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# *Stock Assessment of Scup for 2009*

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## EXECUTIVE SUMMARY

The 2008 Northeast Data Poor Stocks (DPS) Peer Review Panel accepted a revised stock assessment for scup using a statistical catch at age model as the basis for biological reference points and status determination, with fishery and survey catch data through 2007. The new model of scup population dynamics provided a more stable tool for monitoring stock status and specifying annual fishery regulations than the previous single index-based model. This 2009 assessment update uses the same model configuration as the 2008 DPS assessment, with fishery and survey catch information through 2008. The 2009 evaluation of stock status is made with respect to the 2008 DPS biological reference points.

The 2008 DPS Panel recommended F40% as the proxy for FMSY, and the corresponding SSBF40% as the proxy for SSBMSY. The proxy for FMSY = 0.177, the proxy estimate for SSBMSY = 92,044 mt, and the proxy estimate for MSY = 16,161 mt (13,134 mt of landings, 3,027 mt of discards). Fishing mortality varied between F = 0.1 and F = 0.3 during the 1960s and 1970s, and then increased during the 1980s and early 1990s, peaking at about F = 1.0 in 1994. Fishing mortality decreased after 1994, falling to less than F = 0.1 since 2003, with F in 2008 = 0.048, well below the FMSY proxy. There is a 50% chance that F in 2008 was between 0.041 and 0.066. Spawning stock biomass (SSB) decreased from about 100,000 mt in 1963 to about 50,000 mt in 1969, then increased to about 75,000 mt during the late 1970s. SSB declined through the 1980s and early 1990s to less than 5,000 mt in the mid-1990s. With greatly improved recruitment and low fishing mortality rates since 1998, SSB increased to about 188,000 mt in 2008, well above the SSBMSY proxy. There is a 50% chance that SSB in 2008 was between 180,000 and 196,000 mt. Recruitment at age 0 averaged 92 million fish during 1963-1983, the period in which recruitment estimates are influenced mainly by the assessment model stock-recruitment relationship. Since 1984, recruitment estimates from the model are influenced mainly by the fishery and survey catches at age, and recruitment at age 0 has averaged 110 million fish during 1984-2008. The 1999 and 2000 year classes are estimated to be the largest of the time series, at 218 and 267 million age 0 fish. Recruitment exceeded the 1984-2008 average of 110 million in 2001, 2004-2006, and 2008. There is no consistent retrospective pattern in F, SSB, or recruitment evident in the 2009 updated assessment model. While the MSY estimate appears feasible given historical evidence from the fishery, the 2008 DPS Panel and 2009 Southern Demersal Working Group both advised that a gradual increase in the TAC/TAL toward the MSY level would facilitate an evaluation of the performance of the new assessment model and BRPs in monitoring stock status, while reducing the risk to the stock due to rapidly increased catch.

## INTRODUCTION

The Stock Assessment Workshop (SAW) Southern Demersal Working Group (SDWG) met on June 18, 2009 by conference call to review the assessment of scup updated with data through 2008. The following scientists and managers contributed data compilations and expertise to the assessment:

| | |
|---|---|
| Erin Bohaboy | University of Rhode Island Graduate School of Oceanography (URIGSO) |
| Chris Bonzak | Virginia Institute of Marine Science (VIMS) |
| Jeff Brust | New Jersey Department of Fish and Wildlife (NJDFW) |
| Don Byrne | New Jersey Department of Fish and Wildlife (NJDFW) |
| Paul Caruso | Massachusetts Division of Marine Fisheries (MADMF) |
| Jessica Coakley | Mid-Atlantic Fishery Management Council (MAFMC) |
| Scott Crosson | North Carolina Division of Marine Fisheries (NCDMF); Mid-Atlantic Fishery Management Council (MAFMC) Scientific and Statistical Committee (SSC) |
| Toni Kerns | Atlantic States Marine Fisheries Commission (ASMFC) |
| Cynthia Jones | Old Dominion University; Mid-Atlantic Fishery Management Council (MAFMC) Scientific and Statistical Committee (SSC) |
| Jason McNamee | Rhode Island Division of Fish and Wildlife (RIDFW) |
| Tom Miller | University of Maryland; Mid-Atlantic Fishery Management Council (MAFMC) Scientific and Statistical Committee (SSC) |
| Rob O'Reilly | Virginia Marine Resource Commission |
| Eric Powell | Rutgers University |
| Mike Ruccio | National Marine Fisheries Service (NMFS) Northeast Regional Office (NERO) |
| Mark Terceiro | National Marine Fisheries Service (NMFS) Northeast Fisheries Science Center (NEFSC) |
| Alice Weber | New York Department of Environmental Conservation (NYDEC) |
| Greg Wojcik | Connecticut Department of Environmental Protection (CTDEP) |

## BACKGROUND

### Biology

Scup (*Stenotomus chrysops*) is a schooling continental shelf species of the Northwest Atlantic that is distributed primarily between Cape Cod and Cape Hatteras (Morse 1978). Scup undertake extensive migrations between coastal waters in summer and offshore waters in winter. Scup migrate north and inshore to spawn in spring, with larger scup (age 2 and older) tending to arrive in spring first, followed by smaller scup (Neville and Talbot 1964; Sisson 1974). Larger

scup are found during the summer near the mouth of larger bays and in the ocean within 20-fathoms, and often inhabit rough bottom areas. Smaller scup are more likely to be found in shallow, smooth bottom areas of bays during summer (Morse 1978). Scup migrate south and offshore in autumn as the water temperature decreases, arriving in offshore wintering areas by December (Hamer 1970; Morse 1978).

Spawning occurs from May through August and peaks in June. About 50% of age-2 scup are sexually mature (about 17 cm total length; Morse 1978), while nearly all scup of age 3 and older are mature. Scup reach a maximum fork length of at least 41 cm and a maximum age of at least 14 years, with a likely maximum of 20 years (Dery and Rearden 1979). The largest and oldest scup sampled in NEFSC surveys (1973, 1978) were fish 38-41 cm (fork length) and 14 years old. The largest and oldest scup in NEFSC commercial fishery samples (1974) was 40 cm (fork length) and 14 years old. The instantaneous natural mortality rate (M) for scup has been assumed to be 0.20 (Crecco *et al.* 1981, Simpson *et al.* 1990) in this and all previous stock assessments.

**Fishery Management**

The MAFMC and ASMFC jointly manage scup under Amendment 8 (1997) to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP). The assessment and management unit includes all scup from Cape Hatteras, NC north to the US-Canada border. Tagging studies (e.g., Neville and Talbot 1964; Cogswell 1960, 1961; Hamer 1970, 1979) have indicated the possibility of two stocks of scup, one in Southern New England waters and another extending south from New Jersey waters. However, the lack of definitive locations for tag return data coupled with distributional data from the NEFSC bottom trawl surveys supports the concept of a single unit stock (Mayo 1982).

Amendment 8 to the FMP established a recovery plan for scup under which exploitation rates were to be reduced to 47% (F=0.72) during 1997-1999, to 33% (F=0.45) during 2000-2001, and to 21% (F=0.26) during 2002-2007. These goals were to be attained through implementation of a Total Allowable Catch (TAC) that included a commercial quota and a recreational harvest limit, commercial fishery minimum net mesh, trap vent and fish sizes and closed areas, and recreational fishery minimum fish sizes, possession limits, and closed seasons.

Amendment 12 (1998) to the FMP established a biomass threshold (a proxy for one-half BMSY) for scup based on the three-year moving average of the NEFSC spring bottom trawl survey index of Spawning Stock Biomass (SSB) during 1977-1979, which was perceived to be a period when the stock was near one-half BMSY. The scup stock was considered to be overfished when the SSB index fell below a value of 2.77 SSB kg per tow. Amendment 12 defined overfishing for scup to occur when the fishing mortality rate exceeded the threshold fishing mortality of Fmax = 0.26 (as a proxy for FMSY).

Broad scale Gear Restricted Areas (GRAs) for scup were implemented in November 2000 under the framework provisions of the FMP to reduce discards of scup in small mesh fisheries for *Loligo* squid and silver hake. Two Northern Areas off Long Island were implemented for November through January, while a Southern Area off the mid-Atlantic coast was implemented for January through April. The size and boundaries of the GRAs were modified in late 2000 and again in 2005 in response to commercial fishing industry recommendations.

Amendment 14 (2007) to the FMP defined the biomass target and implemented a stock rebuilding plan for scup. The stock was to fully rebuild to the biomass target by January 1, 2015.

The proxy for BMSY was two times the 3-year moving average of the NEFSC spring index of SSB during 1977-1979 noted earlier, or 2*2.77 = 5.54 SSB kg per tow. A target fishing mortality rate of F = 0.10 was to be applied in each year of a 7 year rebuilding period beginning in 2008. A TAC of 4,491 mt (9.90 million lbs) and corresponding Total Allowable Landings (TAL) of 3,329 mt (7.34 million lbs) were established for 2008 to achieve the target F.

The current overfished and overfishing definitions are based on revisions to the FMP through Framework 7 (2007) and use the values established in Amendments 12 (1998) and 14 (2007) as follows:

> "The maximum fishing mortality threshold for each of the species under the FMP is defined as FMSY (or a reasonable proxy thereof) as a function of productive capacity, and based upon the best scientific information consistent with National Standards 1 and 2. Specifically, FMSY is the fishing mortality rate associated with MSY. The maximum fishing mortality threshold (FMSY) or a reasonable proxy may be defined as a function of (but not limited to): total stock biomass, spawning stock biomass, total egg production, and may include males, females, both, or combinations and ratios thereof which provide the best measure of productive capacity for each of the species managed under the FMP. Exceeding the established fishing mortality threshold constitutes overfishing as defined by the Magnuson-Stevens Act."

> "The minimum stock size threshold for each of the species under the FMP is defined as one-half BMSY (or a reasonable proxy thereof) as a function of productive capacity, and based upon the best scientific information consistent with National Standards 1 and 2. The minimum stock size threshold (one-half BMSY) or a reasonable proxy may be defined as a function of (but not limited to): total stock biomass, spawning stock biomass, total egg production, and may include males, females, both, or combinations and ratios thereof which provide the best measure of productive capacity for each of the species managed under the FMP. The minimum stock size threshold is the level of productive capacity associated with the relevant one-half MSY level. Should the measure of productive capacity for the stock or stock complex fall below this minimum threshold, the stock or stock complex is considered overfished. The target for rebuilding is specified as BMSY (or reasonable proxy thereof) at the level of productive capacity associated with the relevant MSY level, under the same definition of productive capacity as specified for the minimum stock size threshold."

**Stock Assessment**

A peer-reviewed assessment including an analytical population model was accepted in 1995 by SAW 19 (NEFSC 1995). The assessment featured a virtual population analysis (VPA) modeled in the ADAPT framework (Conser and Powers 1990), with commercial and recreational landings and discards at age estimates, and with state and NEFSC abundance indices used for calibration. The 1995 SAW 19 assessment indicated that F in 1993 was 1.3, and SSB was 4,600 mt. A yield per recruit (YPR) analysis indicated that Fmax = 0.236.

The VPA was updated through 1996 and reviewed by the 1997 SAW 25 (NEFSC 1997), but due to concerns over the low intensity of fishery length sampling in the 1990s, uncertainty about the magnitude of commercial discards in the late 1990s, and the ongoing high variability and imprecision of survey indices, the VPA was not accepted as a basis for management decisions. Assessment conclusions were therefore based primarily on trends in NEFSC and state

agency survey indices and catch curve analyses using those survey data. The 1997 SAW 25 was able to conclude that in 1996 scup were "over-exploited and near record low abundance levels."

The scup assessment was next updated through 1997 and reviewed by the 1998 SAW 27 (NEFSC 1998). Several configurations of a surplus production model (ASPIC; Prager 1994) were reviewed in addition to an updated VPA, but like the VPA, the production model results were not accepted due to concerns over the validity of the input fishery and survey data. An updated YPR analysis was accepted and indicated that Fmax = 0.26. The 1998 SAW 27 concluded that "A VPA or other analytical model formulation for scup will not be feasible until the quality of the input data, particularly the precision of discard estimates, is significantly improved" and that scup was "over exploited and at a low biomass level."

The 1998 SAW 27 Panel recommended the scup assessment be based on the long-term time series of NEFSC trawl survey indices and fishery catches. The Panel noted that commercial landings were sustained at about 19,000 mt annually during the mid-1950s to mid-1960s, and concluded that the stock was likely near BMSY during that period (Figure 1). The nearest subsequent peak in NEFSC survey indices occurred in the late 1970s. Commercial and total fishery catches in the late 1970s were about one-half of those in the 1950s to 1960s, and so the late 1970s were identified as a period when the stock was likely to have been near one-half of BMSY. The Panel considered the NEFSC spring survey series to be most representative of SSB, since older ages were better represented in the age structure than in the NEFSC fall survey or other state agency surveys. The 1998 SAW 27 Panel recommended that the three-year moving average of the NEFSC spring bottom trawl survey index of SSB during 1977-1979 (2.77 SSB kg per tow) be used as the proxy biomass threshold (one-half BMSY) and that Fmax = 0.26 be used as the proxy fishing mortality threshold (FMSY). Those recommendations were subsequently adopted for the Biological Reference Points (BRPs) in Amendment 12 to the FMP.

The scup assessment was next updated through 1999 and reviewed by the 2000 SAW 31 (NEFSC 2000). The assessment continued to be based on trends in research survey indices and fishery catches and indicated that the stock was overfished and that overfishing was occurring. The stock assessment was reviewed again by the 2002 SAW 35 and included fishery data through 2001 (NEFSC 2002). The assessment was again based on trends in research survey indices and fishery catches, but indicated that the stock was no longer overfished, although the 2002 SAW 35 Panel concluded that "stock status with respect to the overfishing definition cannot currently be evaluated," due to the uncertainty of F estimates derived from research survey catch curve calculations. The 2002 SAW 35 Panel found sufficient evidence to conclude that "The relative exploitation rates have declined in recent years..." and that "Survey observations indicated strong recruitment and some rebuilding of age structure."

During 2002-2008, the status of the stock was evaluated by the MAFMC Monitoring Committee using trends in research survey indices and fishery catches. A relative exploitation index based on the annual total fishery landings and the NEFSC spring three-year average SSB index was used as a proxy for F to monitor status with respect to overfishing and provide guidance to the specification of the annual TAC. A projection of the NEFSC spring survey SSB index using assumptions about maturity, partial recruitment to the survey, and the level of future recruitment as indexed by the NEFSC spring survey at age 1 was used in Amendment 14 to the FMP to forecast stock rebuilding and set the F target for 2008-2105. An update to the status monitoring metrics was completed in 2008 to aid in the specification of fishery regulations for 2009. The update indicated that while the stock was overfished in 2007, the exploitation rate was at about the F target, suggesting that overfishing was not occurring in 2007. However, the

stock rebuilding progress was slower than forecast by the Amendment 14 projection, with the NEFSC spring 2007 SSB index (three-year average = 1.16 kg per tow) at only 56% of the projected 2007 index (2.08 kg per tow).

The most recent peer review of the scup assessment was conducted by the 2008 Northeast Data Poor Stocks (DPS) Peer Review Panel, which accepted an ASAP statistical catch at age (SCAA) model (NFT 2008a) as the basis for biological reference points and status determination, with fishery and survey catch data through 2007. The new model of scup population dynamics was expected to provide a more stable tool for monitoring stock status and specifying annual fishery regulations than the previous single index-based model. The assessment indicated that the stock was not overfished and overfishing was not occurring in 2008, relative to the revised biological reference points. Fishing mortality was estimated to have decreased rapidly after 1994, with F in 2007 = 0.054. With greatly improved recruitment and relatively low fishing mortality rates since 1998, SSB was estimated to have steadily increased to about 119,300 mt in 2007. There was no consistent retrospective pattern in F, SSB, or recruitment evident in the 2008 assessment model (NEFSC 2009). This 2009 assessment update uses the same model configuration as the 2008 DPS assessment, with fishery and survey catch information through 2008. The 2009 evaluation of stock status is made with respect to the 2008 DPS biological reference points.

## COMMERCIAL LANDINGS

US total commercial landings averaged over 18,000 mt per year from 1950 to 1965, peaking at over 22,000 mt in 1960, and then decreased to less than 10,000 mt per year in the late 1960s. Landings fluctuated between about 5,000 and 10,000 mt from 1970 to the early 1990s and then decreased to about 1,200 mt in 2000, less than 6% of the peak observed in 1960. Commercial landings have since increased to average about 4,200 mt during 2003-2008 (Figure 1). About eighty percent of the commercial landings of scup for the period 1979-2008 were in Rhode Island (38%), New Jersey (26%), and New York (16%; Table 1). The otter trawl is the principal commercial fishing gear, accounting for about 75% of the total catch during 1979-2008 (Table 2). The remainder of the commercial landings is taken by floating trap (11%) and hand lines (7%), with paired trawl, pound nets, and pots and traps each contributing between 1 and 4%.

## COMMERCIAL DISCARDS

The NEFSC Fishery Observer Program has collected information on landings and discards in the commercial fishery for 1989-2008. Northeast Region (NER; ME-VA) discard estimates were raised to account for North Carolina landings. A discard mortality rate of 100% was assumed because there are no published estimates of scup discard mortality rates. This assumption is based on limited observations and is a point of contention between scientists and fishermen. Previous peer reviews of the assessment have recommended that research be conducted to better characterize the discard mortality rate of scup in different gear types in order to more accurately quantify the absolute magnitude of scup discard mortality (NEFSC 1995, 1997, 1998, 2000, 2002, 2009). Quantifying discards from the commercial fishery is necessary for a reliable scup assessment, but low sample sizes in the past have resulted in uncertain estimates. Despite the uncertainty of the discard data, recent peer review panels have concluded that commercial discarding of scup has been high during most of the last 20 years, generally

approaching or exceeding the commercial landings. Since the implementation of the GRAs in 2000, estimated discards as a proportion of the total commercial catch have decreased, averaging about 35%.

Commercial discards for scup are estimated using geometric mean discards to landings (GMDL) ratios. Ratios of discards to landings by landings level (for trip landings < 300 kg (661 lbs), the "bycatch fishery"; or => 300 kg, the "directed fishery") and half-year are calculated and multiplied by corresponding observed landings from the NEFSC Dealer Report database to provide estimates of discards. Geometric mean rates (re-transformed, uncorrected, mean ln-transformed Discards to Landings per trip) are used because the distributions of landings, discards and the ratio of discards to landings on a per-trip basis in the scup fishery are highly variable and positively skewed. Observed trips with both scup landings and discard were used to calculate per trip discard to landings ratios. Only trips with both non-zero landings and discards could be used for this approach to avoid division by zero. The number of trawl gear trips used to calculate geometric mean discard-to-landings ratios (GMDL) by half year for 1997-2008 ranged from 1 to 104 for trips < 300 kg and from 1 to 35 for trips =>300 kg, with the best sampling occurring since 2003. No trawl gear trips were available for half year two in 1997 and 1999 for trips < 300 kg and for half year two in 1997-2001 for trips => 300 kg. The ratio calculated for half year one was used to estimate discards for half year two when no trawl gear trips were available in half year two. The ratios ranged from 0.03 in 2004 (half year two, trips => 300 kg) to 121.71 in 1998 (half year one, trips => 300 kg; Table 3).

The large 1998 "directed fishery" ratio and subsequent very high annual discard estimate (111,973 mt) was based on one trawl gear trip. About 93% of the discard from that trip was attributable to a single tow in which an estimated 68.2 mt (150,000 lbs.) of scup were captured. This tow was not lifted from the water and the captain of the vessel estimated the weight of the catch. There has been debate concerning the validity of the catch weight estimate and whether or not it was representative of other vessels or trips in the fishery. However, the observation was reported by a trained NEFSC observer and was therefore included in the initial calculation of the estimate of scup discards (Tables 3-4). Peer reviews of the assessment have since concluded that the 1998 estimate is infeasible, and it has been replaced by the mean of the 1997 and 1999 estimates (3,331 mt) in subsequent tabulations of catch and in subsequent modeling (Tables 5, 9).

## RECREATIONAL CATCH

Scup is the object of a major recreational fishery, with the greatest proportion of catches taken in the states of Massachusetts, Rhode Island, Connecticut and New York. Estimates of the recreational catch in numbers were obtained from the NMFS Marine Recreational Fishery Statistics Survey (MRFSS) for 1981-2008. These estimates were available for three categories: type A - fish landed and available for sampling, type B1 - fish landed but not available for sampling and type B2 - fish caught and released. The estimated recreational landings (types A and B1) in weight during 1981-2008 averaged about 2,000 mt per year (Table 5). Since 1981, the recreational landings have averaged 30% of the commercial and recreational landings total.

The estimated recreational discard in weight during 1984-2008 ranged from 6 mt in 1999 to a high of 393 mt in 2006, averaging about 100 mt per year (Table 5). The weight of discards has been directly calculated only for those years (1984 and later) for which recreational catch at age has been compiled. In compilations of total fishery catch for earlier years, the recreational discards was assumed to be approximately 2% of the estimated recreational landings, based on

the mean discard percentage for 1984-1996, the time period with catch at age estimates before the implementation of the FMP. No length frequency samples of the scup discard were collected under the MRFSS program before 2005, so recreational discards were assumed to be fish aged 0 and 1, in the same relative proportions and with the same mean weight as the landed catch less than state regulated minimum fish sizes. An inspection of discard length frequency samples from the New York recreational fishery for 1989-1991 indicated that this assumption was reasonable. Since 2005 length samples of the recreational fishery discard collected in the MRFSS For-Hire Survey sampling have been used the characterize the size frequency of the discard.

The discard mortality rate in the recreational fishery has been reported to range from 0-15% (Howell and Simpson 1985) and from 0-14% (Williams, pers. comm.). Howell and Simpson (1985) found mortality rates were positively correlated with size, due mainly to the tendency for larger fish to take the hook deep in the esophagus or gills. Williams more clearly demonstrated increased mortality with depth of hook location, as well as handling time, but found no association with fish size. Based on these studies, a discard mortality rate in the recreational fishery of 15% has been used in this and previous assessments.

## COMMERCIAL FISHERY LANDINGS AT LENGTH AND AGE

The NER commercial fishery length frequency sampling is summarized in Table 6. Annual sampling intensity has varied from 18 to 687 mt per 100 lengths, with sampling exceeding the informal threshold criterion of 200 mt per 100 lengths since 1994. For this assessment, commercial fishery landings at age beginning in 1984 have been updated through 2008, with samples generally pooled by market category (pins/small, medium, large/mix, jumbo, and unclassified) and by half-year (January-June, July-December); samples were pooled on a quarterly basis (e.g., January-March) for 2004-2008. Estimates of commercial fishery landings at age (Figure 2) and mean weights at age are presented in Tables 7-8.

## COMMERCIAL FISHERY DISCARDS AT LENGTH AND AGE

The intensity of length sampling of discarded scup from the NEFSC Fishery Observer Program declined in 1992-1995 relative to 1989-1991 (Table 9). Sampling intensity ranged from 489 to 335 mt per 100 lengths sampled in 1992-1995, failing to meet the informal criterion of 200 mt per100 lengths. Sampling intensity improved to 100 mt per 100 lengths in 1996, but then declined to over 200 mt per 100 lengths in 1997-1999. Sampling intensity has generally met the 200 mt per 100 lengths threshold since 2000. The mean weight of the discard was estimated from length frequency data using a length-weight equation, total numbers discarded were then estimated by dividing total weight by mean weight, and numbers at length were then calculated from the length-frequency distribution. Discards at length were aged using a combination of commercial and survey age-length keys, with discards at age dominated by fish aged 0, 1, or 2, depending on the year under consideration. Estimates of commercial fishery discards at age (Figure 3) and mean weights at age are presented in Tables 10-11.

## RECREATIONAL FISHERY LANDINGS AT LENGTH AND AGE

For the recreational fishery, length sampling intensity has varied from 45 to 471 mt per 100 lengths. Sampling in all years except one (1984) during 1981-1987 failed to satisfy the above criterion, but since 1987 the criterion has been met except for 1999-2000 (Table 12).

Numbers at length for recreational landings were determined from recreational fishery length samples pooled by half-years (January-June; July-December) over all regions and fishing modes, and were converted to numbers at age by applying half-year age-length keys constructed from NEFSC commercial and survey samples. Age-length keys from spring surveys and first and second quarter commercial samples were applied to numbers at length from the first half of the year, while age-length keys from fall surveys and third and fourth quarter commercial samples were applied to numbers at length from the second half of the year. Estimates of recreational fishery landings at age (Figure 4) and mean weights at age are presented in Tables 13-14.

## RECREATIONAL FISHERY DISCARDS AT LENGTH AND AGE

As noted earlier, no length samples of the discard were routinely collected under the MRFSS program prior to 2005, so recreational discards were assumed to be fish less than state minimum sizes, in the same relative proportions at length as the landed catch less than the respective state minimum sizes (i.e., sub-legal fish). This assumption for the coastwide fishery is supported by discard length frequency samples from the New York recreational fishery (1989-1991) and samples collected since 2005 by the MRFSS For-Hire Survey. Since 2005, the MRFSS For-Hire Survey discard samples have been used in concert with the MRFSS sub-legal landed lengths to characterize the length frequency of the recreational discard. Numbers at length were converted to numbers at age by applying half-year (January-June; July-December) age-length keys constructed from NEFSC commercial and survey samples. As noted earlier, a 15% discard mortality rate is assumed. Estimates of recreational fishery discards at age (Figure 5) and mean weights at age are presented in Tables 15-16.

## TOTAL FISHERY CATCH

Estimates of the total fishery catch at age and mean weights at age for 1984-2008 (the time series is limited by the availability of sampled fishery ages) are presented in Tables 17-18. An extended time series of the total catch of scup has been estimated to provide an historical perspective of the exploitation of scup in the years before fishery aging data were available (Table 19). These estimates include commercial and recreational landings and discards. The catches before 1981 are the least reliable due to uncertainty about a) the magnitude of domestic commercial fishery discards, b) the magnitude of the distant water fleet (DWF) catch and c) the uncertainty of assumptions made to estimate the recreational catch (50% reduction from interpolations made in Mayo 1982 for 1960-1978; recreational discards assumed to be 2% of the adjusted recreational landings). For years in which no commercial fishery observer data were collected (prior to 1989), commercial discards were estimated using the mean of landings to discards ratios for 1989-2001.

## RESEARCH SURVEY INDICES OF ABUNDANCE

### NEFSC

The NEFSC spring and fall research surveys provide long time series of fishery-independent indices for scup. The NEFSC spring and fall surveys are conducted annually during March-May and September-November, ranging from just south of Cape Hatteras, NC to Canadian waters. NEFSC spring and fall abundance and biomass indices for scup exhibit

considerable inter-annual variability (Table 20). NEFSC spring survey catches are characterized mainly by scup of ages 1 and 2, while the fall survey often captures large numbers of age 0 fish.

The NEFSC survey indices sometimes appear to mainly reflect the availability of scup to the survey, rather than true abundance, making it difficult to interpret large inter-annual changes in the indices. For example, the 2002 spring SSB index was about twice the second highest spring SSB index, which was observed in 1977 (Figure 6). The spring numeric abundance indices are similar; the 2002 index is the highest observed in the series and about twice the 1970 index. These dramatic increases were evident across all ages in the estimated 2002 spring numbers at age (Table 21; Figure 7). However, the previous Fall survey estimates of numbers at age in 2001 had not reflected relatively large values from which the corresponding 2002 spring numbers at age might have been expected to derive (Table 22, Figure 8), nor did they subsequently translate to exceptional indices of biomass or SSB in fall 2002 or spring 2003. Spring survey SSB and abundance indices decreased subsequent to 2002, but are still above the low values of the late 1990s. Fall survey abundance and biomass have been highly variable since 2002.

The NEFSC winter survey was started in 1992 primarily as a flatfish survey, was conducted during February, and ranged from Cape Hatteras, NC to the southwestern part of Georges Bank. The winter survey 2002 abundance and biomass indices were, like the spring survey, the largest of the time series (Table 23). Similar to the spring estimates, numbers at age estimated for the 2002 winter survey were also exceptionally large (Table 24, Figure 9). Winter survey abundance and biomass decreased subsequent to 2002, but were still above the low values of the late 1990s. The winter trawl series ended in 2007.

**Massachusetts DMF**

The Massachusetts Division of Marine Fisheries (MADMF) has conducted a semi-annual bottom trawl survey of Massachusetts territorial waters in May and September since 1978. Survey coverage extends from the New Hampshire to Rhode Island boundaries and seaward to three nautical miles, including Cape Cod Bay and Nantucket Sound. The study area is stratified into geographic zones based on depth and area. The MADMF spring survey catches are characterized mainly by scup of ages 1 and 2, while the fall survey often captures large numbers of age 0 fish. The spring biomass and abundance indices decreased sharply from a high in the early 1980s to relatively low levels through the remainder of the time series, with the exception of spikes in 1990, 2000, and 2002, the latter event in common with the NEFSC spring trawl survey (Table 25, Figure 10). The MADMF fall indices can include large numbers of age 0 fish, and on a numeric basis are more variable than the spring indices (Figure 11). The fall biomass index is less variable than the spring, however, and exhibits an increasing trend since the mid 1990s (Figure 10).

**Rhode Island DFW**

The Rhode Island Division of Fish and Wildlife (RIDFW) has conducted autumn and spring surveys based on a stratified random sampling design since 1979. Three major fishing grounds are considered in the spatial stratification, including Narragansett Bay, Rhode Island Sound, and Block Island Sound. Stations are either fixed or randomly selected for each stratum. The RIDFW spring survey mainly catches scup of ages 1 and 2. The spring indices show relatively low scup abundance and biomass through 1999 followed by a steep increase during

2000-2002, in common with the NEFSC and MADMF indices (Table 26; Figure 12). The RIDFW fall survey is dominated by age 0 scup (Figure 11). Fall indices show a general increase to its 1993 peak, followed by a steep decline until 1998, and a general increase since then (Figure 12).

**Connecticut DEP**

The Connecticut Department of Environmental Protection (CTDEP) trawl survey program was initiated in May 1984 and encompasses both New York and Connecticut waters of Long Island Sound. The stratified random design survey is conducted in the spring (April-June) and fall (September-October). The CTDEP spring indices indicate relatively low abundance through most of the survey period, but have increased substantially since 1999 (Table 27, Figure 13). The CTDEP fall survey, which often catches large numbers of age-0 scup, indicates that recruitment was relatively stable during most of the survey period, but the aggregate fall indices have also increased substantially since 1999 (Table 28, Figures 11, 13). The age compositions of the CTDEP spring and fall surveys generally include a higher proportion of age 2 and older fish than the other state or NEFSC surveys (Figures 14-15).

**New York DEC**

The New York Department of Environmental Conservation (NYDEC) initiated a small mesh trawl survey in 1985 to collect fisheries-independent data on the age and size composition of scup in local waters. This survey is conducted in the Peconic Bays, the estuarine waters which lie between the north and south forks of eastern Long Island. The NYDEC survey provides age 0, 1, and 2+ indices of scup abundance. The age 0 indices are generally low over the survey period, with peaks in 2000, 2002, 2003, 2006, and 2007 that may indicate recruitment of strong cohorts in those years (Table 29, Figure 11). In the early years of the survey there often has not been a strong correspondence between the age 0 indices and age 1 and 2+ indices in the following years (Figure 16).

**New Jersey BMF**

The New Jersey Bureau of Marine Fisheries (NJBMF) conducts a stratified random bottom trawl survey of New Jersey coastal waters from Ambrose Channel south to Cape Henlopen Channel. Latitudinal strata boundaries correspond to those in the NEFSC trawl survey; longitudinal boundaries correspond to the 30, 60, and 90 foot isobaths. Each survey includes two tows per stratum plus one additional tow in each of nine larger strata for a total of 39 tows. The NJBMF abundance indices exhibit variable patterns over the early part of the time series. The index reached a minimum in 1996, and has generally increased since then (Table 29; Figure 17).

