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Stock Assessment of Yellowtail Flounder in the Cape Cod - Gulf of Maine Area

by

Steven X. Cadrin and Jeremy King

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A Report of the 36th Northeast Regional Stock Assessment Workshop

Stock Assessment of Yellowtail Flounder in the Cape Cod - Gulf of Maine Area

by

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ABSTRACT

Cape Cod yellowtail flounder were previously assessed as a unit stock, but are now combined with those in the Gulf of Maine. The Cape Cod–Gulf of Maine stock is overfished and overfishing is occurring. Current fishing mortality is high (2001 $F_{ages\ 3\text{-}4}$=0.75) and much greater than the proposed F_{MSY} proxy ($F_{40\%MSP}$=0.17). Spawning stock biomass declined in the early 1990s, and began increasing in 1998 to 3,200 mt in 2001, but is much less than the proposed SSB_{MSY} proxy (12,600 mt SSB). With the exception of the strong 1987 yearclass, recruitment has been relatively stable, but early indications suggest that the 2000 cohort is extremely low. The age structure of the stock is truncated in comparison to MSY conditions.

INTRODUCTION

Yellowtail flounder, *Limanda ferruginea,* inhabit the continental shelf of the northwest Atlantic from Labrador to Chesapeake Bay (Bigelow and Schroeder 1953, Collette and Klein-MacPhee 2002). Off the U.S. coast, commercially important concentrations are found on Georges Bank, off southern New England, and off Cape Cod (statistical areas 514 and 521; Figure 1). Cape Cod yellowtail inhabit shallow water (10-60 m) relative to offshore stocks of yellowtail (Lux 1964). Spawning occurs during spring and summer, peaking in late May. Larvae are pelagic for a month or more, then develop demersal form and settle to the bottom. Yellowtail flounder on the Cape Cod grounds generally mature at age-3 (O'Brien et al. 1993) and grow to 58 cm total length.

A New England fishery for yellowtail flounder developed in the 1930s, coincident with a decline in winter flounder abundance, and the fishery expanded from southern New England to Georges bank and the Cape Cod grounds in the late 1930s and early 1940s (Royce et al. 1959, Lux 1964). On the Cape Cod grounds, yellowtail are generally caught in multi-species groundfish fisheries (principally by otter trawls) from late fall to spring, with some landings by gillnets in the winter and spring, but may also be specifically targeted in certain seasons (Royce et al. 1959).

Historically, landings from the Cape Cod grounds were a small portion of the total U.S. yellowtail landings. However, during the collapse of Georges Bank and southern New England stocks in the early 1990s (NEFSC 1994), the Cape Cod stock was the most productive of the U.S. yellowtail stocks (Overholtz and Cadrin 1998).

The available information on yellowtail flounder stock structure off the northeast U.S. indicates separate stocks on Georges Bank, off Cape Cod, and from southern New England to the Mid-Atlantic Bight. Distributional analyses indicate a relatively continuous distribution from the Mid Atlantic Bight to Nantucket Shoals, a concentration on Georges Bank, and a relatively separate concentration off Cape Cod (Royce et al. 1959). Geographic variation indicates that yellowtail off Cape Cod comprise a separate phenotypic stock than resources to the south (Begg et al. 1999). Tagging data indicate low dispersion from Cape Cod, Georges Bank and southern New England fishing grounds (Royce et al. 1959, Lux 1963). Descriptive information on early life history stages and circulation patterns suggest that yellowtail spawn in hydrographic retention areas, but there may be some advection of eggs and larvae from Georges Bank and Cape Cod to southern New England and the Mid Atlantic Bight (Sinclair 1988). In summary, yellowtail on the Cape Cod grounds can be considered a separate phenotypic stock (with some question on the northern boundary of the stock area). There is little evidence supporting separate stocks on the Cape Cod grounds and in the northern Gulf of Maine.

Management History

Over the past 25 years, the fishery for yellowtail flounder in federal waters has been managed under several regimes. From 1971 to 1976, national quotas were allocated by the International Commission for Northwest Atlantic Fisheries. From 1977 to 1982, the New England Fishery Management Council Atlantic Groundfish Fishery Management Plan established optimum yield thresholds for yellowtail west of 69^o longitude (which included Cape Cod and southern New England yellowtail stocks) and imposed minimum mesh size, spawning closures, and trip limits (Table 1). In 1982, the Council adopted an Interim Groundfish Plan, which established a minimum size limit of 28 cm (11 in) and a minimum mesh size of 130 mm (5 1/8"; with exemptions). In 1983, the minimum mesh size was increased to 140 mm (5.5"; with exemptions) In 1986, the Council's Multispecies Fishery Management Plan increased the minimum legal size to 30 cm (12 in) and imposed seasonal area closures. Amendment #4 to the Plan further increased the minimum legal size to 33 cm (13 in) in 1989. In 1993, finfish exclusion devices were required in the northern shrimp fishery to reduce groundfish bycatch. Amendments #5, #6, and #7 (1994-1996), limited days at sea, closed areas year-round, further increased minimum mesh size to 142 mm (6 in diamond or square; with fewer exemptions), imposed trip limits for groundfish bycatch in the sea scallop fishery, and prohibited small-mesh fisheries from landing groundfish. Framework #25 was an annual adjustment to the Multispecies Plan which prohibited bottom trawling in two areas of yellowtail habitat on the Cape Cod grounds in 1998: Massachusetts Bay was closed in March, and the waters off Cape Ann were closed in April. Other sections of the western Gulf of Maine were closed in May and June. The 'western Gulf of Maine closure' is too deep to protect yellowtail flounder. Amendment #9 was adopted in 1998 to revise the overfishing definition according to Sustainable Fisheries Act requirements. . In 1999, minimum twine top mesh of scallop dredges was increased from 203mm to 254mm to reduce yellowtail bycatch.

The portion of the Cape Cod yellowtail stock found within the Massachusetts territorial sea is managed by the Massachusetts Division of Marine Fisheries under a suite of management measures. Since 1931, many coastal areas have been closed to bottom trawling year-round (e.g. Winthrop Head to Gloucester), or seasonally (e.g. Boston to Provincetown and Gloucester to New Hampshire). The state has had a succession of more stringent size limits beginning with a 11" minimum size in 1982. The size limit increased to 12" in 1986 and then to 13" in 1988. In 1986, 5" mesh codends were required for trawling within the 20 fathom contour in waters north of Cape Cod. In 1986, a winter flounder spawning closure to trawling and gillnetting extending approximately one to two miles from shore was established in waters from the New Hampshire border to Provincetown from February 1 to April 30 (extended to May 31 in 1990). In 1989, small mesh trawling was restricted to permitted fisheries targeting specific species. In 1991, minimum mesh size throughout the net was increased to 5 1/2" north and east of Cape Cod. Since November 1, 1992 a year-round night closure to mobile gear has abbreviated fishing effort by curtailing "trip fishing". Beginning in 1993, a Coastal Access Permit was required to fish mobile gear. The mesh size was increased again in 1994 to 6". A moratorium on new applicants for this permit was enacted in 1994 stemming an increase in effort into state waters. In 1995, the size limit for vessels fishing mobile gear was reduced from 90' registered length to 72' length over all. From 1995-1999, small mesh trawling in state waters north of Cape Cod was limited to an experimental whiting fishery with drastic ground gear modifications for bycatch reduction, prohibitions on groundfish retention and intensive sea sampling. Scallop dredge fisheries have been limited to 10' combined maximum dredge width since 1990. Gillnet fisheries in Massachusetts have a permit moratorium, 2400' maximum net length, 6" minimum mesh size and seasonally closed areas.

Assessment History

Yellowtail resources on the Cape Cod fishing grounds and in the northern Gulf of Maine have been assessed and managed separately. The Cape Cod yellowtail resource was initially assessed by descriptive summaries of catch, effort, catch samples, survey indices, yield per recruit modeling, and estimates of total mortality rate (Z) from survey and commercial age samples. The stock was more stable than the Georges Bank or southern New England stocks from the 1940s to the 1960s, based on patterns of landings and commercial catch rates (Royce et al. 1959, Lux 1964). However in the early 1970s, effort began to increase, and catch rates began to decline (Parrack 1974). Estimates of fishing mortality rate (F) during the 1970s were at or above the estimated level of maximum yield per recruit (Howe 1975). Although yield remained stable relative to offshore stocks, catch rates were at the lowest levels observed by the late 1970s (Sissenwine et al. 1978). For a brief period in the mid 1970s, the stock appeared to be stable (McBride and Sissenwine 1979). However, by the late 1970s, peak catches produced high mortality rates, the age structure appeared to be truncated, and catch rates continued to decrease (McBride et al. 1980, McBride and Sissenwine 1980, Clark et al. 1981). Despite some indications of good recruitment in early 1980s (McBride and Clark 1983, Clark et al. 1984), landings and relative abundance generally decreased in the 1980s (NEFC 1986). The 1987 year class was dominant and contributed to some rebuilding, however, the most recent descriptive assessment of Cape Cod yellowtail concluded that the stock was overexploited (Rago 1994). An age-based assessment indicated that F was high (>0.7) from 1985 to 1997 and biomass was much less than B_{MSY} (Cadrin et al. 1999). Updated assessments in 1999 and 2000 each indicated a reduction in F in the last year of the assessment (Cadrin and King 2000, Cadrin 2001), but the revised estimate of 1998 F remained high (1.0, Cadrin 2001). An updated assessment of the Cape Cod yellowtail flounder stock was prepared concurrently with this assessment for the Groundfish Assessment Review Meeting (Cadrin and King 2002).

Yellowtail flounder in the northern Gulf of Maine have not been analytically assessed. Royce et al. (1959) compiled yellowtail landings statistics for the scattered shoals in the northern Gulf of Maine in the 1940s, and Lux (1964) updated landings statistics through 1961. McBride and Sissenwine (1980) reported a substantial increase in yellowtail flounder landings from the northern Gulf of Maine during the 1970s, and described the sparse survey information available for yellowtail in the northern Gulf of Maine. This assessment combines catch and survey information from the Cape Cod grounds and the northern Gulf of Maine for a single-stock analysis.

FISHERY DATA

Commercial Landings

Commercial statistics for Cape Cod yellowtail flounder are from statistical areas 514 and 521, and northern Gulf of Maine yellowtail are from statistical areas 511, 512, 513 and 515 (Figure 1). U.S. commercial landings of yellowtail flounder were derived from dealer weighout reports and canvas data according to historical assessment reports (Royce et al. 1959, Lux 1964, Sissenwine et al. 1978, McBride et al. 1980, McBride and Clark 1983, NEFC 1986). Previous to 1994, landings were allocated to statistical area, month, and gear type according to interview data collected by port agents (Burns et al. 1983). For 1994, landings reported by dealers were allocated to stock area using fishing vessel logbook data, by fishing gear, port, and season (Wigley, et al. 1998). For 1995-1997, dealers' reported landings were prorated to stock area using a modified proration that included dealer codes (NEFSC 1998).

Annual landings generally increased from less than 1,000mt in the mid 1930s to a peak of 5,600mt in 1980 (Table 2, Figure 2). Landings decreased to approximately 1,200mt per year in the late 1980s, but peaked again in 1990 at 3,200mt with recruitment of the strong 1987 yearclass. Landings decreased to 800mt in 1993 and remained low through the 1990s, but rapidly increased to greater than 2,400mt in 2000 and 2001.

Landings at age of Cape Cod yellowtail flounder are described in Cadrin et al. (1999), Cadrin and King (2000, 2002) and Cadrin (2001), and sample sizes are reported in Table 3. Very few port samples are available for the northern Gulf of Maine yellowtail fishery (six samples from 1969, 1976, 1983, 1987, 1988 and 1991) and all market categories were not sampled in any year. Therefore, the age distribution of Cape Cod yellowtail landings, by half and market category, were assumed for northern Gulf of Maine landings. Landings at age, by region, are listed in Table 4.

Discarded Catch

Discards were estimated using discard to kept observations from 1989-2001 sea sampling for the trawl and gillnet fisheries and discard per effort for the shrimp and scallop fisheries as described in Cadrin et al. (1999). Discards of Cape Cod yellowtail flounder for 1985-1997 are described in Cadrin et al. (1999), and for 1998-2001 by Cadrin and King 2002 (Table 5a). Discards for the northern Gulf of Maine averaged 38% of Gulf of Maine yellowtail landings, primarily from the trawl fishery and the shrimp fishery prior to the Nordmore grate requirement in 1993 (Table 5b). Discards for 1985-1988 were approximated by assuming a 38% annual discard ratio.

Discards at age of Cape Cod yellowtail flounder are described in Cadrin et al. (1999) and Cadrin and King (2002; Table 6a). Discards at age for yellowtail in the northern Gulf of Maine were estimated using length observations from sea sampling (Table 6b; using pooled-year samples by half and gear for unsampled discards) and survey age-length keys for 1989-2001 by half-year. The proportion discard at age from the Cape Cod grounds were assumed for 1985-1988 discards in the northern Gulf of Maine. Total catch at age is dominated by age-3 and indicates a strong 1987 yearclass (Appendix A, Figure 3). Mean weight at age of catch was relatively stable from 1985 to 1996, but has increased for ages 2+ in recent years (Figure 4).

ABUNDANCE AND BIOMASS INDICES

Stock Abundance and Biomass Indices

NEFSC survey strata for the Cape Cod grounds are offshore strata 25-27 and inshore strata 56-66 and strata for the northern Gulf of Maine are offshore strata 39 and 40 (Figure 5). The NEFSC spring and autumn bottom trawl surveys have sampled offshore strata since 1963 and 1968, respectively (Despres et al. 1988). However, sampling of inshore strata north of Cape Cod began in 1977. Yellowtail are consistently sampled in offshore stratum 27 by the spring survey, but were only caught in 4 years since 1963 by the fall survey. Therefore, the spring index includes offshore stratum 27, but the fall survey does not. The Massachusetts survey has been conducted since 1978 and consistently catches yellowtail in strata 17-36 (Howe 1989).

Survey biomass indices are somewhat noisy, but generally indicate high biomass in the late 1970s and early 1980s, a decline in the 1980s and a rapid increase in the late 1990s (Figure 6). The rapid increases in fall 1999 or spring 2000 do not appear to result from strong recruitment, because catches of all ages increased. Large survey catches were distributed throughout Cape Cod and Massachusetts Bays, Stellwagen Bank and Jeffreys Ledge (Figure 7).

The portion of survey biomass from northern Gulf of Maine is variable, but averages 11% throughout the survey time series (Figure 8). There appears to have been low abundance of yellowtail in the northern Gulf of Maine during the late 1960s, early 1970s, and middle 1980s. Age distribution of survey catches are potted in Figure 9 and listed in Table 8.

Correspondence among survey indices was assessed using correlations among normalized observations [Ln(x/mean); Table 7]. Correlations among survey series were weak to moderate with strongest correlations among indices for ages 2-4 (r=0.12 to 0.69). Normalized indices of catch per tow at age are illustrated in Figure 10.

MORTALITY AND STOCK SIZE

Virtual Population Analysis

Estimates of abundance from virtual population analysis of catch at age-1 to age-5+, 1985-2001, were calibrated using an ADAPT algorithm (Gavaris 1988) that estimated age-2 to age-4 survivors in 2002 and survey catchability coefficients (q) using nonlinear least squares of survey observation errors. Abundance at age was calibrated with survey indices of abundance: spring survey indices were calibrated to January abundance at age, and fall survey indices were calibrated to abundance at age for January of the next year. The instantaneous rate of natural mortality (M) was assumed to be 0.2 based on tag returns (Lux 1969), relationships of Z to effort (Brown and Hennemuth 1971), and the oldest individual sampled in the stock area (age-14). Although catches of yellowtail older than age-8 are rare in commercial or research catches, the stock has been heavily exploited for seven decades. Maturity at age for Cape Cod yellowtail flounder was reported by O'Brien et al. (1993) from 1985-1990 NEFSC spring survey samples. Calibration output is reported in Appendix A. Model Residuals are plotted in Figure 11.

Results indicate that F on ages 3+ decreased from a peak of 1.3 in 1988 to 0.28 in 1993, then increased to an annual average of 0.61 from 1995 to 2000 and was 0.75 in 2001 (Figure 12). With the exception of the strong 1987 year class (29 million at age-1), recruitment has been stable, averaging 10 million at age 1. However, early indications are that the 2000 yearclass is well below average. Spawning biomass averaged 1,000mt during the late 1980s increased to a peak of 3,800mt in 1991 as the 1987 cohort matured, decreased to 1,600mt in 1998, and gradually increased to 3,200 mt in 2001. Retrospective analysis indicates a pattern of underestimating F, and overestimating SSB in the last five years (Figure 13).

Bootstrap analysis indicates that abundance estimates in 2002 were estimated with moderate precision (CVs=0.26-0.51). The 80% confidence limit for 2001 F is 0.59-0.95, and the 80% confidence limit for 2001 SSB is 2,500-4,000mt.

Biological Reference Points

Yield and biomass per recruit were calculated assuming the observed partial recruitment and mean weight at age for 1994-2001 (Thompson and Bell 1934). Results are reported in Table 9 and shown in Figure 14. A comparison of recently observed age distributions with the age distribution expected at $F_{40\%}$ shows a relative truncation in current age structure (Figure 15).

Applying the approach used to estimate MSY proxies for Cape Cod yellowtail (NEFSC 2002), F_{MSY} is approximated as $F_{40\%MSP}$ (0.17). The SSB_{MSY} proxy is 12,600mt, calculated as the product of 40%MSP (1.192kg spawning biomass) and average recruitment (10.5 million). The MSY proxy is 2,300mt, derived as the product of yield per recruit at $F_{40\%MSP}$ (0.213kg) and average recruitment.

Projections

Stochastic projections at 85% of status quo F in 2002 and F=0.06 for 2003-2009 there is a 50% probability of rebuilding to SSB_{MSY} by 2009 (Appendix A, Figure 16). However, retrospective patterns indicate that projections may be optimistic.

DISCUSSION

Although there is little evidence to separate yellowtail flounder in the northern Gulf of Maine from those on the Cape Cod fishing grounds, the lack of samples in the Gulf of Maine, and the resulting need to use Cape Cod samples to characterize the entire catch produce a catch at age matrix that is very similar to that used in previous assessments of Cape Cod yellowtail flounder, though slightly greater to account for Gulf of Maine catch. Therefore, the same patterns of abundance at age are indicated in this combined assessment. Furthermore, the peculiarities of the Cape Cod assessment persist in this assessment. For example, the retrospective pattern of overestimating abundance at older ages (i.e., age 5+) continues. The apparent lack of older fish in the catch and surveys continues to produce extremely high F on older ages. Despite the high estimates of F, recruitment appears to have been stable, and SSB has recently increased.

The possibility that older fish are moving from the fishing and survey areas, giving the false impression of high mortality, was investigated. Size distributions from the longest time series of survey data (fall survey, offshore strata 25, 26, 39 and 40; Figure 17) show that some larger fish were sampled in the assessment strata in the 1960s, but recent length distributions are considerably smaller. More large fish were also sampled in the earliest years of the Massachusetts survey (Figure 18). The Gulf of Maine summer survey, which sampled the inshore strata of the western Gulf of Maine (1977-1981, inshore strata 68-90; Figure 19) caught a similar size distribution of yellowtail as the assessment strata. Survey catches in the central and eastern Gulf of Maine also caught a similar size distribution of yellowtail as the assessment strata (Figure 20), but inconsistently and at much lower densities than those in the assessment strata (e.g., since 1963, yellowtail were only caught twice in stratum 28, six surveys in stratum 29, six surveys in stratum 37 and once in stratum 38). Therefore, the assessment strata appear to reflect the size distribution throughout the Gulf of Maine, and no large yellowtail were sampled anywhere in the Gulf of Maine in recent years.

The initial ADAPT calibration was configured for catch at age for age-1 to age-6+ and exhibited a severe retrospective pattern for SSB and F. A comparison of ADAPT retrospective patterns from Cape Cod-Gulf of Maine and Cape Cod only exhibited little difference. The low numbers of age 5 in the catch and surveys did not appear to be sufficient to reliably estimate F on age 5. As a result, an alternative ADAPT configuration which truncated the catch at age to age-5^+ was considered. Estimation of abundance for the truncated catch at age required that age 3 be considered fully recruited for calculation of F on the oldest true age. The final ADAPT run reduced the magnitude of the retrospective patterns for fully recruited F and spawning biomass. The results revealed a high sensitivity to the calibration change. The fully recruited F decreased while spawning stock biomass increased.

Including a flat-topped selectivity pattern at age 3+ could mask high F's at true fully recruited ages. The original formulation, which estimated F on age 3, suggested that age 3 yellowtail were partially recruited. Assessments of yellowtail flounder in other U.S. management areas (Georges Bank and southern New England-Mid Atlantic, where yellowtail growth is faster) indicate partial recruitment at age-3. A comparison of observed length distribution at age-3 and length selectivity at various mesh sizes indicated only partial retention of age-3 yellowtail. However, mesh selectivity is only one component of fishery selectivity and other factors, such as temporal-spatial elements of the fishery, also influence fishery selectivity. In addition, the mean weights of a plus group at age-5 and older may be difficult to characterize because they continue to grow substantially after age 5.

Yield and SSB per recruit were re-estimated assuming full recruitment at age-3 in order to be consistent with the revised ADAPT configuration. Examination of stock-recruit observations for Cape Cod-Gulf of Maine yellowtail and fishing mortality rates at various levels of replacement suggests that the stock can replace itself at F greater than $F_{40\%}$ (i.e.$F_{med} > F_{40\%\ MSP}$), and $F_{40\%}$ may be a conservative proxy for F_{MSY}. However, extrapolating recruitment at high stock sizes from the VPA time series may overestimate productivity of the stock at higher SSB. The stock recruitment relationship is similar to the Georges Bank stock prior to recovery, in that most stock recruitment points were above the $F_{40\%}$ replacement line. This suggests that a short-term perspective of the stock recruitment relationship may not represent the potential productivity of the Cape Cod-Gulf of Maine stock. The 36th Northeast Stock Assessment Review Committee (SARC) concluded that there is currently no justification for changing the $F_{40\%}$ reference point.

Contributions from the Georges Bank or Southern New England stocks of yellowtail flounder to the Cape Cod-Gulf of Maine stock may occur through both adult movement and recruitment impacts. Given the relative sizes of the stocks, especially the Georges Bank and Cape Cod stocks, any transfer among stocks could overwhelm the recruitment signal from reproduction within the Cape Cod-Gulf of Maine area (Hart and Cadrin 2003). Given the difficulty in estimating fully-recruited fishing mortality with consistency and estimating reliable patterns of mortality and abundance, independent estimates of mortality may be needed to verify estimates from ADAPT. Mark-recapture studies could be used to estimate mortality as well as mixing rates with adjacent areas.

The sharp increase in catch and survey indices from 1999 to 2001 are difficult to interpret, because increases were at all ages and throughout the stock area. Perhaps the rolling closures may have increased both survey and fishery catchability. Surrounding closures may have redirected effort onto Stellwagen Bank. However, sharp increases also occurred in historic landings (Figure 2).

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Table 1. Summary of management of Cape Cod-Gulf of Maine yellowtail flounder.

Year	Comments
1977	FCMA implemented March 1 Groundfish plan adopts quotas for cod, haddock, yellowtail flounder
1982	Interim Groundfish Plan adopted: Georges Bank and Gulf of Maine minimum mesh size of 5 1/8 inches, increasing to 5 1/2 inches in 1983 11 inch minimum size for yellowtail Scallop FMP implemented
1986	Northeast Multispecies FMP adopted: Minimum size for yellowtail flounder: 12 inches Minimum mesh size in GB/GOM: 5 1/2 inch cod end (no minimum size in SNE/MA) Seasonal yellowtail closure, March - May, between 69-30 and 72-30W Small mesh fisheries in GOM/GB area only restricted to specific seasons with limits on landings (not catch) of groundfish and inshore area of GOM
1989	Amendment 2: Yellowtail minimum size increased to 13 inches
1991	Amendment 4: Tightened restrictions on carrying small mesh while in Regulated Mesh Areas Mandated use of selective gear in shrimp fishery, leading to implementation of the Nordmore grate in 1993
1994	Amendment 5 and emergency regulations: DAS limits for most vessels West of 72-30W. Mesh determined by mesh requirements of summer flounder fishery (5 1/2 inch diamond or 6 inch square) GOM/GB mesh of 6 inches (diamond or square) Eliminated seasonal restrictions on small mesh fisheries in Small Mesh Exemption Area of inshore GOM Adopted Nordmore grate requirement into FMP Scallop Amendment 4: adopted permit moratorium, effort control/DAS program, 5.5 inch twine top minimum, and crew limits
1996	Amendment 7 Extended DAS limits to most vessels Limited possession of groundfish by scallop vessels to 300 pounds of regulated multispecies Established criteria for exempted fisheries Established exempted whiting fisheries in GOM/GB in three areas (Small Mesh Areas I and II in inshore GOM, Cultivator Shoals area on GB)
1999	Framework 27: (May 1) Increased square mesh minimum size to 6 1/2 inches in GOM/GB/SNE Regulated mesh areas Framework 29: (June)
	Amendment 9: (November): Revised overfishing definitions
	Scallop Framework 11 mandates 8 inch twine top, authorizes scallop access program for Closed Area II, with yellowtail flounder bycatch limits
	Scallop Framework 13: Scallop vessel closed area access programs with yellowtail bycatch limits
2000	Adopted management measures for small-mesh multispecies, establishing minimum mesh sizes and trip/possession limits to reduce mortality on silver, red, and offshore hake Framework 35: Established exempted whiting fishery in upper Cape Cod Bay using raised footrope trawl

Table 2. Cape Cod – Gulf of Maine yellowtail flounder catch.

	Cape Cod Landings	Cape Cod Discards	Gulf of Maine Landings	Gulf of Maine Discards	Total
1960	1,500	500	39	---	2,039
1961	1,800	600	22	---	2,422
1962	1,900	600	0	---	2,500
1963	3,600	1,000	0	---	4,600
1964	1,851	600	6	---	2,457
1965	1,498	500	8	---	2,006
1966	1,808	300	26	---	2,135
1967	1,542	800	50	---	2,391
1968	1,569	600	13	---	2,181
1969	1,346	300	75	---	1,722
1970	1,185	400	125	---	1,710
1971	1,662	700	56	---	2,418
1972	1,364	300	156	---	1,821
1973	1,662	0	63	---	1,724
1974	2,054	200	104	---	2,358
1975	2,027	0	194	---	2,220
1976	3,587	100	258	---	3,945
1977	3,469	0	252	---	3,722
1978	3,683	400	388	---	4,471
1979	4,163	500	276	---	4,939
1980	5,106	600	461	---	6,167
1981	3,149	600	425	---	4,174
1982	3,150	400	486	---	4,035
1983	1,884	300	324	---	2,509
1984	1,121	20	244	---	1,385
1985	967	77	205	77	1,326
1986	1,041	305	164	62	1,572
1987	1,159	198	194	73	1,624
1988	1,085	283	190	72	1,630
1989	909	390	209	47	1,555
1990	2,984	1,141	238	98	4,461
1991	1,472	405	265	110	2,251
1992	828	637	203	78	1,746
1993	628	90	158	31	907
1994	978	192	321	89	1,580
1995	1,207	233	124	111	1,674
1996	1,064	182	108	51	1,405
1997	1,040	257	74	20	1,392
1998	1,169	259	73	39	1,540
1999	1,089	107	121	40	1,357
2000	2,279	163	133	33	2,609
2001	2,362	447	143	35	2,988

Table 3. Samples of Cape Cod yellowtail flounder.

year	half	trips	unclass. lengths	small lengths	large lengths	ages
1985	1	5	109	304	196	292
	2	12	0	825	543	357
1986	1	4	0	608	206	217
	2	6	0	321	172	240
1987	1	6	0	300	352	353
	2	5	0	284	269	207
1988	1	6	0	477	267	286
	2	5	0	291	364	252
1989	1	6	10	261	314	305
	2	4	97	262	173	200
1990	1	8	536	532	374	339
	2	6	636	429	276	137
1991	1	8	811	501	332	610
	2	7	109	531	242	277
1992	1	4	707	126	254	339
	2	7	136	262	457	268
1993	1	3	170	145	182	177
	2	3	273	244	74	114
1994	1	4	100	261	170	273
	2	3	0	106	144	149
1995	1	4	39	276	201	196
	2	6	998	392	275	157
1996	1	1	2560	0	87	196
	2	12	118	495	640	485
1997	1	7	343	388	483	556
	2	17	317	996	869	634
1998	1	7	4781	0	508	195
	2	6	165	0	600	165
1999	1	4	2501	278	60	49
	2	4	1024	268	116	57
2000	1	46	521	723	2775	903
	2	15	0	566	1057	395
2001	1	8	3502	251	570	192
	2	16	1950	393	774	436

Table 4a. Landings at age of Cape Cod yellowtail flounder.

Landings at age (thousands)			age					
	1	2	3	4	5	6	7	8+	sum
1985	5	738	700	522	268	89	3	7	2,332
1986	0	1,998	579	223	32	6	0	1	2,838
1987	0	609	1,786	268	100	29	12	5	2,808
1988	1	802	1,043	625	172	36	0	0	2,679
1989	0	726	989	231	31	3	2	2	1,986
1990	0	692	6,191	416	32	16	7	3	7,357
1991	0	311	903	1,455	249	33	27	1	2,978
1992	0	338	807	514	150	6	5	1	1,821
1993	0	25	684	573	90	24	15	7	1,418
1994	0	87	1,023	650	236	65	38	9	2,109
1995	0	233	1,730	808	152	78	5	0	3,006
1996	0	150	1,097	798	287	11	5	2	2,349
1997	0	481	1,086	702	160	13	0	1	2,443
1998	0	257	1,681	472	141	41	3	0	2,595
1999	0	328	1,134	646	106	43	1	0	2,258
2000	0	942	2,625	1,152	138	18	13	3	4,891
2001	0	807	2,933	1,058	152	24	13	1	4,987
mean	0	518	1,429	594	147	33	8	3	2,732

Landed weight at age (kg)			age				
	1	2	3	4	5	6	7	8+
1985	0.19	0.32	0.37	0.49	0.60	0.73	1.20	1.39
1986		0.32	0.46	0.57	0.73	0.90	---	1.40
1987		0.31	0.42	0.55	0.65	0.81	1.03	1.18
1988	0.11	0.31	0.37	0.53	0.70	0.85	---	---
1989		0.38	0.45	0.65	0.92	1.41	1.24	1.24
1990		0.31	0.41	0.56	0.82	0.90	0.99	1.17
1991		0.35	0.39	0.54	0.74	0.99	1.06	1.01
1992		0.32	0.41	0.53	0.61	0.73	1.53	1.91
1993		0.31	0.38	0.43	0.74	0.95	1.01	1.17
1994		0.29	0.38	0.50	0.62	0.68	1.04	1.11
1995		0.35	0.36	0.43	0.61	0.78	1.11	---
1996		0.32	0.42	0.50	0.53	0.91	1.19	1.18
1997		0.39	0.41	0.47	0.57	0.78	1.30	1.31
1998		0.33	0.41	0.55	0.63	1.00	1.62	---
1999		0.36	0.45	0.56	0.58	0.88	1.62	---
2000		0.38	0.44	0.56	0.61	0.82	0.87	1.12
2001		0.38	0.44	0.59	0.74	1.07	0.92	1.93
mean	0.15	0.33	0.41	0.52	0.67	0.89	1.23	1.28

Table 4b. Landings at age of northern Gulf of Maine yellowtail flounder.

