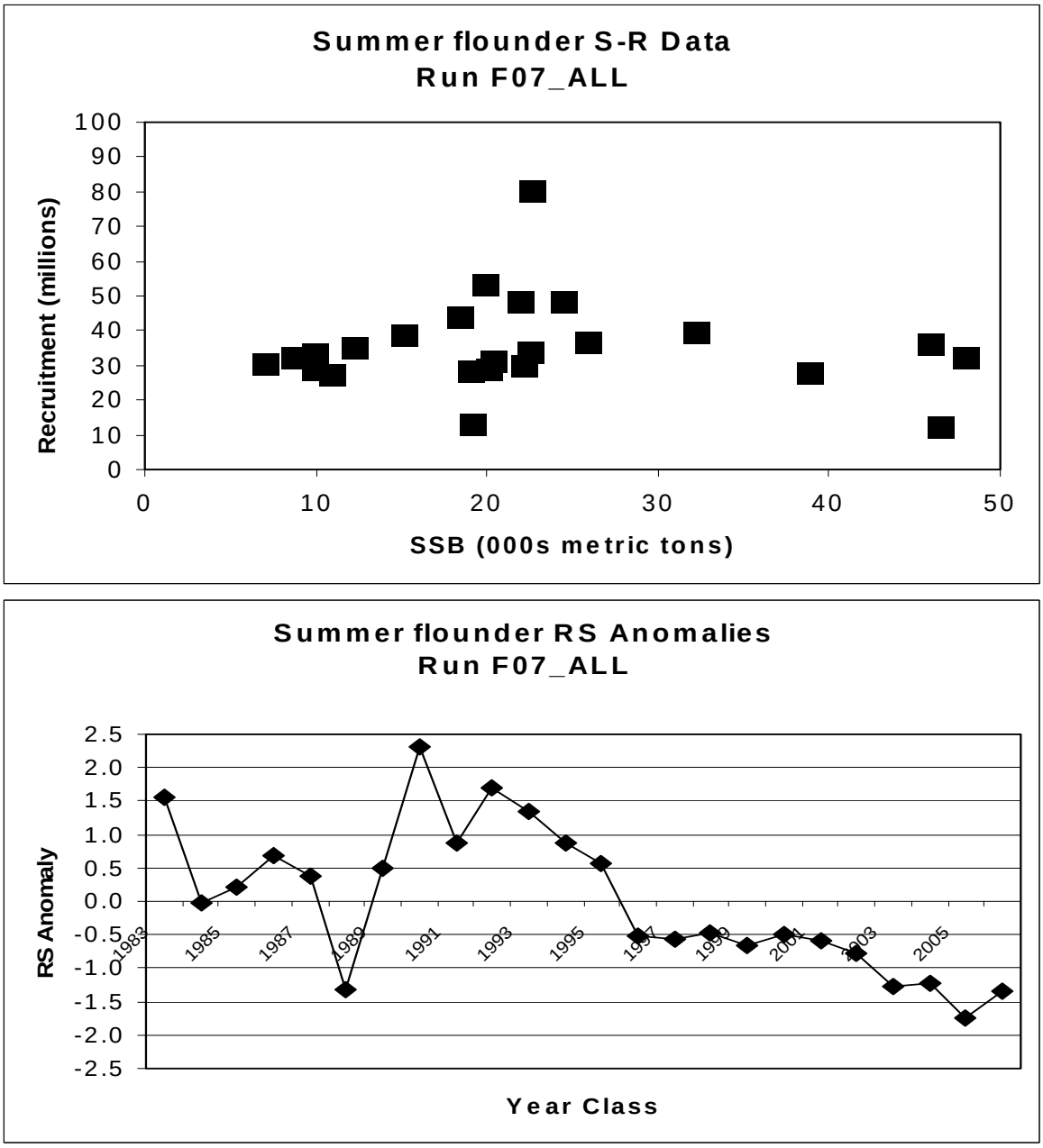


Figure 1. Summer flounder Spawning Stock Biomass (SSB; 000s metric tons) and Recruitment (Age 0 fish; millions) estimates (top) and Recruit-Spawner Anomalies (RSA; bottom) from the SDWG (2007) F07_ALL VPA run for the 1983-2006 year classes. Note that estimates differ from the SDWG (2007) F07_1 VPA run used for official status determination.

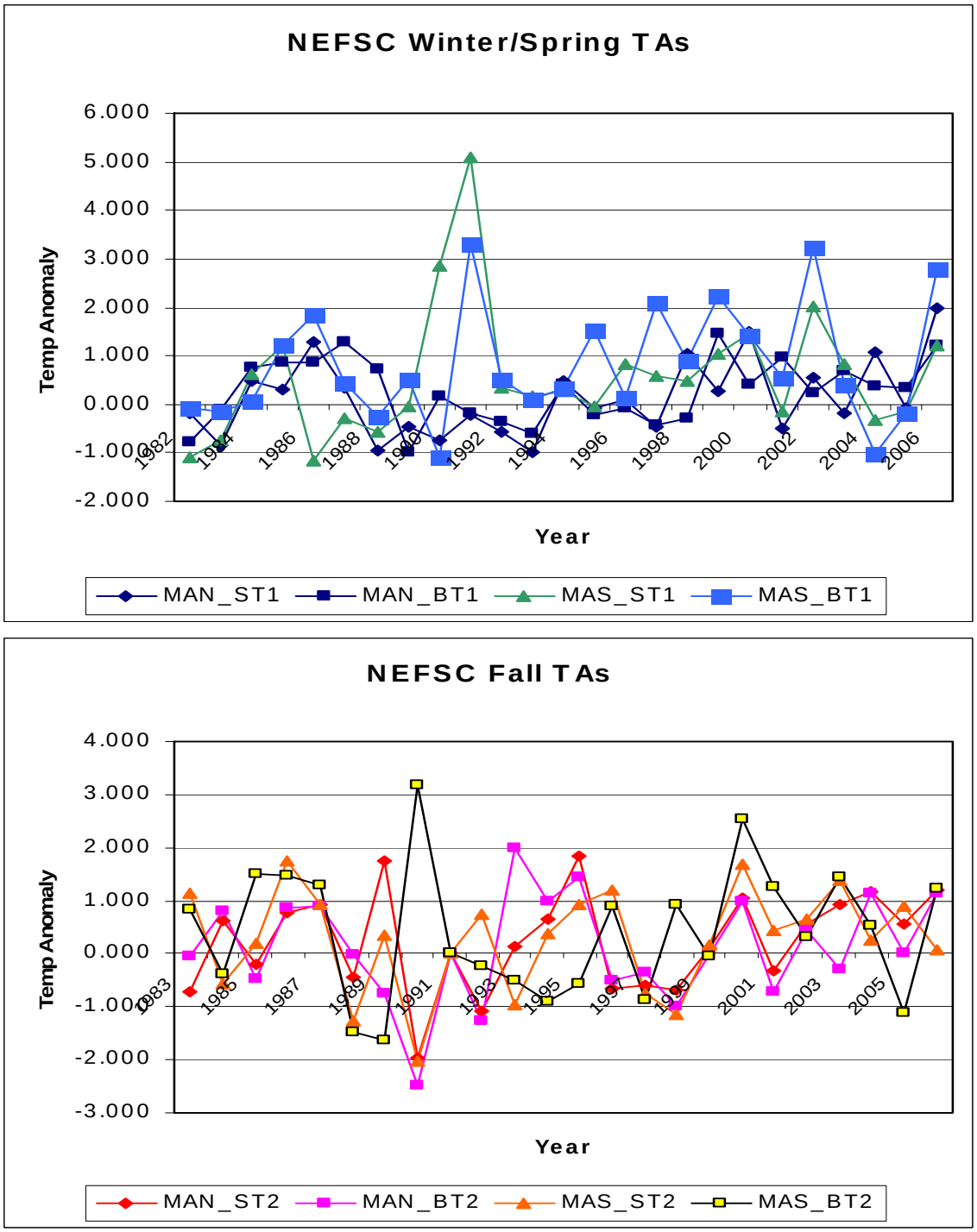
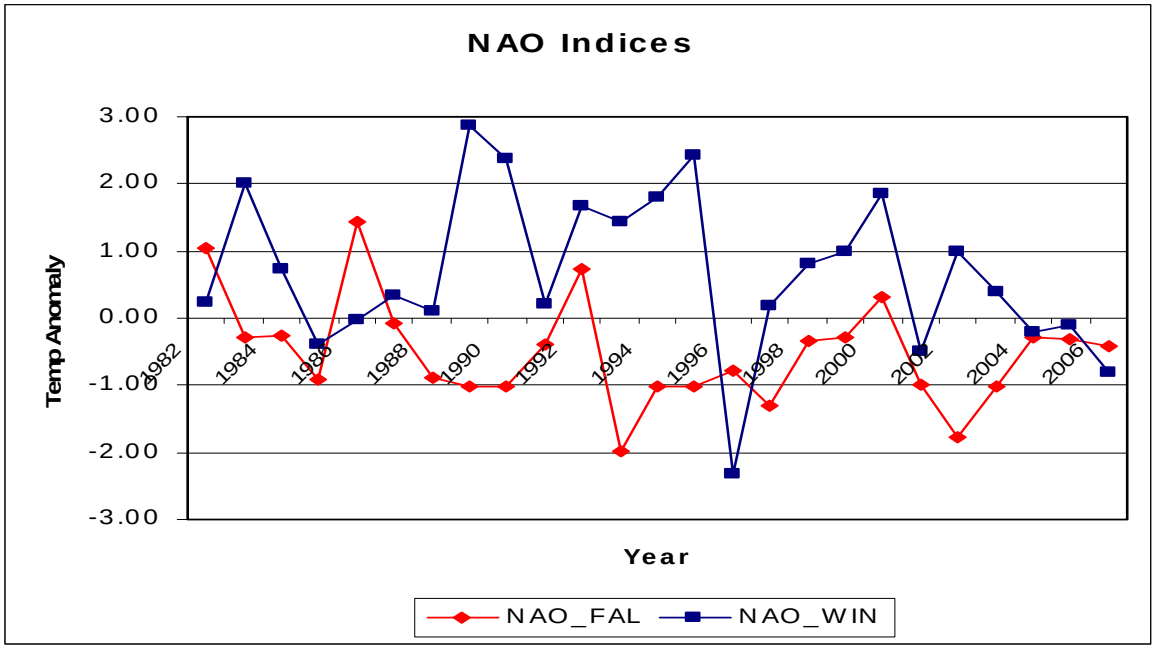