**University of Rhode Island Graduate School of Oceanography (URIGSO)**

University of Rhode Island Graduate School of Oceanography (URIGSO) has conducted a standardized, two-station trawl survey in Narragansett Bay and Rhode Island Sound since the 1950s, with consistent sampling since 1963. Irregular length-frequency samples for scup indicate that most of the survey catch is of fish from ages 0 to 2. The aggregate numbers-based index reached a peak in the late 1970s, was relatively low during the late 1990s, reached a

second peak in 2002 in common with the NEFSC, MADMF, RIDFW spring biomass indices, and has since been variable at relatively high level (Table 30, Figure 18).

**Virginia Institute of Marine Science (VIMS)**

The Virginia Institute of Marine Science (VIMS) has conducted a juvenile scup survey in lower Chesapeake Bay during June-September since 1988. The VIMS age-0 scup survey shows a general decline in recruitment from relatively high levels with peaks in 1990 and 1993 to relatively low levels from 1994 to 2004, and the indication of stronger year classes in 2006 and 2007 (Table 29, Figure 11).

The VIMS Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) trawl survey is designed to support bay-specific stock assessment activities at both a single and multispecies scale. While no single gear or monitoring program can collect all of the data necessary for quantitative assessments, ChesMMAP was designed to fulfill data gaps by maximizing the biological and ecological data collected for several recreationally and commercially important species in the bay. Total abundance and biomass indices composed mainly of age 0 and 1 fish are available since 2002, and indicate strong recruitment in 2005 and 2006 (Table 31, Figure 19).

The VIMS NEAMAP survey was started in Fall 2006, providing research survey samples along the Atlantic Coastal waters from New York to North Carolina, in depths of 20-90 feet (9-43 meters). Due to the brevity of the series, it has not yet been included in population models (Table 32).

## 2009 UPDATED FISHING MORTALITY RATE AND STOCK SIZE ESTIMATES

Fishing mortality rates and stock sizes were estimated using the ASAP SCAA model (NFT 2008a). The catch at age, mean weight at age, maturity at age, and survey index calibration time series were input as in the 2008 DPS assessment (NEFSC 2009). Winter, spring, and mid-year survey indices and all survey recruitment (age-0) indices were compared to population numbers of the same age at the beginning of the same year. Fall survey indices were compared to population numbers one year older at the beginning of the next year. Lognormal error distributions were assumed for the total catch in weight, research survey catch at age calibration indices, internal Beverton-Holt stock-recruitment relationship and parameters, selectivity parameters, annual fishing mortality parameters, survey catchability parameters, and estimated stock numbers at age. A multinomial distribution was assumed for fishery catch at age. Additional model settings including specification of likelihood component emphasis factors (lambdas), size of the deviation factors expressed as standard deviations and penalty functions for extreme fishing mortality estimates were left at the consensus values set in the 2008 DPS assessment.

Summary estimates, estimated January 1 stock size at age in numbers, and estimated fishing mortality (F) at age from the 2009 updated model for 1984-2008 (the years with input fishery catches at age) are provided in Tables 33-35. Spawning stock biomass (SSB) decreased from about 100,000 mt in 1963 to about 50,000 mt in 1969, then increased to about 75,000 mt during the late 1970s. SSB declined through the 1980s and early 1990s to less than 5,000 mt in the mid-1990s. With greatly improved recruitment and low fishing mortality rates since 1998, SSB increased to about 188,000 mt in 2008 (Figures 20-21). There is a 50% chance that SSB in 2008 was between 180,000 and 196,000 mt (Figure 22). Fishing mortality calculated from the

average of the currently fully recruited ages (2-7+) varied between F = 0.1 and F = 0.3 during the 1960s and 1970s. Fishing mortality increased during the 1980s and early 1990s, peaking at about F = 1.0 in the mid-1990s. Fishing mortality decreased after 1994, falling to less than F = 0.1 since 2003, with F in 2008 = 0.048 (Figure 23). There is a 50% chance that F in 2008 was between 0.041 and 0.066 (Figure 24).

Recruitment at age 0 averaged 92 million fish during 1963-1983, the period in which recruitment estimates are influenced mainly by the assessment model stock-recruitment relationship. Since 1984, recruitment estimates from the model are influenced mainly by the fishery and survey catches at age, and averaged 110 million fish during 1984-2008. The 1999 and 2000 year classes are estimated to be the largest of the time series, at 218 and 267 million age 0 fish (Figures 20-21). Recruitment has exceeded the 1984-2008 average of 110 million in 2001, 2004-2006 and 2008. There is no consistent retrospective pattern in F, SSB, or recruitment evident in the 2009 updated assessment model (Figure 25).

## 2008 DPS ASSESSMENT BIOLOGICAL REFERENCE POINTS (BRPs)

The 2008 DPS Peer Review Panel accepted the ASAP SCAA model results as the basis for BRPs and status determination for scup (NEFSC 2009). BRPs were calculated using the non-parametric yield and SSB per recruit/long-term projection approach adopted for summer flounder (NEFSC 2008a) and the New England groundfish stocks (NEFSC 2008b). In the yield and SSB per recruit calculations, the most recent five year averages were used for mean weights and fishery partial recruitment pattern. For the estimation of MSY and SSBMSY, the cumulative distribution function of the 1984-2007 recruitments (corresponding to the period of input fishery catches at age) was re-sampled to provide future recruitment estimates (mean = 117 million age 0 fish). The 2008 DPS Peer Review Panel recommended F40% as the proxy for FMSY, and the corresponding SSBF40% as the proxy for SSBMSY. The F40% proxy for FMSY = 0.177, the proxy estimate for SSBMSY = 92,044 mt, and the proxy estimate for MSY = 16,161 mt (13,134 mt of landings, 3,027 mt of discards).

## 2009 UPDATED STOCK STATUS

The scup stock was not overfished and overfishing was not occurring in 2008 relative to the BRPs recommended by the 2008 DPS Peer Review Panel (NEFSC 2009; Figure 27). Fishing mortality varied between F = 0.1 and F = 0.3 during the 1960s and 1970s. Fishing mortality increased during the 1980s and early 1990s, peaking at about F = 1.0 in 1994. Fishing mortality decreased after 1994, falling to less than F = 0.1 since 2003, with F in 2008 = 0.048, well below the fishing mortality threshold of F40% = 0.177 (Figures 23, 26). There is a 50% chance that F in 2008 was between 0.041 and 0.066 (Figure 24). Spawning stock biomass (SSB) decreased from about 100,000 mt in 1963 to about 50,000 mt in 1969, then increased to about 75,000 mt during the late 1970s. SSB declined through the 1980s and early 1990s to less than 5,000 mt in the mid-1990s. With greatly improved recruitment and low fishing mortality rates since 1998, SSB increased to about 188,000 mt in 2008, well above the biomass target of SSB40% = 92,044 mt (Figures 20, 26). There is a 50% chance that SSB in 2008 was between 180,000 and 196,000 mt (Figure 22). Recruitment at age 0 averaged 92 million fish during 1963-1983, the period in which recruitment estimates are influenced mainly by the assessment model stock-recruitment relationship. Since 1984, recruitment estimates from the model are influenced mainly by the fishery and survey catches at age, and recruitment at age 0 averaged 110 million fish during

1984-2008. The 1999 and 2000 year classes are estimated to be the largest of the time series, at 218 and 267 million age 0 fish (Figures 20-21). Recruitment has exceeded the 1984-2008 average of 110 million in 2001, 2004-2006, and 2008.

## 2009 ASSESSMENT UNCERTAINTY CONSIDERATIONS

The 2009 assessment indicates that the stock was well above the SSBMSY proxy and being fished at well below the FMSY proxy in 2008. The high level of 2008 stock abundance is the result of historically low fishing mortality rates and historically high levels of recruitment since the late 1990s. Age 0 fish accounted for about 30% of the stock size in 2008 due to the large size of the 2008 year class, but the relative percentages of the age 1 and older fish are within of few percent of what might be expected in the stock if it was fished at Fmax = FMSY = 0.283 over the long-term (Figure 27). The age 7+ fish accounted for about 12% of the stock size in 2008, near the 16% in the age 7+ group that would be expected if the stock were fished at F = 0.05 over the long-term (Figure 27). Since 2000, a high proportion of the SSB has accumulated at fully mature ages 3 and older. The percentage of SSB in 2008 at fully mature ages 3-6 (44%) is near the 46% that would be expected if the stock were fished at F = 0.050 over the long-term, while age 7+ fish accounted for about 44% of the SSB in 2008 (Figure 28).

The MSY proxy in terms of total catch is 16,161 mt (35.6 million lbs), with total landings of 13,134 mt (29.0 million lbs) and total discards of 3,027 mt (6.7 million lbs). The extended catch series estimated for scup (Table 19) indicates that this MSY proxy is a feasible estimate. Total fishery catch is estimated to have averaged about 34,000 mt (75.0 million lbs) during 1960-1965, while reported commercial landings alone averaged about 19,000 mt (41.9 million lbs) in that period. While the MSY estimate appears feasible given historical evidence from the fishery, managers may wish to take an adaptive approach to the specification of the TAC/TAL in the short-term. Total fishery landings during 2003-2007 averaged 6,214 mt (13.7 million lbs), and were 4,177 (9.2 million lbs) mt in 2008; the 2009 TAL was set at 5,071 mt (11.2 million lbs). The 2008 DPS Peer Review Panel and 2009 SDWG both advised that a gradual increase in the TAC/TAL toward the MSY level would facilitate an evaluation of the performance of the new assessment model and BRPs in monitoring stock status, while reducing the risk to the stock due to rapidly increased catch.

## PROJECTIONS

Stochastic projections were made to provide forecasts of stock size and catches in 2010 consistent with the 2008 DPS assessment biological reference points. The projections assume that recent (2006-2008) patterns of discarding will continue over the time span of the projections. Different patterns that could develop in the future due to different trip and bag limits and fishery closures have not been evaluated. One hundred projections were made for each of the 1000 MCMC realizations of 2009 stock sizes from the 2009 updated assessment results using NFT AGEPRO version 3.1.3 (NFT 2008b). Future recruitment at age 0 was generated randomly from a cumulative density function of the 2009 updated recruitment series for 1984-2008. The projected quantities are 50%ile estimates for 2010. Three projections were made for 2010: at F40% = 0.177 (the FMSY proxy), at F = 0.033 (equal to F2009 given the 2009 TAL = 5,071 mt is landed), and at 2010 TAL = 5,578 mt (12.297 million lbs), a 10% increase above the 2009 TAL.

**Landings, Discards, and Spawning Stock Biomass (SSB) in metric tons**

| | 2010 | | |
|---|---|---|---|
| | Landings | Discards | SSB |
| **F2010 = F40%= 0.177** | 27,382 | 5,785 | 196,383 |
| **2010 TAL = 2009 TAL + 10%** | 5,578 | 1,180 | 207,319 |
| **F2010 = F2009 = 0.033** | 5,431 | 1,147 | 207,389 |

## RESEARCH RECOMMENDATIONS

### Short term analytical tasks

a) Evaluation of indicators of potential changes in stock status that could provide signs to management of potential reductions of stock productivity in the future would be helpful
b) A management strategy evaluation of alternative approaches to setting quotas would be helpful.

### Long term data and analytical needs

a) Current research trawl surveys are likely adequate to index the abundance of scup at ages 0 to 2. However, the implementation of new standardized research surveys that focus on accurately indexing the abundance of older scup (ages 3 and older) would likely improve the accuracy of the stock assessment.
b) Continuation of at least the current levels of at-sea and port sampling of the commercial and recreational fisheries in which scup are landed and discarded is critical to adequately characterize the quantity, length and age composition of the fishery catches.
c) Quantification of the biases in the catch and discards, including non-compliance, would help confirm the weightings used in the model. Additional studies would be required to address this issue
d) The commercial discard mortality rate was assumed to be 100% in this assessment. Experimental work to better characterize the discard mortality rate of scup captured by different commercial gear types should be conducted to more accurately quantify the magnitude of scup discard mortality.

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Table 1. Commercial landings (mt) of scup by state. One mt was landed in DE in 1995, included with MD 1995 total. Eight mt were landed in PA in 2004 included with MD 2004 total. Landings include revised Massachusetts landings for 1986-1997.

| Year | ME | MA | RI | CT | NY | NJ | MD | VA | NC | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1979 | | 782 | 3,123 | 92 | 1,422 | 2,159 | 21 | 397 | 589 | 8,585 |
| 1980 | 1 | 706 | 2,934 | 17 | 1,294 | 2,310 | 32 | 531 | 599 | 8,424 |
| 1981 | | 523 | 2,959 | 44 | 1,595 | 2,990 | 9 | 1,054 | 682 | 9,856 |
| 1982 | | 545 | 3,203 | 25 | 1,473 | 1,746 | 2 | 1,042 | 668 | 8,704 |
| 1983 | | 672 | 2,583 | 49 | 1,103 | 2,536 | 13 | 536 | 302 | 7,794 |
| 1984 | | 540 | 2,919 | 32 | 904 | 2,217 | 6 | 673 | 478 | 7,769 |
| 1985 | | 387 | 3,583 | 41 | 861 | 1,493 | 17 | 74 | 271 | 6,727 |
| 1986 | | 875 | 2,987 | 67 | 893 | 1,895 | 14 | 273 | 172 | 7,176 |
| 1987 | 5 | 735 | 2,162 | 301 | 911 | 1,817 | | 232 | 113 | 6,276 |
| 1988 | 9 | 536 | 2,832 | 359 | 687 | 1,334 | 1 | 127 | 58 | 5,943 |
| 1989 | 32 | 579 | 1,401 | 89 | 603 | 1,219 | 1 | 45 | 15 | 3,984 |
| 1990 | 4 | 696 | 1,786 | 165 | 755 | 1,005 | 4 | 75 | 81 | 4,571 |
| 1991 | 16 | 553 | 2,902 | 287 | 1,223 | 1,960 | 15 | 56 | 69 | 7,081 |
| 1992 | | 655 | 2,676 | 193 | 1,043 | 1,475 | 17 | 73 | 127 | 6,259 |
| 1993 | | 556 | 1,332 | 148 | 729 | 1,822 | 10 | 76 | 53 | 4,726 |
| 1994 | | 354 | 1,514 | 142 | 688 | 1,456 | 7 | 92 | 139 | 4,392 |
| 1995 | | 310 | 1,045 | 90 | 511 | 1,084 | 2 | 20 | 11 | 3,073 |
| 1996 | | 436 | 773 | 99 | 377 | 1,141 | 20 | 72 | 27 | 2,945 |
| 1997 | | 676 | 486 | 50 | 376 | 596 | 1 | 2 | 1 | 2,188 |
| 1998 | | 435 | 361 | 44 | 282 | 758 | 5 | 4 | 7 | 1,896 |
| 1999 | | 300 | 581 | 44 | 206 | 361 | | 13 | | 1,505 |
| 2000 | | 161 | 461 | 65 | 287 | 232 | | 1 | | 1,207 |
| 2001 | | 149 | 734 | 45 | 297 | 479 | 1 | 24 | | 1,729 |
| 2002 | | 330 | 1,668 | 4 | 714 | 419 | | 25 | 13 | 3,173 |
| 2003 | | 407 | 1,730 | 64 | 839 | 1,033 | 21 | 253 | 58 | 4,405 |
| 2004 | | 353 | 1,562 | 116 | 865 | 862 | 21 | 203 | 249 | 4,231 |
| 2005 | | 515 | 1,553 | 149 | 989 | 880 | 1 | 130 | 50 | 4,266 |
| 2006 | | 493 | 1,653 | 135 | 1,096 | 632 | 0 | 36 | 17 | 4,062 |
| 2007 | | 501 | 1,785 | 118 | 1,054 | 714 | 1 | 10 | 13 | 4,196 |
| 2008 | | 239 | 968 | 127 | 551 | 351 | 3 | 44 | 60 | 2,343 |
| mean | 11 | 509 | 1,906 | 106 | 830 | 1,332 | 10 | 212 | 187 | 5,074 |

Table 2. Commercial landings (mt) of scup by major gear types. Midwater paired trawl landings are combined with other gears during 1994 and later. Landings include revised Massachusetts landings for 1986-1997.

| Year | Otter trawl | Paired trawl | Floating trap | Pound net | Pots and traps | Hand lines | Other gear | Total mt |
|---|---|---|---|---|---|---|---|---|
| 1979 | 6,387 | 146 | 1,305 | 429 | 26 | 215 | 77 | 8,585 |
| 1980 | 6,192 | 160 | 1,559 | 194 | 8 | 303 | 8 | 8,424 |
| 1981 | 7,836 | 79 | 1,291 | 246 | 49 | 306 | 49 | 9,856 |
| 1982 | 6,563 | 104 | 1,514 | 244 | 9 | 226 | 44 | 8,704 |
| 1983 | 5,861 | 398 | 850 | 390 | 8 | 265 | 22 | 7,794 |
| 1984 | 5,617 | 272 | 1,266 | 295 | 8 | 287 | 24 | 7,769 |
| 1985 | 4,856 | 417 | 1,022 | 229 | 5 | 182 | 16 | 6,727 |
| 1986 | 5,163 | 540 | 629 | 332 | 9 | 493 | 10 | 7,176 |
| 1987 | 4,607 | 237 | 590 | 193 | 213 | 423 | 13 | 6,276 |
| 1988 | 4,142 | 166 | 1,052 | 53 | 44 | 396 | 90 | 5,943 |
| 1989 | 3,174 | 89 | 193 | 74 | 104 | 334 | 16 | 3,984 |
| 1990 | 3,205 | 200 | 505 | 60 | 239 | 340 | 22 | 4,571 |
| 1991 | 5,217 | 152 | 988 | 40 | 258 | 395 | 31 | 7,081 |
| 1992 | 4,371 | 94 | 934 | 67 | 303 | 450 | 40 | 6,259 |
| 1993 | 3,865 | 46 | 166 | 25 | 202 | 402 | 20 | 4,726 |
| 1994 | 3,416 | | 331 | 79 | 76 | 340 | 150 | 4,392 |
| 1995 | 2,204 | | 331 | 42 | 57 | 215 | 224 | 3,073 |
| 1996 | 2,196 | | 229 | 8 | 120 | 374 | 18 | 2,945 |
| 1997 | 1,491 | | 86 | 12 | 104 | 489 | 6 | 2,188 |
| 1998 | 1,379 | | 11 | 4 | 98 | 390 | 14 | 1,896 |
| 1999 | 1,005 | | 140 | 30 | 77 | 184 | 69 | 1,505 |
| 2000 | 773 | | 56 | | 78 | 205 | 95 | 1,207 |
| 2001 | 1,088 | | 229 | 65 | 52 | 215 | 80 | 1,729 |
| 2002 | 2,084 | | 220 | | 221 | 450 | 198 | 3,173 |
| 2003 | 2,777 | | 723 | | 168 | 445 | 292 | 4,405 |
| 2004 | 3,767 | | 20 | | 121 | 196 | 127 | 4,231 |
| 2005 | 3,475 | | 117 | | 174 | 448 | 52 | 4,266 |
| 2006 | 3,422 | | 106 | | 201 | 291 | 42 | 4,062 |
| 2007 | 3,332 | | 181 | | 279 | 373 | 31 | 4,196 |
| 2008 | 1,958 | | 103 | | 99 | 171 | 12 | 2,343 |
| mean | 3,775 | 207 | 574 | 141 | 114 | 332 | 65 | 5,074 |

Table 3. Summary NEFSC Fishery Observer Program data for scup. Geometric mean discards to landings ratios (GMDL; retransformed, mean ln-transformed discards to landings ratios [D/L], per trip) are stratified by half-year period (HY1, HY2) and trip landings level (< 300 kg, => 300 kg). N is number of observed trips with both scup landings and discard, which are used to calculate the ratios. Corresponding dealer landings are from the NEFSC database.

| 1997 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.8957 | 17 | 258 | 231 | 0.8221 | 4 | 1,244 | 1,023 |
| HY 2 | 0.8957 | 0 | 279 | 250 | 0.8221 | 0 | 413 | 340 |
| Total | | | 537 | 481 | | | 1,657 | 1,362 |

| 1998 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 2.401 | 7 | 196 | 471 | 121.71 | 1 | 920 | 111,973 |
| HY 2 | 3.126 | 10 | 281 | 878 | 121.71 | 0 | 496 | 60,368 |
| Total | | | 477 | 1,349 | | | 1,416 | 172,341 |

| 1999 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 1.742 | 6 | 245 | 427 | 3.766 | 2 | 785 | 2,956 |
| HY 2 | 1.742 | 0 | 178 | 310 | 3.766 | 0 | 299 | 1,126 |
| Total | | | 423 | 737 | | | 1,084 | 4,082 |

Table 3 continued .

| 2000 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 4.5818 | 13 | 196 | 898 | 0.6018 | 2 | 655 | 394 |
| HY 2 | 3.5001 | 1 | 292 | 1,022 | 0.6018 | 0 | 63 | 38 |
| Total | | 14 | 488 | 1,920 | | 2 | 718 | 432 |

| 2001 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.8916 | 10 | 180 | 160 | 0.9185 | 4 | 1,013 | 930 |
| HY 2 | 0.4606 | 2 | 307 | 141 | 0.9185 | 0 | 290 | 266 |
| Total | | 14 | 487 | 302 | | 4 | 1,303 | 1,197 |

| 2002 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 2.6088 | 11 | 423 | 1,104 | 0.0653 | 2 | 1,484 | 97 |
| HY 2 | 3.4522 | 12 | 829 | 2,862 | 3.6028 | 3 | 437 | 1,574 |
| Total | | 23 | 1,252 | 3,965 | | 5 | 1,921 | 1,671 |

Table 3 continued .

| 2003 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.1371 | 9 | 315 | 43 | 0.2560 | 2 | 2,473 | 633 |
| HY 2 | 1.4299 | 4 | 921 | 1,317 | 0.2304 | 5 | 696 | 160 |
| Total | | 13 | 1,236 | 1,360 | | 7 | 3,169 | 793 |

| 2004 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.3370 | 40 | 344 | 116 | 0.1685 | 25 | 2,353 | 396 |
| HY 2 | 0.4200 | 64 | 868 | 365 | 0.0309 | 10 | 550 | 17 |
| Total | | 104 | 1,212 | 480 | | 35 | 2,903 | 413 |

| 2005 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.7354 | 31 | 292 | 215 | 0.0732 | 7 | 2,390 | 175 |
| HY 2 | 0.2740 | 67 | 850 | 233 | 0.0563 | 2 | 694 | 39 |
| Total | | 98 | 1,142 | 448 | | 9 | 3,084 | 214 |

Table 3 continued .

| 2006 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.6621 | 37 | 472 | 313 | 0.0740 | 10 | 1,814 | 134 |
| HY 2 | 0.8573 | 40 | 814 | 698 | 0.2631 | 10 | 921 | 242 |
| Total | | 77 | 1,286 | 1,010 | | 20 | 2,735 | 377 |

| 2007 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.4821 | 41 | 461 | 222 | 0.2628 | 10 | 2,177 | 572 |
| HY 2 | 0.9404 | 54 | 892 | 839 | 0.3389 | 7 | 666 | 226 |
| Total | | 95 | 1,353 | 1,061 | | 17 | 2,843 | 798 |

| 2008 | | Trips <300 kg | | | | Trips =>300 kg | | |
|---|---|---|---|---|---|---|---|---|
| Period | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) | GM D/L | N | Dealer Landings (mt) | Estimated Discard (mt) |
| HY 1 | 0.8719 | 40 | 422 | 368 | 0.2350 | 16 | 1,218 | 286 |
| HY 2 | 5.2030 | 12 | 401 | 2,086 | 0.4596 | 6 | 303 | 139 |
| Total | | 52 | 823 | 2,454 | | 22 | 1,521 | 425 |

Table 4. A summary of landings, discards, and the aggregate geometric mean discards to landings ratio (GMDL).

| Year | Landings (mt) | Discards (mt) | GMDL ratio | GMDL Discards PSE (%) |
|---|---|---|---|---|
| 1997 | 2,194 | 1,843 | 0.84 | 61 |
| 1998 | 1,893 | 173,690 | 91.75 | 32 |
| 1999 | 1,507 | 4,819 | 3.20 | 9 |
| 2000 | 1,206 | 2,352 | 1.95 | 48 |
| 2001 | 1,790 | 1,499 | 0.84 | 32 |
| 2002 | 3,173 | 5,636 | 1.78 | 95 |
| 2003 | 4,405 | 2,153 | 0.49 | 41 |
| 2004 | 4,227 | 893 | 0.21 | 25 |
| 2005 | 4,226 | 662 | 0.16 | 29 |
| 2006 | 4,021 | 1,387 | 0.34 | 27 |
| 2007 | 4,196 | 1,859 | 0.44 | 26 |
| 2008 | 2,343 | 2,879 | 1.23 | 31 |

Table 5. Total catch (mt) of scup from Maine through North Carolina. Landings include revised Massachusetts landings for 1986-1997. Commercial discards for 1984-1988 calculated as the geometric mean ratio of discards to landings numbers at age for 1989-1993. Commercial discards estimate for 1998 is the mean of 1997 and 1999 estimates.

| Year | Commercial Landings | Commercial Discards | Recreational Landings | Recreational Discards | Total Catch |
|---|---|---|---|---|---|
| 1981 | 9,856 | n/a | 2,636 | n/a | 12,492 |
| 1982 | 8,704 | n/a | 2,361 | n/a | 11,065 |
| 1983 | 7,794 | n/a | 2,836 | n/a | 10,630 |
| 1984 | 7,769 | 2,158 | 1,096 | 30 | 11,053 |
| 1985 | 6,727 | 4,184 | 2,764 | 54 | 13,729 |
| 1986 | 7,176 | 2,005 | 5,264 | 87 | 14,532 |
| 1987 | 6,276 | 2,537 | 2,811 | 38 | 11,662 |
| 1988 | 5,943 | 1,657 | 1,936 | 31 | 9,567 |
| 1989 | 3,984 | 2,229 | 2,521 | 39 | 8,773 |
| 1990 | 4,571 | 3,909 | 1,878 | 38 | 10,396 |
| 1991 | 7,081 | 3,530 | 3,668 | 78 | 14,357 |
| 1992 | 6,259 | 5,668 | 2,001 | 47 | 13,975 |
| 1993 | 4,726 | 1,436 | 1,450 | 28 | 7,640 |
| 1994 | 4,392 | 807 | 1,192 | 37 | 6,428 |
| 1995 | 3,073 | 2,057 | 609 | 13 | 5,752 |
| 1996 | 2,945 | 1,522 | 978 | 20 | 5,465 |
| 1997 | 2,188 | 1,843 | 543 | 8 | 4,582 |
| 1998 | 1,896 | 3,331 | 397 | 14 | 5,638 |
| 1999 | 1,505 | 4,819 | 856 | 6 | 7,186 |
| 2000 | 1,207 | 2,352 | 2,469 | 55 | 6,083 |
| 2001 | 1,729 | 1,499 | 1,933 | 165 | 5,326 |
| 2002 | 3,173 | 5,636 | 1,644 | 137 | 10,590 |
| 2003 | 4,405 | 2,153 | 3,848 | 158 | 10,564 |
| 2004 | 4,231 | 893 | 1,923 | 134 | 7,181 |
| 2005 | 4,266 | 662 | 1,153 | 227 | 6,308 |
| 2006 | 4,062 | 1,387 | 1,331 | 393 | 7,173 |
| 2007 | 4,196 | 1,859 | 1,655 | 316 | 8,026 |
| 2008 | 2,343 | 2,879 | 1,834 | 296 | 7,352 |
| mean | 4,731 | 2,520 | 1,985 | 98 | 9,054 |

Table 6. Summary of the landed fish length sampling for scup in the NER (ME-VA) commercial fishery.

| Year | No. of samples | No. of lengths | NER Landings (mt) | Sampling intensity (mt/100 lengths) |
|---|---|---|---|---|
| 1979 | 10 | 1,250 | 8,585 | 687 |
| 1980 | 26 | 3,478 | 8,424 | 242 |
| 1981 | 16 | 2,005 | 9,856 | 492 |
| 1982 | 81 | 9,896 | 8,704 | 88 |
| 1983 | 72 | 7,860 | 7,794 | 99 |
| 1984 | 60 | 6,303 | 7,769 | 123 |
| 1985 | 31 | 3,058 | 6,727 | 220 |
| 1986 | 54 | 5,467 | 7,176 | 131 |
| 1987 | 61 | 6,491 | 6,276 | 97 |
| 1988 | 85 | 8,691 | 5,943 | 68 |
| 1989 | 46 | 4,806 | 3,984 | 83 |
| 1990 | 46 | 4,736 | 4,571 | 97 |
| 1991 | 31 | 3,150 | 7,081 | 225 |
| 1992 | 33 | 3,260 | 6,259 | 192 |
| 1993 | 23 | 2,287 | 4,726 | 207 |
| 1994 | 22 | 2,163 | 4,392 | 203 |
| 1995 | 22 | 2,487 | 3,073 | 124 |
| 1996 | 61 | 6,544 | 2,945 | 45 |
| 1997 | 37 | 3,732 | 2,188 | 59 |
| 1998 | 41 | 4,022 | 1,896 | 47 |
| 1999 | 56 | 6,040 | 1,505 | 25 |
| 2000 | 22 | 2,352 | 1,207 | 51 |
| 2001 | 40 | 3,934 | 1,729 | 44 |
| 2002 | 26 | 2,587 | 3,173 | 123 |
| 2003 | 78 | 6,681 | 4,405 | 66 |
| 2004 | 144 | 13,172 | 4,231 | 32 |
| 2005 | 124 | 9,324 | 4,266 | 46 |
| 2006 | 152 | 12,506 | 4,062 | 32 |
| 2007 | 198 | 15,704 | 4,196 | 27 |
| 2008 | 154 | 12,764 | 2,343 | 18 |

Table 7. Commercial fishery scup landings (000s) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 1 | 2691 | 6114 | 7090 | 5793 | 1418 | 536 | 251 | 1 | 0 | 0 | 23895 |
| 1985 | 79 | 3245 | 6767 | 7696 | 2640 | 346 | 520 | 159 | 0 | 0 | 0 | 21452 |
| 1986 | 9 | 301 | 12321 | 4773 | 1004 | 75 | 106 | 337 | 5 | 0 | 0 | 18931 |
| 1987 | 2 | 1679 | 9952 | 10399 | 1725 | 177 | 124 | 21 | 18 | 0 | 1 | 24098 |
| 1988 | 17 | 423 | 7709 | 9526 | 2424 | 58 | 127 | 39 | 0 | 0 | 0 | 20323 |
| 1989 | 17 | 1484 | 4943 | 7071 | 685 | 22 | 69 | 24 | 0 | 0 | 0 | 14315 |
| 1990 | 0 | 247 | 10203 | 6781 | 1022 | 355 | 149 | 2 | 0 | 0 | 0 | 18759 |
| 1991 | 0 | 2412 | 12956 | 10202 | 2161 | 409 | 193 | 0 | 0 | 0 | 0 | 28334 |
| 1992 | 21 | 1577 | 10883 | 3737 | 3797 | 1243 | 138 | 0 | 0 | 0 | 0 | 21396 |
| 1993 | 1 | 230 | 6558 | 6877 | 1500 | 1143 | 124 | 0 | 0 | 0 | 0 | 16433 |
| 1994 | 0 | 1052 | 13544 | 6358 | 836 | 82 | 39 | 0 | 0 | 0 | 0 | 21911 |
| 1995 | 0 | 2198 | 8345 | 2878 | 891 | 248 | 31 | 0 | 0 | 0 | 0 | 14591 |
| 1996 | 0 | 346 | 6343 | 1640 | 770 | 469 | 62 | 0 | 0 | 0 | 0 | 9630 |
| 1997 | 0 | 131 | 2080 | 4089 | 732 | 84 | 97 | 0 | 0 | 0 | 0 | 7213 |
| 1998 | 0 | 340 | 1453 | 2373 | 1092 | 381 | 2 | 0 | 0 | 0 | 0 | 5641 |
| 1999 | 0 | 1 | 1148 | 2688 | 527 | 117 | 0 | 0 | 0 | 0 | 0 | 4481 |
| 2000 | 0 | 0 | 661 | 2144 | 511 | 15 | 0 | 0 | 0 | 0 | 0 | 3331 |
| 2001 | 0 | 31 | 1635 | 3033 | 695 | 46 | 6 | 1 | 1 | 0 | 0 | 5448 |
| 2002 | 0 | 124 | 1219 | 5051 | 2132 | 393 | 5 | 0 | 0 | 0 | 0 | 8922 |
| 2003 | 0 | 2 | 955 | 2974 | 4553 | 1131 | 121 | 41 | 5 | 14 | 0 | 9796 |
| 2004 | 0 | 1 | 844 | 2406 | 2826 | 2089 | 296 | 40 | 4 | 14 | 0 | 8520 |
| 2005 | 0 | 31 | 683 | 1558 | 2361 | 2515 | 807 | 92 | 3 | 3 | 0 | 8053 |
| 2006 | 0 | 89 | 2233 | 2231 | 1119 | 1477 | 1219 | 366 | 28 | 3 | 0 | 8765 |
| 2007 | 0 | 91 | 2787 | 2661 | 1390 | 680 | 940 | 590 | 124 | 12 | 0 | 9275 |
| 2008 | 0 | 36 | 1299 | 2402 | 1104 | 305 | 253 | 256 | 34 | 1 | 1 | 5691 |

