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Stock Assessment of Summer Flounder for 2006

by Mark Terceiro

August 2006

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SUMMARY

This assessment of the summer flounder (*Paralichthys dentatus*) stock along the Atlantic coast (Maine to North Carolina) is an update through 2005/2006 of commercial and recreational fishery catch data, research survey indices of abundance, and the analyses of the data. For 2005, commercial and recreational fishery final quotas were 8,246 mt and 5,434 mt, respectively, for a total of 13,553 mt. The reported commercial landings used in this assessment for 2005 were 7,765 mt, while estimated recreational landings were 4,550 mt, for a 2005 landings total of 12,315 mt. An analytical assessment (virtual population analysis, VPA) of commercial and recreational total catch at age (landings plus discards) was conducted. Indices of recruitment and stock abundance were developed from Northeast Fisheries Science Center winter, spring and autumn, Massachusetts spring and autumn, Rhode Island annual, Connecticut spring and autumn, New Jersey annual, and Delaware annual trawl survey data. Recruitment indices were also developed from young-of-year surveys conducted by the states of North Carolina, Virginia, and Maryland.

The stock assessment indicates the summer flounder stock is not overfished, but overfishing is occurring relative to the biological reference points. The fishing mortality rate declined from 1.32 in 1994 to 0.46 during 2003-2004, before increasing to 0.53 in 2005, well above the overfishing definition reference point ($F_{threshold} = F_{target} = F_{max} = 0.276$). There is an 80% chance that the 2005 F was between 0.42 and 0.75. The estimate of F for 2005 may understate the actual fishing mortality; retrospective analysis shows that the current assessment method tends to underestimate recent fishing mortality rates. Over the last 5 years, the annual retrospective increase in fishing mortality has averaged 33%. Total stock biomass increased substantially during the 1990s and through 2004, but has decreased slightly since 2004 and was estimated to be 47,800 mt on January 1, 2006 -- just above the biomass threshold (46,323 mt). There is an 80% chance that total stock biomass in 2006 was between 41,600 and 56,900 mt. Spawning stock biomass (SSB; Age 0+) declined 72% from 1983 to 1989 (18,800 mt to 5,200 mt), but with improved recruitment and decreased fishing mortality had increased to 32,600 mt by 2004, before decreasing to 30,600 mt in 2005. Retrospective analysis shows a tendency to overestimate the SSB in the most recent years. Over the last 5 years, the annual retrospective decrease in SSB has averaged 17%. The age structure of the spawning stock has expanded, with 74% at ages 2 and older, and 23% at ages 5 and older. Under equilibrium conditions at F_{max}, about 85% of the spawning stock biomass would be expected to be ages 2 and older, with 50% at ages 5 and older. The arithmetic average recruitment from 1982 to 2005 is 35 million fish at age 0, with a median of 33 million fish. The 2005 year class is currently estimated to be well below the median recruitment level. Retrospective analysis shows that the current assessment method tends to overestimate the abundance of age 0 fish in the most recent years. Over the last 5 years, the annual retrospective decrease in recruitment has averaged 10%.

Stochastic forecasts only incorporate uncertainty in 2006 stock sizes due to survey variability and assume current discard to landings proportions. If landings in 2006 are 10,700 mt (23.6 million lbs) and discards are 800 mt (1.8 million lbs), the forecast estimates a median (50% probability) F in 2006 = 0.35 and a median total stock biomass on January 1, 2007 of 51,200 mt, above the biomass threshold of ½ B_{MSY} = 46,323 mt. A subsequent reduction in fishing mortality in 2007 to F = 0.276 is forecast to yield landings of 9,026 mt (19.899 million lbs) and a median total stock biomass level on January 1, 2008 of 58,100 mt.

INTRODUCTION

The Stock Assessment Workshop (SAW) Southern Demersal Working Group (SDWG) met on June 20, 2006 to update the assessment of summer flounder through 2005/2006. The following scientists and managers participated in the meeting:

Eleanor Bochenek	Rutgers University
Paul Caruso	Massachusetts Division of Marine Fisheries (MADMF)
Jessica Coakley	Mid-Atlantic Fishery Management Council (MAFMC)
Toni Kerns	Atlantic States Marine Fisheries Commission (ASMFC)
Chris Legault	National Marine Fisheries Service Northeast Fisheries Science Center (NMFS NEFSC)
Sarah McLaughlin	National Marine Fisheries Service Northeast Regional Office (NMFS NERO)
Brian Murphy	Rhode Island Department of Environmental Management, Division of Fish and Wildlife (RIDFW)
Paul Nitschke	NMFS NEFSC
Bill Overholtz	NMFS NEFSC
Kathy Sosebee	NMFS NEFSC
Mark Terceiro	NMFS NEFSC
Richard Wong	Delaware Department of Fish and Wildlife (DEDFW)

Although they were unable to attend the meeting, Laura Lee of the RIDFW, David Simpson of the Connecticut Department of Environmental Protection (CTDEP), Anne Mooney of the New York Department of Environmental Conservation (NYDEC), Don Byrne and Jeff Brust of the New Jersey Department of Fish and Wildlife (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 Virginia Marine Resources Commission (VMRC), and Chris Batsavage of the North Carolina Division of Marine Fisheries (NCDMF) provided research survey and/or fisheries catch data that were used in the assessment.

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 joint Mid-Atlantic Fishery Management Council (MAFMC) Atlantic States Marine Fisheries Commission (ASMFC) Fishery Management Plan (FMP) for summer flounder has as a management unit all summer flounder from the southern border of North Carolina, northeast 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. A 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.

The most recent benchmark stock assessment was completed in 2002 (SARC 35; NEFSC 2002) and found that 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 definition reference point ($F_{threshold} = F_{target} = F_{max} = 0.26$). Total stock biomass in 2001 was estimated to be 42,900 mt, 19% below the biomass threshold (53,200 mt). In the review of the 2002 stock assessment, SARC 35 had 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 2003), 2004 (SDWG 2004), and 2005 (SAW 41; NEFSC 2005). While the 2003 assessment found the stock not overfished and no overfishing occurring, the 2004 and 2005 assessments found the stock again experiencing overfishing. The 2005 SAW 41 assessment also provided updated values for the fishing mortality and stock biomass reference points. This 2006 assessment updates uses the same data compilation methods and analytical configurations as the 2005 SAW 41 assessment (NEFSC 2005).

FISHERY DATA

COMMERCIAL FISHERY LANDINGS

Total U.S. commercial landings of summer flounder from Maine to North Carolina peaked in 1979 at nearly 18,000 mt (40 million lbs, Table 1). The reported landings in 2005 of 7,765 mt (about 17.1 million lbs) were about 6% under the final 2005 quota of 8,246 mt (18.2 million lbs). Since 1980, 70% of the commercial landings of summer flounder have come from the Exclusive Economic Zone (EEZ; greater than 3 miles from shore). The percentage of landings attributable to the EEZ was lowest in 1983 and 1990 at 63% and was highest in 1989 at 77%. 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 1994-2002, dealer landings were allocated to statistical area using fishing Vessel Trip Reports (VTR data) according to the general procedures developed by Wigley *et al.* (1997), in which a matched set of dealer and VTR data is used as a sample to characterize the statistical area distribution of monthly state landings. A comparison of the distribution of landings by state and month as indicated by the dealer, VTR, and matched set data for 2003-2005 is presented in Tables 2-4 (see Terceiro 2003 for years prior to 2003). Since the implementation of the annual commercial landings quota in 1993, the commercial landings have become concentrated during the first calendar quarter of the year, with 52% of the landings taken during the first quarter in 2005 (Table 4).

The distribution of Northeast Region (ME to VA) 1992-2005 landings by three-digit statistical area is presented in Table 5. 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 6. 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 30-60 mt per 100 lengths, and temporal and geographic coverage has generally improved as well (e.g., for 2003-2005 in Tables 7-9).

The age composition of the NER commercial landings for 1982-1999 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 2003-2005, 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 2003-2005 length frequency samples by market category, 1- and 2-digit statistical area (division), and calendar quarter is presented in Tables 7-9 (see Terceiro 2003 for years prior to 2003). 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, 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 in the NER landings has increased since 1996, while the proportion of small market category landings has become very low. 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 2000-2005, typical of an age 3 summer flounder (Tables 10-11).

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 (2003-2005) at a mean rate of 10 mt of landings per 100 lengths measured (Table 12). 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 (1988-2005) 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 and mean weights at age from this fishery are shown in Tables 13-14.

COMMERCIAL FISHERY DISCARDS

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 days fished metric correlates 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 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 2002-2005, 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 1994-2005 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. Discard rates of summer flounder in the scallop dredge fishery were much higher than in the trawl fishery (Tables 15-16).

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 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 1994-2005.

Two adjustments were made to the dealer/VTR matched data subset days fished estimates to fully account for summer flounder fishery effort during 1994-2005. 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.

Discard estimates for 1989-2005 are summarized in Table 17. 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 (Table 18), with discards ranging from 41% (1990) to 6% (1995) of the reported landings. 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 are of the same order of magnitude as in the trawl fishery.

These discard estimates were based only on the days 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.

Existing fishery observer data were used to develop estimates of commercial fishery discard for 1989-2005. 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 is recognized that not accounting directly for commercial fishery discards in 1982-1988 likely results 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 1994-2005, 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 is summarized in Table

17. Estimates of discarded numbers at age, mean length and mean weight at age are summarized in Tables 19-21.

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. 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 19).

RECREATIONAL FISHERY LANDINGS

Landings statistics for the summer flounder recreational fishery (catch type A+B1) are estimated by the National Marine Fisheries Service (NMFS) Marine Recreational Fishery Statistics Survey (MRFSS; Tables 22-23). Recreational fishery landings decreased 13% by number and 6% by weight from 2004 to 2005, as the fishery landed 84% (4,550 mt, 10.0 million lbs) of the 5,434 mt (11.98 million lbs) harvest limit established for 2005. The Proportional Standard Error (PSE) of MRFSS landings estimates by number and weight averaged 6% over the 1982-2005 period, ranging from 26% in 1982 to 3% in 1996 and 2000 (Tables 22-23).

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 2.30 for the 1995-2005 period, ranging from a factor of 1.02 in 1998 to 4.35 in 2005 (Table 24). It is not clear 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) on a metric tons of landings per hundred lengths measured basis (Burns *et al. In* Doubleday and Rivard, 1983). For 2005, aggregate sampling intensity averaged 162 mt of landings per 100 fish measured (Table 25).

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.

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 15.5 [38 cm] to 17.5 in [44 cm] in 2001-2005) and a trend to lower fishing mortality rates, the age composition of the recreational landings now includes mainly fish at ages 2 and 3. The number of summer flounder of ages 4 and older landed by the recreational fishery in 2005 (28% of the landings by number) was the highest in the time series (Table 26). 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.

RECREATIONAL FISHERY DISCARDS

The MRFSS estimates of live discard (catch type B2) to total catch (catch types A+B1+B2) in the recreational fishery for summer flounder has varied from about 18% (1985) to about 85% (2005; Table 27). The Proportional Standard Error (PSE) of MRFSS live discards estimates by number averaged 8% over the 1982-2005 period, ranging from 59% in 1982 to 3% in 2001 and 2002 (Table 27).

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 needed 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 2001). 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 sizes by state has continued since 2001. For 2002-2005, increased samples of the recreational fishery discards by the CT VAS, NYDEC PBS, and, for 2005, the MRFSS For Hire Survey (FHS), has allowed direct characterization the length frequencies of the discards from sample data (Table 28).

Studies conducted to estimate hooking mortality for striped bass and black sea bass indicated 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, three subsequent investigations of summer flounder recreational fishery release mortality suggested that a lower release mortality rate was 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. Gearhart (1999) used field cages to hold summer flounder angled in North Carolina for 72 hours after acapture, and found a short-term mortality rate of 7%. 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 (Table 29). In 2005, the number of fish discarded and assumed dead in the recreational fishery (2.2 million fish, 899 mt) was 57% by number and 20% by weight of the total landed (3.8 million fish, 4,550 mt) in the recreational fishery. The total catch and mean weight at age for the recreational fishery are provided in Tables 30-31.

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 1982-2005 (Table 32). 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 over 40% in 2002 and later years. 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 33-34). The respective components of the total summer flounder catch in weight are summarized in Table 35.

RESEARCH SURVEY INDICES

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 in 2003 (2.42 kg/tow; a new historical high), about 20% above the previous peak value in 1976 of 2.00 kg/tow (Table 36, Figure 1). Since 2003, the spring biomass index has declined by about 45%. Age composition data from the NEFSC spring surveys indicate a substantial reduction in the number of ages in the stock between 1976-1990 (Table 37). Between 1976-1981, fish of ages 5-8 were captured regularly in the survey, with the oldest individuals aged 8-10 years. Between 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 (Figure 2). Mean lengths at age in the NEFSC spring survey are presented in Table 38.

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 level as in the spring survey (Table 36, Figure 1). Furthermore, the autumn survey catches age-0 summer flounder in abundance, providing an index of summer flounder recruitment (Table 39, Figure 3). Autumn survey indices suggest improved recruitment since the late 1980s, and an increase in abundance of age-2 and older fish since 1995. Mean lengths at age in the NEFSC autumn survey are presented in Table 40.

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 target flatfish when they are concentrated offshore during the winter. A modified 36 Yankee trawl is used that differs from the standard trawl employed during the spring and autumn surveys in that long trawl sweeps (wires) are added before the trawl doors to better herd fish to the mouth of the net, and the large rollers used on the standard gear are 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) has resulted in greater catchability of summer flounder compared to the other surveys. Most fish area captured in survey strata 61-76 (27-110 meters; 15-60 fathoms) off the Delmarva and North Carolina coasts . Other concentrations of fish are found in strata 1-12, south of the New York and Rhode Island coasts, in slightly deeper waters. Significant numbers of large summer flounder are 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 (Table 36). 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. Since 1998, the Winter trawl survey indices have increased, with the Winter 2003 survey number and weight per tow indices the highest in the time series. Since 2003, the Winter survey abundance and biomass indices have declined by about 40%. As with the other two 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 41. Figure 1). Mean lengths at age in the NEFSC winter survey are presented in Table 42.

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 (MADMF fall survey), and 1991 (MADMF spring survey). 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 43-44, Figure 4). The spring index peaked in 2000, and has since declined by about 40%. The fall survey index, in contrast, has continued to increase and reached an historical peak in 2005. 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 45, Figure 5).

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 in 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 2002 spring and autumn indices were the highest in the respective time series, and both series have since declined by over 60% (Tables 46-47 Figure 6). An index of recruitment from the autumn series is available (Table 47, Figure 3).

RHODE ISLAND DFW

Standardized bottom trawl surveys have been conducted since 1979 during the spring and autumn 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, and has since declined by 40% (Table 48, Figure 4). An abundance index has also been developed from a set of fixed stations sampled monthly during 1990-2005. Indices of abundance at age from this series indicate that strong year classes recruited to the stock in 1996, 1999, 2000, and 2002, with age 2+ abundance peaking in 2003, and declining by about 35% since then (Table 49). Recruitment indices are available from both the autumn (Figure 5) 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. 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. Indices of the 1996-2001 year classes are below average, while the 2002 year class is average. The NJBMF survey indices reached a peak in 2002, and have declined by about 35% since then (Table 50, Figure 7). Age 0 recruitment indices are available from the NJBMF survey (Figure 3).

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 1988 and 1993, improved recruitment in 1994-1995, above average recruitment in 2000 and 2004, and poor recruitment in 2005 (Tables 51, Figure 5). 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 index from the 30 foot survey was near the time series peak in 2001, and has declined over 80% since then (Table 52, Figure 7).

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 1972-2002. This index suggests that weakest year class in the time series recruited to the stock in 1988, and the strongest in 1972, 1983, 1986, and 1994, and 2001. The 2005 index was the lowest since 1988 (Table 53, Figure 8).

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 1999, with strong year classes recruiting during 1980-1984, and 1990. Recruitment indices since 1990 have been below average, and the 2005 index was the lowest since 1975 (Table 54, Figure 8).

NORTH CAROLINA DMF

The 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, 2001, and 2002 (Table 55, Figure 8). 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 (NEFSC 2000) and subsequent assessments.

ESTIMATES OF MORTALITY AND STOCK SIZE

VIRTUAL POPULATION ANALYSIS

Fishing mortality rates in 2005 and stock sizes in 2006 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) version 2.51 VPA. As recommended by the MAFMC S&S 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. Alternative estimates of M were considered in the SAW 20 assessment (NEFSC 1996). In the SAW 20 work, estimates were derived with the methods described by: 1) Pauly (1980) using growth parameters derived from NCDMF 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 1996) 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. Maturities at age for all years were 38% for age-0, 72% for age-1, 90% for age-2, and 100% for ages 3 and older. Stock sizes in 2006 were directly estimated for ages 1-6, while the age 7+ group was calculated from Fs estimated in 2005. 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 unweighted.

The final VPA run (run F06_1) included the same set of indices (n=41) in terms of source and age range as used in the 2002-2005 assessments (NEFSC 2002, Terceiro 2003, SDWG 2004, NEFSC 2005). In addition to a run including all available indices (F06_ALL) and the run chosen as final (F06_1), the results from two other runs were also considered. The NEFSC survey indices generally had the lowest partial variances within the VPA, but sometimes indicated patterns in stock size dissimilar to those in the state surveys. Therefore runs were also examined that contrasted the VPA solutions provided by NEFSC (F06_NEFSC) versus state survey (F06_STATE) series. The sensitivity of the summer flounder VPA estimates of F and SSB is illustrated in Figure 9. The output for the final 2006 assessment VPA (run F06_1) is presented in Table 56.

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 about 0.20 during 2000-2002 and less than 0.20 during 2003-2005. The partial recruitment of age-2 fish has decreased from 1.00 in 1993 to about 0.80 during 2000-2002 and to about 0.70 during 2003-2005. 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) was very high, varying between 0.9 and 2.2 during 1982-1997 (55%-83% exploitation), far in excess of the revised FMP Amendment 12 (MAFMC 1999) overfishing definition, $F_{threshold} = F_{target} = F_{max} = 0.276$. The fishing mortality rate has declined since 1997 and was estimated to be 0.46 during 2003-2004, rising to 0.53 (37% exploitation) in 2005 (Figure 10). The estimate of F for 2005 may understate the actual fishing mortality; retrospective analysis shows that the current assessment method tends to underestimate recent fishing mortality rates, continuing the pattern observed in the last six assessments (NEFSC 2000, MAFMC 2001, NEFSC 2002, Terceiro 2003, SDWG 2004, NEFSC 2005). Over the last 5 years, the annual retrospective increase in fishing mortality has averaged 33% (Figure 11).

Total stock biomass increased substantially during the 1990s and through 2004, but has decreased slightly since 2004 and was estimated to be 47,800 mt on January 1, 2006, just above the biomass threshold (46,323 mt; Figures 12 & 14). Spawning stock biomass (SSB; Age 0+) declined 72% from 1983 to 1989 (18,800 mt to 5,200 mt), but with improved recruitment and decreased fishing mortality had increased to 32,600 mt by 2004, before decreasing to 30,600 mt in 2005 (Figures 12-13). Retrospective analysis shows a tendency to overestimate the SSB in the most recent years, continuing the pattern observed in the last six assessments (NEFSC 2000, MAFMC 2001, NEFSC 2002, Terceiro 2003, SDWG 2004, NEFSC 2005). Over the last 5 years, the annual retrospective decrease in SSB has averaged 17% (Figure 11). The age structure of the spawning stock has expanded, with 74% at ages 2 and older, and 23% at ages 5 and older. Under equilibrium conditions at F_{max}, about 85% of the spawning stock biomass would be expected to be ages 2 and older, with 50% at ages 5 and older (Figure 15).