Landings at age (thousands) age

year	1	2	3	4	5	6	7	8+	sum
1985	1	138	139	112	61	20	1	1	474
1986	0	235	116	49	8	1	0	0	409
1987	0	75	315	41	17	5	2	1	456
1988	0	115	239	119	27	5	0	0	505
1989	0	112	295	55	6	1	0	0	469
1990	0	26	472	56	3	2	0	0	559
1991	0	50	162	263	43	6	7	0	531
1992	0	72	223	130	38	1	1	0	465
1993	0	9	184	150	20	5	3	1	372
1994	0	42	344	200	74	36	11	1	708
1995	0	20	196	90	15	7	0	0	329
1996	0	7	83	93	39	2	1	0	225
1997	0	12	78	66	13	0	0	0	169
1998	0	12	106	31	8	3	0	0	160
1999	0	28	119	85	12	7	0	0	251
2000	0	62	163	70	4	0	0	0	299
2001	0	35	153	100	15	5	0	0	307
mean	0	62	199	101	24	6	2	0	393

Landed weight at age (kg) age

year	1	2	3	4	5	6	7	8+
1985	0.19	0.31	0.37	0.49	0.60	0.72	1.17	1.39
1986		0.32	0.46	0.58	0.74	0.93		1.40
1987		0.31	0.41	0.56	0.67	0.86	1.10	1.25
1988	0.11	0.29	0.33	0.48	0.64	0.76		
1989		0.37	0.41	0.69	0.95	1.41	1.24	1.24
1990		0.31	0.41	0.54	0.90	0.99	0.99	1.79
1991		0.34	0.37	0.54	0.76	0.95	1.07	1.53
1992		0.32	0.40	0.50	0.58	0.80	1.49	1.89
1993		0.31	0.38	0.42	0.72	0.94	1.00	1.14
1994		0.28	0.38	0.49	0.60	0.67	1.04	1.12
1995		0.32	0.34	0.40	0.60	0.80	1.18	
1996		0.31	0.43	0.50	0.53	0.91	1.19	1.19
1997		0.38	0.40	0.47	0.56	0.93	1.30	1.30
1998		0.33	0.41	0.54	0.63	1.00	1.62	
1999		0.35	0.42	0.58	0.58	0.85	1.62	
2000		0.37	0.42	0.55	0.59	0.97	0.87	1.06
2001		0.35	0.41	0.56	0.57	0.69	1.62	
mean	0.15	0.33	0.40	0.52	0.66	0.89	1.23	1.36

Table 5a. Discard estimates for Cape Cod yellowtail flounder, by fishery.

Large-mesh Trawl Fishery

year	half	observed kept (mt)	discard (mt)	d/k	total landings	discards (mt)	discard lengths
1998	1	0.1551	0.0095	0.061	355	21.8	6
	2	0.1810	0.0230	0.127	426	54.1	7
1999	1	0.0091	0.0014	0.150	282	42.3	48
	2	2.2226	0.0945	0.043	564	24.0	0
2000	1	10.6743	0.4195	0.039	871	34.2	608
	2	1.1785	0.0431	0.037	1079	39.4	45
2001	1	5.9789	0.6183	0.103	789	81.6	42
	2	6.3832	1.6209	0.254	1311	332.8	890

Gillnet Fishery

year	half	observed kept (mt)	discard (mt)	d/k	total landings	discards (mt)	
1998	1	33.6627	0.5355	0.016	360	5.7	5101
	2	1.1959	0.0290	0.024	23	0.5	159
1999	1	16.6555	0.3622	0.022	207	4.5	521
	2	3.3086	0.0174	0.005	36	0.2	5
2000	1	29.5608	0.4748	0.016	295	4.7	426
	2	0.1919	0.0095	0.050	32	1.6	3
2001	1	13.1767	0.1202	0.009	223	2.0	63
	2	1.2431	0.0095	0.008	35	0.3	0

Small-mesh Trawl Fishery

year	half	observed effort (d)	discard (mt)	mt/d	total effort	discards (mt)	
1998	1	0.0000	0.0000	0.046 *	74	3.4	0
	2	0.0000	0.0000	0.046 *	308	14.0	0
1999	1	0.0000	0.0000	0.046 *	39	1.8	0
	2	0.4583	0.0209	0.046	214	9.7	0
2000	1	0.0000	0.0000	0.009 *	27	0.2	0
	2	9.0417	0.0794	0.009	201	1.8	0
2001	1	0.8125	0.0123	0.015	51	0.8	0
	2	1.0792	0.0014	0.001	121	0.2	0

Scallop Dredge Fishery

year	half	observed effort (d)	discard (mt)	mt/d	total effort	discards (mt)	
1998	1	0.6250	0.0302	0.048	1019	49.2	19
	2	7.0833	0.5643	0.080	1379	109.8	296
1999	1	2.7917	0.0372	0.013	1092	14.6	23
	2	6.7500	0.0445	0.007	1478	9.7	11
2000	1	0.0000	0.0000	0.045 *	772	34.6	0
	2	0.0000	0.0000	0.045 *	1045	46.8	0
2001	1	0.2583	0.0116	0.045	284	12.7	0
	2	0.0000	0.0000	0.045 *	384	17.2	0

* assumed from adjacent cell

Table 5b. Discard estimates for the northern Gulf of Maine yellowtail flounder, by fishery.

Trawl Fishery

year	half	observed kept	observed discard	d/k	landings	discards	discard lengths
1989	1	0.097	0.010	0.103	121	12	26
	2	0.029	0.005	0.186	45	8	0
1990	1	0.034	0.010	0.294	117	34	8
	2	0.007	0.002	0.265	80	21	0
1991	1	0.273	0.063	0.231	152	35	10
	2	0.122	0.047	0.387	86	33	0
1992	1	0.196	0.055	0.282	129	36	0
	2	0.720	0.017	0.024	56	1	0
1993	1	0.036	0.002	0.050	71	4	0
	2	0.681	0.082	0.120	72	9	2
1994	1	0.000	0.000	0.235	220	52	0
	2	0.000	0.000	0.501	55	28	0
1995	1	0.014	0.006	0.454	70	32	5
	2	0.002	0.006	2.478	26	63	14
1996	1	0.013	0.004	0.311	82	26	11
	2	0.000	0.060	0.501	13	7	147
1997	1	0.003	0.001	0.185	46	9	1
	2	0.000	0.000	0.501	10	5	0
1998	1	0.038	0.012	0.314	45	14	38
	2	0.000	0.000	0.501	17	8	0
1999	1	0.000	0.000	0.235	69	16	0
	2	0.000	0.000	0.501	23	12	0
2000	1	0.660	0.079	0.119	78	9	102
	2	0.186	0.066	0.353	44	15	27
2001	1	0.158	0.039	0.247	103	25	190
	2	0.206	0.041	0.199	32	6	64

Table 5b, continued.

Shrimp Fishery

year	half	observed effort	observed discard	d/e	effort	discards	discard lengths
1989	1	11	0.017	0.002	8200	13	18
	2	4	0.014	0.004	1361	5	8
1990	1	19	0.067	0.004	8647	31	83
	2	2	0.003	0.002	1111	2	0
1991	1	35	0.171	0.005	7402	36	222
	2	5	0.020	0.004	566	2	0
1992	1	62	0.322	0.005	7413	39	175
	2	3	0.002	0.001	385	0	2
1993	1	45	0.127	0.003	5666	16	394
	2	1	0.003	0.003	492	1	0
1994	1	35	0.047	0.001	4777	6	86
	2	4	0.010	0.002	1213	3	70
1995	1	34	0.052	0.002	8494	13	212
	2	6	0.008	0.001	1971	3	29
1996	1	13	0.020	0.002	9656	15	88
	2	2	0.004	0.002	2135	4	14
1997	1	6	0.003	0.000	9648	4	9
	2	0	0.000	0.002	1086	3	0
1998	1	0	0.000	0.002	6295	15	0
	2	0	0.000	0.002	311	1	0
1999	1	0	0.000	0.002	3811	9	0
	2	0	0.000	0.002	0	0	0
2000	1	0	0.000	0.002	3382	8	0
	2	0	0.000	0.002	0	0	0
2001	1	2	0.002	0.001	2963	3	0
	2	0	0.000	0.002	0	0	0

Table 5b, continued.

Gillnet Fishery

year	half	observed kept	observed discard	d/k	landings	discards	discard lengths
1989	1	0.000	0.000	0.323	25	8	0
	2	0.013	0.004	0.323	2	1	0
1990	1	0.049	0.012	0.249	29	7	0
	2	0.004	0.012	2.878	1	3	0
1991	1	0.074	0.011	0.147	12	2	1
	2	0.069	0.075	1.099	1	1	3
1992	1	0.968	0.095	0.098	11	1	40
	2	0.065	0.026	0.403	1	0	7
1993	1	1.292	0.098	0.076	13	1	31
	2	0.010	0.003	0.308	1	0	1
1994	1	0.662	0.005	0.007	44	0	4
	2	0.222	0.003	0.011	2	0	1
1995	1	2.794	0.015	0.005	27	0	36
	2	0.083	0.001	0.008	1	0	1
1996	1	2.775	0.004	0.001	11	0	3
	2	0.055	0.001	0.026	0	0	1
1997	1	7.112	0.008	0.001	17	0	7
	2	0.067	0.000	0.000	1	0	0
1998	1	0.031	0.002	0.075	11	1	0
	2	0.003	0.000	0.000	0	0	0
1999	1	0.076	0.000	0.000	23	0	0
	2	0.003	0.002	0.500	6	3	0
2000	1	0.267	0.000	0.000	10	0	2
	2	0.002	0.000	0.000	1	0	0
2001	1	0.047	0.007	0.145	6	1	0
	2	0.003	0.000	0.000	2	0	0

Table 6a. Discards at age of Cape Cod yellowtail flounder.

Discards at age (thousands)				age		
	1	2	3	4	5	6
1985	340	184	34	0	0	0
1986	79	1,657	75	26	0	0
1987	14	877	168	0	0	0
1988	360	1,328	177	0	0	0
1989	114	1,405	396	1	0	0
1990	81	2,047	2,501	19	0	0
1991	460	895	561	100	7	0
1992	1,688	3,543	731	29	3	0
1993	138	324	173	30	0	0
1994	60	383	279	49	4	1
1995	453	469	652	50	2	0
1996	7	397	327	94	11	0
1997	1	399	351	117	22	1
1998	56	393	420	46	11	0
1999	11	153	188	22	3	3
2000	3	81	219	76	15	4
2001	19	837	700	26	3	1
mean	228	904	468	40	5	1

Discarded weight at age (kg)				age		
	1	2	3	4	5	6
1985	0.13	0.15	0.15			
1986	0.10	0.17	0.19	0.18		
1987	0.06	0.19	0.19			
1988	0.12	0.15	0.20			
1989	0.13	0.21	0.25	0.36		
1990	0.08	0.24	0.27	0.33		
1991	0.12	0.19	0.27	0.37	0.54	
1992	0.05	0.11	0.22	0.31	0.36	
1993	0.09	0.15	0.27	0.33	0.63	
1994	0.08	0.20	0.29	0.32	0.38	0.34
1995	0.07	0.16	0.23	0.33	0.48	
1996	0.04	0.15	0.28	0.36	0.50	
1997	0.03	0.21	0.29	0.39	0.54	0.65
1998	0.03	0.23	0.33	0.37	0.46	0.59
1999	0.03	0.25	0.29	0.45	0.48	0.99
2000	0.03	0.29	0.38	0.57	0.61	0.80
2001	0.03	0.26	0.30	0.46	0.80	1.13
mean	0.07	0.19	0.26	0.37	0.53	0.75

Table 6b. Discards at age of northern Gulf of Maine yellowtail flounder.

Discards at age (thousands)	age							
	1	2	3	4	5	6	7	sum
1985	341	185	34	0	0	0	0	560
1986	16	336	15	5	0	0	0	372
1987	5	324	62	0	0	0	0	391
1988	91	336	45	0	0	0	0	472
1989	4	53	132	10	0	0	0	199
1990	3	134	236	2	0	0	0	375
1991	5	116	139	134	0	0	0	394
1992	21	26	200	58	0	0	0	305
1993	21	67	33	43	0	0	0	164
1994	15	22	7	132	53	41	30	300
1995	5	29	175	120	70	0	0	400
1996	0	38	84	92	2	0	0	216
1997	2	20	58	4	0	0	0	84
1998	52	46	92	14	3	0	0	207
1999	6	55	108	17	1	0	0	187
2000	7	58	52	12	0	0	0	130
2001	1	26	26	78	4	0	0	134
mean	35	110	88	43	8	2	2	288

Discarded weight at age (kg)	age						
	1	2	3	4	5	6	7
1985	0.13	0.15	0.15				
1986	0.10	0.17	0.19	0.18			
1987	0.06	0.19	0.19				
1988	0.12	0.15	0.20				
1989	0.13	0.21	0.24	0.39			
1990	0.09	0.20	0.29	0.41			
1991	0.08	0.22	0.28	0.32			
1992	0.06	0.11	0.27	0.32			
1993	0.08	0.12	0.25	0.30			
1994	0.09	0.12	0.18	0.27	0.31	0.36	0.54
1995	0.04	0.14	0.25	0.32	0.34		
1996		0.10	0.25	0.28	0.43		
1997	0.12	0.09	0.30	0.35			
1998	0.06	0.15	0.26	0.31	0.27		
1999	0.19	0.13	0.24	0.32	0.49		
2000	0.06	0.14	0.33	0.49	0.30		
2001	0.07	0.19	0.23	0.29	0.37		
mean	0.09	0.15	0.24	0.33	0.36	0.36	0.54

Table 7a. Indices of Cape Cod – Gulf of Maine yellowtail flounder abundance at age and biomass.

MADMF Spring Survey				age					
	1	2	3	4	5	6	7	8+	sum	kg/tow
1978	2.71	20.69	11.82	1.60	0.63	0.54	0.10	0.13	38.22	10.16
1979	2.63	22.58	13.85	3.68	0.86	0.00	0.17	0.00	43.77	11.38
1980	2.68	17.62	10.10	2.30	0.15	0.00	0.00	0.00	32.85	10.03
1981	5.61	58.83	9.00	2.26	1.59	0.27	0.00	0.00	77.56	16.35
1982	0.69	17.06	17.04	4.45	0.94	0.06	0.04	0.00	40.28	12.85
1983	3.13	8.50	11.51	4.28	0.04	0.17	0.03	0.00	27.66	9.00
1984	0.43	18.13	7.56	2.29	0.85	0.00	0.00	0.00	29.26	7.37
1985	1.97	8.27	7.15	1.52	0.59	0.39	0.05	0.05	19.99	5.21
1986	1.73	15.39	1.74	0.24	0.21	0.04	0.00	0.00	19.36	4.52
1987	2.53	4.95	5.31	0.97	0.27	0.11	0.08	0.00	14.22	3.67
1988	3.10	14.46	2.52	0.60	0.05	0.02	0.00	0.00	20.74	3.83
1989	0.67	22.26	3.18	1.08	0.06	0.00	0.00	0.00	27.25	4.73
1990	0.63	11.77	15.57	0.63	0.14	0.01	0.02	0.01	28.77	6.60
1991	0.06	5.34	3.31	2.15	0.48	0.12	0.05	0.00	11.50	3.32
1992	1.30	11.03	9.71	2.38	1.45	0.03	0.03	0.00	25.94	6.54
1993	0.63	7.99	6.31	1.94	0.23	0.06	0.20	0.03	17.38	4.60
1994	2.67	24.02	7.53	1.49	0.33	0.12	0.00	0.00	36.15	6.23
1995	7.51	14.64	24.96	2.88	1.20	0.02	0.02	0.00	51.22	10.38
1996	1.17	18.03	14.70	6.78	1.74	0.00	0.04	0.00	42.46	9.25
1997	0.52	16.94	12.22	4.04	0.54	0.00	0.00	0.00	34.26	7.55
1998	0.55	4.96	13.50	1.25	0.19	0.02	0.00	0.00	20.46	5.17
1999	0.10	6.34	10.90	1.28	0.08	0.00	0.00	0.00	18.70	5.08
2000	0.83	21.92	33.29	11.28	1.30	0.52	0.00	0.00	69.14	20.37
2001	0.22	10.21	38.20	10.39	1.68	0.00	0.00	0.00	60.71	19.34
2002	0.36	1.29	13.84	5.34	0.26	0.17	0.00	0.00	21.27	7.43
mean	1.78	15.33	12.19	3.08	0.63	0.11	0.03	0.01	33.16	8.44

Table 7b.

MADMF Fall Survey					age					
	0	1	2	3	4	5	6	7	8+	sum	kg/tow
1978	0.04	7.13	7.74	1.45	0.11	0.00	0.01	0.00	0.00	16.48	2.80
1979	0.03	24.11	22.82	1.78	0.06	0.00	0.00	0.00	0.00	48.80	7.33
1980	0.03	26.54	12.38	2.70	0.35	0.00	0.00	0.00	0.00	42.00	5.90
1981	0.00	2.93	6.54	1.54	0.23	0.17	0.00	0.00	0.00	11.41	2.76
1982	0.00	9.58	3.36	5.54	0.30	0.08	0.00	0.00	0.00	18.86	4.20
1983	0.00	9.68	6.68	1.60	0.13	0.00	0.00	0.00	0.00	18.09	3.39
1984	0.04	1.91	3.00	0.86	0.39	0.10	0.02	0.00	0.04	6.37	1.18
1985	0.04	5.70	1.63	1.03	0.00	0.00	0.00	0.00	0.02	8.42	1.17
1986	0.01	2.60	4.95	0.20	0.03	0.01	0.00	0.00	0.00	7.80	1.36
1987	0.44	5.85	2.30	0.49	0.07	0.02	0.00	0.00	0.00	9.17	1.09
1988	0.00	8.96	11.24	2.27	0.15	0.00	0.00	0.00	0.00	22.62	3.71
1989	0.00	2.64	5.22	0.96	0.10	0.00	0.00	0.00	0.00	8.92	1.52
1990	0.00	5.20	11.93	4.84	0.01	0.00	0.00	0.00	0.00	21.98	4.16
1991	0.00	3.76	5.14	5.03	0.86	0.00	0.00	0.00	0.00	14.78	3.23
1992	0.20	7.18	3.62	2.08	0.47	0.20	0.00	0.00	0.00	13.75	2.00
1993	0.00	8.39	7.29	5.80	1.43	0.00	0.00	0.00	0.00	22.91	3.99
1994	0.00	2.36	11.79	1.79	0.15	0.00	0.00	0.00	0.00	16.09	3.27
1995	0.00	8.38	15.16	5.85	0.00	0.00	0.00	0.00	0.00	29.40	5.75
1996	0.01	1.87	3.94	2.18	0.17	0.00	0.00	0.00	0.00	8.17	1.56
1997	0.00	1.01	7.38	1.14	0.16	0.10	0.00	0.00	0.00	9.79	2.10
1998	0.00	7.05	6.74	2.25	0.00	0.00	0.00	0.00	0.00	16.05	2.68
1999	0.15	4.73	11.94	4.10	0.65	0.08	0.00	0.00	0.00	21.66	4.71
2000	0.00	1.36	8.25	3.53	0.22	0.10	0.00	0.03	0.00	13.48	3.46
2001	0.00	0.57	8.06	4.23	0.14	0.00	0.00	0.00	0.00	13.00	3.55
mean	0.04	6.65	7.88	2.63	0.26	0.04	0.00	0.00	0.00	17.50	3.20

Table 7c.

NMFS Spring Survey

year	1	2	3	4	5	6	7	8+	sum	kg/tow
1977	0.775	0.329	0.185	0.049	0.093	0.000	0.000	0.000	1.431	0.566
1978	0.000	0.057	0.247	0.036	0.088	0.000	0.000	0.000	0.427	0.209
1979	0.228	0.315	0.748	0.770	0.068	0.021	0.000	0.019	2.169	0.795
1980	0.000	4.150	2.189	0.828	0.167	0.000	0.000	0.000	7.334	2.426
1981	0.041	2.921	2.198	1.143	0.584	0.473	0.179	0.000	7.538	2.468
1982	0.016	1.195	3.009	1.519	0.416	0.232	0.219	0.099	6.705	2.814
1983	1.190	3.203	2.093	1.298	0.092	0.064	0.000	0.000	7.939	2.340
1984	0.039	1.020	0.606	0.394	0.257	0.023	0.032	0.069	2.440	0.809
1985	0.047	0.806	0.865	0.205	0.123	0.043	0.000	0.000	2.089	0.615
1986	0.024	1.786	0.198	0.137	0.100	0.000	0.000	0.000	2.245	0.470
1987	0.062	1.599	2.356	0.637	0.538	0.570	0.611	0.304	6.676	2.971
1988	0.896	3.781	0.922	0.513	0.268	0.097	0.057	0.000	6.533	1.077
1989	0.177	2.179	1.442	0.372	0.274	0.038	0.038	0.038	4.559	0.863
1990	2.285	6.144	0.210	0.000	0.099	0.000	0.000	0.000	8.739	1.948
1991	0.421	3.554	2.834	1.049	0.222	0.000	0.047	0.000	8.128	1.783
1992	0.155	0.915	1.835	0.498	0.018	0.000	0.000	0.000	3.421	0.764
1993	0.064	0.656	1.045	0.563	0.000	0.000	0.000	0.000	2.327	0.501
1994	0.347	2.631	1.578	0.951	0.593	0.208	0.000	0.000	6.308	1.201
1995	0.182	1.040	3.978	2.991	0.432	0.048	0.000	0.000	8.670	2.036
1996	0.015	0.547	1.430	2.009	0.335	0.000	0.000	0.000	4.336	1.108
1997	0.021	0.934	2.025	1.545	0.288	0.000	0.000	0.000	4.813	1.311
1998	0.000	0.748	2.934	0.887	0.144	0.000	0.000	0.000	4.712	1.155
1999	0.018	0.848	3.633	1.853	0.332	0.147	0.000	0.000	6.831	1.977
2000	0.238	3.931	17.630	5.837	0.953	0.715	0.000	0.000	29.305	9.506
2001	0.000	1.201	4.878	1.030	0.216	0.000	0.000	0.000	7.324	2.292
2002	0.015	1.568	7.092	3.271	0.213	0.026	0.000	0.026	12.211	4.554
average	0.279	1.848	2.622	1.169	0.266	0.104	0.046	0.021	6.354	1.868

Table 7d.

NMFS Fall Survey

year	1	2	3	4	5	6	7	8+	sum	kg/tow
1977	4.882	9.330	4.987	0.788	0.197	0.053	0.062	0.123	20.421	7.526
1978	0.354	3.540	2.383	0.152	0.168	0.015	0.015	0.015	6.642	2.047
1979	4.003	4.072	1.227	0.306	0.075	0.016	0.000	0.000	9.698	2.596
1980	10.534	8.937	4.115	1.556	0.340	0.000	0.037	0.000	25.518	6.557
1981	1.596	4.965	1.330	0.532	0.266	0.177	0.000	0.000	8.866	1.881
1982	0.572	2.743	2.593	0.313	0.379	0.000	0.000	0.000	6.599	2.056
1983	0.285	0.546	0.312	0.020	0.000	0.000	0.000	0.000	1.162	0.264
1984	0.320	1.124	0.443	0.763	0.546	0.151	0.075	0.075	3.497	1.380
1985	4.609	1.778	1.352	0.068	0.068	0.068	0.000	0.000	7.943	1.583
1986	1.308	3.613	0.297	0.019	0.019	0.000	0.000	0.000	5.257	0.970
1987	0.564	1.357	0.476	0.057	0.049	0.000	0.000	0.000	2.503	0.556
1988	3.128	4.587	0.443	0.134	0.000	0.000	0.000	0.000	8.292	1.126
1989	1.657	5.338	2.008	0.417	0.146	0.066	0.000	0.000	9.631	2.202
1990	3.500	6.201	2.874	0.046	0.010	0.000	0.000	0.000	12.630	2.345
1991	1.840	1.643	1.639	0.332	0.000	0.000	0.000	0.000	5.453	1.202
1992	2.537	2.758	1.878	0.948	0.183	0.142	0.000	0.000	8.447	1.932
1993	4.445	4.507	0.601	0.099	0.000	0.000	0.000	0.000	9.652	1.106
1994	2.472	7.368	2.596	0.824	0.354	0.000	0.000	0.000	13.615	2.701
1995	0.516	0.713	1.068	0.297	0.171	0.000	0.000	0.000	2.765	0.783
1996	1.058	2.907	4.928	1.179	0.133	0.000	0.000	0.000	10.205	2.614
1997	1.049	2.440	2.945	1.223	0.670	0.115	0.000	0.000	8.441	2.277
1998	1.022	2.984	1.197	0.986	0.234	0.000	0.000	0.000	6.422	1.637
1999	4.147	8.090	5.532	1.697	0.698	0.027	0.000	0.000	20.191	5.983
2000	0.955	6.729	4.455	0.260	0.000	0.000	0.000	0.000	12.399	3.472
2001	0.117	3.835	2.231	0.114	0.019	0.000	0.000	0.000	6.316	1.889
average	2.299	4.084	2.156	0.525	0.189	0.033	0.008	0.009	9.303	2.347

Table 8. Correlation among indices of abundance at age for Cape Cod – Gulf of Maine yellowtail flounder.

Age-1	MASS_F	MASS_S	NMFS_S
MASS_F	1.00		
MASS_S	0.07	1.00	
NMFS_S	0.48	-0.10	1.00

Age-2	MASS_F	MASS_S	NMFS_F	NMFS_S
MASS_F	1.00			
MASS_S	0.33	1.00		
NMFS_F	0.17	0.59	1.00	
NMFS_S	0.16	0.59	0.63	1.00

Age-3	MASS_F	MASS_S	NMFS_F	NMFS_S
MASS_F	1.00			
MASS_S	0.45	1.00		
NMFS_F	0.58	0.37	1.00	
NMFS_S	0.64	0.45	0.54	1.00

Age-4	MASS_F	MASS_S	NMFS_F	NMFS_S
MASS_F	1.00			
MASS_S	0.56	1.00		
NMFS_F	0.69	0.56	1.00	
NMFS_S	0.43	0.48	0.63	1.00

Age-5	MASS_F	MASS_S	NMFS_F	NMFS_S
MASS_F	1.00			
MASS_S	0.00	1.00		
NMFS_F	-0.04	0.28	1.00	
NMFS_S	-0.08	0.50	0.24	1.00

Age-6+	MASS_F	MASS_S	NMFS_F	NMFS_S
MASS_F	1.00			
MASS_S	0.10	1.00		
NMFS_F	-0.01	0.04	1.00	
NMFS_S	-0.44	0.52	0.27	1.00

Table 9. Yield and biomass per recruit of Cape Cod – Gulf of Maine yellowtail flounder.

```
   The NEFC Yield and Stock Size per Recruit Program - PDBYPRC
    PC Ver.1.2 [Method of Thompson and Bell (1934)] 1-Jan-1992
             ----------------------------------------
             Run Date:  4-12-2002;  Time: 14:49:47.35
 CC_GOM YELLOWTAIL FLOUNDER - 1994-2001 INPUT
 ____________________________________________________________________
 Proportion of F before spawning:  .4167
 Proportion of M before spawning:  .4167
 Natural Mortality is Constant at:  .200
 Initial age is:  1; Last age is:  8
 Last age is a PLUS group;
 Original age-specific PRs, Mats, and Mean Wts from file:
 ==> CCGOMYT.DAT
------------------------------------------------------------
 Age-specific Input data for Yield per Recruit Analysis
------------------------------------------------------------
  Age | Fish Mort  Nat Mort | Proportion | Average Weights
      |  Pattern    Pattern |   Mature   |  Catch   Stock
------------------------------------------------------------
   1  |   .0200     1.0000  |    .0000   |   .043    .043
   2  |   .2200     1.0000  |    .0800   |   .273    .273
   3  |   .9800     1.0000  |    .8100   |   .387    .387
   4  |  1.0000     1.0000  |   1.0000   |   .501    .501
   5  |  1.0000     1.0000  |   1.0000   |   .588    .588
   6  |  1.0000     1.0000  |   1.0000   |   .845    .845
   7  |  1.0000     1.0000  |   1.0000   |  1.176   1.176
   8+ |  1.0000     1.0000  |   1.0000   |  1.328   1.328

------------------------------------------------------------
 Summary of Yield per Recruit Analysis for:
 CC_GOM YELLOWTAIL FLOUNDER - 1994-2001 INPUT
 ____________________________________________________________________
  Slope of the Yield/Recruit Curve at F=0.00: -->    3.0044
    F level at slope=1/10 of the above slope (F0.1): ----->    .195
      Yield/Recruit corresponding to F0.1: ----->     .2205
    F level to produce Maximum Yield/Recruit (Fmax): ----->    .437
      Yield/Recruit corresponding to Fmax: ----->     .2432
    F level at 40 % of Max Spawning Potential (F40): ----->    .174
      SSB/Recruit corresponding to F40: -------->    1.1917
 ____________________________________________________________________
```

Table 9 cont.

	FMORT	TOTCTHN	TOTCTHW	TOTSTKN	TOTSTKW	SPNSTKN	SPNSTKW	% MSP
	.000	.00000	.00000	5.5167	3.5367	3.3453	2.9798	100.00
	.100	.23532	.16955	4.3458	2.1815	2.1818	1.6643	55.85
F0.1	.195	.34935	.22052	3.7809	1.5853	1.6236	1.0959	36.78
F40%	.174	.32915	.21343	3.8808	1.6866	1.7221	1.1917	39.99
	.200	.35385	.22197	3.7586	1.5630	1.6017	1.0748	36.07
	.300	.42566	.23872	3.4049	1.2250	1.2549	.7584	25.45
	.400	.47407	.24300	3.1678	1.0191	1.0246	.5688	19.09
Fmax	.437	.48838	.24322	3.0981	.9623	.9573	.5172	17.36
	.500	.50912	.24277	2.9975	.8838	.8607	.4462	14.97
	.600	.53579	.24102	2.8687	.7896	.7383	.3622	12.15
	.700	.55687	.23890	2.7677	.7210	.6436	.3018	10.13
	.800	.57404	.23682	2.6861	.6691	.5682	.2567	8.62
	.900	.58834	.23493	2.6186	.6286	.5067	.2221	7.45
	1.000	.60050	.23325	2.5617	.5962	.4557	.1947	6.53
	1.100	.61099	.23175	2.5128	.5696	.4128	.1725	5.79
	1.200	.62018	.23041	2.4704	.5473	.3762	.1543	5.18
	1.300	.62832	.22919	2.4330	.5284	.3446	.1390	4.67
	1.400	.63560	.22807	2.3998	.5120	.3171	.1261	4.23
	1.500	.64217	.22702	2.3699	.4977	.2929	.1150	3.86
	1.600	.64814	.22604	2.3429	.4851	.2715	.1054	3.54
	1.700	.65361	.22511	2.3182	.4738	.2525	.0970	3.25
	1.800	.65865	.22422	2.2956	.4636	.2355	.0895	3.00
	1.900	.66332	.22337	2.2746	.4544	.2201	.0830	2.78
	2.000	.66766	.22254	2.2552	.4459	.2063	.0771	2.59

Figure 1. Statistical areas for Cape Cod – Gulf of Maine yellowtail flounder.