Table 8. Commercial fishery scup landings mean weights (kg) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 0.033 | 0.155 | 0.190 | 0.293 | 0.344 | 0.398 | 0.767 | 1.044 | 1.545 | 0.000 | 0.000 | 0.288 |
| 1985 | 0.043 | 0.134 | 0.197 | 0.293 | 0.409 | 0.517 | 0.739 | 1.042 | 0.000 | 0.000 | 0.000 | 0.272 |
| 1986 | 0.036 | 0.140 | 0.219 | 0.357 | 0.676 | 0.670 | 1.010 | 1.246 | 1.616 | 0.000 | 2.500 | 0.302 |
| 1987 | 0.034 | 0.136 | 0.203 | 0.244 | 0.407 | 0.544 | 0.747 | 1.194 | 1.068 | 0.000 | 0.000 | 0.237 |
| 1988 | 0.044 | 0.123 | 0.201 | 0.263 | 0.441 | 0.636 | 0.715 | 0.982 | 0.000 | 0.000 | 0.000 | 0.263 |
| 1989 | 0.025 | 0.144 | 0.188 | 0.275 | 0.367 | 0.651 | 0.721 | 1.036 | 0.000 | 0.000 | 0.000 | 0.240 |
| 1990 | 0.000 | 0.140 | 0.189 | 0.246 | 0.367 | 0.518 | 0.842 | 0.846 | 0.000 | 1.096 | 0.000 | 0.230 |
| 1991 | 0.000 | 0.187 | 0.194 | 0.263 | 0.389 | 0.511 | 0.729 | 0.000 | 0.000 | 0.000 | 0.000 | 0.241 |
| 1992 | 0.039 | 0.173 | 0.199 | 0.325 | 0.419 | 0.503 | 0.859 | 0.000 | 0.000 | 1.096 | 0.000 | 0.280 |
| 1993 | 0.031 | 0.140 | 0.197 | 0.261 | 0.442 | 0.510 | 0.782 | 0.000 | 0.000 | 0.000 | 0.000 | 0.272 |
| 1994 | 0.000 | 0.203 | 0.193 | 0.259 | 0.430 | 0.663 | 0.742 | 0.000 | 0.000 | 0.000 | 0.000 | 0.224 |
| 1995 | 0.000 | 0.161 | 0.209 | 0.295 | 0.396 | 0.480 | 0.724 | 0.000 | 0.000 | 0.000 | 0.000 | 0.236 |
| 1996 | 0.000 | 0.206 | 0.200 | 0.325 | 0.468 | 0.554 | 0.784 | 0.000 | 0.000 | 0.000 | 0.000 | 0.264 |
| 1997 | 0.000 | 0.227 | 0.253 | 0.300 | 0.386 | 0.529 | 0.749 | 0.000 | 0.000 | 0.000 | 0.000 | 0.303 |
| 1998 | 0.000 | 0.200 | 0.254 | 0.313 | 0.459 | 0.556 | 0.748 | 0.000 | 0.000 | 0.000 | 0.000 | 0.336 |
| 1999 | 0.000 | 0.075 | 0.220 | 0.323 | 0.497 | 0.748 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.328 |
| 2000 | 0.000 | 0.000 | 0.221 | 0.367 | 0.504 | 0.674 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.360 |
| 2001 | 0.000 | 0.229 | 0.265 | 0.346 | 0.476 | 0.562 | 0.779 | 1.003 | 1.003 | 0.000 | 0.000 | 0.340 |
| 2002 | 0.000 | 0.231 | 0.281 | 0.339 | 0.465 | 0.577 | 0.748 | 0.000 | 0.000 | 0.000 | 0.000 | 0.370 |
| 2003 | 0.000 | 0.187 | 0.285 | 0.362 | 0.471 | 0.659 | 0.859 | 0.884 | 1.241 | 0.000 | 0.000 | 0.448 |
| 2004 | 0.000 | 0.182 | 0.313 | 0.398 | 0.518 | 0.591 | 0.812 | 1.002 | 1.370 | 1.674 | 0.000 | 0.496 |
| 2005 | 0.000 | 0.196 | 0.269 | 0.362 | 0.471 | 0.652 | 0.809 | 1.044 | 1.099 | 1.311 | 0.000 | 0.529 |
| 2006 | 0.000 | 0.213 | 0.283 | 0.344 | 0.460 | 0.591 | 0.727 | 0.915 | 1.108 | 1.314 | 0.000 | 0.463 |
| 2007 | 0.000 | 0.217 | 0.265 | 0.353 | 0.470 | 0.646 | 0.768 | 0.894 | 1.077 | 1.697 | 0.000 | 0.452 |
| 2008 | 0.000 | 0.197 | 0.264 | 0.321 | 0.486 | 0.634 | 0.804 | 0.973 | 1.176 | 1.435 | 2.437 | 0.412 |

Table 9. Summary of length sampling for scup in the NEFSC Fishery Observer Program. OT =number of otter trawl trips sampled with scup discard lengths. H1 = first half year; H2 = second half year.

| Year | OT trips | Lengths H1 | Lengths H2 | Lengths Total | Discards (mt) | Intensity (mt/100 lengths) |
|---|---|---|---|---|---|---|
| 1989 | 61 | 4,449 | 2,910 | 7,359 | 2,229 | 30 |
| 1990 | 52 | 2,582 | 781 | 3,363 | 3,909 | 116 |
| 1991 | 91 | 1,237 | 1,780 | 3,017 | 3,530 | 117 |
| 1992 | 53 | 1,158 | 0 | 1,158 | 5,668 | 489 |
| 1993 | 29 | 275 | 154 | 429 | 1,436 | 335 |
| 1994 | 7 | 99 | 119 | 218 | 807 | 370 |
| 1995 | 18 | 162 | 383 | 556 | 2,057 | 370 |
| 1996 | 27 | 1,093 | 435 | 1,528 | 1,522 | 100 |
| 1997 | 45 | 750 | 1 | 751 | 1,843 | 245 |
| 1998 | 33 | 618 | 64 | 682 | 3,331 | 488 |
| 1999 | 35 | 586 | 89 | 675 | 4,819 | 714 |
| 2000 | 62 | 3,981 | 762 | 4,743 | 2,352 | 50 |
| 2001 | 67 | 1,231 | 229 | 1,460 | 1,499 | 103 |
| 2002 | 65 | 1,422 | 866 | 2,288 | 5,636 | 246 |
| 2003 | 72 | 925 | 284 | 1,209 | 2,153 | 178 |
| 2004 | 80 | 1,948 | 1,051 | 2,999 | 893 | 30 |
| 2005 | 73 | 797 | 1,159 | 1,956 | 662 | 34 |
| 2006 | 47 | 1,486 | 777 | 2,263 | 1,387 | 61 |
| 2007 | 59 | 1,313 | 1,058 | 2,371 | 1,859 | 78 |
| 2008 | 54 | 1,217 | 1,259 | 2,476 | 2,879 | 116 |

Table 10. Commercial fishery scup discards (000s) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 78 | 10847 | 6367 | 924 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 18237 |
| 1985 | 52773 | 13093 | 6534 | 1060 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 73470 |
| 1986 | 78 | 1180 | 14040 | 602 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 15903 |
| 1987 | 78 | 6814 | 12215 | 1366 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 20478 |
| 1988 | 1552 | 1698 | 9242 | 1339 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 13841 |
| 1989 | 387 | 8943 | 13603 | 813 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 23774 |
| 1990 | 822 | 8269 | 17249 | 2801 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29141 |
| 1991 | 1794 | 17231 | 5397 | 1733 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 26160 |
| 1992 | 38804 | 10023 | 26380 | 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75279 |
| 1993 | 5386 | 1549 | 6960 | 224 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14119 |
| 1994 | 6858 | 3099 | 3422 | 74 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13453 |
| 1995 | 1855 | 50174 | 335 | 108 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 52486 |
| 1996 | 199 | 3009 | 5990 | 691 | 21 | 1 | 0 | 0 | 0 | 0 | 0 | 9911 |
| 1997 | 1 | 618 | 8250 | 1871 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10740 |
| 1998 | 18 | 17524 | 11849 | 1127 | 247 | 57 | 0 | 0 | 0 | 0 | 0 | 30822 |
| 1999 | 1338 | 2563 | 18123 | 3139 | 691 | 201 | 0 | 0 | 0 | 0 | 0 | 26055 |
| 2000 | 853 | 11206 | 4890 | 1475 | 55 | 57 | 0 | 0 | 0 | 0 | 0 | 18536 |
| 2001 | 3536 | 4232 | 2647 | 355 | 281 | 207 | 57 | 0 | 0 | 0 | 0 | 11315 |
| 2002 | 9561 | 22393 | 5834 | 4431 | 518 | 571 | 75 | 0 | 0 | 0 | 0 | 43383 |
| 2003 | 1480 | 1578 | 3779 | 937 | 752 | 503 | 93 | 0 | 0 | 0 | 0 | 9122 |
| 2004 | 545 | 1397 | 1423 | 1176 | 220 | 187 | 8 | 0 | 0 | 0 | 0 | 4956 |
| 2005 | 460 | 893 | 1879 | 516 | 79 | 47 | 15 | 0 | 0 | 0 | 0 | 3889 |
| 2006 | 4809 | 8083 | 2354 | 642 | 53 | 13 | 16 | 0 | 0 | 0 | 0 | 15970 |
| 2007 | 1412 | 3936 | 5370 | 1420 | 94 | 41 | 87 | 0 | 0 | 0 | 0 | 12360 |
| 2008 | 1061 | 7526 | 2937 | 821 | 215 | 86 | 81 | 128 | 86 | 0 | 0 | 12941 |

Table 11. Commercial fishery scup discards mean weights (kg) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 0.033 | 0.108 | 0.125 | 0.198 | 0.222 | 0 | 0 | 0 | 0 | 0 | 0 | 0.118 |
| 1985 | 0.033 | 0.108 | 0.125 | 0.198 | 0.222 | 0 | 0 | 0 | 0 | 0 | 0 | 0.057 |
| 1986 | 0.033 | 0.108 | 0.125 | 0.198 | 0.222 | 0 | 0 | 0 | 0 | 0 | 0 | 0.126 |
| 1987 | 0.033 | 0.108 | 0.125 | 0.198 | 0.222 | 0 | 0 | 0 | 0 | 0 | 0 | 0.124 |
| 1988 | 0.033 | 0.108 | 0.125 | 0.198 | 0.222 | 0 | 0 | 0 | 0 | 0 | 0 | 0.120 |
| 1989 | 0.039 | 0.060 | 0.111 | 0.198 | 0.217 | 0 | 0 | 0 | 0 | 0 | 0 | 0.094 |
| 1990 | 0.026 | 0.121 | 0.137 | 0.187 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.134 |
| 1991 | 0.057 | 0.127 | 0.163 | 0.207 | 0.252 | 0 | 0 | 0 | 0 | 0 | 0 | 0.135 |
| 1992 | 0.033 | 0.078 | 0.136 | 0.243 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.075 |
| 1993 | 0.026 | 0.106 | 0.154 | 0.269 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.102 |
| 1994 | 0.024 | 0.068 | 0.122 | 0.198 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.060 |
| 1995 | 0.038 | 0.037 | 0.229 | 0.310 | 0.331 | 0 | 0 | 0 | 0 | 0 | 0 | 0.039 |
| 1996 | 0.033 | 0.110 | 0.169 | 0.240 | 0.268 | 0.532 | 0 | 0 | 0 | 0 | 0 | 0.154 |
| 1997 | 0.020 | 0.028 | 0.137 | 0.362 | 0.000 | 0.000 | 0 | 0 | 0 | 0 | 0 | 0.170 |
| 1998 | 0.092 | 0.069 | 0.147 | 0.224 | 0.418 | 0.564 | 0 | 0 | 0 | 0 | 0 | 0.108 |
| 1999 | 0.010 | 0.037 | 0.158 | 0.398 | 0.599 | 0.690 | 0 | 0 | 0 | 0 | 0 | 0.183 |
| 2000 | 0.044 | 0.076 | 0.195 | 0.299 | 0.486 | 0.768 | 0 | 0 | 0 | 0 | 0 | 0.127 |
| 2001 | 0.015 | 0.063 | 0.168 | 0.345 | 0.500 | 0.670 | 0.944 | 0 | 0 | 0 | 0 | 0.108 |
| 2002 | 0.035 | 0.064 | 0.201 | 0.361 | 0.524 | 0.757 | 1.071 | 0 | 0 | 0 | 0 | 0.123 |
| 2003 | 0.022 | 0.091 | 0.212 | 0.315 | 0.537 | 0.784 | 0.878 | 0 | 0 | 0 | 0 | 0.236 |
| 2004 | 0.029 | 0.109 | 0.166 | 0.268 | 0.371 | 0.453 | 0.750 | 0 | 0 | 0 | 0 | 0.180 |
| 2005 | 0.019 | 0.090 | 0.154 | 0.267 | 0.416 | 0.652 | 0.912 | 0 | 0 | 0 | 0 | 0.153 |
| 2006 | 0.026 | 0.086 | 0.166 | 0.217 | 0.313 | 0.549 | 0.755 | 0 | 0 | 0 | 0 | 0.087 |
| 2007 | 0.041 | 0.094 | 0.163 | 0.282 | 0.342 | 0.597 | 0.770 | 0 | 0 | 0 | 0 | 0.148 |
| 2008 | 0.039 | 0.096 | 0.182 | 0.294 | 0.495 | 0.742 | 0.884 | 1.078 | 1.442 | 0 | 0 | 0.158 |

Table 12. Summary of the landed fish length sampling for scup in the recreational fishery (includes MRFSS and state agency sampling).

| Year | No. of lengths | Estimated landings (A + B1) (mt) | Sampling intensity (mt/100 lengths) |
|---|---|---|---|
| 1981 | 642 | 2,636 | 411 |
| 1982 | 1,057 | 2,361 | 223 |
| 1983 | 1,384 | 2,836 | 205 |
| 1984 | 943 | 1,096 | 116 |
| 1985 | 741 | 2,764 | 373 |
| 1986 | 2,580 | 5,264 | 204 |
| 1987 | 777 | 2,811 | 362 |
| 1988 | 2,156 | 1,936 | 90 |
| 1989 | 4,111 | 2,521 | 61 |
| 1990 | 2,698 | 1,878 | 70 |
| 1991 | 4,230 | 3,668 | 87 |
| 1992 | 4,419 | 2,001 | 45 |
| 1993 | 2,206 | 1,450 | 66 |
| 1994 | 1,374 | 1,192 | 87 |
| 1995 | 822 | 609 | 74 |
| 1996 | 526 | 978 | 186 |
| 1997 | 399 | 543 | 136 |
| 1998 | 286 | 397 | 139 |
| 1999 | 265 | 856 | 323 |
| 2000 | 524 | 2,469 | 471 |
| 2001 | 1,038 | 1,933 | 186 |
| 2002 | 1,006 | 1,644 | 163 |
| 2003 | 2,508 | 3,848 | 153 |
| 2004 | 1,802 | 1,923 | 107 |
| 2005 | 1,794 | 1,153 | 64 |
| 2006 | 2,217 | 1,331 | 60 |
| 2007 | 2,262 | 1,655 | 73 |
| 2008 | 2,426 | 1,834 | 76 |

Table 13. Recreational fishery scup landings (000s) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 23 | 3036 | 1353 | 570 | 182 | 219 | 442 | 86 | 51 | 30 | 66 | 6058 |
| 1985 | 431 | 4478 | 3054 | 1330 | 788 | 441 | 137 | 33 | 0 | 0 | 115 | 10807 |
| 1986 | 538 | 4353 | 15570 | 2617 | 845 | 431 | 87 | 5 | 4 | 57 | 315 | 24822 |
| 1987 | 77 | 2299 | 4686 | 1261 | 824 | 598 | 112 | 0 | 0 | 11 | 46 | 9914 |
| 1988 | 9 | 1001 | 2229 | 1824 | 460 | 216 | 123 | 92 | 20 | 0 | 86 | 6060 |
| 1989 | 311 | 3978 | 3371 | 823 | 86 | 235 | 154 | 13 | 0 | 50 | 148 | 9169 |
| 1990 | 169 | 1352 | 5091 | 1102 | 147 | 112 | 36 | 7 | 2 | 3 | 22 | 8043 |
| 1991 | 299 | 4838 | 3797 | 3319 | 700 | 210 | 19 | 0 | 2 | 20 | 68 | 13272 |
| 1992 | 99 | 1850 | 4457 | 530 | 672 | 84 | 12 | 6 | 8 | 7 | 30 | 7755 |
| 1993 | 46 | 1245 | 3051 | 908 | 254 | 133 | 2 | 2 | 0 | 2 | 7 | 5650 |
| 1994 | 31 | 1473 | 1840 | 691 | 95 | 88 | 21 | 6 | 0 | 0 | 0 | 4245 |
| 1995 | 15 | 613 | 1399 | 225 | 89 | 20 | 3 | 3 | 0 | 0 | 0 | 2367 |
| 1996 | 9 | 351 | 1467 | 812 | 365 | 54 | 10 | 15 | 0 | 0 | 0 | 3083 |
| 1997 | 32 | 52 | 983 | 562 | 168 | 63 | 33 | 17 | 6 | 0 | 0 | 1916 |
| 1998 | 13 | 223 | 257 | 415 | 248 | 19 | 13 | 23 | 0 | 0 | 0 | 1211 |
| 1999 | 61 | 469 | 2169 | 359 | 182 | 11 | 0 | 0 | 0 | 0 | 0 | 3251 |
| 2000 | 6 | 912 | 3443 | 2113 | 641 | 129 | 0 | 0 | 0 | 0 | 0 | 7244 |
| 2001 | 0.3 | 514 | 1511 | 1705 | 806 | 244 | 101 | 218 | 0 | 0 | 0 | 5099 |
| 2002 | 7 | 70 | 688 | 1635 | 1005 | 179 | 24 | 39 | 0 | 0 | 0 | 3647 |
| 2003 | 0.3 | 75 | 1723 | 2655 | 3127 | 1407 | 350 | 115 | 0 | 0 | 0 | 9452 |
| 2004 | 0.9 | 45 | 284 | 1551 | 1441 | 1166 | 470 | 32 | 0 | 0 | 0 | 4990 |
| 2005 | 0 | 13 | 100 | 513 | 700 | 845 | 349 | 26 | 0 | 0 | 0 | 2546 |
| 2006 | 1 | 50 | 658 | 819 | 404 | 431 | 541 | 46 | 0 | 1 | 0 | 2951 |
| 2007 | 3 | 47 | 456 | 1347 | 775 | 378 | 605 | 206 | 26 | 1 | 0 | 3844 |
| 2008 | 2 | 52 | 732 | 1352 | 842 | 205 | 338 | 133 | 17 | 1 | 0 | 3674 |

Table 14. Recreational fishery scup landings mean weights (kg) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 0.044 | 0.117 | 0.266 | 0.373 | 0.472 | 0.557 | 0.678 | 0.825 | 0.912 | 1.002 | 1.145 | 0.274 |
| 1985 | 0.038 | 0.125 | 0.253 | 0.340 | 0.573 | 0.718 | 0.913 | 1.087 | 0.000 | 0.000 | 1.673 | 0.270 |
| 1986 | 0.052 | 0.101 | 0.234 | 0.374 | 0.534 | 0.654 | 0.801 | 0.912 | 1.003 | 1.003 | 1.638 | 0.261 |
| 1987 | 0.029 | 0.105 | 0.242 | 0.381 | 0.548 | 0.698 | 0.737 | 0.000 | 0.000 | 1.003 | 3.808 | 0.302 |
| 1988 | 0.026 | 0.142 | 0.240 | 0.325 | 0.497 | 0.663 | 0.794 | 1.144 | 1.099 | 0.000 | 1.532 | 0.330 |
| 1989 | 0.035 | 0.123 | 0.234 | 0.376 | 0.433 | 0.653 | 0.696 | 0.657 | 0.000 | 1.003 | 1.332 | 0.235 |
| 1990 | 0.057 | 0.128 | 0.208 | 0.325 | 0.461 | 0.567 | 0.761 | 0.939 | 1.088 | 1.202 | 1.947 | 0.225 |
| 1991 | 0.064 | 0.150 | 0.275 | 0.361 | 0.474 | 0.714 | 0.675 | 0.000 | 1.003 | 1.003 | 1.305 | 0.271 |
| 1992 | 0.092 | 0.140 | 0.240 | 0.373 | 0.454 | 0.598 | 0.804 | 0.859 | 1.311 | 1.003 | 2.117 | 0.256 |
| 1993 | 0.087 | 0.135 | 0.226 | 0.336 | 0.460 | 0.524 | 0.912 | 0.827 | 0.000 | 1.026 | 1.100 | 0.242 |
| 1994 | 0.054 | 0.180 | 0.281 | 0.357 | 0.467 | 0.674 | 0.905 | 1.430 | 0.000 | 0.000 | 0.000 | 0.274 |
| 1995 | 0.065 | 0.155 | 0.279 | 0.450 | 0.557 | 0.756 | 1.044 | 1.311 | 0.000 | 0.000 | 0.000 | 0.279 |
| 1996 | 0.093 | 0.171 | 0.231 | 0.368 | 0.540 | 0.772 | 0.876 | 1.383 | 0.000 | 0.000 | 0.000 | 0.314 |
| 1997 | 0.083 | 0.110 | 0.253 | 0.299 | 0.510 | 0.684 | 0.819 | 1.342 | 0.779 | 0.000 | 0.000 | 0.318 |
| 1998 | 0.072 | 0.121 | 0.211 | 0.312 | 0.491 | 0.866 | 1.066 | 1.950 | 0.000 | 0.000 | 0.000 | 0.337 |
| 1999 | 0.095 | 0.173 | 0.274 | 0.451 | 0.635 | 0.900 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.298 |
| 2000 | 0.075 | 0.138 | 0.296 | 0.424 | 0.544 | 0.825 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.345 |
| 2001 | 0.092 | 0.220 | 0.344 | 0.485 | 0.637 | 0.776 | 0.875 | 1.127 | 0.000 | 0.000 | 0.000 | 0.490 |
| 2002 | 0.110 | 0.152 | 0.296 | 0.427 | 0.618 | 0.795 | 0.932 | 1.427 | 0.000 | 0.000 | 0.000 | 0.481 |
| 2003 | 0.092 | 0.161 | 0.314 | 0.416 | 0.536 | 0.720 | 0.908 | 1.499 | 0.000 | 0.000 | 0.000 | 0.512 |
| 2004 | 0.094 | 0.151 | 0.325 | 0.437 | 0.523 | 0.575 | 0.858 | 0.748 | 0.000 | 0.000 | 0.000 | 0.527 |
| 2005 | 0.000 | 0.112 | 0.270 | 0.384 | 0.516 | 0.679 | 0.881 | 1.098 | 0.000 | 0.000 | 0.000 | 0.588 |
| 2006 | 0.092 | 0.151 | 0.304 | 0.411 | 0.525 | 0.695 | 0.883 | 0.999 | 0.000 | 1.311 | 0.000 | 0.536 |
| 2007 | 0.111 | 0.152 | 0.313 | 0.418 | 0.509 | 0.672 | 0.882 | 0.935 | 1.056 | 1.322 | 0.000 | 0.551 |
| 2008 | 0.080 | 0.162 | 0.318 | 0.442 | 0.545 | 0.714 | 0.996 | 1.035 | 1.201 | 1.350 | 0.000 | 0.528 |

Table 15. Recreational fishery scup discards (000s) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 2 | 255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 257 |
| 1985 | 40 | 417 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 457 |
| 1986 | 100 | 807 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 907 |
| 1987 | 12 | 357 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 369 |
| 1988 | 2 | 219 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 221 |
| 1989 | 24 | 308 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 332 |
| 1990 | 36 | 284 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 320 |
| 1991 | 31 | 505 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 536 |
| 1992 | 17 | 325 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 342 |
| 1993 | 8 | 204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 212 |
| 1994 | 4 | 203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 207 |
| 1995 | 63 | 135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 198 |
| 1996 | 44 | 222 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 266 |
| 1997 | 163 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| 1998 | 80 | 139 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 219 |
| 1999 | 208 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 208 |
| 2000 | 20 | 561 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 606 |
| 2001 | 0.3 | 484 | 325 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 809 |
| 2002 | 14 | 199 | 381 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 649 |
| 2003 | 1 | 168 | 550 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 782 |
| 2004 | 7 | 232 | 242 | 211 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 692 |
| 2005 | 5 | 88 | 232 | 135 | 44 | 46 | 11 | 1 | 0 | 0 | 0 | 562 |
| 2006 | 1 | 143 | 644 | 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 854 |
| 2007 | 20 | 185 | 375 | 124 | 20 | 2 | 1 | 0 | 0 | 0 | 0 | 727 |
| 2008 | 24 | 230 | 511 | 282 | 50 | 9 | 5 | 8 | 1 | 0 | 0 | 1120 |

Table 16. Recreational fishery scup discards mean weights (kg) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 0.044 | 0.117 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.116 |
| 1985 | 0.038 | 0.125 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.117 |
| 1986 | 0.052 | 0.101 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.096 |
| 1987 | 0.029 | 0.105 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.103 |
| 1988 | 0.026 | 0.142 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.141 |
| 1989 | 0.035 | 0.123 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.117 |
| 1990 | 0.057 | 0.128 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.120 |
| 1991 | 0.064 | 0.150 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.145 |
| 1992 | 0.092 | 0.140 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.138 |
| 1993 | 0.087 | 0.135 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.133 |
| 1994 | 0.054 | 0.180 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.178 |
| 1995 | 0.063 | 0.065 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.064 |
| 1996 | 0.075 | 0.075 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.075 |
| 1997 | 0.043 | 0.075 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.045 |
| 1998 | 0.061 | 0.068 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.065 |
| 1999 | 0.028 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.028 |
| 2000 | 0.075 | 0.087 | 0.189 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.091 |
| 2001 | 0.092 | 0.194 | 0.218 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.204 |
| 2002 | 0.110 | 0.155 | 0.238 | 0.250 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.211 |
| 2003 | 0.092 | 0.141 | 0.215 | 0.251 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.202 |
| 2004 | 0.094 | 0.149 | 0.206 | 0.233 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.194 |
| 2005 | 0.035 | 0.114 | 0.215 | 0.311 | 0.481 | 0.698 | 0.810 | 1.110 | 0.000 | 0.000 | 0.000 | 0.294 |
| 2006 | 0.092 | 0.148 | 0.229 | 0.243 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.216 |
| 2007 | 0.067 | 0.127 | 0.220 | 0.322 | 0.408 | 0.567 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.215 |
| 2008 | 0.039 | 0.121 | 0.242 | 0.343 | 0.507 | 0.781 | 0.854 | 1.074 | 1.233 | 0.000 | 0.000 | 0.264 |

Table 17. Total fishery scup catch (000s) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 104 | 16829 | 13834 | 8584 | 5996 | 1637 | 978 | 337 | 52 | 30 | 66 | 48447 |
| 1985 | 53323 | 21233 | 16355 | 10086 | 3438 | 787 | 657 | 192 | 0 | 0 | 115 | 106186 |
| 1986 | 725 | 6641 | 41931 | 7992 | 1852 | 506 | 193 | 342 | 9 | 57 | 315 | 60563 |
| 1987 | 169 | 11149 | 26853 | 13026 | 2554 | 775 | 236 | 21 | 18 | 11 | 47 | 54859 |
| 1988 | 1580 | 3341 | 19180 | 12689 | 2894 | 274 | 250 | 131 | 20 | 0 | 86 | 40445 |
| 1989 | 739 | 14713 | 21917 | 8707 | 799 | 257 | 223 | 37 | 0 | 50 | 148 | 47590 |
| 1990 | 1027 | 10152 | 32543 | 10684 | 1169 | 467 | 185 | 9 | 2 | 3 | 22 | 56263 |
| 1991 | 2124 | 24986 | 22150 | 15254 | 2866 | 619 | 212 | 0 | 2 | 20 | 68 | 68302 |
| 1992 | 38941 | 13775 | 41720 | 4339 | 4469 | 1327 | 150 | 6 | 8 | 7 | 30 | 104772 |
| 1993 | 5441 | 3228 | 16569 | 8009 | 1754 | 1276 | 126 | 2 | 0 | 2 | 7 | 36414 |
| 1994 | 6893 | 5827 | 18806 | 7123 | 931 | 170 | 60 | 6 | 0 | 0 | 0 | 39816 |
| 1995 | 1933 | 53120 | 10079 | 3211 | 994 | 268 | 34 | 3 | 0 | 0 | 0 | 69642 |
| 1996 | 252 | 3928 | 13800 | 3143 | 1156 | 524 | 72 | 15 | 0 | 0 | 0 | 22890 |
| 1997 | 196 | 811 | 11313 | 6522 | 900 | 147 | 130 | 17 | 6 | 0 | 0 | 20042 |
| 1998 | 111 | 18226 | 13559 | 3915 | 1587 | 457 | 15 | 23 | 0 | 0 | 0 | 37893 |
| 1999 | 1607 | 3033 | 21440 | 6186 | 1400 | 329 | 0 | 0 | 0 | 0 | 0 | 33995 |
| 2000 | 879 | 12679 | 9019 | 5732 | 1207 | 201 | 0 | 0 | 0 | 0 | 0 | 29717 |
| 2001 | 3537 | 5261 | 6118 | 5093 | 1782 | 497 | 164 | 219 | 1 | 0 | 0 | 22671 |
| 2002 | 9582 | 22786 | 8122 | 11172 | 3655 | 1143 | 104 | 39 | 0 | 0 | 0 | 56601 |
| 2003 | 1481 | 1823 | 7007 | 6629 | 8432 | 3041 | 564 | 156 | 5 | 14 | 0 | 29152 |
| 2004 | 553 | 1675 | 2793 | 5344 | 4487 | 3442 | 774 | 72 | 4 | 14 | 0 | 19158 |
| 2005 | 465 | 1025 | 2894 | 2722 | 3184 | 3453 | 1182 | 119 | 3 | 3 | 0 | 15050 |
| 2006 | 4811 | 8365 | 5889 | 3758 | 1576 | 1921 | 1776 | 412 | 28 | 4 | 0 | 28540 |
| 2007 | 1435 | 4259 | 8988 | 5552 | 2279 | 1101 | 1633 | 796 | 150 | 13 | 0 | 26206 |
| 2008 | 1087 | 7844 | 5479 | 4857 | 2211 | 605 | 677 | 525 | 138 | 2 | 1 | 23426 |