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. This assessment indicates that the 1982 and 1983 year classes were the largest of the VPA series, at 74 and 80 million fish, respectively. The 1988 year class was the smallest of the series, at only 13 million fish. The arithmetic average recruitment from 1982 to 2005 is 35 million fish at age 0, with a median of 33 million fish. The 2005 year class is estimated to be the smallest since 1988, at about 15 million fish (Table 56, Figures 12-13). Retrospective analysis shows that the current assessment method tends to overestimate the abundance of age 0 fish in the most recent years. Over the last 5 years, the annual retrospective decrease in recruitment has averaged 10% (Figure 11).

The precision and bias of the 2005 fishing mortality rates, 1 January 2006 stock sizes, and stock biomass estimates are presented in Table 57. Bias was less than 10% for all parameters estimated. The bootstrap estimate of the 2006 total stock biomass was relatively precise, with a corrected CV of 10%. The bootstrap mean (48,616 mt) was slightly higher than the VPA point estimate (47,789 mt). There is an 80% chance that total stock biomass in 2006 was between 41,600 and 56,900 mt. The bootstrap mean F for 2005 (0. 5611) was slightly higher (6%) than the point estimate from the VPA (0.5279). There is a 80% chance that F in 2005 was between about 0.42 and 0.75, given variability in survey observations.

BIOLOGICAL REFERENCE POINTS

The calculation of biological reference points based on yield per recruit for summer flounder using the Thompson and Bell (1934) model was detailed in the 1990 SAW 11 assessment (NEFC 1990). The 1990 analysis estimated F_{max} = 0.23. In the 1997 SAW 25 assessment (NEFSC 1997b), 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 Fmax = 0.263.

The Overfishing Definition Review Panel (Applegate *et al.* 1998) recommended that the MAFMC base MSY proxy reference points on yield per recruit analysis, and this recommendation was adopted in formulating the FMP Amendment 12 reference points (see Introduction), based on the 1999 assessment (Terceiro 1999). The 1999 assessment yield per recruit analysis indicated that $F_{threshold} = F_{target} = F_{max}$ = 0.263, yield per recruit (YPR) at F_{max} was 0.55219 kg/recruit, and January 1 biomass per recruit (BPR) at Fmax was 2.8127 kg/recruit. The median number of summer flounder recruits estimated from the 1999 VPA for the 1982-1998 period was 37.844 million fish. Based on this recruitment, maximum sustainable yield (MSY) was estimated to be 20,897 mt (46 million lbs) at a biomass (B_{MSY}) of 106,444 mt (235 million lbs). The biomass threshold, 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 and 2001 stock assessments (NEFSC 2000, MAFMC 2001) because of the stability of the input data. In the review of the 2002 stock assessment, SARC 35 concluded that updating the reference points was not warranted (NEFSC 2002).

The biological reference points for summer flounder were reviewed and updated for the 2005 SAW 41 assessment (NEFSC 2005). The yield per recruit analysis conducted for the 2005 assessment indicated that F_{max} = 0.276, which was used as a proxy for F_{target} and $F_{threshold}$ (Figure 14). Updated FMP Amendment 12 (MAFMC 1999) stock biomass reference points were estimated as the product of yield per recruit (0.576 kg per recruit) and total stock biomass per recruit (2.798 kg per recruit) at F_{max} = 0.276, and median recruitment of 33.111 million fish per year (1982-2004; from NEFSC (2005)). Yield at F_{max}, used as a proxy for MSY, was estimated to be 19,072 mt (42.0 million lbs), and the corresponding stock biomass, used as a proxy for $B_{MSY,}$ was estimated to be 92,645 mt (204.2 million lbs; Figure 14). The biomass threshold of 0.5* B_{MSY} = 46,323 mt (102.1 million lbs).

PROJECTIONS

Stochastic projections were made to provide forecasts of stock size and catches in 2006-2007 consistent with target reference points established in the FMP. The projections assume that recent patterns of discarding will continue over the time span of the projections. Different patterns that could develop in the future due to additional trip and bag limits and fishery closures have not been evaluated. The partial recruitment pattern (including discards) used in the projections was estimated as the geometric mean of F at age for 2003-2005, reflecting recent conditions in the fisheries. Mean weights at age were estimated as the geometric means of 2003-2005 values. Separate mean weight at age vectors were developed for the January 1 biomass, landings, and discards.

One hundred projections were made for each of the 1000 bootstrapped realizations of 2006 stock sizes from the final VPA, using algorithms and software described by Brodziak and Rago (MS 1994) as implemented in the NFT AGEPRO version 3.20. Future recruitment at age 0 was generated randomly from a cumulative density function of the VPA recruitment series for 1982-2005 (median recruitment = 32.7 million fish).

If landings in 2006 are 10,700 mt (23.6 million lbs) and discards are 800 mt (1.8 million lbs), the forecast estimates a median (50% probability) F in 2006 = 0.35 and a median total stock biomass on January 1, 2007 of 51,200 mt, above the biomass threshold of ½ B_{MSY} = 46,323 mt. A subsequent reduction in fishing mortality in 2007 to F = 0.276 is forecast to yield landings of 9,026 mt (19.899 million lbs) and a median total stock biomass level on January 1, 2008 of 58,100 mt (Table 58).

CONCLUSIONS

ASSESSMENT RESULTS

The summer flounder stock is not overfished but overfishing is occurring relative to the biological reference points. The fishing mortality rate declined from 1.32 in 1994 to 0.46 during 2003-2004, before increasing to 0.53 in 2005, well above the overfishing definition reference point ($F_{threshold}$ = F_{target} = F_{max} = 0.276). There is an 80% chance that the 2005 F was between 0.42 and 0.75. The estimate of F for 2005 may understate the actual fishing mortality; retrospective analysis shows that the current assessment method tends to underestimate recent fishing mortality rates. Over the last 5 years, the annual retrospective increase in fishing mortality has averaged 33%.

Total stock biomass increased substantially during the 1990s and through 2004, but has decreased slightly since 2004 and was estimated to be 47,800 mt on January 1, 2006, just above the biomass threshold (46,323 mt). There is an 80% chance that total stock biomass in 2006 was between 41,600 and 56,900 mt. Spawning stock biomass (SSB; Age 0+) declined 72% from 1983 to 1989 (18,800 mt to 5,200 mt), but with improved recruitment and decreased fishing mortality had increased to 32,600 mt by 2004, before decreasing to 30,600 mt in 2005. Retrospective analysis shows a tendency to overestimate the SSB in the most recent years. Over the last 5 years, the annual retrospective decrease in SSB has averaged 17%. The age structure of the spawning stock has expanded, with 74% at ages 2 and older, and 23% at ages 5 and older. Under equilibrium conditions at F_{max}, about 85% of the spawning stock biomass would be expected to be ages 2 and older, with 50% at ages 5 and older. The arithmetic average recruitment from 1982 to 2005 is 35 million fish at age 0, with a median of 33 million fish. The 2005 year class is currently estimated to be well below the median recruitment level. Retrospective analysis shows that the current assessment method tends to overestimate the abundance of age 0 fish in the most recent years. Over the last 5 years, the annual retrospective decrease in recruitment has averaged 10%.

Stochastic forecasts only incorporate uncertainty in 2006 stock sizes due to survey variability and assume current discard to landings proportions. If landings in 2006 are 10,700 mt (23.6 million lbs) and discards are 800 mt (1.8 million lbs), the forecast estimates a median (50% probability) F in 2006 = 0.35 and a median total stock biomass on January 1, 2007 of 51,200 mt, above the biomass threshold of ½ B_{MSY} = 46,323 mt. A subsequent reduction in fishing mortality in 2007 to F = 0.276 is forecast to yield landings of 9,026 mt (19.899 million lbs) and a median total stock biomass level on January 1, 2008 of 58,100 mt. Given the persistent retrospective underestimation of fishing mortality in the assessment, managers should consider adopting a lower TAL for 2007 than indicated by the median projection results to reduce the risk that overfishing will occur.

SPECIAL COMMENTS

1. The landings from the commercial fisheries used in this assessment assume no under reporting of summer flounder landings. Therefore, reported landings from the commercial fisheries should be considered minimum 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 among the most precise produced by the MRFSS, they are subject to possible error and bias. A sensitivity analysis to examine to determine the impact of uncertainty in the recreational data on the assessment results revealed that the Proportional Standard Errors (PSEs) of MRFSS estimated landed numbers of fish (1982-2005 average = 6%) and discarded numbers of fish (1982-2005 average = 8%) are relatively small. Therefore, the impact of potential bias within the range of +/- 2 PSEs is also small. Changes in biomass estimates are directly proportional to the input changes in catch (e.g., increasing/decreasing total catch by 5% increases/decreases total biomass by 5%). Changes in fishing mortality are relatively smaller, because of restriction to fully recruited ages 3-5.
3. Given the persistent retrospective underestimation of fishing mortality in the assessment, managers should consider adopting a lower TAL for 2007 than indicated by the median projection results to reduce the risk that overfishing will occur. Managers should note that over the last 5 years, the annual retrospective increase in fishing mortality has averaged 33%, the annual retrospective decrease in SSB has averaged 17%, and the annual retrospective decrease in recruitment has averaged 10%.
4. The SAW 2006 Southern Demersal Working Group reviewed the in-progress and proposed research recommendations from the SAW41 assessment, and developed a prioritized list of research recommendations for future consideration. Research recommendations are grouped into high, medium, and low priority categories:

High

- Conduct further research to better determine the discard mortality rate of commercial fishery summer flounder discards.
- Continue ongoing age structure exchanges between the NEFSC and all interested state agencies and academic institutions.
- Complete the NEFSC comparison study between scales and otoliths as aging structures for summer flounder.
- Develop a long term protocol to sample otoliths from summer flounder caught in the recreational and commercial fisheries (e.g., purchase samples; as a component of Research Set-Aside projects; as Cooperative Research with industry).

- As an alternative to "production sampling" of ototliths, develop a long term protocol to correct summer flounder scale ages using a more limited sample of otolith ages.

Medium

- Conduct further research to better determine the discard mortality rate of recreational fishery summer flounder discards.
- 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.
- Evaluate trends in the regional components of the NEFSC surveys and contrast with the state surveys that potentially index components of the stock. 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.

Low

- Explore the sensitivity of the VPA results to separating the summer flounder stock into multiple components.
- Develop a program to annually sample the length and age frequency of summer flounder discards from all sectors of the recreational fishery. The NMFS For-Hire Survey (FHS) has been implemented for 2005 and subsequent years to collect data from the party/charter boat discards, but synoptic data for private boat and shore discards continue to be needed.

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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+	'000 lbs	Total 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+	'000 lb	Total 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	1179	2522	239	1567	2723	5	268	3764	4812	17018	7748
2005	0	0	1274	2930	440	1789	2536	2	298	3819	4028	17119	7765

* = less than 500 lb; na = not available;
Sources: 1980-2005 State and Federal reporting systems

Table 2. 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 3. 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	534.7	6.9	436.9	6.1	139.9	3.3
RI	1144.1	14.8	881.1	12.3	592.6	14.0
CT	108.6	1.4	155.7	2.2	53.0	1.3
NY	711.1	9.2	641.3	9.0	155.4	3.7
NJ	1235.3	15.9	1249.8	17.5	973.7	23.0
DE	2.3	0.0	0.0	0.0	0.0	0.0
MD	121.4	1.6	121.8	1.7	91.1	2.2
VA	1707.4	22.0	1642.4	22.9	1018.9	24.1
NC	2182.8	28.2	1957.1	27.3	1208.7	28.6
Unknown	0.0	0.0	71.5	1.0	0.0	0.0
Total	7747.9	100.0	7162.1	100.0	4233.2	100.0
Month	mt	%	mt	%	mt	%
Jan	1119.0	14.4	1067.2	14.9	696.4	16.5
Feb	1648.7	21.3	1637.0	22.9	898.2	21.2
Mar	925.6	11.9	916.4	12.8	569.3	13.4
Apr	307.4	4.0	319.7	4.5	163.9	3.9
May	289.5	3.7	228.7	3.2	123.4	2.9
Jun	340.3	4.4	267.3	3.7	153.0	3.6
Jul	298.3	3.9	232.4	3.2	141.8	3.4
Aug	284.5	3.7	216.6	3.0	100.5	2.4
Sep	423.0	5.5	369.2	5.2	241.1	5.7
Oct	343.2	4.4	357.6	5.0	199.0	4.7
Nov	892.7	11.5	801.3	11.2	510.5	12.1
Dec	875.8	11.3	748.8	10.5	436.1	10.3
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	7747.9	100.0	7162.1	100.0	4233.2	100.0

Table 4. 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	578.0	7.4	544.3	8.0	191.8	4.8
RI	1329.0	17.1	936.9	13.7	645.4	16.2
CT	199.6	2.6	162.6	2.4	121.3	3.1
NY	811.3	10.4	723.9	10.6	246.5	6.2
NJ	1150.3	14.8	1126.0	16.5	901.8	22.7
DE	1.0	0.0	0.0	0.0	0.0	0.0
MD	135.1	1.7	102.1	1.5	84.7	2.1
VA	1732.4	22.3	1543.3	22.6	875.2	22.0
NC	1826.9	23.5	1570.3	23.0	906.7	22.8
Unknown	0.0	0.0	112.5	1.6	0.0	0.0
Total	7765.1	100.0	6824.4	100.0	3973.7	100.0

Month	mt	%	mt	%	mt	%
Jan	1331.9	17.2	1349.9	19.8	723.8	18.2
Feb	1544.3	19.9	1471.6	21.6	785.2	19.8
Mar	1123.7	14.5	972.9	14.3	523.1	13.2
Apr	574.0	7.4	536.5	7.9	365.4	9.2
May	316.5	4.1	252.2	3.7	153.2	3.9
Jun	328.0	4.2	242.0	3.5	154.4	3.9
Jul	316.7	4.1	233.1	3.4	145.6	3.7
Aug	389.8	5.0	292.8	4.3	185.2	4.7
Sep	376.0	4.8	328.6	4.8	202.0	5.1
Oct	224.3	2.9	209.6	3.1	139.9	3.5
Nov	594.3	7.7	505.8	7.4	307.5	7.7
Dec	645.6	8.3	429.4	6.3	288.4	7.3
Unknown	0.0	0.0	0.0	0.0	0.0	0.0
Total	7765.1	100.0	6824.4	100.0	3973.7	100.0

Table 5. 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 5 continued.

Area	2000	2001	2002	2003	2004	2005
511	1	0	0	0	1	0
512	1	0	0	0	3	0
513	0	1	0	1	1	5
514	2	1	2	2	3	14
515	0	0	3	1	2	0
521	4	15	31	12	7	12
522	6	5	12	10	10	10
561	4	7	8	1	0	1
562	8	3	24	9	4	11
525	41	29	43	32	56	94
526	16	23	23	17	31	76
533	10	2	1	2	3	8
537	326	337	446	451	711	958
538	260	214	257	275	288	223
539	455	432	543	551	503	465
611	142	155	206	217	361	460
612	308	379	613	606	666	612
613	170	162	241	240	324	292
614	3	11	26	25	29	49
615	70	115	90	63	88	70
616	384	247	218	359	566	715
621	208	274	533	303	387	267
622	101	234	153	394	586	444
623	8	18	3	14	30	69
625	60	129	296	261	151	309
626	697	510	648	763	668	650
631	185	142	189	119	9	69
632	39	41	8	82	40	54
635	54	212	99	21	11	0
636	1	7	5	4	27	1
Total	3564	3705	4723	4835	5565	5938

Table 6. Summary of sampling of the commercial fishery for summer flounder, ME-VA[1].

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	5,565	40
2005	17,188	4,903	5,938	35

Table 7. 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

DIV	Quarter 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

DIV	Quarter 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 7 continued.

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

DIV	Quarter 1	Quarter 2	Quarter 3	Quarter 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	Quarter 2	Quarter 3	Quarter 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 8. 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 = 2,624 mt; 47% 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 (1,737 mt) plus Small, 1214 (7 mt); Landings = 1,744 mt, 31% 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 8 continued.

MC = Jumbo, 1218   Landings = 990 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 = 206 mt;   4% 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 9. 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 = 2,715 mt; 46% of NER Total

DIV	Quarter				Total
	1	2	3	4	
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 (1,906 mt) plus Small, 1214 (19 mt); Landings = 1,925 mt, 32% of NER Total

DIV	Quarter				Total
	1	2	3	4	
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 9 continued.

MC = Jumbo, 1218   Landings = 1,037 mt; 18% of NER Total

DIV	Quarter 1	Quarter 2	Quarter 3	Quarter 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 = 262 mt;   4% of NER Total

DIV	Quarter 1	Quarter 2	Quarter 3	Quarter 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 10. 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	4,096
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	0	1	0	0	7,182
1996	0	1,401	3,187	798	156	15	3	0	1	0	5,559
1997	0	380	2,442	1,214	261	69	10	4	0	0	4,381
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	266	2,436	1,633	687	273	109	52	29	9	5,494
2005	0	503	1,372	1,620	1,078	667	360	180	126	64	5,970

Table 11. Mean weight (kg) at age of summer flounder landed in the commercial fishery, ME-VA.

	AGE										
Year	0	1	2	3	4	5	6	7	8	9+	ALL
1982	0.26	0.42	0.62	1.84	2.33	2.94	2.71	4.04	5.99		0.55
1983	0.31	0.46	0.80	1.40	2.35	1.85	2.76	3.30	4.17	4.37	0.56
1984	0.28	0.39	0.60	1.11	1.43	2.16	3.21	3.62	4.64	4.03	0.54
1985	0.33	0.44	0.59	1.08	1.73	2.22	2.59	4.71	4.78	4.80	0.59
1986	0.30	0.44	0.63	1.11	1.76	1.89	3.14	2.96	4.81		0.63
1987	0.27	0.45	0.62	1.06	2.00	2.85	3.08	3.02	4.14		0.59
1988	0.36	0.46	0.60	1.21	2.07	2.88	3.98	3.91	4.50		0.60
1989	0.36	0.55	0.74	1.06	1.83	2.47	3.57	3.59	2.25		0.74
1990		0.52	0.86	1.37	1.84	2.13	3.21	3.92	5.03		0.72
1991		0.48	0.75	1.54	2.26	3.01	3.91	3.87			0.64
1992	0.34	0.50	0.82	1.88	2.68	3.09		4.59			0.67
1993	0.35	0.49	0.75	1.63	2.10	1.79	2.81	4.14	5.20		0.62
1994	0.39	0.55	0.62	1.43	2.27	3.08	3.32		3.70		0.63
1995	0.33	0.54	0.70	1.54	2.37	2.92		4.09			0.68
1996		0.54	0.58	1.14	1.88	2.85	3.78		4.76		0.69
1997		0.54	0.63	0.84	1.31	2.10	2.56	3.43			0.76
1998		0.55	0.64	0.85	1.39	2.31	2.52	3.98			0.84
1999		0.52	0.62	0.86	1.36	1.93	2.84	3.62			0.89
2000		0.57	0.68	0.97	1.46	2.13	2.51	2.60	3.30	3.53	0.92
2001		0.59	0.76	1.03	1.73	2.39	2.86	3.57	3.90	4.94	1.01
2002		0.60	0.71	1.01	1.65	2.16	2.85	3.60	3.36	2.98	0.93
2003		0.61	0.69	0.99	1.40	1.87	2.51	3.17	3.53	4.03	0.96
2004		0.56	0.72	0.99	1.43	1.91	2.49	2.99	3.15	3.87	1.01
2005		0.56	0.63	0.79	1.05	1.39	1.69	1.99	2.28	3.21	1.00

Table 12. 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

Table 13. 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	5,691
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

Table 14. Mean weight (kg) at age of summer flounder landed in the North Carolina commercial winter trawl fishery.