Figure 2. NEFSC survey Temperature Anomalies (TAs). Fall season anomalies are forward lagged to the next calendar year for correspondence with year class designation. MAN = Mid-Atlantic Bight North, MAS = Mid-Atlantic Bight South); ST = Surface Temperature, BT = Bottom Temperature; 1 = Winter/Spring= January-June, 2 = Fall= July-December.



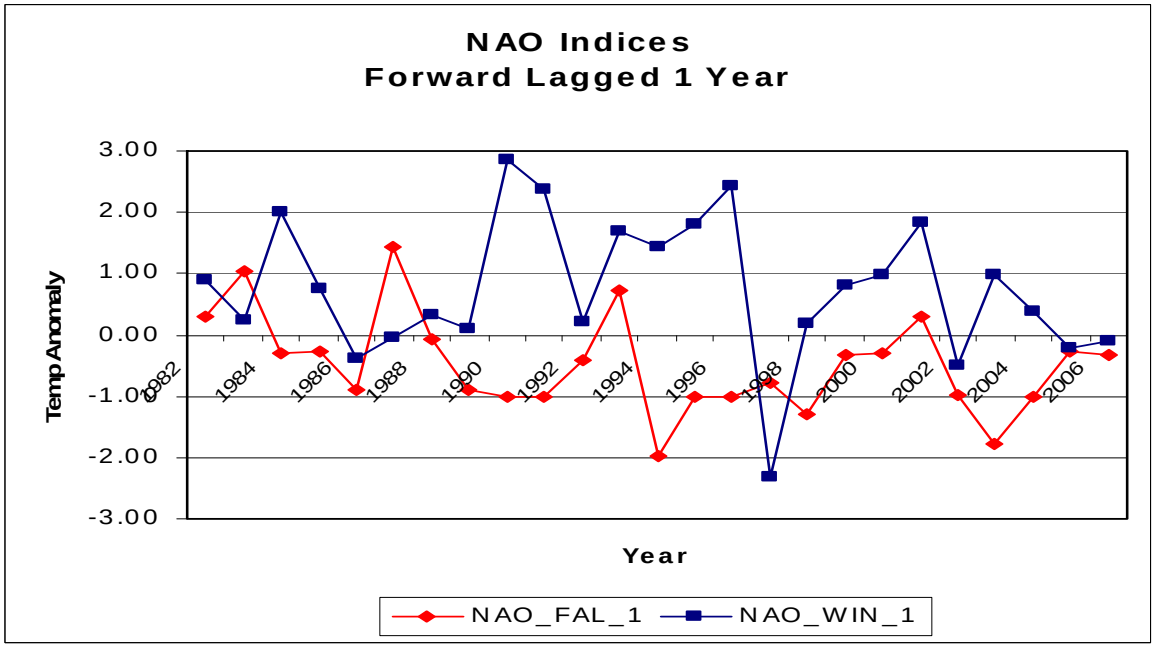


Figure 3. North Atlantic Oscillation (NAO) climate indices. Winter indices (NAO_WIN) are December-March. Fall (NAO_FAL) indices are September-November. Indices are also forward lagged one (_1) and two (_2) years because the NAO can produce both contemporary local and time-lagged, broad-scale physical changes.

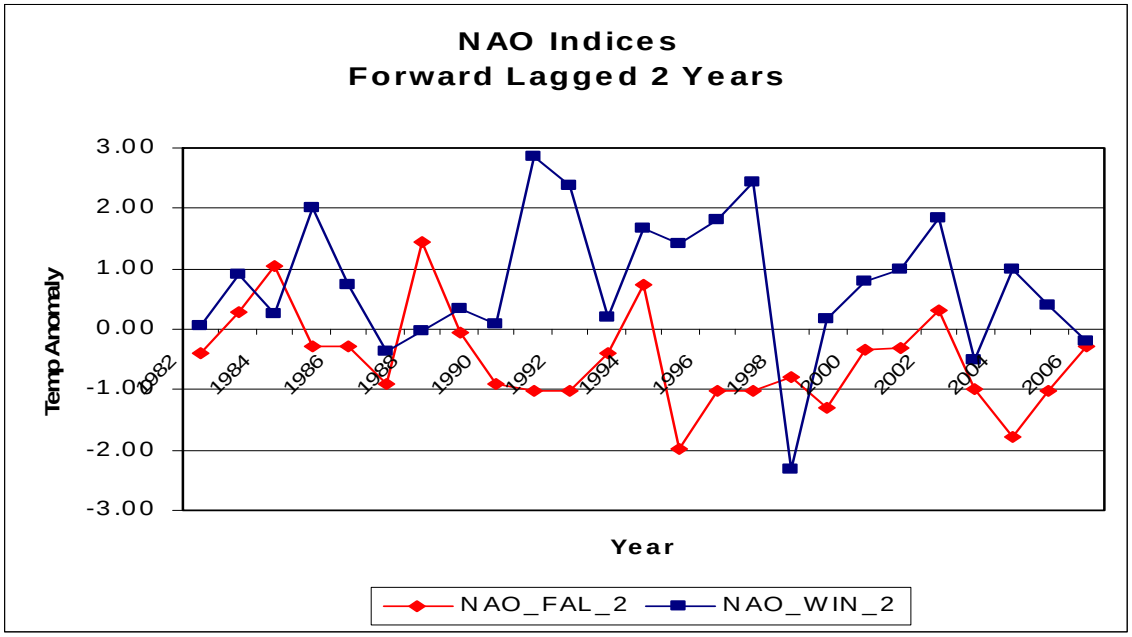


Figure 3 Continued.

