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Assessment of the Georges Bank Atlantic Cod Stock for 2001

by

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ABSTRACT

This report presents an updated analytical assessment of the status of the Georges Bank Atlantic cod *Gadus morhua* stock (NAFO Division 5Z and Subarea 6) for the period 1978-2000 based on analysis of USA and Canadian commercial landings and effort data and research vessel survey data through 2000. Estimates of 2000 fishing mortality and spawning stock biomass, 2001 beginning year stock size, and the precision of the fishing mortality and spawning stock biomass estimates are presented.

Total commercial landings of Georges Bank cod in 2000 were estimated at 9,189 mt, a 7% decrease from the 9,880 mt landed in 1999. The USA fleet landed 83% of the total, and the Canadian fleet landed the remaining 17%. Commercial landings per unit of standardized effort (LPUE) declined to a record low in 1995, then increased in 1996 and 1997 and have remained relatively stable through 2000. Fishery-independent surveys, conducted by the Northeast Fisheries Science Center, show similar trends in both biomass and numbers of cod since 1982. The 2000 indices remain well below the long term average. Since 1989 recruitment indices of age 1 cod have been below the time series average and among the lowest in the time series.

Spawning stock biomass declined from about 93,000 mt in the early 1980s to a record low of 18,000 mt in 1995 and has since increased to 29,000 mt in 2000. Mean biomass exhibits similar trends. Fishing mortality doubled between 1979 and 1985, increased to a record high of 1.47 (71% exploitation rate) in 1994 and has since declined to 0.22 (18% exploitation rate) in 2000. However, recruiting year classes have been well below the long term average (16 million fish) since 1991. Recent increases in stock biomass are attributed to increased survival of adults rather than improved recruitment.

INTRODUCTION

This report presents an updated analytical assessment of the Georges Bank cod *Gadus morhua* stock (NAFO Division 5Z and Subarea 6) for the period 1978-2000 based on analysis of commercial landings and research vessel survey data through 2000. The life history of Georges Bank cod and the history of the commercial fishery is described in O'Brien (1999). An outline of the history of management is provided in Table 1.

THE FISHERY

Commercial Landings

The collecting and processing of the commercial fishery and landings data has been conducted using two methods during the time series. Prior to 1994, information of the catch quantity, by market category, was derived from reports of landings transactions submitted voluntarily by processors and dealers. More detailed data on fishing effort and location of fishing activity were obtained for a subset of trips from personal interviews of fishing captains conducted by port agents in the major ports of the Northeast. Information acquired from the interview was used to augment the total catch information obtained from the dealer.

In 1994, a mandatory reporting system was initiated requiring anyone fishing for or purchasing regulated groundfish in the Northeast to submit either vessel trip reports (logbooks) or dealer reports, respectively (Power *et al.* 1997 WP). Information on fishing effort (number of hauls, average haul time) and catch location were now obtained from logbooks submitted to NMFS by vessel captains instead of personal interviews. Estimates of total catch by species and market category were derived from mandatory dealer reports submitted on a trip basis to NMFS. Catches by market category were allocated to stock based on a matched subset of trips between the dealer and logbook databases. Both databases were stratified by calendar quarter, port group and gear group to form a pool of observations from which proportion of catch, by stock, could be allocated to market category with the matched subset. The cross products of the market category by stock proportions derived from the matched subset were employed to compute the total catch by stock, market category, calendar quarter, port group, and gear group in the full dealer database. The USA landings for Atlantic cod for 1994-1996 were derived for Eastern Georges Bank (statistical areas 560, 561, 562, 551, 552) and Western Georges Bank (statistical areas 520-526,530,537-539,600-639) using the proration methodology described above. The 1997-2000 data were also prorated using the same methodology, however, the criteria for matching the data were modified and resulted in a larger data set being available for proration (Wigley *et al.* 1998).

Total commercial landings of Georges Bank cod in 2000 were estimated to be 9,189 mt, 7% lower than in 1999 (Table 2, Figures1a and 1b). The USA fleets landed 83% (7,617 mt) of the total, and the Canadian fleets landed the remaining17% (1,572 mt).

USA cod landings are generally highest in the second calender quarter (April-June) and are taken

predominantly from the western part (statistical areas 521-522, 525-526, 537-539, and Subarea 6) of Georges Bank throughout the year (Figures 2 and 3). Historically, landings from the eastern part (SA 561-562) of Georges Bank were taken in the first and second calender quarter (January to June). Since 1993, the contribution of landings from the eastern part of Georges Bank has declined by more than 70% (Table 3). The Canadian fishery for Georges Bank cod opens in June, and the majority of the landings are taken in the third calendar quarter (July-September).

USA landings were taken primarily by otter trawl gear (62%)and line trawl gear (18%) during 1994-1999. In 2000, otter trawl gear accounted for the majority (62%) of the USA landings (Table 4). Canadian landings were taken primarily by the otter trawl (36%) and long line (48%) fisheries during 1994-1999. In 2000, otter trawl gear accounted for 34% and long line gear accounted for 51% of the Canadian landings (Hunt and Hatt, 2001).

Cod landings from Georges Bank, categorized by size as 'scrod' (small) , 'market' (medium), and 'large', continued to be dominated by 'market' cod in both weight (60%) and number (54%) in 2000 (Table 5). Historically, 'market' cod have accounted for 35-60% of the landings by weight.

Commercial Discards

Preliminary estimates of the weight of fish discarded on otter trawl and gill net trips were derived for 1989-2000 using the Sea Sampling Database. Discard ratios were estimated as the amount of cod discarded to the amount kept for catch taken in the western part and the eastern part of Georges Bank. In the otter trawl fishery discard ratios ranged from 0.0 to 0.10 with less discarding occurring in the eastern part than in the western part of Georges Bank (Appendix 1, Table 1a). In the gill net fishery discard ratios ranged from 0.0 to 0.19 but were predominantly less than 0.10 (Appendix 1, Table 1b).

Estimates of discards in the otter trawl and gill net fisheries were also derived using the Vessel Trip Report (VTR) database for 1994-2000. Discard ratios were estimated from a subset of trips (VTRs) that had a history of recording discarded fish of any species (Appendix 1, Table 2). A trip limit of 2000 lb/day or 20,000 lb/trip was implemented in August 1999 and remains in effect at the current time. Comparisons to discard rates reported on VTRs prior to 1999 indicate that discarding did increase in 1999 and 2000. Quarterly discard rates prior to 1999 had been about 1% or less and in 1999 increased to as much as 9% in the otter trawl fishery and 5% in the gill net fishery. In 2000, discard rates were about 2-3 % for both fisheries (Appendix 1, Table 2).