	AGE									
Year	0	1	2	3	4	5	6	7	8+	ALL
1982	0.34	0.46	0.76	1.28	1.66	2.05	2.12	2.23	2.58	0.53
1983	0.32	0.45	0.75	1.14	1.26	1.49	1.73	2.43	2.70	0.57
1984	0.33	0.48	0.70	1.06	1.50	2.17	3.48			0.59
1985	0.38	0.46	0.66	1.20	1.66	2.49	3.07	4.57		0.62
1986	0.36	0.51	0.67	1.09	1.62	1.96	3.40	3.23	3.63	0.64
1987	0.33	0.51	0.66	1.09	1.88	2.94				0.59
1988		0.41	0.60	0.93	1.19	1.70	2.24	2.98	3.41	0.57
1989	0.12	0.38	0.60	0.99	1.16	2.10	3.09	2.50		0.78
1990	0.08	0.48	0.66	0.87	1.31	2.10	1.90	3.97		0.77
1991		0.45	0.66	1.07	1.73	2.25	2.51	3.13	4.10	0.77
1992		0.36	0.50	0.85	1.20	1.46	2.30			0.71
1993		0.49	0.61	1.13	1.37	2.95	3.41			0.66
1994	0.27	0.45	0.62	1.27	2.04	2.44	2.89	5.78		0.84
1995	0.04	0.21	0.46	0.85	1.47	2.49	3.79	3.82		0.72
1996		0.42	0.47	0.73	1.35	1.72	2.29	3.20	2.86	0.56
1997		0.41	0.62	0.76	1.32	2.07	3.25			0.68
1998	0.41	0.71	0.89	1.24	1.49	2.80	3.38			0.89
1999	0.14	0.58	0.73	0.92	1.40	1.68	2.61	3.06	3.90	0.95
2000		0.56	0.66	0.80	1.20	1.96	2.59	3.31	3.52	0.90
2001		0.59	0.67	0.76	1.07	1.72	2.39	3.07	4.24	0.87
2002		0.51	0.65	0.76	0.99	1.65	2.20	3.03	4.42	0.83
2003		0.46	0.70	0.89	1.55	2.48	3.25	3.87	4.82	0.94
2004		0.51	0.64	0.82	1.12	1.41	2.14	2.99	3.98	0.97
2005		0.58	0.67	0.87	1.15	1.65	2.43	2.90	3.73	0.96

Table 15. 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 15 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 16. 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 16 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

Table 17. 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. 1994-2004 lengths converted to age using 1994-2004 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
1998	Trawl	721		318	44	318	254
	Scallop	150		169	113	169	135
	All	871	n/a	487	56	487	389

Table 17 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)
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 18. 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	7,748	-36
2005	13,215	3,478	7,765	-55

Table 19. Estimated summer flounder discard at age in the commercial fishery. 1994-2005 lengths converted to age using 1994-2005 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	1,098
	All	571	1,677	493	36	2,778
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	479
	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	167
	Scallop	<1	14	64	27	105
	All	2	39	134	98	272
2005	Trawl	4	33	44	65	146
	Scallop	<1	8	52	40	100
	All	4	41	96	105	246

Table 20. Estimated summer flounder discard mean length at age in the commercial fishery. 1994-2005 lengths converted to age using 1994-2005 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	42.2

Table 21. Estimated summer flounder discard mean weight at age in the commercial fishery. 1994-2005 lengths converted to age using 1994-2005 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

Table 22. 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	138	201	5	3	48	7	1	1	1	8	1
P/R	1,293	747	568	382	2,562	648	379	137	99	173	211
TOTAL	1,598	1,092	635	395	2,680	694	422	142	116	190	238
Mid											
Shore	682	3,296	977	272	478	251	594	84	96	505	200
P/C	5,745	3,321	2,381	1,068	1,541	1,143	1,164	141	412	589	374
P/R	5,731	12,345	11,764	8,454	5,924	5,499	7,271	1,141	2,658	4,573	3,983
TOTAL	12,158	18,962	15,122	9,794	7,943	6,893	9,029	1,366	3,166	5,667	4,557
South											
Shore	272	523	316	504	689	115	306	91	150	51	50
P/C	53	52	110	81	20	1	1	1	1	1	1
P/R	1,392	367	1,292	292	289	162	355	117	361	159	156
TOTAL	1,717	942	1,718	877	998	278	662	209	512	211	207
All											
Shore	1,121	3,963	1,355	786	1,237	405	942	179	262	565	276
P/C	5,936	3,574	2,496	1,152	1,609	1,151	1,166	143	414	598	376
P/R	8,416	13,459	13,624	9,128	8,775	6,309	8,005	1,395	3,118	4,905	4,350
TOTAL	15,473	20,996	17,475	11,066	11,621	7,865	10,113	1,717	3,794	6,068	5,002
PSE	26	7	8	12	7	5	4	6	4	4	4

Table 22 continued.

	YEAR										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
North											
Shore	36	49	19	22	27	44	34	57	5	18	25
P/C Boat	10	24	6	7	22	26	19	45	14	21	36
P/R Boat	250	596	449	717	669	970	769	1,355	555	401	485
TOTAL	296	669	474	746	718	1,040	822	1,457	574	440	546
Mid											
Shore	176	195	175	137	195	243	157	445	199	124	142
P/C Boat	872	773	267	1,167	907	333	281	557	316	238	355
P/R Boat	3,969	4,372	2,312	4,999	5,059	4,972	2,610	4,565	3,878	2,248	3,383
TOTAL	5,017	5,340	2,754	6,303	6,161	5,548	3,048	5,567	4,393	2,610	3,880
South											
Shore	113	180	48	46	32	30	23	38	23	14	32
P/C Boat	1	2	1	5	2	2	<1	1	<1	3	<1
P/R Boat	236	197	100	274	247	360	214	312	304	172	54
TOTAL	350	379	149	325	281	391	237	351	327	189	86
All Regions											
Shore	325	424	242	205	254	317	214	540	227	156	199
P/C Boat	883	799	274	1,179	931	361	301	603	331	262	392
P/R Boat	4,455	5,165	2,861	5,990	5,975	6,302	3,593	6,232	4,737	2,821	3,922
TOTAL	5,663	6,388	3,377	7,374	7,160	6,979	4,107	7,375	5,294	3,239	4,512
PSE (%)	4	4	4	3	4	4	4	3	4	4	4

Table 22 continued.

	YEAR	
	2004	2005
North		
Shore	23	64
P/C Boat	25	12
P/R Boat	728	543
TOTAL	776	619
Mid		
Shore	138	109
P/C Boat	381	274
P/R Boat	2,928	2,706
TOTAL	3,447	3,089
South		
Shore	46	15
P/C Boat	3	1
P/R Boat	126	110
TOTAL	175	126
All		
Shore	206	188
P/C Boat	409	287
P/R Boat	3,782	3,359
TOTAL	4,397	3,834
PSE (%)	4	5

Table 23. 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	289	141	89	150	175
TOTAL	1,047	600	409	337	2,667	607	322	144	106	162	196
Mid											
Shore	295	1,254	399	140	293	129	329	52	56	306	126
P/C Boat	3,112	2,196	1,426	609	1,093	1,098	799	125	264	364	267
P/R Boat	3,085	8,389	5,686	4,187	3,521	3,596	5,003	985	1,665	2,673	2,536
TOTAL	6,492	11,839	7,511	4,936	4,907	4,823	6,131	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	166	71	161	80	91
TOTAL	728	248	592	392	528	89	280	129	238	106	117
All Regions											
Shore	469	1,447	514	377	743	184	474	111	148	337	171
P/C Boat	3,209	2,295	1,453	631	1,145	1,103	801	127	266	371	269
P/R Boat	4,589	8,945	6,545	4,657	6,214	4,232	5,458	1,197	1,915	2,903	2,802
TOTAL	8,267	12,687	8,512	5,665	8,102	5,519	6,733	1,435	2,329	3,611	3,242
PSE (%)	25	7	8	11	9	9	4	6	4	4	4

Table 23 continued.

	YEAR										
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
North											
Shore	25	30	14	15	17	56	27	69	6	20	32
P/C Boat	7	14	5	13	17	22	18	40	16	29	46
P/R Boat	181	424	371	531	445	833	738	1,454	695	559	538
TOTAL	213	468	390	559	479	911	783	1,563	717	608	616
Mid											
Shore	88	112	108	80	127	160	136	346	187	136	152
P/C Boat	534	478	185	746	712	274	286	611	349	274	478
P/R Boat	2,453	2,849	1,699	3,155	3,898	4,096	2,461	4,373	3,842	2,494	3,963
TOTAL	3,075	3,439	1,992	3,981	4,737	4,530	2,883	5,330	4,378	2,904	4,593
South											
Shore	59	100	29	24	18	18	13	22	15	9	21
P/C Boat	<1	1	<1	2	1	1	<1	<1	<1	1	<1
P/R Boat	136	103	84	138	143	199	115	174	168	88	34
TOTAL	196	204	114	164	162	218	129	197	183	98	56
All Regions											
Shore	172	242	151	119	162	234	176	437	208	165	205
P/C Boat	542	493	191	761	730	297	305	652	366	304	525
P/R Boat	2,770	3,376	2,154	3,824	4,486	5,128	3,314	6,001	4,705	3,141	4,535
TOTAL	3,484	4,111	2,496	4,704	5,378	5,659	3,795	7,090	5,278	3,610	5,265
PSE (%)	4	4	5	3	4	5	5	4	4	4	4

Table 23 continued.

	YEAR	
	2004	2005
North		
Shore	27	66
P/C Boat	23	16
P/R Boat	949	674
TOTAL	999	756
Mid		
Shore	144	95
P/C Boat	282	344
P/R Boat	3,305	3,275
TOTAL	3,730	3,714
South		
Shore	30	10
P/C Boat	4	1
P/R Boat	79	69
TOTAL	112	80
All Regions		
Shore	200	171
P/C Boat	308	361
P/R Boat	4,333	4,018
TOTAL	4,841	4,550
PSE (%)	4	5

Table 24. 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	274	1.18
1996	289	58	347	1,179	3.40
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	603	2.13
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	409	3.08
2005	80	21	101	439	4.35

Table 25. 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
1988	North	322	310	104
	Mid	6,131	2,865	214
	South	280	743	38
	TOTAL	6,733	3,918	172

Table 25 continued.

Year	Subregion	Landings (A+B1; mt)	Number of Summer Flounder Measured	mt/100 Lengths
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	213	338	63
	Mid	3,075	4,174	74
	South	196	995	20
	TOTAL	3,484	5,507	63
1994	North	468	621	75
	Mid	3,439	3,834	90
	South	204	1,467	14
	TOTAL	4,111	5,922	69
1995	North	390	501	78
	Mid	1,992	1,470	136
	South	114	485	24
	TOTAL	2,496	2,456	102

Table 25 continued.

Year	Subregion	Landings (A+B1; mt)	Number of Summer Flounder Measured	mt/100 Lengths
1996	North	559	919	61
	Mid	3,981	3,373	118
	South	164	1,188	14
	TOTAL	4,704	5,480	86
1997	North	480	786	61
	Mid	4,736	2,988	159
	South	162	1,026	16
	TOTAL	5,378	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	1,563	707	221
	Mid	5,330	1,892	282
	South	197	722	27
	TOTAL	7,090	3,321	213
2001	North	717	351	204
	Mid	4,378	2,963	148
	South	183	933	20
	TOTAL	5,278	4,247	124
2002	North	608	366	166
	Mid	2,904	2,695	108
	South	98	596	16
	TOTAL	3,610	3,657	99

Table 25 continued.

Year	Subregion	Landings (A+B1; mt)	Number of Summer Flounder Measured	mt/100 Lengths
2003	North	616	514	120
	Mid	4,593	3,003	153
	South	56	139	40
	TOTAL	5,265	3,656	144
2004	North	776	1,548	50
	Mid	3,447	2,486	139
	South	174	276	63
	TOTAL	4,397	4,310	102
2005North	North	756	551	137
	Mid	3,714	1,994	186
	South	80	269	30
	TOTAL	4,550	2,814	162

Table 26. 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	434	5,855	3,345	386	90	3	0	0	0	10,113
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	71	3,470	1,981	139	<1	2	0	0	0	5,663
1994	765	3,872	1,549	171	26	<1	5	0	0	6,388
1995	235	1,557	1,426	117	26	16	<1	0	0	3,377
1996	115	3,093	3,664	372	129	1	0	0	0	7,374
1997	4	1,147	4,183	1,464	274	88	0	0	0	7,160
1998	0	768	2,915	2,714	515	63	3	0	0	6,979
1999	0	201	1,982	1,520	325	60	19	0	0	4,107
2000	0	544	3,897	2,161	609	160	4	0	0	7,375
2001	0	838	1,975	1,781	539	121	36	4	0	5,294
2002	1	194	1,321	1,201	408	91	20	1	2	3,239
2003	0	235	1,657	1,733	641	169	61	16	0	4,512
2004	23	206	1,499	1,660	657	212	116	24	0	4,397
2005	4	191	1,138	1,421	696	218	92	55	19	3,834

Table 27. 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.

	Numbers (000s)				
Year	A+B1	B2	A+B1+B2	PSE (%)	B2 / (A+B1+B2)
1982	15,473	8,089	23,562	59	0.343
1983	20,996	11,066	32,062	16	0.345
1984	17,475	12,310	29,785	11	0.413
1985	11,066	2,460	13,526	15	0.182
1986	11,621	13,672	25,293	8	0.541
1987	7,865	13,159	21,024	6	0.626
1988	10,113	7,249	17,362	6	0.418
1989	1,717	960	2,677	10	0.359
1990	3,794	5,307	9,101	5	0.583
1991	6,068	10,007	16,075	5	0.623
1992	5,002	6,907	11,909	5	0.580
1993	5,663	14,321	19,984	5	0.717
1994	6,388	10,345	16,733	5	0.618
1995	3,377	12,860	16,237	5	0.792
1996	7,374	12,368	19,742	4	0.626
1997	7,160	12,860	20,020	4	0.642
1998	6,979	15,107	22,086	4	0.684
1999	4,107	17,271	21,378	5	0.808
2000	7,375	16,712	24,087	4	0.694
2001	5,294	22,894	28,188	3	0.812
2002	3,239	13,386	16,625	3	0.805
2003	4,512	15,776	20,288	4	0.778
2004	4,397	15,898	20,295	4	0.783
2005	3,834	21,759	25,593	5	0.850

Table 28. 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.

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	342	2,705	13
1989	MRFSS		448	
	ALS		171	
	Total	45	619	7

Table 28 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	344	1,401	
	ALS		1,807	
	Total	344	3,208	11
1993	MRFSS	736	966	
	ALS		3,923	
	Total	736	4,889	15
1994	MRFSS	577	1,079	
	ALS		3,061	
	Total	577	4,140	14
1995	MRFSS		267	
	ALS		2,307	
	Total	714	2,574	28
1996	MRFSS		639	
	ALS		2,383	
	Total	615	3,022	20
1997	MRFSS		221	
	ALS		2,468	
	Total	627	2,689	23
1998	MRFSS		1,083	
	ALS		3,015	
	Total	517	4,098	13
1999	MRFSS		429	
	ALS		3,688	
	Total	688	4,117	17

Table 28 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	855	9,957	9
2001	MRFSS		637	
	ALS		3,399	
	CTVAS		999	
	NYPBS		834	
	MDVAL		2,316	
	Total	1,216	8,185	15
2002	MRFSS		721	
	CTVAS		1,526	
	NYPBS		1,840	
	MADMF		12	
	Total	676	4,099	16
2003	MRFSS		215	
	CTVAS		1,407	
	NYPBS		2,167	
	Total	684	3,789	18
2004	MRFSS		321	
	CTVAS		661	
	NYPBS		1,222	
	Total	999	2,204	45
2005	MRFSS		142	
	CTVAS		1,199	
	MRF FHS		3,210	
	Total	899	4,551	20

Table 29. Estimated recreational fishery discard at age of summer flounder (catch type B2). 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 2001-2005 allocated to age groups either in the same relative proportion as fish less than the minimum size in the respective state catch, or as indicate by state agency 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	56	669	0	0	725	16	326	0	0	342
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	22	1,410	0	0	1,432	6	730	0	0	736
1994	177	857	0	0	1,034	77	500	0	0	577
1995	170	1,116	0	0	1,286	72	642	0	0	714
1996	24	1,213	0	0	1,237	8	645	0	0	653
1997	18	752	495	21	1,286	4	296	206	9	515
1998	0	548	833	130	1,511	0	129	330	58	517
1999	84	569	954	122	1,729	11	215	407	55	688
2000	0	510	1,001	161	1,672	0	244	524	87	855
2001	0	1,166	869	254	2,289	0	550	495	171	1,216
2002	258	332	590	158	1,338	37	137	375	127	676
2003	257	571	576	174	1,578	40	236	363	45	684
2004	40	496	760	294	1,590	9	240	519	225	993
2005	237	1,181	639	119	2,176	49	418	351	81	899

Table 30. Estimated recreational total catch at age of summer flounder (000s).

	Age									
Year	0	1	2	3	4	5	6	7	8	Total
1982	2,922	9,081	3,498	561	215	<1	4	0	0	16,281
1983	2,477	12,544	4,978	1,340	528	220	0	16	0	22,103
1984	2,492	10,218	4,831	1,012	147	5	<1	0	0	18,705
1985	1,042	5,208	4,382	473	148	59	0	0	0	11,312
1986	1,319	7,621	2,784	1,088	129	15	28	0	0	12,984
1987	572	5,884	2,083	448	182	1	5	0	0	9,175
1988	490	6,524	3,345	386	90	3	0	0	0	10,838
1989	87	622	946	135	16	2	5	0	0	1,813
1990	413	3,240	529	118	23	<1	1	0	0	4,324
1991	110	4,588	2,251	79	40	1	0	0	0	7,069
1992	99	3,857	1,620	90	<1	27	0	0	0	5,693
1993	93	4,880	1,981	139	<1	2	0	0	0	7,095
1994	942	4,729	1,549	171	26	<1	5	0	0	7,422
1995	405	2,673	1,426	117	26	16	<1	0	0	4,663
1996	139	4,306	3,664	372	129	1	0	0	0	8,611
1997	22	1,899	4,678	1,485	274	88	0	0	0	8,446
1998	0	1,316	3,748	2,844	515	63	3	0	0	8,489
1999	84	770	2,936	1,642	325	60	19	0	0	5,836
2000	0	1,054	4,898	2,322	609	160	4	0	0	9,047
2001	0	2,004	2,844	2,035	539	121	36	4	0	7,583
2002	259	526	1,911	1,359	408	91	20	1	2	4,577
2003	257	806	2,233	1,907	641	169	61	16	0	6,090
2004	63	702	2,259	1,954	657	212	116	24	0	5,987
2005	241	1,372	1,777	1,540	696	218	92	55	19	6,010

Table 31. Mean weight (kg) at age of summer flounder catch in the recreational fishery.