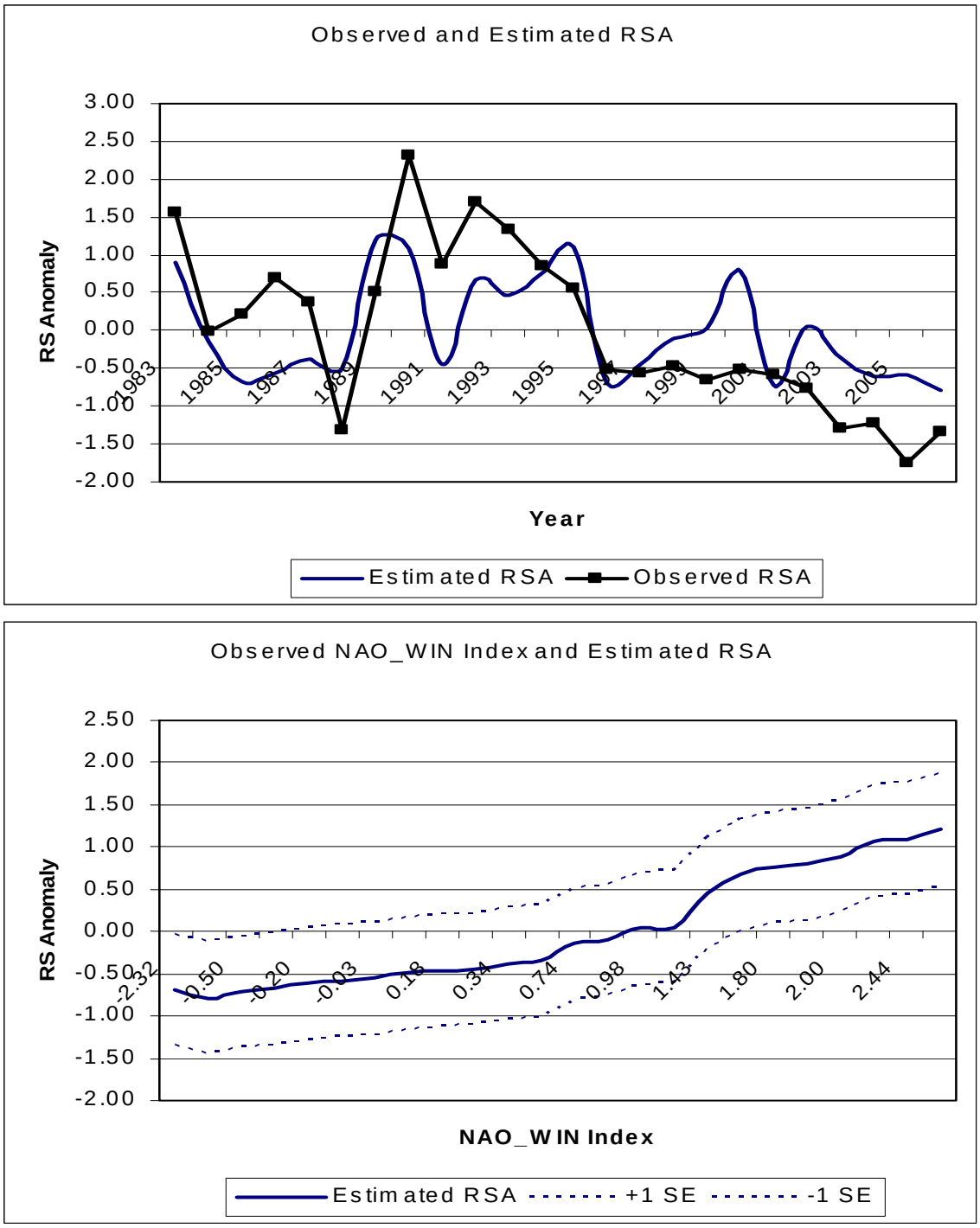


Figure 4. Results from the GAM1 regression and smoothing model of NAO_WIN climate index and Recruit-Spawner Anomaly (RSA).

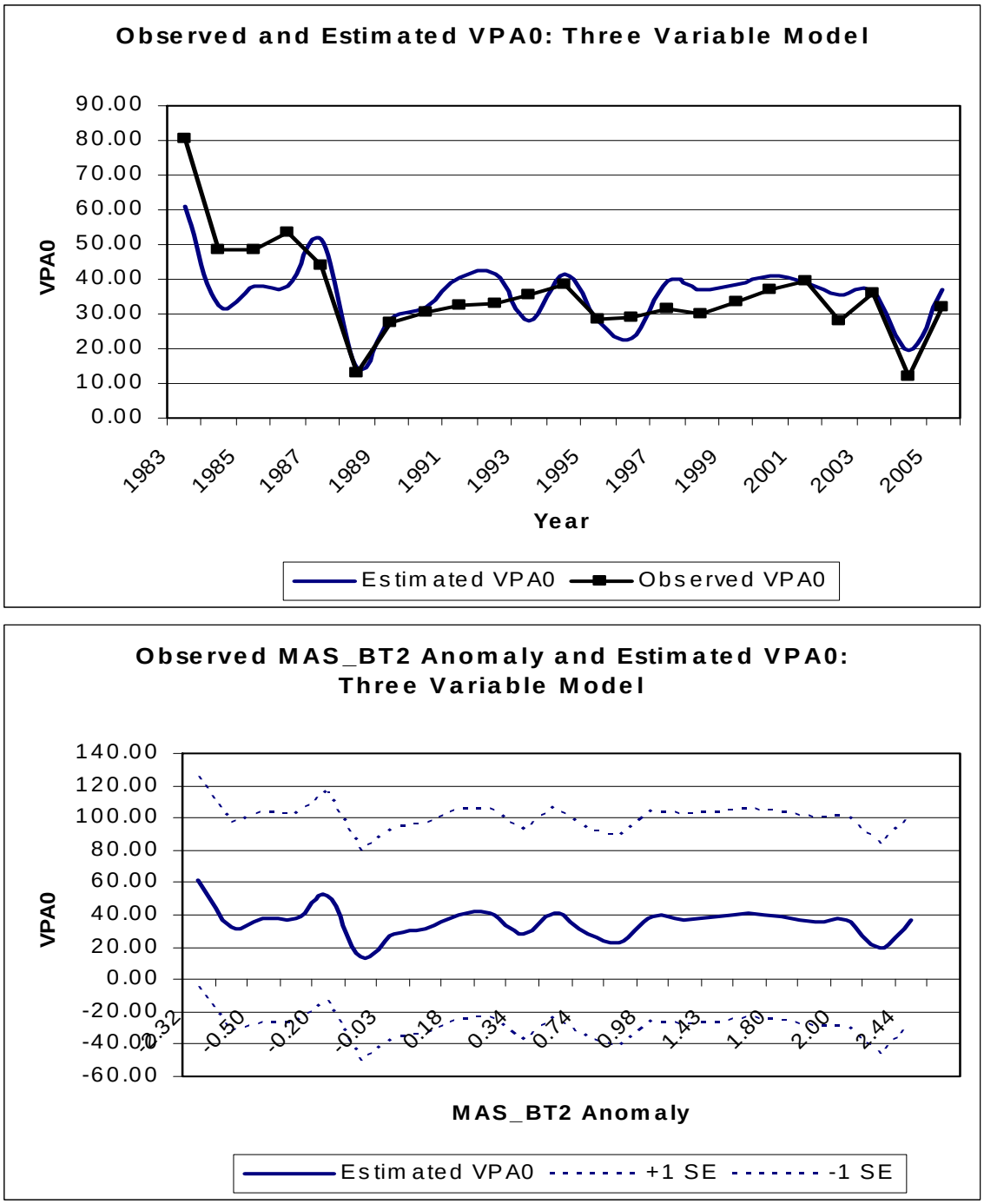
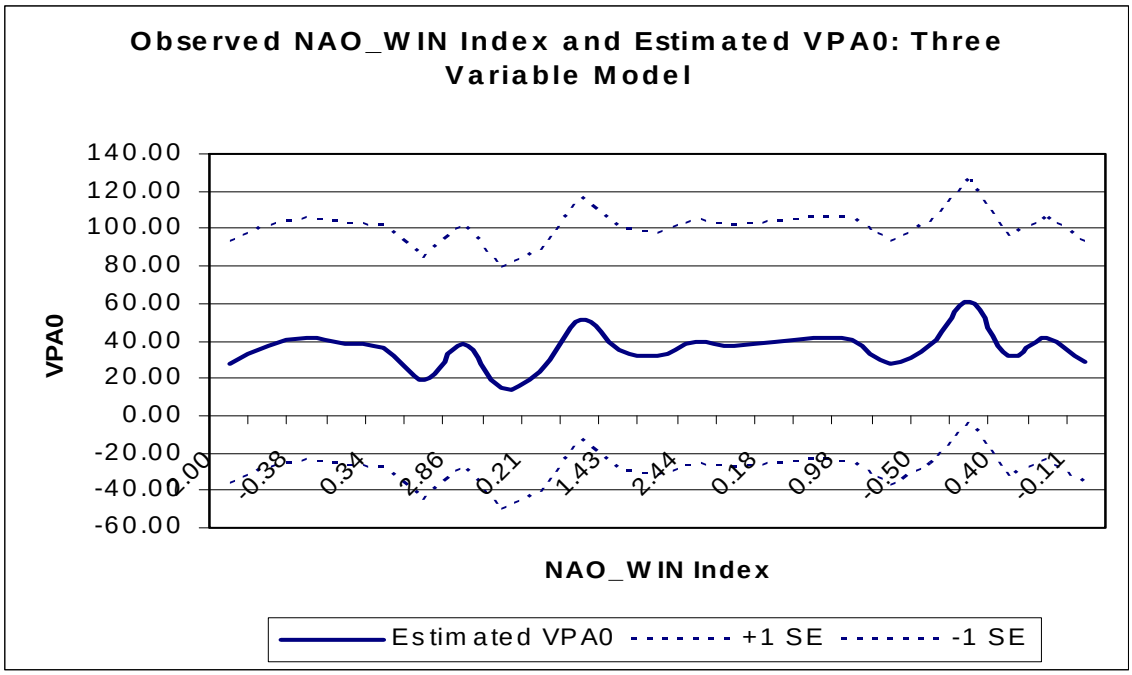