Discard estimates were not included in the assessment due primarily to the lack of data for 1978-1988. In addition, the available Sea Sampling data from 1989-2000 are limited by both inadequate coverage of trips and few biological samples.

Recreational Landings

Recreational cod landings during 1981-2000 ranged between 400 to 9,000 mt, accounting for 1-19% of the total landings (Table 6). Recreational landings were 1,056 mt in 2000, almost three

times the 356 mt landed in 1999. The 2000 recreational landings account for 10.4% of the total (total commercial + recreational) landings, the highest since 1995.

A previous assessment that incorporated recreational landings in the catch at age resulted in slightly elevated stock sizes with little change in fishing mortality or spawning stock biomass estimates from the VPA (O'Brien 1999). The 24th SARC recommended that recreational catches not be included in the assessment analysis at that time because 1) the recreational catch at age is based on very few length samples and may not fully characterize the recreational landings, 2) including the recreational catch at age would require excluding the first three years of the time series given the lack of recreational landings data for 1978-1980, and 3) the minimal difference in estimates of fishing mortality and spawning stock biomass observed in the terminal year from comparable ADAPT formulations that had commercial catch at age only *vs.* commercial plus recreational catch at age (NEFSC 1997) .

Sampling Intensity

Commercial Landings

The numbers of samples taken to characterize the length and age composition of the USA and Canadian commercial cod landings from Georges Bank are summarized in Table 7. Sampling intensity was high in 2000 with 1 sample per 49 mt for the USA (Table 8) and 1 sample per 15 mt for the Canadian fishery. The average number in each length sample was 79 fish for the USA and 194 fish for Canada during 2000. Although overall sampling intensity was high, the spatial and temporal pattern of sampling for USA landings resulted in semi-annual pooling of quarterly samples for the 'large' market category. The sampling for USA landings from the eastern part of Georges Bank (SA 561 and 562) was minimal in 2000 with a total of 2 'scrod' samples. The distribution of sampling by market category (large:4%, market:41%, scrod:54%) does not approximate the distribution of the 2000 landings (by number) as well as in previous years (Table 5).

Recreational Landings

Since 1981, 0.02% of the total recreational landings have been sampled for both weight and length (0.1% of the USA commercial landings were sampled for the same time period). During 1981-2000, the number of fish sampled ranged from 0.01 to 0.06% of the total number landed. In 2000, 0.01% of the fish landed were sampled, a sample of 15 fish.

Commercial Landings at Age

The age composition of the 1978-1993 USA landings was estimated, by market category, from length frequency and age samples pooled by calendar quarter. Landed mean weights were estimated by applying the length-weight equation:

$$\ln \text{Weight (kg,live)} = -11.7231 + 3.0521 \ln \text{Length (cm)} ,$$

to the quarterly length frequency samples, by market category. Numbers landed, by quarter, were estimated by dividing the mean weight into the quarterly landings, by market category, and prorating the total numbers by the corresponding market category sample length frequency. Quarterly age-length keys were then applied to the numbers-at-length to estimate numbers caught at age. Annual estimates of landings at age were obtained by summing values over market category and quarter (Table 9). Derivation of landings by quarter, rather than by month, was performed since not all months had at least two length frequency samples per market category (i.e., minimum desired for monthly catch estimates).

The age composition of the 1994-1996 USA landings was also estimated, by market category, from quarterly length frequency and age samples, but in some years samples were pooled semi-annually due to an insufficient number of samples within a quarter. The landings were dis-aggregated into eastern (SA 561-562) and western Georges Bank (SA 521-522, 525-526, 537-539). The age composition of the USA landings from eastern Georges Bank was estimated by applying USA length frequencies and combined USA and Canadian age samples, while the age composition of the USA landings from western Georges Bank was estimated by applying USA length frequencies and age samples.

The age composition of the 1997-2000 USA landings was estimated in a similar manner, however, due to the lack of length samples from eastern Georges Bank, combined length frequencies were applied. The assumption was made that length frequencies from eastern and western Georges Bank would be similar, therefore, all length frequencies were combined to characterize the eastern component of landings. In addition, for 2000 only, the otter trawl and gill net samples were pooled, and the handline and longline samples were pooled and then applied to the corresponding combined landings. The 1994-2000 landings-at-age was then derived as described above for the 1978-1993 landings-at-age. The eastern and western Georges Bank landings-at-age were combined to obtain the landings-at-age matrix for USA Georges Bank cod landings for 2000 (Table 9). The USA eastern Georges Bank landings-at-age was included in the Canadian assessment of cod in area 5Zj,m (Hunt and Hatt 2000).

Canadian landings-at-age data (Table 10) from the Northeast Peak of Georges Bank (SA 551-552) were provided by J. Hunt (DFO, St. Andrews, NB, pers. comm) for 2000. Canadian and USA data were combined to produce a total landings-at-age matrix for 1978-2000 (Table 11). The USA fishery accounted for 85% and 83% of the total landings by number and weight, respectively in 2000.

Total commercial landings and USA landings in 2000 were dominated by age 4 fish from the 1996 year class in both numbers and weight and by the age 2 fish from the 1998 year class in numbers of fish (Table 12 and Figure 4). In the Canadian fishery the landings were dominated by the 1996 year class in both weight and numbers of fish (Table 12 and Figure 4).

Commercial Mean Weights at Age

Mean lengths and weights at age for ages 1-10+ are summarized for USA, Canadian, and total landings in Tables 9-11. There does not appear to be a consistent trend in mean weight by age during the 23-year time series. The mean weight for age 2 fish in 2000 is the highest in the time series and may be due to the record high number of samples taken for the 'scrod' category. Variability in mean weight of the older fish in recent years may be due to poorer sampling in these years. Beginning year stock mean weights at age, derived from catch mean weights at age (Rivard 1980), are presented in Table 13 and Figure 5.