	Age									
Year	0	1	2	3	4	5	6	7	8+	ALL
1982	0.22	0.40	0.57	1.33	1.84	1.89	2.98			0.46
1983	0.18	0.37	0.63	0.93	1.19	1.40				0.47
1984	0.21	0.36	0.62	0.97	1.77	2.20	4.17			0.45
1985	0.24	0.40	0.63	1.10	1.75	2.44				0.53
1986	0.23	0.45	0.75	1.29	1.74	2.72	3.48	5.96		0.58
1987	0.23	0.41	0.76	1.34	1.84	3.05	4.81	4.64		0.56
1988	0.29	0.49	0.71	1.11	1.92	2.32				0.58
1989	0.26	0.51	0.81	1.23	1.78	3.33	1.58			0.73
1990	0.30	0.46	0.97	1.44	1.68	2.90	6.46			0.54
1991	0.27	0.43	0.67	1.31	1.37	2.45				0.52
1992	0.23	0.50	0.72	1.62	2.28	3.34				0.59
1993	0.25	0.52	0.72	1.87	2.44	3.03				0.60
1994	0.44	0.58	0.69	1.44	1.92	2.83	3.90			0.61
1995	0.43	0.58	0.82	1.46	2.60	2.93	3.54			0.68
1996	0.34	0.53	0.62	1.34	1.34	2.36				0.61
1997	0.23	0.45	0.65	0.90	1.15	2.38				0.68
1998		0.41	0.61	0.81	1.26	2.51	2.79			0.70
1999	0.13	0.41	0.62	0.91	1.55	2.33	2.60			0.74
2000		0.52	0.71	0.95	1.31	2.39	3.48			0.83
2001		0.53	0.79	0.99	1.52	2.09	2.29	3.74		0.86
2002	0.14	0.44	0.82	1.06	1.51	2.28	2.60	3.20	4.21	0.91
2003	0.15	0.49	0.84	1.11	1.59	2.02	2.79	2.73		0.99
2004	0.22	0.53	0.79	1.01	1.40	1.91	2.32	3.00		0.97
2005	0.21	0.38	0.75	1.10	1.40	1.76	2.33	2.27		0.89

Table 32. 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	795	20,557	14,562	2,137	644	121	19	15	6	0	38,856
1989	960	4,790	7,306	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	12,149	7,148	742	217	32	3	1	0	0	21,293
1992	1,368	11,197	6,026	1,125	151	70	2	1	0	0	19,940
1993	1,285	11,235	5,601	566	73	45	20	2	1	0	18,828
1994	1,638	10,362	6,996	982	205	26	14	0	5	0	20,227
1995	592	5,828	7,303	1,239	397	77	2	1	0	0	15,440
1996	162	6,925	9,278	1,785	417	71	16	1	3	0	18,658
1997	30	2,545	8,046	3,149	553	160	11	4	0	0	14,498
1998	45	2,233	6,380	5,243	980	138	19	1	0	0	15,039
1999	181	2,185	6,260	4,018	1,161	358	55	14	0	0	14,232
2000	22	1,480	7,690	4,538	1,495	360	73	19	8	2	15,687
2001	11	2,888	4,760	3,737	1,293	363	123	26	4	3	13,208
2002	272	1,135	5,411	3,839	1,302	319	135	22	2	1	12,438
2003	259	1,583	4,937	4,002	1,579	563	233	66	17	3	13,242
2004	65	1,031	5,437	4,492	1,826	732	288	105	31	10	14,017
2005	245	1,933	3,716	4,036	2,193	1,041	506	257	148	64	14,139

Table 33. Mean length (cm) at age of summer flounder catch, ME-NC.

	Age										
Year	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		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		38.2
1987	29.9	35.3	39.7	46.9	55.8	63.3	65.9	63.2	73.5		37.7
1988	32.4	35.8	39.1	46.6	53.1	60.2	69.6	68.5	72.7		37.9
1989	27.1	35.7	40.8	45.5	50.6	58.5	59.1	63.1	59.0		39.1
1990	29.6	35.1	41.9	46.8	51.4	57.4	66.4	71.7	75.2		36.6
1991	24.8	34.5	40.4	47.1	54.3	61.0	61.7	68.1			36.7
1992	29.6	36.0	41.2	46.9	49.7	61.0	58.8	72.2			37.9
1993	30.3	36.5	40.6	50.4	52.9	54.7	62.6	70.6	75.5		37.9
1994	32.2	37.1	39.3	49.6	57.3	63.4	66.3		68.5		38.3
1995	33.7	37.1	39.9	44.9	52.4	62.2	70.5	71.9			39.4
1996	32.6	36.9	38.3	45.7	51.3	54.4	58.5	63.0	66.0		38.8
1997	28.5	36.2	39.8	43.4	48.3	58.1	60.8	66.3			40.4
1998	28.7	37.2	40.0	43.4	49.5	59.3	60.9	71.1			41.6
1999	25.3	33.6	38.8	43.9	50.7	55.5	62.2	67.1	67.0		40.8
2000	18.1	37.2	40.9	44.2	49.3	58.0	60.8	60.3	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	43.4
2002	25.3	36.1	41.5	44.8	49.5	56.9	61.3	68.2	72.9	64.0	43.1
2003	26.0	36.8	42.0	45.9	51.8	56.9	62.0	65.0	67.2	69.1	44.5
2004	29.0	37.6	41.6	45.2	49.8	53.8	59.1	64.1	64.8	73.6	44.7
2005	28.6	35.1	40.7	44.4	47.8	51.5	55.3	57.3	51.2	66.1	43.7

Table 34. Mean weight (kg) at age of summer flounder catch, ME-NC.

	Age										
Year	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	4.370	0.504
1983	0.243	0.419	0.716	1.075	1.257	1.495	2.572	2.594	3.849	4.030	0.521
1984	0.251	0.398	0.632	1.046	1.500	2.163	3.302	3.620	4.640	4.800	0.518
1985	0.290	0.429	0.613	1.109	1.726	2.297	2.671	4.682	4.780		0.575
1986	0.256	0.453	0.668	1.160	1.739	1.994	3.311	4.000	4.432		0.613
1987	0.263	0.446	0.651	1.140	1.941	2.855	3.326	3.314	4.140		0.581
1988	0.319	0.462	0.624	1.130	1.739	2.485	3.888	3.545	4.316		0.588
1989	0.207	0.459	0.723	1.044	1.479	2.249	2.399	2.861	2.251		0.668
1990	0.250	0.429	0.810	1.169	1.538	2.121	3.461	3.951	5.029		0.540
1991	0.140	0.404	0.702	1.186	1.811	2.527	2.837	3.586			0.537
1992	0.246	0.467	0.749	1.222	1.390	2.696	2.302	4.479			0.595
1993	0.264	0.480	0.699	1.461	1.659	1.859	2.816	4.136	5.199		0.571
1994	0.342	0.521	0.628	1.353	2.096	2.736	3.437		3.703		0.605
1995	0.375	0.527	0.678	1.056	1.639	2.628	3.750	4.047			0.675
1996	0.327	0.504	0.570	1.080	1.545	1.957	2.546	3.200	3.164		0.621
1997	0.212	0.452	0.639	0.866	1.233	2.252	2.572	3.429			0.697
1998	0.259	0.490	0.648	0.859	1.321	2.410	2.577	3.983			0.759
1999	0.143	0.371	0.594	0.896	1.439	1.998	2.716	3.496	3.904		0.755
2000	0.066	0.509	0.692	0.924	1.331	2.214	2.586	2.728	3.359	3.532	0.850
2001	0.114	0.544	0.766	0.968	1.449	2.145	2.597	3.459	3.915	4.935	0.903
2002	0.147	0.493	0.736	0.958	1.371	2.099	2.666	3.728	4.232	2.983	0.898
2003	0.149	0.507	0.759	1.034	1.531	2.072	2.759	3.172	3.570	3.912	0.999
2004	0.220	0.529	0.737	0.967	1.345	1.750	2.354	3.029	3.186	3.736	0.983
2005	0.202	0.430	0.691	0.926	1.186	1.504	1.891	2.149	2.306	3.110	0.938

Table 35. 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	6,733	342	7,075	21,419	342	21,761
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	3,484	736	4,220	9,199	1,582	10,781
1994	6,588	906	7,494	4,111	577	4,688	10,699	1,483	12,182
1995	6,977	308	7,285	2,496	714	3,210	9,473	1,022	10,495
1996	5,861	463	6,324	4,704	615	5,319	10,565	1,078	11,643
1997	3,994	326	4,320	5,378	627	6,005	9,372	953	10,325
1998	5,076	389	5,465	5,659	517	6,176	10,735	906	11,641
1999	4,820	1,548	6,368	3,795	688	4,483	8,615	2,236	10,851
2000	5,085	726	5,811	7,090	855	7,945	12,175	1,581	13,756
2001	4,970	468	5,438	5,278	1,216	6,494	10,248	1,684	11,932
2002	6,573	449	7,022	3,610	676	4,286	10,183	1,125	11,308
2003	6,450	528	6,978	5,265	684	5,949	11,715	1,212	12,927
2004	7,748	244	7,992	4,841	993	5,834	12,589	1,237	13,826
2005	7,765	230	7,995	4,550	899	5,449	12,315	1,129	13,444
Mean	8,291	679	8,763	5,296	547	5,843	13,587	1,019	14,606

Table 36. 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 and later) 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.

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 36 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		

Table 37. 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
Mean	0.47	0.74	0.31	0.11	0.05	0.03	0.02	0.01	0.01	0.01	1.65

Table 38. 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	
Mean	28.3	37.3	45.6	51.5	57.6	62.0	63.8	72.2	65.5	74.5	69.0	75.0

Table 39. 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
Mean	0.38	1.10	0.57	0.18	0.06	0.03	0.04	0.02	2.30

Table 40. 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
Mean	25.7	35.5	43.3	52.9	56.9	61.8	64.8	67.6

Table 41. 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.

	Age												
Year	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
Mean	4.98	6.86	3.09	1.17	0.51	0.23	0.14	0.10	0.05	0.03	0.01	0.02	16.90

Table 42. 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
Mean	28.9	37.9	45.5	53.2	58.0	62.0	65.6	66.0	67.5	70.6	67.8	72.9

Table 43. MADMF Spring survey cruises: stratified mean number per tow at age.

Year	Age									Total
	0	1	2	3	4	5	6	7	8+	
1978		0.097	0.520	0.274	0.221		0.042			1.154
1979			0.084	0.087	0.147	0.048	0.011			0.377
1980		0.055	0.061	0.052	0.075	0.053	0.055	0.011		0.362
1981		0.405	0.558	0.074	0.031	0.043	0.060		0.031	1.202
1982		0.376	1.424	0.118	0.084	0.020		0.010		2.032
1983		0.241	1.304	0.544	0.021	0.009	0.003			2.122
1984		0.042	0.073	0.063	0.111	0.010				0.299
1985		0.142	1.191	0.034	0.042					1.409
1986		0.966	0.528	0.140	0.008					1.642
1987		0.615	0.583	0.012			0.011			1.221
1988		0.153	0.966	0.109	0.012					1.240
1989			0.338	0.079			0.010			0.427
1990		0.247	0.021	0.079	0.012					0.359
1991		0.029	0.048	0.010						0.087
1992		0.274	0.320	0.080		0.011	0.011			0.696
1993		0.120	0.470	0.060	0.010		0.020			0.680
1994		1.770	1.160	0.050	0.020		0.020			3.020
1995		0.089	1.245	0.050						1.384
1996		0.072	0.641	0.110	0.012					0.835
1997		0.512	1.212	0.169	0.109		0.005			2.007
1998		0.137	1.144	0.630	0.041	0.047				1.999
1999		0.073	0.814	1.042	0.286	0.028		0.015		2.258
2000		0.224	1.566	1.137	0.296	0.202	0.049		0.012	3.486
2001		0.172	0.963	0.687	0.216	0.054				2.092
2002		0.142	1.400	0.362	0.098	0.061	0.023	0.012	0.018	2.116
2003		0.189	1.328	0.576	0.172	0.109	0.011	0.022		2.407
2004		0.025	0.267	0.307	0.054	0.057	0.024	0.022	0.022	0.778
2005		0.124	0.314	0.918	0.317	0.121	0.068	0.049	0.111	2.022
Mean		0.280	0.734	0.280	0.104	0.058	0.026	0.020	0.039	1.418

Table 44. MADMF Autumn survey cruises: stratified mean number per tow at age.

	Age									
Year	0	1	2	3	4	5	6	7	8+	Total
1978		0.011	0.124	0.024		0.007				0.166
1979			0.047	0.101		0.019				0.167
1980		0.114	0.326	0.020	0.020	0.010				0.490
1981	0.009	0.362	0.367	0.011						0.749
1982		0.255	1.741	0.016						2.012
1983		0.026	0.583	0.140	0.004					0.753
1984	0.033	0.453	0.249	0.120	0.008					0.863
1985	0.051	0.108	1.662	0.033						1.854
1986	0.128	2.149	0.488	0.128						2.893
1987		1.159	0.598	0.010	0.004					1.771
1988		0.441	0.414	0.018						0.873
1989			0.286	0.024						0.310
1990		0.108		0.012						0.120
1991	0.021	0.493	0.262	0.010						0.786
1992		1.110	0.170							1.280
1993	0.010	0.300	0.430	0.020	0.020					0.780
1994	0.050	2.130	0.070							2.250
1995	0.032	0.401	0.323	0.013						0.769
1996	0.020	0.709	1.165	0.082	0.039	0.004				2.019
1997		0.462	1.399	0.323	0.018	0.030				2.232
1998		0.011	0.553	0.248	0.016	0.011				0.839
1999	0.058	0.325	0.878	0.359	0.035					1.655
2000	0.071	1.300	2.129	0.443	0.085	0.084	0.012	0.015		4.139
2001	0.011	1.166	1.000	0.271	0.025	0.000	0.010	0.012		2.494
2002	0.272	2.529	1.195	0.158	0.044	0.033				4.231
2003	0.126	2.907	1.182	0.235	0.033	0.023	0.004		0.010	4.520
2004	0.011	0.573	1.375	0.123	0.008					2.090
2005	0.006	1.702	2.235	0.756	0.186	0.021	0.042	0.271	0.014	5.233
Mean	0.057	0.819	0.787	0.142	0.036	0.022	0.017	0.099	0.012	1.726

Table 45. 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
Mean	8

Table 46. 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.

	Age								
Year	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
Mean	0.000	0.451	0.380	0.168	0.062	0.023	0.015	0.008	1.107

Table 47. 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.

	Age								
Year	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
Mean	0.085	0.876	0.681	0.184	0.040	0.015	0.005	0.003	1.887

Table 48. RIDFW autumn trawl survey summer flounder index of abundance. RIDFW lengths aged with NEFSC autumn trawl survey age-length keys.

	Age										
Year	0	1	2	3	4	5	6	7	8	9	Total
1980	0.13	0.20	0.39	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.81
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	0.12	0.42	0.70	0.09	0.01	0.00	0.00	0.00	0.00	0.00	1.36
1985	0.34	0.22	0.34	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.95
1986	0.55	1.18	1.52	0.18	0.01	0.00	0.00	0.00	0.00	0.00	3.44
1987	0.14	0.50	0.58	0.12	0.01	0.00	0.00	0.00	0.00	0.00	1.36
1988	0.01	0.17	0.35	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.57
1989	0.00	0.00	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.07
1990	0.05	0.26	0.48	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.83
1991	0.00	0.06	0.13	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.23
1992	0.07	0.39	0.69	0.19	0.03	0.00	0.00	0.00	0.00	0.00	1.37
1993	0.02	0.15	0.40	0.14	0.02	0.00	0.00	0.00	0.00	0.00	0.74
1994	0.01	0.05	0.13	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.19
1995	0.03	0.18	0.39	0.14	0.01	0.01	0.00	0.00	0.00	0.00	0.76
1996	0.19	0.70	1.35	0.17	0.01	0.00	0.00	0.00	0.00	0.00	2.43
1997	0.08	0.56	1.05	0.17	0.01	0.00	0.00	0.00	0.00	0.00	1.88
1998	0.01	0.09	0.36	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.55
1999	0.24	0.93	1.89	0.25	0.02	0.01	0.00	0.00	0.00	0.00	3.34
2000	0.37	0.51	1.31	0.65	0.05	0.04	0.00	0.00	0.00	0.00	2.92
2001	0.08	0.55	0.64	0.80	0.05	0.01	0.00	0.00	0.00	0.00	2.14
2002	0.44	2.42	1.37	0.39	0.06	0.00	0.03	0.00	0.00	0.00	4.70
2003	0.10	2.47	2.19	0.50	0.13	0.03	0.06	0.00	0.00	0.00	5.47
2004	0.03	0.38	1.02	1.02	0.28	0.10	0.03	0.00	0.00	0.00	2.86
2005	0.01	0.84	1.38	0.69	0.15	0.14	0.01	0.04	0.03	0.00	3.29
Mean	0.13	0.55	0.80	0.22	0.03	0.01	0.01	0.00	0.00	0.00	1.75

Table 49. RIDFW monthly fixed station trawl survey summer flounder index of abundance. RIDFW lengths aged with NEFSC spring and autumn trawl survey age-length keys.

	Age											
Year	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					0.33	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	0.56	0.99	0.53	0.17	0.16	0.02	0.03			1.90	2.50
Mean	0.05	0.35	0.42	0.20	0.07	0.04	0.02	0.01	0.00	0.00	0.75	1.06

Table 50. NJBMF trawl survey, April - October: index of summer flounder abundance. NJBMF lengths aged with NEFSC autumn trawl survey age-length keys.

	Age					
Year	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
Mean	1.47	4.44	1.68	0.34	0.17	8.10

Table 51. DEDFW 16 foot trawl survey: indices of summer flounder recruitment at age-0 in the Delaware Bay Estuary and in the Inland Bays.

Year	Estuary: geometric mean number per tow	Inland Bays: geometric mean number per tow
1980	0.120	n/a
1981	0.060	n/a
1982	0.110	n/a
1983	0.031	n/a
1984	0.076	n/a
1985	0.063	n/a
1986	0.096	0.317
1987	0.136	0.258
1988	0.007	0.013
1989	0.115	0.139
1990	0.229	0.361
1991	0.073	0.378
1992	0.315	0.368
1993	0.029	0.047
1994	0.294	0.571
1995	0.170	0.301
1996	0.033	0.080
1997	0.016	0.222
1998	0.025	0.390
1999	0.048	0.350
2000	0.177	0.205
2001	0.074	0.142
2002	0.067	0.125
2003	0.091	0.214
2004	0.101	0.268
2005	0.004	0.012
Mean	0.098	0.238

Table 52. 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
Mean	0.49	0.52	0.36	0.16	0.07	1.60

Table 53. MD DNR Coastal Bays trawl survey: index of summer flounder recruitment at age-0.

Year	Geometric mean number/tow	Lower 95% CI	Upper 95% CI
1972	12.3	6.5	21.8
1973	4.2	3.0	5.7
1974	5.1	3.9	6.6
1975	2.1	1.6	2.6
1976	1.9	1.4	2.6
1977	2.4	1.8	3.2
1978	3.2	2.4	4.1
1979	2.9	2.0	4.1
1980	4.2	2.6	6.2
1981	3.9	2.6	5.4
1982	2.0	0.8	3.7
1983	10.6	6.0	17.9
1984	5.4	3.1	8.7
1985	5.6	3.6	8.1
1986	16.2	10.1	25.2
1987	4.6	2.4	7.8
1988	0.5	0.3	0.8
1989	1.3	0.9	1.9
1990	2.1	1.6	2.7
1991	3.1	2.4	3.9
1992	3.5	2.5	4.7
1993	1.6	1.2	2.1
1994	8.2	6.5	10.3
1995	5.0	4.0	6.2
1996	2.6	2.0	3.2
1997	3.3	2.5	4.3
1998	5.2	4.2	6.6
1999	3.4	2.6	4.2
2000	4.1	3.1	5.2
2001	5.3	4.1	6.9
2002	2.1	1.6	2.7
2003	3.7	2.6	4.4
2004	2.9	2.2	3.7
2005	0.7	0.5	1.0
Mean	4.3		

Table 54. 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
1990	2.54	2.06	3.09	162
1991	2.64	2.14	3.22	207
1992	0.89	0.68	1.12	187

Table 54 continued.