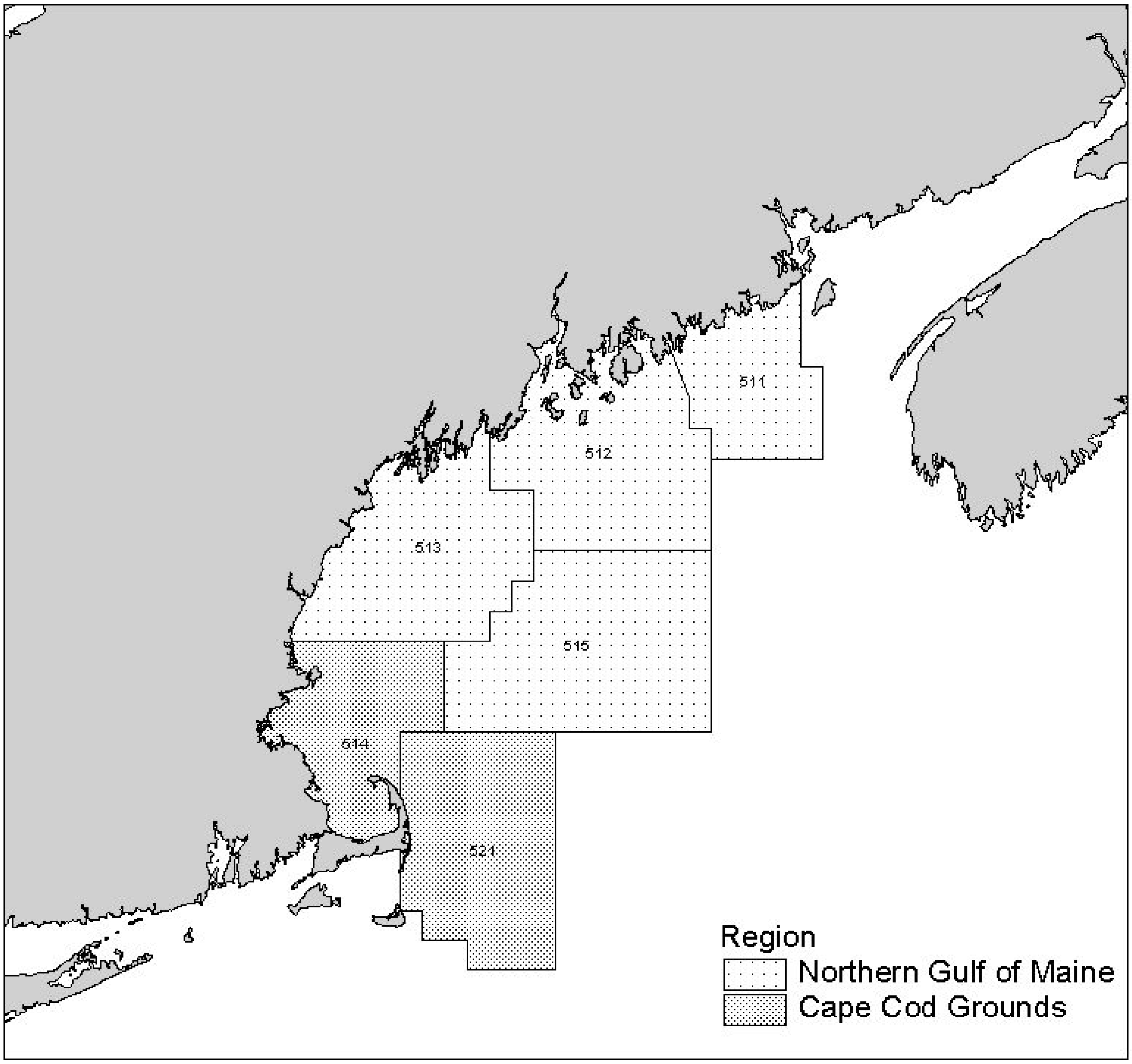


Figure 2. Cape Cod – Gulf of Maine yellowtail flounder catch.

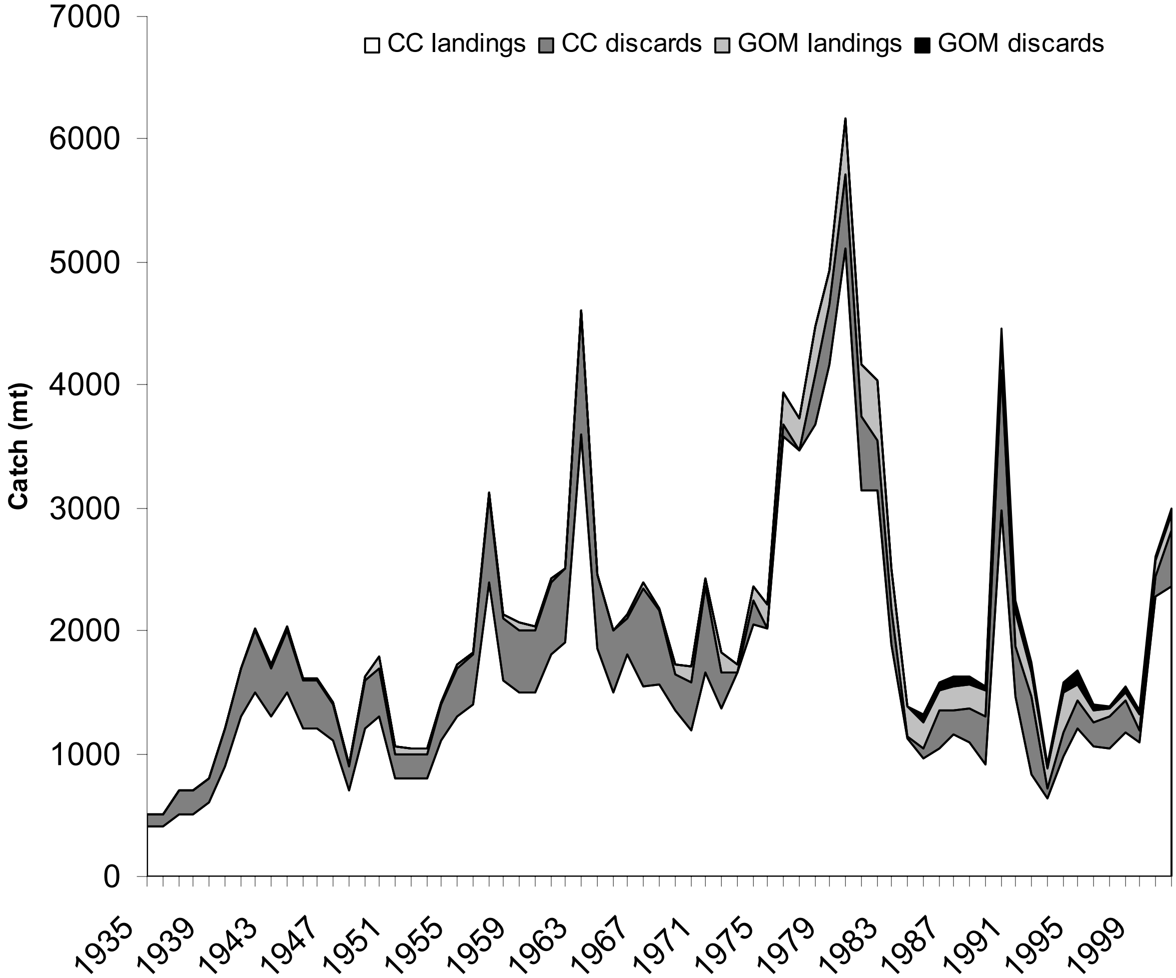


Figure 3. Total catch at age of Cape Cod – Gulf of Maine yellowtail flounder.

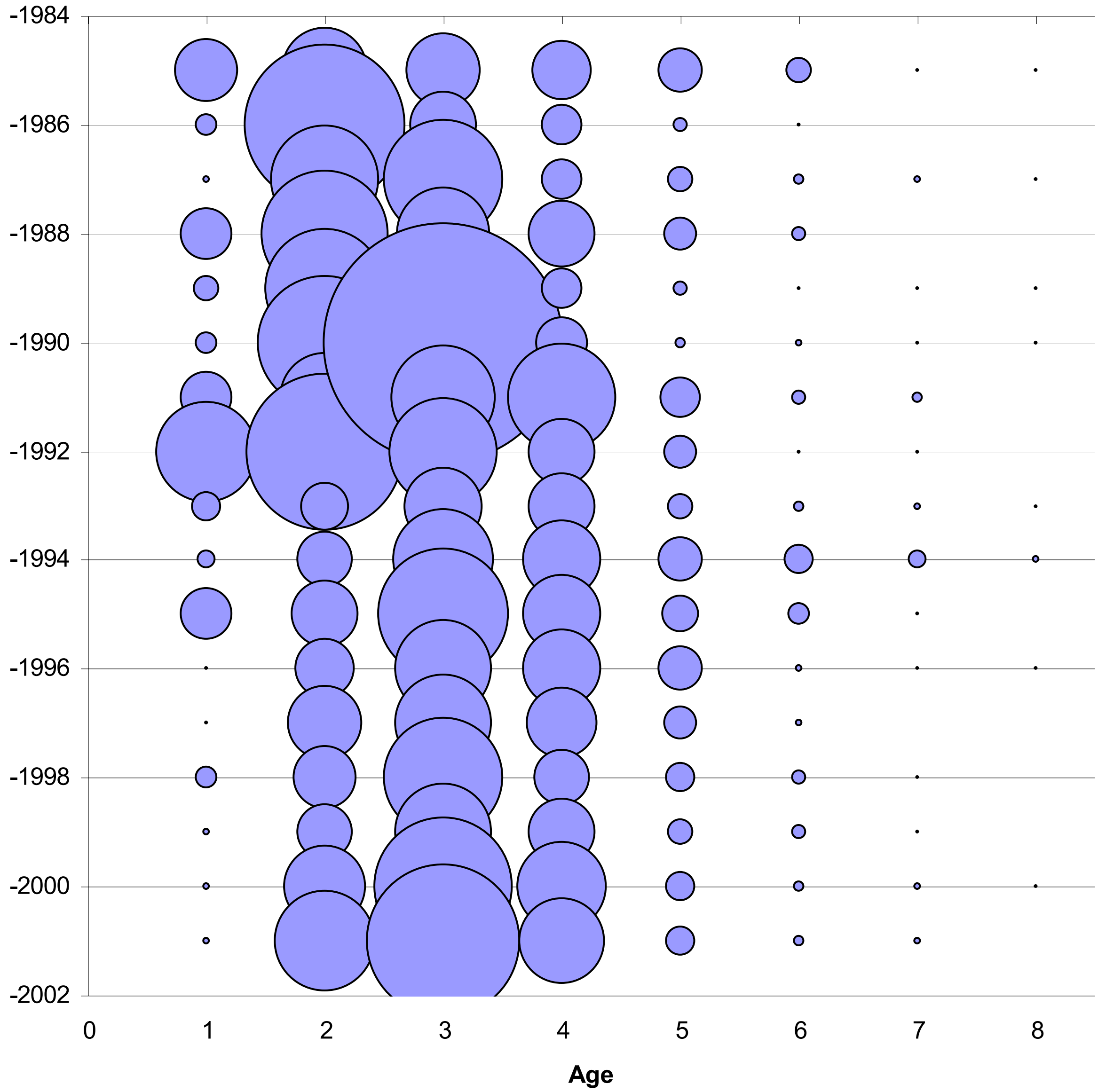


Figure 4. Mean weight at age of Cape Cod – Gulf of Maine yellowtail flounder catch.

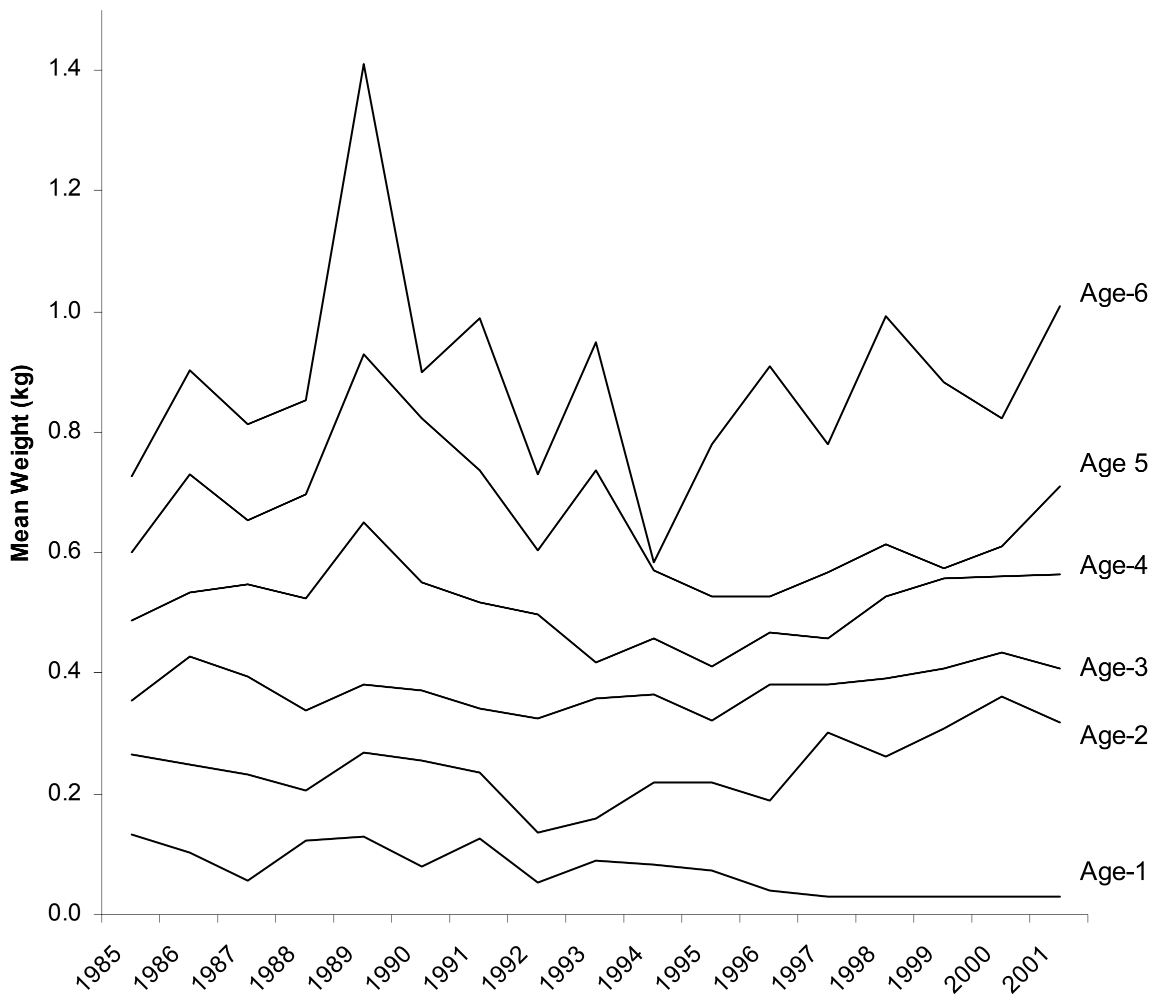


Figure 5. NEFSC survey strata used for Cape Cod – Gulf of Maine yellowtail flounder.

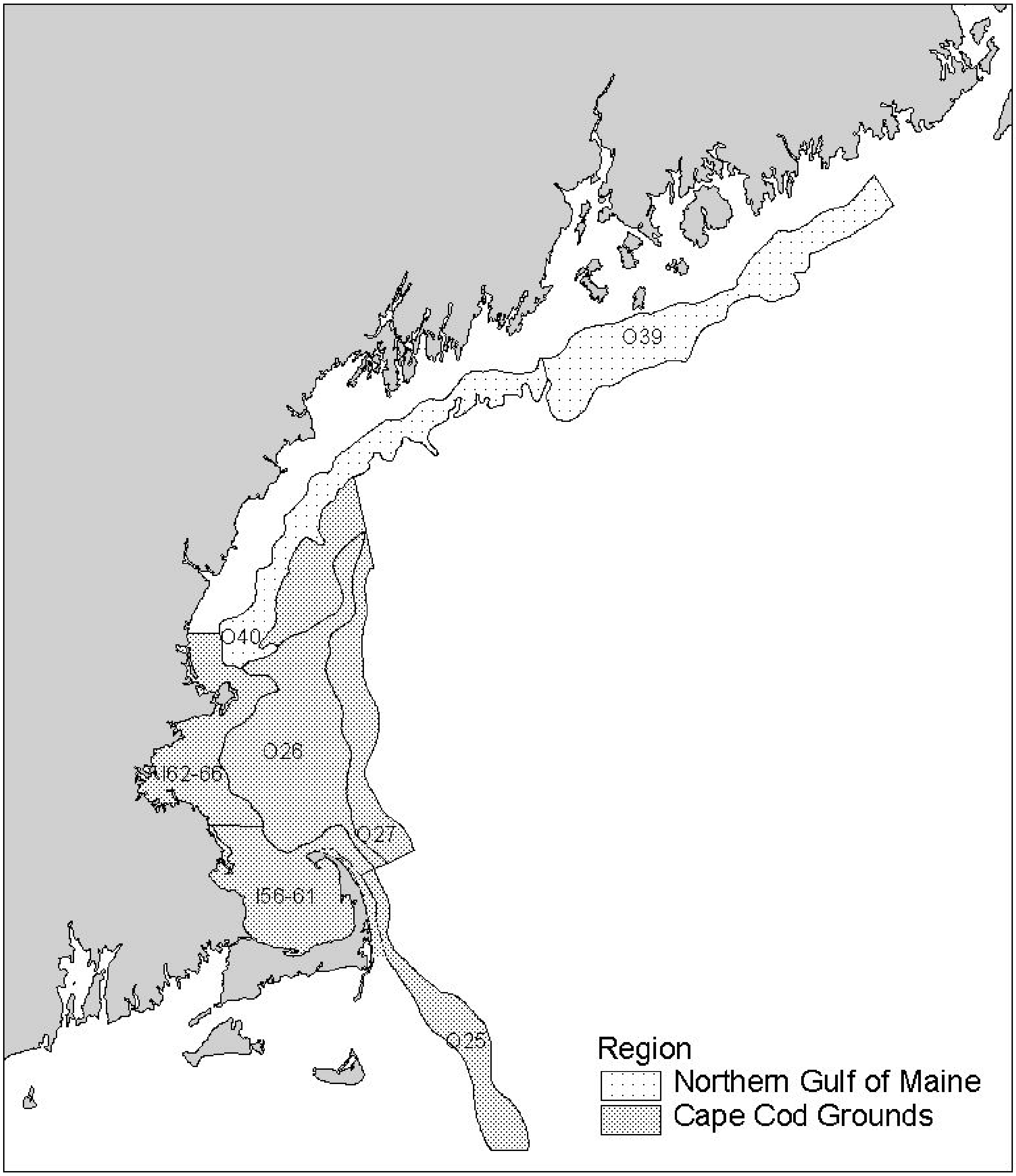
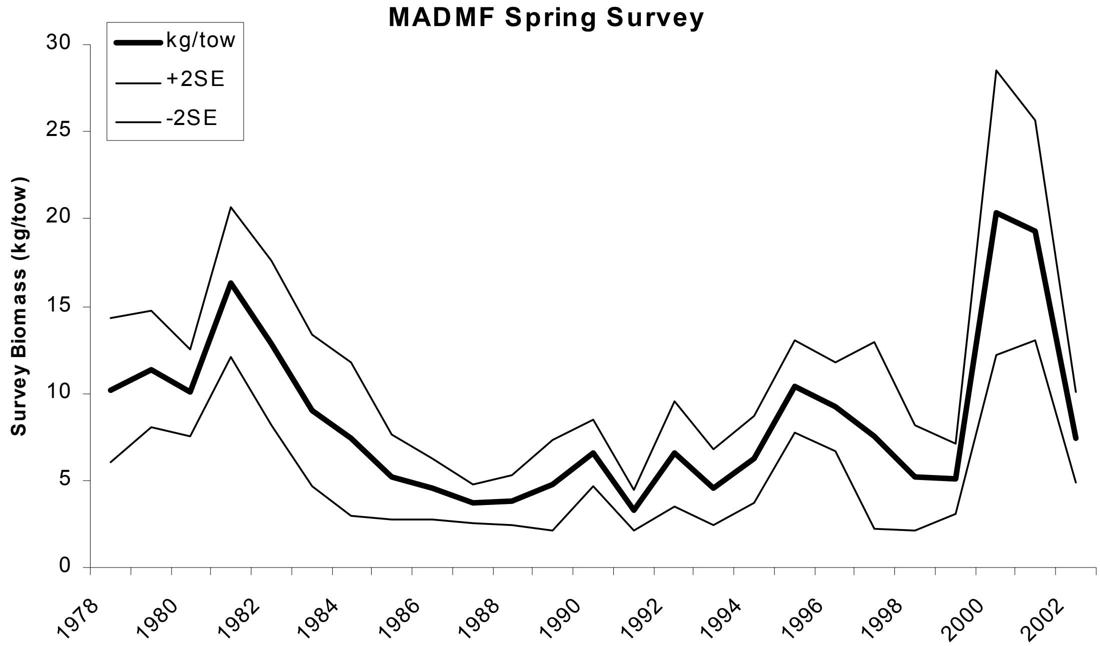


Figure 6a. Survey indices of Cape Cod – Gulf of Maine yellowtail flounder biomass.



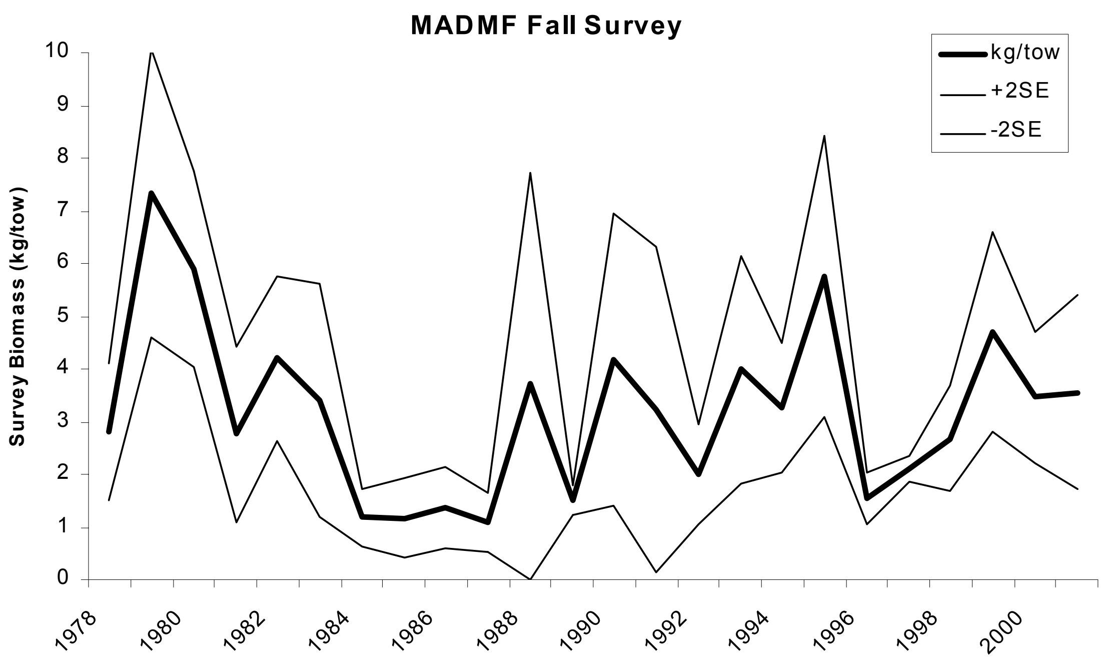
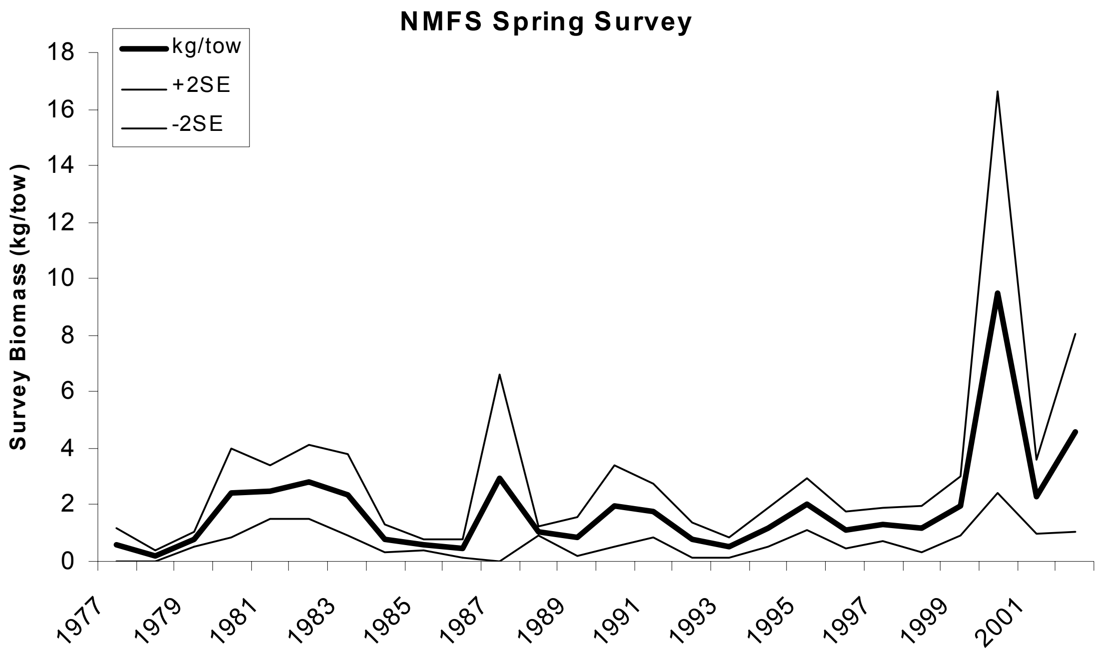


Figure 6b.


NMFS Spring Survey
kg/tow
+2SE
-2SE
Survey Biomass (kg/tow)
0
2
4
6
8
10
12
14
16
18
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001

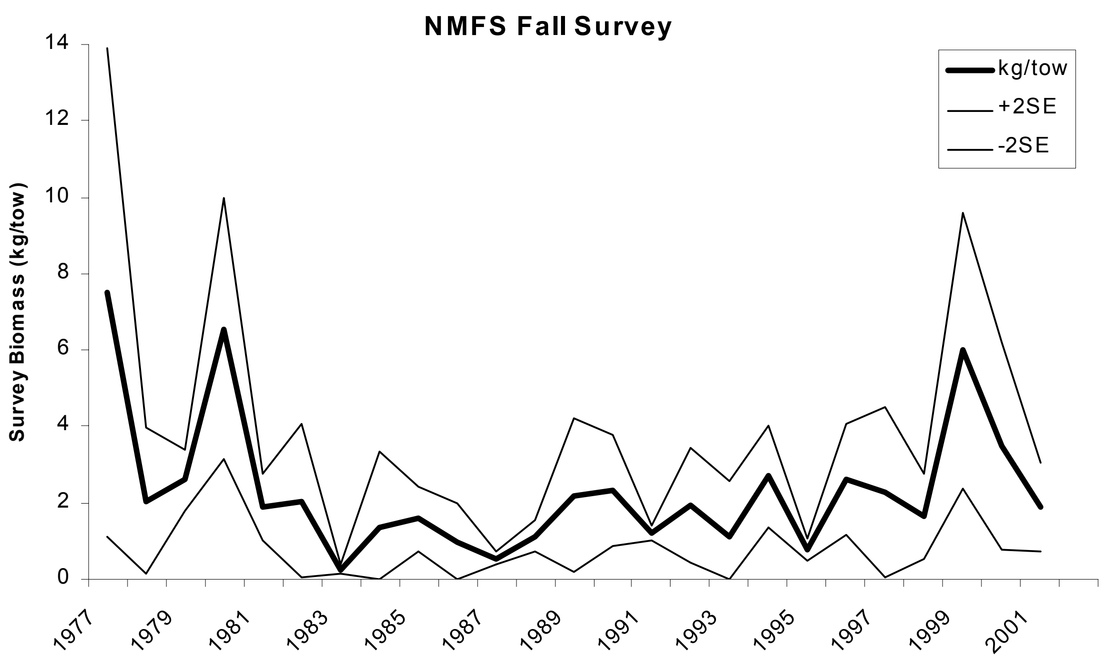

NMFS Fall Survey
kg/tow
+2SE
-2SE
Survey Biomass (kg/tow)
0
2
4
6
8
10
12
14
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001

Figure 7a. Distribution of yellowtail flounder from recent surveys.

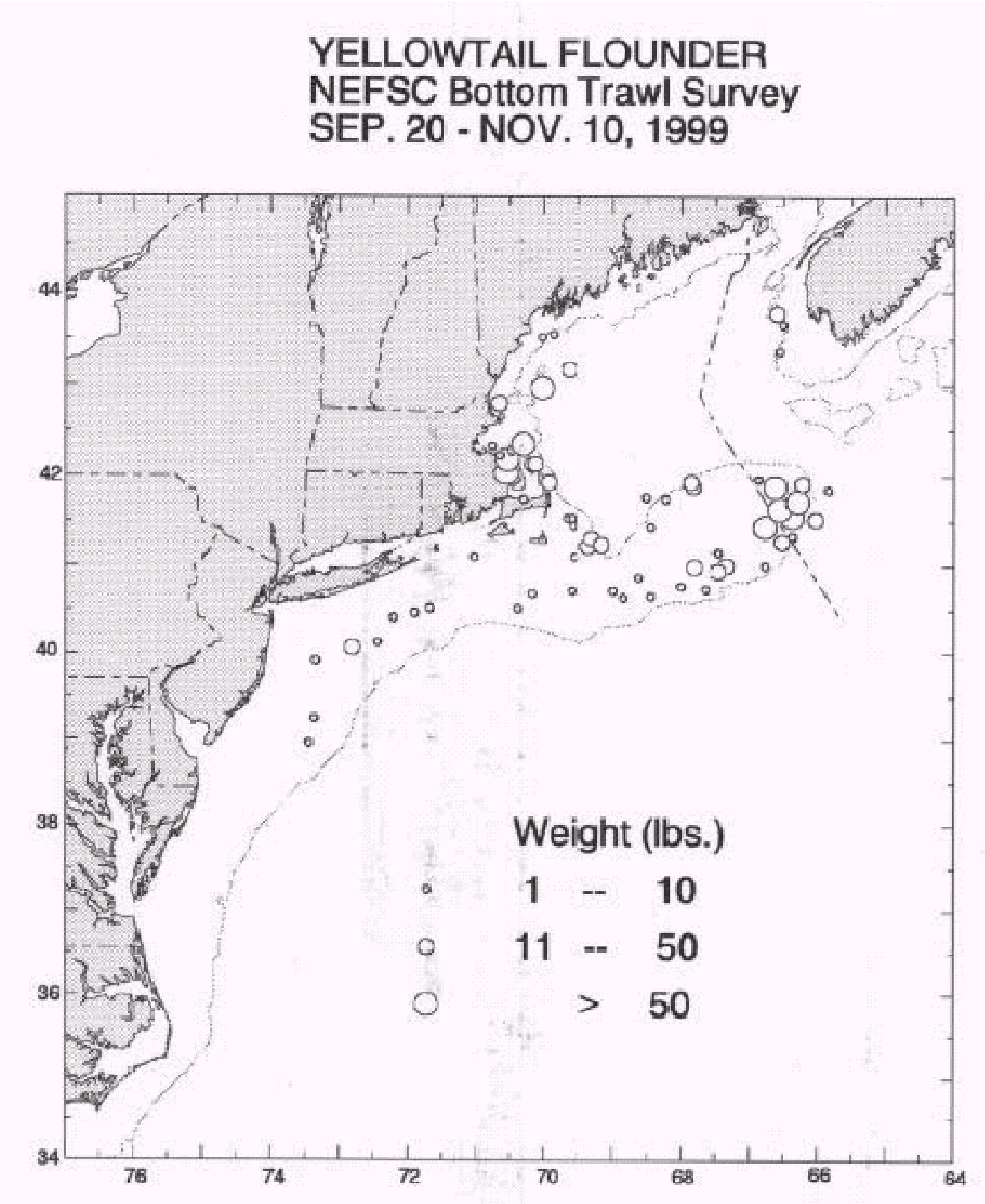


Figure 7b.