STOCK ABUNDANCE AND BIOMASS INDICES

Commercial Catch Rates

A general linear model (GLM) was applied to all USA interviewed otter trawl trips landing cod from Georges Bank and South during 1978-1993 to derive standardized fishing effort and commercial landings-per-unit-effort (LPUE) (O'Brien 1999; Mayo *et al.* 1994). Standardized fishing effort and LPUE during 1994-2000 were estimated by applying the re-transformed GLM coefficients (area, quarter, tonnage class, and depth) to the effort estimate of all trips reporting cod landings in the Vessel Trip Reporting (VTR) database (Table 14). Total standardized or 'raised' effort was calculated by dividing total USA landings by the standardized LPUE (Table 15).

Nominal and standardized LPUE exhibit similar trends and, since 1985, are almost equivalent (Table 15, Figure 6). Standardized LPUE peaked in 1980 at 2.9 mt/day fished and declined steadily from 1982 to1987. LPUE increased slightly until 1990 and then declined steadily until 1995. LPUE increased slightly
in 1996 and 1997 and has remained relatively stable through 2000. LPUE is estimated to be about 0.5 mt/day fished in 2000. Standardized raised effort and nominal effort have similar trends in general, although effort trends did diverge in 1989, 1991, and 1995 (Figure 7). Raised effort more than doubled from 1978 to 1985, declined in 1986, and then increased to historic high levels until 1991. Standardized raised effort has since declined and in 2000 is similar to estimates for the early 1980s.

Under the current management restrictions of days at sea (DAS), greater mesh sizes, closed areas since December of 1994, mandatory logbooks for collection of effort data, implemented in May 1994, and other management measures, the 1994-2000 effort data may no longer be equivalent to the historic 1978-1993 effort series. Additionally, the effort estimates for 1994-2000 were derived from provisional data. The LPUE series was, therefore, not used as an index of abundance in the subsequent calibration of the VPA.

Research Vessel Survey Indices

USA Surveys
NEFSC spring and autumn research vessel bottom trawl surveys have been conducted off the Northeast coast of the USA since 1968 and 1963, respectively (Azarovitz 1981). Indices of abundance (stratified mean number per tow) and biomass (stratified mean weight per tow (kg)) were estimated from both the spring and autumn surveys for Ge.orges Bank cod (strata 13-25) during 1963-2000 (Table 16). All surveys were conducted with a '36 Yankee' trawl except for spring surveys during 1973-1981 when a '41 Yankee' trawl was employed. No adjustments were made for gear chnages, however, the indices were adjusted for differences in fishing power of the *Albatross IV* and the *Delaware II*, and for differences between catchability of BMV and polyvalent doors, introduced in 1985. The fishing power coefficients of 0.79 and 0.67 and the door conversion coefficients of 1.56 and 1.62 were applied to abundance and biomass indices, respectively (NEFSC 1991). The entire time series for both spring and autumn was re- estimated in 2001 to include any large tows that had previously been excluded, and these indices were used in the calibration of the VPA. Standardized catch per tow at age in number for NEFSC spring and autumn surveys and the catch per tow at age for Canadian spring surveys are presented in Appendix 2: Tables 1 and 2.

NEFSC spring and autumn catch per tow biomass and abundance indices show similar trends throughout the time series (Table 16, Figures 8-9). Survey biomass indices were stable between 1963 and 1971 and then increased to a record high in 1973. Biomass indices generally declined over the next two decades, reaching record low levels between 1991 and 1994. The index increased in 1995, and has fluctuated in recent years. The spring and autumn indices indicate an opposite trend in biomass and a similar increasing trend in numbers, in 2000. Both the spring and autumn biomass and abundance indices remained well below average in 2000. Autumn survey abundance indices for both ages 1 and 2 indicate above-average recruitment of the 1965, 1966, 1971, 1975, 1977, 1980, 1985, and 1988 year classes (Appendix 2: Table 1; Figure 10-11). As 2 year old fish, the 1993 year class was above average. The magnitude of an above-average year class has been declining over time, particularly noticeable in the recruits at age 1 (Figure 12).

Canadian Surveys
Canadian research vessel bottom trawl surveys have been conducted in the spring on Georges Bank since 1986. Survey abundance indices have fluctuated and have generally declined during 1990-2001 (Appendix 2: Table 2, Figure 9). Abundance indices for ages 1 and 2 indicate above average recruitment of the 1985, 1988, and 1990 year classes and below average recruitment for the 1991 - 1998 year classes (Figure 13). In 1993 and 1994, the Canadian survey did not sample the western part of Georges Bank (Canadian strata 5Z5 - 5Z7), therefore, the indices of stratified mean number per tow at age in those years were not used in the calibration of the VPA.

MORTALITY

Natural Mortality

Instantaneous natural mortality (M) of Georges Bank cod is assumed to be 0.2 , the conventional value of M used for all Northwest Atlantic cod stocks (Paloheimo and Koehler 1968, Pinhorn 1975, Minet 1978)

Total Mortality

Estimates of instantaneous total mortality (Z) were derived from both NEFSC spring and autumn survey catch per tow indices (Appendix 2: Table 1). Total mortality was estimated with spring data using Heincke's method (Ricker 1975) as:

ln (Σ age 4+ for years i to j/ Σ age 5+ for years i+1 to j+1).

Total mortality was estimated with autumn data as :

ln (Σ age 3+ for years i-1 to j-1/ Σ age 4+ for years i to j).

A three year moving average was fit to each survey series (Figure 14a-14b) and also to the sequential spring and autumn mortality estimates (Figure 14c). The estimates are highly variable throughout the time series, although there appears to be a trend of increasing Z from the mid-1970s to the mid-1990s.

ESTIMATES OF STOCK SIZE AND FISHING MORTALITY

Virtual Population Analysis Calibration

The ADAPT calibration method (Parrack 1986, Gavaris 1988, Conser and Powers 1990) was used to derive estimates of instantaneous fishing mortality (F) in 2000 and beginning-year stock sizes in 2001. The landings at age data used in the VPA consisted of combined USA and Canadian commercial landings from 1978-2000 for ages 1-9 with a 10+ age group (Table 11). The indices of abundance used to calibrate the VPA included the NEFSC 1978-2000 spring survey indices for ages 1-8, the Canadian 1986-1992 and 1995-2001 spring survey indices for ages 1-8, and the NEFSC 1977-2000 autumn survey indices for ages 0-6 (Appendix 2: Tables 1 and 2). The NEFSC spring survey was dis-aggregated into two series based on the use of the Yankee #36 or #41 trawls. The NEFSC employed the #41 trawl during 1973 to 1981. The spring indices were split into a index series for 1978-1981 for the #41 trawl and a series for 1982-2000 for the #36 trawl. The autumn survey indices were lagged forward one age and one year to match cohorts in the subsequent year. The transformed (ln) observed survey indices, standardized to the mean, generally show similar trends between surveys (Figure 15).