Year	Geometric mean catch per trawl	Lower 95% confidence limit	Upper 95% confidence limit	Number of stations
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
Mean	1.41			

Table 55. 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	10.14	21
1998	9.96	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
Mean	10.38	22

Table 56. Virtual population analysis (VPA) results for summer flounder.

JAN-1 Population Numbers

AGE	1982	1983	1984	1985	1986
0	74269.	80323.	48380.	48579.	53444.
1	42907.	55970.	61306.	35265.	37893.
2	16205.	17555.	20090.	26141.	15641.
3	2203.	4085.	4500.	2465.	5134.
4	807.	957.	1371.	807.	419.
5	161.	364.	157.	372.	212.
6	152.	27.	6.	42.	77.
7	68.	71.	14.	11.	20.
Total	136772.	159352.	135824.	113683.	112841.

AGE	1987	1988	1989	1990	1991
0	43921.	13033.	27270.	30352.	28686.
1	41999.	34931.	9951.	21458.	23171.
2	15515.	18812.	9998.	3813.	9599.
3	2803.	2896.	2226.	1575.	1143.
4	782.	804.	438.	291.	389.
5	57.	148.	75.	39.	38.
6	47.	24.	11.	12.	5.
7	71.	27.	5.	4.	2.
Total	105195.	70675.	49974.	57545.	63032.

AGE	1992	1993	1994	1995	1996
0	32315.	33156.	35248.	38660.	28194.
1	22580.	25220.	25983.	27376.	31116.
2	7978.	8356.	10482.	11898.	17141.
3	1391.	1079.	1773.	2252.	3133.
4	264.	121.	371.	563.	723.
5	122.	80.	33.	119.	102.
6	3.	37.	25.	3.	27.
7	1.	6.	9.	2.	5.
Total	64655.	68054.	73924.	80872.	80441.

AGE	1997	1998	1999	2000	2001
0	28973.	30716.	28643.	35050.	28965.
1	22937.	23694.	25108.	23287.	28677.
2	19210.	16476.	17378.	18579.	17726.
3	5638.	8447.	7717.	8564.	8253.
4	950.	1767.	2172.	2682.	2905.
5	214.	277.	560.	728.	843.
6	19.	31.	102.	135.	270.
7	7.	2.	26.	53.	72.
Total	77948.	81410.	81705.	89078.	87713.

AGE	2002	2003	2004	2005	2006
0	34080.	24517.	34543.	14496.	33680.
1	23705.	27656.	19839.	28223.	11647.
2	20865.	18381.	21211.	15310.	21358.
3	10206.	12187.	10582.	12446.	9172.
4	3376.	4882.	6357.	4599.	6538.
5	1209.	1586.	2569.	3552.	1781.
6	362.	701.	789.	1441.	1966.
7	67.	259.	397.	1251.	1300.
Total	93870.	90169.	96286.	81317.	87442.

Table 56 continued.

Fishing Mortality Calculated

AGE	1982	1983	1984	1985	1986
0	0.0829	0.0702	0.1162	0.0484	0.0410
1	0.6937	0.8246	0.6524	0.6130	0.6929
2	1.1781	1.1613	1.8980	1.4276	1.5192
3	0.6332	0.8918	1.5187	1.5711	1.6825
4	0.5963	1.6093	1.1037	1.1376	1.7873
5	1.6001	3.9505	1.1075	1.3793	1.3116
6	0.6553	1.0601	1.3963	1.4385	1.6732
7	0.6553	1.0601	1.3963	1.4385	1.6732

AGE	1987	1988	1989	1990	1991
0	0.0290	0.0698	0.0397	0.0700	0.0393
1	0.6032	1.0510	0.7592	0.6045	0.8662
2	1.4784	1.9344	1.6481	1.0047	1.7317
3	1.0491	1.6899	1.8336	1.1979	1.2637
4	1.4666	2.1666	2.2217	1.8237	0.9575
5	0.6550	2.3629	1.6410	1.9213	2.5093
6	1.1170	1.7931	1.8802	1.2830	1.1948
7	1.1170	1.7931	1.8802	1.2830	1.1948

AGE	1992	1993	1994	1995	1996
0	0.0479	0.0438	0.0527	0.0171	0.0064
1	0.7941	0.6779	0.5811	0.2682	0.2823
2	1.8006	1.3503	1.3379	1.1344	0.9118
3	2.2436	0.8668	0.9471	0.9366	0.9934
4	0.9970	1.1024	0.9420	1.5111	1.0153
5	1.0008	0.9741	2.0791	1.2661	1.4759
6	1.8129	0.8933	0.9565	1.0367	1.0073
7	1.8129	0.8933	0.9565	1.0367	1.0073

AGE	1997	1998	1999	2000	2001
0	0.0011	0.0016	0.0070	0.0007	0.0004
1	0.1308	0.1100	0.1011	0.0728	0.1180
2	0.6216	0.5585	0.5077	0.6114	0.3521
3	0.9603	1.1582	0.8567	0.8810	0.6940
4	1.0313	0.9492	0.8933	0.9571	0.6770
5	1.7425	0.7987	1.2261	0.7910	0.6458
6	0.9873	1.1088	0.8811	0.8917	0.6864
7	0.9873	1.1088	0.8811	0.8917	0.6864

AGE	2002	2003	2004	2005
0	0.0089	0.0117	0.0021	0.0189
1	0.0544	0.0653	0.0592	0.0787
2	0.3377	0.3522	0.3331	0.3123
3	0.5373	0.4509	0.6333	0.4438
4	0.5556	0.4423	0.3819	0.7486
5	0.3448	0.4982	0.3783	0.3914
6	0.5242	0.4525	0.5098	0.5279
7	0.5242	0.4525	0.5098	0.5279

Table 56 continued.

Average Fishing Mortality For Ages 3- 5

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
1982	0.9432	0.6728	0.7023	0.7058
1983	2.1505	1.2248	1.4284	1.3564
1984	1.2433	1.4136	1.3781	1.4254
1985	1.3627	1.4555	1.4141	1.4664
1986	1.5938	1.6765	1.6665	1.6780
1987	1.0569	1.1325	1.1663	1.1471
1988	2.0732	1.8153	1.8822	1.8238
1989	1.8988	1.8903	1.9096	1.8938
1990	1.6476	1.3083	1.3467	1.3263
1991	1.5769	1.2184	1.2190	1.2369
1992	1.4138	1.9726	1.8436	2.0391
1993	0.9811	0.8957	0.9048	0.8990
1994	1.3228	0.9633	0.9782	0.9705
1995	1.2379	1.0602	1.1309	1.0846
1996	1.1616	1.0098	1.0220	1.0125
1997	1.2447	0.9949	1.0319	1.0029
1998	0.9687	1.1135	1.0925	1.1182
1999	0.9921	0.8841	0.9028	0.8883
2000	0.8764	0.8926	0.8910	0.8937
2001	0.6722	0.6865	0.6831	0.6867
2002	0.4792	0.5258	0.5146	0.5304
2003	0.4638	0.4526	0.4548	0.4530
2004	0.4645	0.5178	0.4909	0.5417
2005	0.5279	0.5028	0.5048	0.5282

Table 56 continued.

Back Calculated Partial Recruitment

AGE	1982	1983	1984	1985	1986
0	0.0518	0.0178	0.0612	0.0308	0.0229
1	0.4335	0.2087	0.3437	0.3902	0.3877
2	0.7363	0.2940	1.0000	0.9087	0.8500
3	0.3957	0.2258	0.8002	1.0000	0.9414
4	0.3727	0.4074	0.5815	0.7241	1.0000
5	1.0000	1.0000	0.5835	0.8780	0.7339
6	0.4095	0.2683	0.7357	0.9156	0.9362
7	0.4095	0.2683	0.7357	0.9156	0.9362

AGE	1987	1988	1989	1990	1991
0	0.0196	0.0295	0.0179	0.0364	0.0157
1	0.4080	0.4448	0.3417	0.3146	0.3452
2	1.0000	0.8187	0.7418	0.5230	0.6901
3	0.7096	0.7152	0.8253	0.6235	0.5036
4	0.9920	0.9169	1.0000	0.9492	0.3816
5	0.4430	1.0000	0.7386	1.0000	1.0000
6	0.7555	0.7588	0.8463	0.6678	0.4762
7	0.7555	0.7588	0.8463	0.6678	0.4762

AGE	1992	1993	1994	1995	1996
0	0.0214	0.0324	0.0254	0.0113	0.0043
1	0.3540	0.5021	0.2795	0.1775	0.1913
2	0.8025	1.0000	0.6435	0.7507	0.6178
3	1.0000	0.6419	0.4555	0.6198	0.6731
4	0.4444	0.8164	0.4531	1.0000	0.6879
5	0.4461	0.7214	1.0000	0.8379	1.0000
6	0.8080	0.6616	0.4601	0.6860	0.6825
7	0.8080	0.6616	0.4601	0.6860	0.6825

AGE	1997	1998	1999	2000	2001
0	0.0007	0.0014	0.0057	0.0007	0.0006
1	0.0751	0.0950	0.0825	0.0761	0.1700
2	0.3567	0.4823	0.4140	0.6388	0.5073
3	0.5511	1.0000	0.6987	0.9205	1.0000
4	0.5919	0.8196	0.7286	1.0000	0.9755
5	1.0000	0.6896	1.0000	0.8264	0.9306
6	0.5666	0.9574	0.7186	0.9317	0.9891
7	0.5666	0.9574	0.7186	0.9317	0.9891

AGE	2002	2003	2004	2005
0	0.0159	0.0236	0.0033	0.0252
1	0.0979	0.1312	0.0934	0.1051
2	0.6079	0.7069	0.5260	0.4172
3	0.9672	0.9050	1.0000	0.5928
4	1.0000	0.8877	0.6031	1.0000
5	0.6207	1.0000	0.5973	0.5228
6	0.9436	0.9083	0.8051	0.7052
7	0.9436	0.9083	0.8051	0.7052

Table 56 continued.

JAN-1 Biomass

AGE	1982	1983	1984	1985	1986
0	14720.	15004.	9134.	11212.	10229.
1	13705.	18218.	18901.	11489.	13710.
2	7557.	9604.	10314.	12880.	8363.
3	3420.	3324.	3894.	2064.	4330.
4	1738.	1291.	1741.	1084.	583.
5	468.	615.	259.	691.	393.
6	416.	71.	13.	102.	212.
7	262.	185.	56.	53.	81.
Total	42285.	48313.	44312.	39575.	37900.

AGE	1987	1988	1989	1990	1991
0	8508.	3413.	3940.	6019.	2309.
1	14045.	12097.	3794.	6425.	7422.
2	8425.	9880.	5785.	2328.	5280.
3	2446.	2484.	1796.	1448.	1120.
4	1173.	1132.	566.	369.	566.
5	128.	324.	149.	69.	76.
6	120.	82.	28.	33.	11.
7	249.	102.	14.	20.	6.
Total	35094.	29513.	16072.	16710.	16790.

AGE	1992	1993	1994	1995	1996
0	5623.	6190.	10173.	13183.	7951.
1	5896.	8703.	9702.	11953.	13878.
2	4404.	4789.	5792.	7118.	9484.
3	1288.	1129.	1724.	1834.	2681.
4	340.	172.	650.	838.	923.
5	270.	128.	70.	278.	182.
6	6.	101.	62.	11.	71.
7	6.	14.	33.	7.	15.
Total	17833.	21227.	28205.	35222.	35185.

AGE	1997	1998	1999	2000	2001
0	4039.	6647.	2171.	806.	1587.
1	8858.	7637.	7783.	6283.	5434.
2	10967.	8917.	9376.	9414.	11068.
3	3962.	6259.	5880.	6344.	6754.
4	1096.	1890.	2415.	2929.	3362.
5	400.	478.	910.	1299.	1425.
6	43.	74.	261.	306.	648.
7	20.	6.	91.	151.	241.
Total	29384.	31907.	28887.	27532.	30520.

AGE	2002	2003	2004	2005	2006
0	2699.	1939.	5437.	1924.	4143.
1	5620.	7550.	5571.	8681.	3344.
2	13204.	11244.	12966.	9256.	13011.
3	8743.	10632.	9065.	10282.	7812.
4	3889.	5913.	7497.	4925.	7544.
5	2108.	2673.	4204.	5052.	2817.
6	866.	1687.	1742.	2621.	4217.
7	251.	1023.	1484.	4534.	4901.
Total	37379.	42660.	47966.	47275.	47789.

Table 56 continued.

Spawning Stock Biomass

AGE	1982	1983	1984	1985	1986
0	5668.	5854.	3507.	4341.	4207.
1	6150.	7180.	8615.	5534.	5890.
2	2862.	3655.	2003.	3735.	2257.
3	1596.	1774.	1130.	629.	1248.
4	795.	268.	697.	459.	140.
5	101.	17.	115.	230.	120.
6	200.	24.	5.	29.	54.
7	129.	65.	15.	14.	17.
Total	17501.	18837.	16087.	14972.	13934.

AGE	1987	1988	1989	1990	1991
0	3574.	1251.	1767.	2323.	1296.
1	6863.	4123.	1487.	3415.	2802.
2	2257.	1797.	1403.	1023.	1220.
3	1133.	682.	430.	577.	402.
4	380.	196.	87.	84.	270.
5	81.	44.	37.	14.	10.
6	52.	18.	5.	12.	4.
7	83.	19.	2.	6.	2.
Total	14424.	8130.	5217.	7453.	6007.

AGE	1992	1993	1994	1995	1996
0	2449.	2717.	3855.	4785.	2979.
1	3348.	4258.	5165.	7176.	7657.
2	1022.	1452.	1653.	2398.	3494.
3	224.	650.	926.	926.	1257.
4	136.	68.	302.	223.	407.
5	122.	56.	14.	92.	50.
6	1.	42.	33.	5.	26.
7	1.	6.	13.	2.	6.
Total	7303.	9249.	11960.	15608.	15874.

AGE	1997	1998	1999	2000	2001
0	1975.	2557.	1311.	744.	1062.
1	5672.	6463.	5224.	6805.	8627.
2	5586.	5120.	5164.	5900.	7728.
3	1864.	2350.	2876.	3226.	3804.
4	421.	899.	1261.	1366.	2033.
5	96.	292.	343.	708.	896.
6	18.	27.	113.	141.	336.
7	8.	2.	37.	61.	115.
Total	15641.	17710.	16328.	18951.	24603.

AGE	2002	2003	2004	2005
0	1601.	1164.	2442.	928.
1	6813.	8100.	6094.	6933.
2	8845.	7940.	9039.	6223.
3	5302.	7342.	5124.	6755.
4	2472.	4386.	5275.	2482.
5	1614.	1841.	2782.	3270.
6	529.	1125.	1030.	1489.
7	138.	595.	823.	2478.
Total	27314.	32493.	32608.	30558.

Table 57. ADAPT VPA Bootstrap Confidence Interval Summary Report.

Bootstrap Output Variable: Stock Estimates (2006)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 1	11647.	12008.	2613.	0.2176
N 2	21358.	21761.	3786.	0.1740
N 3	9172.	9365.	1648.	0.1759
N 4	6538.	6675.	1310.	0.1963
N 5	1781.	1874.	761.	0.4061
N 6	1966.	1992.	707.	0.3547

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Est. Corrected For Bias	C.V. For Corrected Estimate
N 1	361.	83.	3.1017	11285.	0.2316
N 2	403.	120.	1.8872	20955.	0.1807
N 3	193.	52.	2.1008	8979.	0.1835
N 4	137.	42.	2.0953	6401.	0.2047
N 5	92.	24.	5.1896	1689.	0.4506
N 6	26.	22.	1.3212	1940.	0.3642

	LOWER 90. % CI	UPPER 90. % CI
N 1	8059.	16646.
N 2	16122.	28053.
N 3	6705.	12246.
N 4	4652.	8852.
N 5	749.	3280.
N 6	896.	3202.

Bootstrap Output Variable: Average F (2005) AGES 3 - 5

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.5279	0.5611	0.130099	0.2319

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Est. Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.033209	0.004246	6.2906	0.4947	0.2630

	LOWER 90. % CI	UPPER 90. % CI
AVG F	0.424745	0.748696

Bootstrap Output Variable: Biomass
JAN-1 Biomass (2006) Mean Biomass & SSB (2005)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
JAN-1	47789.	48616.	4508.	0.0927
MEAN	42710.	43374.	3704.	0.0854
SSB	30558.	31056.	3130.	0.1008

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Est. Corrected For Bias	C.V. For Corrected Estimate
JAN-1	828.	145.	1.7323	46961.	0.0960
MEAN	664.	119.	1.5550	42046.	0.0881
SSB	498.	100.	1.6307	30060.	0.1041

	LOWER 90. % CI	UPPER 90. % CI
JAN-1	41567.	56850.
MEAN	37636.	50050.
SSB	26281.	36616.

Table 58. AGEPRO Projection results for summer flounder.