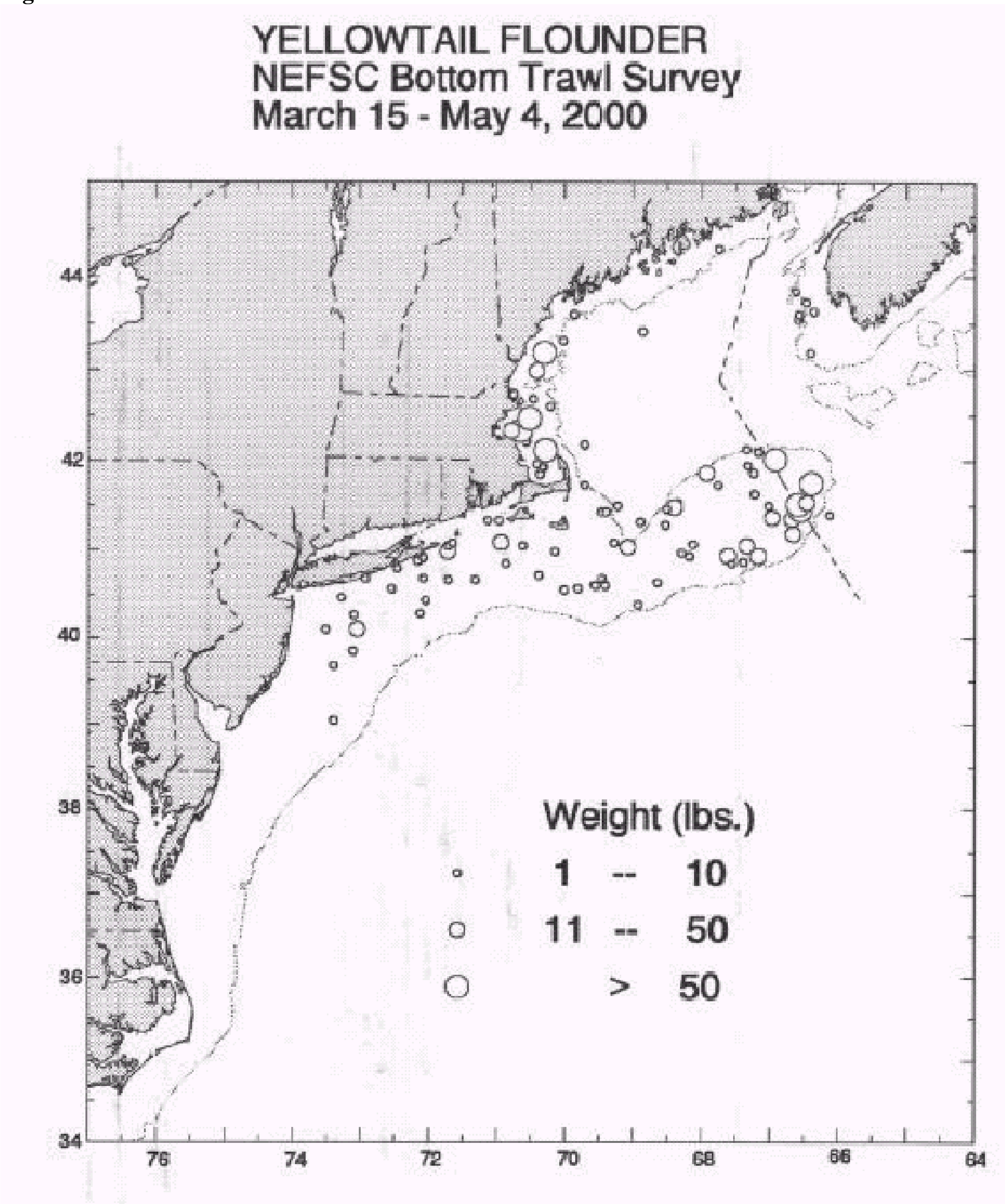

YELLOWTAIL FLOUNDER
NEFSC Bottom Trawl Survey
March 15 - May 4, 2000
Weight (lbs.)
1 -- 10
11 -- 50
> 50
44
42
40
38
36
34
76
74
72
70
68
66
64

Figure 8. Geographic distribution of area-swept biomass of Cape Cod – Gulf of Maine yellowtail flounder from the NEFSC fall survey (offshore strata only).

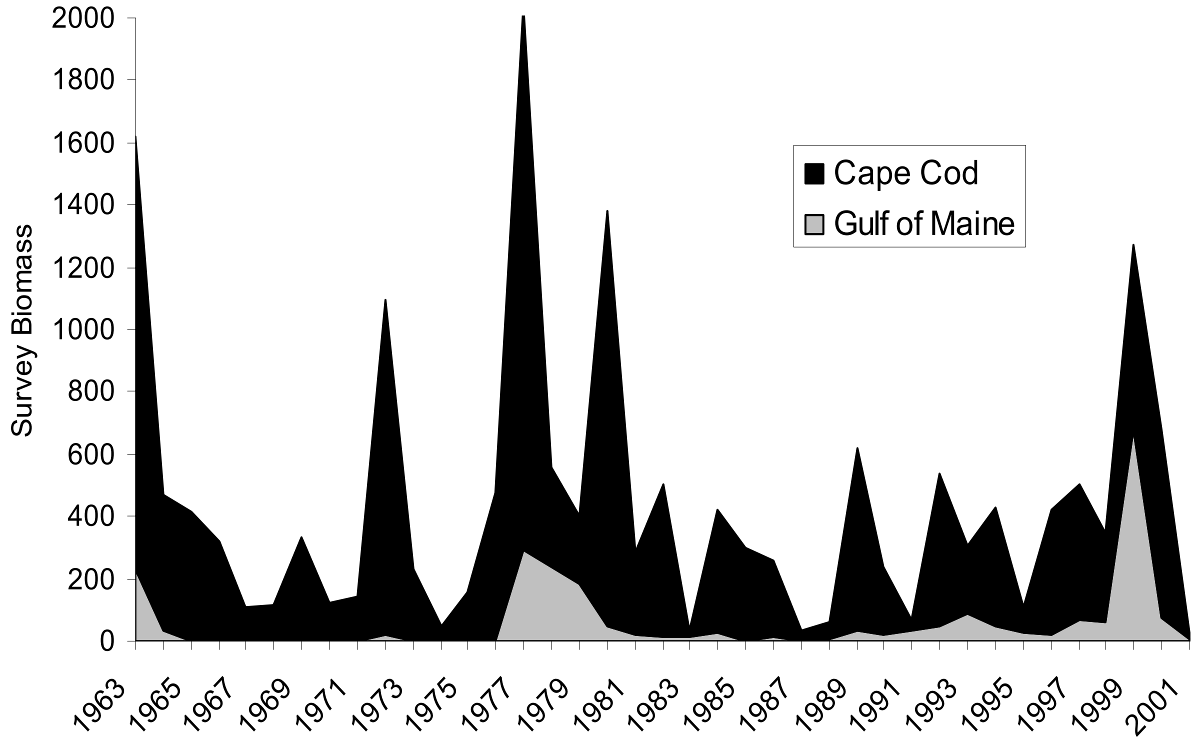


Figure 9a. Survey age distributions of Cape Cod – Gulf of Maine yellowtail flounder.

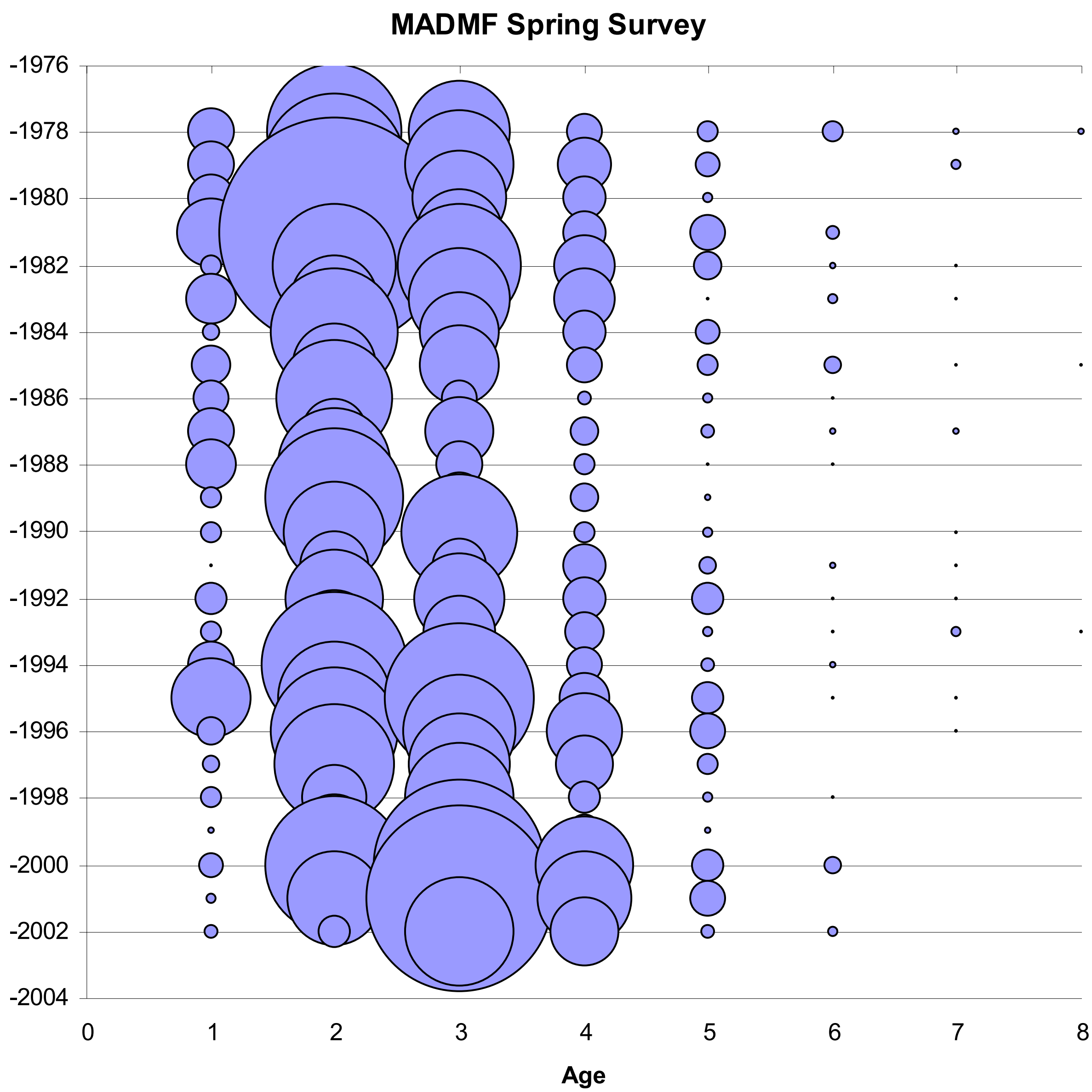


Figure 9b.

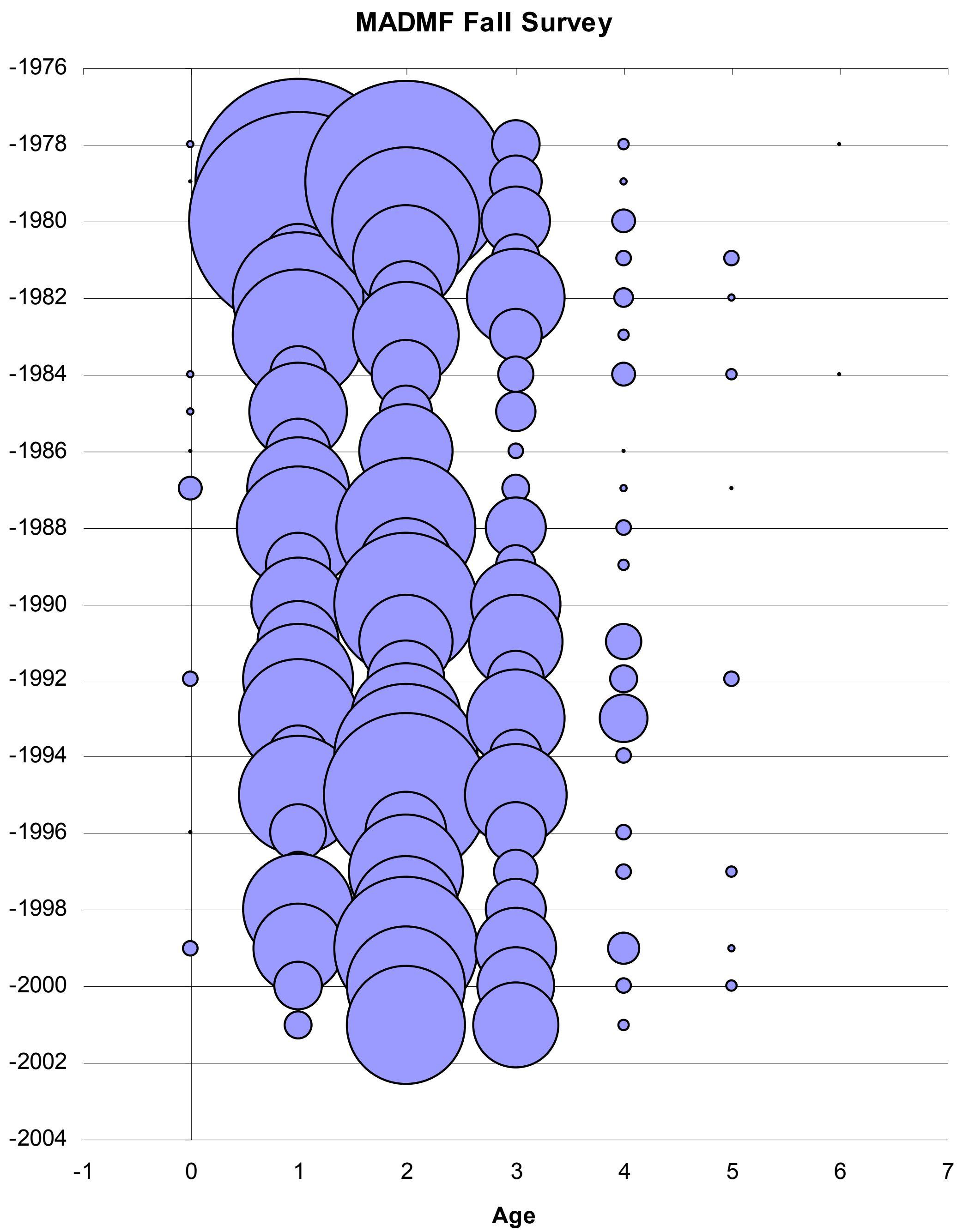

MADMF Fall Survey
-1976
-1978
-1980
-1982
-1984
-1986
-1988
-1990
-1992
-1994
-1996
-1998
-2000
-2002
-2004
-1
0
1
2
3
4
5
6
7
Age

Figure 9c.

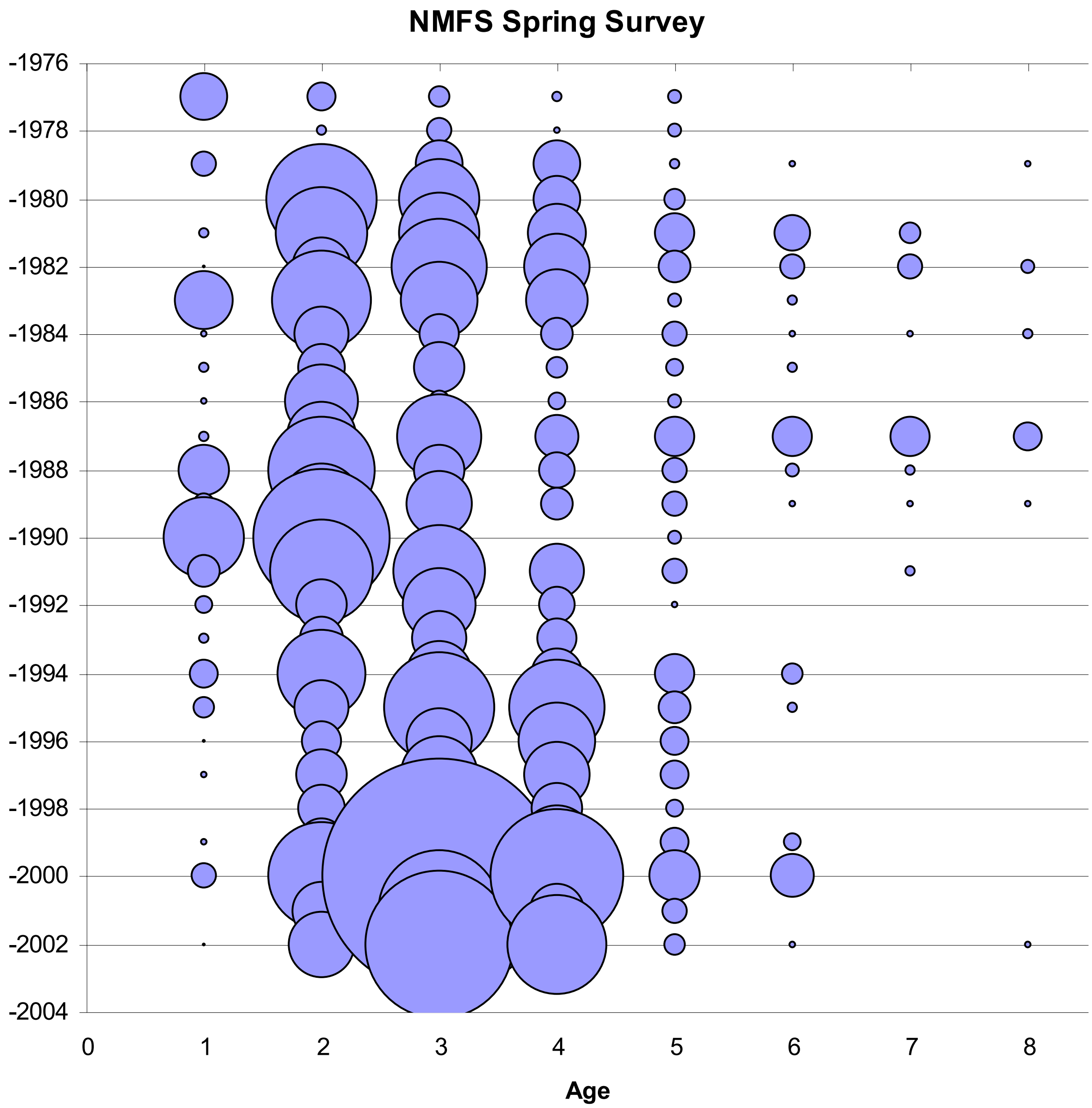

NMFS Spring Survey
-1976
-1978
-1980
-1982
-1984
-1986
-1988
-1990
-1992
-1994
-1996
-1998
-2000
-2002
-2004
0
1
2
3
4
5
6
7
8
Age

Figure 9d.

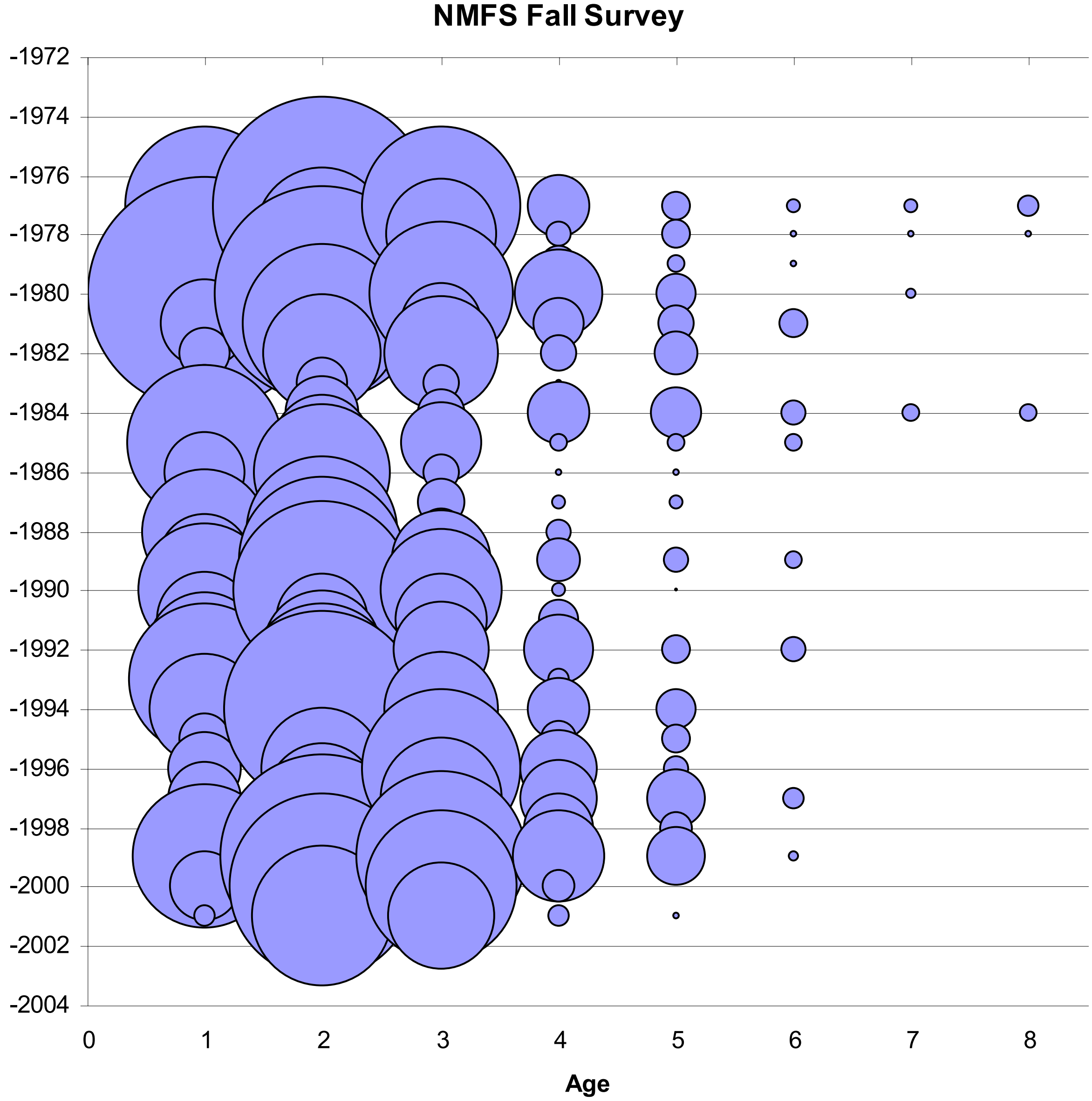

NMFS Fall Survey
-1972
-1974
-1976
-1978
-1980
-1982
-1984
-1986
-1988
-1990
-1992
-1994
-1996
-1998
-2000
-2002
-2004
0
1
2
3
4
5
6
7
8
Age

Figure 10. Normalized indices of abundance of Cape Cod – Gulf of Maine yellowtail flounder.

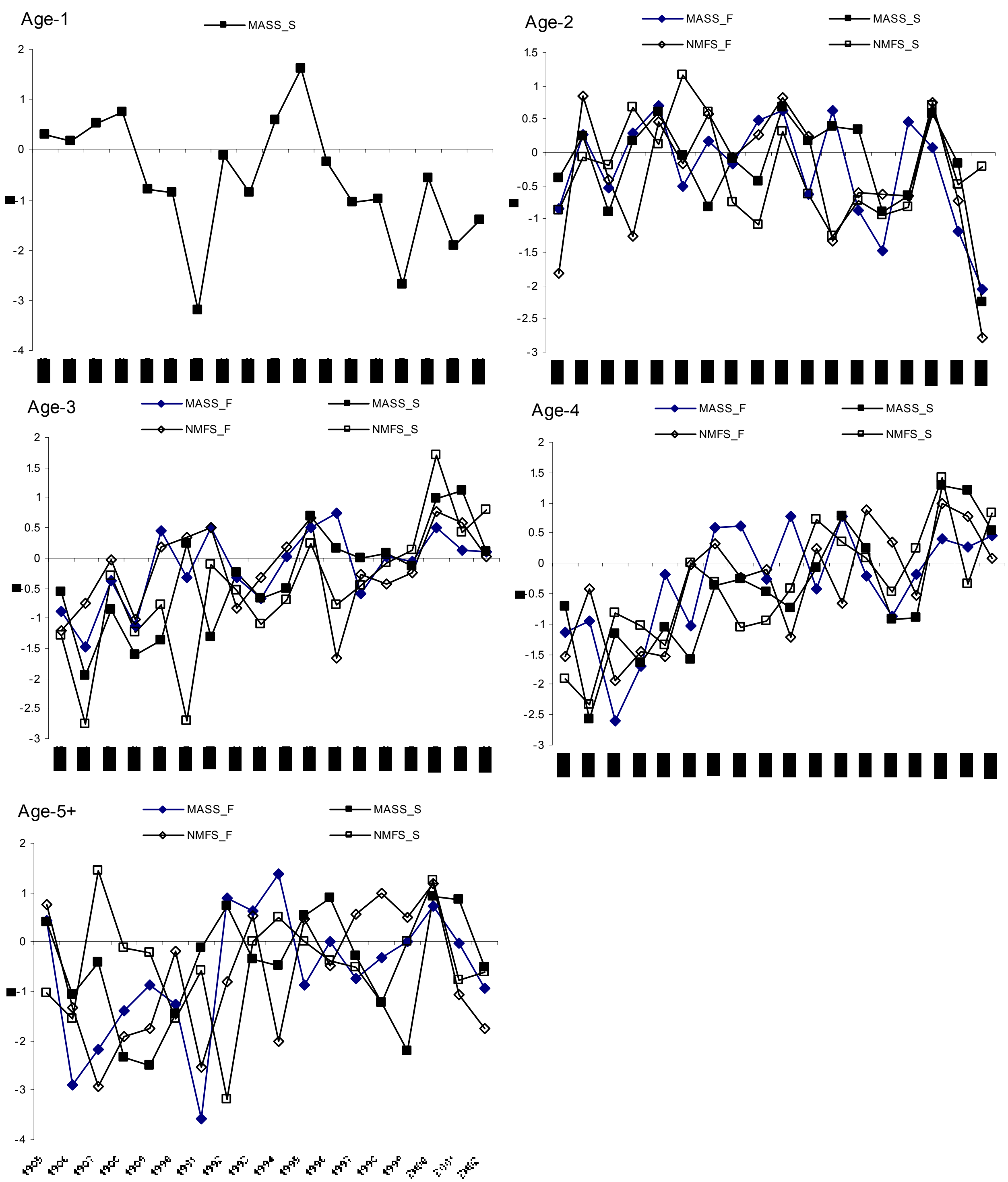


Figure 11. Residuals of the Cape Cod – Gulf of Maine yellowtail flounder ADAPT calibration.

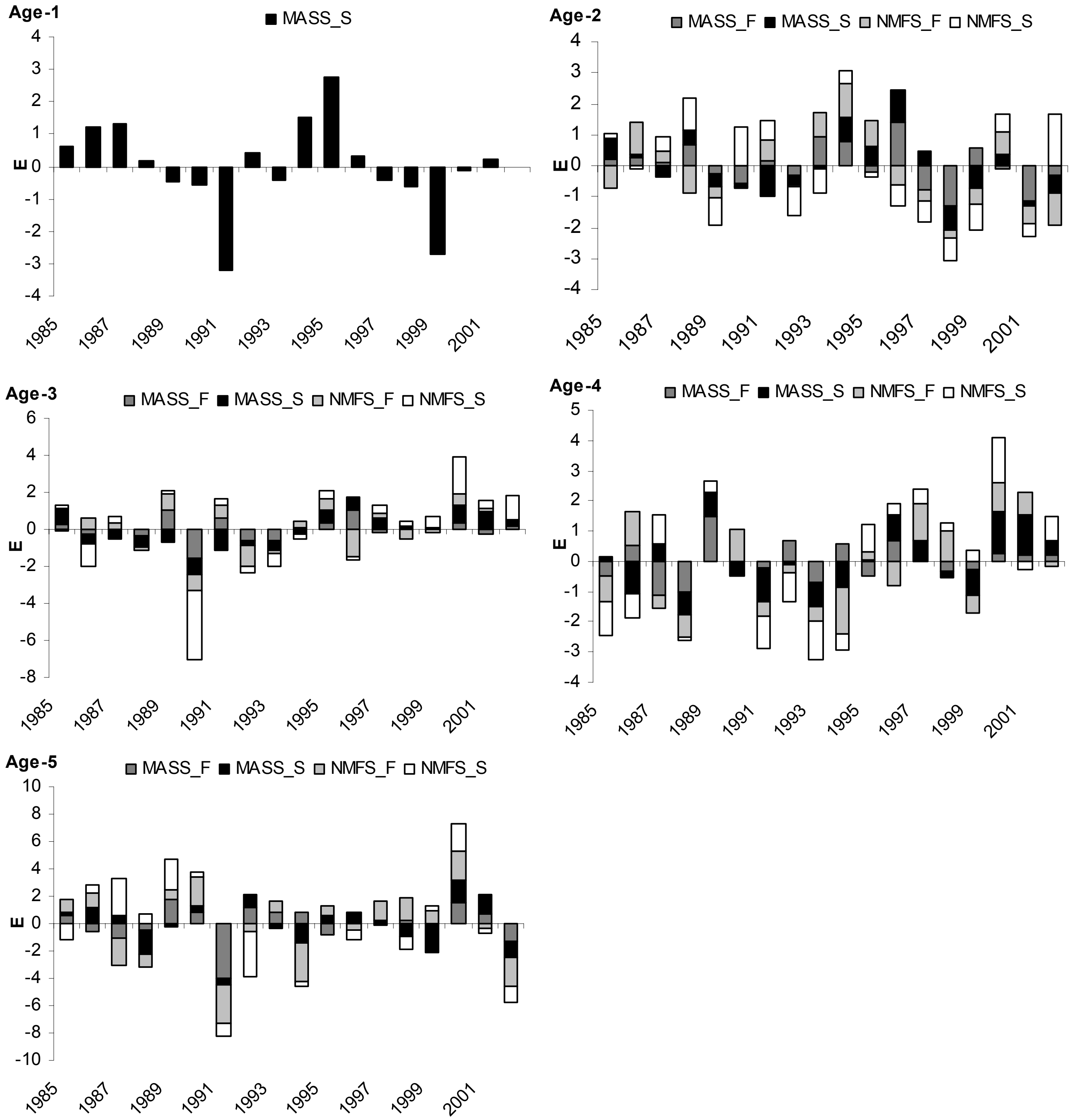


Figure 12a. Results of the Cape Cod – Gulf of Maine VPA.

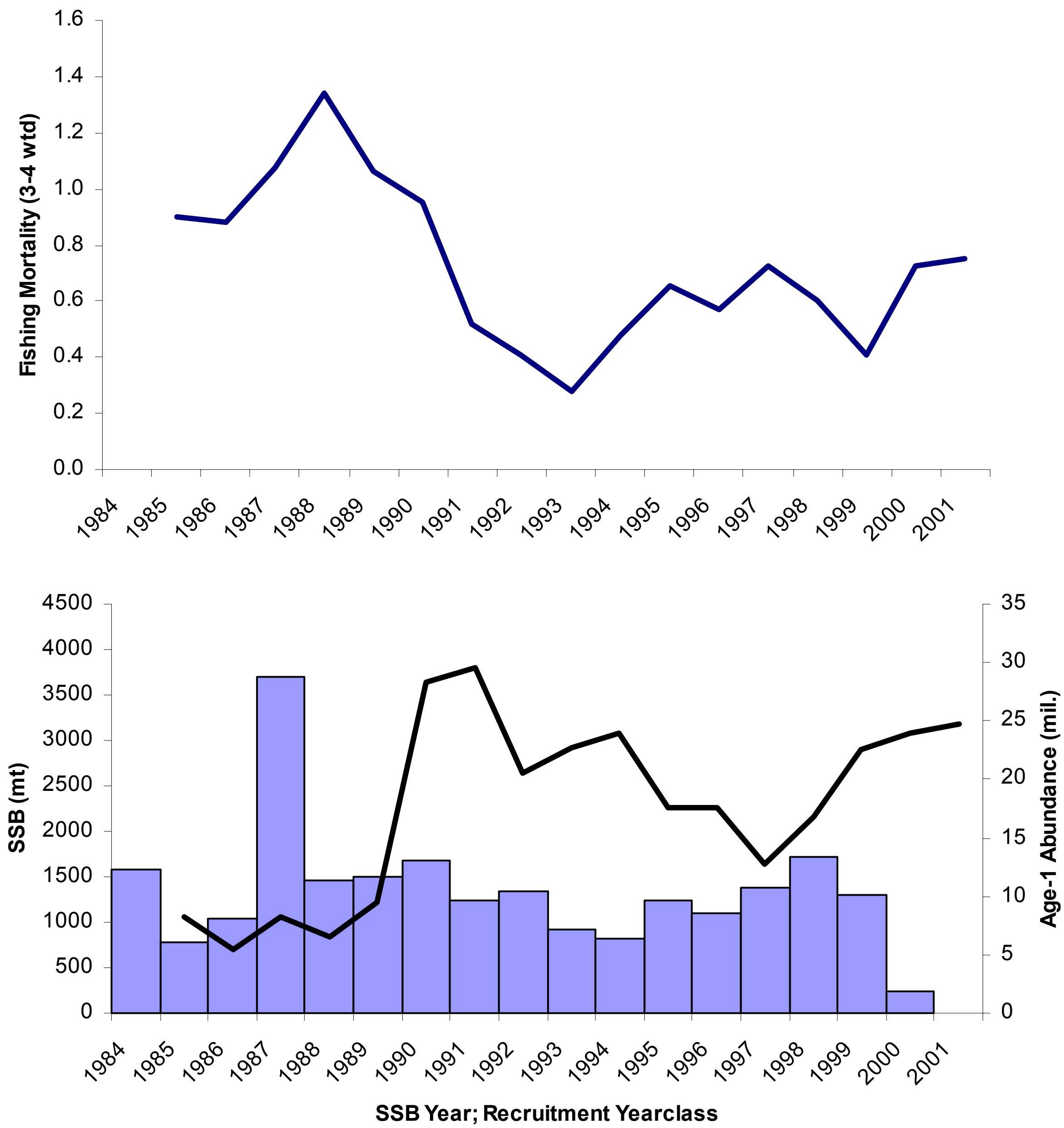


Figure 12b. Stock and recruitment of Cape Cod – Gulf of Maine yellowtail flounder (extreme points labeled by yearclass).