The base ADAPT formulation provided stock size estimates for ages 1-8 in 2001 and corresponding unweighted F estimates for ages 1-7 in 2000. Assuming full recruitment at age 4,

the unweighted F on ages 8 and 9 in the terminal year was estimated as the average of the F on ages 4-8. The unweighted F on age 9 in all years prior to the terminal year was derived from weighted estimates of Z for ages 4-9. For all years, the unweighted F on age 9 was applied to the 10+ age group. Spawning stock size estimates were derived by applying pooled maturity ogives for 1978-1981, 1982-1985, 1986-1989, 1990-1993, 1994-1996, and 1997-2000 (Table 17) derived from NEFSC spring research survey data using methodology described in O'Brien (1990). Due to the insufficiency of the annual number of samples, data for adjacent years that had similar annual median maturity at length and age were pooled to derive a more representative ogive.

The final ADAPT calibration results are presented in Appendix 3 for estimates of F, stock size, and SSB at age and are summarized in Table 17. Estimates of stock size were more precise for ages 2-8, with CVs ranging from 0.31 to 0.37, than for age 1 (CV=0.76). The residual patterns of the indices did not show any strong trends for the four surveys (Figure 16).

Average fishing mortality (ages 4-8) in 2000 was estimated at 0.22 (18% exploitation), a decrease from the 1999 estimate of 0.45 (33% exploitation) (Table 17, Figure 17a). The 2000 estimate of SSB was 29,000 mt, an increase of about 6% from the 1999 estimate (Table 17, Figure 18).

Since 1978, recruitment at age 1 has ranged from 3 million (1997 year class) to 43 million (1985 year class). The 2000 year class is estimated to be about 1.7 million fish at age 1, well below the long term average of 16 million fish and the lowest in the time series. The most recent above average year class occurred in 1990 (18 million age 1 fish). The 1996 year class (10 million age 1 fish), although below average, is the strongest since 1990. The 1994 and 1997 year classes are the poorest of the 23-year time series (Table 17, Figure 18). The survival ratio of recruits to spawning stock biomass indicates a trend similar to the estimates of recruits at age 1, however, after 1991 the relationship is not as apparent (Figure 19). In the last decade, low recruitment at age 1 has been associated with low SSB in contrast to the earlier time period (1978-1990) when higher recruitment was realized from higher SSB (Figure 20).

In the terminal year, fishing mortality estimates from the VPA indicate a pronounced domed partial recruitment with the highest F occurring on age 3 fish, the 1997 year class. This pattern of domed partial recruitment. although not as strong and more variable, appears to have occurred since 1994. Alternative ADAPT runs that estimated age 9 as well as ages 1-8 did not influence this pattern. The pattern in the terminal year may be influenced by having only two surveys (DFO spring ages 1-9 and NEFSC autumn ages 1-6) in the calibration instead of three, and only one index for the larger age 7 and age 8 fish.

The variable domed partial recruitment pattern since 1994 may be influenced by both a shift in fishing pattern and by a shift in the catch at age matrix. Since 1994 , year round closures have been in effect for both Area I and Area II. Fishing patterns may have shifted such that the older fish are no longer as available to the fishery as they would have been before the closure. Also, since 1994 sampling for larger fish has not been adequate (Table 8) and the lack of samples may have caused a biased characterization of the landings to the smaller ‘market’ and ‘scrod’ fish in the catch at age.

In addition to the estimate of unweighted F for ages 4-8 , an alternative F weighted by population size for ages 3-8 is also presented (Figure 17b).

Precision of F and Stock Biomass Estimates

A conditional non-parametric bootstrap procedure (Efron 1982) was used to evaluate the uncertainty associated with the estimates of fishing mortality and spawning stock biomass from the final VPA. One thousand bootstrap iterations were performed to estimate standard errors, coefficients of variation (CVs), and bias for age 1-8 stock size estimates at the start of 2001, the catchability estimates (q) for each index of abundance used in calibrating the VPA, and the F at ages 1-7 in 2000 (Appendix 4).

The bootstrap results indicate that stock sizes were well estimated for ages 2-8 with coefficients of variation (CVs) varying between 0.25 and 0.28. Stock size for age 1 was not well estimated with a CV of 0.83. The CVs for the catchability coefficients for all indices ranged between 0.11 and 0.31. The fully recruited F for ages 4+ was well estimated with a CV=0.13 . The bootstrap estimate was almost equivalent to the non-linear least squares (NLLS) estimate (Appendix 4). The distribution of the 2000 F estimates, derived from 1,000 bootstrap iterations, ranged from 0.16 to 0.39. There is an 80% probability that the F in 2000 is between 0.18 and 0.25 (Figure 21).

The spawning stock biomass was reasonably well estimated (CV=0.10) and slightly higher than the NLLS estimate of 29,000 mt (Appendix 4). The distribution of the 2000 spawning stock biomass estimates, derived from the 1000 bootstrap iterations, ranged from 22,000 to 40,000 mt (Figure 22). There is an 80% probability that the 2000 SSB is between 25,000 and 32,000 mt (Figure 22).
The distribution of the 2000 mean biomass estimates, derived from 1000 bootstrap iterations, ranged from 30,000 to 54,000 mt (Figure 23). There is a 80% probability that the mean biomass in 2000 was between 33,000 mt and 43,000 mt.

Retrospective Analysis

A retrospective analysis was performed to evaluate how well the current ADAPT calibration would estimate recruits at age 1, spawning stock biomass, and fishing mortality for the six years prior to the current assessment, 1996-2000. Convergence of the estimates generally occurs after about six years (Figures 24A-C). With the exception of the1998 value, the retrospective analysis indicates a pattern of underestimating the recruits at age 1 (Figure 24A). Estimates of SSB are consistently overestimated, (Figure 24B) and estimates of fishing mortality (F) are consistently underestimated (Figure 24C). Factors influencing the retrospective pattern may include mis-reporting of catch, immigration or emigration, an unrepresentative estimate of natural mortality, and mis-specification of the model.

Fishing mortality in 2000 was projected to be 0.22 (= status quo F in 1999) and landings were projected to be 7,658 mt (NDWG, NESAW 2001). The current assessment estimated F in 2000 to be 0.22 and total landings were 9,189 mt (USA landings were 7,617 mt).