INPUT HARVEST SCENARIO:
MIXTURE OF F AND QUOTA BASED CATCHES

YEAR	F	QUOTA (THOUSAND MT)
2006		10.700
2007	0.276	
2008	0.276	
2009	0.276	
2010	0.276	

PROJECTION RESULTS:
PERCENTILES OF TOTAL STOCK BIOMASS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2006	38.292	41.365	42.953	45.276	48.003	51.462	54.314	56.613	59.041
2007	39.245	43.013	44.804	47.789	51.213	55.233	58.968	61.268	64.671
2008	45.853	49.523	51.420	54.494	58.108	62.190	66.231	68.674	73.663
2009	49.440	54.397	56.976	61.012	65.506	70.754	76.730	80.691	87.814
2010	52.272	57.853	60.843	65.596	70.994	77.460	84.638	88.855	97.226

PERCENTILES OF REALIZED F SERIES

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2006	0.266	0.282	0.297	0.321	0.349	0.378	0.406	0.427	0.472
2007	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276
2008	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276
2009	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276
2010	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276

PERCENTILES OF LANDINGS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2006	10.700	10.700	10.700	10.700	10.700	10.700	10.700	10.700	10.700
2007	6.448	7.311	7.705	8.341	9.026	9.950	10.699	11.305	11.910
2008	7.850	8.604	8.940	9.444	10.076	10.845	11.555	11.974	12.554
2009	9.160	9.948	10.380	11.004	11.733	12.577	13.464	14.083	15.281
2010	9.540	10.617	11.206	12.095	13.019	14.164	15.577	16.495	17.991

PERCENTILES OF DISCARDS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2006	0.631	0.670	0.693	0.731	0.780	0.829	0.879	0.912	0.988
2007	0.488	0.524	0.542	0.569	0.602	0.639	0.676	0.697	0.733
2008	0.548	0.606	0.648	0.698	0.737	0.790	0.866	0.961	1.030
2009	0.468	0.577	0.633	0.736	0.810	0.931	1.077	1.206	1.342
2010	0.473	0.592	0.654	0.754	0.847	0.978	1.131	1.245	1.408

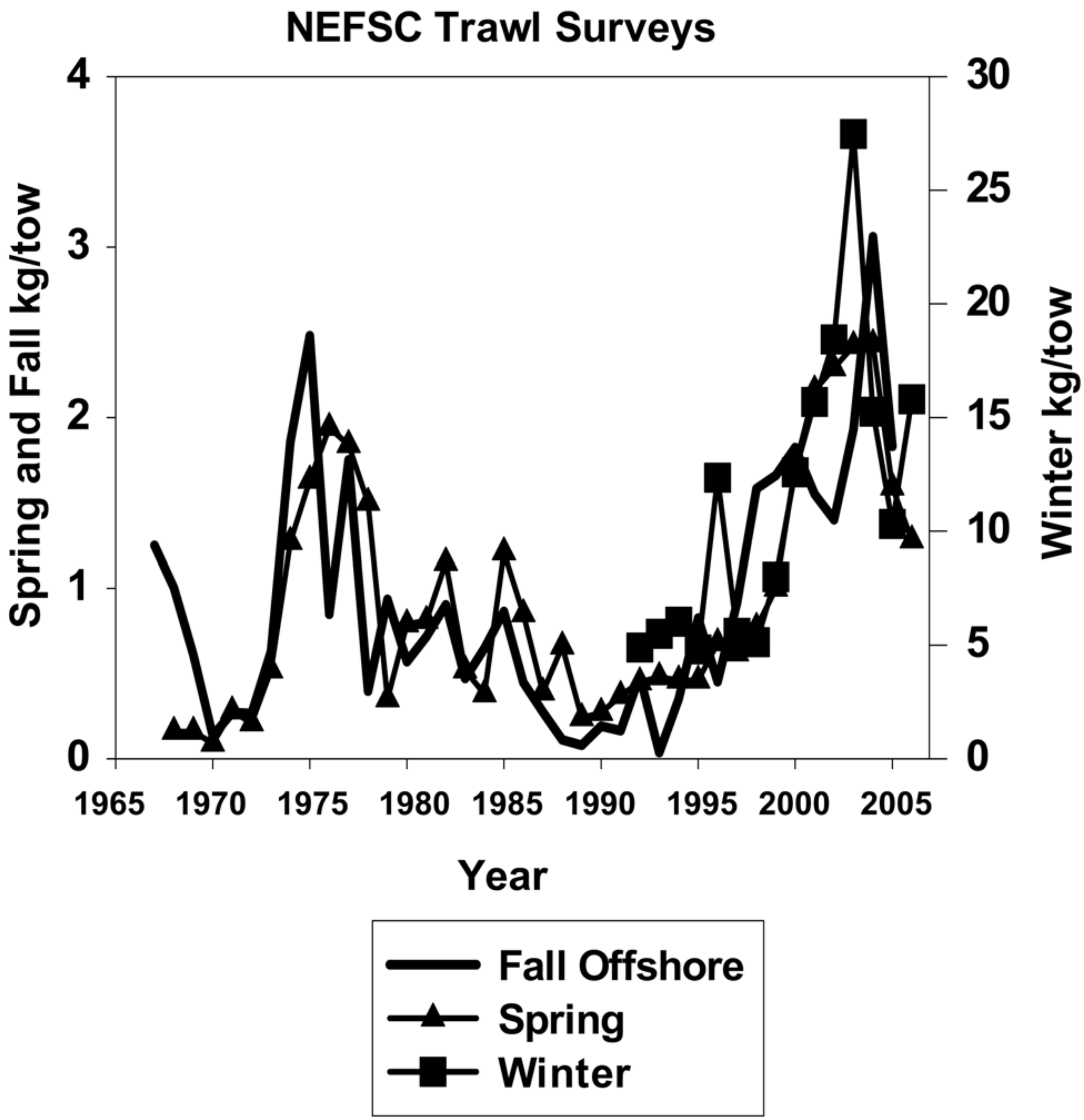

Figure 1. Trends in NEFSC trawl survey biomass indices for summer flounder.

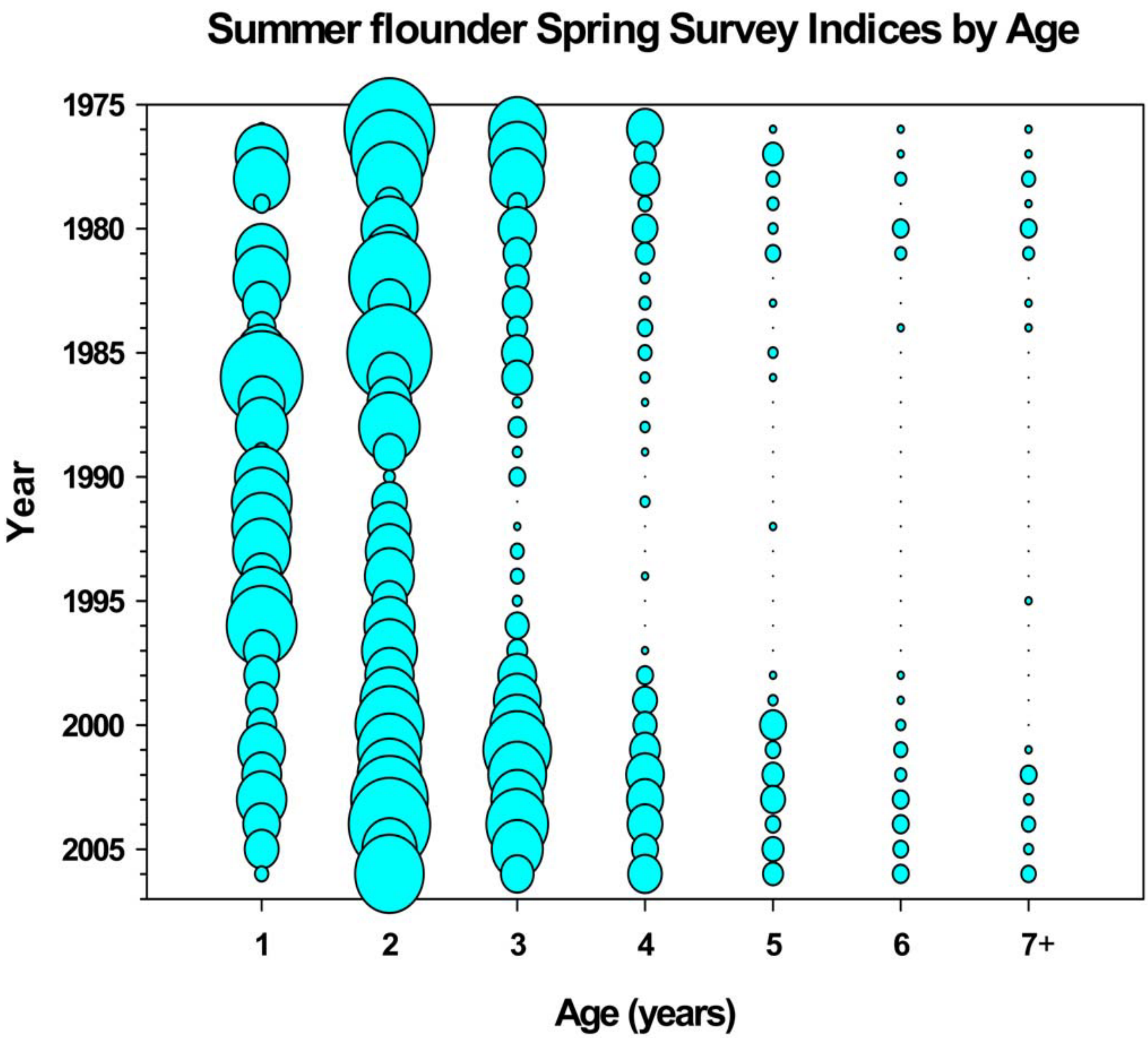

Figure 2. Age 1+ structure of the summer flounder population, 1976-2006.

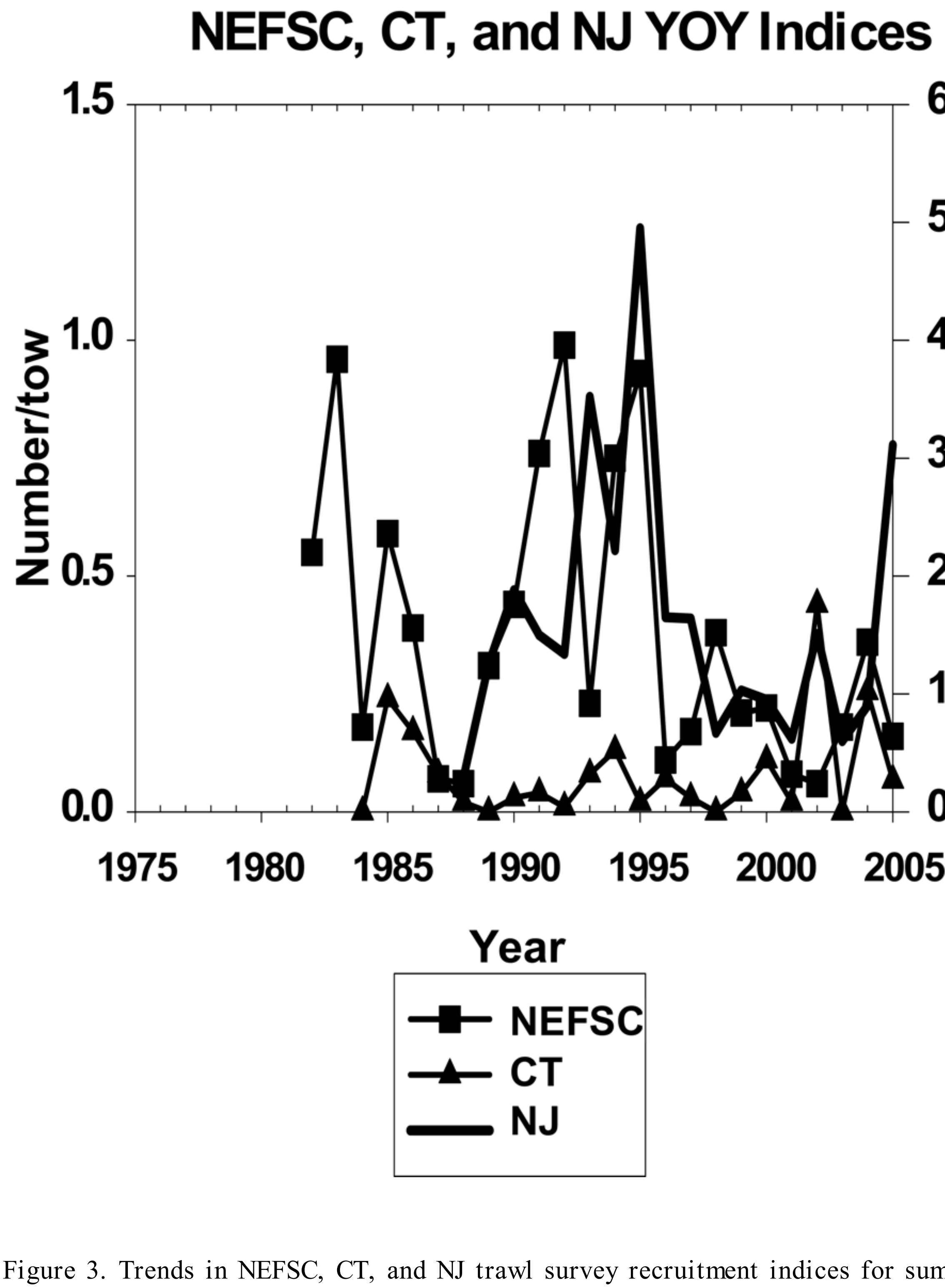

Figure 3. Trends in NEFSC, CT, and NJ trawl survey recruitment indices for summer flounder.

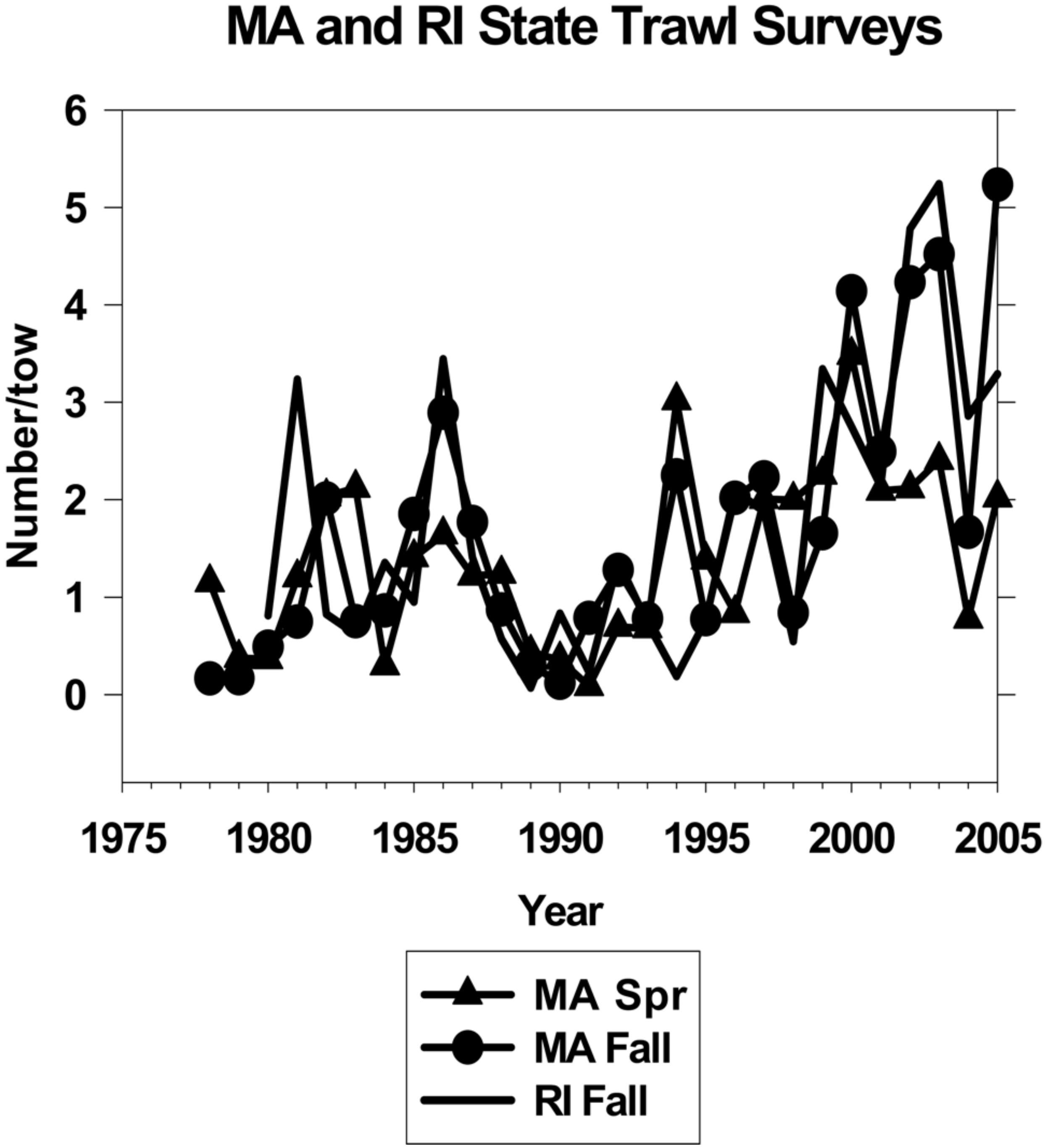

Figure 4. Trends in MA and RI trawl survey abundance indices for summer flounder

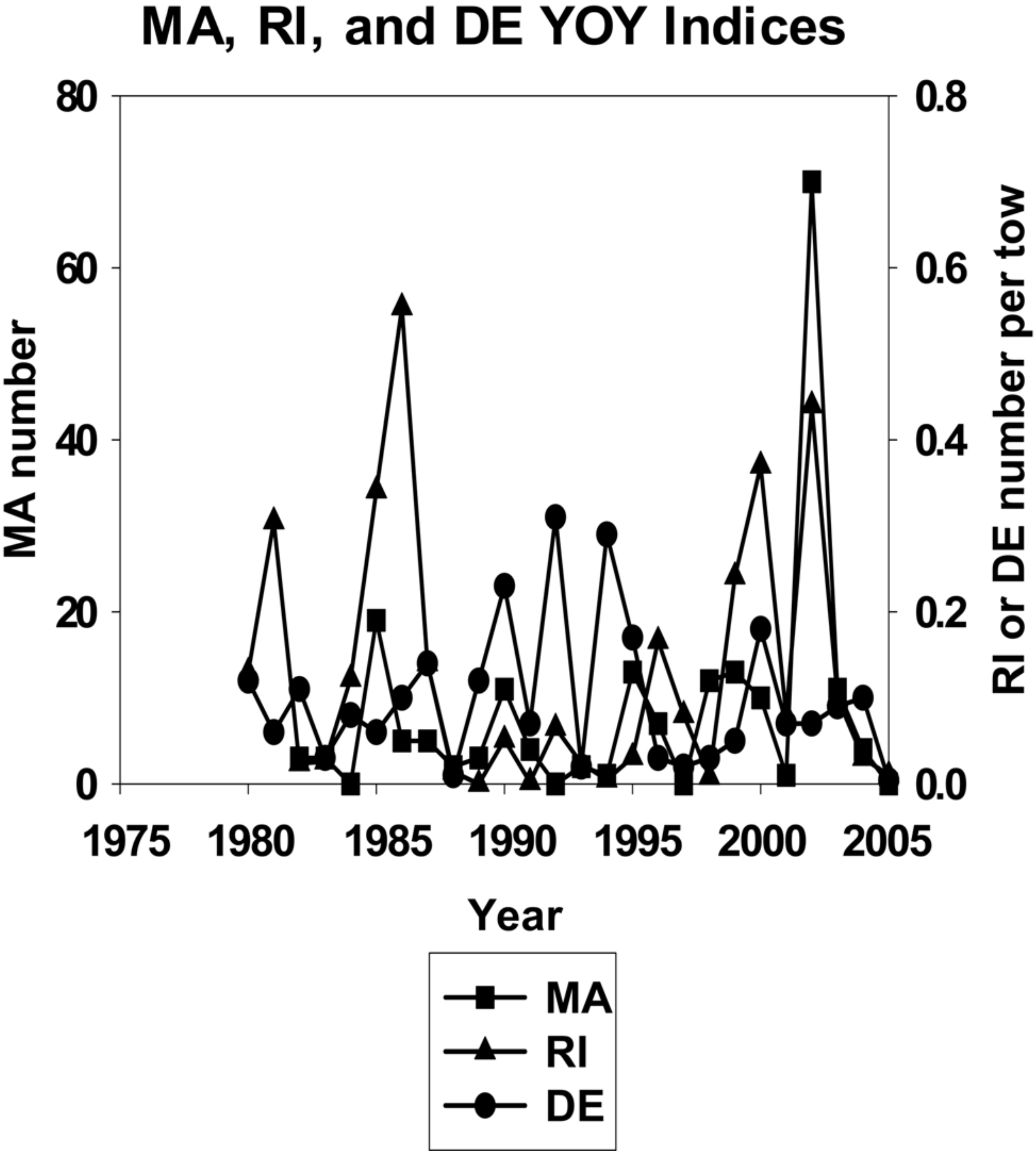

Figure 5. Trends in MA, RI, and DE survey recruitment indices for summer flounder.