Figure 5. Results from the GAM2 regression and smoothing model of NAO_WIN and NAO_FAL_1 climate indices and MAS_BT2 temperature anomaly and Age 0 recruitment (VPA0).



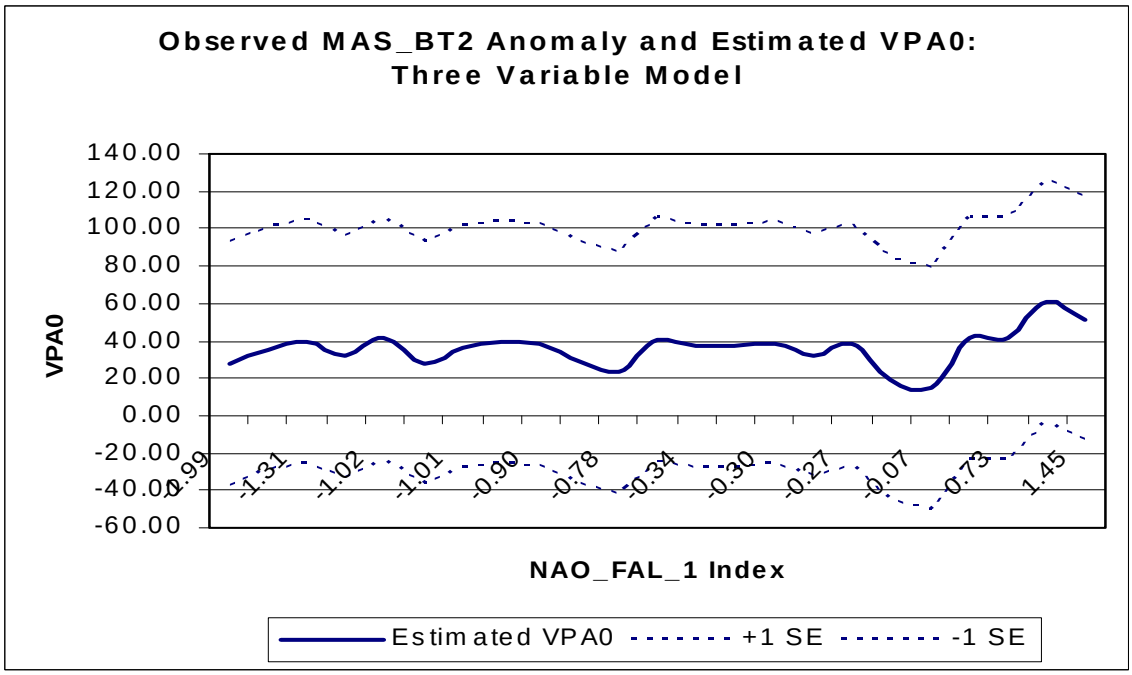


Figure 5 continued.

SAW 47 Working Paper 12 (TOR 6) – Wavelet Analysis

Wavelet Analysis of Trends in Summer Flounder YOY and Spawner-Recruit Relationships

by Eric Powell

Introduction

Two climatic signals are most significant in affecting oceanographic and estuarine processes in the Mid-Atlantic Bight, the North Atlantic Oscillation (NAO) and the Pacific North American (PNA). The NAO is closely related to the Arctic Oscillation (AO) and primarily affects temperature. The PNA has a well-described teleconnection with the El Niño-Southern Oscillation (ENSO) and is dominantly an effector of precipitation and, thus, freshwater inflow, in the northeast region. The NAO has a well-described 8-year cycle and indications of a 4-yr periodicity that are superimposed on longer-term trends. These periodicities are known to profoundly effect estuarine oyster populations, including recruitment and mortality.

Methods

Meteorological Data Sets

Monthly values for the NAO and PNA indices were obtained from the National Weather Service Climate Prediction Center [1]. Both are obtained from a rotated principal component analysis using the monthly standardized 500-mb height anomalies obtained from the CDAS in the analysis region 20^o N-90^o N. Details are provided at the NOAA web site.

Analytical Approach

The time series technique of wavelet analysis was used. Application of this technique to oyster populations is described in Soniat et al. (2006), who reference a wide range of other applications of this technique. Wavelet analysis resolves 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 our group have evaluated the use of a number of mother wavelets (e.g., Paul, Morlet). The Morlet wavelets have good frequency resolution, but smear the dominant signals in the time domain. The Paul wavelets provide good time resolution, but smear the signals in the frequency domain. Comparison of the two show that, for applications of the type that follow, 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.

[1] www.cpc.ncep.noaa.gov/products/precip/CWlink

Fisheries data

The fisheries data used are the spawning stock biomass (SSB) and recruitment estimates (VPA0) for summer flounder obtained as described by Terceiro[2].

Results

Four wavelet analyses are 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 VPA0/SSB (labeled `SR' on the plots that follow) index.