BIOLOGICAL REFERENCE POINTS

Yield and Spawning Stock Biomass per Recruit

Yield, total stock biomass, and spawning stock biomass per recruit were estimated using methodology of Thompson and Bell (1934). The input data and the results presented were derived in the 1998 assessment (O'Brien and Cadrin 1999). Estimates were based on arithmetic means of the 1995-1997 catch mean weight at age and stock mean weight at age and the 1994-1997 maturity ogive. A partial recruitment (PR) vector was calculated as the geometric mean of the 1994-1997 F estimates from the final VPA to reflect the change in mesh regulations in 1994. The final exploitation pattern was derived by dividing the PR by the geometric mean of the unweighted F for ages 4-8 and smoothed by applying full exploitation at ages 4 and older.

Input values for the yield-per-recruit analysis are provided in Table 18, and results of the analysis are provided in Table 18 and Figure 25. The resulting biological reference points were $F_{0.1}$= 0.18 and F_{max} = 0.34.

Projections

Short term projections will not be presented in this assessment. These analyses will be performed at a later date by the Multispecies Monitoring Committee (MMC) of the New England Fisheries Management Council.

SFA Control Rule

The Sustainable Fisheries Act (SFA) control rule for Georges Bank cod is based on B_{MSY} (108,000 mt) and states that when the stock biomass is between 1/4 and ½ B_{MSY} (27,000-54,000 mt), the threshold mortality rate is defined by a five year rebuilding time period, and if the stock is between 1/2 B_{MSY} and B_{MSY} the rebuilding time period is10 years. In 2000, mean biomass is estimated to have been about 38,500 mt, less than ½ B_{MSY}. Applying the 2000 mean biomass to the target control rule indicates that the stock should be fished at a biomass weighted F of about 0.11 (Figure 26).

CONCLUSIONS

The Georges Bank cod stock remains at a low biomass level. Biomass indices derived from research surveys indicate that the stock remains below the long term average of the 37 year time series. Fishing mortality (ages 4-8) declined from record-high levels in 1993 and 1994 (1.1,1.4) to 0.22 in 2000. Spawning stock biomass declined from about 93,000 mt in the early 1980s and reached a record-low of 18,000 mt in 1995. As fishing mortality has declined, the SSB has gradually increased, primarily due to somatic growth, but was still near record-low size (29,000 mt) in 2000. Trends in mean biomass have been similar to the trends in SSB. Recruiting year

classes have been well below the long term average (16 million fish) since 1991. The 2000 year class is estimated to be about 2 million fish, about 13% of the long-term average.

Accounting for the estimation uncertainty associated with SSB (29,000 mt), mean biomass (39,000 mt), and F (0.22) estimates, there is an 80% probability that SSB was between 25,000 and 33,000 mt, that mean biomass was between 33,000 mt and 43,000 mt, and that F was between 0.18 and 0.25 in 2000. Retrospective analysis indicates a pattern of inconsistencies in which estimates of SSB in the last year of the VPA are greater than the converged estimates of SSB. Similarly, F estimates in the last year of the VPA are less than the converged estimates of F.

Recovery of the stock will depend on further reductions in fishing mortality as well as improved recruitment.

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Table 1. History of USA management of Atlantic cod.

1953-1977	ICNAF Era
1953	Minimum mesh in body and codend - 4 ½".
1970	Areas 1(A) and 2(B) closed during haddock spawning season; from March through April. 1972-1974 Areas 1(A) and 2(B) closure extended to March through May. Total Allowable Catch (TAC) regulations implemented for Div. 5Z cod on an annual basis beginning in 1973-76; set at 35,000 mt per year.
1975	Areas 1(A) and 2(B) closure extended to February through May
1977-Present	Extended Jurisdiction and National Management
1977	USA Magnuson-Stevens Fishery Conservation and Management Act of 1976 (FCMA) effective.
1977-1982	Fishery Management Plan (FMP) for Atlantic groundfish (cod, haddock and yellowtail fl.); mesh size of 5 1/8 ", seasonal spawning closure (areas 1 and 2), quotas established on annual, quarterly and vessel class basis, eventually leading to trip limits.
1982-1985	The "Interim Plan" for Atlantic groundfish; eliminated all catch controls, retained closed area and mesh size regulations, implemented minimum landings sizes.
1983	Mesh size increased to 5½“ diamond.
1984 October	The 'Hague' line established separate fishing zones for the USA and Canada in the Gulf of Maine and on Georges Bank.
1986 September	Fishery Management Plan for the Northeast Multispecies Fishery Effective; Areas 1 and 2 closed during February 1-May 31. Mesh size increased to 5 ½" (yr 1+ 2), 6 “ (yr 3) Minimum size landed - commercial 17 “ (yr 1), 19 “(yr 2+) Recreational 15" (yr 1),17" (yr 2+3), 19" (yr 4+)
1989 January	Amendment # 2 - seasonal large-mesh area for Nantucket Shoals winter fishery Eliminate scheduled 6" mesh increase. Minimum size in recreational = commercial = 19 “
1993	Area 2 closure in effect from Jan 1-June 30.

1994 January	Amendment 5: 50% reduction in effort (5-7 years) Expanded Area 2 closure; Area 1 closure not in effect. Days at sea (DAS) monitoring; mandatory logbook reporting.
May	6" diamond or square mesh restriction (delayed from March 1). Fishing year May-April.
1994 December	Both Area 1,2 and Nantucket Lightship Area closed year-round until *further notice*.
1996 October	Sustainable Fisheries Act (SFA) effective.
May	Recreational minimum size increases to 20"
July 1	Amendment 7 effective. Establishes target TACs, rebuilding target of $F_{0.1}$
1997 May	Recreational minimum size increases to 21"
1999 May	Minimum mesh size increase to 6 ½" square, remains at 6" diamond
June 15	Scallopers allowed limited access to Area II
November 15	Amendment 9 effective; Redefines over fishing definitions to comply with SFA
August 15	Trip limit: 2000 lb/ day, 20,000 lb/trip with trigger when approach TAC
2000 May	SQ Trip limit: 2000 lb/ day, 20,000 lb/trip without trigger
	Additional closures on Georges Bank for May only (109-114, 98-99), Adjacent to Area 1

Year	USA Target TAC (May $_{yr}$ - April $_{yr+1}$)	Assumed Canadian TAC	Canadian TAC -5Zjm (June-Dec $_{yr}$)
1996	1,851 mt	1,000 mt	2,000 mt
1997	3,646 mt	2,000 mt	3,000 mt
1998	4,692 mt	3,000 mt	1,900 mt
1999	5,354 mt	1,900 mt	1,800 mt
2000	4,145 mt	1,900 mt	1,600 mt
2001	4,900 mt		(2,200 mt includes U.S.)