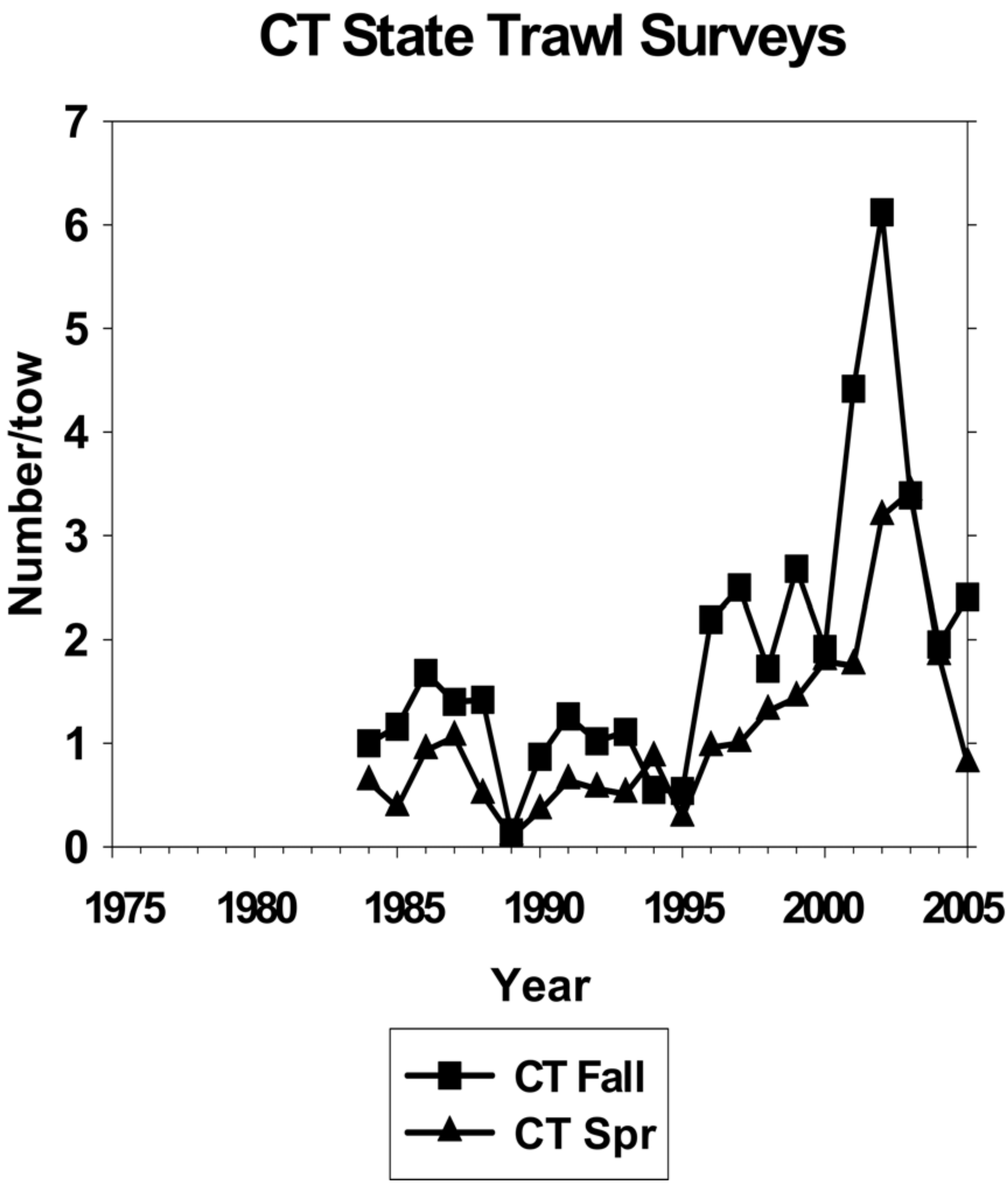

Figure 6. Trends in CT trawl survey abundance indices for summer flounder.

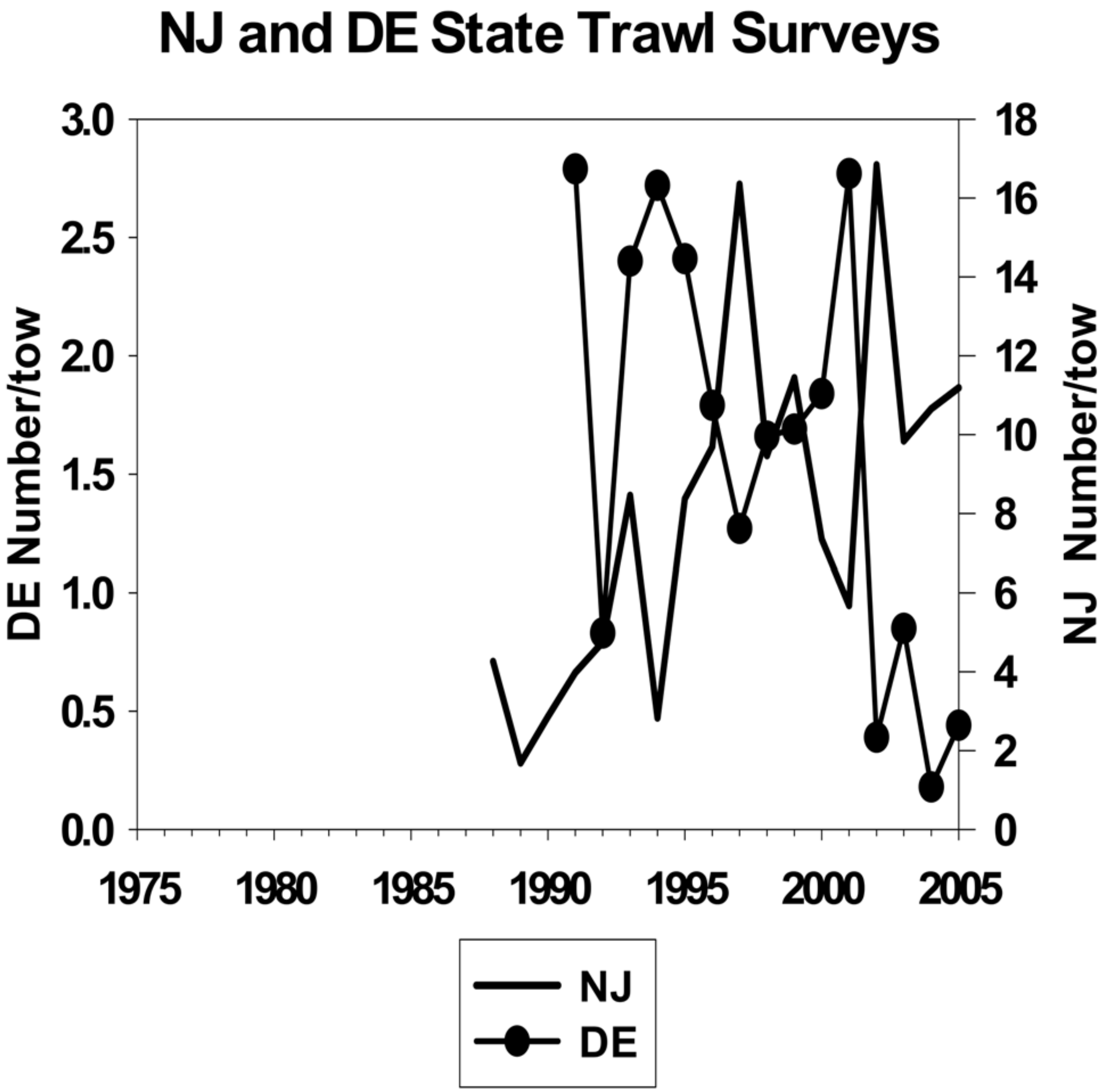

Figure 7. Trends in NJ and DE trawl survey abundance indices for summer flounder.

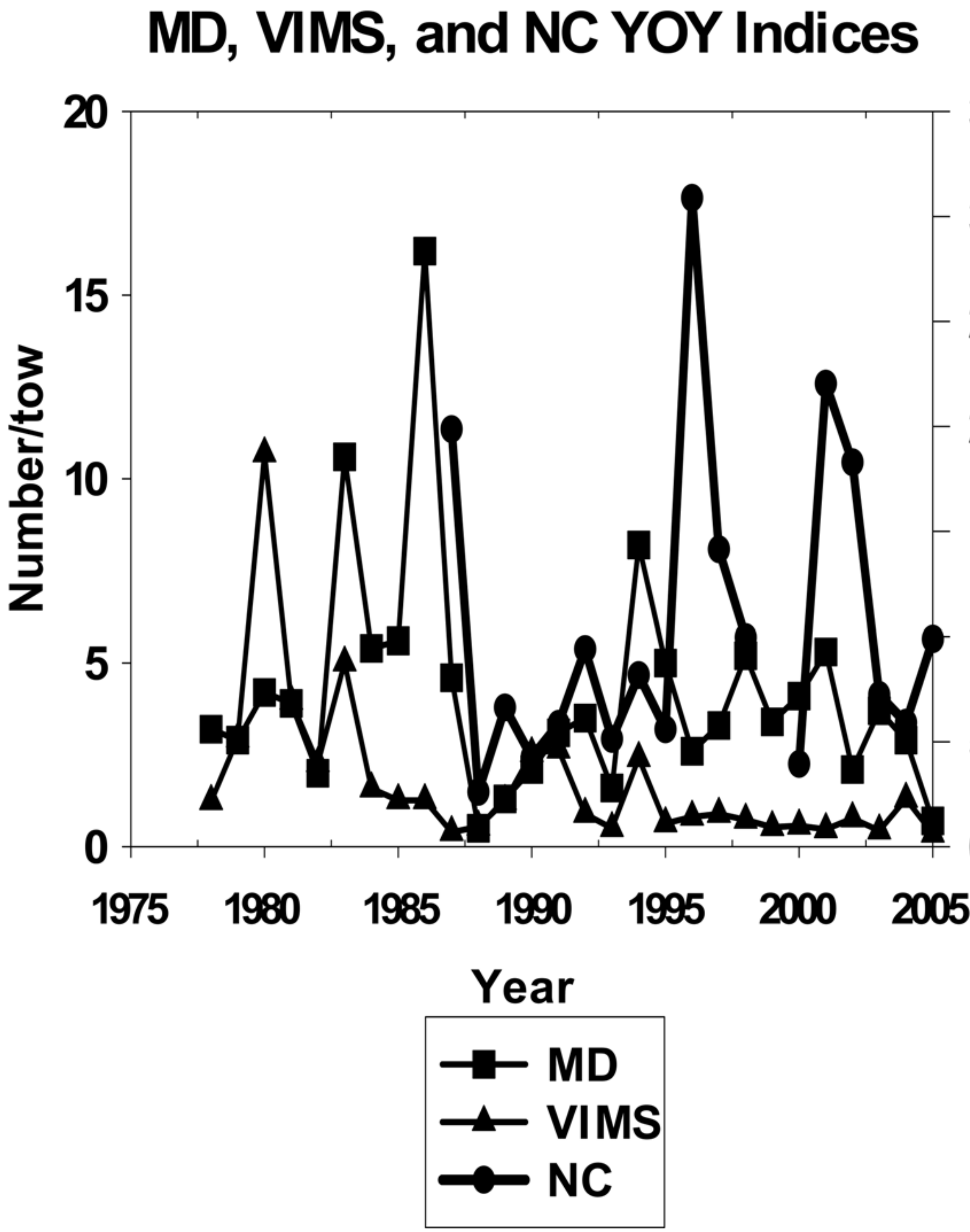

Figure 8. Trends in MD, VIMS, and NC trawl survey recruitment indices for summer flounder.

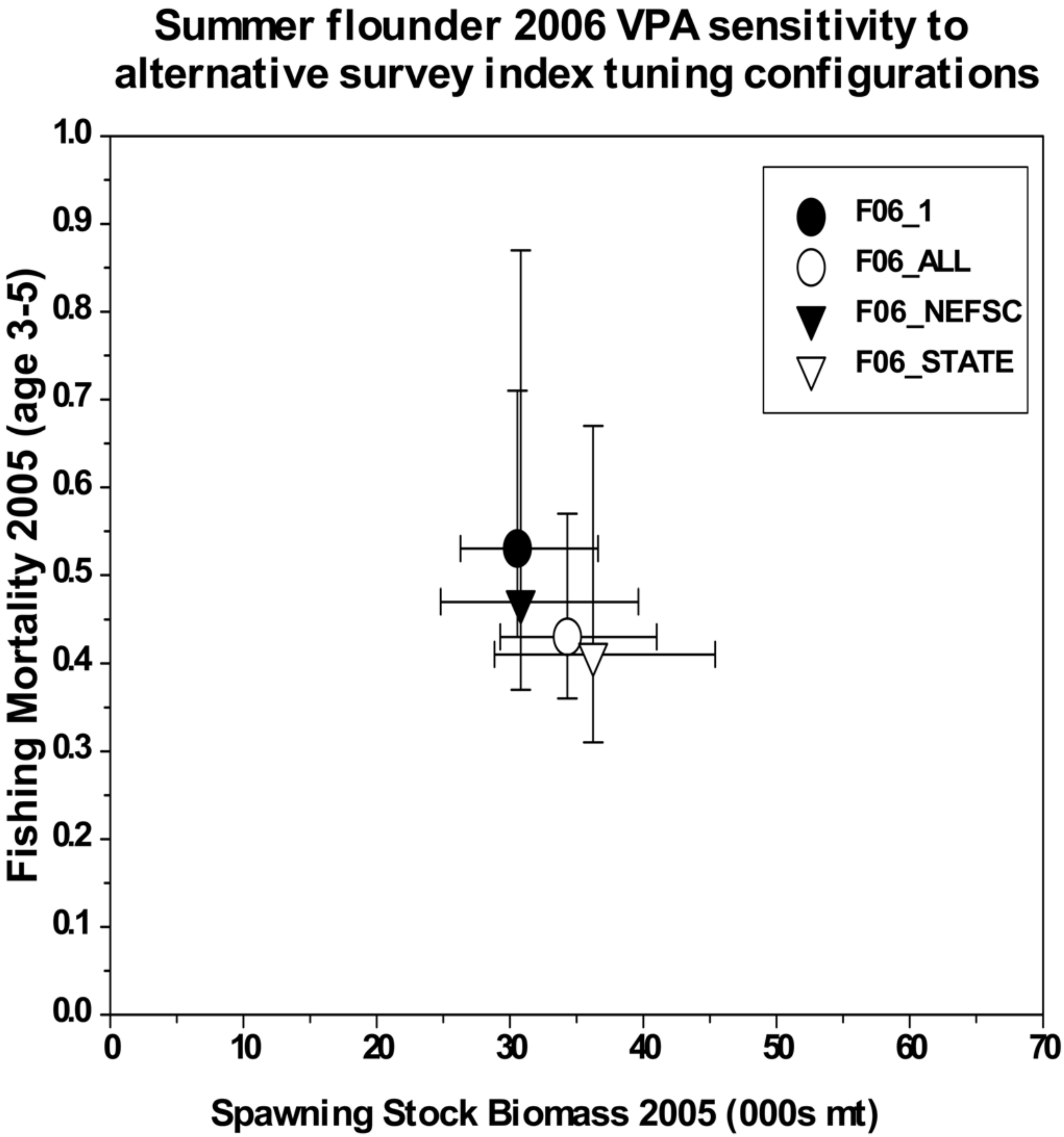

Figure 9. Sensitivity of summer flounder VPA estimates to alternative survey tuning index configurations.

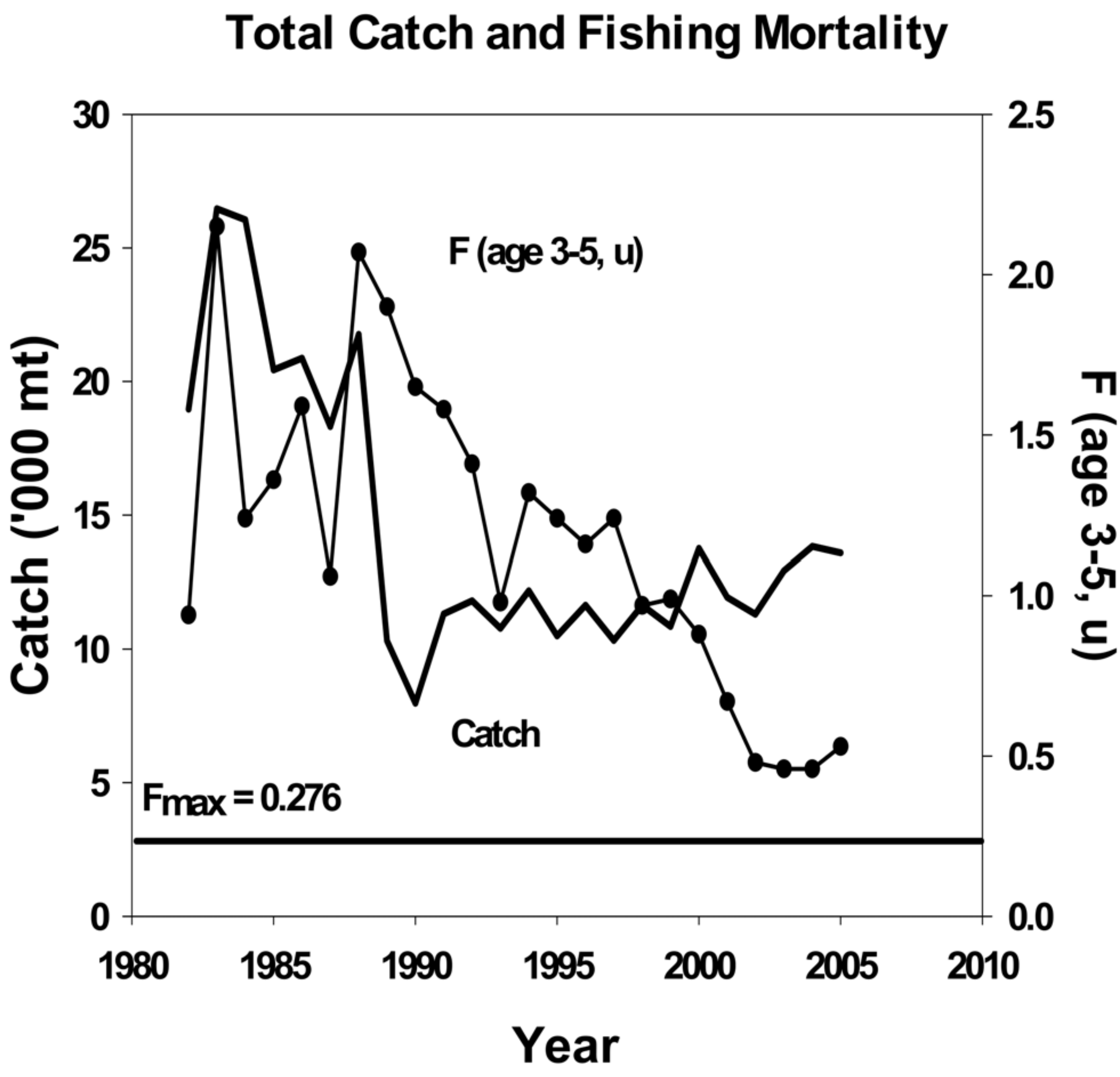

Figure 10. Total catch (landings and discards, thousands of metric tons) and fishing mortality rate (F, ages 3-5, unweighted) for summer flounder.