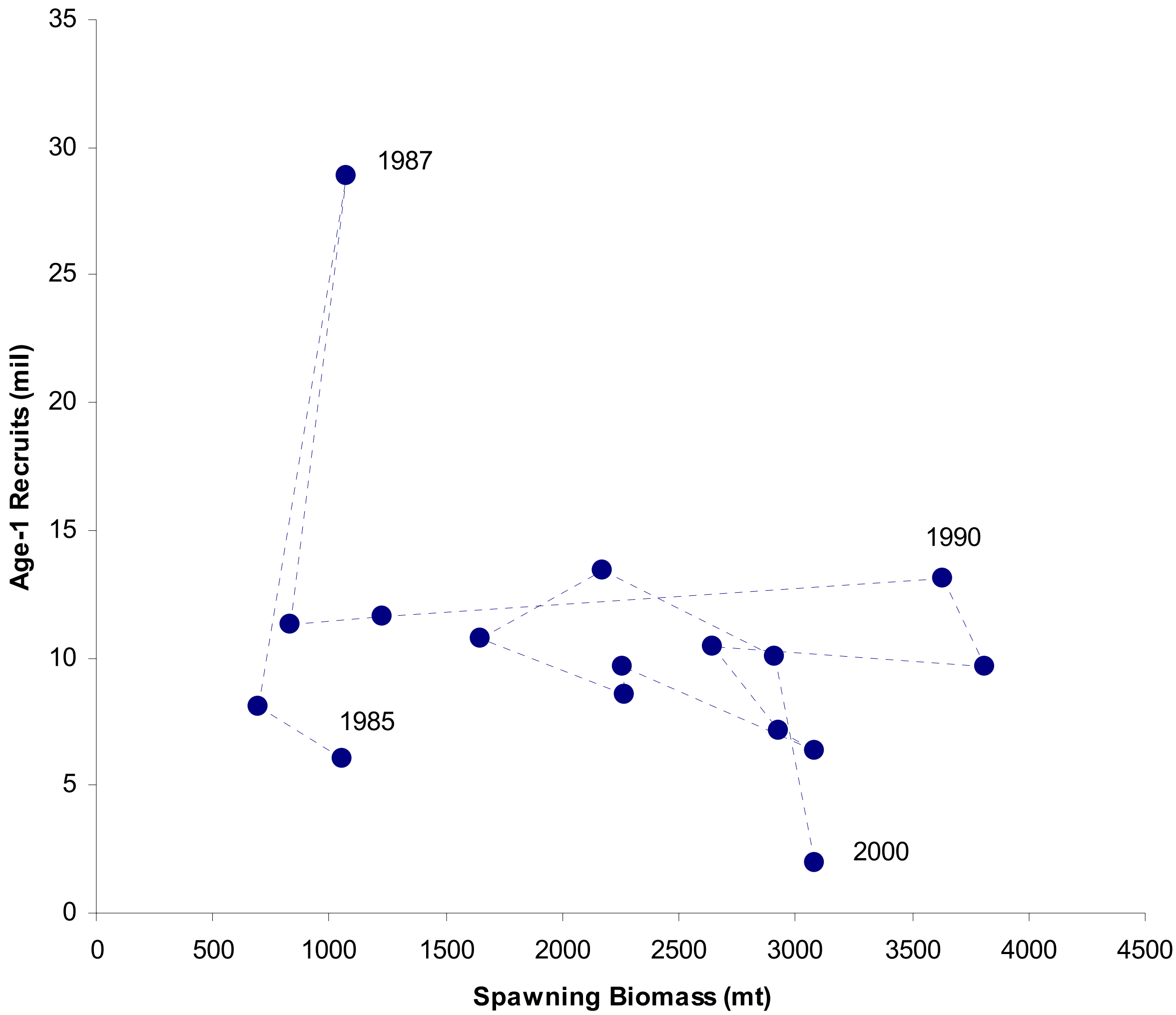


Figure 12c. Abundance at age of Cape Cod – Gulf of Maine yellowtail flounder.

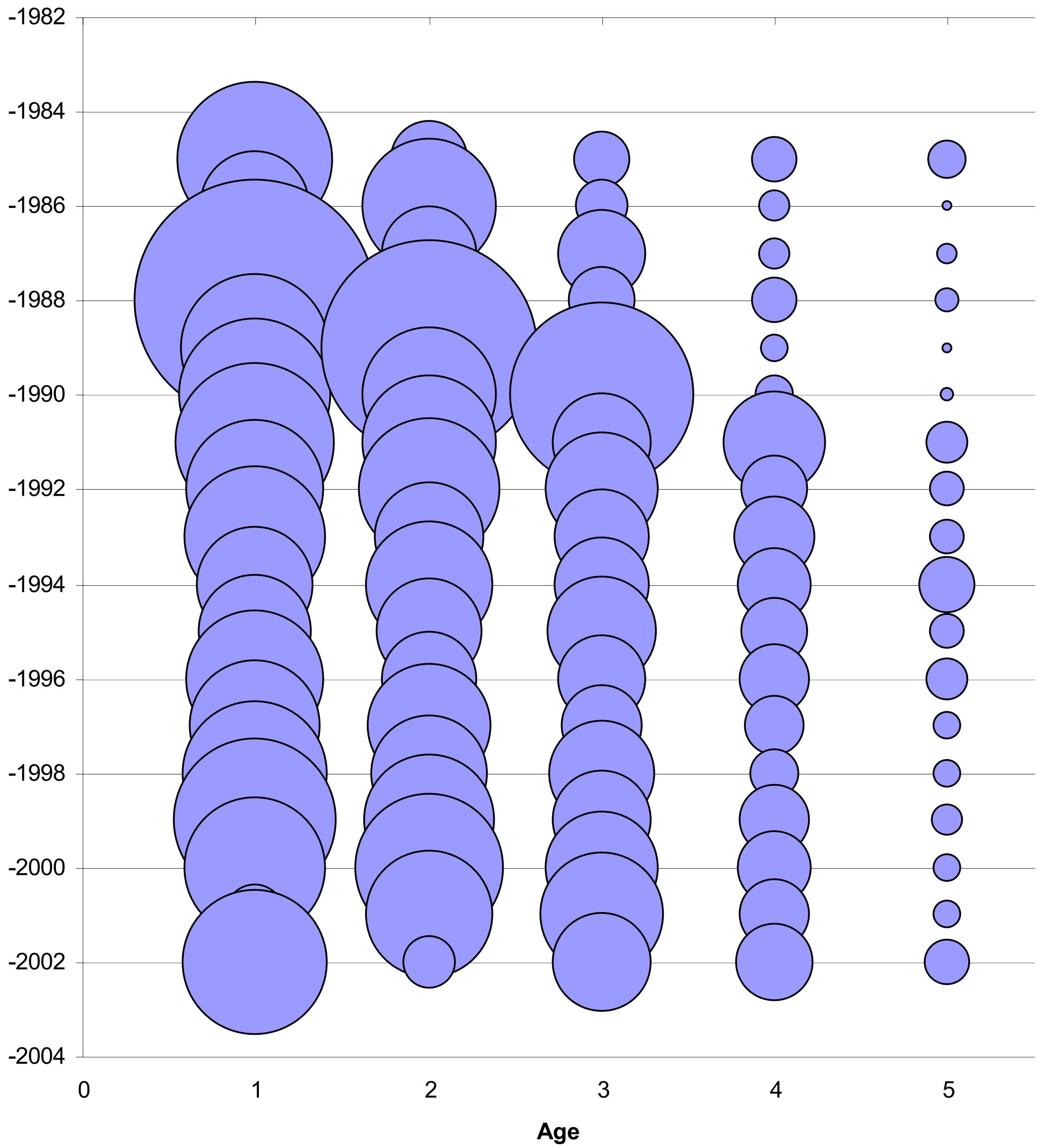
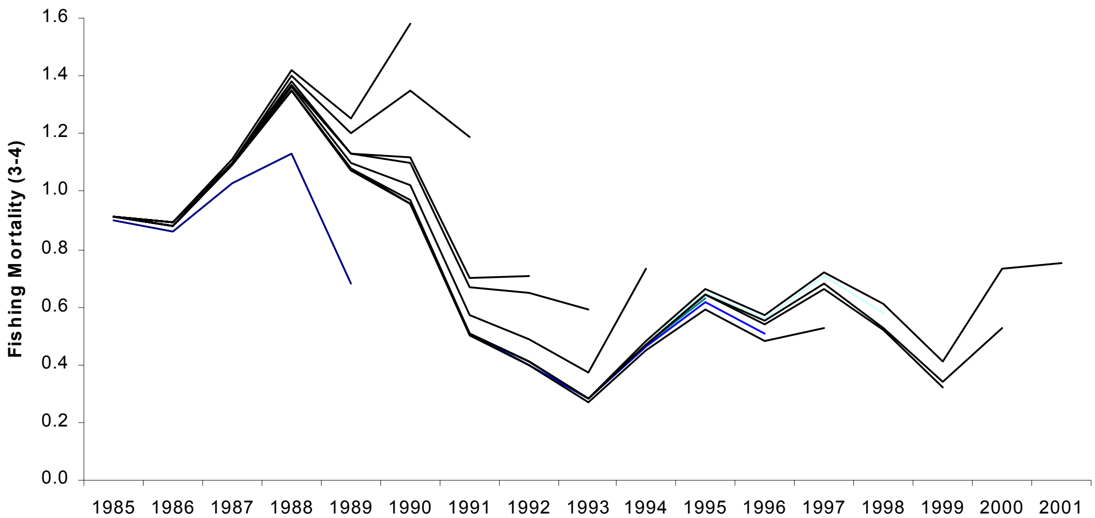
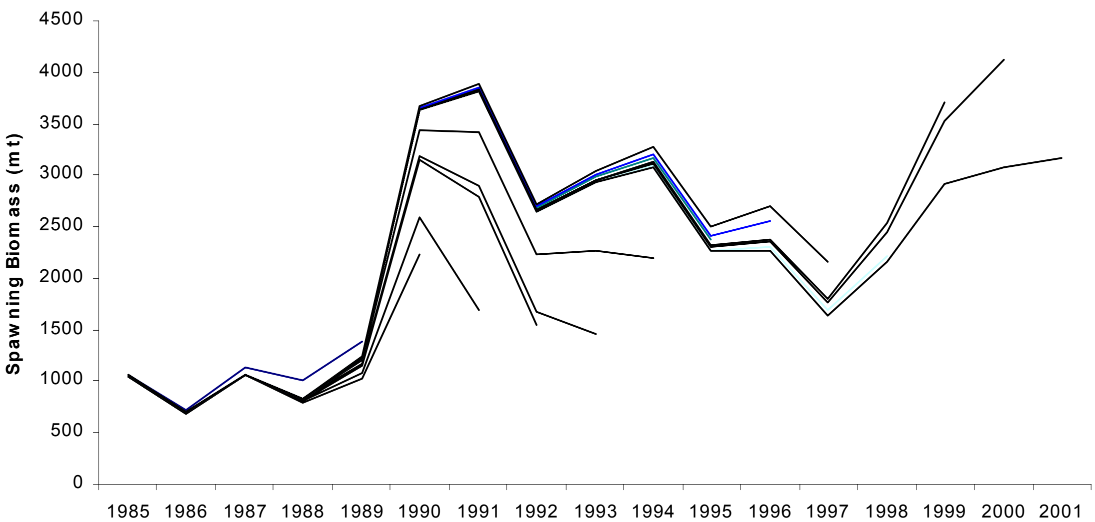


Figure 13. Retrospective analysis of the Cape Cod – Gulf of Maine yellowtail flounder VPA.





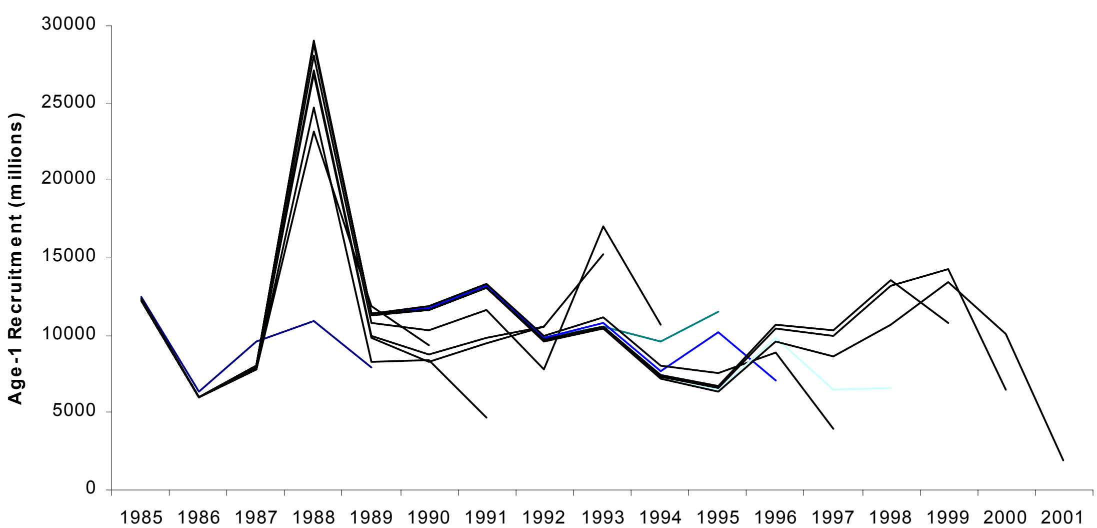


Figure 14. Yield and spawning biomass per recruit of Cape Cod – Gulf of Maine yellowtail flounder.

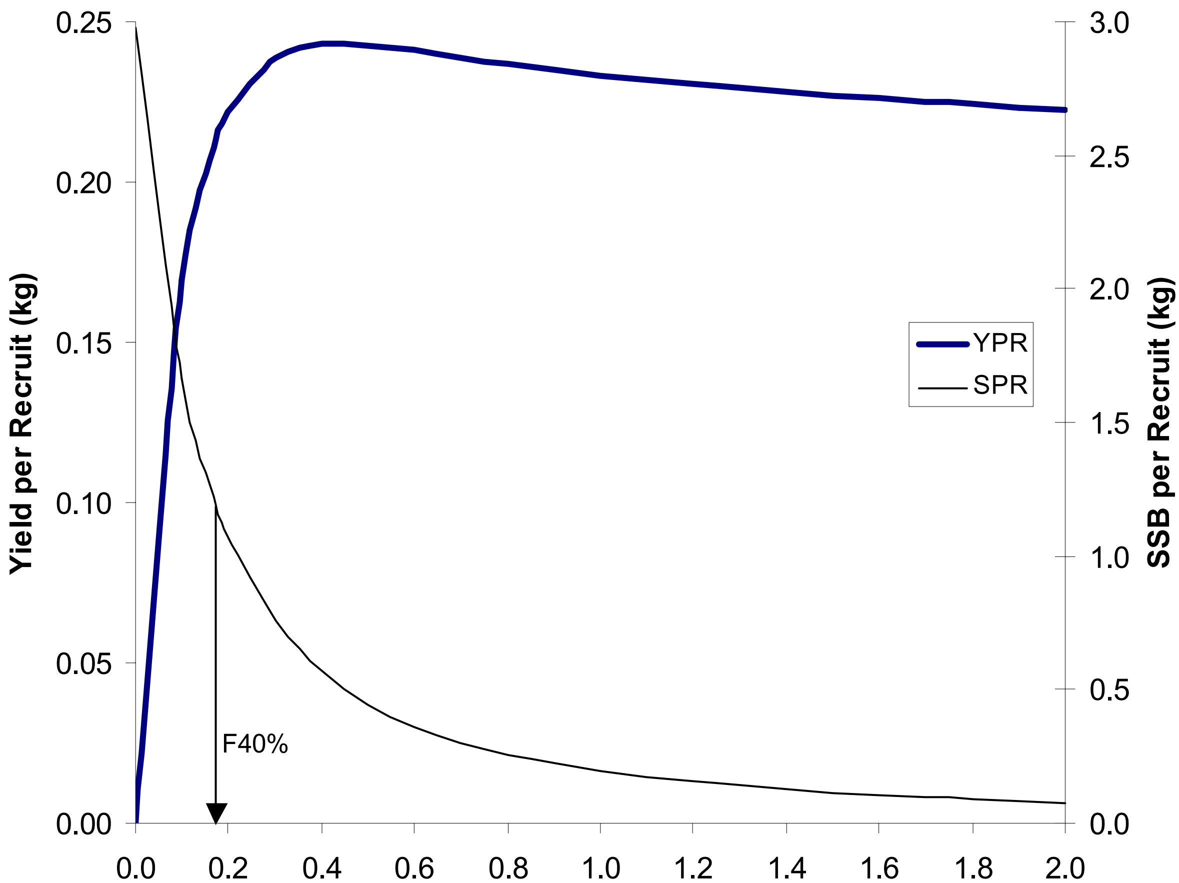


Figure 15. Observed and expected age distribution of spawning biomass at $F_{40\%}$ for Cape Cod-Gulf of Maine yellowtail flounder.

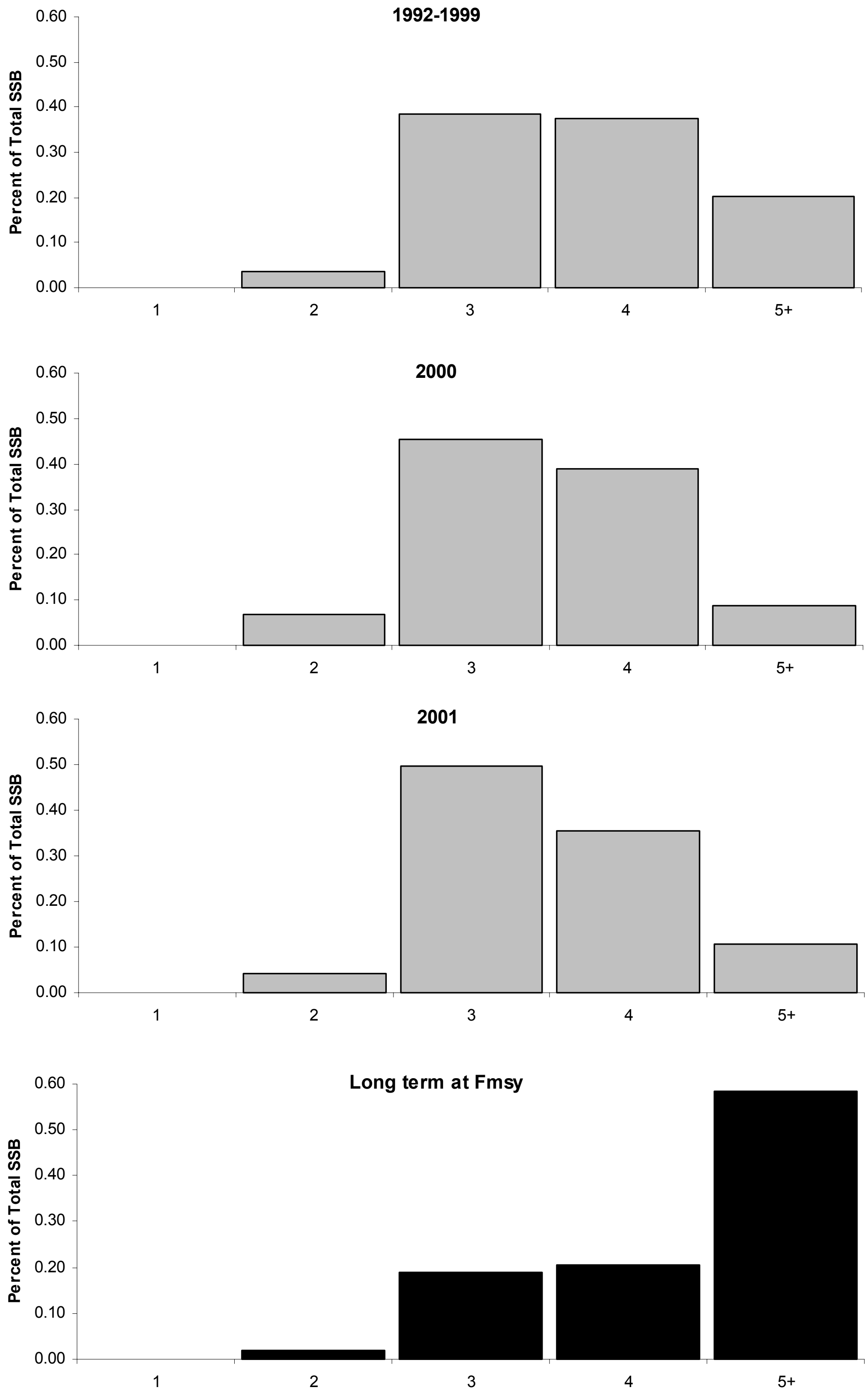


Figure 16. Stochastic projection of Cape Cod- Gulf of Maine yellowtail flounder spawning biomass (upper panel) and landings (lower panel) at 2002 F = 0.64 and 2003-2009 F=0.03; dotted lines indicate 90% confidence limits and the horizontal dashed line indicates SSB_{MSY}).

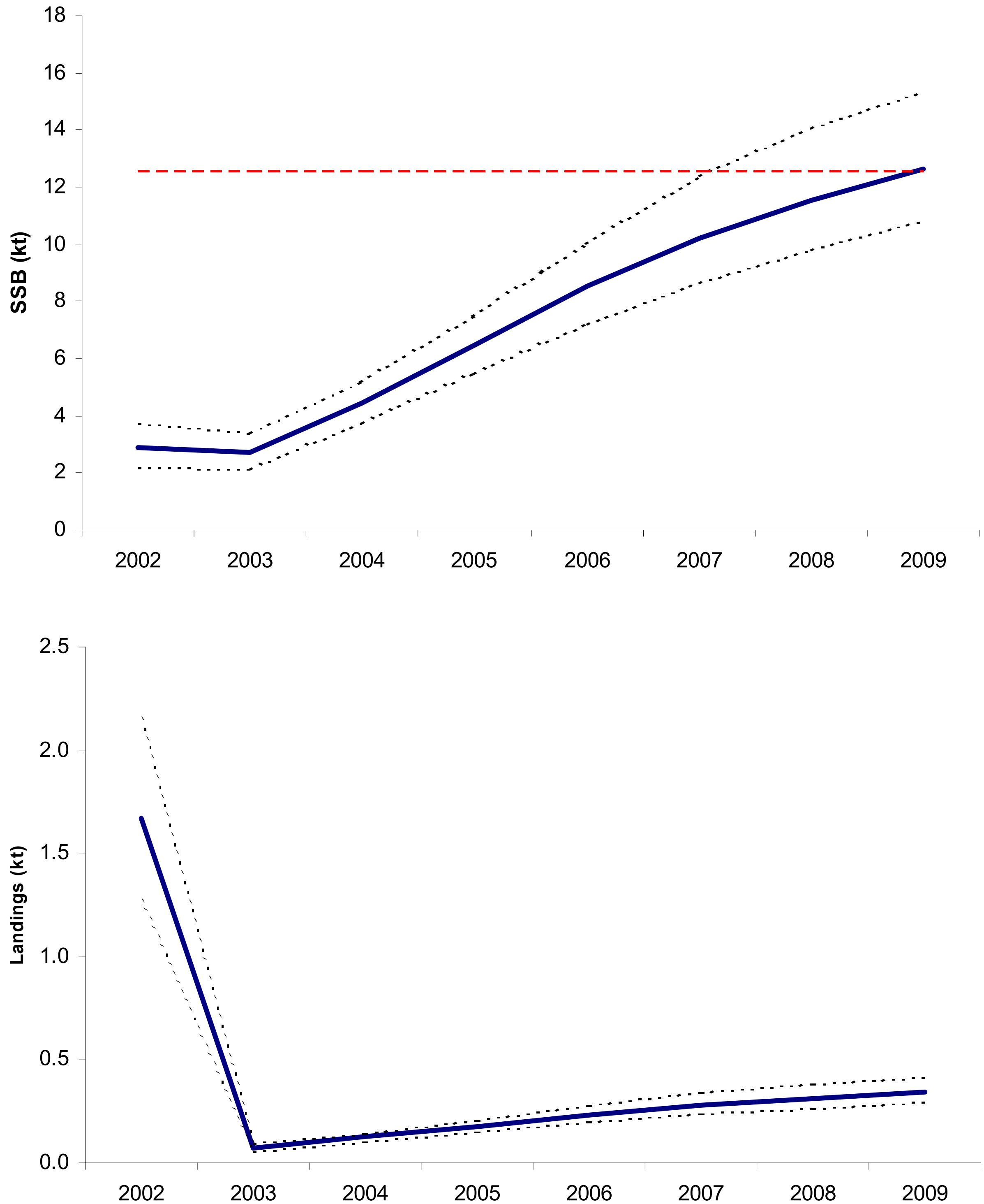


Figure 17. Length distribution of Cape Cod – Gulf of Maine yellowtail flounder by decade, from offshore survey strata 25, 27, 39 and 40.

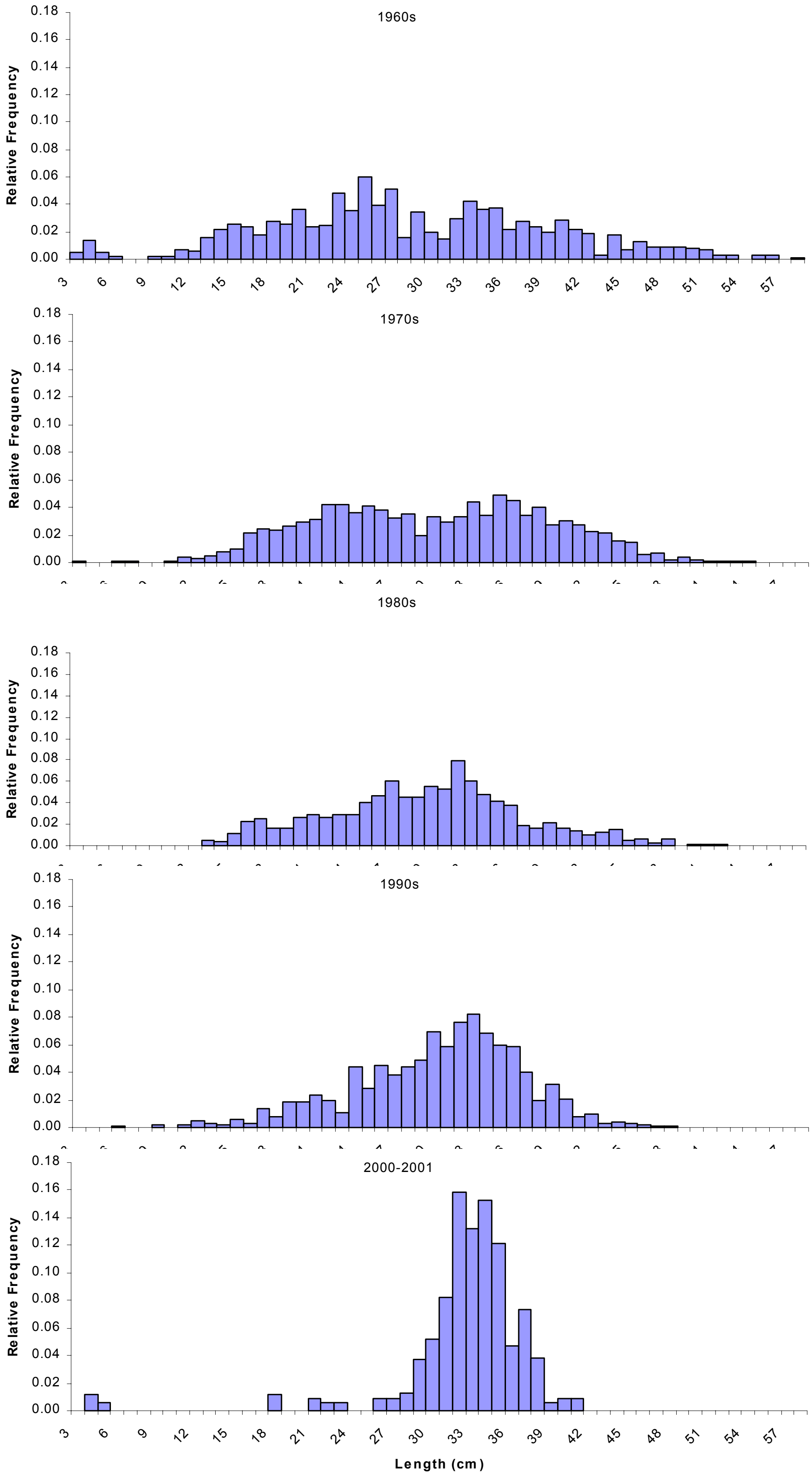


Figure 18a. Length distribution of Cape Cod – Gulf of Maine yellowtail flounder by decade, from the Massachusetts spring survey.

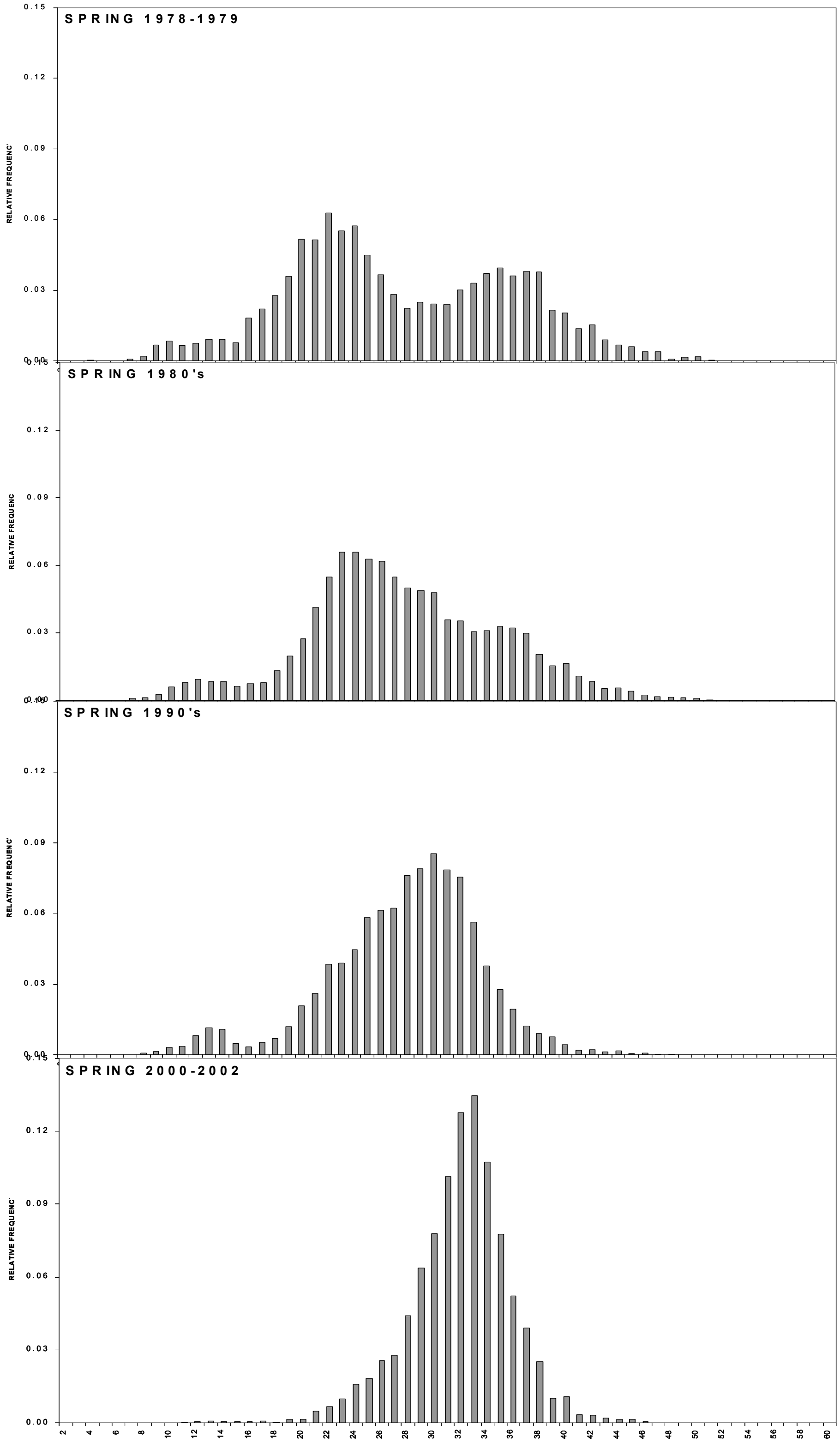


Figure 18b. Length distribution of Cape Cod – Gulf of Maine yellowtail flounder by decade, from the Massachusetts fall survey.