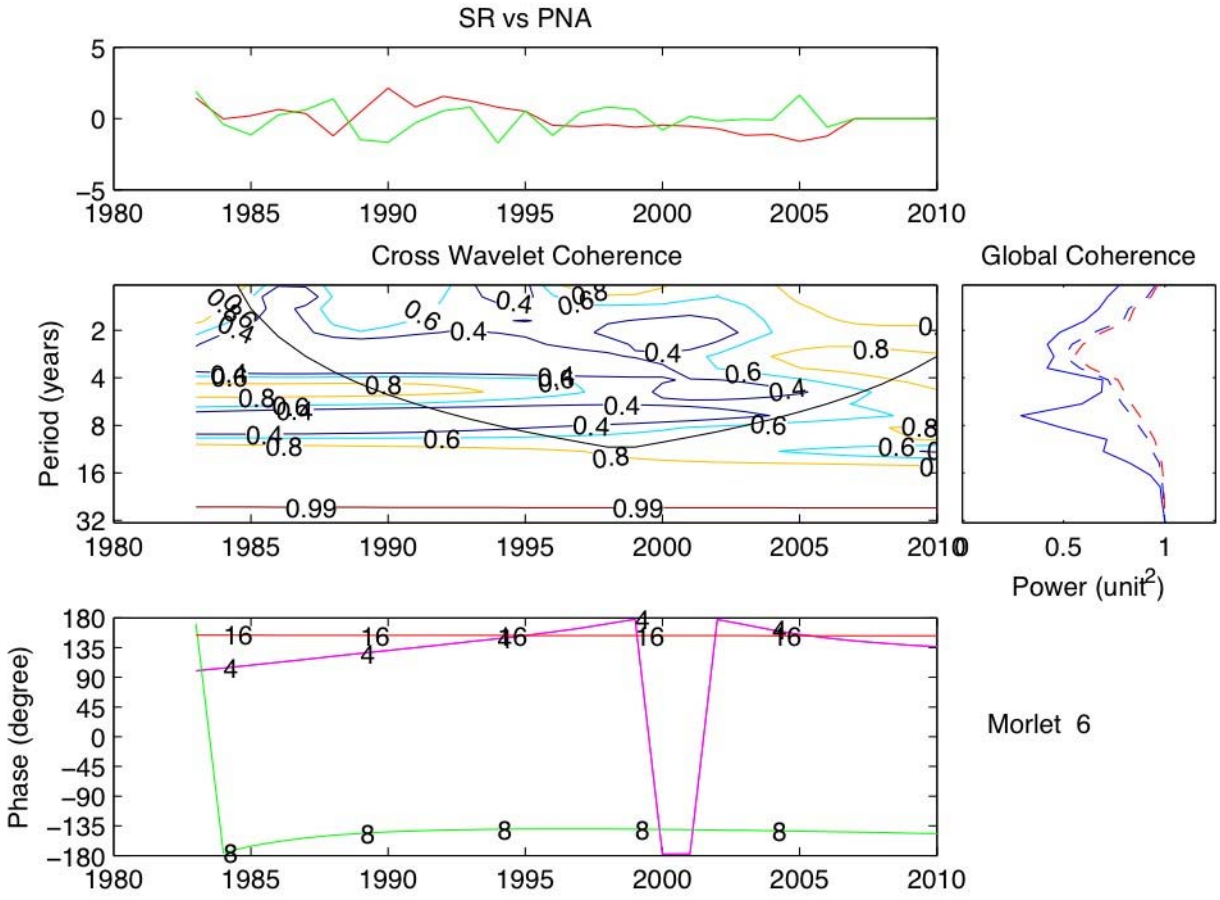


Figure 1. Cross-wavelet analysis between the VPA0/SSB (spawner-recruit) index and the PNA (Pacific North American) index.

Figure 1 shows the cross-wavelet analysis between the spawner-recruit index and the PNA. The top graph reports the data time series standardized to a mean of zero. The middle righthand graph labeled `global coherence' reports the significance of periodicities from <1 to >16 years. The dashed lines on this graph identify the significance at the $\alpha = 0.10$ (left dashed line) and $\alpha = 0.05$ (right dashed line) levels. The time series is 24 years long. A rule-of-thumb is

[2] Working Paper: Modeling environmental factors and summer flounder recruitment success.

that no periodicity can be safely identified with a period that exceeds half the time series length, so that results exceeding 12 years should be ignored. In the case of the PNA and the spawner-recruit relationship, no significant periodic interaction is found. Other analyses, not figured here, also failed to find any relationship with the PNA and recruitment (VPA0).

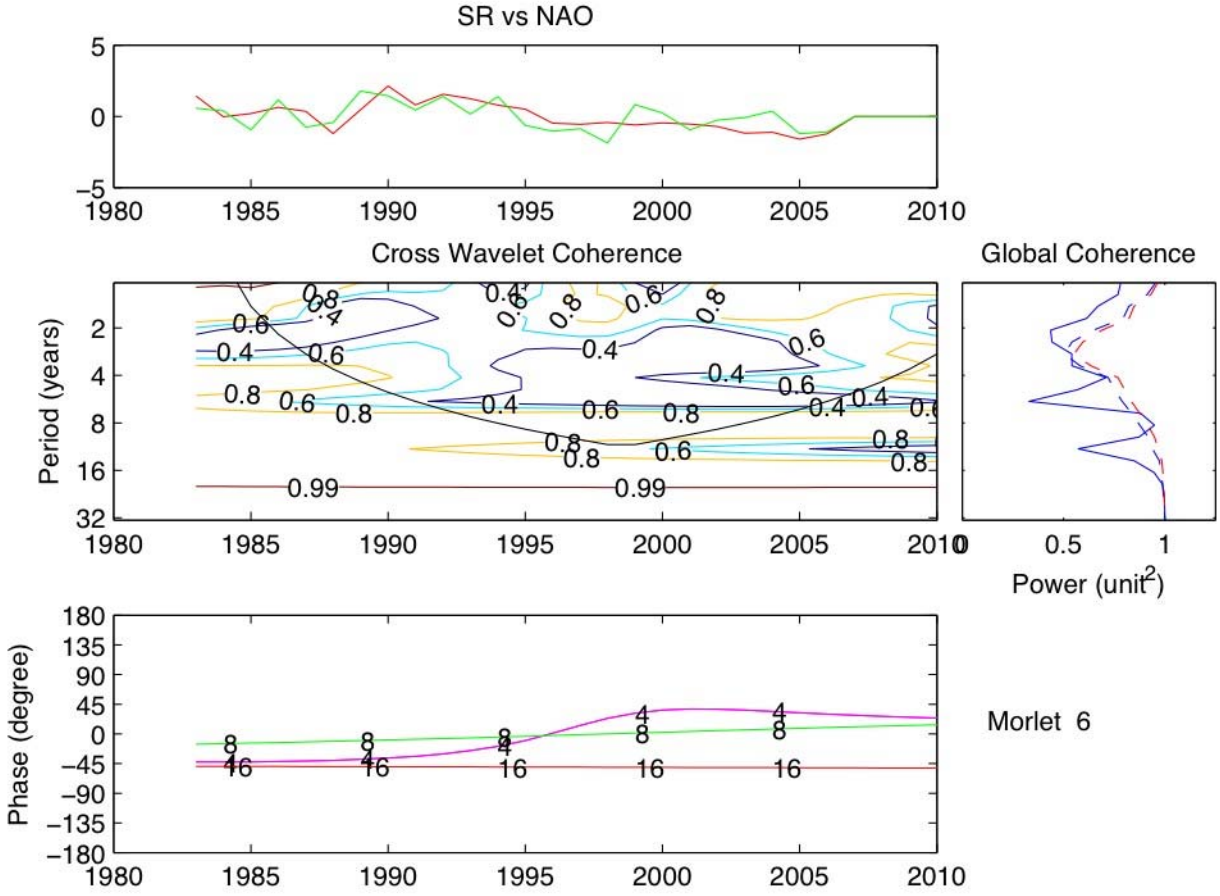


Figure 2. Cross-wavelet analysis between the VPA0/SSB (spawner-recruit) index and the NAO (North American Oscillation) Index.

Figure 2 shows results of the cross-wavelet analysis for the spawner-recruit index and the NAO. The analysis shows two significant coherences, at 4 years and 8 years (middle, right plot labeled `global coherence'). These same two periodicities are significant in other species we have examined such as oysters. The lower plot shows the phase relationships, with the first variable leading the second. Thus, the 8-year periodicity has a phase of near 0. Highs in NAO and the spawner-recruit index more or less coincide. The 4-yr periodicity shows a strong shift in phase between 1995 and 2000. Prior to 1995, the phase was -45^{o}. That is, NAO led the spawner-recruit relationship by

$4 \times (45^{o} / 360^{o}) = 0.5$ yr. After 2000, the two periods were nearly synchronous.

Figure 3 shows the results of cross-wavelet analysis between the VPA0 index and NAO. The 8-year signal is significant and the 4-yr signal barely so. The phase shift in the 4-year signal is dramatic.