Table 2. Commercial landings (metric tons, live) of Atlantic cod from the Georges Bank and South (NAFO Division 5Z and Subarea 6) stock, 1960 - 2000 (* = Provisional data).

	Country						
Year	USA	Canada	USSR	Spain	Poland	Other	Total
1960	10834	19	-	-	-	-	10853
1961	14453	223	55	-	-	-	14731
1962	15637	2404	5302	-	143	-	23486
1963	14139	7832	5217	-	-	1	27189
1964	12325	7108	5428	18	48	238	25165
1965	11410	10598	14415	59	1851	-	38333
1966	11990	15601	16830	8375	269	69	53134
1967	13157	8232	511	14730	-	122	36752
1968	15279	9127	1459	14622	2611	38	43136
1969	16782	5997	646	13597	798	119	37939
1970	14899	2583	364	6874	784	148	25652
1971	16178	2979	1270	7460	256	36	28179
1972	13406	2545	1878	6704	271	255	25059
1973	16202	3220	2977	5980	430	114	28923
1974	18377	1374	476	6370	566	168	27331
1975	16017	1847	2403	4044	481	216	25008
1976	14906	2328	933	1633	90	36	19926
1977	21138	6173	54	2	-	-	27367
1978	26579	8778	-	-	-	-	35357
1979	32645	5978	-	-	-	-	38623
1980	40053	8063	-	-	-	-	48116
1981	33849	8499	-	-	-	-	42348
1982	39333	17824	-	-	-	-	57157
1983	36756	12130	-	-	-	-	48886
1984	32915	5763	-	-	-	-	38678
1985	26828	10443	-	-	-	-	37271
1986	17490	8411	-	-	-	-	25901
1987	19035	11845	-	-	-	-	30880
1988	26310	12932	-	-	-	-	39242
1989	25097	8001	-	-	-	-	33098
1990	28193	14310	-	-	-	-	42503
1991	24175	13455	-	-	-	-	37630
1992	16855	11712	-	-	-	-	28567
1993	14594	8519	-	-	-	-	23113
1994	9893*	5276	-	-	-	-	15169
1995	6759*	1100	-	-	-	-	7859
1996	7020*	1885	-	-	-	-	8905
1997	7537*	2898	-	-	-	-	10435
1998	6959*	1873	-	-	-	-	8832
1999	8061*	1819	-	-	-	-	9880
2000	7617*	1572	-	-	-	-	9189

Table 3. Distribution of USA commercial Atlantic cod landings by quarter and area (Georges Bank, Georges Bank West, Georges Bank East) in metric tons and percentage of total landings, 1978-2000 (SA=statistical area).

Landings (metric tons, live)

Year	Georges Bank (Division 5Z and Subarea 6) Quarter 1	2	3	4	TOTAL	Georges Bank West SA 521-522, 525-526, 537-539 & Subarea 6 Quarter 1	2	3	4	TOTAL	Georges Bank East SA 561-562 Quarter 1	2	3	4	TOTAL
1978	5494	8435	5925	5603	25457	3519	6523	5130	4783	19955	1975	1912	795	820	5502
1979	4480	10067	10136	7074	31757	2729	8019	8569	6032	25349	1751	2048	1567	1042	6408
1980	7104	13078	12111	6735	39028	3755	11366	11101	6388	32610	3349	1712	1010	347	6418
1981	7482	11047	9027	5471	33027	4037	9178	7035	4686	24936	3445	1869	1992	785	8091
1982	6801	10936	12204	8502	38443	3500	8768	9691	7918	29877	3301	2168	2513	584	8566
1983	7655	10793	10617	6870	35935	4528	8822	8258	5755	27363	3127	1971	2359	1115	8572
1984	8907	9820	8252	5058	32037	3895	7100	6226	4266	21487	5012	2720	2026	792	10550
1985	6725	8537	5756	5077	26095	3206	7064	4719	4465	19454	3519	1473	1037	612	6641
1986	6234	5526	3207	2309	17276	2625	3759	3012	2184	11580	3609	1767	195	125	5696
1987	4089	6326	4334	4006	18755	2651	4012	3976	3322	13961	1438	2314	358	684	4794
1988	7235	7305	5714	5781	26035	3641	4500	5255	4993	18389	3594	2805	459	788	7646
1989	5614	8767	6163	4243	24787	3707	5683	5809	3405	18604	1907	3084	354	838	6183
1990	5949	9102	7012	5781	27844	3616	5650	6553	5610	21429	2333	3452	459	171	6415
1991	6323	9828	4264	3575	23990	4275	6070	4120	3172	17637	2048	3758	144	403	6353
1992	4528	5514	3258	3473	16773	2574	3340	3068	2711	11693	1954	2174	190	762	5080
1993	3553	5140	2547	3200	14440	2242	3148	2314	2709	10413	1311	1992	233	491	4027
1994	2595	3529	2114	1615	9853	2488	2837	1882	1418	8624	107	692	233	197	1229
1995	1348	2248	2002	1161	6759	1164	1830	1972	1128	6094	185	419	29	33	665
1996	1375	2863	1858	924	7020	1206	2411	1789	840	6246	169	452	69	83	773
1997	1097	3482	1849	1108	7537	1010	3062	1822	1086	6980	88	420	27	21	557
1998	1309	2860	1432	1305	6907	1269	2148	1396	1292	6106	41	712	36	13	801
1999	1588	3649	1740	1084	8061	1338	2783	1715	1075	6911	250	867	25	9	1150
2000	1663	2795	1690	1469	7617	1426	2414	1669	1446	6955	236	382	21	23	662