Table 18. Total fishery scup catch mean weights (kg) at age.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 0.036 | 0.117 | 0.168 | 0.288 | 0.348 | 0.419 | 0.727 | 0.988 | 0.924 | 1.002 | 1.145 | 0.222 |
| 1985 | 0.033 | 0.116 | 0.179 | 0.289 | 0.446 | 0.629 | 0.775 | 1.050 | 0.000 | 0.000 | 1.673 | 0.122 |
| 1986 | 0.050 | 0.104 | 0.193 | 0.351 | 0.611 | 0.656 | 0.916 | 1.241 | 1.344 | 1.003 | 1.638 | 0.236 |
| 1987 | 0.031 | 0.112 | 0.174 | 0.253 | 0.452 | 0.663 | 0.742 | 1.194 | 1.068 | 1.003 | 3.727 | 0.206 |
| 1988 | 0.033 | 0.122 | 0.169 | 0.265 | 0.449 | 0.657 | 0.754 | 1.096 | 1.099 | 0.000 | 1.532 | 0.223 |
| 1989 | 0.037 | 0.087 | 0.147 | 0.277 | 0.369 | 0.653 | 0.704 | 0.903 | 0.000 | 1.003 | 1.332 | 0.165 |
| 1990 | 0.032 | 0.123 | 0.164 | 0.239 | 0.379 | 0.530 | 0.826 | 0.918 | 1.088 | 1.195 | 1.947 | 0.179 |
| 1991 | 0.058 | 0.138 | 0.201 | 0.278 | 0.409 | 0.580 | 0.724 | 0.000 | 1.003 | 1.003 | 1.305 | 0.206 |
| 1992 | 0.033 | 0.099 | 0.164 | 0.329 | 0.424 | 0.509 | 0.854 | 0.859 | 1.311 | 1.004 | 2.117 | 0.131 |
| 1993 | 0.027 | 0.121 | 0.184 | 0.270 | 0.445 | 0.512 | 0.784 | 0.827 | 0.000 | 1.026 | 1.100 | 0.200 |
| 1994 | 0.024 | 0.125 | 0.189 | 0.267 | 0.434 | 0.669 | 0.799 | 1.430 | 0.000 | 0.000 | 0.000 | 0.174 |
| 1995 | 0.039 | 0.044 | 0.219 | 0.306 | 0.409 | 0.501 | 0.752 | 1.311 | 0.000 | 0.000 | 0.000 | 0.088 |
| 1996 | 0.042 | 0.122 | 0.190 | 0.317 | 0.487 | 0.577 | 0.796 | 1.327 | 0.000 | 0.000 | 0.000 | 0.221 |
| 1997 | 0.049 | 0.066 | 0.168 | 0.318 | 0.409 | 0.595 | 0.767 | 1.342 | 0.779 | 0.000 | 0.000 | 0.231 |
| 1998 | 0.067 | 0.072 | 0.160 | 0.287 | 0.458 | 0.570 | 1.024 | 1.950 | 0.000 | 0.000 | 0.000 | 0.149 |
| 1999 | 0.016 | 0.058 | 0.173 | 0.368 | 0.565 | 0.718 | 0.947 | 1.538 | 0.000 | 0.000 | 0.000 | 0.212 |
| 2000 | 0.045 | 0.081 | 0.235 | 0.371 | 0.524 | 0.798 | 0.947 | 1.538 | 0.000 | 0.000 | 0.000 | 0.205 |
| 2001 | 0.015 | 0.091 | 0.240 | 0.392 | 0.553 | 0.712 | 0.896 | 1.126 | 0.000 | 0.000 | 0.000 | 0.253 |
| 2002 | 0.035 | 0.066 | 0.223 | 0.360 | 0.515 | 0.701 | 1.024 | 1.427 | 0.000 | 0.000 | 0.000 | 0.186 |
| 2003 | 0.022 | 0.099 | 0.247 | 0.376 | 0.501 | 0.708 | 0.893 | 1.337 | 1.241 | 0.000 | 0.000 | 0.396 |
| 2004 | 0.030 | 0.116 | 0.230 | 0.374 | 0.512 | 0.578 | 0.839 | 0.889 | 1.370 | 1.674 | 0.000 | 0.412 |
| 2005 | 0.019 | 0.096 | 0.190 | 0.346 | 0.480 | 0.659 | 0.832 | 1.056 | 1.099 | 1.311 | 0.000 | 0.433 |
| 2006 | 0.026 | 0.089 | 0.233 | 0.335 | 0.472 | 0.614 | 0.775 | 0.924 | 1.108 | 1.313 | 0.000 | 0.253 |
| 2007 | 0.042 | 0.099 | 0.205 | 0.350 | 0.477 | 0.653 | 0.810 | 0.905 | 1.073 | 1.668 | 0.000 | 0.316 |
| 2008 | 0.039 | 0.098 | 0.225 | 0.351 | 0.510 | 0.679 | 0.910 | 1.016 | 1.345 | 1.393 | 2.437 | 0.283 |

Table 19. Extended series of total fishery catch. Catches in metric tons (mt). To estimate commercial discards for 1960-1988, D/L ratio for 1989-1997 = 0.504 was applied to commercial landings. To estimate recreational catch for 1960-1980, 50% of the Mayo 1982 estimates were included.

| Year | Comm. Land. | Comm. Disc. | DWF Land. | Rec Catch | Total Catch |
|---|---|---|---|---|---|
| 1960 | 22236 | 11198 | 0 | 3765 | 37,199 |
| 1961 | 20944 | 10548 | 0 | 3716 | 35,208 |
| 1962 | 20831 | 10491 | 0 | 3667 | 34,989 |
| 1963 | 18884 | 9510 | 5863 | 3528 | 37,785 |
| 1964 | 17204 | 8664 | 459 | 3341 | 29,668 |
| 1965 | 15785 | 7950 | 2089 | 3265 | 29,089 |
| 1966 | 11960 | 6023 | 823 | 2474 | 21,280 |
| 1967 | 8748 | 4406 | 896 | 1879 | 15,929 |
| 1968 | 6630 | 3339 | 2251 | 1473 | 13,693 |
| 1969 | 5149 | 2593 | 485 | 1107 | 9,334 |
| 1970 | 4493 | 2263 | 288 | 1003 | 8,047 |
| 1971 | 3974 | 2001 | 889 | 853 | 7,717 |
| 1972 | 4203 | 2117 | 1647 | 796 | 8,763 |
| 1973 | 5024 | 2530 | 1783 | 1118 | 10,455 |
| 1974 | 7106 | 3579 | 958 | 1,388 | 13,031 |
| 1975 | 7623 | 3839 | 685 | 1,403 | 13,550 |
| 1976 | 7302 | 3677 | 87 | 1,183 | 12,249 |
| 1977 | 8330 | 4195 | 28 | 1,398 | 13,951 |
| 1978 | 8936 | 4500 | 3 | 1,256 | 14,695 |
| 1979 | 8585 | 4324 | 0 | 1,198 | 14,107 |
| 1980 | 8424 | 4242 | 16 | 3,109 | 15,791 |
| 1981 | 9,856 | 4964 | 1 | 2,636 | 17,457 |
| 1982 | 8,704 | 4383 | 0 | 2,361 | 15,448 |
| 1983 | 7,794 | 3925 | 0 | 2,836 | 14,555 |
| 1984 | 7,769 | 2158 | 0 | 1,126 | 11,053 |
| 1985 | 6,727 | 4184 | 0 | 2,818 | 13,729 |
| 1986 | 7,176 | 2005 | 0 | 5,351 | 14,532 |
| 1987 | 6,276 | 2537 | 0 | 2,849 | 11,662 |
| 1988 | 5,943 | 1657 | 0 | 1,967 | 9,567 |
| 1989 | 3,984 | 2229 | 0 | 2,560 | 8,773 |
| 1990 | 4,571 | 3909 | 0 | 1,916 | 10,396 |
| 1991 | 7,081 | 3530 | 0 | 3,746 | 14,357 |
| 1992 | 6,259 | 5668 | 0 | 2,048 | 13,975 |
| 1993 | 4,726 | 1436 | 0 | 1,478 | 7,640 |
| 1994 | 4,392 | 807 | 0 | 1,229 | 6,428 |
| 1995 | 3,073 | 2,057 | 0 | 622 | 5,752 |
| 1996 | 2,945 | 1,522 | 0 | 998 | 5,465 |
| 1997 | 2,188 | 1,843 | 0 | 551 | 4,582 |
| 1998 | 1,896 | 3,331 | 0 | 411 | 5,638 |
| 1999 | 1,505 | 4,819 | 0 | 862 | 7,186 |
| 2000 | 1,207 | 2,352 | 0 | 2,524 | 6,083 |
| 2001 | 1,729 | 1,499 | 0 | 2,098 | 5,326 |
| 2002 | 3,173 | 5,636 | 0 | 1,781 | 10,590 |
| 2003 | 4,405 | 2,153 | 0 | 4,006 | 10,564 |
| 2004 | 4,231 | 893 | 0 | 2,057 | 7,181 |
| 2005 | 4,266 | 662 | 0 | 1,380 | 6,308 |
| 2006 | 4,062 | 1,387 | 0 | 1,724 | 7,173 |
| 2007 | 4,196 | 1,859 | 0 | 1,971 | 8,026 |
| 2008 | 2,343 | 2,879 | 0 | 2,130 | 7,352 |

Table 20. NEFSC spring and fall trawl survey indices for scup. Strata set includes only offshore strata 1-12, 23, 25 and 61-76 for consistency over entire time series. Fall strata set excludes inshore strata 1-61 that are included in the 1984 and later indices at age.

| Year | Spring No./tow | Spring Kg/tow | Spring SSB kg/tow | Spring SSB 3-yr avg | Fall No./tow | Fall Kg/tow |
|---|---|---|---|---|---|---|
| 1963 | | | | | 2.12 | 1.21 |
| 1964 | | | | | 118.70 | 2.23 |
| 1965 | | | | | 3.84 | 0.62 |
| 1966 | | | | | 2.00 | 0.41 |
| 1967 | | | | | 29.38 | 1.46 |
| 1968 | 59.21 | 2.25 | 0.94 | | 14.35 | 0.54 |
| 1969 | 2.26 | 0.40 | 0.39 | 0.88 | 99.41 | 4.48 |
| 1970 | 78.50 | 3.01 | 1.30 | 1.09 | 10.34 | 0.22 |
| 1971 | 70.91 | 2.41 | 1.57 | 1.28 | 7.730 | 0.25 |
| 1972 | 49.80 | 2.30 | 0.98 | 1.21 | 40.56 | 2.34 |
| 1973 | 3.62 | 1.19 | 1.09 | 1.38 | 22.82 | 0.93 |
| 1974 | 30.28 | 3.24 | 2.06 | 1.92 | 9.94 | 1.01 |
| 1975 | 14.01 | 3.12 | 2.61 | 1.73 | 52.21 | 3.40 |
| 1976 | 4.09 | 0.63 | 0.53 | 2.50 | 161.14 | 7.35 |
| 1977 | 42.46 | 4.48 | 4.35 | 2.49 | 32.69 | 1.71 |
| 1978 | 39.85 | 3.49 | 2.59 | 2.77 | 12.17 | 1.32 |
| 1979 | 22.42 | 1.95 | 1.38 | 1.69 | 15.77 | 0.61 |
| 1980 | 9.31 | 1.31 | 1.09 | 1.12 | 11.05 | 0.92 |
| 1981 | 14.72 | 1.16 | 0.89 | 1.00 | 67.14 | 3.01 |
| 1982 | 7.88 | 1.16 | 1.02 | 0.65 | 25.47 | 1.17 |
| 1983 | 0.80 | 0.29 | 0.03 | 0.46 | 4.59 | 0.34 |
| 1984 | 8.52 | 0.51 | 0.33 | 0.24 | 24.03 | 1.22 |
| 1985 | 14.67 | 0.80 | 0.37 | 0.68 | 68.30 | 3.56 |
| 1986 | 11.74 | 1.30 | 1.33 | 0.98 | 46.19 | 1.66 |
| 1987 | 10.82 | 1.21 | 1.24 | 1.10 | 5.76 | 0.15 |
| 1988 | 25.41 | 1.26 | 0.73 | 0.66 | 5.75 | 0.09 |
| 1989 | 1.63 | 0.12 | 0.00 | 0.35 | 94.05 | 3.37 |
| 1990 | 1.17 | 0.39 | 0.34 | 0.26 | 16.53 | 0.83 |
| 1991 | 12.61 | 0.75 | 0.45 | 0.32 | 9.52 | 0.43 |
| 1992 | 6.79 | 0.40 | 0.21 | 0.32 | 16.19 | 1.12 |
| 1993 | 2.93 | 0.33 | 0.31 | 0.18 | 0.43 | 0.04 |
| 1994 | 1.54 | 0.09 | 0.03 | 0.15 | 3.59 | 0.11 |
| 1995 | 2.90 | 0.22 | 0.12 | 0.06 | 24.72 | 0.91 |
| 1996 | 0.53 | 0.03 | 0.02 | 0.08 | 4.46 | 0.23 |
| 1997 | 0.91 | 0.11 | 0.11 | 0.06 | 16.92 | 0.88 |
| 1998 | 40.04 | 0.87 | 0.05 | 0.08 | 25.35 | 0.69 |
| 1999 | 1.70 | 0.12 | 0.09 | 0.08 | 85.23 | 2.07 |
| 2000 | 6.71 | 0.33 | 0.11 | 0.25 | 99.33 | 4.79 |
| 2001 | 13.03 | 0.80 | 0.54 | 3.30 | 20.28 | 1.11 |
| 2002 | 154.86 | 13.46 | 9.24 | 3.31 | 95.62 | 3.79 |
| 2003 | 6.01 | 0.28 | 0.15 | 3.74 | 28.18 | 0.80 |
| 2004 | 57.58 | 2.84 | 1.82 | 0.69 | 10.38 | 0.27 |
| 2005 | 19.22 | 0.55 | 0.10 | 1.32 | 4.50 | 0.07 |
| 2006 | 5.71 | 2.10 | 2.04 | 0.76 | 96.41 | 1.92 |
| 2007 | 10.60 | 0.36 | 0.14 | 1.16 | 41.52 | 2.21 |
| 2008 | 9.68 | 1.44 | 1.30 | | 38.49 | 1.38 |

Table 21. NEFSC spring trawl survey stratified mean number of scup per tow at age. Strata set includes only offshore strata 1-12, 23, 25, and 61-76.

| Spring | Age | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Total | age 2+ | age 3+ |
| 1977 | | 6.62 | 32.08 | 3.54 | 0.16 | 0.04 | 0.01 | 0.01 | | | | | 42.46 | 35.84 | 3.76 |
| 1978 | | 26.90 | 4.67 | 6.50 | 1.31 | 0.32 | 0.12 | 0.03 | | | | | 39.85 | 12.95 | 8.28 |
| 1979 | | 15.63 | 4.04 | 0.88 | 1.28 | 0.37 | 0.06 | 0.13 | 0.02 | 0.01 | | | 22.42 | 6.79 | 2.75 |
| 1980 | | 2.39 | 5.61 | 0.57 | 0.17 | 0.25 | 0.15 | 0.08 | 0.08 | 0.01 | | | 9.31 | 6.92 | 1.31 |
| 1981 | | 10.78 | 2.16 | 1.15 | 0.17 | 0.14 | 0.05 | 0.15 | 0.12 | | | | 14.72 | 3.94 | 1.78 |
| 1982 | | 3.80 | 1.77 | 1.39 | 0.38 | 0.17 | 0.13 | 0.07 | 0.07 | 0.10 | | | 7.88 | 4.08 | 2.31 |
| 1983 | | 0.70 | 0.03 | 0.06 | | | | 0.01 | | | | | 0.80 | 0.10 | 0.07 |
| 1984 | | 6.14 | 1.97 | 0.22 | 0.12 | 0.07 | | | | | | | 8.52 | 2.38 | 0.41 |
| 1985 | | 12.11 | 2.32 | 0.20 | 0.04 | | | | | | | | 14.67 | 2.56 | 0.24 |
| 1986 | | 1.05 | 10.26 | 0.43 | | | | | | | | | 11.74 | 10.69 | 0.43 |
| 1987 | | 4.57 | 3.60 | 1.81 | 0.74 | 0.04 | 0.02 | 0.03 | 0.01 | | | | 10.82 | 6.25 | 2.65 |
| 1988 | | 16.74 | 8.36 | 0.17 | 0.03 | 0.01 | 0.03 | 0.07 | | | | | 25.41 | 8.67 | 0.31 |
| 1989 | | 0.79 | 0.74 | 0.09 | 0.01 | | | | | | | | 1.63 | 0.84 | 0.10 |
| 1990 | | 0.12 | 0.30 | 0.30 | 0.18 | 0.09 | 0.13 | 0.05 | | | | | 1.17 | 1.05 | 0.75 |
| 1991 | | 10.61 | 0.70 | 1.11 | 0.19 | | | | | | | | 12.61 | 2.00 | 1.30 |
| 1992 | | 5.72 | 0.88 | 0.07 | 0.05 | 0.06 | 0.01 | | | | | | 6.79 | 1.07 | 0.19 |
| 1993 | | 0.61 | 2.02 | 0.17 | 0.11 | 0.02 | | | | | | | 2.93 | 2.32 | 0.30 |
| 1994 | | 1.34 | 0.16 | 0.04 | | | | | | | | | 1.54 | 0.20 | 0.04 |
| 1995 | | 2.29 | 0.44 | 0.11 | 0.05 | 0.01 | | | | | | | 2.90 | 0.61 | 0.17 |
| 1996 | | 0.44 | 0.05 | 0.03 | 0.01 | | | | | | | | 0.53 | 0.09 | 0.04 |
| 1997 | | 0.17 | 0.64 | 0.10 | | | | | | | | | 0.91 | 0.74 | 0.10 |
| 1998 | | 39.90 | 0.12 | 0.02 | | | | | | | | | 40.04 | 0.14 | 0.02 |
| 1999 | | 1.03 | 0.67 | | | | | | | | | | 1.70 | 0.67 | 0.00 |
| 2000 | | 5.93 | 0.71 | 0.07 | | | | | | | | | 6.71 | 0.78 | 0.07 |
| 2001 | | 7.90 | 5.03 | 0.08 | | 0.02 | | | | | | | 13.03 | 5.13 | 0.10 |
| 2002 | | 109.01 | 15.60 | 26.67 | 3.27 | 0.31 | | | | | | | 154.86 | 45.85 | 30.25 |
| 2003 | | 5.08 | 0.79 | 0.07 | 0.06 | | | | | | | | 6.01 | 0.92 | 0.14 |
| 2004 | | 38.69 | 16.15 | 1.31 | 0.82 | 0.60 | | | | | | | 57.58 | 18.89 | 2.74 |
| 2005 | | 18.26 | 0.81 | 0.13 | 0.02 | | | | | | | | 19.22 | 0.96 | 0.15 |
| 2006 | | 1.56 | 0.51 | 0.80 | 0.35 | 0.70 | 1.69 | 0.10 | | | | | 5.71 | 4.15 | 3.64 |
| 2007 | | 9.73 | 0.41 | 0.44 | 0.00 | 0.01 | 0.01 | | | | | | 10.60 | 0.87 | 0.46 |
| 2008 | | 0.40 | 5.82 | 2.92 | 0.18 | 0.09 | 0.15 | 0.05 | 0.07 | | | | 9.68 | 9.28 | 3.46 |

Table 22. NEFSC fall trawl survey stratified mean number of scup per tow at age. Strata set includes offshore strata 1-12, 23, 25, 61-76, and inshore strata 1-61.

| Fall | Age | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Total | age 2+ | age 3+ |
| 1984 | 47.64 | 9.20 | 0.34 | 0.03 | 0.01 | | 0.01 | | | | | | 59.96 | 0.39 | 0.05 |
| 1985 | 61.22 | 11.53 | 1.10 | 0.26 | 0.06 | 0.05 | | | | | | | 74.71 | 1.47 | 0.37 |
| 1986 | 70.19 | 6.58 | 0.57 | | 0.01 | | | | | | | | 77.36 | 0.58 | 0.01 |
| 1987 | 49.93 | 29.85 | 0.46 | 0.01 | | | | | | | | | 80.45 | 0.47 | 0.01 |
| 1988 | 47.44 | 15.95 | 0.67 | 0.10 | | | | | | | | | 64.22 | 0.77 | 0.10 |
| 1989 | 176.37 | 25.92 | 0.66 | 0.03 | | | | | | | | | 202.99 | 0.69 | 0.03 |
| 1990 | 77.45 | 9.21 | 0.75 | 0.04 | | | | | | | | | 87.46 | 0.79 | 0.04 |
| 1991 | 151.62 | 12.51 | 0.07 | 0.02 | | | | | | | | | 164.24 | 0.09 | 0.02 |
| 1992 | 25.92 | 14.51 | 1.66 | 0.04 | 0.02 | | | | | | | | 42.15 | 1.72 | 0.06 |
| 1993 | 46.78 | 9.76 | 0.32 | | | | | | | | | | 56.86 | 0.32 | 0.00 |
| 1994 | 39.54 | 3.92 | 0.04 | 0.01 | | | | | | | | | 43.52 | 0.05 | 0.01 |
| 1995 | 33.04 | 2.61 | 0.08 | 0.01 | | | | | | | | | 35.74 | 0.09 | 0.01 |
| 1996 | 24.42 | 2.86 | 0.43 | 0.01 | | | | | | | | | 27.73 | 0.44 | 0.01 |
| 1997 | 46.91 | 0.61 | 0.02 | | 0.01 | | | | | | | | 47.66 | 0.03 | 0.01 |
| 1998 | 57.73 | 9.64 | 0.09 | 0.03 | 0.01 | | | | | | | | 67.50 | 0.13 | 0.04 |
| 1999 | 96.06 | 9.77 | 1.37 | 0.07 | 0.01 | | | | | | | | 107.28 | 1.45 | 0.08 |
| 2000 | 98.72 | 20.60 | 3.14 | 0.48 | 0.11 | 0.07 | | | | | | | 123.12 | 3.80 | 0.66 |
| 2001 | 91.84 | 10.32 | 1.82 | 0.12 | 0.04 | 0.01 | | | | | | | 104.15 | 1.99 | 0.17 |
| 2002 | 180.09 | 43.31 | 0.90 | 0.35 | 0.04 | 0.01 | | | | | | | 224.70 | 1.30 | 0.40 |
| 2003 | 53.70 | 5.66 | 2.30 | 1.33 | 0.82 | 0.20 | 0.02 | | | | | | 64.02 | 4.67 | 2.37 |
| 2004 | 41.83 | 33.46 | 1.14 | 1.70 | 0.39 | 0.12 | 0.04 | 0.01 | | | | | 78.69 | 3.40 | 2.26 |
| 2005 | 27.26 | 7.94 | 1.02 | 0.14 | 0.04 | 0.04 | | | | | | | 36.43 | 1.23 | 0.21 |
| 2006 | 146.85 | 20.08 | 0.92 | 0.07 | 0.05 | 0.01 | 0.03 | 0.01 | | | | | 168.02 | 1.09 | 0.17 |
| 2007 | 113.95 | 40.28 | 0.60 | 0.24 | 0.05 | 0.03 | 0.05 | 0.02 | | | | | 155.22 | 0.99 | 0.39 |
| 2008 | 70.43 | 65.48 | 0.52 | 0.06 | 0.01 | | | | | | | | 136.50 | 0.59 | 0.07 |

Table 23. NEFSC 1992-2007 winter trawl survey indices of abundance for scup, offshore survey strata 1-12 and 61-76. The winter survey ended in 2007.

| Year | Mean number per tow | Mean kg per tow |
|---|---|---|
| 1992 | 65.56 | 2.87 |
| 1993 | 25.71 | 2.73 |
| 1994 | 17.09 | 0.66 |
| 1995 | 69.50 | 2.26 |
| 1996 | 18.28 | 1.19 |
| 1997 | 13.90 | 0.32 |
| 1998 | 46.92 | 1.20 |
| 1999 | 15.04 | 0.71 |
| 2000 | 24.21 | 1.33 |
| 2001 | 55.49 | 1.58 |
| 2002 | 267.83 | 7.56 |
| 2003 | 24.16 | 0.49 |
| 2004 | 380.59 | 3.82 |
| 2005 | 84.74 | 1.96 |
| 2006 | 201.96 | 3.72 |
| 2007 | 101.08 | 2.95 |

Table 24. NEFSC 1992-2007 winter trawl survey stratified mean number of scup per tow at age, offshore survey strata 1-12 and 61-76. The 1992, 1993, and 1996 lengths are aged with the corresponding annual spring survey age-length key. The winter survey ended in 2007.

| Winter | Age | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Total | age 2+ | age 3+ |
| 1992 | | 57.61 | 4.75 | 0.19 | 0.09 | 0.10 | 0.45 | | | 63.18 | 5.57 | 0.82 |
| 1993 | | 2.51 | 22.05 | 0.56 | 0.57 | 0.02 | | | | 25.71 | 23.19 | 1.15 |
| 1994 | | 16.31 | 0.73 | 0.02 | 0.02 | 0.01 | | | | 17.09 | 0.78 | 0.05 |
| 1995 | | 64.94 | 1.87 | 0.15 | 0.01 | 0.01 | 0.02 | 0.01 | | 67.01 | 2.07 | 0.20 |
| 1996 | | 12.95 | 5.31 | 0.03 | 0.01 | | | | | 18.29 | 5.34 | 0.04 |
| 1997 | | 13.27 | 0.52 | 0.11 | | | | | | 13.90 | 0.64 | 0.11 |
| 1998 | | 45.62 | 0.75 | 0.22 | 0.21 | 0.08 | 0.03 | 0.01 | | 46.92 | 1.30 | 0.55 |
| 1999 | | 12.48 | 2.41 | 0.12 | 0.02 | 0.01 | | | | 15.04 | 2.56 | 0.15 |
| 2000 | | 20.28 | 3.21 | 0.68 | 0.03 | | | 0.01 | | 24.21 | 3.93 | 0.72 |
| 2001 | | 48.54 | 6.48 | 0.36 | 0.09 | 0.02 | | | | 55.49 | 6.95 | 0.47 |
| 2002 | | 257.08 | 7.44 | 2.96 | 0.33 | 0.01 | 0.01 | | | 267.83 | 10.75 | 3.31 |
| 2003 | | 23.77 | 0.28 | 0.07 | 0.03 | | 0.02 | | | 24.16 | 0.39 | 0.11 |
| 2004 | | 380.22 | 0.29 | 0.07 | 0.01 | | | | | 380.59 | 0.37 | 0.08 |
| 2005 | | 80.03 | 4.62 | 0.09 | | | | | | 84.74 | 4.71 | 0.09 |
| 2006 | | 198.52 | 2.64 | 0.66 | 0.03 | 0.04 | 0.07 | | | 201.96 | 3.44 | 0.80 |
| 2007 | | 99.18 | 1.86 | 0.02 | 0.02 | | | | | 101.08 | 1.90 | 0.04 |

Table 25. MADMF trawl survey mean number of scup per tow and mean weight (kg) per tow for spring (survey regions 1-3) and fall (survey regions 1-5).

| | Spring | | Fall | |
|---|---|---|---|---|
| Year | No./Tow | Kg/tow | No./Tow | Kg/Tow |
| 1978 | 90.08 | 31.71 | 1859.40 | 14.82 |
| 1979 | 76.14 | 18.05 | 1150.16 | 12.20 |
| 1980 | 189.82 | 41.39 | 1183.02 | 12.53 |
| 1981 | 298.53 | 17.63 | 971.87 | 14.34 |
| 1982 | 10.46 | 0.98 | 2153.76 | 9.17 |
| 1983 | 25.29 | 3.51 | 1623.13 | 12.90 |
| 1984 | 17.90 | 6.53 | 963.49 | 12.29 |
| 1985 | 67.02 | 3.40 | 647.63 | 12.09 |
| 1986 | 44.17 | 7.35 | 773.61 | 9.15 |
| 1987 | 6.05 | 1.37 | 561.61 | 7.72 |
| 1988 | 13.98 | 2.09 | 1396.86 | 14.15 |
| 1989 | 13.32 | 2.02 | 580.73 | 7.77 |
| 1990 | 144.06 | 21.45 | 1128.07 | 7.21 |
| 1991 | 28.73 | 6.05 | 1150.71 | 10.18 |
| 1992 | 14.49 | 2.52 | 2440.96 | 11.54 |
| 1993 | 19.13 | 4.23 | 1023.11 | 10.06 |
| 1994 | 9.71 | 2.85 | 820.31 | 9.84 |
| 1995 | 49.29 | 2.76 | 507.02 | 4.11 |
| 1996 | 5.18 | 0.68 | 1019.96 | 9.15 |
| 1997 | 3.22 | 0.71 | 921.21 | 7.25 |
| 1998 | 1.37 | 0.21 | 709.61 | 6.94 |
| 1999 | 11.61 | 1.93 | 1212.23 | 18.07 |
| 2000 | 307.00 | 18.02 | 867.00 | 11.63 |
| 2001 | 7.28 | 2.37 | 1205.60 | 9.89 |
| 2002 | 281.36 | 18.77 | 1137.64 | 8.32 |
| 2003 | 0.22 | 0.07 | 3209.61 | 14.87 |
| 2004 | 41.71 | 13.04 | 1483.56 | 10.07 |
| 2005 | 9.32 | 3.25 | 4005.89 | 21.53 |
| 2006 | 92.97 | 22.41 | 1231.49 | 9.46 |
| 2007 | 13.30 | 2.03 | 1774.23 | 11.65 |
| 2008 | 145.72 | 27.89 | 743.19 | 10.78 |

Table 26. RIDFW trawl survey mean number of scup per tow and mean weight (kg) per tow for spring and fall.

| | Spring | | Fall | |
|---|---|---|---|---|
| Year | No./Tow | Kg/tow | No./Tow | Kg/Tow |
| 1981 | 12.49 | 0.40 | 196.22 | 2.54 |
| 1982 | 0.43 | 0.04 | 63.87 | 0.70 |
| 1983 | 3.59 | 0.32 | 173.63 | 2.75 |
| 1984 | 13.24 | 0.88 | 589.68 | 10.57 |
| 1985 | 8.30 | 0.41 | 74.27 | 1.51 |
| 1986 | 1.78 | 0.33 | 340.06 | 4.20 |
| 1987 | 0.04 | 0.01 | 314.20 | 4.73 |
| 1988 | 0.23 | 0.04 | 804.00 | 7.10 |
| 1989 | 0.17 | 0.04 | 326.86 | 6.62 |
| 1990 | 0.64 | 0.15 | 527.31 | 5.66 |
| 1991 | 2.93 | 0.57 | 655.69 | 16.62 |
| 1992 | 1.88 | 0.61 | 1105.51 | 9.10 |
| 1993 | 1.12 | 0.06 | 1246.35 | 8.90 |
| 1994 | 2.08 | 0.53 | 236.12 | 3.66 |
| 1995 | 4.33 | 0.53 | 423.02 | 5.03 |
| 1996 | 0.52 | 0.07 | 184.73 | 3.83 |
| 1997 | 1.93 | 0.15 | 597.90 | 6.04 |
| 1998 | 0.15 | 0.03 | 150.38 | 1.89 |
| 1999 | 0.38 | 0.07 | 832.22 | 12.39 |
| 2000 | 84.05 | 3.54 | 588.73 | 9.11 |
| 2001 | 29.68 | 5.08 | 1139.17 | 11.07 |
| 2002 | 174.80 | 10.28 | 716.12 | 9.27 |
| 2003 | 0.00 | 0.00 | 1181.83 | 11.38 |
| 2004 | 2.59 | 0.45 | 1616.24 | 9.58 |
| 2005 | 2.95 | 1.63 | 2216.72 | 21.35 |
| 2006 | 53.12 | 3.90 | 765.90 | 11.26 |
| 2007 | 1.95 | 0.24 | 2410.00 | 23.76 |
| 2008 | 0.19 | 0.04 | 705.10 | 18.15 |