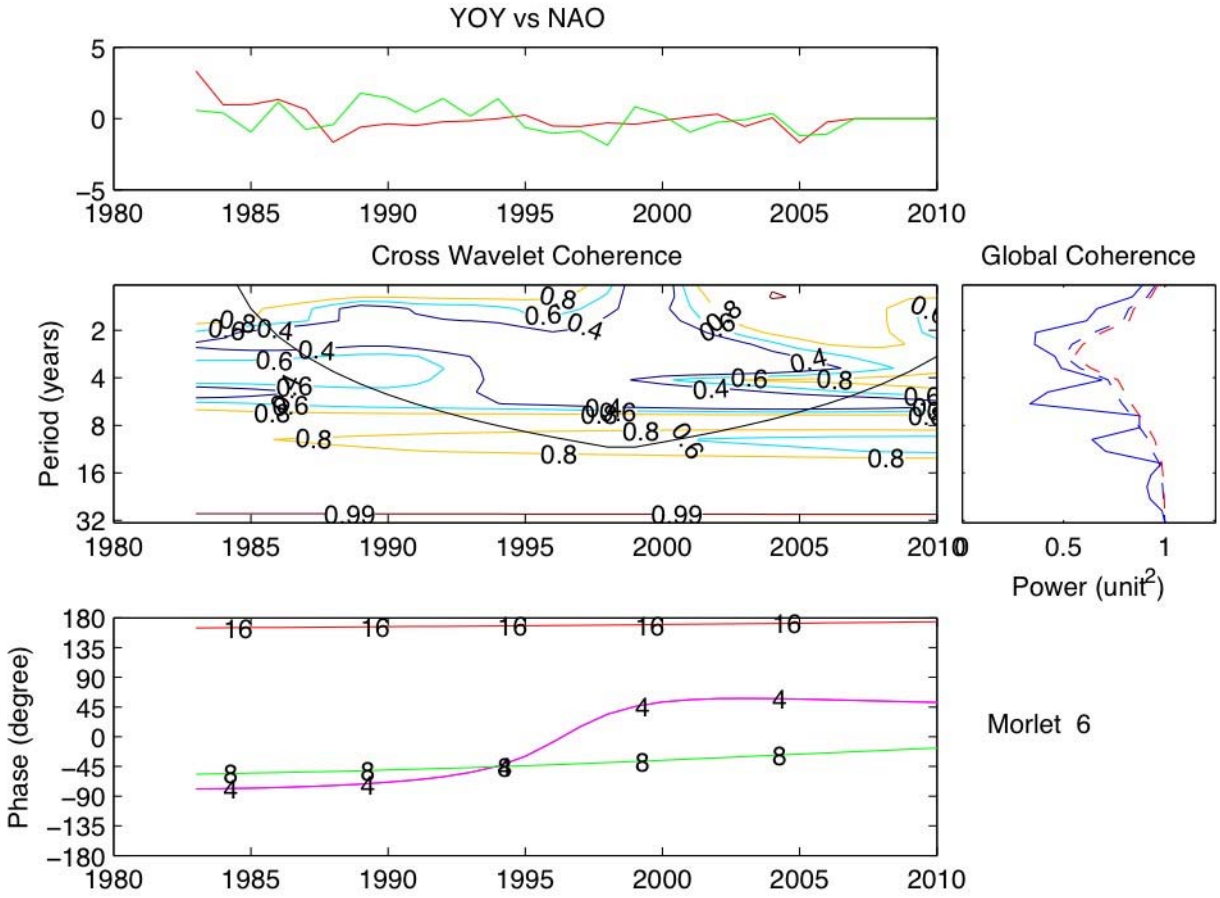


Figure 3. Cross-wavelet analysis between the VPA0 index and the NAO (North American Oscillation) Index.

The spawner-recruit index has a long-term downward trend that might affect the wavelet analysis. A final analysis was conducted with this trend in the spawner-recruit relationship removed prior to analysis. Figure 4 shows that the 8-year periodicity remains strongly significant. The 4-year periodicity is no longer significant, although the phase shift remains apparent.

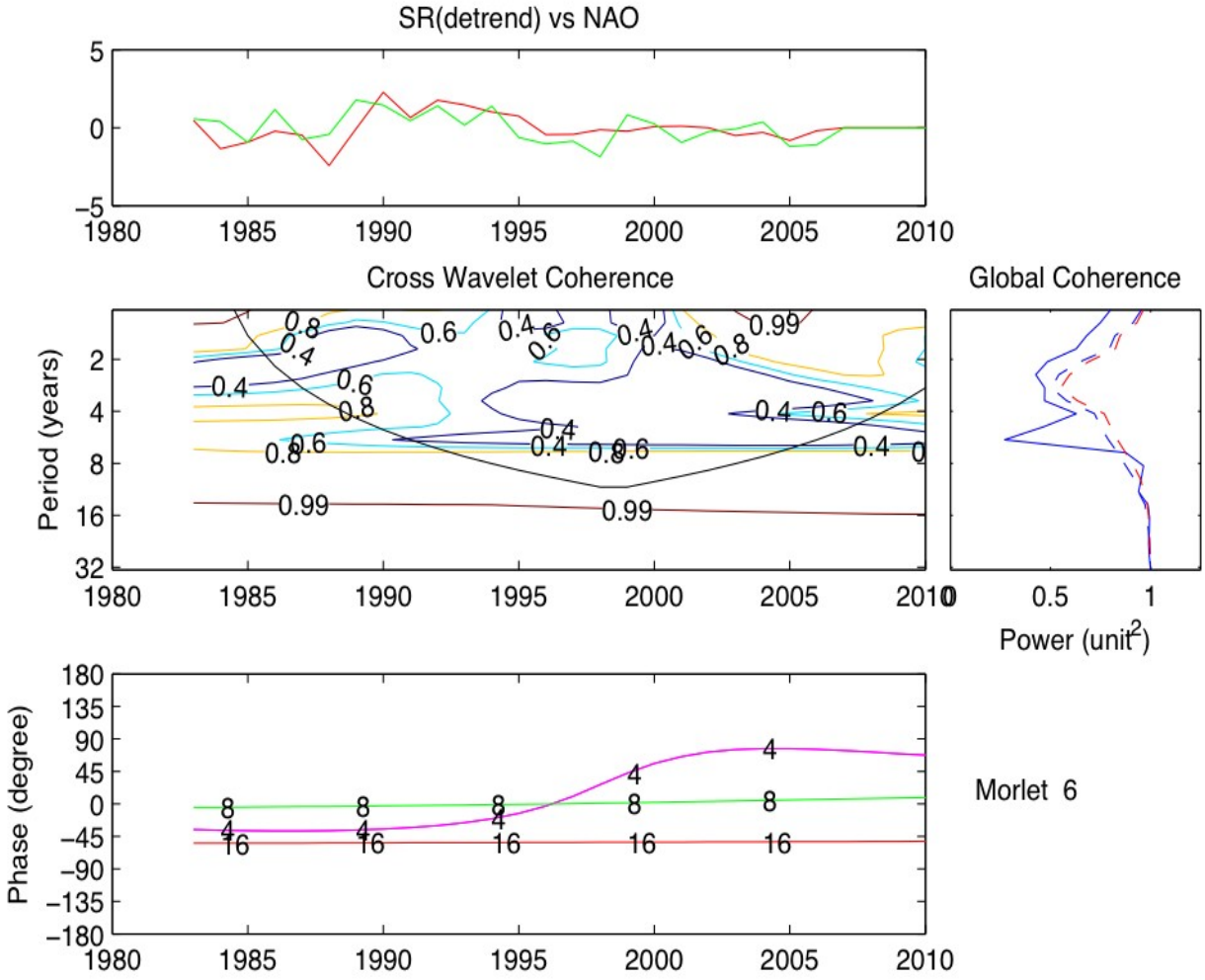


Figure 4. Cross-wavelet analysis between the VPA0/SSB index and the NAO (North American Oscillation) Index, with the spawner-recruit relationship de-trended prior to analysis.

Conclusions

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.

I have not included a long list of references. Those interested in further information on wavelet analysis are directed towards the references contained in Soniat et al. (2006) [Soniat, T.M., J.M. Klinck, E.N. Powell and E.E. Hofmann. 2006. Understanding the success and failure of oyster populations: Climatic cycles and *Perkinsus marinus. J. Shellfish Res.* 25:83-93]. A recent review of the NAO/AO that provides access to this literature is Cohen and Barlow (2005) [Cohen, J. and M. Barlow. 2005. The NAO, the AO, and global warming: how closely related? *J. Climate* 18:2298-4513].

APPENDIX 7

SAW 47 Working Paper 13 (TOR 7) – GARM Reference Point Paper

Draft Working Paper for Pre-Dissemination Peer Review Only.
Working Paper 1.1 April 22, 2008

Specifying Initial Conditions for Forecasting When Retrospective Pattern Present

by
Chris Legault and Mark Terceiro

A Working Paper in Support of GARM Reference Points Meeting Term of Reference 1

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GARM 2008 Reference Points Meeting
Woods Hole, MA
28 April – 2 May

Summary

There is currently no generally agreed methodological approach to adjusting projections to account for retrospective patterns in the stock assessment. This paper presents three alternative approaches and compares the resulting time series of spawning stock biomass, landings, and fishing mortality rate based on a summer flounder-like stock assessment. The three adjustments for retrospective patterns all reduce landings in the quota setting year, but the magnitude of the reduction is quite variable and the implications for future years in the projections are quite different. Adjusting the fishing mortality rate in the quota setting year is not recommended in the context of rebuilding programs because the future catches are greater than the unadjusted projections. Adjusting all ages in the starting population creates the largest decrease in projected catch, but typically cannot be justified based on the patterns observed at age. Making adjustments to the starting population based on the age specific retrospective patterns produces the most consistent approach, although the overall impact is relatively minor. A number of technical questions remain regarding exactly how to compute the retrospective adjustments at age. Management strategy evaluation work is required in the future to determine if any adjustment method performs better than the others.