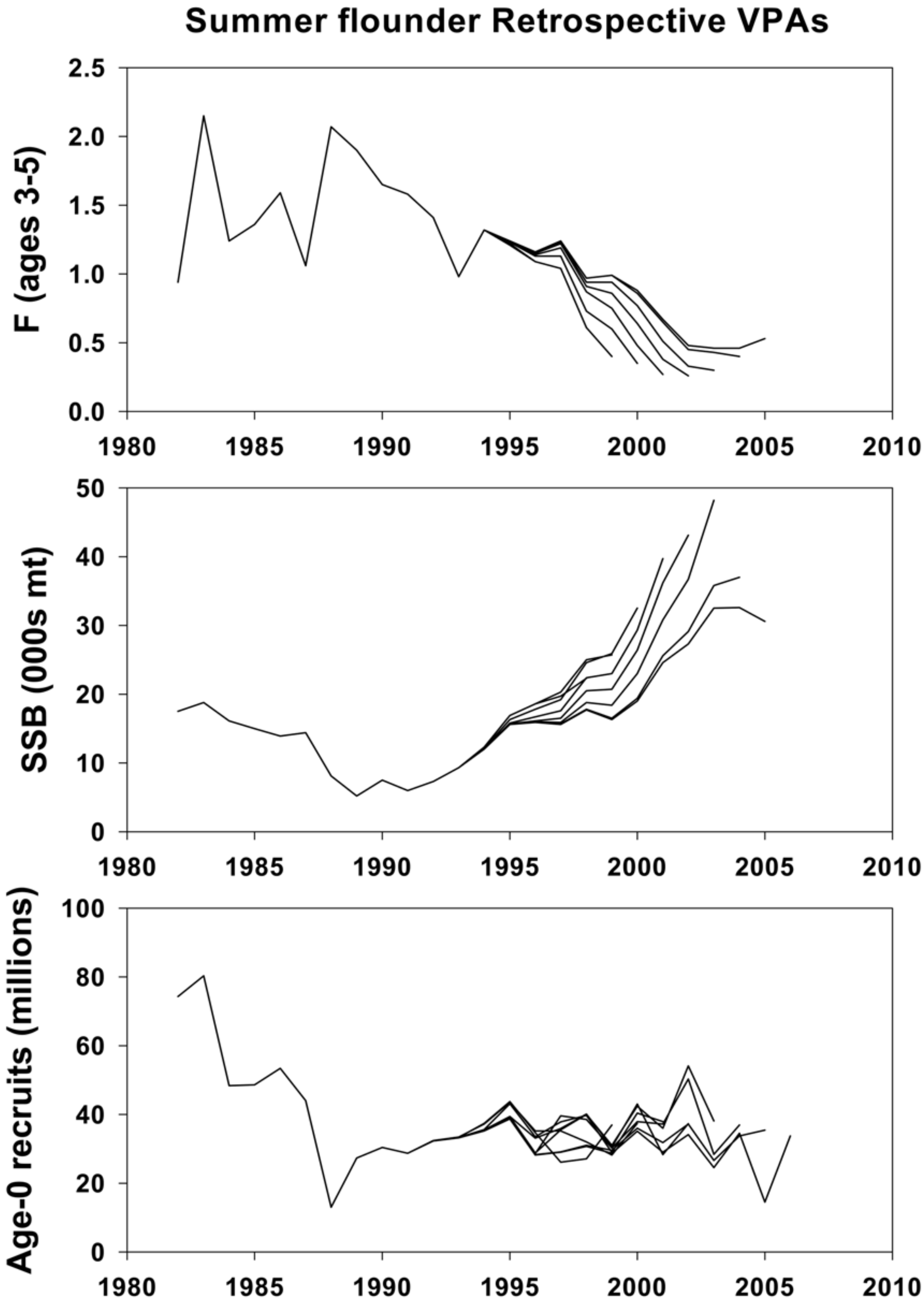

Figure 11. Retrospective VPAs for summer flounder.

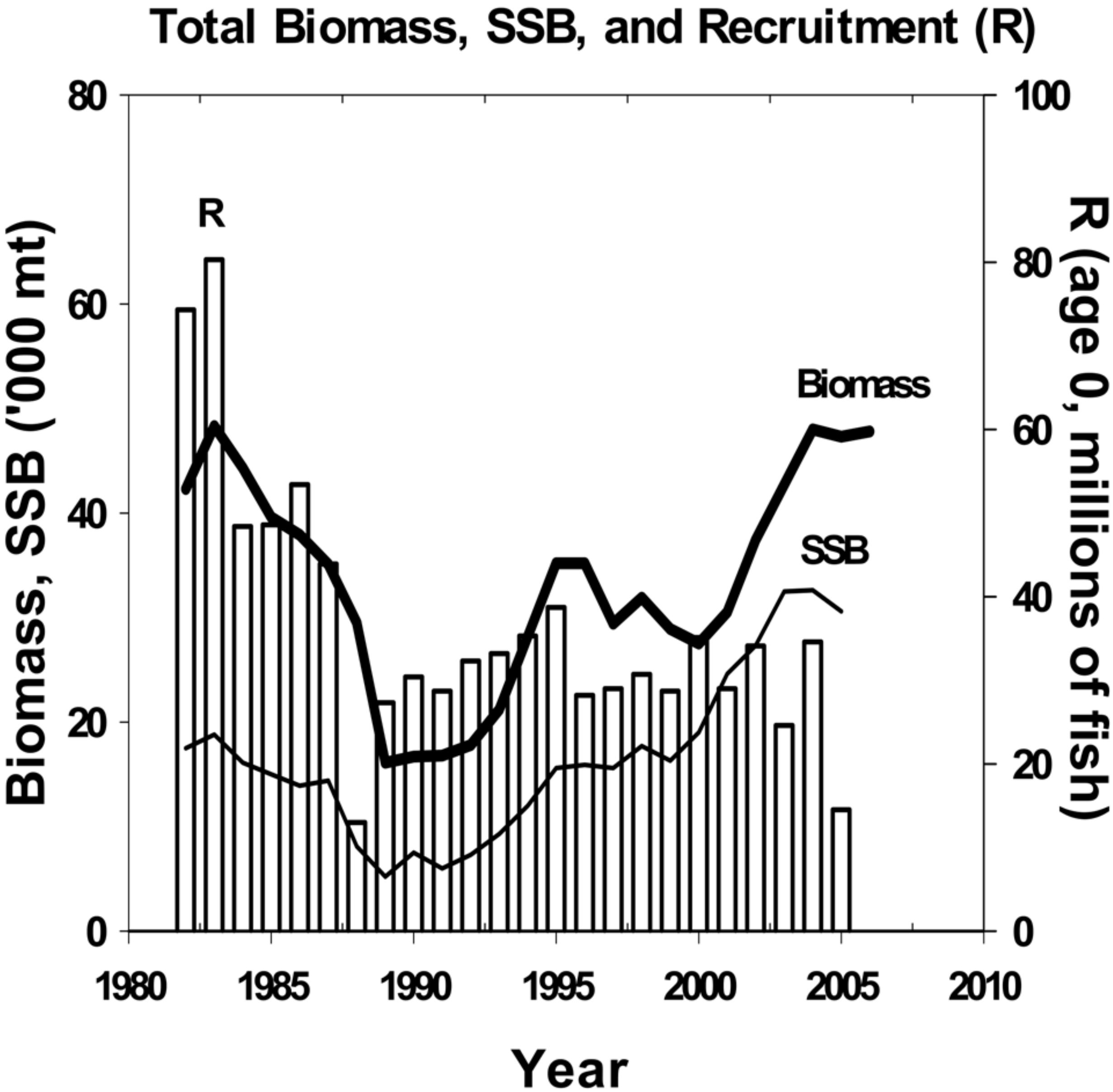

Figure 12. Total stock biomass ('000 mt; thick line), spawning stock biomass (SSB, '000 mt; thin line), and recruitment (millions of fish at age-0; bars) for summer flounder.

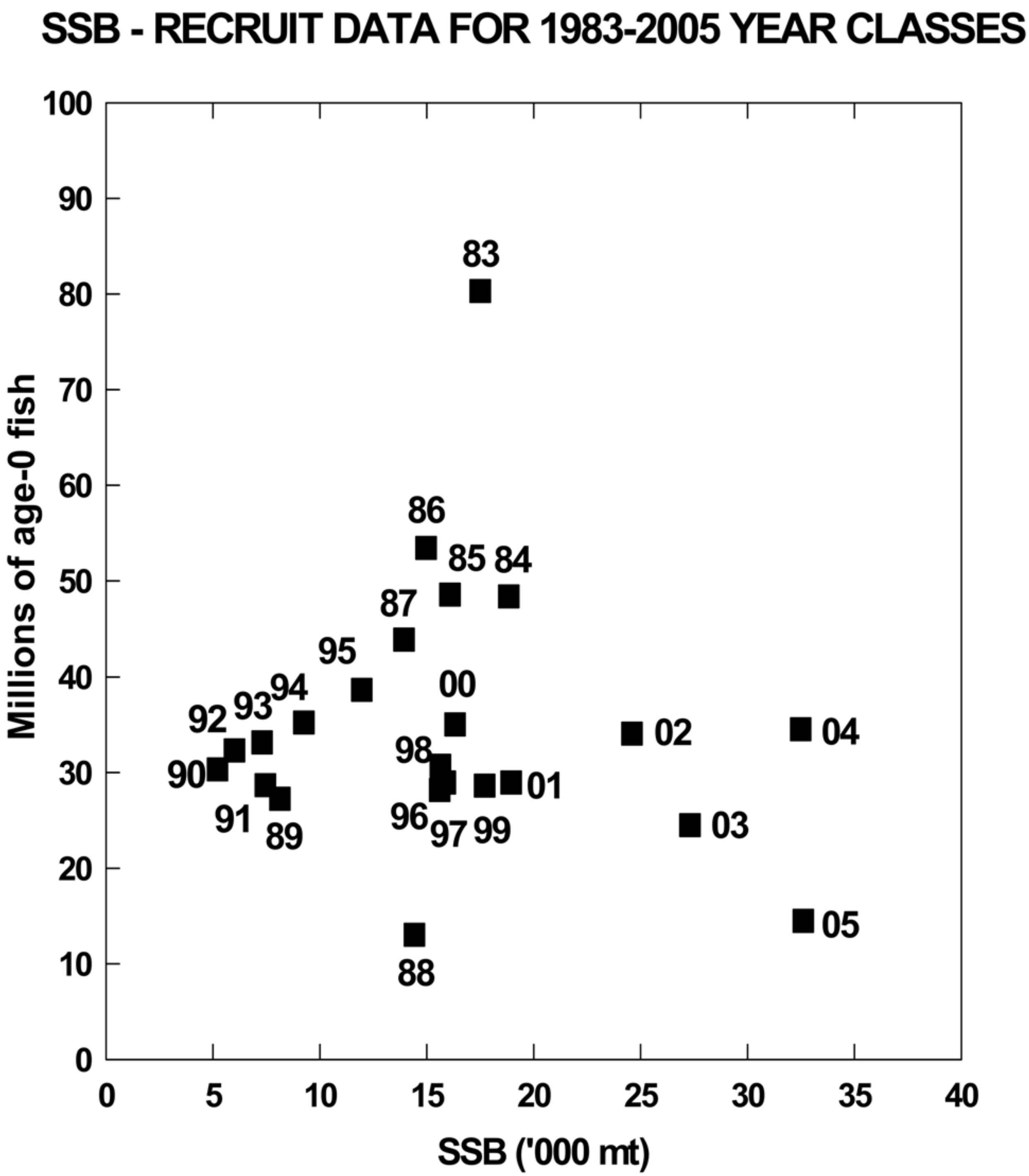

Figure 13. VPA spawning stock biomass and recruitment estimates for summer flounder.

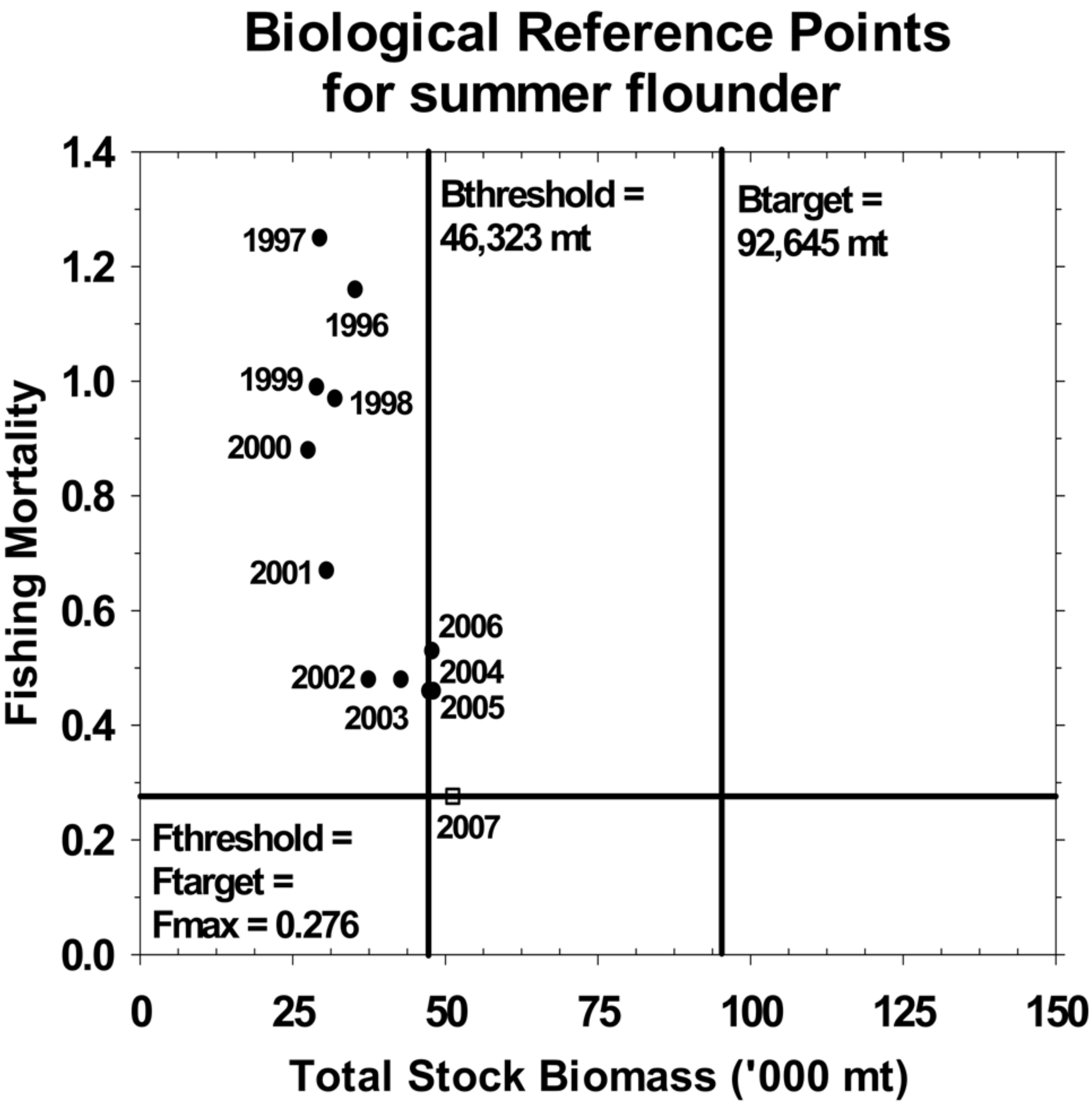

Figure 14. MAFMC FMP Amendment 12 SFA reference points for summer flounder, with 1996-2005/2006 VPA estimates of F and total stock biomass, and forecast estimates of F and total stock biomass.

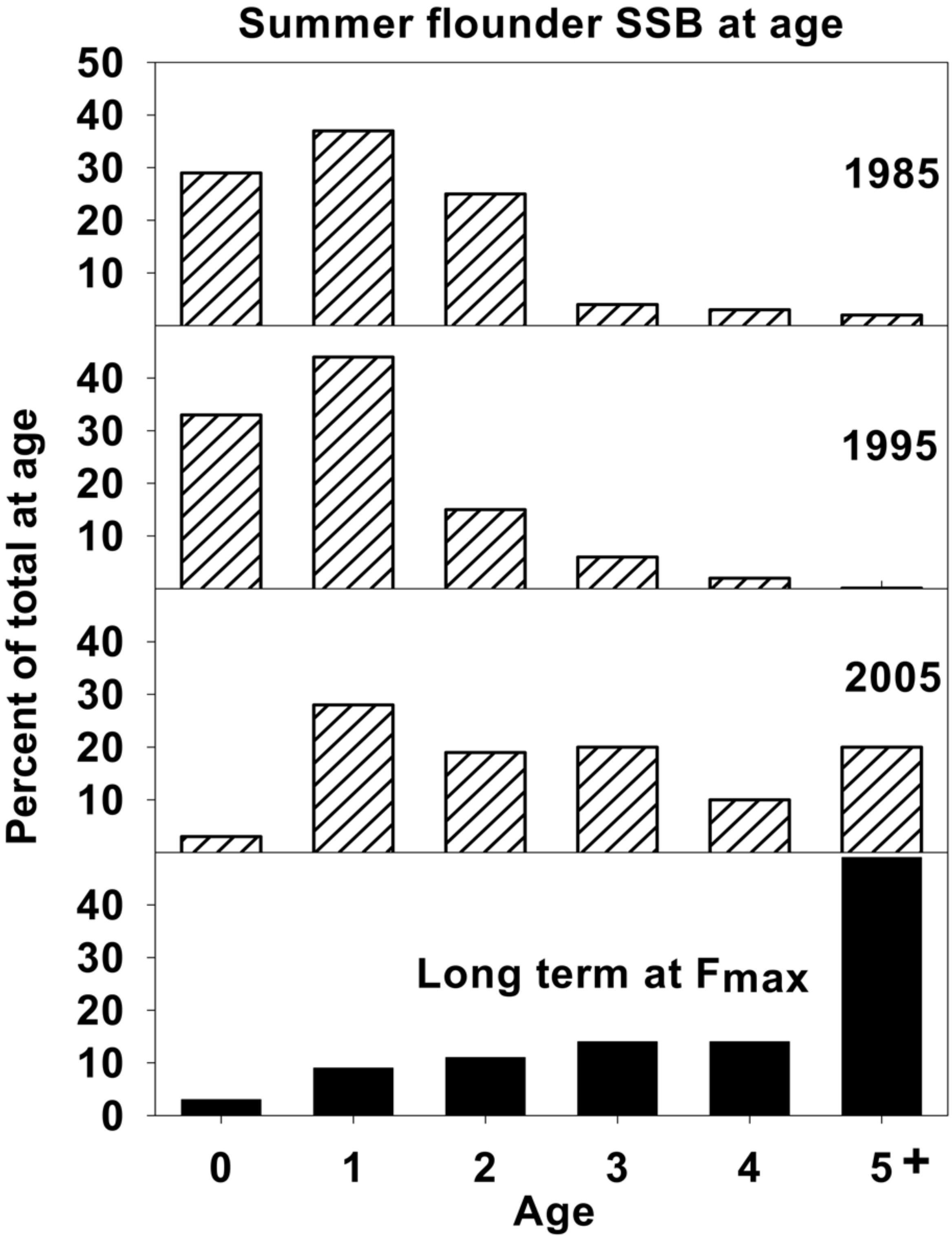

Figure 15. Percent of summer flounder spawning stock biomass (SSB) at age in 1985, 1995, 2005 and long-term at Fmax = 0.276.

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