Percentage of Annual Landings

Year	Georges Bank (Div. 5Z and 6) Quarter 1	2	3	4	TOTAL	Georges Bank West SA 521-522, 525-526, 537-539 and Div. 6 Quarter 1	2	3	4	TOTAL	Georges Bank East SA 561-562 Quarter 1	2	3	4	TOTAL	GRAND TOTAL
1978	21.6	33.1	23.3	22.0	100.0	13.8	25.6	20.2	18.8	78.4	7.8	7.5	3.1	3.2	21.6	100.0
1979	14.1	31.7	31.9	22.3	100.0	8.6	25.3	27.0	19.0	79.8	5.5	6.4	4.9	3.3	20.2	100.0
1980	18.2	33.5	31.0	17.3	100.0	9.6	29.1	28.4	16.4	83.6	8.6	4.4	2.6	0.9	16.4	100.0
1981	22.7	33.4	27.3	16.6	100.0	12.2	27.8	21.3	14.2	75.5	10.4	5.7	6.0	2.4	24.5	100.0
1982	17.7	28.4	31.7	22.1	100.0	9.1	22.8	25.2	20.6	77.7	8.6	5.6	6.5	1.5	22.3	100.0
1983	21.3	30.0	29.5	19.1	100.0	12.6	24.5	23.0	16.0	76.1	8.7	5.5	6.6	3.1	23.9	100.0
1984	27.8	30.7	25.8	15.8	100.0	12.2	22.2	19.4	13.3	67.1	15.6	8.5	6.3	2.5	32.9	100.0
1985	25.8	32.7	22.1	19.5	100.0	12.3	27.1	18.1	17.1	74.6	13.5	5.6	4.0	2.3	25.4	100.0
1986	36.1	32.0	18.6	13.4	100.0	15.2	21.8	17.4	12.6	67.0	20.9	10.2	1.1	0.7	33.0	100.0
1987	21.8	33.7	23.1	21.4	100.0	14.1	21.4	21.2	17.7	74.4	7.7	12.3	1.9	3.6	25.6	100.0
1988	27.8	28.1	21.9	22.2	100.0	14.0	17.3	20.2	19.2	70.6	13.8	10.8	1.8	3.0	29.4	100.0
1989	22.6	35.4	24.9	17.1	100.0	15.0	22.9	23.4	13.7	75.1	7.7	12.4	1.4	3.4	24.9	100.0
1990	21.4	32.7	25.2	20.8	100.0	13.0	20.3	23.5	20.1	77.0	8.4	12.4	1.6	0.6	23.0	100.0
1991	26.4	41.0	17.8	14.9	100.0	17.8	25.3	17.2	13.2	73.5	8.5	15.7	0.6	1.7	26.5	100.0
1992	27.0	32.9	19.4	20.7	100.0	15.3	19.9	18.3	16.2	69.7	11.6	13.0	1.1	4.5	30.3	100.0
1993	24.6	35.6	17.6	22.2	100.0	15.5	21.8	16.0	18.8	72.1	9.1	13.8	1.6	3.4	27.9	100.0
1994	26.3	35.8	21.5	16.4	100.0	25.2	28.8	19.1	14.4	87.5	1.1	7.0	2.4	2.0	12.5	100.0
1995	20.0	33.3	29.6	17.2	100.0	17.2	27.1	29.2	16.7	90.2	2.7	6.2	0.4	0.5	9.8	100.0
1996	19.6	40.8	26.5	13.2	100.0	17.2	34.3	25.5	12.0	89.0	2.4	6.4	1.0	1.2	11.0	100.0
1997	14.6	46.2	24.5	14.7	100.0	13.4	40.6	24.2	14.4	92.6	1.2	5.6	0.4	0.3	7.4	100.0
1998	19.0	41.4	20.7	18.9	100.0	18.4	31.1	20.2	18.7	88.4	0.6	10.3	0.5	0.2	11.6	100.0
1999	19.7	45.3	21.6	13.4	100.0	16.6	34.5	21.3	13.3	85.7	3.1	10.7	0.3	0.1	14.3	100.0
2000	21.8	36.7	22.2	19.3	100.0	18.7	31.7	21.9	19.0	91.3	3.1	5.0	0.3	0.3	8.7	100.0

Table 4. Distribution of USA commercial landings (metric tons, live) of Atlantic cod from Georges Bank and South (NAFO Division 5Z and Subarea 6), by gear type, 1965-1999. The percentage of total USA commercial landings of Atlantic cod from Georges Bank, by gear type, is also presented for each year. Data only reflect Georges Bank cod landings that could be identified by gear type.

	Landings (metric tons, live)						Percentage of Annual Landings					
Year	Otter Trawl	Sink Gill Net	Line Trawl	Handline	Other Gear	Total	Otter Trawl	Sink Gill Net	Line Trawl	Handline	Other Gear	Total
1965	10251	0	582	505	9	11347	90.3	-	5.1	4.5	0.1	100.0
1966	10206	0	787	757	19	11769	86.7	-	6.7	6.4	0.2	100.0
1967	10915	0	894	704	9	12522	87.2	-	7.1	5.6	0.1	100.0
1968	12084	0	936	524	<1	13544	89.2	-	6.9	3.9	-	100.0
1969	13194	0	1371	387	<1	14952	88.2	-	9.2	2.6	-	100.0
1970	11270	0	1676	404	<1	13350	84.4	-	12.6	3.0	-	100.0
1971	12436	0	2334	230	2	15002	82.9	-	15.6	1.5	-	100.0
1972	10179	0	2071	217	10	12477	81.6	-	16.6	1.7	0.1	100.0
1973	12431	3	2185	206	21	14846	83.7	-	14.7	1.4	0.2	100.0
1974	14078	3	2548	11	9	16649	84.6	-	15.3	0.1	-	100.0
1975	12069	0	2435	84	4	14592	82.7	-	16.7	0.6	-	100.0
1976	12257	4	1519	153	5	13938	88.0	-	10.9	1.1	-	100.0
1977	18529	30	912	83	22	19576	94.7	0.2	4.7	0.4	0.1	100.0
1978	20862	81	1569	1180	59	23751	87.8	0.3	6.6	5.0	0.3	100.0
1979	26562	620	2707	860	159	30908	85.9	2.0	8.8	2.8	0.5	100.0
1980	32479	4491	1102	0	273	38345	84.7	11.7	2.9	-	0.7	100.0
1981	27694	3515	120	584	197	32110	86.2	10.9	0.4	1.8	0.6	100.0
1982	33371	2935	385	624	210	37525	88.9	7.8	1.0	1.7	0.6	100.0
1983	30981	1812	831	441	81	34146	90.7	5.3	2.4	1.3	0.3	100.0
1984	26161	2573	366	753	197	30050	87.1	8.6	1.2	2.5	0.6	100.0
1985	21444	2482	436	284	163	24809	86.4	10.0	1.8	1.1	0.7	100.0
1986	13576	1679	692	305	95	16347	83.0	10.3	4.2	1.9	0.6	100.0
1987	13711	1522	1636	222	71	17162	79.9	8.9	9.5	1.3	0.4	100.0
1988	20296	1864	1950	232	116	24458	83.0	7.6	8.0	0.9	0.5	100.0
1989	17946	3150	1583	119	91	22889	78.4	13.8	6.9	0.5	0.4	100.0
1990	21707	2316	1252	395	133	25803	84.1	9.0	4.9	1.5	0.5	100.0
1991	17892	2171	1919	286	180	22448	79.7	9.7	8.5	1.3	0.8	100.0
1992	11696	1747	1709	186	114	15452	75.7	11.3	11.1	1.2	0.7	100.0
1993	10893	1321	1316	62	78	13670	79.7	9.7	9.6	0.4	0.6	100.0
1994	7139	1318	1372	-	21	9850	72.5	13.4	13.9	-	0.2	100.0
1995	3780	1300	1660	-	18	6758	55.9	19.2	24.6	-	0.3	100.0
1996	4047	1552	1413	-	6	7018	57.7	22.1	20.1	-	0.1	100.0
1997	4583	1595	1331	-	28	7537	60.8	21.2	17.7	-	0.3	100.0
1998	4083	858	1995	-	23	6959	58.6	12.3	28.7	-	0.4	100.0
1999	4760	1452	1831	-	18	8061	59.1	18.0	22.7	-	0.2	100.0
2000	4227	1635	1238	-	18	7617	62.1	21.5	16.3	-	0.2	100.0