Introduction

Term of Reference 1 for the GARM 2008 Biological Reference Points meeting is for relevant stocks, determine the influence of retrospective patterns in parameter estimates (e.g., fishing mortality, biomass, and/or recruitment) from assessment models on the computation of BRPs and on specification of initial conditions for forecasting.

This paper addresses only the latter aspect of this TOR, methods for adjusting initial conditions for forecasting when the stock assessment exhibits a retrospective pattern.

There is currently no generally agreed methodological approach to adjusting projections to account for retrospective patterns in the stock assessment. Two types of approaches that have been tried are: 1) adjust the TAC by the amount of retrospective seen in the SSB and 2) adjust the initial population to account for the retrospective pattern. The first approach can also be constructed by adjusting the fishing mortality rate in the quota year to account for the retrospective pattern observed in F. These two approaches will produce similar changes in the quota for next year, but have widely different implications for rebuilding strategies. This is because the first approach does not adjust the population, so the reduction in quota will actually allow the population to grow more and allow more fishing during the rest of the rebuilding period. In contrast, the second approach has a compounding effect, forcing a reduction in F during the rebuilding because the initial population abundance is further away from the target than the unadjusted population. The second approach is consistent in how the retrospective adjustment impacts the projections and is favored over the first approach.

There remain a number of technical issues for how to make the adjustment to the initial population abundance. All ages in the initial population could be scaled according to some average retrospective change, or else age-specific retrospective adjustments could be applied. The calculation of the average retrospective change can also be done numerous ways, as an average of the one-year update from the last five years or as the average change from the original to the most recent assessment result from the last five years, for example. Even more complex derivations can be made to fill in how much change is expected to occur based on regression of previous changes. There was insufficient time to address these issues through management strategy evaluations (MSE), the tool needed. Instead, a number of examples are provided to demonstrate the magnitude of effect that can occur when retrospective adjustments are made.

Methods

A stock assessment similar to the summer flounder 2007 assessment was used as the basis for all comparisons. This assessment demonstrated a strong retrospective pattern with F adjusted higher and SSB adjusted lower with additional years of data (Figure 1). The SSB target for rebuilding was determined to be 89,411 metric tons. A catch of 7,762 metric tons was assumed to be caught in 2007, the quota for that year. An iterative search found the constant F needed to rebuild the stock to the SSB target in year 2012 with 50% probability when no adjustments were made to the initial population to account for the retrospective pattern (Frebuild).

Retrospective adjustments were made in three different ways:

1. The F in 2008 was adjusted from Frebuild
2. The initial population abundance at age in 2007 was reduced over all ages at the same rate

3. The initial population abundance at age in 2007 was reduced by age-specific rates

The F adjustment was made based on the average of the last 5 years single year update retrospective, meaning a 28% reduction in F2008. When the initial population abundance at age in 2007 was reduced over all ages at the same rate, the same reduction as case 1 was applied, meaning the numbers at age at the start of 2007 were all reduced by 28%. This was selected as a compromise between the lower one year adjustments to SSB and the higher full year adjustments to SSB, and to allow more direct comparison between cases 1 and 2. The third case adjusted all ages based on the age specific one year adjustments averaged over the last five years, which resulted in both increases and decreases to the initial population abundance in 2007 (Table 1).

Results

Time series of spawning stock biomass (thousand metric tons), landings (thousand metric tons), and fully selected fishing mortality rate are presented in both Table 2 and Figure 2. The landings in 2007 are assumed constant for all four runs. The median spawning stock biomass in 2012 was the target and the fishing mortality rates were solved to an extreme number of digits to ensure complete consistency with the SSBmsy target in 2012. The Base and adj F cases have the same starting population and thus the same F in 2007, while the two adj N cases have lower starting populations which require higher F in 2007 to achieve the landings. The three retrospective adjustment approaches all reduce landings in 2008 relative to the Base case. However, the adj F case then allows landings to increase above the Base case for the remaining years because the stock has been fished lighter in 2008. This increase in landings for years 2009-2012, causing the adj F case to have the highest total landings over all years. The two adj N cases both have lower catches for years 2008-2012 relative to the Base case due to starting at a lower initial stock abundance. However, the adj N by age case has nearly the same level of landings in years 2009-2012 as the Base case (less than 5% difference). This similarity is due to the large changes in retrospective adjustment occurring for the oldest ages, which wash out of the projections relatively quickly. In contrast, the adj N all ages case reduces all cohorts significantly, requiring a greater number of years to remove their impact in the projections.

Discussion

In most of the groundfish assessments examined to date, the retrospective patterns are most pronounced for the oldest ages and least pronounced for the youngest ages. This means that adjusting all ages with the same factor is not warranted. Making the age-specific adjustments will cause the short-term catch to decrease, but the effect will not last long in most cases.

There are many other ways that the retrospective adjustments could be formed. For example, the full adjustment relating the shorter time series to the full time series could be used. Other approaches could be used to estimate the corrections for incomplete cohorts and then create the average retrospective adjustment on similar time periods. However, none of the approaches have been tested using management strategy evaluations.

One question that inevitably arises when dealing with retrospective patterns is “What happens if the retrospective pattern goes away or changes direction?” In these cases, adjusting for the retrospective pattern will be worse than not adjusting. However, while changes in direction of retrospective patterns have been observed in some stocks, they are the exception.

Table 1. Average of the most recent 5 years of single year adjustments in retrospective pattern observed by age.

Age	Retro Change
0	4.8%
1	4.8%
2	4.2%
3	-0.4%
4	-6.0%
5	3.2%
6	-65.5%
7	-26.8%

Table 2. Comparison of median spawning stock biomass, landings, and fishing mortality rate time series for the unadjusted (Base) and three alternative approaches to adjusting for retrospective patterns: F, N all ages, and N by age.

Spawning Stock Biomass (thousand metric tons)

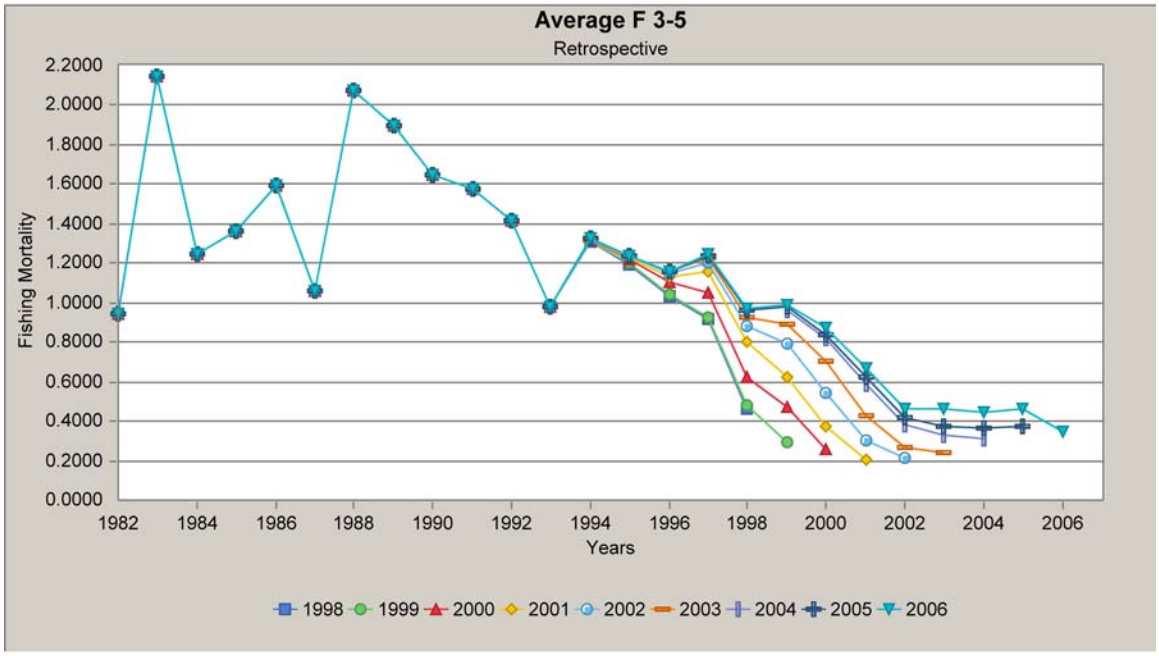
Year	Base	adj F	adj N all ages	adj N by age
2007	51.719	51.719	35.068	47.005
2008	61.535	63.644	44.193	58.433
2009	70.123	72.113	56.044	68.188
2010	78.314	79.666	68.438	77.169
2011	83.796	84.457	78.846	83.219
2012	89.411	89.411	89.411	89.411