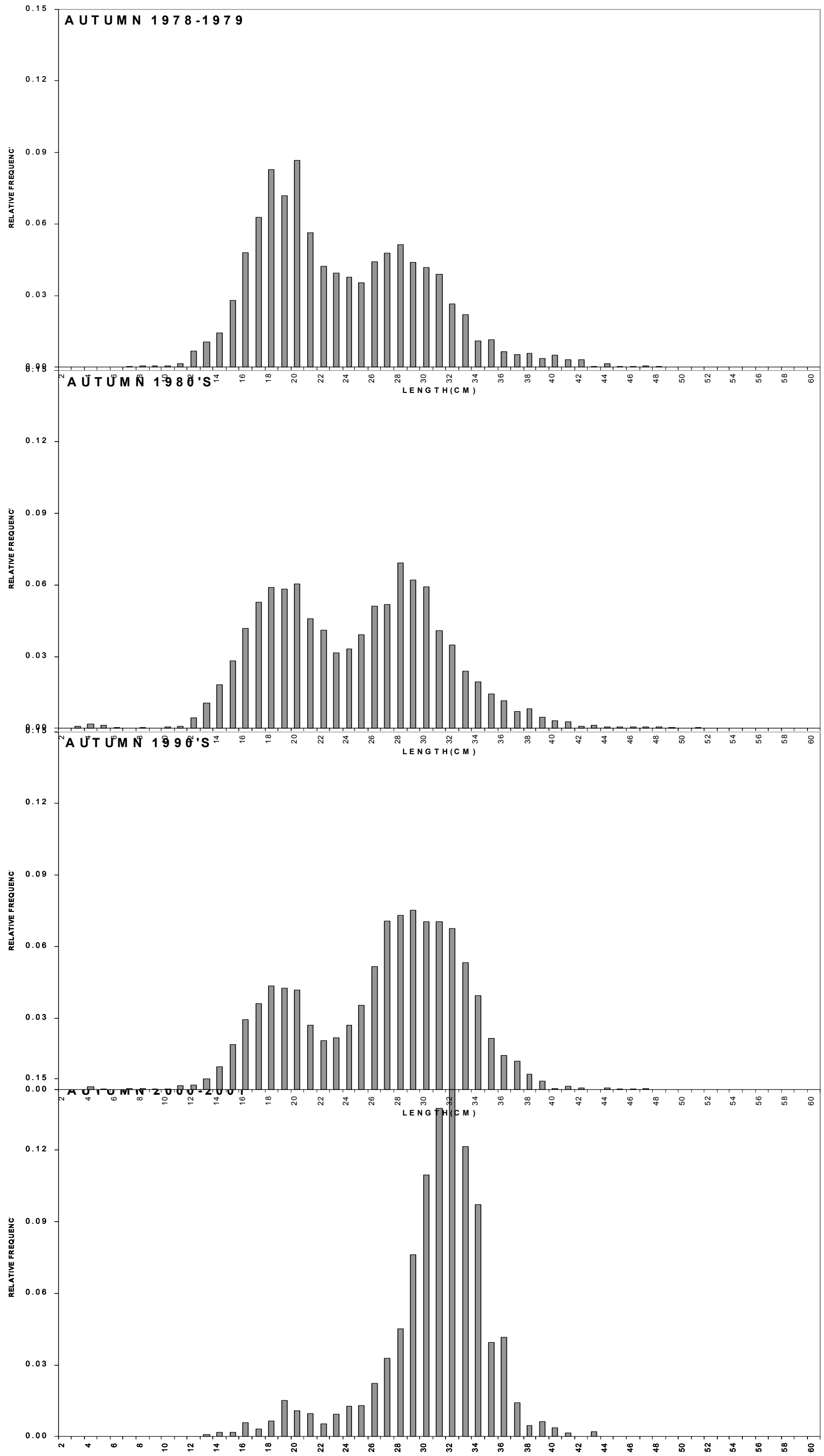


Figure 19. Size distribution of yellowtail flounder sampled from the inshore Gulf of Maine (NEFSC summer surveys, 1978-1981).

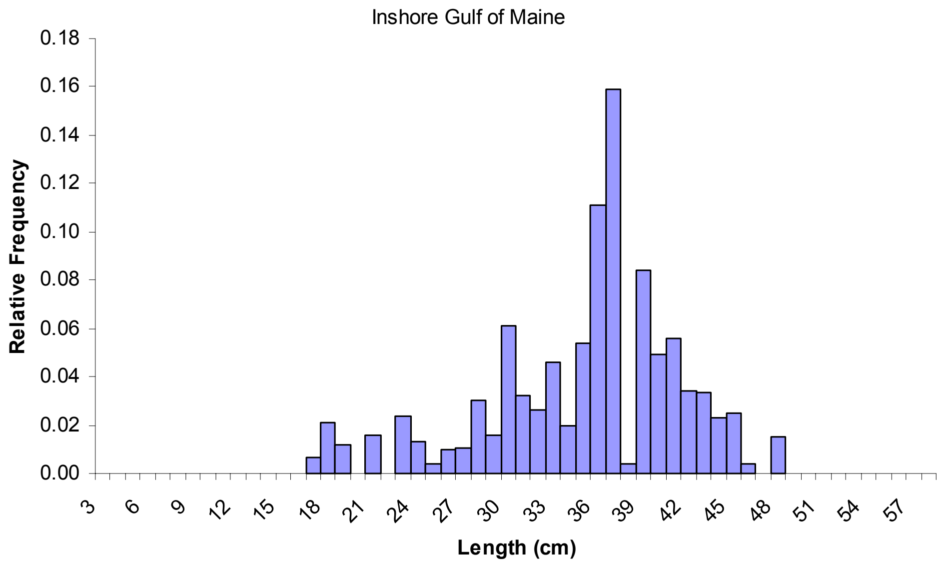
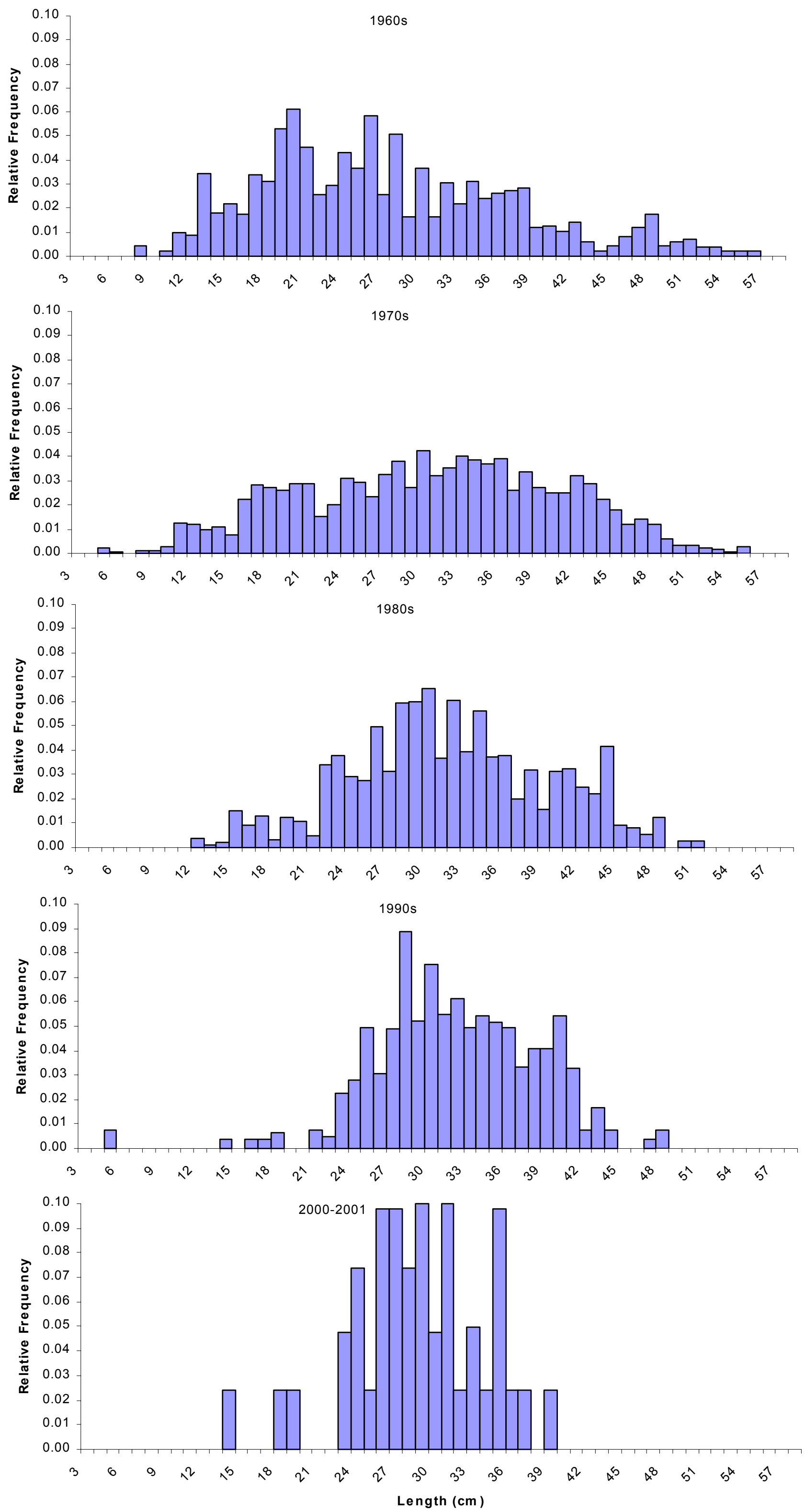


Figure 20. Size distribution of yellowtail flounder sampled from the NEFSC survey in the central and eastern Gulf of Maine, by decade.



Appendix A. Cape Cod – Gulf of Maine yellowtail flounder ADAPT

```
Fisheries Assessment Toolbox  Cape Cod -Gulf of Maine Yellowtail Flounder - SAW36  Run
Number  1   12/4/02   2:56:38 PM
FACT Version 1.5.0
Cape Cod -Gulf of Maine Yellowtail Flounder - SAW36  1985 - 2002
Input Parameters and Options Selected
---------------------------------------
Natural mortality is a matrix below
Oldest age (not in the plus group) is  4
For all years prior to the terminal year ( 17 ), backcalculated
stock sizes for the following ages used to estimate
total mortality (Z) for age  4 : 3 4
This method for estimating F on the oldest age is generally used when a
flat-topped partial recruitment curve is thought to be characteristic of the stock.
F for age  5 + is then calculated from the following
ratios of F[age 5 +] to F[age 4 ]
          1985              1
          1986              1
          1987              1
          1988              1
          1989              1
          1990              1
          1991              1
          1992              1
          1993              1
          1994              1
          1995              1
          1996              1
          1997              1
          1998              1
          1999              1
          2000              1
          2001              1
Stock size of the  5 + group is then calculated using
the following method:  CATCH EQUATION
 Partial recruitment estimate for  2002
 1            0.01
 2            0.1
 3            1
 4            1
Objective function is Sum w*(LOG(OBS)-LOG(PRED))**2
 Indices normalized (by dividing by mean observed value)
before tuning to VPA stocksizes
Downweighting is None or Uniform
Biomass estimates (other than SSB) reflect mean stock sizes.
SSB calculated as in the NEFSC projection program
(see note below SSB table for description of the algorithm).
Initial estimates of parameters for the Marquardt algorithm
and lower and upper bounds on the parameter estimates:
Par.          Initial Est   Lower Bnd     Upper Bnd
N  2          1.00E+06      0.00E+00      1.00E+08
N  3          1.00E+06      0.00E+00      1.00E+08
N  4          1.00E+05      0.00E+00      1.00E+08
q NMFSs2      1.00E-04      0.00E+00      1.00E-01
q NMFSs3      1.00E-04      0.00E+00      1.00E-01
q NMFSs4      1.00E-04      0.00E+00      1.00E-01
q NMFSs5      1.00E-04      0.00E+00      1.00E-01
q NMFSf2      1.00E-04      0.00E+00      1.00E-01
q NMFSf3      1.00E-04      0.00E+00      1.00E-01
q NMFSf4      1.00E-04      0.00E+00      1.00E-01
q NMFSf5      1.00E-04      0.00E+00      1.00E-01
q MASSs1      1.00E-04      0.00E+00      1.00E-01
q MASSs2      1.00E-04      0.00E+00      1.00E-01
q MASSs3      1.00E-04      0.00E+00      1.00E-01
q MASSs4      1.00E-04      0.00E+00      1.00E-01
q MASSs5      1.00E-04      0.00E+00      1.00E-01
q MASSf2      1.00E-04      0.00E+00      1.00E-01
q MASSf3      1.00E-04      0.00E+00      1.00E-01
q MASSf4      1.00E-04      0.00E+00      1.00E-01
q MASSf5      1.00E-04      0.00E+00      1.00E-01
```

The Indices that will be used in this run are:

1	NMFSs2
2	NMFSs3
3	NMFSs4
4	NMFSs5
5	NMFSf2
6	NMFSf3
7	NMFSf4
8	NMFSf5
9	MASSs1
10	MASSs2
11	MASSs3
12	MASSs4
13	MASSs5
14	MASSf2
15	MASSf3
16	MASSf4
17	MASSf5

Obs Indices (before transvba.formation) by index and year; with Index means

	1985	1986	1987	1988	1989	1990	1991
NMFSs2	0.81	1.79	1.60	3.78	2.18	6.14	3.55
NMFSs3	0.87	0.20	2.36	0.92	1.44	0.21	2.83
NMFSs4	0.21	0.14	0.64	0.51	0.37	0.00	1.05
NMFSs5	0.17	0.10	2.02	0.42	0.39	0.10	0.27
NMFSf2	0.32	4.61	1.31	0.56	3.13	1.66	3.50
NMFSf3	1.12	1.78	3.61	1.36	4.59	5.34	6.20
NMFSf4	0.44	1.35	0.30	0.48	0.44	2.01	2.87
NMFSf5	1.61	0.20	0.04	0.11	0.13	0.63	0.06
MASSs1	1.97	1.73	2.53	3.10	0.67	0.63	0.06
MASSs2	8.27	15.39	4.95	14.46	22.26	11.77	5.34
MASSs3	7.15	1.74	5.31	2.52	3.18	15.57	3.31
MASSs4	1.52	0.24	0.97	0.60	1.08	0.63	2.15
MASSs5	1.07	0.25	0.47	0.07	0.06	0.17	0.65
MASSf2	1.91	5.70	2.60	5.85	8.96	2.64	5.20
MASSf3	3.00	1.63	4.95	2.30	11.24	5.22	11.93
MASSf4	0.86	1.03	0.20	0.49	2.27	0.96	4.84
MASSf5	0.55	0.02	0.04	0.09	0.15	0.10	0.01

	1992	1993	1994	1995	1996	1997	1998
NMFSs2	0.91	0.66	2.63	1.04	0.55	0.93	0.75
NMFSs3	1.83	1.05	1.58	3.98	1.43	2.02	2.93
NMFSs4	0.50	0.56	0.95	2.99	2.01	1.55	0.89
NMFSs5	0.02	0.00	0.80	0.48	0.33	0.29	0.14
NMFSf2	1.84	2.54	4.45	2.47	0.52	1.06	1.05
NMFSf3	1.64	2.76	4.51	7.37	0.71	2.91	2.44
NMFSf4	1.64	1.88	0.60	2.60	1.07	4.93	2.94
NMFSf5	0.33	1.27	0.10	1.18	0.47	1.31	2.01
MASSs1	1.30	0.63	2.67	7.51	1.17	0.52	0.55
MASSs2	11.03	7.99	24.02	14.64	18.03	16.94	4.96
MASSs3	9.71	6.31	7.53	24.96	14.70	12.22	13.50
MASSs4	2.38	1.94	1.49	2.88	6.78	4.04	1.25
MASSs5	1.51	0.51	0.45	1.24	1.78	0.54	0.21
MASSf2	3.76	7.18	8.39	2.36	8.38	1.87	1.01
MASSf3	5.14	3.62	7.29	11.79	15.16	3.94	7.38
MASSf4	5.03	2.08	5.80	1.79	5.85	2.18	1.14
MASSf5	0.86	0.67	1.43	0.15	0.00	0.17	0.26

	1999	2000	2001	2002	Average
NMFSs2	0.85	3.93	1.20	1.57	1.937
NMFSs3	3.63	17.63	4.88	7.09	3.160
NMFSs4	1.85	5.84	1.03	3.27	1.433
NMFSs5	0.48	1.67	0.22	0.26	0.480
NMFSf2	1.02	4.15	0.95	0.12	1.959
NMFSf3	2.98	8.09	6.73	3.84	3.777
NMFSf4	1.20	5.53	4.46	2.23	2.054
NMFSf5	1.22	2.42	0.26	0.13	0.749
MASSs1	0.10	0.83	0.22	0.36	1.475
MASSs2	6.34	21.92	10.21	1.29	12.212
MASSs3	10.90	33.29	38.20	13.84	12.441
MASSs4	1.28	11.28	10.39	5.34	3.124
MASSs5	0.08	1.82	1.68	0.43	0.722
MASSf2	7.05	4.73	1.36	0.57	4.418
MASSf3	6.74	11.94	8.25	8.06	7.199
MASSf4	2.25	4.10	3.53	4.23	2.702
MASSf5	0.00	0.73	0.35	0.14	0.358

Catch at age (thousands) - C:\all_work\yt\2002\ccgom\ccgomyt_5.2

	1985	1986	1987	1988	1989	1990	1991
1	686	95	19	452	118	84	465
2	1245	4225	1885	2582	2297	2897	1372
3	907	785	2331	1503	1812	9400	1765
4	635	304	309	744	298	493	1953
5	450	48	169	240	46	64	372
1+	3923	5457	4713	5521	4571	12938	5927

	1992	1993	1994	1995	1996	1997	1998
1	1709	159	75	458	07	02	108
2	3979	425	535	751	592	912	707
3	1961	1074	1653	2754	1593	1574	2299
4	731	795	1031	1069	1077	889	563
5	205	165	599	330	359	210	211
1+	8585	2618	3893	5362	3628	3587	3888

	1999	2000	2001
1	17	09	20
2	564	1144	1705
3	1549	3059	3811
4	770	1310	1261
5	177	196	217
1+	3077	5718	7014

Weight at age (mid year) in kg - C:\all_work\yt\2002\ccgom\ccgomyt_5.2

	1985	1986	1987	1988	1989	1990	1991
1	0.130	0.100	0.060	0.120	0.130	0.080	0.120
2	0.270	0.250	0.230	0.210	0.270	0.250	0.240
3	0.360	0.430	0.390	0.340	0.380	0.370	0.340
4	0.490	0.530	0.550	0.520	0.650	0.550	0.520
5	0.650	0.770	0.730	0.720	1.000	0.880	0.790

	1992	1993	1994	1995	1996	1997	1998
1	0.050	0.090	0.080	0.070	0.040	0.030	0.030
2	0.130	0.160	0.220	0.220	0.190	0.300	0.260
3	0.320	0.360	0.370	0.320	0.380	0.380	0.390
4	0.500	0.420	0.460	0.410	0.470	0.460	0.530
5	0.640	0.820	0.650	0.600	0.560	0.590	0.710

	1999	2000	2001
1	0.030	0.030	0.030
2	0.310	0.360	0.320
3	0.410	0.430	0.410
4	0.560	0.560	0.560
5	0.680	0.660	0.780

Percent Mature (females)- C:\all_work\yt\2002\ccgom\ccgomyt_5.2

	1985	1986	1987	1988	1989	1990	1991
1	00	00	00	00	00	00	00
2	08	08	08	08	08	08	08
3	81	81	81	81	81	81	81
4	100	100	100	100	100	100	100
5	100	100	100	100	100	100	100

	1992	1993	1994	1995	1996	1997	1998
1	00	00	00	00	00	00	00
2	08	08	08	08	08	08	08
3	81	81	81	81	81	81	81
4	100	100	100	100	100	100	100
5	100	100	100	100	100	100	100

	1999	2000	2001
1	00	00	00
2	08	08	08
3	81	81	81
4	100	100	100
5	100	100	100

Natural Mortality C:\all_work\yt\2002\ccgom\ccgomyt_5.2

	1985	1986	1987	1988	1989	1990	1991
1	.200	.200	.200	.200	.200	.200	.200
2	.200	.200	.200	.200	.200	.200	.200
3	.200	.200	.200	.200	.200	.200	.200
4	.200	.200	.200	.200	.200	.200	.200
5	.200	.200	.200	.200	.200	.200	.200

	1992	1993	1994	1995	1996	1997	1998
1	.200	.200	.200	.200	.200	.200	.200
2	.200	.200	.200	.200	.200	.200	.200
3	.200	.200	.200	.200	.200	.200	.200
4	.200	.200	.200	.200	.200	.200	.200
5	.200	.200	.200	.200	.200	.200	.200

	1999	2000	2001
1	.200	.200	.200
2	.200	.200	.200
3	.200	.200	.200
4	.200	.200	.200
5	.200	.200	.200

Sex Ratio (Percent Female) - C:\all_work\yt\2002\ccgom\ccgomyt_5.2

	1985	1986	1987	1988	1989	1990	1991
1	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3	0.5	0.5	0.5	0.5	0.5	0.5	0.5
4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

	1992	1993	1994	1995	1996	1997	1998

1	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2	0.5	0.5	0.5	0.5	0.5	0.5	0.5
3	0.5	0.5	0.5	0.5	0.5	0.5	0.5
4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

	1999	2000	2001
1	0.5	0.5	0.5
2	0.5	0.5	0.5
3	0.5	0.5	0.5
4	0.5	0.5	0.5
5	0.5	0.5	0.5

```
pF is  0.4167
pM is  0.4167

Residual Sum of Squares from Marquardt Algorithm
Number  1
RSS           1167.20610570676
Lambda        1.00E-02

Number  2
RSS           960.501312588428
Lambda        1.00E-03

Number  3
RSS           812.825939753472
Lambda        1.00E-01

Number  4
RSS           713.970645319367
Lambda        1.00E-02

Number  5
RSS           673.699577834991
Lambda        1.00E+00

Number  6
RSS           606.43245075567
Lambda        1.00E-01

Number  7
RSS           577.10979290372
Lambda        1.00E+01

Number  8
RSS           529.352828448824
Lambda        1.00E+00

Number  9
RSS           507.505243244601
Lambda        1.00E+02

Number  10
RSS           472.756446761431
Lambda        1.00E+01

Number  11
RSS           456.135501171479
Lambda        1.00E+00

Number  12
RSS           430.295151140774
Lambda        1.00E+02


Number  13
RSS           325.711420522229
Lambda        1.00E+01
```

```
Number  14
RSS          313.832802099644
Lambda      1.00E+00

Number  15
RSS          278.1395076188
Lambda      1.00E+02

Number  16
RSS          247.371317320554
Lambda      1.00E+01

Number  17
RSS          242.514033336774
Lambda      1.00E+00

Number  18
RSS          242.483110462957
Lambda      1.00E+02

Number  19
RSS          242.482958798594
Lambda      1.00E+01

Number  20
RSS          242.482972319165
Lambda      1.00E+00

Number  21
RSS          242.482959173079
Lambda      1.00E-01

Number  22
RSS          242.482958801263
Lambda      1.00E+01

Number  23
RSS          242.482958798597
Lambda      1.00E+00

Number  24
RSS          242.482958798595
Lambda      1.00E-01

Number  25
RSS          242.482958798594
Lambda      1.00E-02
```

RESULTS

Approximate Statistics Assuming Linearity Near Solution
Sum of Squares: 242.482958798594
Mean Square Residuals: 0.85987

	PAR. EST.	STD. ERR.	T-STATISTIC	C.V.
N 2	1.57E+03	6.76E+02	2.32E+00	0.43
N 3	5.19E+03	1.89E+03	2.75E+00	0.36
N 4	3.07E+03	8.80E+02	3.49E+00	0.29
q NMFSs2	1.10E-04	2.44E-05	4.50E+00	0.22
q NMFSs3	1.31E-04	2.89E-05	4.52E+00	0.22
q NMFSs4	3.59E-04	8.21E-05	4.37E+00	0.23
q NMFSs5	1.35E-03	3.08E-04	4.37E+00	0.23
q NMFSf2	9.86E-05	2.19E-05	4.50E+00	0.22
q NMFSf3	1.82E-04	4.03E-05	4.52E+00	0.22
q NMFSf4	4.13E-04	9.16E-05	4.50E+00	0.22
q NMFSf5	1.13E-03	2.51E-04	4.50E+00	0.22
q MASSs1	6.19E-05	1.42E-05	4.37E+00	0.23
q MASSs2	1.16E-04	2.58E-05	4.50E+00	0.22
q MASSs3	1.60E-04	3.55E-05	4.52E+00	0.22
q MASSs4	3.59E-04	7.98E-05	4.50E+00	0.22
q MASSs5	1.35E-03	2.99E-04	4.50E+00	0.22
q MASSf2	1.10E-04	2.44E-05	4.50E+00	0.22
q MASSf3	1.89E-04	4.18E-05	4.52E+00	0.22
q MASSf4	4.19E-04	9.31E-05	4.50E+00	0.22
q MASSf5	1.15E-03	2.71E-04	4.25E+00	0.24

Catchability Estimates in Original Units

	Estimate	Std.Err.	C.V.
q NMFSs2	2.13E-04	4.73E-05	0.22
q NMFSs3	4.13E-04	9.15E-05	0.22
q NMFSs4	5.14E-04	1.18E-04	0.23
q NMFSs5	6.46E-04	1.48E-04	0.23
q NMFSf2	1.93E-04	4.29E-05	0.22
q NMFSf3	6.88E-04	1.52E-04	0.22
q NMFSf4	8.47E-04	1.88E-04	0.22
q NMFSf5	8.45E-04	1.88E-04	0.22
q MASSs1	9.13E-05	2.09E-05	0.23
q MASSs2	1.42E-03	3.15E-04	0.22
q MASSs3	1.99E-03	4.41E-04	0.22
q MASSs4	1.12E-03	2.49E-04	0.22
q MASSs5	9.72E-04	2.16E-04	0.22
q MASSf2	4.85E-04	1.08E-04	0.22
q MASSf3	1.36E-03	3.01E-04	0.22
q MASSf4	1.13E-03	2.52E-04	0.22
q MASSf5	4.11E-04	9.69E-05	0.24

CORRELATION BETWEEN PARAMETERS ESTIMATED

1	0.04	0.04	-0.11	-0.01	-0.01	-0.01	-0.11	-0.01	-0.01	-0.01	-0.12	-0.11	-0.01	-0.01	-0.01	-0.11	-0.01	-0.01	-0.01
0.04	1	0.05	-0.08	-0.1	-0.01	-0.01	-0.08	-0.1	-0.01	-0.01	-0.08	-0.08	-0.1	-0.01	-0.01	-0.08	-0.1	-0.01	-0.01
0.04	0.05	1	-0.07	-0.08	-0.15	-0.15	-0.07	-0.08	-0.15	-0.15	-0.08	-0.07	-0.08	-0.15	-0.15	-0.07	-0.08	-0.15	-0.14
-0.11	-0.08	-0.07	1	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
-0.01	-0.1	-0.08	0.01	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
-0.01	-0.01	-0.15	0.01	0.01	1	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
-0.01	-0.01	-0.15	0.01	0.01	0.02	1	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
-0.11	-0.08	-0.07	0.02	0.01	0.01	0.01	1	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
-0.01	-0.1	-0.08	0.01	0.01	0.01	0.01	0.01	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
-0.01	-0.01	-0.15	0.01	0.01	0.02	0.02	0.01	0.01	1	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
-0.01	-0.01	-0.15	0.01	0.01	0.02	0.02	0.01	0.01	0.02	1	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
-0.12	-0.08	-0.08	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	1	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01
-0.11	-0.08	-0.07	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	1	0.01	0.01	0.01	0.02	0.01	0.01	0.01
-0.01	-0.1	-0.08	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1	0.01	0.01	0.01	0.01	0.01	0.01
-0.01	-0.01	-0.15	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	1	0.02	0.01	0.01	0.02	0.02
-0.01	-0.01	-0.15	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	1	0.01	0.01	0.02	0.02
-0.11	-0.08	-0.07	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	1	0.01	0.01	0.01
-0.01	-0.1	-0.08	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1	0.01	0.01
-0.01	-0.01	-0.15	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	1	0.02
-0.01	-0.01	-0.14	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02	1

```
CORRELATION BETWEEN PARAMETERS ESTIMATED (SYMBOLIC FORM)
N 2
                    * . . . . . . . . . . . . . . . . . . .
N 3
                    . * . . . . . . . . . . . . . . . . . .
N 4
                    . . * . . . . . . . . . . . . . . . . .
NMFSs
                    . . . * . . . . . . . . . . . . . . . .
NMFSs
                    . . . . * . . . . . . . . . . . . . . .
NMFSs
                    . . . . . * . . . . . . . . . . . . . .
NMFSs
                    . . . . . . * . . . . . . . . . . . . .
NMFSf
                    . . . . . . . * . . . . . . . . . . . .
NMFSf
                    . . . . . . . . * . . . . . . . . . . .
NMFSf
                    . . . . . . . . . * . . . . . . . . . .
NMFSf
                    . . . . . . . . . . * . . . . . . . . .
MASSs
                    . . . . . . . . . . . * . . . . . . . .
MASSs
                    . . . . . . . . . . . . * . . . . . . .
MASSs
                    . . . . . . . . . . . . . * . . . . . .
MASSs
                    . . . . . . . . . . . . . . * . . . . .
MASSs
                    . . . . . . . . . . . . . . . * . . . .
MASSf
                    . . . . . . . . . . . . . . . . * . . .
MASSf
                    . . . . . . . . . . . . . . . . . * . .
MASSf
                    . . . . . . . . . . . . . . . . . . * .
MASSf
                    . . . . . . . . . . . . . . . . . . . *

SYMBOLS:  = LARGE NEGATIVE CORRELATION    whenever -1 <= R <  -L
          - MODERATE NEGATIVE CORRELATION whenever -L <= R <  -M
          . SMALL CORRELATION             whenever -M <= R <= +M
          + MODERATE POSITIVE CORRELATION whenever +M <  R <= +L
          * LARGE POSITIVE CORRELATION    whenever +L <  R <= +1

Where R is the estimated correlation, M is,  0.25  and L is  0.5
```