Table 27. CTDEP spring trawl survey mean number of scup per tow at age, total mean number per tow, and total mean weight (kg) per tow.

| | | | | | | | Age | | | | | | | | Total | Total | Age |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | No./Tow | Kg/Tow | 2+ |
| 1984 | 0.49 | 1.31 | 0.59 | 0.30 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 2.80 | 0.64 | 2.31 |
| 1985 | 2.94 | 2.00 | 0.33 | 0.24 | 0.05 | 0.02 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 5.61 | 1.22 | 2.71 |
| 1986 | 4.44 | 1.65 | 0.99 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.40 | 0.78 | 2.79 |
| 1987 | 0.43 | 1.65 | 0.07 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.17 | 0.37 | 1.76 |
| 1988 | 1.18 | 0.30 | 0.51 | 0.05 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.11 | 0.32 | 0.88 |
| 1989 | 5.63 | 0.56 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.77 | 0.63 | 0.62 |
| 1990 | 2.56 | 2.06 | 0.21 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.25 | 0.61 | 2.30 |
| 1991 | 4.25 | 1.44 | 1.26 | 0.09 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.09 | 0.94 | 2.80 |
| 1992 | 0.39 | 1.21 | 0.09 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.75 | 0.48 | 1.36 |
| 1993 | 0.04 | 2.29 | 0.19 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.32 | 0.49 | 2.49 |
| 1994 | 0.81 | 2.03 | 0.93 | 0.10 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.88 | 0.58 | 3.09 |
| 1995 | 12.94 | 0.39 | 0.20 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.24 | 0.65 | 0.64 |
| 1996 | 5.20 | 2.48 | 0.07 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.25 | 0.73 | 2.56 |
| 1997 | 3.16 | 2.61 | 1.68 | 0.06 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 3.23 | 0.75 | 4.39 |
| 1998 | 10.07 | 0.58 | 0.12 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.25 | 0.75 | 0.76 |
| 1999 | 2.71 | 1.75 | 0.16 | 0.07 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.22 | 0.56 | 2.02 |
| 2000 | 124.51 | 17.18 | 4.24 | 0.20 | 0.06 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.46 | 4.56 | 21.71 |
| 2001 | 1.65 | 18.99 | 1.57 | 0.25 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.20 | 2.85 | 20.84 |
| 2002 | 49.15 | 66.61 | 123.25 | 17.44 | 1.29 | 0.10 | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 257.91 | 13.16 | 208.76 |
| 2003 | 0.14 | 4.05 | 3.28 | 4.96 | 0.61 | 0.07 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 13.12 | 2.28 | 12.98 |
| 2004 | 0.01 | 3.97 | 8.96 | 4.90 | 8.21 | 0.76 | 0.08 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 26.92 | 3.93 | 26.90 |
| 2005 | 1.16 | 1.28 | 1.06 | 1.51 | 1.27 | 1.94 | 0.22 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.49 | 1.65 | 7.33 |
| 2006 | 18.48 | 23.72 | 5.63 | 2.07 | 2.56 | 3.16 | 2.90 | 0.53 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 59.06 | 10.41 | 40.58 |
| 2007 | 7.51 | 15.86 | 5.84 | 1.49 | 0.55 | 0.54 | 0.54 | 0.39 | 0.07 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 32.80 | 3.32 | 25.29 |
| 2008 | 16.96 | 40.62 | 27.82 | 4.94 | 0.91 | 0.16 | 0.30 | 0.24 | 0.15 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 92.10 | 5.88 | 75.14 |

Table 28. CTDEP fall trawl survey mean number of scup per tow at age, total mean number per tow, and total mean weight (kg) per tow.

| Year | 0 | 1 | 2 | 3 | 4 | 5 | Age 6 | 7 | 8 | 9 | 10 | Total No/Tow | Total Kg/Tow | Age 2+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1984 | 7.99 | 1.04 | 0.78 | 0.52 | 0.28 | 0.09 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 10.72 | 1.36 | 1.69 |
| 1985 | 25.01 | 4.71 | 0.40 | 0.59 | 0.19 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 30.97 | 2.50 | 1.25 |
| 1986 | 13.06 | 9.98 | 2.50 | 0.19 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 25.76 | 2.95 | 2.72 |
| 1987 | 12.47 | 4.17 | 1.25 | 0.58 | 0.06 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 18.55 | 1.79 | 1.91 |
| 1988 | 31.89 | 5.71 | 1.82 | 0.24 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 39.69 | 2.27 | 2.09 |
| 1989 | 40.88 | 22.60 | 1.51 | 0.08 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 65.08 | 3.65 | 1.60 |
| 1990 | 54.34 | 7.74 | 6.95 | 0.40 | 0.03 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 69.49 | 5.00 | 7.41 |
| 1991 | 291.58 | 17.03 | 1.76 | 1.04 | 0.15 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 311.57 | 8.30 | 2.96 |
| 1992 | 50.91 | 26.58 | 5.54 | 0.40 | 0.29 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 83.74 | 4.96 | 6.25 |
| 1993 | 74.06 | 1.83 | 1.02 | 0.12 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 77.05 | 3.72 | 1.16 |
| 1994 | 90.76 | 1.12 | 0.46 | 0.18 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 92.53 | 3.33 | 0.65 |
| 1995 | 32.46 | 26.52 | 0.14 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 59.13 | 4.63 | 0.15 |
| 1996 | 51.50 | 8.56 | 1.37 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 61.47 | 3.68 | 1.41 |
| 1997 | 31.79 | 8.68 | 0.63 | 0.17 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 41.28 | 2.49 | 0.81 |
| 1998 | 90.40 | 12.24 | 0.54 | 0.07 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 103.27 | 4.50 | 0.63 |
| 1999 | 498.18 | 30.93 | 8.35 | 0.19 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 537.68 | 22.72 | 8.57 |
| 2000 | 250.39 | 261.45 | 8.32 | 0.79 | 0.14 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 521.10 | 30.76 | 9.26 |
| 2001 | 140.51 | 16.90 | 18.42 | 1.61 | 0.19 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 177.66 | 11.28 | 20.25 |
| 2002 | 259.90 | 47.62 | 23.32 | 16.81 | 0.67 | 0.33 | 0.05 | 0.00 | 0.01 | 0.00 | 0.00 | 348.70 | 23.69 | 41.18 |
| 2003 | 52.91 | 15.35 | 32.07 | 22.39 | 26.44 | 2.49 | 0.54 | 0.02 | 0.02 | 0.00 | 0.00 | 152.23 | 28.95 | 83.96 |
| 2004 | 251.05 | 4.13 | 8.34 | 15.08 | 5.98 | 6.25 | 0.53 | 0.07 | 0.01 | 0.02 | 0.00 | 291.46 | 16.31 | 36.28 |
| 2005 | 373.32 | 32.56 | 8.14 | 2.44 | 4.01 | 1.50 | 1.69 | 0.33 | 0.06 | 0.00 | 0.00 | 424.05 | 13.79 | 18.17 |
| 2006 | 52.16 | 51.02 | 9.52 | 2.34 | 0.26 | 0.35 | 0.38 | 0.68 | 0.04 | 0.00 | 0.00 | 116.75 | 10.49 | 13.57 |
| 2007 | 319.89 | 118.06 | 29.34 | 5.93 | 0.90 | 0.23 | 0.30 | 0.31 | 0.31 | 0.03 | 0.00 | 475.30 | 24.42 | 37.35 |
| 2008 | 243.68 | 35.10 | 11.92 | 7.04 | 3.56 | 1.05 | 0.50 | 0.14 | 0.12 | 0.14 | 0.00 | 303.26 | 16.53 | 24.48 |

Table 29. NYDEC trawl survey indices at ages 0, 1 and 2 and older (2+); NJBMF trawl survey mean number of scup per tow and mean weight (kg) per tow; VIMS age 0 index.

| | NYDEC Trawl | | | NJBMF Trawl | | VIMS |
|---|---|---|---|---|---|---|
| Year | Age 0 | Age 1 | Age 2+ | No/tow | Kg/tow | Age 0 |
| 1987 | 0.33 | 3.43 | 0.09 | | | 2.07 |
| 1988 | 1.19 | 1.96 | 0.05 | | | 3.06 |
| 1989 | 0.67 | 11.02 | 0.04 | 72.75 | 2.75 | 4.81 |
| 1990 | 5.32 | 1.30 | 0.14 | 74.72 | 3.77 | 1.90 |
| 1991 | 13.17 | 2.31 | 0.22 | 200.61 | 6.17 | 0.65 |
| 1992 | 15.25 | 1.54 | 0.06 | 227.70 | 7.16 | 3.30 |
| 1993 | 0.29 | 0.72 | 0.04 | 256.91 | 5.21 | 0.90 |
| 1994 | 6.11 | 0.36 | 0.06 | 86.45 | 3.30 | 0.39 |
| 1995 | 0.61 | 7.49 | 0.03 | 27.13 | 2.08 | 0.54 |
| 1996 | 0.42 | 0.94 | 0.15 | 30.81 | 1.04 | 0.21 |
| 1997 | 20.23 | 0.74 | 0.20 | 52.09 | 3.82 | 0.50 |
| 1998 | 73.22 | 1.46 | 0.05 | 220.05 | 4.88 | 0.27 |
| 1999 | 35.85 | 2.25 | 0.03 | 209.10 | 10.30 | 0.13 |
| 2000 | 186.07 | 16.73 | 1.02 | 260.97 | 6.56 | 1.34 |
| 2001 | 83.01 | 2.99 | 1.22 | 163.37 | 4.32 | 0.24 |
| 2002 | 346.32 | 5.47 | 6.01 | 565.96 | 25.65 | 0.96 |
| 2003 | 266.56 | 0.38 | 1.35 | 804.08 | 10.19 | 0.46 |
| 2004 | 40.82 | 0.92 | 0.70 | 449.12 | 11.70 | 1.11 |
| 2005 | n/a | n/a | n/a | 147.98 | 4.19 | 1.58 |
| 2006 | 122.23 | 3.12 | 0.35 | 943.63 | 16.52 | 2.99 |
| 2007 | 109.47 | 4.18 | 0.61 | 1185.54 | 38.27 | 0.20 |
| 2008 | 245.48 | 4.80 | 0.30 | 141.17 | 3.19 | |

Table 30. University of Rhode Island Graduate School of Oceanography (URIGSO) trawl survey indices for scup (total catch number).

| Year | Number |
|---|---|
| 1963 | 59.81 |
| 1964 | 60.73 |
| 1965 | 41.11 |
| 1966 | 20.73 |
| 1967 | 114.35 |
| 1968 | 36.15 |
| 1969 | 23.31 |
| 1970 | 24.27 |
| 1971 | 87.04 |
| 1972 | 56.93 |
| 1973 | 114.13 |
| 1974 | 90.01 |
| 1975 | 207.22 |
| 1976 | 430.70 |
| 1977 | 294.15 |
| 1978 | 161.94 |
| 1979 | 151.06 |
| 1980 | 83.27 |
| 1981 | 143.61 |
| 1982 | 75.11 |
| 1983 | 246.22 |
| 1984 | 206.00 |
| 1985 | 235.10 |
| 1986 | 177.01 |
| 1987 | 134.73 |
| 1988 | 127.01 |
| 1989 | 397.63 |
| 1990 | 158.81 |
| 1991 | 290.54 |
| 1992 | 104.91 |
| 1993 | 295.76 |
| 1994 | 77.84 |
| 1995 | 113.70 |
| 1996 | 104.74 |
| 1997 | 85.96 |
| 1998 | 91.79 |
| 1999 | 304.98 |
| 2000 | 352.34 |
| 2001 | 171.02 |
| 2002 | 221.10 |
| 2003 | 90.47 |
| 2004 | 67.70 |
| 2005 | 158.42 |
| 2006 | 275.27 |
| 2007 | 311.41 |
| 2008 | 361.89 |

Table 31. VIMS ChesMMAP trawl survey indices for scup. Indices are geometric mean numbers (N) and biomass per tow.

| Year | Number | Biomass | Age 0 N | Age 1 N |
|---|---|---|---|---|
| 2002 | 3.61 | 1.03 | 1.04 | 1.91 |
| 2003 | 5.28 | 1.51 | 0.98 | 4.09 |
| 2004 | 13.00 | 2.64 | 0.42 | 10.92 |
| 2005 | 13.78 | 2.99 | 4.91 | 3.46 |
| 2006 | 10.69 | 2.03 | 3.53 | 2.57 |
| 2007 | 19.32 | 2.29 | 1.16 | 11.97 |
| 2008 | 1.24 | 0.41 | n/a | n/a |

Table 32. VIMS NEAMAP trawl survey indices for scup. Indices are minimum swept area estimates, in millions of fish (N) or metric tons (B). Where available, ages are percent of total number.

| Season | Total N | Total B | Age 0 | Age 1 | Age 2+ |
|---|---|---|---|---|---|
| Fall 2006 | 1,269.5 | 32,136.3 | n/a | n/a | n/a |
| Fall 2007 | 943.9 | 15,083.8 | 89.1 | 10.5 | 0.0 |
| Fall 2008 | 236.9 | 7,875.4 | n/a | n/a | n/a |
| Spring 2008 | 217.9 | 5,081.3 | n/a | n/a | n/a |

Table 33. Summary results for 1984-2008 from the 2009 updated assessment. Spawning Stock Biomass (SSB) in metric tons (mt); Recruitment (R) at age 0 in millions; Fishing Mortality (F) for fully recruited ages 2-7+.

| Year | SSB | R | F |
|---|---|---|---|
| 1984 | 18,087 | 107.3 | 0.531 |
| 1985 | 17,049 | 79.1 | 0.607 |
| 1986 | 15,949 | 57.7 | 0.782 |
| 1987 | 13,501 | 57.6 | 0.682 |
| 1988 | 10,487 | 88.6 | 0.711 |
| 1989 | 8,978 | 69.7 | 0.697 |
| 1990 | 9,554 | 106.2 | 0.665 |
| 1991 | 9,458 | 93.4 | 1.008 |
| 1992 | 8,081 | 39.8 | 1.047 |
| 1993 | 6,216 | 46.6 | 1.093 |
| 1994 | 4,562 | 70.2 | 1.095 |
| 1995 | 4,210 | 36.6 | 0.880 |
| 1996 | 5,211 | 29.2 | 0.738 |
| 1997 | 5,663 | 85.8 | 0.477 |
| 1998 | 6,813 | 114.6 | 0.325 |
| 1999 | 12,338 | 217.6 | 0.205 |
| 2000 | 25,189 | 266.9 | 0.150 |
| 2001 | 50,332 | 154.9 | 0.081 |
| 2002 | 80,491 | 118.1 | 0.086 |
| 2003 | 105,428 | 89.7 | 0.082 |
| 2004 | 118,421 | 157.9 | 0.055 |
| 2005 | 133,136 | 159.2 | 0.044 |
| 2006 | 142,519 | 199.3 | 0.043 |
| 2007 | 158,208 | 113.0 | 0.043 |
| 2008 | 187,888 | 192.4 | 0.042 |

Table 34. January 1 population number (N, 000s) estimates for 1984-2008 from the 2009 assessment update.

| N | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| 1984 | 107,341 | 60,493 | 29,895 | 8,319 | 3,445 | 3,016 | 4,811 | 13,258 |
| 1985 | 79,087 | 79,847 | 39,861 | 13,953 | 4,081 | 1,630 | 1,427 | 8,894 |
| 1986 | 57,749 | 57,288 | 49,485 | 16,265 | 6,439 | 1,773 | 708 | 4,781 |
| 1987 | 57,638 | 42,971 | 36,554 | 21,386 | 6,469 | 2,309 | 636 | 2,179 |
| 1988 | 88,642 | 43,146 | 28,119 | 16,683 | 9,233 | 2,592 | 925 | 1,210 |
| 1989 | 69,709 | 66,699 | 28,531 | 12,989 | 6,967 | 3,601 | 1,011 | 876 |
| 1990 | 106,187 | 51,791 | 42,871 | 12,552 | 5,563 | 2,740 | 1,416 | 777 |
| 1991 | 93,372 | 78,531 | 33,220 | 18,702 | 5,491 | 2,273 | 1,119 | 923 |
| 1992 | 39,814 | 67,053 | 46,241 | 11,504 | 5,961 | 1,561 | 646 | 618 |
| 1993 | 46,605 | 27,134 | 35,912 | 12,764 | 3,481 | 1,641 | 429 | 370 |
| 1994 | 70,221 | 32,640 | 15,259 | 10,932 | 3,690 | 913 | 430 | 223 |
| 1995 | 36,584 | 51,380 | 19,918 | 5,575 | 3,154 | 965 | 239 | 179 |
| 1996 | 29,222 | 25,777 | 29,788 | 6,647 | 1,961 | 1,038 | 317 | 143 |
| 1997 | 85,793 | 21,508 | 16,327 | 12,450 | 2,703 | 744 | 394 | 180 |
| 1998 | 114,610 | 64,582 | 14,277 | 8,194 | 6,238 | 1,356 | 373 | 295 |
| 1999 | 217,572 | 87,619 | 44,737 | 8,016 | 4,804 | 3,661 | 796 | 400 |
| 2000 | 266,878 | 170,021 | 64,071 | 28,386 | 5,317 | 3,189 | 2,430 | 802 |
| 2001 | 154,859 | 212,330 | 129,613 | 44,410 | 19,907 | 3,730 | 2,237 | 2,282 |
| 2002 | 118,078 | 124,701 | 166,898 | 97,115 | 33,467 | 15,006 | 2,812 | 3,425 |
| 2003 | 89,656 | 90,965 | 89,095 | 104,763 | 72,784 | 25,111 | 11,259 | 4,703 |
| 2004 | 157,942 | 71,911 | 70,894 | 65,792 | 78,823 | 54,779 | 18,900 | 12,059 |
| 2005 | 159,170 | 127,749 | 57,165 | 54,632 | 50,898 | 60,989 | 42,386 | 24,029 |
| 2006 | 199,275 | 128,879 | 101,865 | 44,588 | 42,768 | 39,850 | 47,751 | 52,121 |
| 2007 | 112,965 | 160,728 | 101,919 | 78,566 | 34,912 | 33,494 | 31,209 | 78,437 |
| 2008 | 192,401 | 91,018 | 126,810 | 77,975 | 61,525 | 27,346 | 26,236 | 86,187 |

Table 35. Fishing mortality (F) estimates for 1984-2008 from the 2009 assessment update.

| F | Age | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| 1984 | 0.096 | 0.217 | 0.562 | 0.512 | 0.548 | 0.548 | 0.549 | 0.495 |
| 1985 | 0.122 | 0.278 | 0.696 | 0.573 | 0.634 | 0.634 | 0.635 | 0.559 |
| 1986 | 0.096 | 0.249 | 0.639 | 0.722 | 0.825 | 0.826 | 0.826 | 0.709 |
| 1987 | 0.090 | 0.224 | 0.584 | 0.640 | 0.715 | 0.715 | 0.715 | 0.624 |
| 1988 | 0.084 | 0.214 | 0.572 | 0.673 | 0.742 | 0.742 | 0.742 | 0.654 |
| 1989 | 0.097 | 0.242 | 0.621 | 0.648 | 0.733 | 0.733 | 0.734 | 0.635 |
| 1990 | 0.102 | 0.244 | 0.630 | 0.627 | 0.695 | 0.695 | 0.696 | 0.611 |
| 1991 | 0.131 | 0.330 | 0.860 | 0.943 | 1.058 | 1.058 | 1.059 | 0.922 |
| 1992 | 0.183 | 0.424 | 1.087 | 0.995 | 1.090 | 1.090 | 1.092 | 0.967 |
| 1993 | 0.156 | 0.376 | 0.989 | 1.041 | 1.138 | 1.138 | 1.139 | 1.010 |
| 1994 | 0.112 | 0.294 | 0.807 | 1.043 | 1.141 | 1.141 | 1.142 | 1.010 |
| 1995 | 0.150 | 0.345 | 0.897 | 0.845 | 0.912 | 0.912 | 0.914 | 0.817 |
| 1996 | 0.106 | 0.257 | 0.672 | 0.700 | 0.769 | 0.769 | 0.770 | 0.680 |
| 1997 | 0.084 | 0.210 | 0.489 | 0.491 | 0.490 | 0.490 | 0.478 | 0.438 |
| 1998 | 0.069 | 0.167 | 0.377 | 0.334 | 0.333 | 0.333 | 0.325 | 0.298 |
| 1999 | 0.047 | 0.113 | 0.255 | 0.211 | 0.210 | 0.210 | 0.206 | 0.187 |
| 2000 | 0.029 | 0.071 | 0.167 | 0.155 | 0.154 | 0.154 | 0.153 | 0.135 |
| 2001 | 0.017 | 0.041 | 0.089 | 0.083 | 0.083 | 0.083 | 0.081 | 0.073 |
| 2002 | 0.061 | 0.136 | 0.266 | 0.088 | 0.087 | 0.087 | 0.086 | 0.080 |
| 2003 | 0.021 | 0.049 | 0.103 | 0.084 | 0.084 | 0.084 | 0.083 | 0.075 |
| 2004 | 0.012 | 0.029 | 0.061 | 0.057 | 0.057 | 0.057 | 0.055 | 0.050 |
| 2005 | 0.011 | 0.026 | 0.048 | 0.045 | 0.045 | 0.045 | 0.044 | 0.040 |
| 2006 | 0.015 | 0.035 | 0.060 | 0.045 | 0.044 | 0.044 | 0.043 | 0.040 |
| 2007 | 0.016 | 0.037 | 0.068 | 0.044 | 0.044 | 0.044 | 0.043 | 0.040 |
| 2008 | 0.019 | 0.043 | 0.079 | 0.043 | 0.043 | 0.043 | 0.042 | 0.039 |

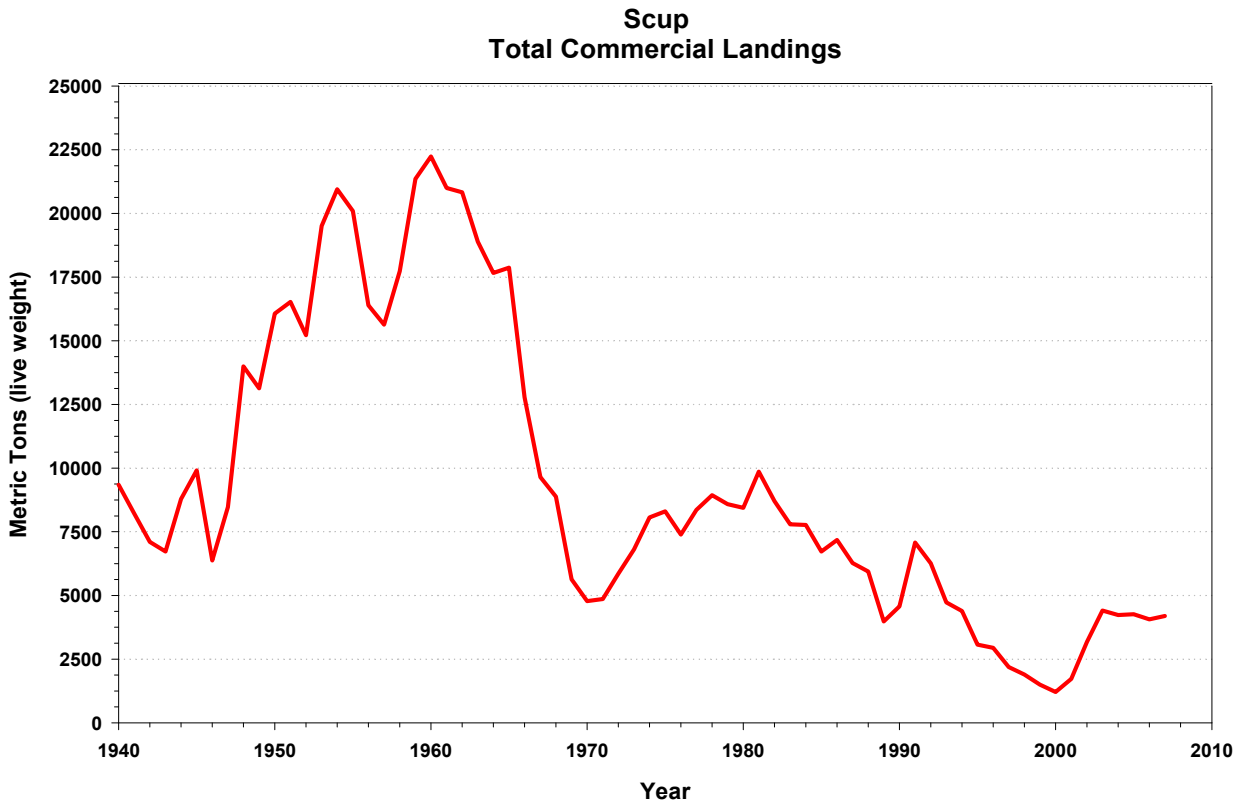


Figure 1. Total commercial fishery landings for scup.

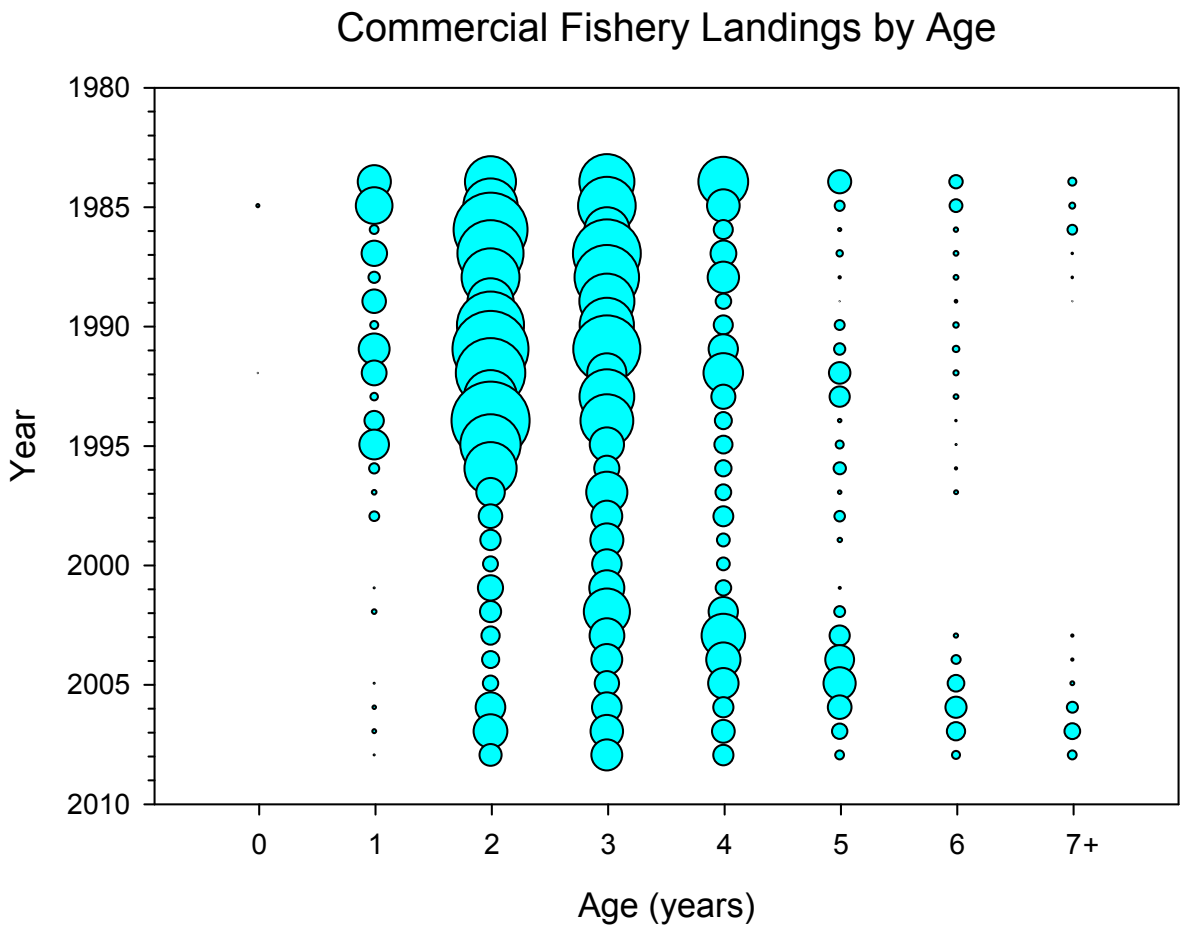


Figure 2. Commercial fishery landings by age for scup.

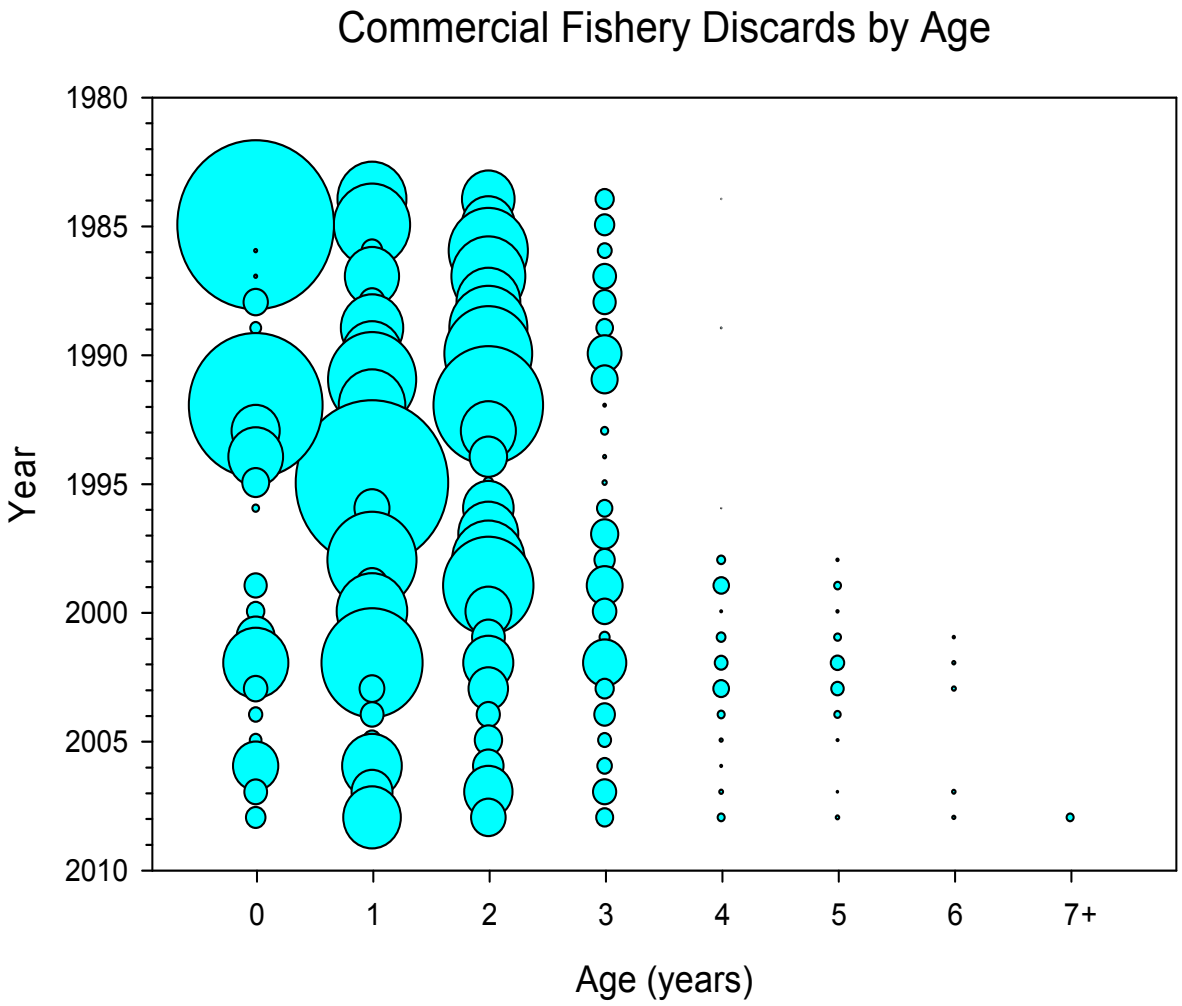


Figure 3. Commercial fishery discards by age for scup.