Landings (thousand metric tons)

Year	Base	adj F	adj N all ages	adj N by age
2007	7.762	7.762	7.762	7.762
2008	7.936	5.851	3.831	7.108
2009	9.583	10.312	4.976	9.048
2010	10.882	11.643	6.303	10.644
2011	12.366	12.957	7.849	12.145
2012	13.155	13.644	9.069	13.013

Fishing Mortality Rate

Year	Base	Base adj F	adj N all ages	adj N by age
2007	0.227	0.227	0.330	0.255
2008	0.198645	0.1430244	0.14069	0.197615
2009	0.198645	0.205265	0.14069	0.197615
2010	0.198645	0.205265	0.14069	0.197615
2011	0.198645	0.205265	0.14069	0.197615
2012	0.198645	0.205265	0.14069	0.197615



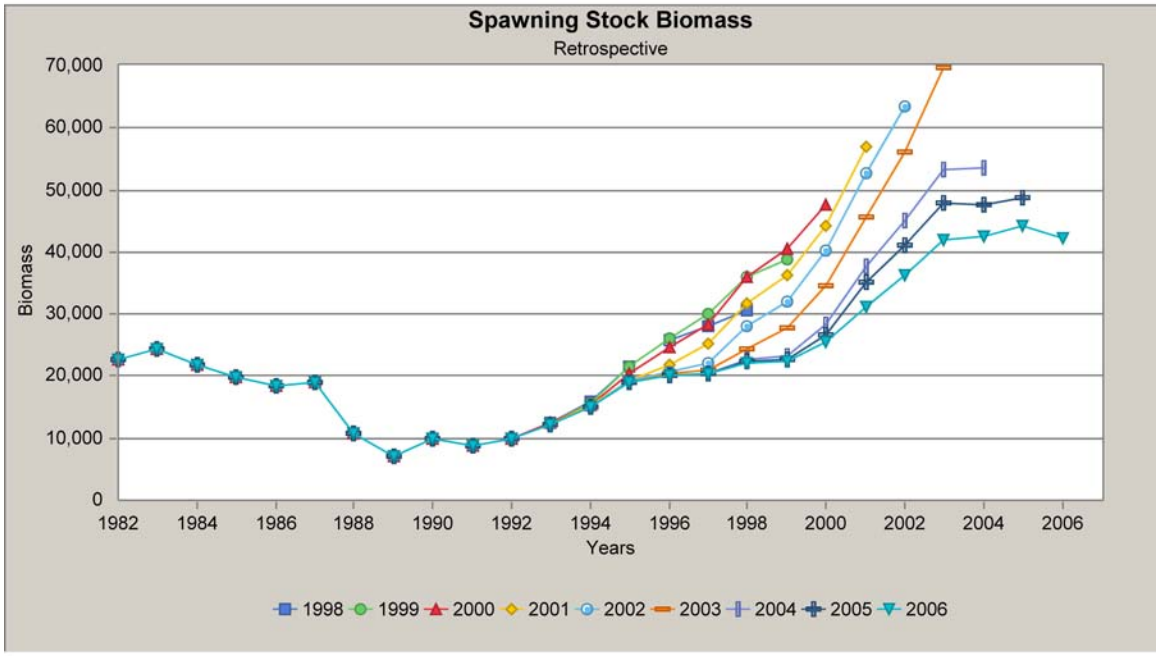
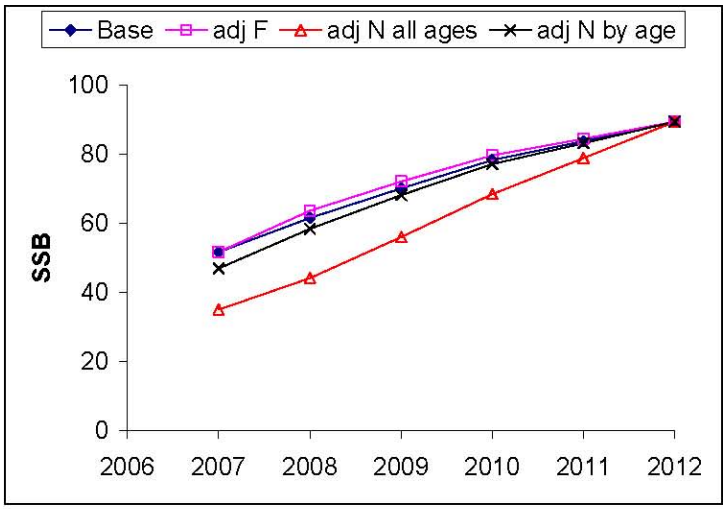
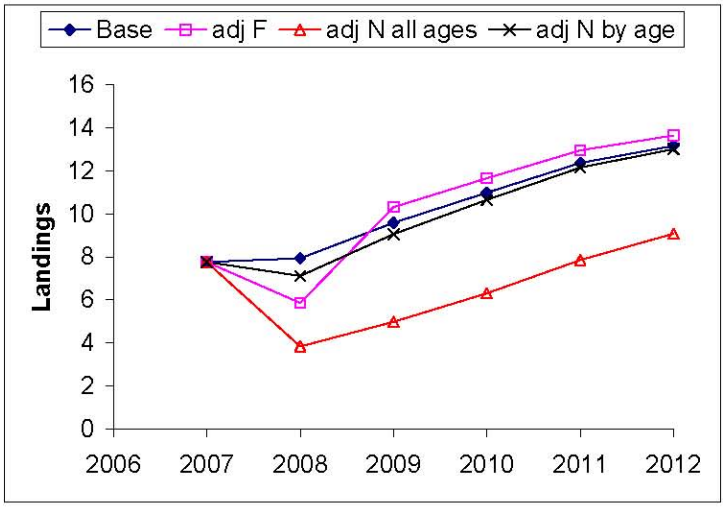


Figure 1. Retrospective patterns in average fishing mortality rate and spawning stock biomass for the example stock assessment.





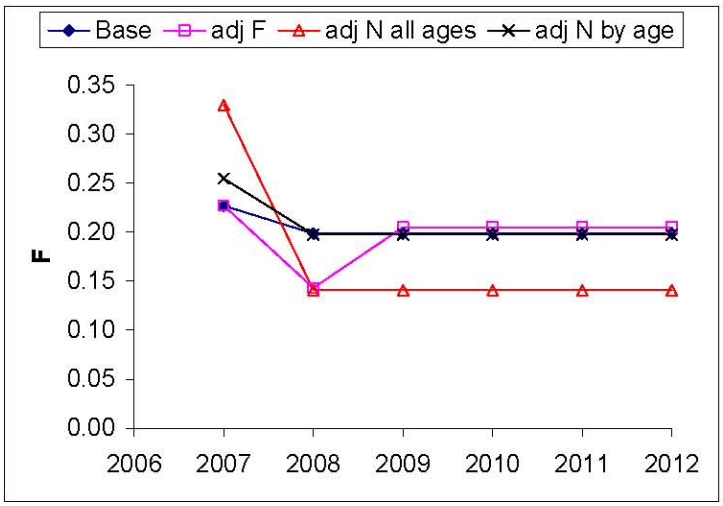


Figure 2. Comparison of median spawning stock biomass, landings, and fishing mortality rate time series for the unadjusted (Base) and three alternative approaches to adjusting for retrospective patterns: F, N all ages, and N by age.

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