Summary of Residuals
NMFSs
Tuned to: 1-Jan and number
For ages: 2

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.810	0.681	-0.872	-1.046	1	0.174	0.187	3195
1986	1.790	2.014	-0.079	0.039	1	-0.118	-0.127	9451
1987	1.600	1.033	-0.191	-0.628	1	0.437	0.471	4851
1988	3.780	1.406	0.668	-0.320	1	0.989	1.066	6601
1989	2.180	4.944	0.118	0.937	1	-0.819	-0.883	23207
1990	6.140	1.953	1.154	0.008	1	1.146	1.235	9166
1991	3.550	2.013	0.606	0.038	1	0.567	0.612	9449
1992	0.910	2.190	-0.756	0.123	1	-0.878	-0.947	10281
1993	0.660	1.352	-1.077	-0.360	1	-0.717	-0.773	6346
1994	2.630	1.784	0.306	-0.082	1	0.388	0.418	8375
1995	1.040	1.237	-0.622	-0.448	1	-0.174	-0.187	5808
1996	0.550	1.025	-1.259	-0.637	1	-0.622	-0.671	4809
1997	0.930	1.678	-0.734	-0.144	1	-0.590	-0.636	7874
1998	0.750	1.498	-0.949	-0.257	1	-0.692	-0.746	7031
1999	0.850	1.850	-0.824	-0.046	1	-0.778	-0.839	8682
2000	3.930	2.341	0.707	0.189	1	0.518	0.559	10988
2001	1.200	1.751	-0.479	-0.101	1	-0.378	-0.407	8218
2002	1.570	0.334	-0.210	-1.757	1	1.547	1.668	1569

Partial Variance: 0.571

NMFSs
Tuned to: 1-Jan and number
For ages: 3

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.870	0.701	-1.290	-1.506	1	0.216	0.233	1696
1986	0.200	0.616	-2.760	-1.636	1	-1.124	-1.212	1489
1987	2.360	1.618	-0.292	-0.669	1	0.377	0.407	3915
1988	0.920	0.936	-1.234	-1.216	1	-0.018	-0.019	2266
1989	1.440	1.268	-0.786	-0.913	1	0.127	0.137	3068
1990	0.210	6.993	-2.711	0.794	1	-3.506	-3.780	16922
1991	2.830	2.018	-0.110	-0.448	1	0.338	0.365	4883
1992	1.830	2.684	-0.546	-0.163	1	-0.383	-0.413	6495
1993	1.050	1.991	-1.102	-0.462	1	-0.640	-0.690	4817
1994	1.580	1.988	-0.693	-0.463	1	-0.230	-0.248	4811
1995	3.980	2.634	0.231	-0.182	1	0.413	0.445	6372
1996	1.430	1.684	-0.793	-0.629	1	-0.164	-0.177	4076
1997	2.020	1.406	-0.447	-0.810	1	0.362	0.391	3402
1998	2.930	2.323	-0.076	-0.308	1	0.232	0.250	5621
1999	3.630	2.115	0.139	-0.402	1	0.540	0.583	5117
2000	17.630	2.727	1.719	-0.147	1	1.866	2.013	6598
2001	4.880	3.290	0.435	0.040	1	0.394	0.425	7961
2002	7.090	2.143	0.808	-0.388	1	1.196	1.290	5185

Partial Variance: 1.202

NMFSs
Tuned to: 1-Jan and number
For ages: 4

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.210	0.601	-1.920	-0.869	1	-1.051	-1.134	1168
1986	0.140	0.292	-2.326	-1.591	1	-0.735	-0.793	568
1987	0.640	0.262	-0.806	-1.699	1	0.893	0.964	509
1988	0.510	0.564	-1.033	-0.933	1	-0.100	-0.108	1096
1989	0.370	0.255	-1.354	-1.727	1	0.373	0.403	495
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	1.050	2.751	-0.311	0.652	1	-0.963	-1.039	5349
1992	0.500	1.235	-1.053	-0.149	1	-0.904	-0.975	2401
1993	0.560	1.823	-0.940	0.241	1	-1.180	-1.273	3543
1994	0.950	1.529	-0.411	0.065	1	-0.476	-0.513	2972
1995	2.990	1.257	0.736	-0.131	1	0.867	0.935	2443
1996	2.010	1.402	0.338	-0.022	1	0.360	0.389	2725
1997	1.550	0.975	0.079	-0.385	1	0.463	0.500	1896
1998	0.890	0.700	-0.476	-0.716	1	0.240	0.259	1361
1999	1.850	1.297	0.255	-0.099	1	0.355	0.383	2522
2000	5.840	1.434	1.405	0.001	1	1.404	1.514	2788
2001	1.030	1.355	-0.330	-0.056	1	-0.274	-0.296	2634
2002	3.270	1.579	0.825	0.097	1	0.728	0.785	3069

Partial Variance: 0.62

NMFSs
Tuned to: 1-Jan and number
For ages: 5

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.170	0.526	-1.038	0.091	1	-1.129	-1.217	814
1986	0.100	0.057	-1.569	-2.132	1	0.563	0.607	88
1987	2.020	0.176	1.437	-1.002	1	2.439	2.630	273
1988	0.420	0.223	-0.134	-0.767	1	0.633	0.683	345
1989	0.390	0.048	-0.208	-2.294	1	2.087	2.250	75
1990	0.100	0.072	-1.569	-1.899	1	0.331	0.357	111
1991	0.270	0.651	-0.575	0.305	1	-0.880	-0.949	1008
1992	0.020	0.431	-3.178	-0.108	1	-3.071	-3.311	668
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.800	1.104	0.511	0.833	1	-0.322	-0.348	1710
1995	0.480	0.481	0.000	0.002	1	-0.002	-0.002	745
1996	0.330	0.580	-0.375	0.189	1	-0.564	-0.608	898
1997	0.290	0.285	-0.504	-0.521	1	0.017	0.018	442
1998	0.140	0.325	-1.232	-0.389	1	-0.844	-0.910	504
1999	0.480	0.371	0.000	-0.257	1	0.257	0.277	575
2000	1.670	0.266	1.247	-0.592	1	1.838	1.983	411
2001	0.220	0.289	-0.780	-0.509	1	-0.271	-0.293	447
2002	0.260	0.767	-0.613	0.469	1	-1.082	-1.167	1188

Partial Variance: 1.797

NMFSf
Tuned to: 1-Jan and number
For ages: 2

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.320	0.617	-1.812	-1.155	1	-0.657	-0.708	3195
1986	4.610	1.825	0.856	-0.071	1	0.926	0.999	9451
1987	1.310	0.937	-0.402	-0.738	1	0.335	0.362	4851
1988	0.560	1.275	-1.252	-0.430	1	-0.823	-0.887	6601
1989	3.130	4.482	0.469	0.828	1	-0.359	-0.387	23207
1990	1.660	1.770	-0.166	-0.101	1	-0.064	-0.069	9166
1991	3.500	1.825	0.580	-0.071	1	0.651	0.702	9449
1992	1.840	1.986	-0.063	0.014	1	-0.076	-0.082	10281
1993	2.540	1.226	0.260	-0.469	1	0.729	0.786	6346
1994	4.450	1.617	0.821	-0.192	1	1.012	1.091	8375
1995	2.470	1.122	0.232	-0.557	1	0.789	0.851	5808
1996	0.520	0.929	-1.326	-0.746	1	-0.580	-0.626	4809
1997	1.060	1.521	-0.614	-0.253	1	-0.361	-0.389	7874
1998	1.050	1.358	-0.624	-0.366	1	-0.257	-0.277	7031
1999	1.020	1.677	-0.653	-0.155	1	-0.497	-0.536	8682
2000	4.150	2.122	0.751	0.080	1	0.671	0.723	10988
2001	0.950	1.587	-0.724	-0.210	1	-0.513	-0.553	8218
2002	0.120	0.303	-2.793	-1.866	1	-0.926	-0.999	1569

Partial Variance: 0.426

NMFSf
Tuned to: 1-Jan and number
For ages: 3

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	1.120	1.166	-1.216	-1.175	1	-0.041	-0.044	1696
1986	1.780	1.024	-0.752	-1.305	1	0.552	0.596	1489
1987	3.610	2.693	-0.045	-0.338	1	0.293	0.316	3915
1988	1.360	1.559	-1.021	-0.885	1	-0.136	-0.147	2266
1989	4.590	2.110	0.195	-0.582	1	0.777	0.838	3068
1990	5.340	11.639	0.346	1.126	1	-0.779	-0.840	16922
1991	6.200	3.359	0.496	-0.117	1	0.613	0.661	4883
1992	1.640	4.467	-0.834	0.168	1	-1.002	-1.081	6495
1993	2.760	3.313	-0.314	-0.131	1	-0.183	-0.197	4817
1994	4.510	3.309	0.177	-0.132	1	0.310	0.334	4811
1995	7.370	4.383	0.669	0.149	1	0.520	0.560	6372
1996	0.710	2.803	-1.671	-0.298	1	-1.373	-1.481	4076
1997	2.910	2.340	-0.261	-0.479	1	0.218	0.235	3402
1998	2.440	3.867	-0.437	0.024	1	-0.460	-0.496	5621
1999	2.980	3.520	-0.237	-0.071	1	-0.166	-0.179	5117
2000	8.090	4.538	0.762	0.184	1	0.578	0.623	6598
2001	6.730	5.476	0.578	0.371	1	0.206	0.222	7961
2002	3.840	3.567	0.017	-0.057	1	0.074	0.080	5185

Partial Variance: 0.354

NMFSf
Tuned to: 1-Jan and number
For ages: 4

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.440	0.990	-1.541	-0.730	1	-0.811	-0.874	1168
1986	1.350	0.481	-0.420	-1.452	1	1.032	1.113	568
1987	0.300	0.431	-1.924	-1.560	1	-0.363	-0.392	509
1988	0.480	0.929	-1.454	-0.794	1	-0.660	-0.712	1096
1989	0.440	0.420	-1.541	-1.588	1	0.048	0.051	495
1990	2.010	0.739	-0.022	-1.022	1	1.000	1.079	872
1991	2.870	4.532	0.335	0.791	1	-0.457	-0.493	5349
1992	1.640	2.034	-0.225	-0.010	1	-0.215	-0.232	2401
1993	1.880	3.002	-0.088	0.380	1	-0.468	-0.505	3543
1994	0.600	2.518	-1.231	0.204	1	-1.434	-1.547	2972
1995	2.600	2.070	0.236	0.008	1	0.228	0.246	2443
1996	1.070	2.309	-0.652	0.117	1	-0.769	-0.830	2725
1997	4.930	1.606	0.876	-0.246	1	1.122	1.209	1896
1998	2.940	1.153	0.359	-0.577	1	0.936	1.009	1361
1999	1.200	2.137	-0.537	0.040	1	-0.577	-0.622	2522
2000	5.530	2.362	0.990	0.140	1	0.851	0.917	2788
2001	4.460	2.232	0.775	0.083	1	0.692	0.747	2634
2002	2.230	2.601	0.082	0.236	1	-0.154	-0.166	3069

Partial Variance: 0.604

NMFSf
Tuned to: 1-Jan and number
For ages: 5

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	1.610	0.688	0.765	-0.085	1	0.851	0.918	814
1986	0.200	0.074	-1.320	-2.308	1	0.988	1.065	88
1987	0.040	0.231	-2.930	-1.178	1	-1.752	-1.889	273
1988	0.110	0.292	-1.918	-0.943	1	-0.975	-1.051	345
1989	0.130	0.063	-1.751	-2.470	1	0.719	0.776	75
1990	0.630	0.094	-0.173	-2.076	1	1.903	2.052	111
1991	0.060	0.852	-2.524	0.129	1	-2.653	-2.861	1008
1992	0.330	0.564	-0.819	-0.284	1	-0.536	-0.578	668
1993	1.270	0.617	0.528	-0.193	1	0.722	0.778	731
1994	0.100	1.444	-2.013	0.657	1	-2.670	-2.880	1710
1995	1.180	0.629	0.455	-0.174	1	0.629	0.678	745
1996	0.470	0.759	-0.466	0.013	1	-0.479	-0.517	898
1997	1.310	0.373	0.559	-0.697	1	1.256	1.355	442
1998	2.010	0.426	0.987	-0.565	1	1.552	1.674	504
1999	1.220	0.486	0.488	-0.433	1	0.921	0.994	575
2000	2.420	0.347	1.173	-0.768	1	1.941	2.093	411
2001	0.260	0.378	-1.058	-0.685	1	-0.373	-0.402	447
2002	0.130	1.003	-1.751	0.293	1	-2.044	-2.204	1188

Partial Variance: 2.281

MASSs
Tuned to: 1-Jan and number
For ages: 1

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	1.970	1.124	0.289	-0.272	1	0.562	0.606	12302
1986	1.730	0.551	0.159	-0.985	1	1.145	1.234	6030
1987	2.530	0.738	0.540	-0.692	1	1.232	1.328	8083
1988	3.100	2.634	0.743	0.580	1	0.163	0.176	28844
1989	0.670	1.034	-0.789	-0.355	1	-0.434	-0.468	11325
1990	0.630	1.063	-0.851	-0.328	1	-0.523	-0.564	11634
1991	0.060	1.194	-3.202	-0.212	1	-2.991	-3.225	13071
1992	1.300	0.880	-0.126	-0.516	1	0.390	0.420	9639
1993	0.630	0.950	-0.851	-0.440	1	-0.411	-0.443	10404
1994	2.670	0.655	0.593	-0.811	1	1.404	1.515	7177
1995	7.510	0.583	1.628	-0.929	1	2.556	2.757	6380
1996	1.170	0.879	-0.232	-0.518	1	0.286	0.308	9625
1997	0.520	0.785	-1.043	-0.631	1	-0.411	-0.443	8590
1998	0.550	0.979	-0.986	-0.409	1	-0.577	-0.622	10724
1999	0.100	1.227	-2.691	-0.184	1	-2.507	-2.704	13439
2000	0.830	0.918	-0.575	-0.475	1	-0.100	-0.108	10047
2001	0.220	0.177	-1.903	-2.120	1	0.217	0.234	1939
2002	0.360	0.000	-1.410	0	0	0.000	0.000	00

Partial Variance: 1.684

MASSs
Tuned to: 1-Jan and number
For ages: 2

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	8.270	4.533	-0.390	-0.991	1	0.601	0.648	3195
1986	15.390	13.409	0.231	0.094	1	0.138	0.149	9451
1987	4.950	6.882	-0.903	-0.573	1	-0.330	-0.355	4851
1988	14.460	9.365	0.169	-0.265	1	0.434	0.468	6601
1989	22.260	32.924	0.600	0.992	1	-0.391	-0.422	23207
1990	11.770	13.004	-0.037	0.063	1	-0.100	-0.107	9166
1991	5.340	13.406	-0.827	0.093	1	-0.920	-0.993	9449
1992	11.030	14.586	-0.102	0.178	1	-0.279	-0.301	10281
1993	7.990	9.003	-0.424	-0.305	1	-0.119	-0.129	6346
1994	24.020	11.881	0.676	-0.027	1	0.704	0.759	8375
1995	14.640	8.240	0.181	-0.393	1	0.575	0.620	5808
1996	18.030	6.823	0.390	-0.582	1	0.972	1.048	4809
1997	16.940	11.171	0.327	-0.089	1	0.416	0.449	7874
1998	4.960	9.975	-0.901	-0.202	1	-0.699	-0.753	7031
1999	6.340	12.318	-0.656	0.009	1	-0.664	-0.716	8682
2000	21.920	15.589	0.585	0.244	1	0.341	0.368	10988
2001	10.210	11.659	-0.179	-0.046	1	-0.133	-0.143	8218
2002	1.290	2.226	-2.248	-1.702	1	-0.546	-0.589	1569

Partial Variance: 0.302

MASSs
Tuned to: 1-Jan and number
For ages: 3

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	7.150	3.380	-0.554	-1.303	1	0.749	0.808	1696
1986	1.740	2.969	-1.967	-1.433	1	-0.534	-0.576	1489
1987	5.310	7.804	-0.851	-0.466	1	-0.385	-0.415	3915
1988	2.520	4.517	-1.597	-1.013	1	-0.584	-0.629	2266
1989	3.180	6.116	-1.364	-0.710	1	-0.654	-0.705	3068
1990	15.570	33.732	0.224	0.997	1	-0.773	-0.834	16922
1991	3.310	9.734	-1.324	-0.245	1	-1.079	-1.163	4883
1992	9.710	12.947	-0.248	0.040	1	-0.288	-0.310	6495
1993	6.310	9.602	-0.679	-0.259	1	-0.420	-0.453	4817
1994	7.530	9.590	-0.502	-0.260	1	-0.242	-0.261	4811
1995	24.960	12.703	0.696	0.021	1	0.675	0.728	6372
1996	14.700	8.125	0.167	-0.426	1	0.593	0.639	4076
1997	12.220	6.781	-0.018	-0.607	1	0.589	0.635	3402
1998	13.500	11.206	0.082	-0.105	1	0.186	0.201	5621
1999	10.900	10.200	-0.132	-0.199	1	0.066	0.072	5117
2000	33.290	13.153	0.984	0.056	1	0.929	1.001	6598
2001	38.200	15.869	1.122	0.243	1	0.878	0.947	7961
2002	13.840	10.337	0.107	-0.185	1	0.292	0.315	5185

Partial Variance: 0.402

MASSs
Tuned to: 1-Jan and number
For ages: 4

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	1.520	1.311	-0.721	-0.868	1	0.148	0.160	1168
1986	0.240	0.637	-2.566	-1.590	1	-0.976	-1.053	568
1987	0.970	0.572	-1.170	-1.699	1	0.529	0.571	509
1988	0.600	1.230	-1.650	-0.932	1	-0.718	-0.774	1096
1989	1.080	0.556	-1.062	-1.727	1	0.664	0.716	495
1990	0.630	0.979	-1.601	-1.160	1	-0.441	-0.476	872
1991	2.150	6.004	-0.374	0.653	1	-1.027	-1.107	5349
1992	2.380	2.695	-0.272	-0.148	1	-0.124	-0.134	2401
1993	1.940	3.977	-0.477	0.241	1	-0.718	-0.774	3543
1994	1.490	3.336	-0.740	0.065	1	-0.806	-0.869	2972
1995	2.880	2.742	-0.081	-0.130	1	0.049	0.053	2443
1996	6.780	3.059	0.775	-0.021	1	0.796	0.858	2725
1997	4.040	2.128	0.257	-0.384	1	0.641	0.692	1896
1998	1.250	1.527	-0.916	-0.716	1	-0.200	-0.216	1361
1999	1.280	2.831	-0.892	-0.099	1	-0.794	-0.856	2522
2000	11.280	3.129	1.284	0.001	1	1.282	1.383	2788
2001	10.390	2.957	1.202	-0.055	1	1.257	1.355	2634
2002	5.340	3.445	0.536	0.098	1	0.438	0.473	3069

Partial Variance: 0.581

MASSs
Tuned to: 1-Jan and number
For ages: 5

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	1.070	0.791	0.394	0.092	1	0.302	0.326	814
1986	0.250	0.086	-1.060	-2.131	1	1.071	1.154	88
1987	0.470	0.265	-0.429	-1.000	1	0.572	0.616	273
1988	0.070	0.336	-2.333	-0.766	1	-1.567	-1.690	345
1989	0.060	0.073	-2.487	-2.293	1	-0.194	-0.209	75
1990	0.170	0.108	-1.446	-1.898	1	0.452	0.488	111
1991	0.650	0.980	-0.105	0.306	1	-0.411	-0.443	1008
1992	1.510	0.649	0.738	-0.106	1	0.845	0.911	668
1993	0.510	0.710	-0.347	-0.016	1	-0.331	-0.357	731
1994	0.450	1.662	-0.472	0.834	1	-1.307	-1.409	1710
1995	1.240	0.724	0.541	0.003	1	0.538	0.580	745
1996	1.780	0.873	0.903	0.191	1	0.712	0.768	898
1997	0.540	0.429	-0.290	-0.519	1	0.229	0.247	442
1998	0.210	0.490	-1.234	-0.387	1	-0.847	-0.914	504
1999	0.080	0.559	-2.200	-0.256	1	-1.944	-2.096	575
2000	1.820	0.400	0.925	-0.590	1	1.515	1.634	411
2001	1.680	0.434	0.845	-0.507	1	1.352	1.459	447
2002	0.430	1.155	-0.518	0.470	1	-0.988	-1.065	1188

Partial Variance: 1.035

MASSf
Tuned to: 1-Jan and number
For ages: 2

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	1.910	1.550	-0.839	-1.048	1	0.209	0.225	3195
1986	5.700	4.584	0.255	0.037	1	0.218	0.235	9451
1987	2.600	2.353	-0.530	-0.630	1	0.100	0.108	4851
1988	5.850	3.201	0.281	-0.322	1	0.603	0.650	6601
1989	8.960	11.255	0.707	0.935	1	-0.228	-0.246	23207
1990	2.640	4.445	-0.515	0.006	1	-0.521	-0.562	9166
1991	5.200	4.583	0.163	0.037	1	0.126	0.136	9449
1992	3.760	4.986	-0.161	0.121	1	-0.282	-0.304	10281
1993	7.180	3.078	0.486	-0.361	1	0.847	0.914	6346
1994	8.390	4.062	0.641	-0.084	1	0.725	0.782	8375
1995	2.360	2.817	-0.627	-0.450	1	-0.177	-0.191	5808
1996	8.380	2.332	0.640	-0.639	1	1.279	1.379	4809
1997	1.870	3.819	-0.860	-0.146	1	-0.714	-0.770	7874
1998	1.010	3.410	-1.476	-0.259	1	-1.217	-1.312	7031
1999	7.050	4.211	0.467	-0.048	1	0.515	0.556	8682
2000	4.730	5.329	0.068	0.188	1	-0.119	-0.129	10988
2001	1.360	3.986	-1.178	-0.103	1	-1.075	-1.160	8218
2002	0.570	0.761	-2.048	-1.759	1	-0.289	-0.312	1569

Partial Variance: 0.434

MASSf
Tuned to: 1-Jan and number
For ages: 3

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	3.000	2.304	-0.875	-1.139	1	0.264	0.285	1696
1986	1.630	2.023	-1.485	-1.269	1	-0.216	-0.233	1489
1987	4.950	5.319	-0.375	-0.303	1	-0.072	-0.077	3915
1988	2.300	3.078	-1.141	-0.850	1	-0.291	-0.314	2266
1989	11.240	4.168	0.446	-0.546	1	0.992	1.070	3068
1990	5.220	22.988	-0.321	1.161	1	-1.482	-1.599	16922
1991	11.930	6.634	0.505	-0.082	1	0.587	0.633	4883
1992	5.140	8.823	-0.337	0.203	1	-0.540	-0.583	6495
1993	3.620	6.544	-0.687	-0.095	1	-0.592	-0.639	4817
1994	7.290	6.536	0.013	-0.097	1	0.109	0.118	4811
1995	11.790	8.657	0.493	0.184	1	0.309	0.333	6372
1996	15.160	5.537	0.745	-0.262	1	1.007	1.086	4076
1997	3.940	4.621	-0.603	-0.443	1	-0.159	-0.172	3402
1998	7.380	7.637	0.025	0.059	1	-0.034	-0.037	5621
1999	6.740	6.951	-0.066	-0.035	1	-0.031	-0.033	5117
2000	11.940	8.964	0.506	0.219	1	0.287	0.309	6598
2001	8.250	10.815	0.136	0.407	1	-0.271	-0.292	7961
2002	8.060	7.045	0.113	-0.022	1	0.135	0.145	5185

Partial Variance: 0.339

MASSf
Tuned to: 1-Jan and number
For ages: 4

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.860	1.323	-1.145	-0.714	1	-0.431	-0.465	1168
1986	1.030	0.643	-0.964	-1.435	1	0.471	0.508	568
1987	0.200	0.577	-2.603	-1.544	1	-1.059	-1.142	509
1988	0.490	1.242	-1.707	-0.777	1	-0.930	-1.003	1096
1989	2.270	0.561	-0.174	-1.572	1	1.398	1.508	495
1990	0.960	0.988	-1.035	-1.006	1	-0.029	-0.031	872
1991	4.840	6.059	0.583	0.808	1	-0.225	-0.242	5349
1992	5.030	2.720	0.622	0.007	1	0.615	0.663	2401
1993	2.080	4.014	-0.262	0.396	1	-0.657	-0.709	3543
1994	5.800	3.367	0.764	0.220	1	0.544	0.587	2972
1995	1.790	2.768	-0.412	0.024	1	-0.436	-0.470	2443
1996	5.850	3.087	0.773	0.133	1	0.639	0.689	2725
1997	2.180	2.147	-0.215	-0.230	1	0.015	0.016	1896
1998	1.140	1.541	-0.863	-0.561	1	-0.302	-0.325	1361
1999	2.250	2.857	-0.183	0.056	1	-0.239	-0.258	2522
2000	4.100	3.158	0.417	0.156	1	0.261	0.282	2788
2001	3.530	2.984	0.267	0.099	1	0.168	0.181	2634
2002	4.230	3.477	0.448	0.252	1	0.196	0.211	3069

Partial Variance: 0.38

MASSf
Tuned to: 1-Jan and number
For ages: 5

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1985	0.550	0.335	0.431	-0.065	1	0.496	0.535	814
1986	0.020	0.036	-2.883	-2.288	1	-0.596	-0.642	88
1987	0.040	0.112	-2.190	-1.158	1	-1.033	-1.114	273
1988	0.090	0.142	-1.379	-0.923	1	-0.456	-0.492	345
1989	0.150	0.031	-0.869	-2.450	1	1.582	1.706	75
1990	0.100	0.046	-1.274	-2.055	1	0.781	0.843	111
1991	0.010	0.415	-3.577	0.149	1	-3.726	-4.018	1008
1992	0.860	0.275	0.878	-0.263	1	1.141	1.231	668
1993	0.670	0.301	0.628	-0.173	1	0.801	0.864	731
1994	1.430	0.704	1.386	0.677	1	0.709	0.765	1710
1995	0.150	0.306	-0.869	-0.154	1	-0.714	-0.770	745
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.170	0.182	-0.743	-0.677	1	-0.067	-0.072	442
1998	0.260	0.207	-0.318	-0.545	1	0.226	0.244	504
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.730	0.169	0.714	-0.748	1	1.461	1.576	411
2001	0.350	0.184	-0.021	-0.665	1	0.643	0.694	447
2002	0.140	0.489	-0.937	0.313	1	-1.250	-1.348	1188

Partial Variance: 1.754

Partial variance (and proportion of total) by index

Index	Partial Variance	Proportion
NMFSs 2	0.571	0.039
NMFSs 3	1.202	0.081
NMFSs 4	0.62	0.042
NMFSs 5	1.797	0.122
NMFSf 2	0.426	0.029
NMFSf 3	0.354	0.024
NMFSf 4	0.604	0.041
NMFSf 5	2.281	0.154
MASSs 1	1.684	0.114
MASSs 2	0.302	0.02
MASSs 3	0.402	0.027
MASSs 4	0.581	0.039
MASSs 5	1.035	0.07
MASSf 2	0.434	0.029
MASSf 3	0.339	0.023
MASSf 4	0.38	0.026
MASSf 5	1.754	0.119

Standardized residuals by index and year; with row/column/grand means

	1985	1986	1987	1988	1989	1990	1991
NMFSs2	0.187	-0.127	0.471	1.066	-0.883	1.235	0.612
NMFSs3	0.233	-1.212	0.407	-0.019	0.137	-3.780	0.365
NMFSs4	-1.134	-0.793	0.964	-0.108	0.403	0.000	-1.039
NMFSs5	-1.217	0.607	2.630	0.683	2.250	0.357	-0.949
NMFSf2	-0.708	0.999	0.362	-0.887	-0.387	-0.069	0.702
NMFSf3	-0.044	0.596	0.316	-0.147	0.838	-0.840	0.661
NMFSf4	-0.874	1.113	-0.392	-0.712	0.051	1.079	-0.493
NMFSf5	0.918	1.065	-1.889	-1.051	0.776	2.052	-2.861
MASSs1	0.606	1.234	1.328	0.176	-0.468	-0.564	-3.225
MASSs2	0.648	0.149	-0.355	0.468	-0.422	-0.107	-0.993
MASSs3	0.808	-0.576	-0.415	-0.629	-0.705	-0.834	-1.163
MASSs4	0.160	-1.053	0.571	-0.774	0.716	-0.476	-1.107
MASSs5	0.326	1.154	0.616	-1.690	-0.209	0.488	-0.443
MASSf2	0.225	0.235	0.108	0.650	-0.246	-0.562	0.136
MASSf3	0.285	-0.233	-0.077	-0.314	1.070	-1.599	0.633
MASSf4	-0.465	0.508	-1.142	-1.003	1.508	-0.031	-0.242
MASSf5	0.535	-0.642	-1.114	-0.492	1.706	0.843	-4.018
Col Avg	0.029	0.178	0.141	-0.281	0.361	-0.176	-0.790

	1992	1993	1994	1995	1996	1997	1998
NMFSs2	-0.947	-0.773	0.418	-0.187	-0.671	-0.636	-0.746
NMFSs3	-0.413	-0.690	-0.248	0.445	-0.177	0.391	0.250
NMFSs4	-0.975	-1.273	-0.513	0.935	0.389	0.500	0.259
NMFSs5	-3.311	0.000	-0.348	-0.002	-0.608	0.018	-0.910
NMFSf2	-0.082	0.786	1.091	0.851	-0.626	-0.389	-0.277
NMFSf3	-1.081	-0.197	0.334	0.560	-1.481	0.235	-0.496
NMFSf4	-0.232	-0.505	-1.547	0.246	-0.830	1.209	1.009
NMFSf5	-0.578	0.778	-2.880	0.678	-0.517	1.355	1.674
MASSs1	0.420	-0.443	1.515	2.757	0.308	-0.443	-0.622
MASSs2	-0.301	-0.129	0.759	0.620	1.048	0.449	-0.753
MASSs3	-0.310	-0.453	-0.261	0.728	0.639	0.635	0.201
MASSs4	-0.134	-0.774	-0.869	0.053	0.858	0.692	-0.216
MASSs5	0.911	-0.357	-1.409	0.580	0.768	0.247	-0.914
MASSf2	-0.304	0.914	0.782	-0.191	1.379	-0.770	-1.312
MASSf3	-0.583	-0.639	0.118	0.333	1.086	-0.172	-0.037
MASSf4	0.663	-0.709	0.587	-0.470	0.689	0.016	-0.325
MASSf5	1.231	0.864	0.765	-0.770	0.000	-0.072	0.244
Col Avg	-0.354	-0.225	-0.100	0.422	0.141	0.192	-0.175

	1999	2000	2001	2002
NMFSs2	-0.839	0.559	-0.407	1.668
NMFSs3	0.583	2.013	0.425	1.290
NMFSs4	0.383	1.514	-0.296	0.785
NMFSs5	0.277	1.983	-0.293	-1.167
NMFSf2	-0.536	0.723	-0.553	-0.999
NMFSf3	-0.179	0.623	0.222	0.080
NMFSf4	-0.622	0.917	0.747	-0.166
NMFSf5	0.994	2.093	-0.402	-2.204
MASSs1	-2.704	-0.108	0.234	0.000
MASSs2	-0.716	0.368	-0.143	-0.589
MASSs3	0.072	1.001	0.947	0.315
MASSs4	-0.856	1.383	1.355	0.473
MASSs5	-2.096	1.634	1.459	-1.065
MASSf2	0.556	-0.129	-1.160	-0.312
MASSf3	-0.033	0.309	-0.292	0.145
MASSf4	-0.258	0.282	0.181	0.211
MASSf5	0.000	1.576	0.694	-1.348
Col Avg	-0.373	0.985	0.160	-0.170