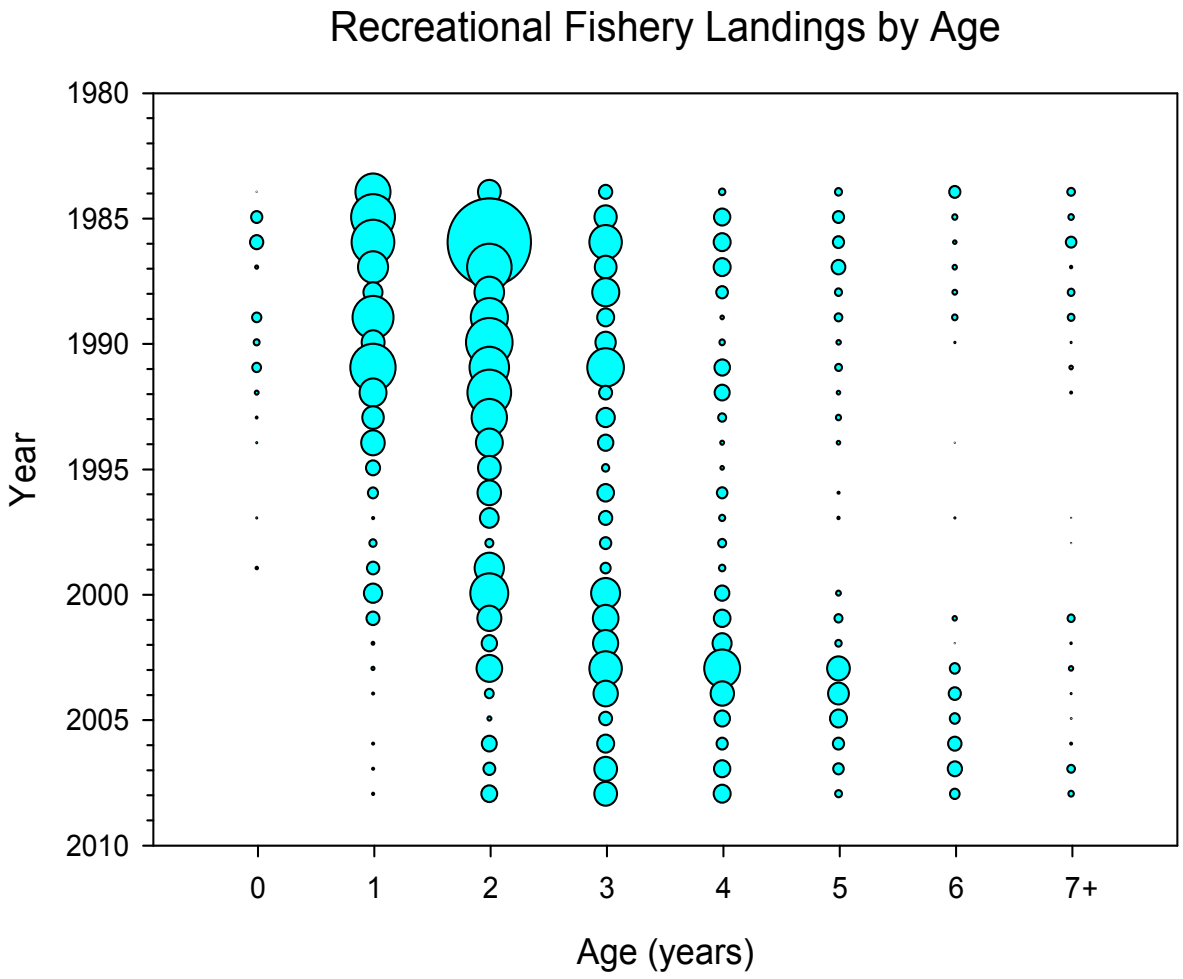


Figure 4. Recreational fishery landings by age for scup.

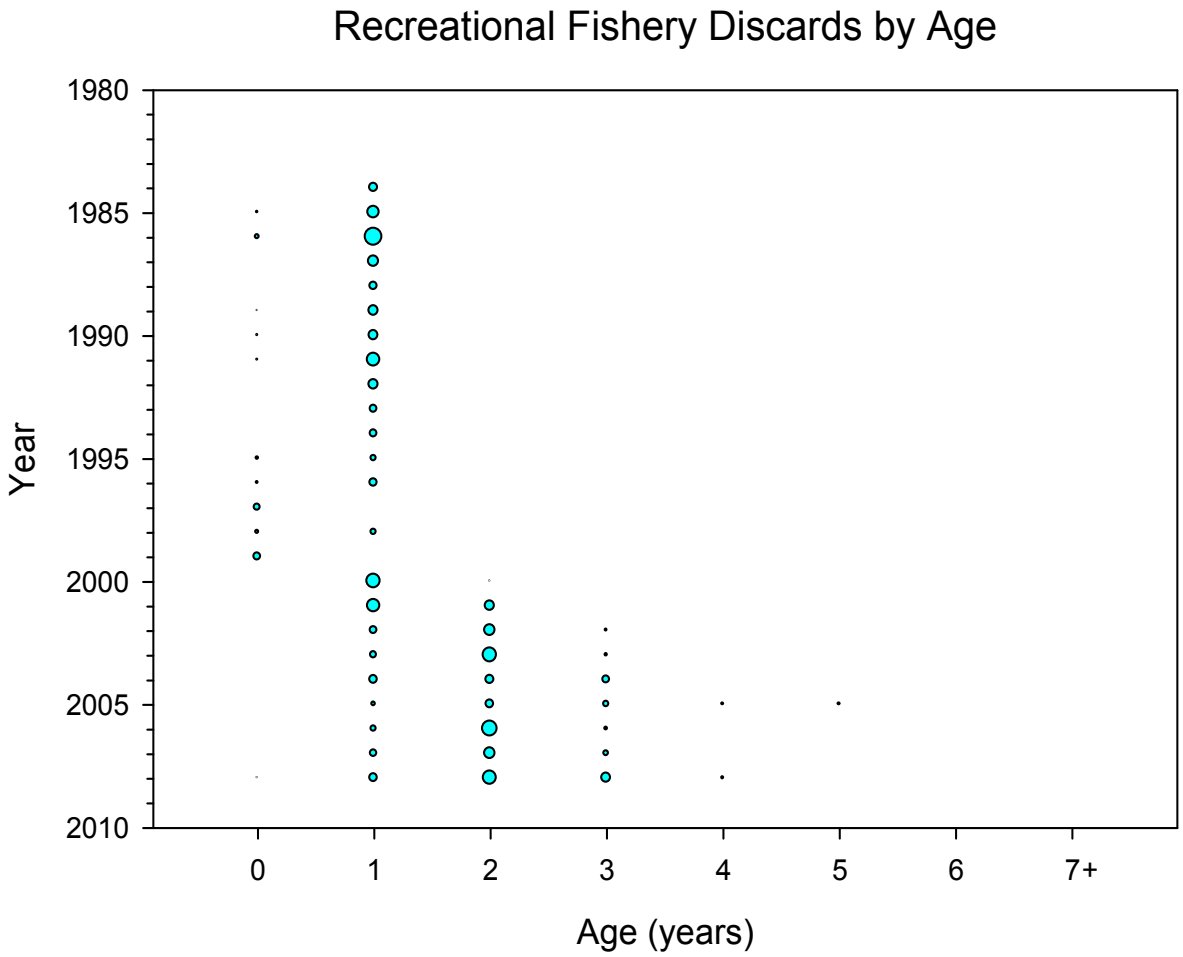


Figure 5. Recreational fishery discards by age for scup.

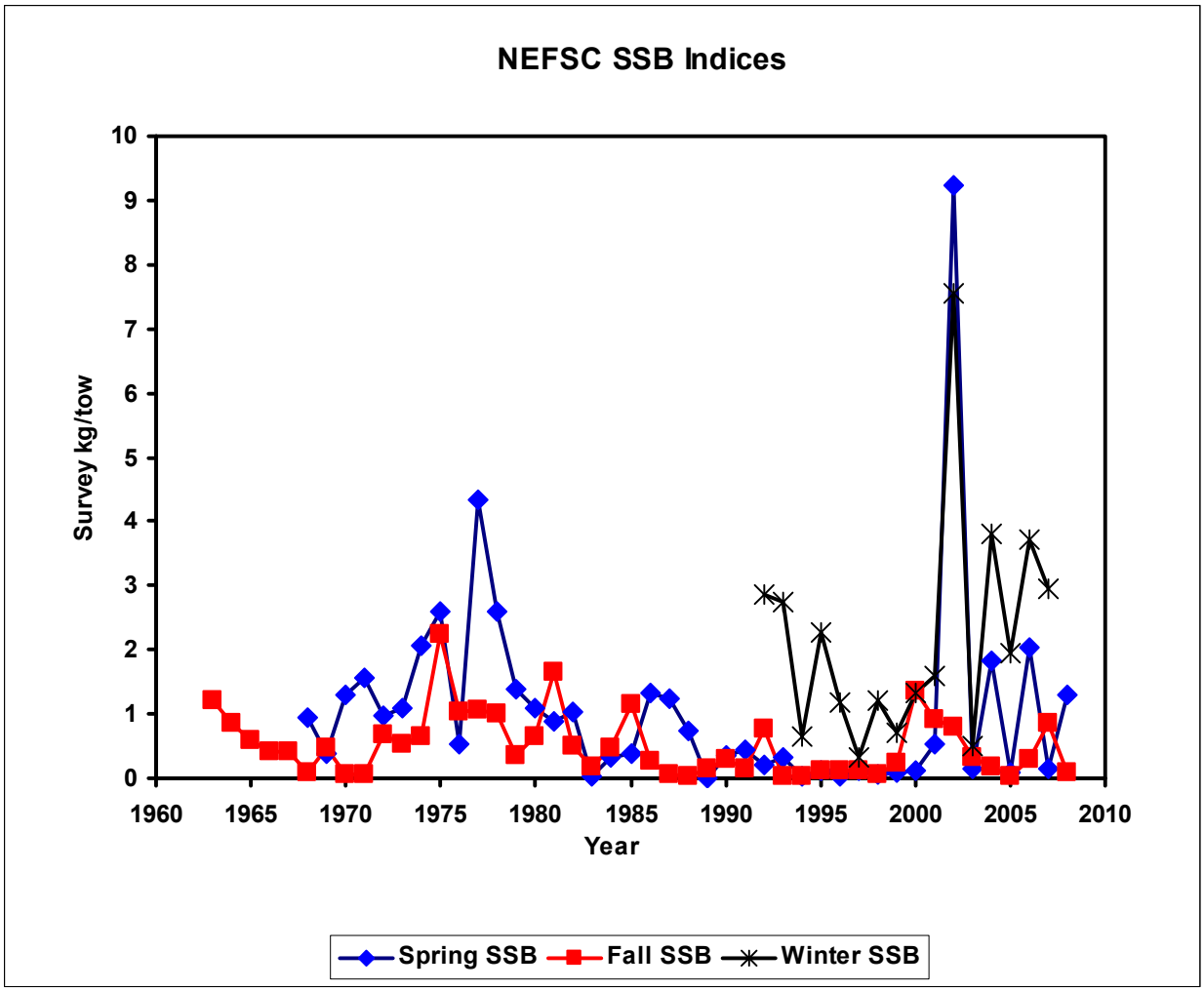


Figure 6. NEFSC Spring and Fall survey Spawning Stock Biomass (SSB) indices for scup.

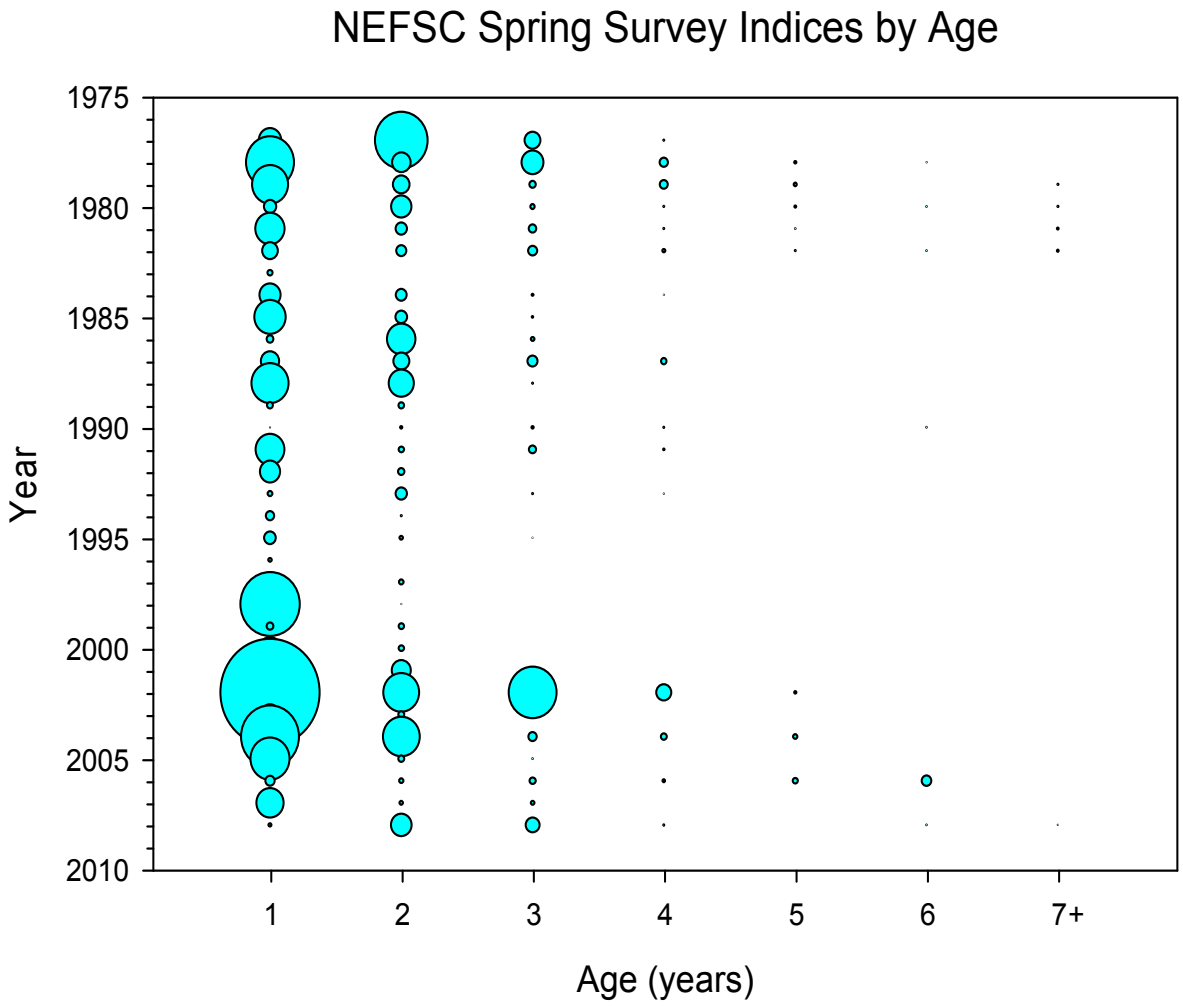


Figure 7. NEFSC Spring survey indices by age for scup.

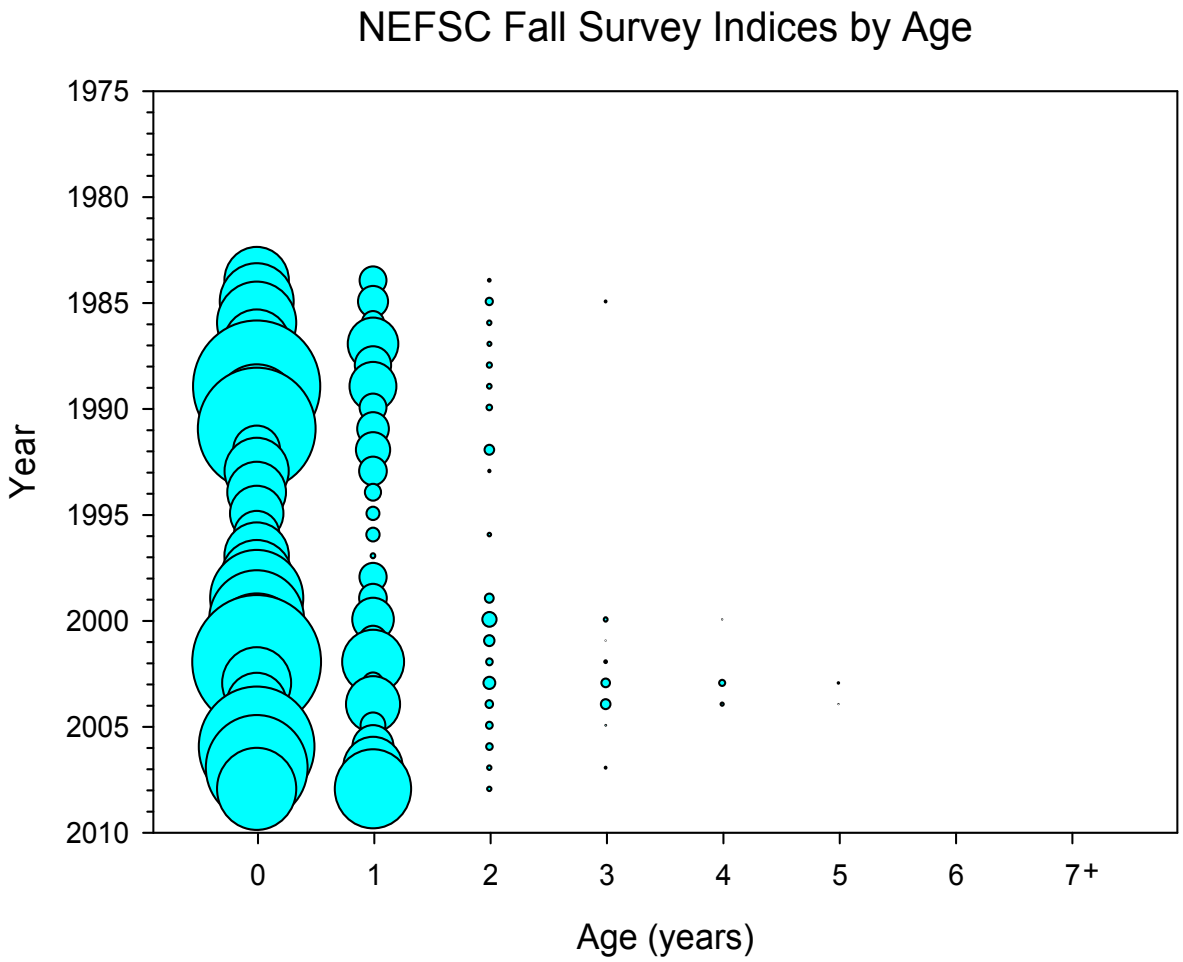


Figure 8. NEFSC Fall survey indices by age for scup.

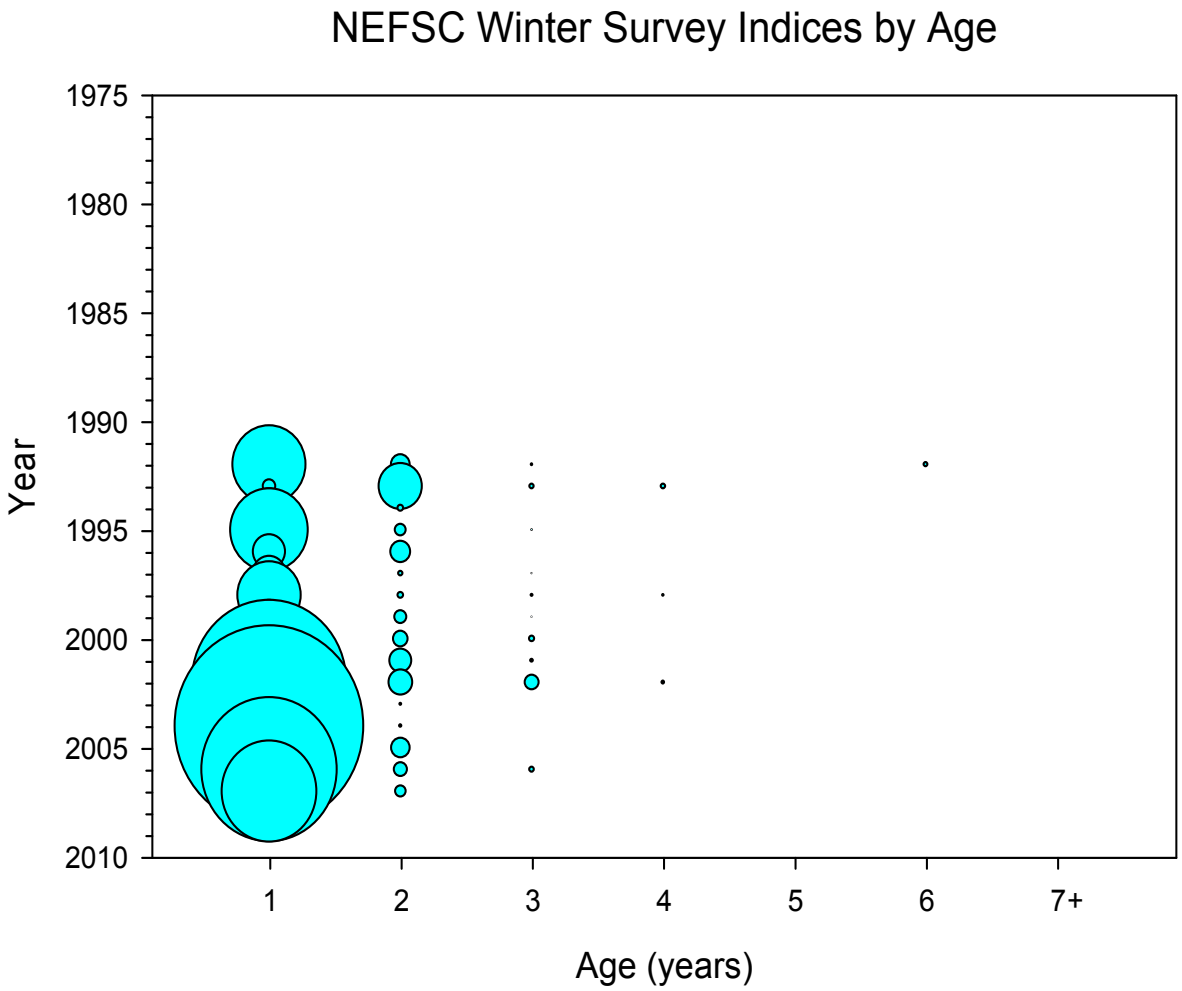


Figure 9. NEFSC Winter survey indices by age for scup.

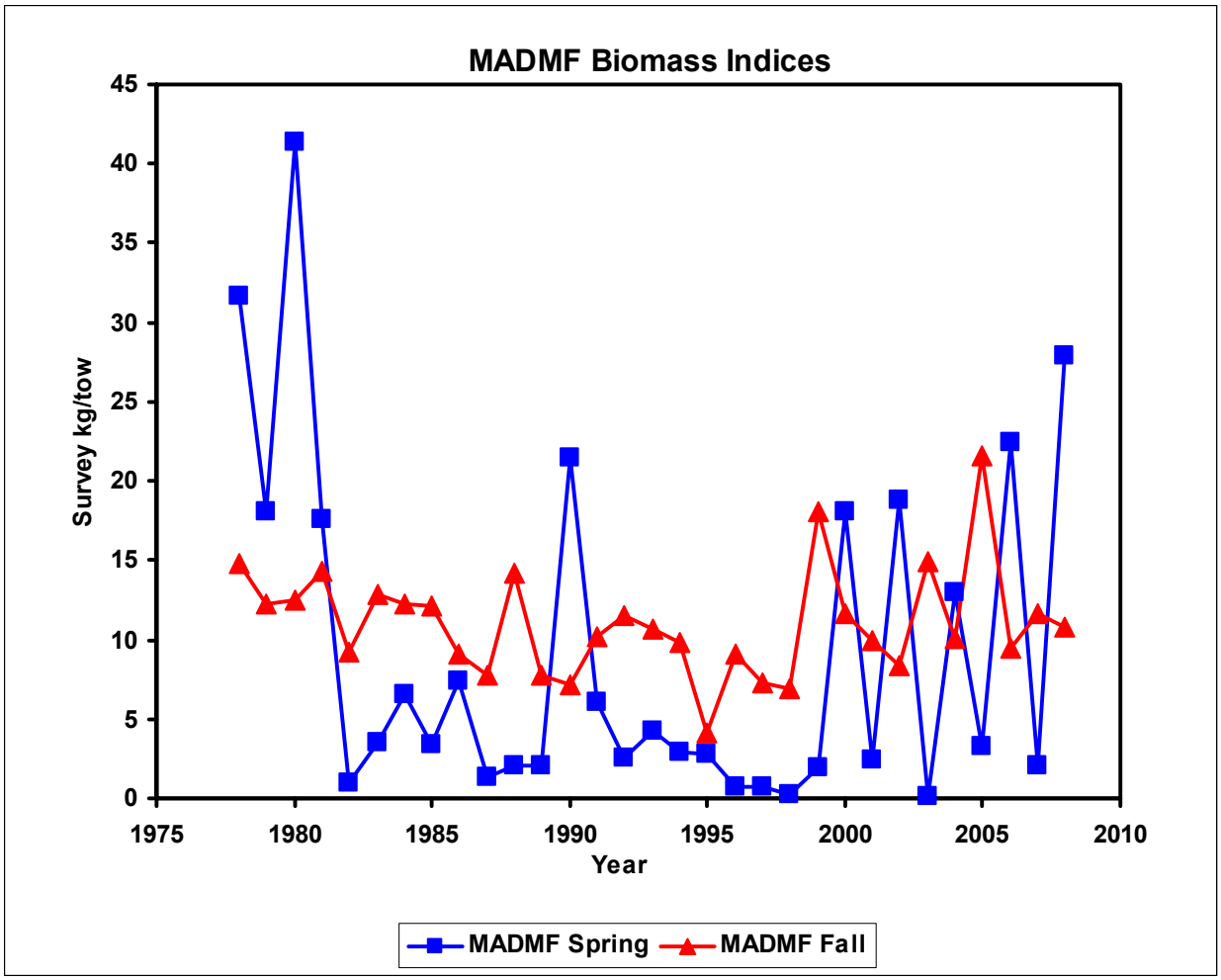


Figure 10. MADMF Spring and Fall survey aggregate biomass indices.

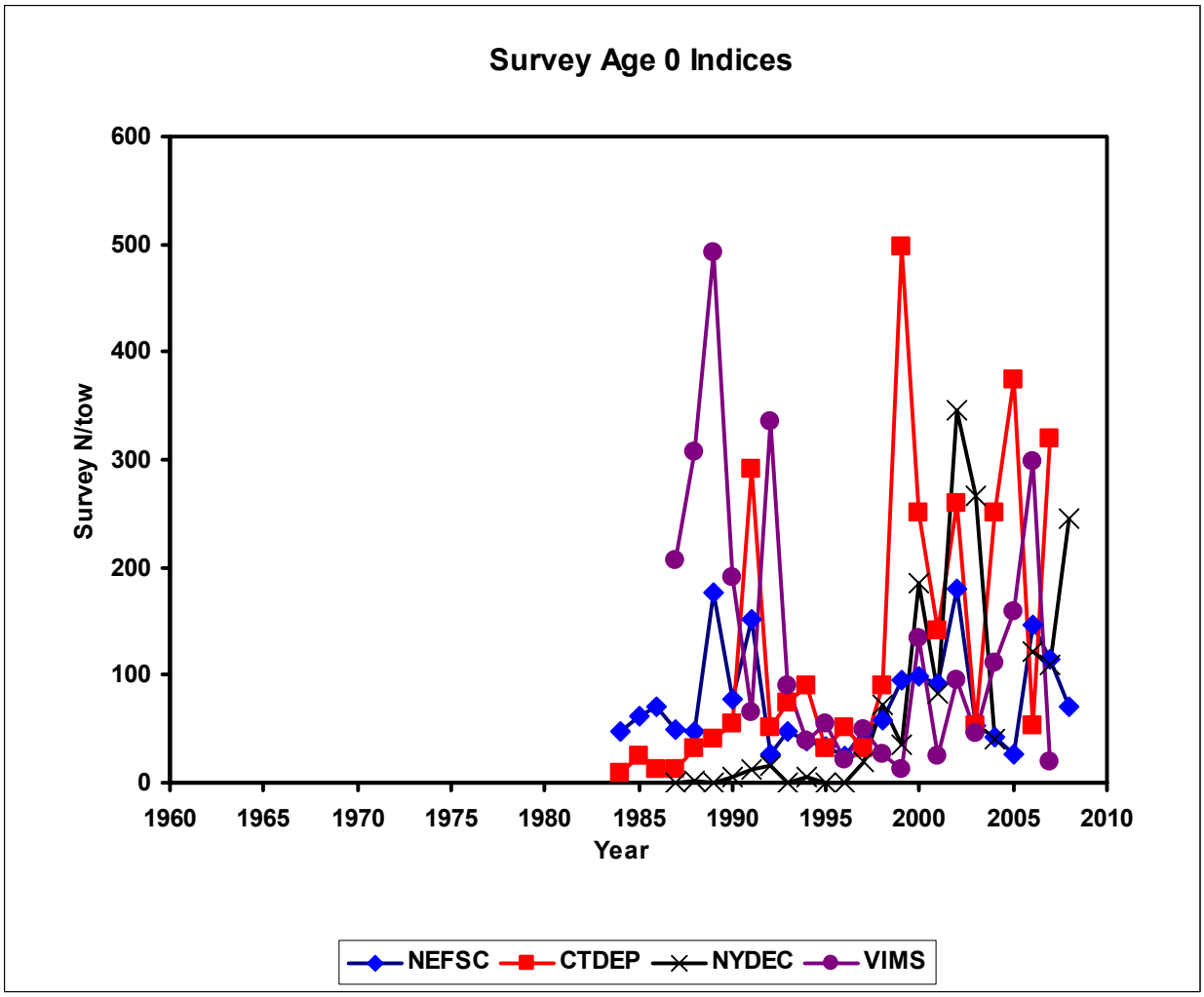


Figure 11. Research survey recruitment (age 0 abundance) indices.