Percent of total sum of squares by index and year; with row/column sums

	1985	1986	1987	1988	1989	1990	1991
NMFSs2	0.012	0.006	0.079	0.403	0.277	0.541	0.133
NMFSs3	0.019	0.521	0.059	0.000	0.007	5.068	0.047
NMFSs4	0.456	0.223	0.329	0.004	0.058	0.000	0.383
NMFSs5	0.525	0.131	2.453	0.165	1.796	0.045	0.320
NMFSf2	0.178	0.354	0.046	0.279	0.053	0.002	0.175
NMFSf3	0.001	0.126	0.035	0.008	0.249	0.250	0.155
NMFSf4	0.271	0.439	0.054	0.180	0.001	0.413	0.086
NMFSf5	0.299	0.402	1.266	0.392	0.213	1.493	2.903
MASSs1	0.130	0.540	0.626	0.011	0.078	0.113	3.688
MASSs2	0.149	0.008	0.045	0.078	0.063	0.004	0.349
MASSs3	0.231	0.118	0.061	0.140	0.176	0.246	0.480
MASSs4	0.009	0.393	0.115	0.213	0.182	0.080	0.435
MASSs5	0.038	0.473	0.135	1.013	0.016	0.084	0.070
MASSf2	0.018	0.020	0.004	0.150	0.021	0.112	0.007
MASSf3	0.029	0.019	0.002	0.035	0.406	0.906	0.142
MASSf4	0.077	0.092	0.463	0.357	0.806	0.000	0.021
MASSf5	0.101	0.146	0.440	0.086	1.032	0.252	5.724
++	2.543	4.011	6.212	3.514	5.433	9.610	15.116

	1992	1993	1994	1995	1996	1997	1998
NMFSs2	0.318	0.212	0.062	0.012	0.160	0.144	0.197
NMFSs3	0.061	0.169	0.022	0.070	0.011	0.054	0.022
NMFSs4	0.337	0.574	0.093	0.310	0.054	0.089	0.024
NMFSs5	3.888	0.000	0.043	0.000	0.131	0.000	0.293
NMFSf2	0.002	0.219	0.422	0.257	0.139	0.054	0.027
NMFSf3	0.414	0.014	0.040	0.111	0.778	0.020	0.087
NMFSf4	0.019	0.090	0.848	0.021	0.244	0.519	0.361
NMFSf5	0.118	0.215	2.941	0.163	0.095	0.651	0.993
MASSs1	0.063	0.070	0.814	2.695	0.034	0.070	0.137
MASSs2	0.032	0.006	0.204	0.136	0.389	0.071	0.201
MASSs3	0.034	0.073	0.024	0.188	0.145	0.143	0.014
MASSs4	0.006	0.212	0.268	0.001	0.261	0.170	0.017
MASSs5	0.294	0.045	0.704	0.119	0.209	0.022	0.296
MASSf2	0.033	0.296	0.217	0.013	0.675	0.210	0.611
MASSf3	0.120	0.145	0.005	0.039	0.418	0.010	0.000
MASSf4	0.156	0.178	0.122	0.078	0.168	0.000	0.038
MASSf5	0.537	0.265	0.207	0.210	0.000	0.002	0.021
++	6.434	2.782	7.036	4.426	3.911	2.227	3.341

	1999	2000	2001	2002	++
NMFSs2	0.249	0.111	0.059	0.987	3.961
NMFSs3	0.120	1.437	0.064	0.590	8.342
NMFSs4	0.052	0.813	0.031	0.219	4.047
NMFSs5	0.027	1.394	0.030	0.483	11.725
NMFSf2	0.102	0.186	0.109	0.354	2.958
NMFSf3	0.011	0.138	0.018	0.002	2.457
NMFSf4	0.137	0.298	0.198	0.010	4.191
NMFSf5	0.350	1.553	0.057	1.722	15.826
MASSs1	2.593	0.004	0.019	0.000	11.684
MASSs2	0.182	0.048	0.007	0.123	2.097
MASSs3	0.002	0.356	0.318	0.035	2.786
MASSs4	0.260	0.678	0.651	0.079	4.031
MASSs5	1.558	0.947	0.754	0.402	7.179
MASSf2	0.110	0.006	0.477	0.034	3.012
MASSf3	0.000	0.034	0.030	0.007	2.350
MASSf4	0.024	0.028	0.012	0.016	2.634
MASSf5	0.000	0.881	0.171	0.645	10.720
++	5.778	8.911	3.006	5.709	100.000

STOCK NUMBERS (Jan 1) in thousands - C:\all_work\yt\2002\ccgom\ccgomyt_5.2

	1985	1986	1987	1988	1989	1990	1991
1	12302	6030	8083	28844	11325	11634	13071
2	3195	9451	4851	6601	23207	9166	9449
3	1696	1489	3915	2266	3068	16922	4883
4	1168	568	509	1096	495	872	5349
5	814	88	273	345	75	111	1008
1+	19175	17626	17631	39152	38170	38705	33760

	1992	1993	1994	1995	1996	1997	1998
1	9639	10404	7177	6380	9625	8590	10724
2	10281	6346	8375	5808	4809	7874	7031
3	6495	4817	4811	6372	4076	3402	5621
4	2401	3543	2972	2443	2725	1896	1361
5	668	731	1710	745	898	442	504
1+	29484	25841	25045	21748	22134	22203	25241

	1999	2000	2001	2002
1	13439	10047	1939	00
2	8682	10988	8218	1569
3	5117	6598	7961	5185
4	2522	2788	2634	3069
5	575	411	447	1188
1+	30335	30832	21199	11012

FISHING MORTALITY - C:\all_work\yt\2002\ccgom\ccgomyt_5.2

	1985	1986	1987	1988	1989	1990	1991
1	0.06	0.02	0.00	0.02	0.01	0.01	0.04
2	0.56	0.68	0.56	0.57	0.12	0.43	0.17
3	0.89	0.87	1.07	1.32	1.06	0.95	0.51
4	0.92	0.90	1.11	1.39	1.09	0.98	0.52
5	0.92	0.90	1.11	1.39	1.09	0.98	0.52

	1992	1993	1994	1995	1996	1997	1998
1	0.22	0.02	0.01	0.08	0.00	0.00	0.01
2	0.56	0.08	0.07	0.15	0.15	0.14	0.12
3	0.41	0.28	0.48	0.65	0.57	0.72	0.60
4	0.41	0.28	0.48	0.66	0.57	0.73	0.61
5	0.41	0.28	0.48	0.66	0.57	0.73	0.61

	1999	2000	2001
1	0.00	0.00	0.01
2	0.07	0.12	0.26
3	0.41	0.72	0.75
4	0.41	0.73	0.75
5	0.41	0.73	0.75

3,4
Average F for 3,4

	1985	1986	1987	1988	1989	1990	1991
3,4	0.91	0.88	1.09	1.35	1.08	0.97	0.51

	1992	1993	1994	1995	1996	1997	1998
3,4	0.41	0.28	0.48	0.66	0.57	0.72	0.61

	1999	2000	2001
3,4	0.41	0.73	0.75

BACKCALCULATED PARTIAL RECRUITMENT

	1985	1986	1987	1988	1989	1990	1991
1	0.07	0.02	0.00	0.01	0.01	0.01	0.08
2	0.61	0.76	0.51	0.41	0.11	0.44	0.34
3	0.97	0.97	0.97	0.95	0.97	0.97	0.99
4	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	1992	1993	1994	1995	1996	1997	1998
1	0.39	0.06	0.02	0.13	0.00	0.00	0.02
2	1.00	0.27	0.15	0.23	0.25	0.19	0.19
3	0.73	0.99	0.99	0.98	0.99	0.98	0.98
4	0.74	1.00	1.00	1.00	1.00	1.00	1.00
5	0.74	1.00	1.00	1.00	1.00	1.00	1.00

	1999	2000	2001
1	0.00	0.00	0.02
2	0.18	0.17	0.35
3	0.99	0.98	1.00
4	1.00	1.00	1.00
5	1.00	1.00	1.00

SSB AT THE START OF THE SPAWNING SEASON -MALES AND FEMALES (MT) (using SSB mean weights)

	1985	1986	1987	1988	1989	1990	1991
1	00	00	00	00	00	00	00
2	50	131	65	81	439	141	155
3	313	332	728	331	559	3138	1000
4	359	191	162	294	188	293	2063
5	332	43	115	128	44	60	591
1+	1055	696	1070	834	1230	3633	3810

	1992	1993	1994	1995	1996	1997	1998
1	00	00	00	00	00	00	00
2	78	72	132	88	63	164	128
3	1308	1149	1087	1159	912	715	1272
4	931	1216	1028	700	928	592	514
5	331	490	836	312	364	177	255
1+	2648	2926	3083	2260	2267	1647	2169

	1999	2000	2001
1	00	00	00
2	192	277	174
3	1319	1567	1777
4	1095	1058	992
5	303	184	234
1+	2909	3087	3177

The number of bootstraps: 500
Bootstrap Output Variable: N hat

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
N 2	1569	1706	727	0.46
N 3	5185	5394	1818	0.35
N 4	3069	3088	794	0.26

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
N 2	137	33	8.70	1433	0.507538	908	2552
N 3	209	81	4.03	4977	0.365209	3170	7645
N 4	19	36	0.61	3051	0.260409	2153	4255

Bootstrap Output Variable: Q_unscaled

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
q NMFSs2	0.0002131	0.0002192	0.0000455	0.21
q NMFSs3	0.0004133	0.0004226	0.0000860	0.21
q NMFSs4	0.0005144	0.0005219	0.0001188	0.23
q NMFSs5	0.0006457	0.0006491	0.0001333	0.21
q NMFSf2	0.0001931	0.0001946	0.0000412	0.21
q NMFSf3	0.0006878	0.0007032	0.0001453	0.21
q NMFSf4	0.0008473	0.0008619	0.0001804	0.21
q NMFSf5	0.0008446	0.0008615	0.0001776	0.21
q MASSs1	0.0000913	0.0000936	0.0000200	0.22
q MASSs2	0.0014187	0.0014222	0.0003010	0.21
q MASSs3	0.0019934	0.0020707	0.0004281	0.21
q MASSs4	0.0011224	0.0011489	0.0002404	0.21
q MASSs5	0.0009720	0.0009982	0.0002136	0.22
q MASSf2	0.0004850	0.0005014	0.0001061	0.22
q MASSf3	0.0013585	0.0013820	0.0003112	0.23
q MASSf4	0.0011328	0.0011696	0.0002559	0.23
q MASSf5	0.0004115	0.0004236	0.0000966	0.23

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
q NMFSs2	0.00000612	0.000002033	2.872	0.000206936	0.22	0.0001576	0.0002763
q NMFSs3	0.00000930	0.000003847	2.250	0.000403986	0.21	0.0003021	0.0005279
q NMFSs4	0.00000749	0.000005313	1.455	0.000506923	0.23	0.0003867	0.0006816
q NMFSs5	0.00000342	0.000005963	0.530	0.000642272	0.21	0.0004951	0.0008712
q NMFSf2	0.00000149	0.000001845	0.773	0.000191641	0.22	0.0001471	0.0002548
q NMFSf3	0.00001541	0.000006498	2.240	0.000672429	0.22	0.0005038	0.0008737
q NMFSf4	0.00001460	0.000008069	1.723	0.000832687	0.22	0.0006273	0.0010674
q NMFSf5	0.00001681	0.000007941	1.990	0.000827835	0.21	0.0006234	0.0010605
q MASSs1	0.00000231	0.000000894	2.528	0.000089019	0.22	0.0000706	0.0001198
q MASSs2	0.00000350	0.000013461	0.247	0.001415229	0.21	0.0011026	0.0019276
q MASSs3	0.00007732	0.000019146	3.879	0.001916089	0.22	0.0014495	0.0025068
q MASSs4	0.00002648	0.000010751	2.359	0.001095963	0.22	0.0008648	0.0014987
q MASSs5	0.00002621	0.000009552	2.697	0.000945751	0.23	0.0007145	0.0012522
q MASSf2	0.00001640	0.000004747	3.381	0.000468611	0.23	0.0003448	0.0006041
q MASSf3	0.00002344	0.000013916	1.725	0.001335089	0.23	0.0010149	0.0018078
q MASSf4	0.00003682	0.000011445	3.251	0.001095988	0.23	0.0008543	0.0014335
q MASSf5	0.00001218	0.000004319	2.959	0.000399287	0.24	0.0002816	0.0005261

Bootstrap Output Variable: N t1

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
Age 1	9347.4	9349.8	308.6	0.0330
Age 2	1569.2	1705.8	727.1	0.4634
Age 3	5185.4	5394.2	1817.5	0.3505
Age 4	3069.5	3088.4	794.4	0.2588
Age 5	1188.0	1195.3	307.8	0.2591

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
Age 1	2.38	13.80	0.025	9345.00	0.03	8975.1	9762.2
Age 2	136.55	32.52	8.702	1432.69	0.51	908.3	2552.3
Age 3	208.80	81.28	4.027	4976.62	0.37	3169.8	7644.6
Age 4	18.86	35.53	0.615	3050.63	0.26	2153.3	4255.4
Age 5	7.34	13.77	0.618	1180.65	0.26	833.0	1647.6

Bootstrap Output Variable: F t

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
Age 1	0.0115	0.0125	0.0055	0.48
Age 2	0.2605	0.2758	0.0903	0.35
Age 3	0.7530	0.7761	0.1439	0.19
Age 4	0.7530	0.7761	0.1439	0.19
Age 5	0.7530	0.7761	0.1439	0.19

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
Age 1	0.0010210	0.0002474	8.905	0.0104451	0.53	0.0070	0.0194
Age 2	0.0153796	0.0040390	5.905	0.2450722	0.37	0.1824	0.3933
Age 3	0.0231098	0.0064362	3.069	0.7299197	0.20	0.5900	0.9526
Age 4	0.0231098	0.0064362	3.069	0.7299197	0.20	0.5900	0.9526
Age 5	0.0231098	0.0064362	3.069	0.7299197	0.20	0.5900	0.9526

Bootstrap Output Variable: F full t

NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
0.7530	0.7761	0.1439	0.19

BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
0.02311	0.00644	3.07	0.72992	0.20	0.5900	0.9526

Bootstrap Output Variable: PR t

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
Age 1	0.0152	0.0166	0.0080	0.53
Age 2	0.3459	0.3658	0.1326	0.38
Age 3	1.0000	1.0000	0.0000	0.00
Age 4	1.0000	1.0000	0.0000	0.00
Age 5	1.0000	1.0000	0.0000	0.00

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
Age 1	0.00137	0.000358	9.00	0.01385688	0.58	0.0091	0.0278
Age 2	0.01992	0.005931	5.76	0.32595487	0.41	0.2323	0.5485
Age 3	0.00000	0.000000	0.00	1.00000000	0.00	1.0000	1.0000
Age 4	0.00000	0.000000	0.00	1.00000000	0.00	1.0000	1.0000
Age 5	0.00000	0.000000	0.00	1.00000000	0.00	1.0000	1.0000

Bootstrap Output Variable: PR mean

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
Age 1	0.0041	0.0042	0.0007	0.18
Age 2	0.2186	0.2198	0.0244	0.11
Age 3	0.9900	0.9899	0.0009	0.00
Age 4	1.0000	1.0000	0.0000	0.00
Age 5	1.0000	1.0000	0.0000	0.00

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
Age 1	0.00005	0.0000332	1.23	0.0040700	0.18	0.0034	0.0054
Age 2	0.00119	0.0010904	0.54	0.2174200	0.11	0.1926	0.2538
Age 3	-0.00007	0.0000396	-0.01	0.9900540	0.00	0.9888	0.9911
Age 4	0.00000	0.0000000	0.00	1.0000000	0.00	1.0000	1.0000
Age 5	0.00000	0.0000000	0.00	1.0000000	0.00	1.0000	1.0000

```
Bootstrap Output Variable:  Mean Biomass
-------------------------------------------------------------------------
              NLLS          BOOTSTRAP     BOOTSTRAP     C.V. FOR
              ESTIMATE      MEAN          StdError      NLLS SOLN
                5439.9491     5526.6750      901.3463     0.17

                                                        NLLS EST      C.V. FOR
              BIAS          BIAS          PERCENT       CORRECTED     CORRECTED     LOWER         UPPER
              ESTIMATE      STD ERROR     BIAS          FOR BIAS      ESTIMATE      80%CI         80%CI
             86.7259            40.3094     1.59          5353.2232     0.17          4401.4875     6656.5462

Bootstrap Output Variable:  SSB female mean
-------------------------------------------------------------------------
              NLLS          BOOTSTRAP     BOOTSTRAP     C.V. FOR
              ESTIMATE      MEAN          StdError      NLLS SOLN
                1524.4416     1531.2888      261.7565     0.17

                                                        NLLS EST      C.V. FOR
              BIAS          BIAS          PERCENT       CORRECTED     CORRECTED     LOWER         UPPER
              ESTIMATE      STD ERROR     BIAS          FOR BIAS      ESTIMATE      80%CI         80%CI
               6.847            11.706      0.45           1517.594     0.17          1223.0888     1921.7306

Bootstrap Output Variable:  SSB spawn t
-------------------------------------------------------------------------
              NLLS          BOOTSTRAP     BOOTSTRAP     C.V. FOR
              ESTIMATE      MEAN          StdError      NLLS SOLN
                3176.9612     3188.7615      543.8036     0.17

                                                        NLLS EST      C.V. FOR
              BIAS          BIAS          PERCENT       CORRECTED     CORRECTED     LOWER         UPPER
              ESTIMATE      STD ERROR     BIAS          FOR BIAS      ESTIMATE      80%CI         80%CI
               11.80            24.32       0.37          3165.16       0.17          2547.0699     3998.3867

Bootstrap Output Variable: Jan 1 biomass
-------------------------------------------------------------------------
              NLLS          BOOTSTRAP     BOOTSTRAP     C.V. FOR
              ESTIMATE      MEAN          StdError      NLLS SOLN
                5521.7750     5561.8378      624.8018     0.11

                                                        NLLS EST      C.V. FOR
              BIAS          BIAS          PERCENT       CORRECTED     CORRECTED     LOWER         UPPER
              ESTIMATE      STD ERROR     BIAS          FOR BIAS      ESTIMATE      80%CI         80%CI
               40.06            27.94       0.73          5481.71       0.11            4804.18       6452.91
```

```
Projection Input:
CC-GOM yellowtail SAW 36
      2002 ! first year
         9 ! number of years
        10 ! recruitment simulations
    123456 ! seed
         0 ! age-2 recruitment?
         0 ! F and quota basis?
         1 ! discards?
         0 ! quota-based?
         0 ! constant catch?
         0 ! F target?
         0 ! index?
         1 ! thresholds?
         0 ! market categories?
         0 ! total mortality?
         0 ! PR?
         1 ! constant discards?
         1 ! bounded recruitment?
         1 ! constant M?
         1 ! bootstrap abundance?
         5 1 5 ! ages, first and last
    0.2        ! M
    0.15 0.34 0.40 0.51 0.65 ! spawn wts
    0.11 0.35 0.41 0.52 0.66  ! landed wts
    0.06 0.20 0.29 0.37 0.48  ! discard wts
    0.00    0.08    0.81    1.00    1.00    1.00  ! maturity
    0.42 ! spawning time
      14 ! recruitment option
      17 ! 1984-2000 recruitment
 12302000 6030000 8083000 28844000 11325000 11634000 13071000 9639000
 10404000 7177000 6380000 9625000 8590000 10724000 13439000 10047000 1939000
     500  ! number of bootstrap replicates
ccgomyt.dat
    1000.0  ! bootstrap scaling
    12600000 17800000 0.17 17800000 0.13 ! SSB,Jan1B,Ffull,MeanB,Fwb thresholds
   0.02   0.22 0.98 1.00 1.00      ! PR
   1.00 0.53 0.21 0.12 0.11      ! proportion discard at age
   0.64 0.03 0.03 0.03 0.03 0.03 0.03 0.03 0.03 ! schedule of F
```

Projection Output:
PROJECTION RUN: CC-GOM yellowtail SAW 36
INPUT FILE: ccgomyt.in
OUTPUT FILE: ccgomyt.out
RECRUITMENT MODEL: 14
NUMBER OF SIMULATIONS: 10

F-BASED PROJECTIONS
TIME-VARYING F

YEAR	F
2002	0.640
2003	0.030
2004	0.030
2005	0.030
2006	0.030
2007	0.030
2008	0.030
2009	0.030
2010	0.030

SPAWNING STOCK BIOMASS (THOUSAND MT)

YEAR	AVG SSB (000 MT)	STD
2002	2.928	0.612
2003	2.729	0.513
2004	4.439	0.552
2005	6.511	0.901
2006	8.636	1.265
2007	10.386	1.556
2008	11.767	1.705
2009	12.873	1.811
2010	13.737	1.881

PERCENTILES OF SPAWNING STOCK BIOMASS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2002	1.537	2.023	2.185	2.491	2.881	3.322	3.727	3.992	4.512
2003	1.667	1.955	2.125	2.369	2.706	3.037	3.423	3.584	4.036
2004	3.272	3.599	3.774	4.045	4.418	4.782	5.178	5.364	5.797
2005	4.702	5.230	5.497	5.951	6.451	6.918	7.483	8.030	9.733
2006	6.133	6.837	7.230	7.862	8.520	9.195	10.040	11.182	12.723
2007	7.337	8.175	8.646	9.404	10.221	11.074	12.424	13.520	15.068
2008	8.348	9.331	9.818	10.672	11.564	12.576	14.102	15.109	16.755
2009	9.316	10.338	10.822	11.704	12.654	13.772	15.337	16.286	18.064
2010	10.066	11.042	11.576	12.478	13.513	14.722	16.287	17.195	19.242

ANNUAL PROBABILITY THAT SSB EXCEEDS THRESHOLD: 12.600 THOUSAND MT

YEAR	Pr(SSB > Threshold Value)
2002	0.000
2003	0.000
2004	0.000
2005	0.000
2006	0.012
2007	0.093
2008	0.246
2009	0.518
2010	0.726

MEAN BIOMASS (THOUSAND MT) FOR AGES:1 TO 5

YEAR	AVG MEAN B (000 MT)	STD
2002	4.557	0.746
2003	6.048	0.704
2004	8.359	1.207
2005	10.476	1.483
2006	12.606	1.727
2007	14.348	1.949
2008	15.732	2.097
2009	16.816	2.174
2010	17.672	2.204

PERCENTILES OF MEAN STOCK BIOMASS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2002	3.019	3.434	3.654	4.022	4.513	5.013	5.581	5.829	6.473
2003	4.551	4.969	5.218	5.562	6.004	6.473	6.949	7.241	8.023
2004	5.966	6.629	7.010	7.613	8.267	8.900	9.672	10.509	12.597
2005	7.540	8.365	8.812	9.542	10.336	11.152	12.269	13.457	15.099
2006	9.139	10.148	10.633	11.499	12.415	13.427	14.902	15.986	17.628
2007	10.439	11.562	12.117	13.105	14.125	15.301	17.018	18.082	20.030
2008	11.571	12.734	13.372	14.349	15.485	16.831	18.562	19.625	21.752
2009	12.579	13.655	14.322	15.378	16.574	17.980	19.745	20.876	23.192
2010	13.307	14.469	15.114	16.181	17.446	18.859	20.578	21.781	24.111

ANNUAL PROBABILITY THAT MEAN BIOMASS EXCEEDS THRESHOLD: 17.800 THOUSAND MT

YEAR	Pr(MEAN B > Threshold Value)
2002	0.000
2003	0.000
2004	0.000
2005	0.001
2006	0.008
2007	0.060
2008	0.149
2009	0.276
2010	0.426

F WEIGHTED BY MEAN BIOMASS FOR AGES:1 TO 5

YEAR	AVG F_WT_B	STD

2002	0.450	0.029
2003	0.016	0.001
2004	0.019	0.002
2005	0.021	0.002
2006	0.023	0.002
2007	0.023	0.001
2008	0.024	0.001
2009	0.024	0.001
2010	0.025	0.001

PERCENTILES OF F WEIGHTED BY MEAN BIOMASS FOR AGES:1 TO 5

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2002	0.357	0.403	0.412	0.432	0.452	0.469	0.485	0.494	0.512
2003	0.012	0.013	0.014	0.015	0.016	0.017	0.017	0.018	0.019
2004	0.014	0.016	0.017	0.018	0.019	0.020	0.021	0.022	0.023
2005	0.016	0.018	0.019	0.020	0.021	0.022	0.023	0.024	0.025
2006	0.018	0.020	0.021	0.022	0.023	0.024	0.024	0.025	0.026
2007	0.019	0.021	0.022	0.023	0.024	0.024	0.025	0.026	0.027
2008	0.020	0.022	0.022	0.023	0.024	0.025	0.026	0.026	0.027
2009	0.021	0.022	0.023	0.024	0.025	0.025	0.026	0.026	0.027
2010	0.021	0.023	0.023	0.024	0.025	0.026	0.026	0.027	0.027

ANNUAL PROBABILITY THAT F WEIGHTED BY MEAN BIOMASS EXCEEDS THRESHOLD: 0.130

YEAR	Pr(F_WT_B > Threshold Value)
2002	1.000
2003	0.000
2004	0.000
2005	0.000
2006	0.000
2007	0.000
2008	0.000
2009	0.000
2010	0.000

TOTAL STOCK BIOMASS (THOUSAND MT)

YEAR	AVG TOTAL B (000 MT)	STD
2002	6.492	1.055
2003	7.007	0.868
2004	9.527	1.361
2005	11.853	1.657
2006	14.197	1.918
2007	16.121	2.167
2008	17.643	2.326
2009	18.837	2.407
2010	19.783	2.443

PERCENTILES OF TOTAL STOCK BIOMASS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2002	4.246	4.921	5.226	5.742	6.449	7.125	7.921	8.295	9.157
2003	5.190	5.709	5.999	6.433	6.946	7.487	8.071	8.515	9.712
2004	6.861	7.572	7.990	8.688	9.409	10.152	11.088	12.049	14.135
2005	8.519	9.512	9.969	10.813	11.688	12.602	13.927	15.130	16.863
2006	10.356	11.463	12.003	12.968	13.986	15.124	16.776	17.928	19.814
2007	11.808	13.002	13.654	14.717	15.863	17.173	19.120	20.260	22.369
2008	13.043	14.293	15.003	16.099	17.371	18.876	20.778	21.943	24.324
2009	14.142	15.326	16.058	17.244	18.565	20.133	22.081	23.284	25.931
2010	14.908	16.233	16.916	18.129	19.530	21.116	23.041	24.316	26.911

ANNUAL PROBABILITY THAT TOTAL STOCK BIOMASS EXCEEDS THRESHOLD: 17.800 THOUSAND MT

YEAR	Pr(B > Threshold Value)
2002	0.000
2003	0.000
2004	0.000
2005	0.004
2006	0.055
2007	0.189
2008	0.410
2009	0.645
2010	0.803

RECRUITMENT UNITS ARE:1000. FISH

BIRTH YEAR	AVG RECRUITMENT	STD
2002	10314.052	3929.655
2003	10227.902	3767.061
2004	10297.420	3821.556
2005	10233.164	3790.634
2006	10300.605	3879.492
2007	10207.951	3835.446
2008	10188.915	3752.985
2009	10209.153	3871.535
2010	10304.924	3822.402

PERCENTILES OF RECRUITMENT UNITS ARE:1000. FISH

BIRTH YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2002	2572.243	5375.282	6261.513	8134.272	10056.230	11692.031	13235.250	17095.808	26663.468
2003	2768.862	5341.919	6237.515	8128.374	10093.052	11615.277	13184.411	15175.162	26499.819
2004	2660.581	5708.333	6257.184	8168.939	10059.612	11687.485	13220.463	16526.135	26494.305
2005	2634.604	5382.393	6229.699	8061.477	10060.593	11736.947	13215.668	15621.186	26146.995
2006	2422.072	5284.432	6295.067	8156.284	10060.613	11629.025	13238.528	17128.554	26316.505
2007	2659.372	5195.097	6222.910	7970.817	10051.001	11644.248	13207.994	16216.961	26140.012
2008	2539.160	5092.214	6244.088	8124.641	10103.205	11594.478	13181.109	14946.936	25903.932
2009	2605.043	5162.777	6239.607	8091.648	10015.463	11609.300	13189.498	16321.958	26728.068
2010	2850.141	5566.452	6269.738	8164.893	10089.615	11666.431	13223.332	16326.657	26061.229

LANDINGS FOR F-BASED PROJECTIONS

YEAR	AVG LANDINGS (000 MT)	STD
2002	1.695	0.354
2003	0.076	0.014
2004	0.125	0.015
2005	0.180	0.026
2006	0.237	0.035
2007	0.284	0.042
2008	0.321	0.046
2009	0.350	0.049
2010	0.373	0.051

PERCENTILES OF LANDINGS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2002	0.882	1.168	1.268	1.441	1.668	1.922	2.148	2.319	2.581
2003	0.047	0.055	0.059	0.066	0.075	0.084	0.094	0.098	0.111
2004	0.093	0.102	0.107	0.114	0.125	0.134	0.145	0.150	0.163
2005	0.130	0.144	0.152	0.165	0.179	0.192	0.207	0.223	0.273
2006	0.168	0.188	0.199	0.216	0.234	0.252	0.276	0.307	0.348
2007	0.201	0.224	0.236	0.257	0.279	0.302	0.340	0.368	0.411
2008	0.227	0.255	0.267	0.291	0.315	0.342	0.384	0.412	0.457
2009	0.254	0.281	0.295	0.318	0.344	0.374	0.416	0.443	0.491
2010	0.274	0.300	0.315	0.339	0.367	0.400	0.442	0.466	0.522

DISCARDS FOR F-BASED PROJECTIONS

YEAR	AVG DISCARDS (000 MT)	STD
2002	0.255	0.055
2003	0.012	0.002
2004	0.021	0.002
2005	0.027	0.005
2006	0.032	0.005
2007	0.037	0.006
2008	0.040	0.006
2009	0.043	0.006
2010	0.045	0.006

PERCENTILES OF DISCARDS (000 MT)

YEAR	1%	5%	10%	25%	50%	75%	90%	95%	99%
2002	0.140	0.172	0.189	0.216	0.250	0.290	0.328	0.347	0.393
2003	0.009	0.010	0.010	0.011	0.012	0.013	0.015	0.015	0.017
2004	0.016	0.018	0.019	0.020	0.021	0.023	0.024	0.026	0.030
2005	0.018	0.021	0.022	0.024	0.027	0.029	0.032	0.036	0.045
2006	0.022	0.025	0.027	0.029	0.032	0.035	0.039	0.042	0.049
2007	0.026	0.029	0.030	0.033	0.036	0.039	0.044	0.047	0.054
2008	0.028	0.032	0.033	0.036	0.039	0.043	0.047	0.051	0.058
2009	0.030	0.034	0.036	0.039	0.042	0.046	0.051	0.054	0.061
2010	0.033	0.036	0.037	0.040	0.044	0.048	0.053	0.056	0.063

ANNUAL PROBABILITY FULLY-RECRUITED F EXCEEDS THRESHOLD: 0.170

YEAR	Pr(F > Threshold Value)
2002	1.000
2003	0.000
2004	0.000
2005	0.000
2006	0.000
2007	0.000
2008	0.000
2009	0.000
2010	0.000

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Publications and Reports of the Northeast Fisheries Science Center

The mission of NOAA's National Marine Fisheries Service (NMFS) is "stewardship of living marine resources for the benefit of the nation through their science-based conservation and management and promotion of the health of their environment." As the research arm of the NMFS's Northeast Region, the Northeast Fisheries Science Center (NEFSC) supports the NMFS mission by "planning, developing, and managing multidisciplinary programs of basic and applied research to: 1) better understand the living marine resources (including marine mammals) of the Northwest Atlantic, and the environmental quality essential for their existence and continued productivity; and 2) describe and provide to management, industry, and the public, options for the utilization and conservation of living marine resources and maintenance of environmental quality which are consistent with national and regional goals and needs, and with international commitments." Results of NEFSC research are largely reported in primary scientific media (*e.g.*, anonymously-peer-reviewed scientific journals). However, to assist itself in providing data, information, and advice to its constituents, the NEFSC occasionally releases its results in its own media. Those media are in four categories:

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Northeast Fisheries Science Center Reference Document -- This series is issued irregularly. The series typically includes: data reports on field and lab studies; progress reports on experiments, monitoring, and assessments; background papers for, collected abstracts of, and/or summary reports of scientific meetings; and simple bibliographies. Issues receive internal scientific review, but no technical or copy editing.

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The Shark Tagger -- This newsletter is an annual summary of tagging and recapture data on large pelagic sharks as derived from the NMFS's Cooperative Shark Tagging Program; it also presents information on the biology (movement, growth, reproduction, etc.) of these sharks as subsequently derived from the tagging and recapture data. There is internal scientific review, but no technical or copy editing, of this newsletter.

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