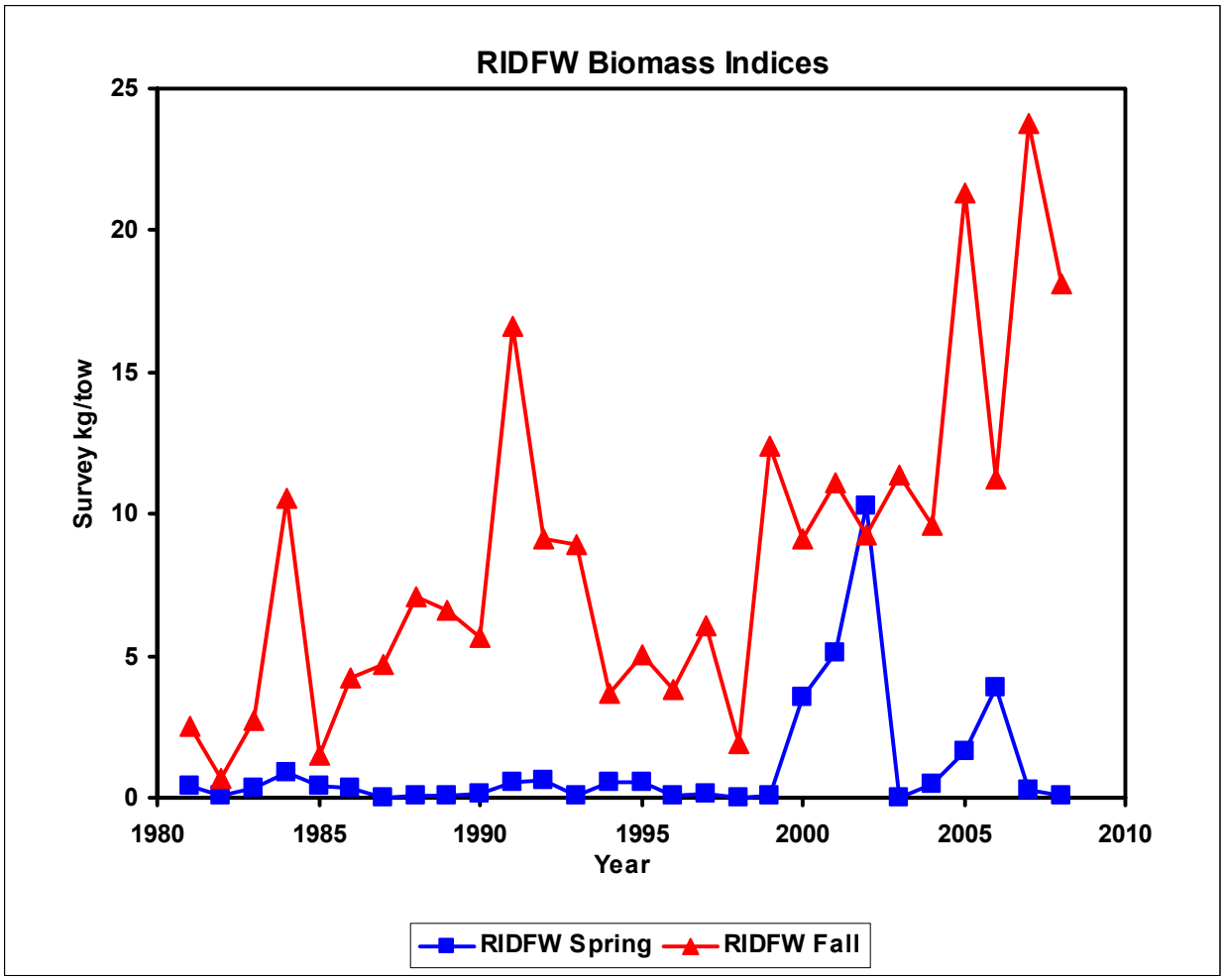


Figure 12. RIDFW Spring and Fall survey aggregate biomass indices.

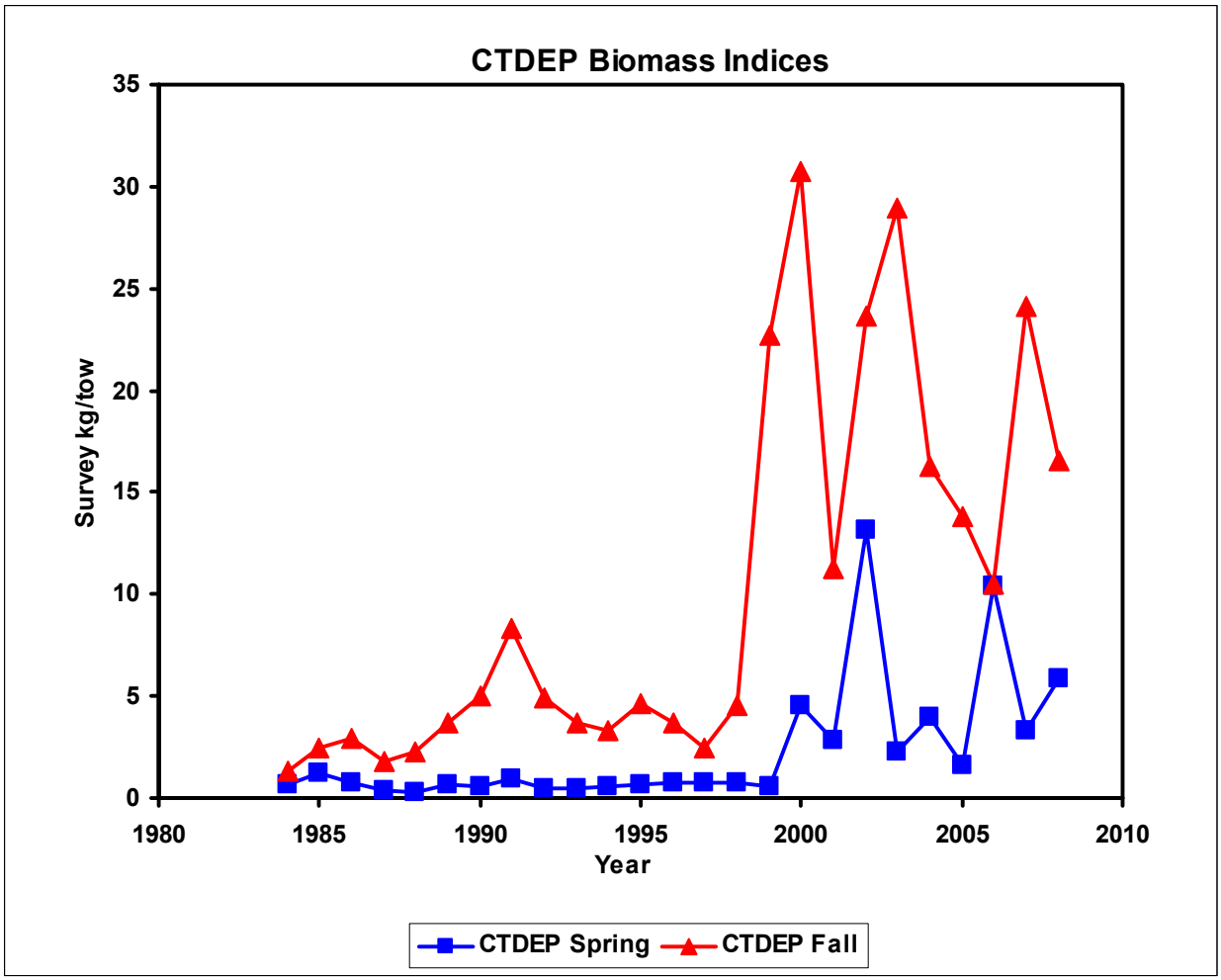


Figure 13. CTDEP Spring and Fall survey aggregate biomass indices.

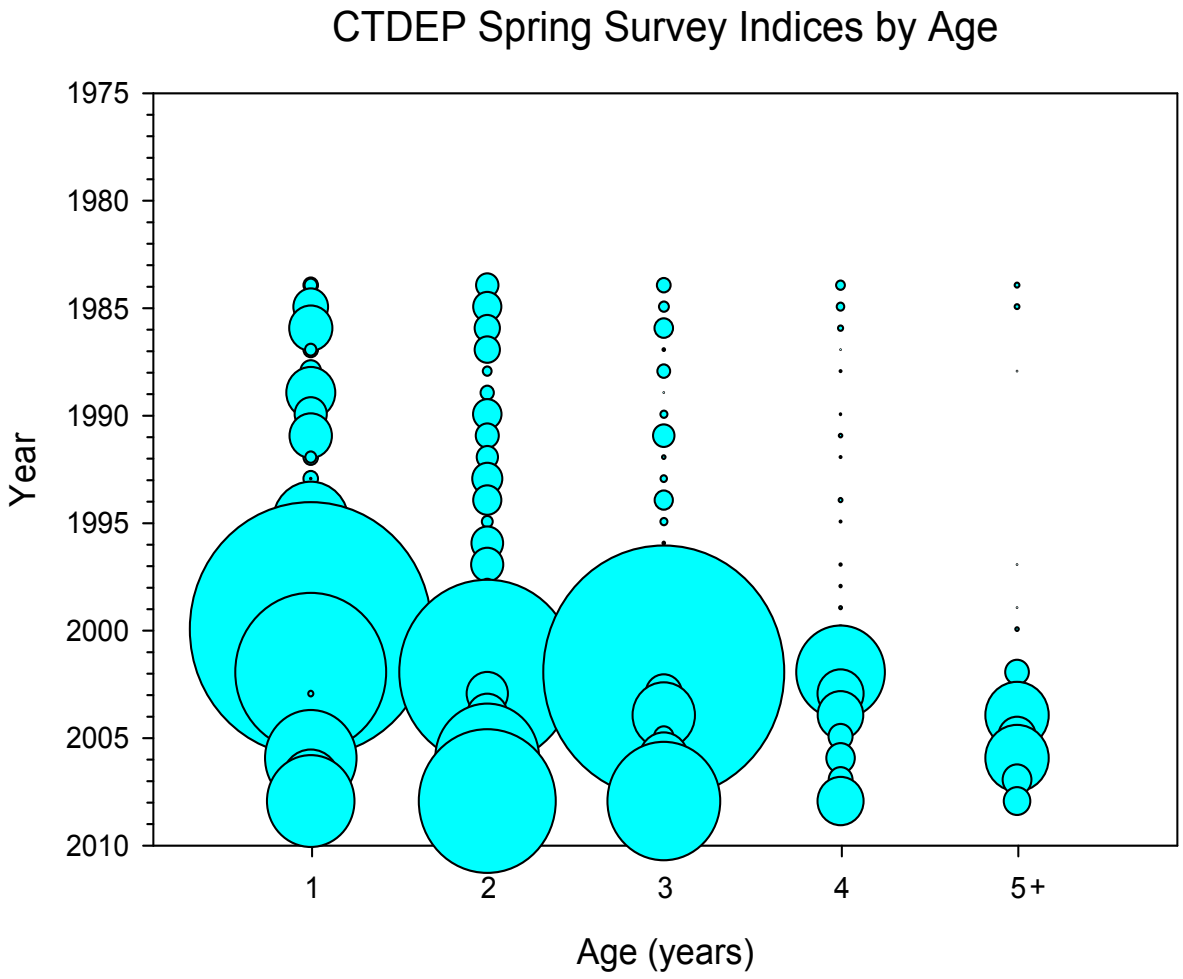


Figure 14. CTDEP Spring survey indices by age for scup.

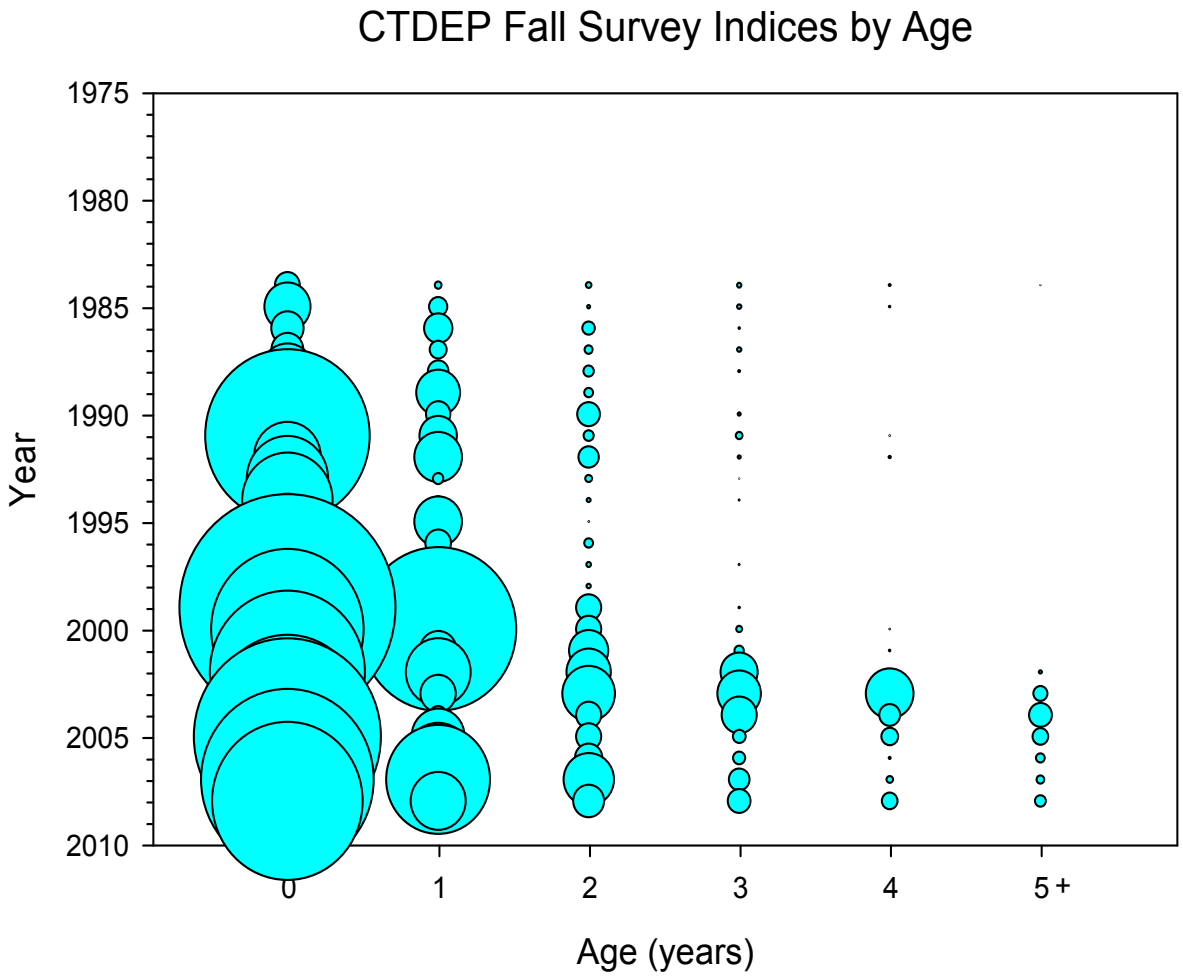


Figure 15. CTDEP Fall survey indices by age for scup.

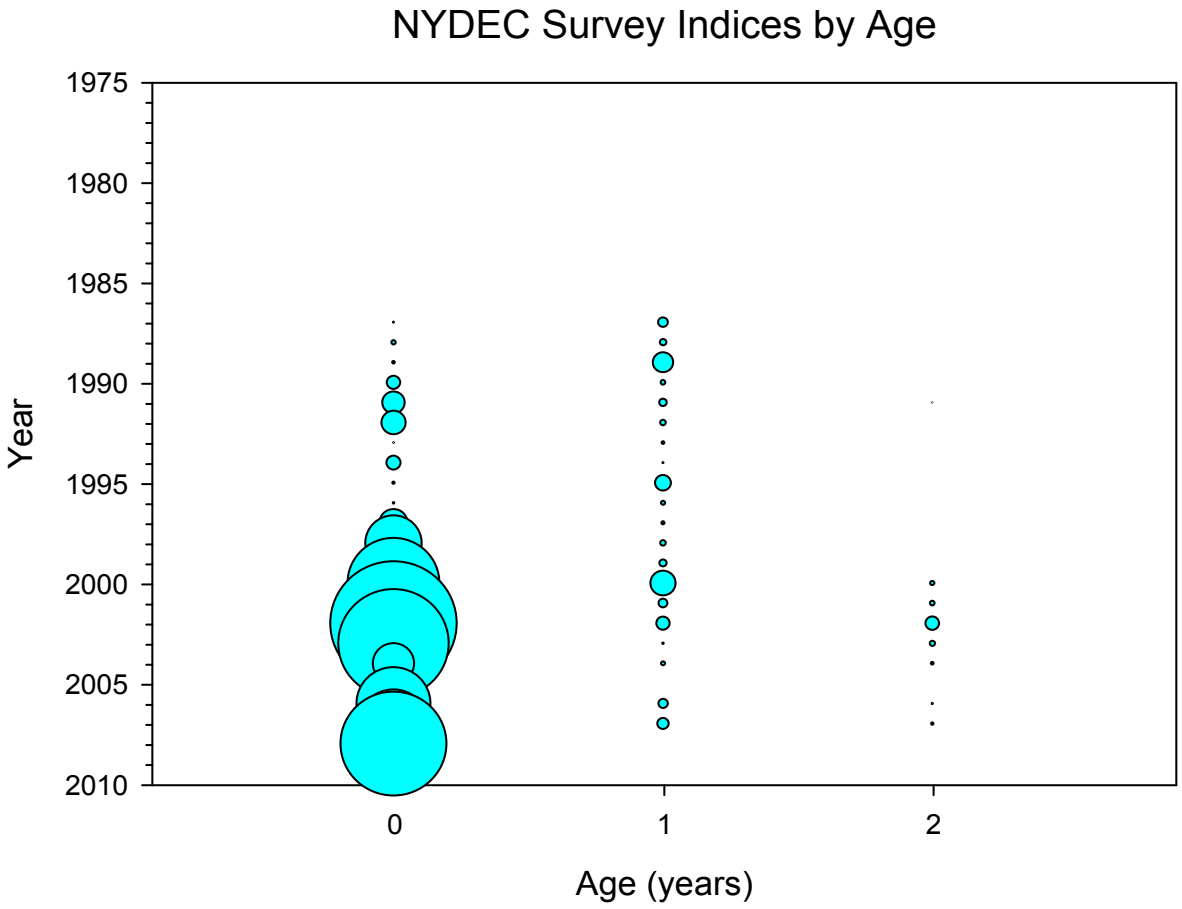


Figure 16. NYDEC survey indices by age for scup.

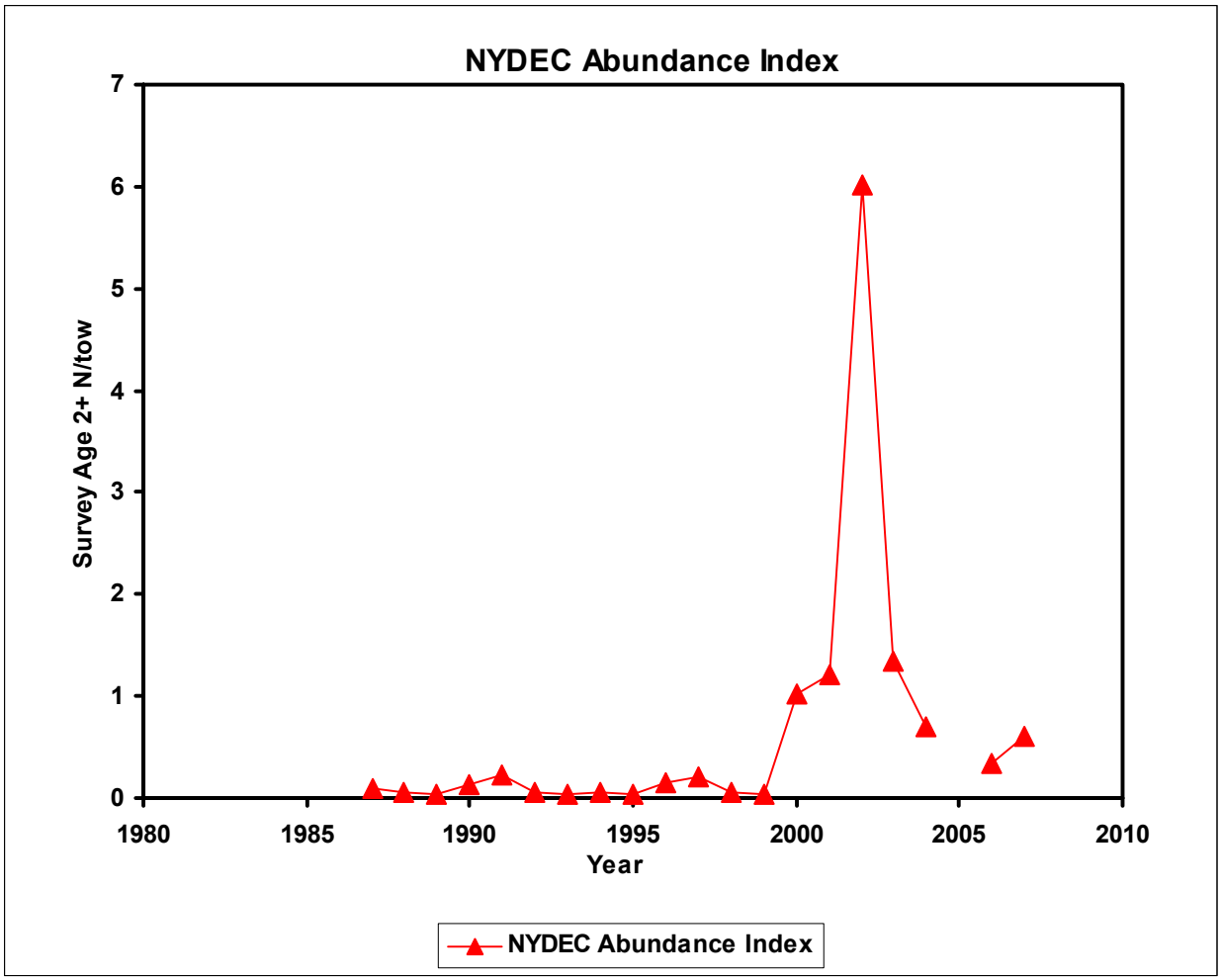


Figure 17. NYDEC survey age 2+ abundance index.

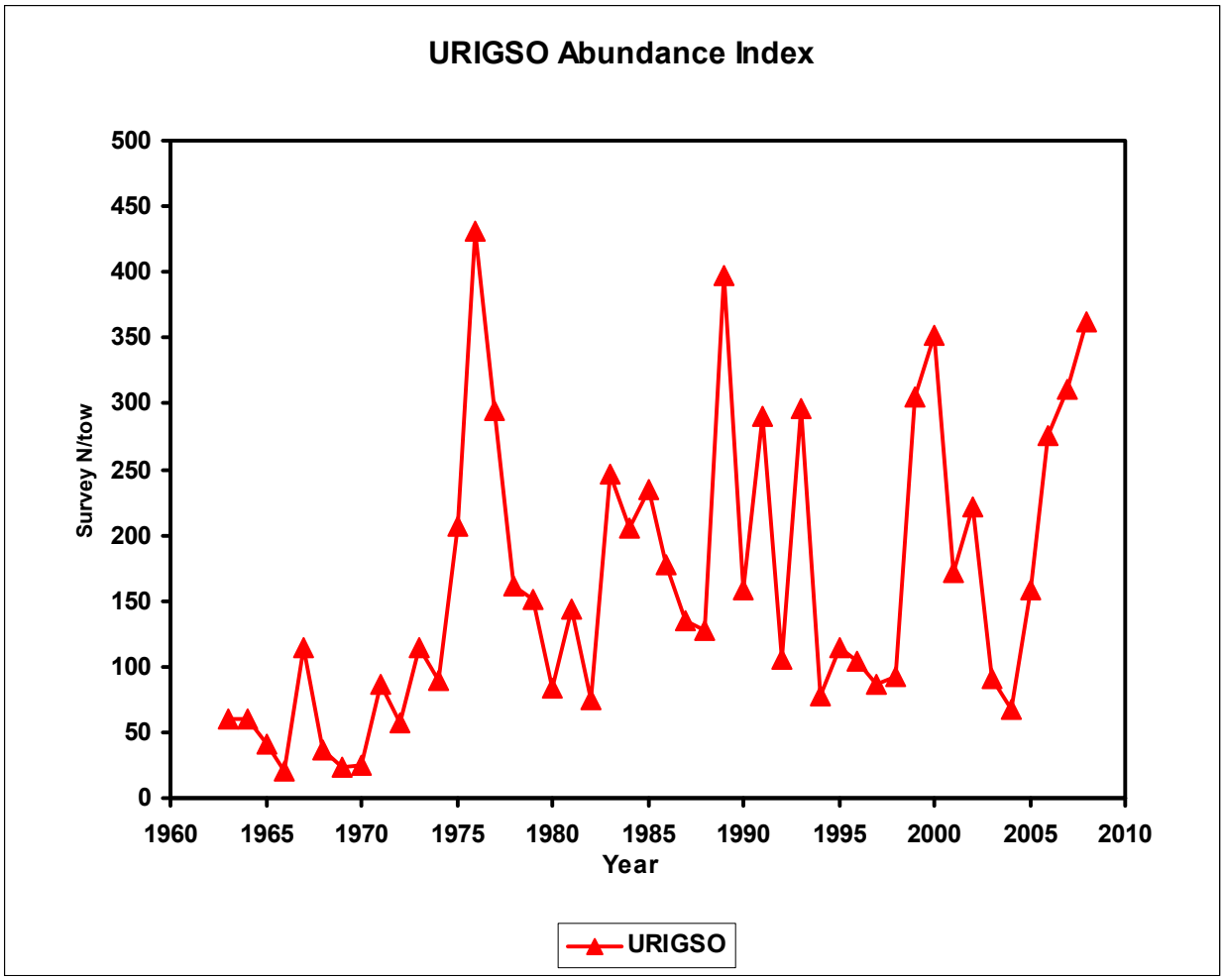


Figure 18. URIGSO aggregate abundance index.

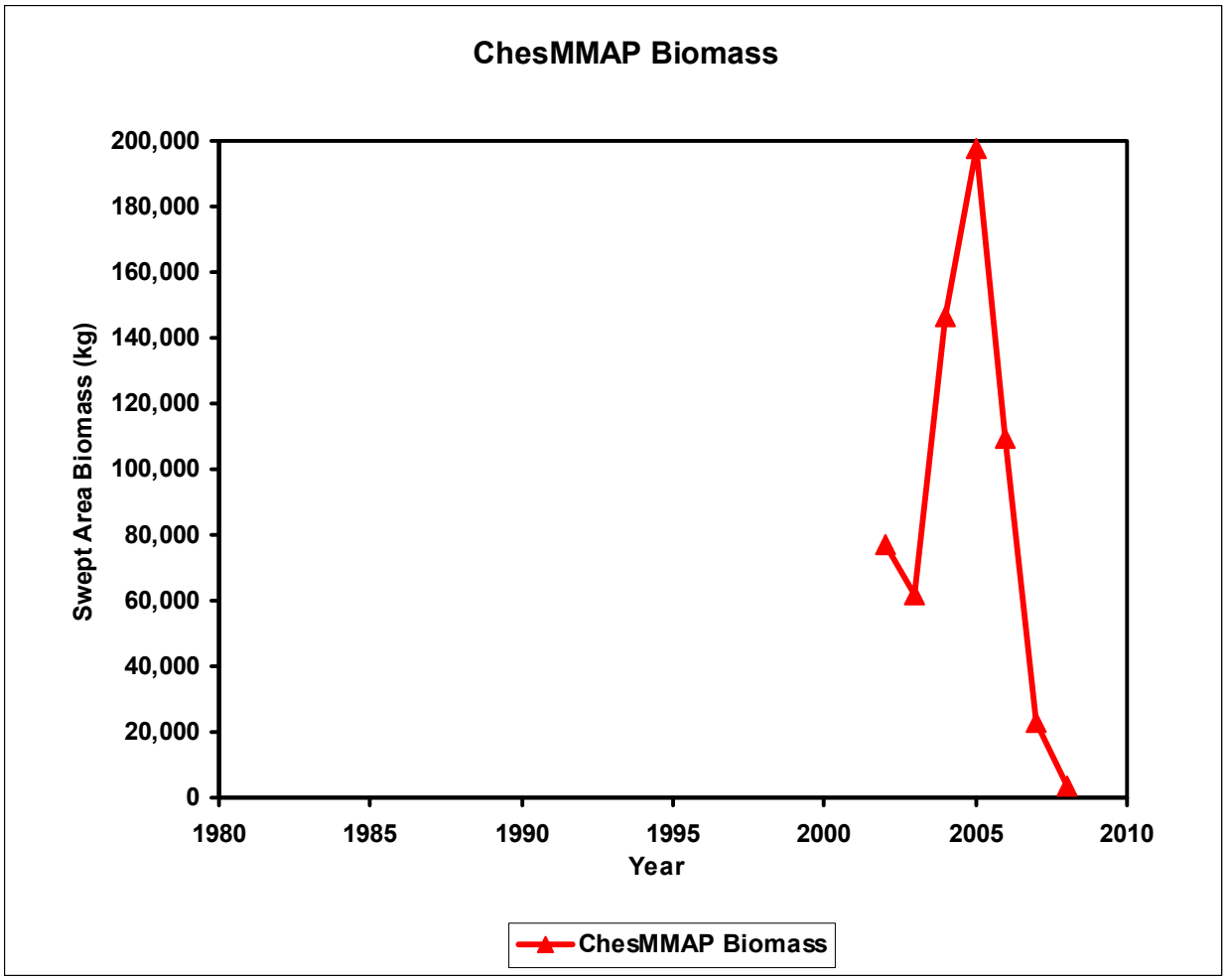


Figure 19. VIMS ChesMMap swept area aggregate biomass index.

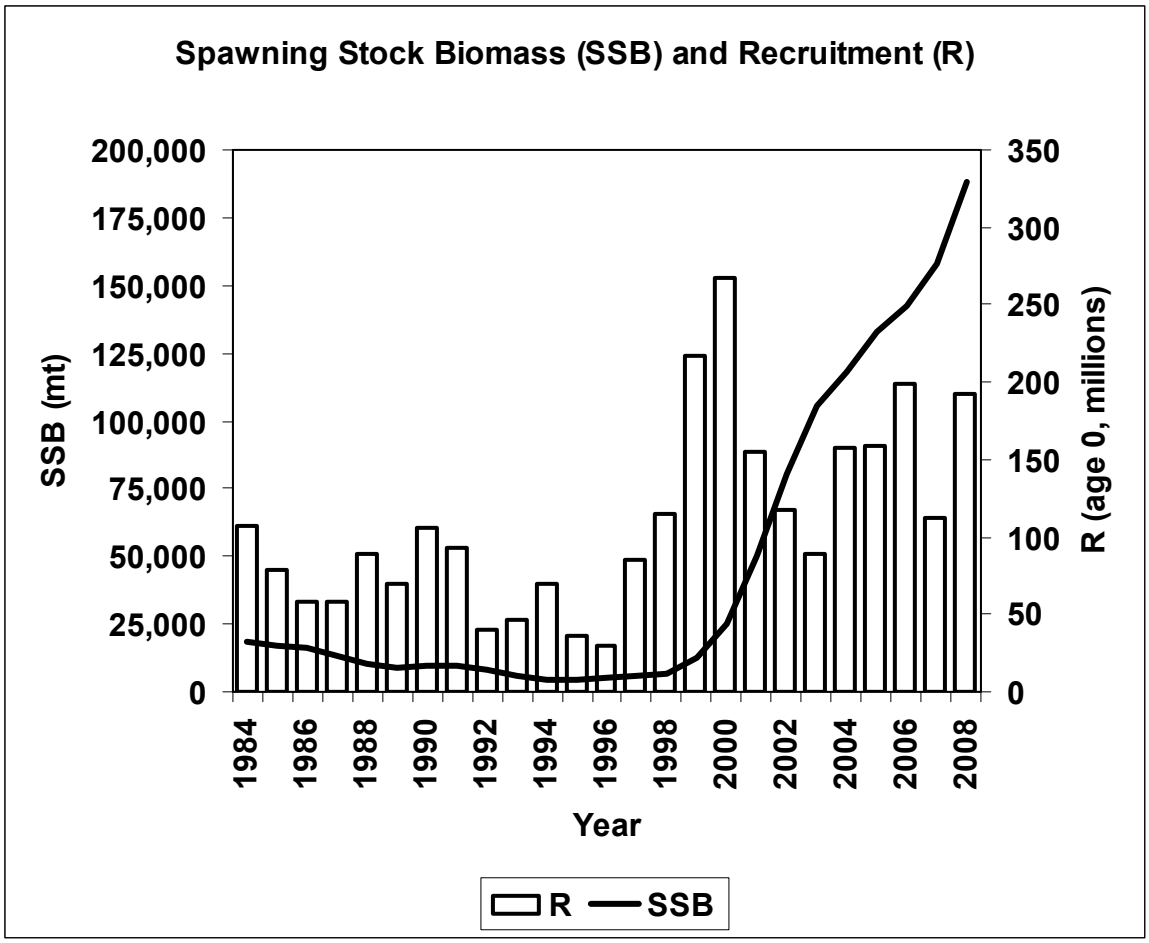


Figure 20. Trends in Spawning Stock Biomass (SSB) and Recruitment (R; age 0 fish).

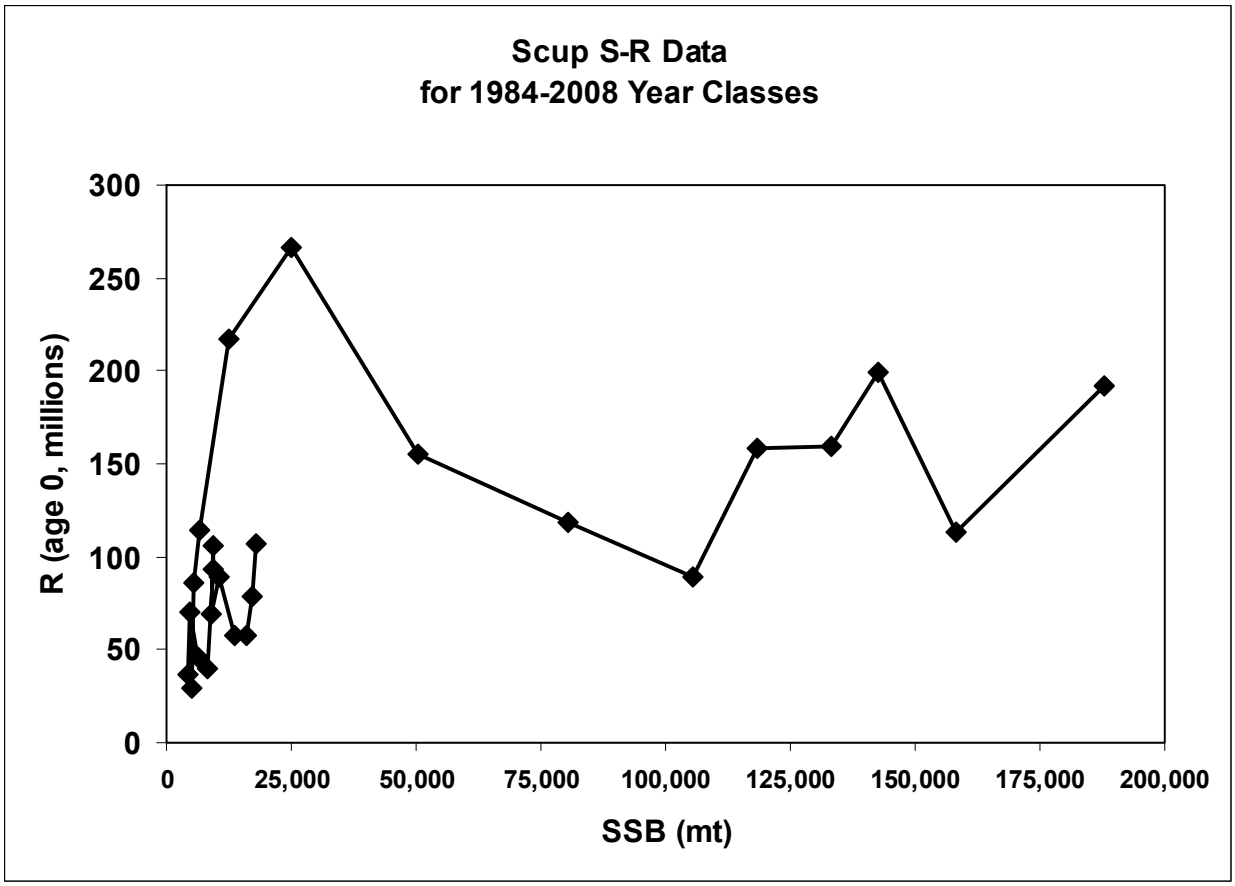


Figure 21. Spawning Stock Biomass (SSB) and Recruitment (R) scatterplot for scup.

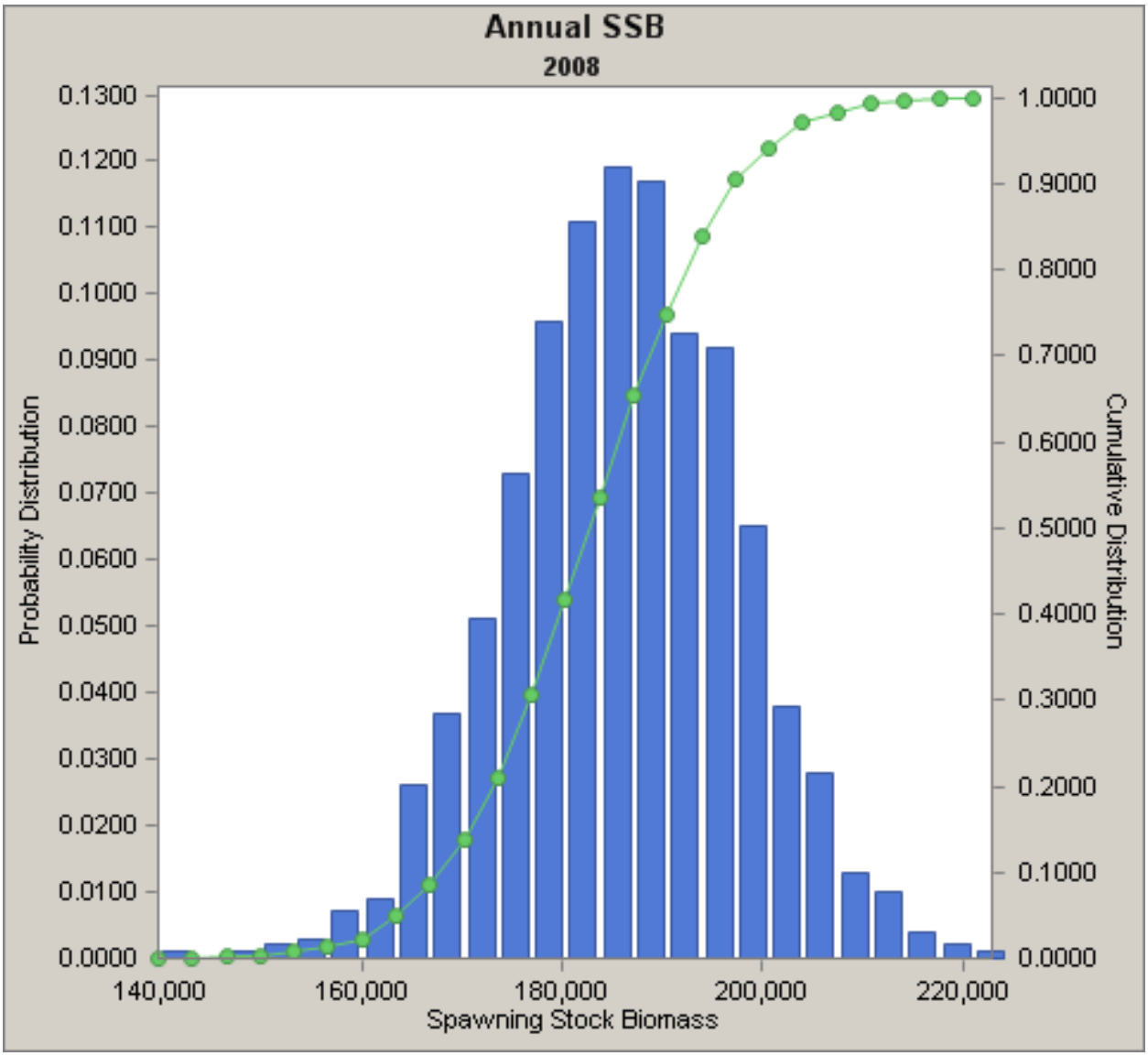


Figure 22. MCMC distribution plot for the 2008 estimate of SSB.

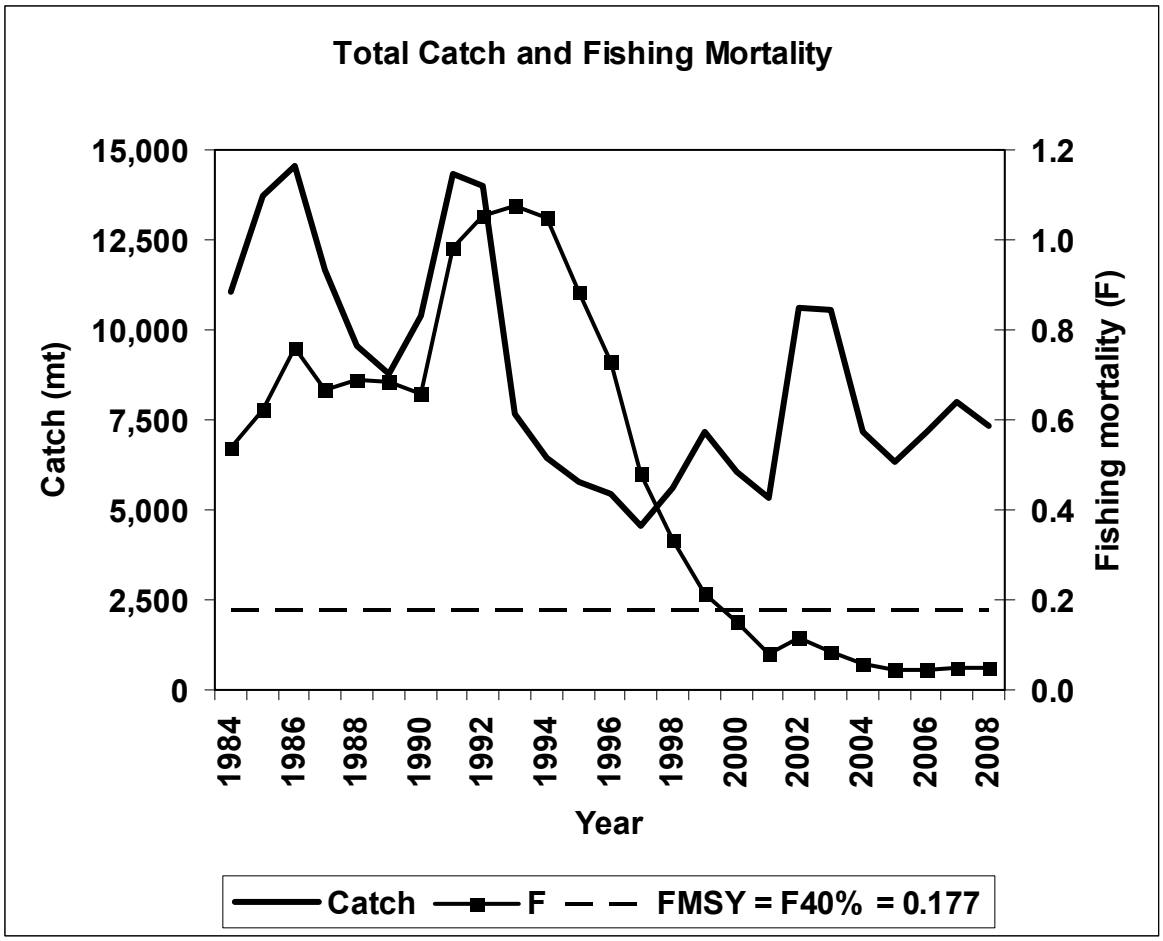


Figure 23. Trends in Total Fishery Catch (Catch) and Fishing Mortality (F, ages 2-7+). The dashed horizontal line is the F40% = 0.177 proxy for FMSY.

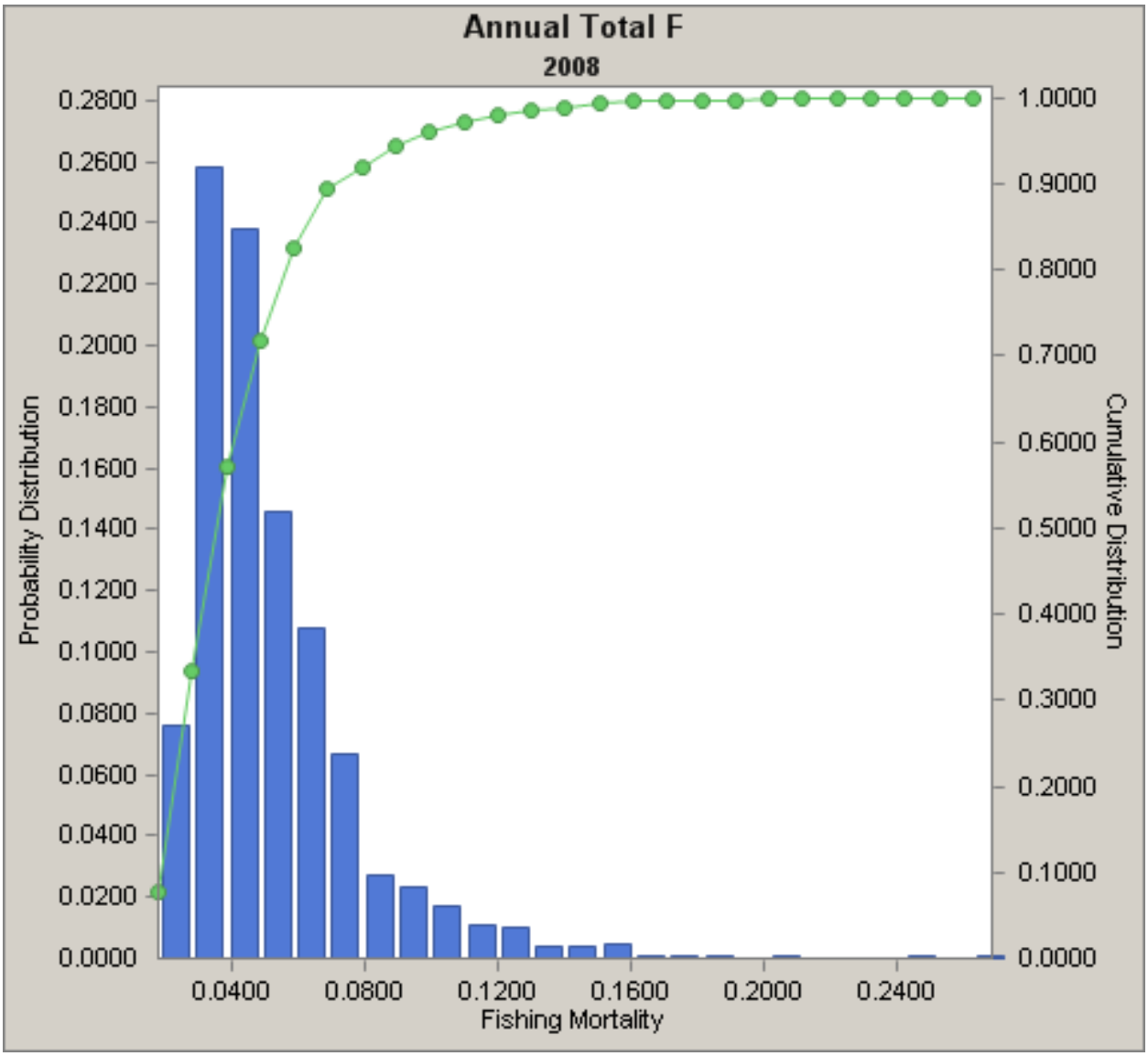


Figure 24. MCMC distribution plot for the 2008 estimate of fishing mortality (F).

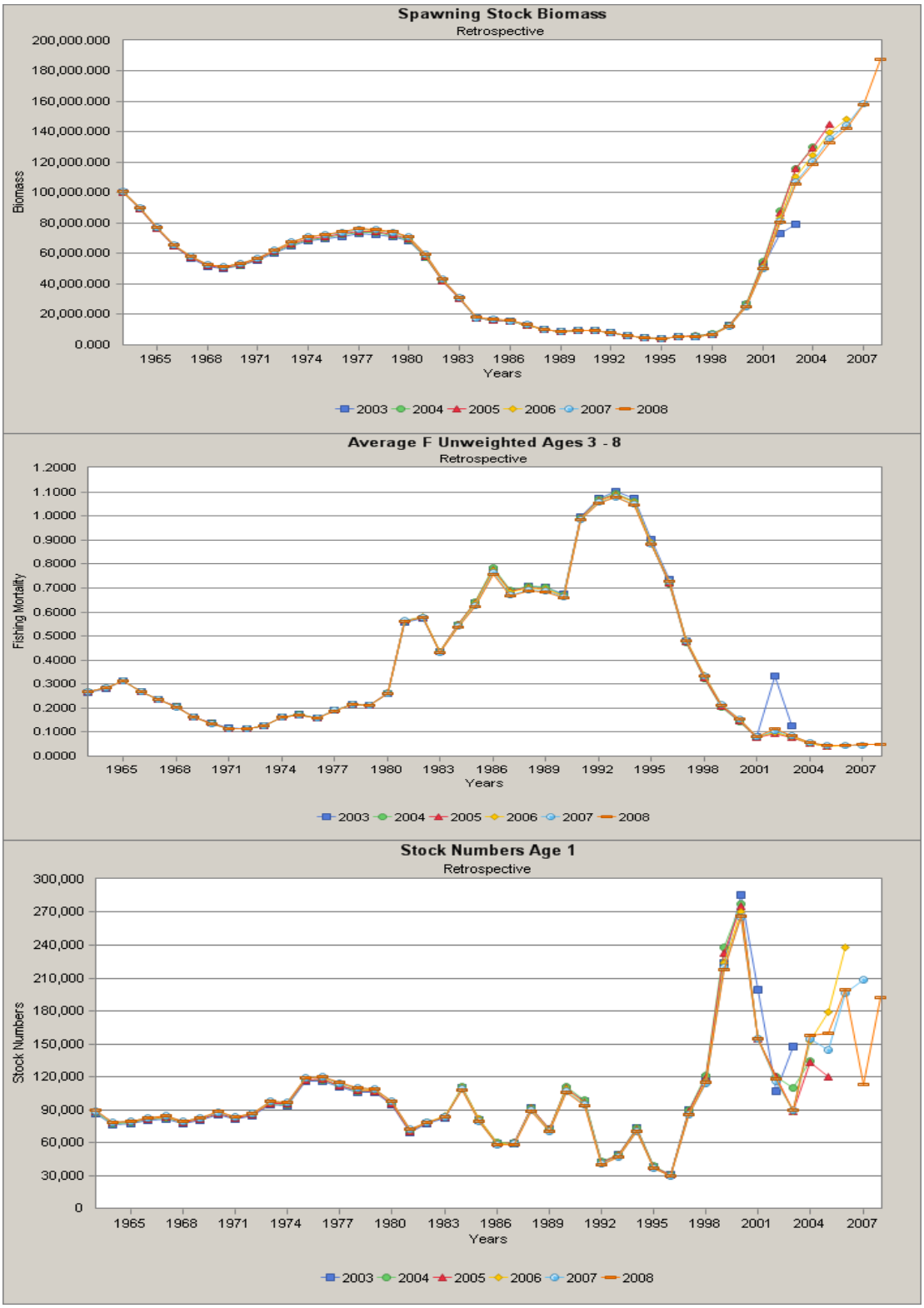


Figure 25. Retrospective analysis of the ASAP SCAA for scup: SSB, F, and R. Note that model ages 3-8 are true ages 2-7+ and model age 1 is true age 0.

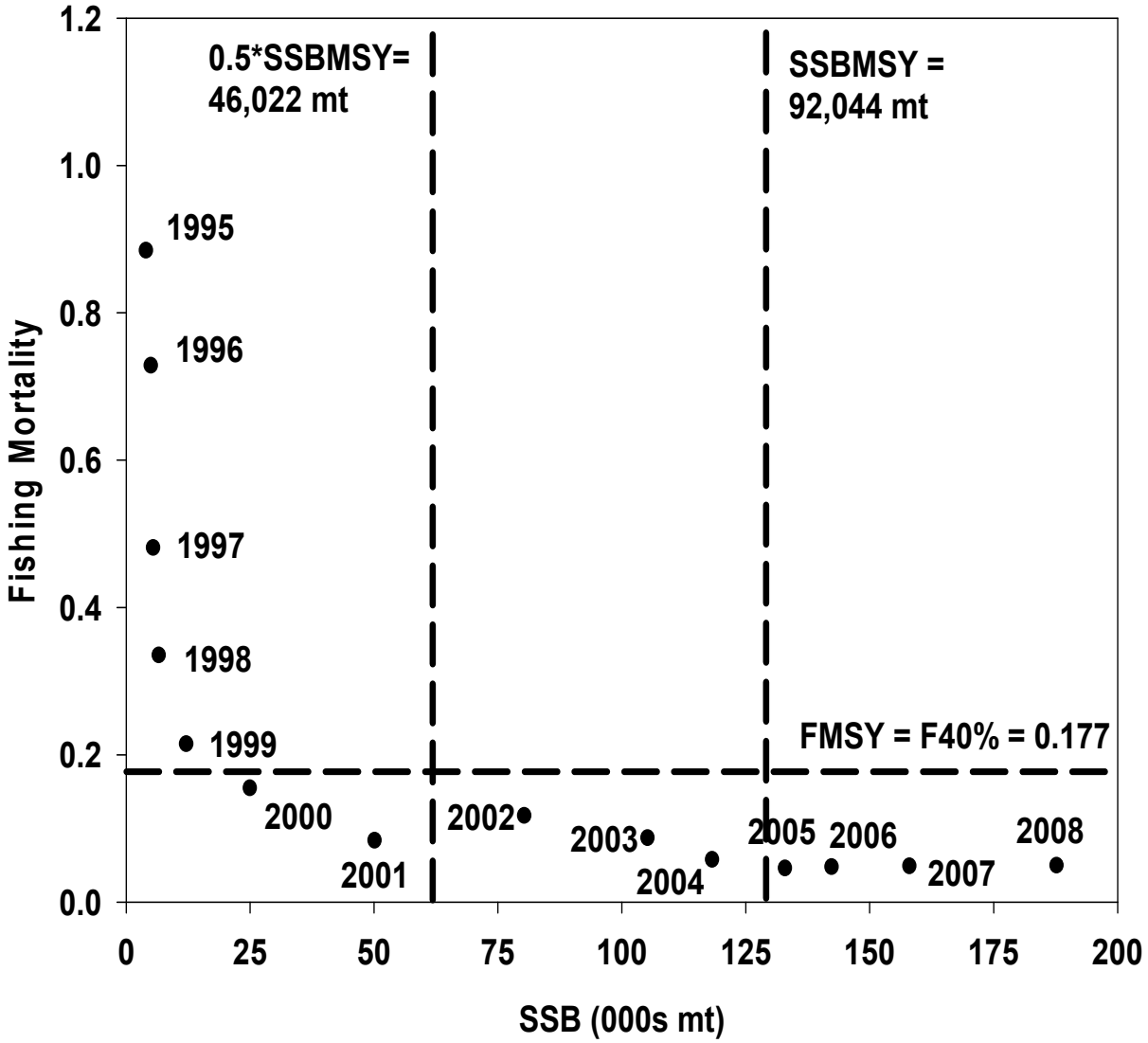


Figure 26. Status determination plot for scup, comparing estimates from the 2009 updated assessment with BRPs from the 2008 DPS assessment.

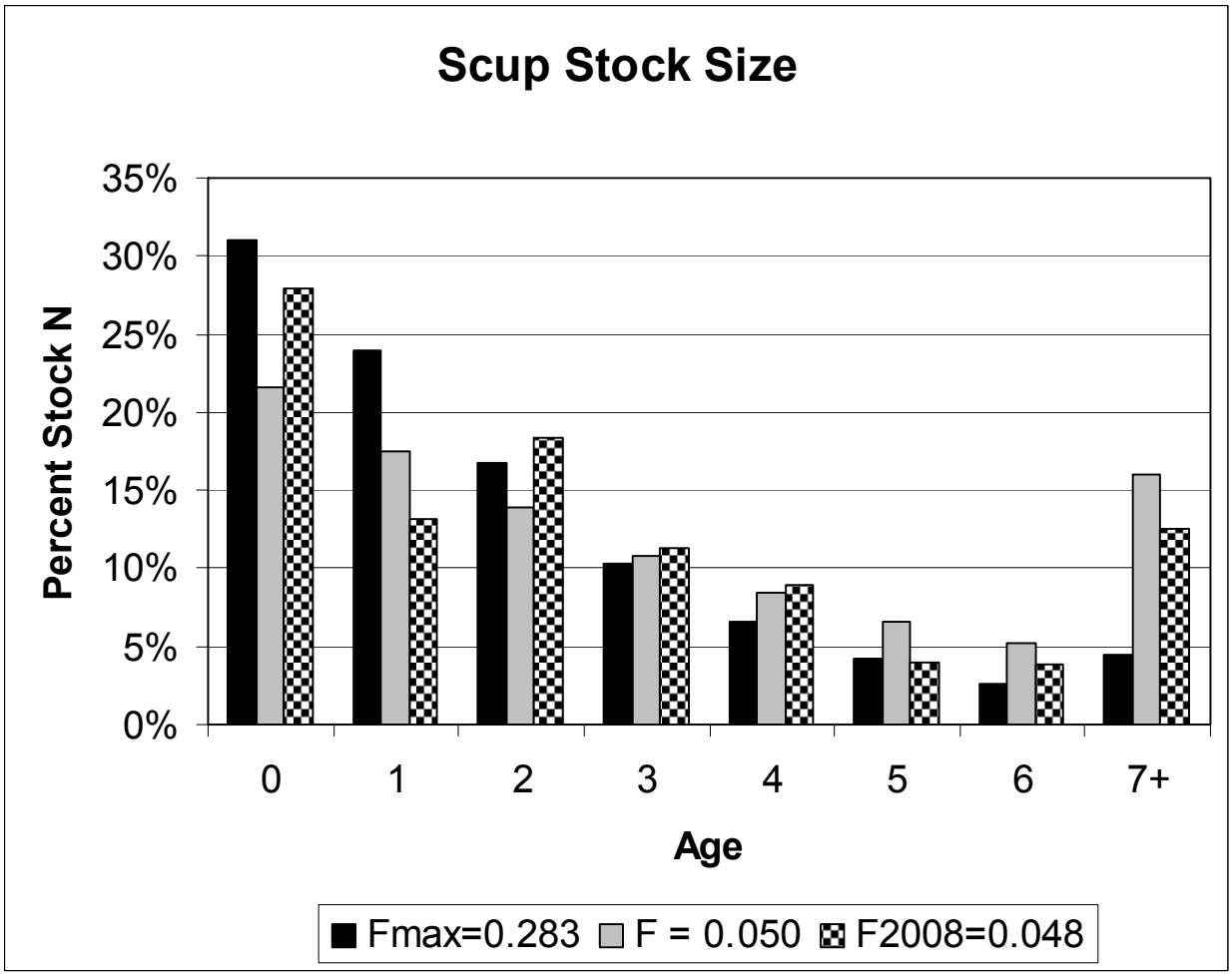


Figure 27. Percentage of scup stock size in numbers expected if the stock were fished at Fmax = FMSY = 0.283 or F = 0.050 over the long-term, compared with stock size percentages estimated for 2008 at F = 0.048.

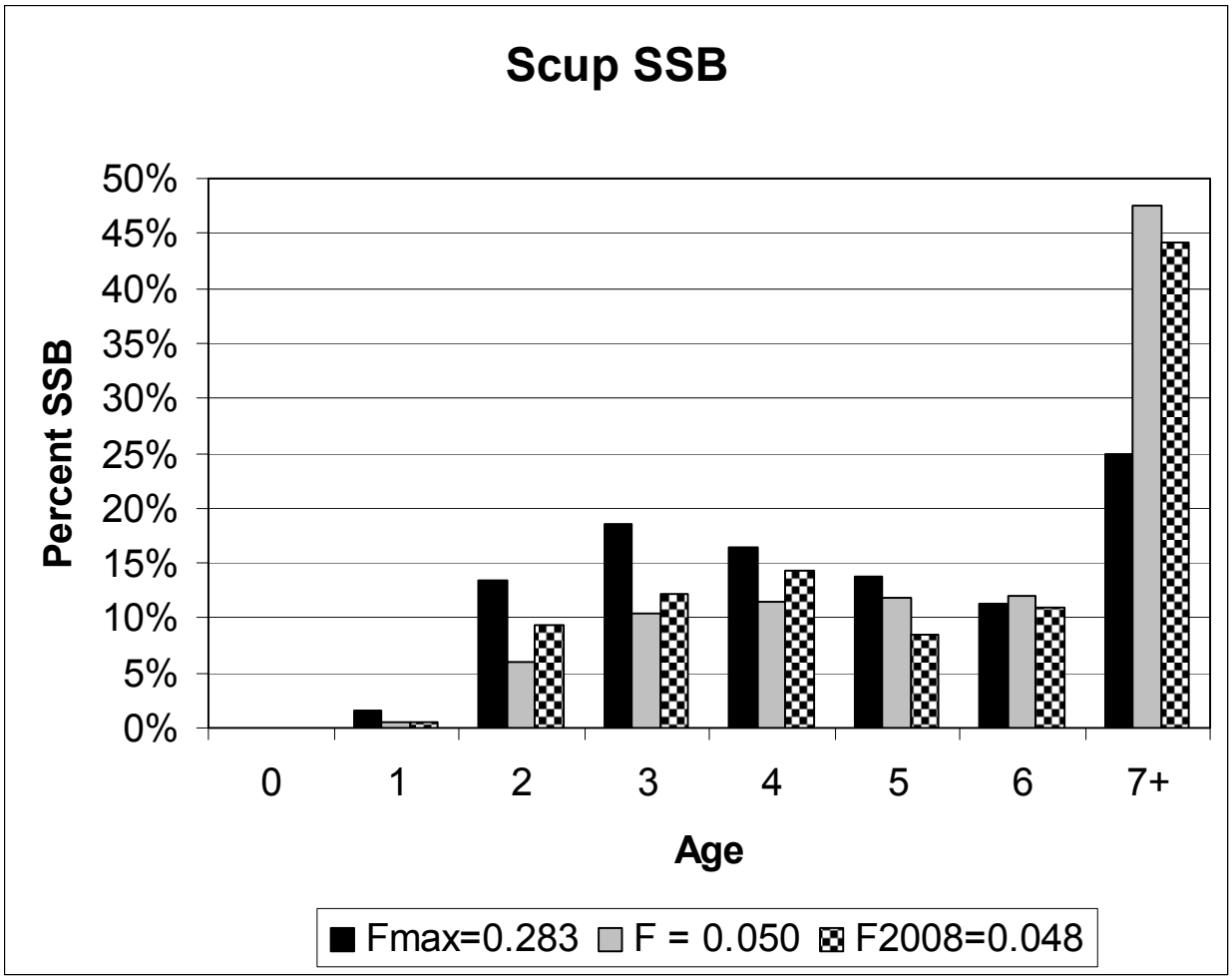


Figure 28. Percentage of SSB in weight expected if the stock were fished at Fmax = FMSY = 0.283 or F = 0.050 over the long-term, compared with SSB percentages estimated for 2008 at F = 0.048. Fish at ages 3 and older are fully (>99%) mature.

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