Otter trawl includes tonnage from pair trawls in 1990 (849 t), 1991 (1068 t), 1992 (1149 t) and 1993 (1352 t).

Handline included with line trawl, 1994-2000.

Table 5. Percentage, by weight and number of fish landed, of USA commercial Atlantic cod landings from Georges Bank and South (NAFO Division 5Z and Subarea 6), by market category, 1964 - 2000. Percent values, by number, are only available from 1978 onwards.

	Percentage by Weight				Percentage by Number			
Year	Large	Market	Scrod	Total [a]	Large	Market	Scrod	Total [a]
1964	45	47	8	100	-	-	-	-
1965	56	40	3	100	-	-	-	-
1966	53	37	10	100	-	-	-	-
1967	41	42	16	100	-	-	-	-
1968	34	46	19	100	-	-	-	-
1969	27	57	16	100	-	-	-	-
1970	30	62	8	100	-	-	-	-
1971	40	51	9	100	-	-	-	-
1972	37	53	10	100	-	-	-	-
1973	24	40	36	100	-	-	-	-
1974	24	59	17	100	-	-	-	-
1975	28	62	10	100	-	-	-	-
1976	34	48	18	100	-	-	-	-
1977	26	39	34	100	-	-	-	-
1978	29	60	11	100	14	64	22	100
1979	37	55	8	100	20	57	23	100
1980	42	47	11	100	20	53	27	100
1981	37	51	12	100	13	56	31	100
1982	31	47	22	100	10	42	48	100
1983	25	53	22	100	9	48	43	100
1984	32	56	12	100	13	60	27	100
1985	28	47	25	100	10	35	55	100
1986	31	48	21	100	11	46	43	100
1987	25	38	37	100	8	27	65	100
1988	24	48	28	100	9	43	48	100
1989	24	54	22	100	10	49	41	100
1990	23	45	32	100	9	36	55	100
1991	31	50	19	100	14	49	37	100
1992	31	42	27	100	12	37	51	100
1993	28	43	29	100	10	39	51	100
1994	27	52	21	100	11	49	40	100
1995	26	49	25	100	11	40	49	100
1996	23	57	20	100	12	54	34	100
1997	27	55	18	100	13	51	36	100
1998	25	50	25	100	10	44	46	100
1999	23	56	21	100	10	53	37	100
2000	20	60	20	100	9	54	37	100

[a] Includes landings of 'mixed' cod.

Table 6. Estimated number (000's) and weight (metric tons, live) of Atlantic cod caught by marine recreational fishermen from the Georges Bank and South (NAFO Division 5Z and Subarea 6) stock during 1979 - 2000.[1]

	Total Cod Caught		Total Cod Retained (excluding those caught and released)			
Year	Number (000's)	Weight (mt)	Number (000's)	Weight (mt)	Mean Weight (kg)	Percent of Total Landings
1979	393	580	393	580	1.476	1.5
1980	186	471	133	270	2.523	1.0
1981	1749	6265	1695	6074	3.161	12.5
1982	1650	4582	1600	4444	1.022	7.2
1983	1885	5994	1709	5435	2.860	10.0
1984	499	1385	464	1289	2.603	3.2
1985	2144	9075	2054	8693	3.619	18.9
1986	354	1060	291	872	2.311	3.3
1987	472	797	434	734	2.539	2.3
1988	1321	4368	1102	3643	3.096	8.5
1989	567	1979	404	1411	3.517	4.1
1990	586	989	463	782	2.728	1.8
1991	485	1908	333	1308	3.356	3.4
1992	265	556	193	405	2.046	1.4
1993	1106	2856	755	1948	1.864	7.8
1994	437	1458	303	1010	2.140	6.2
1995	742	2080	471	1320	2.272	14.4
1996	235	817	174	603	3.059	6.3
1997	392	1220	247	769	2.591	6.9
1998	818	1724	244	515	3.018	5.5
1999	419	1343	111	356	2.348	3.5
2000	702	2638	281	1056	3.147	10.4

[1] 1981 to present derived from new expanded catch methodology from Marine Recreational Fishery Statistics Survey (MRFSS) methodology (1 January 1997).

Table 7. USA and Canadian sampling of commercial Atlantic cod landings from the Georges Bank and South cod stock (NAFO Division 5Z and Subarea 6), 1978 - 2000.

	USA				Canada			
	Length Samples		Age Samples		Length Samples		Age Samples	
Year	No.	# Fish Measured	No.	# Fish Aged	No.	# Fish Measured	No.	# Fish Aged
1978	88	6841	76	1463	29	7684	29	1308
1979	80	6973	79	1647	13	3991	12	656
1980	69	4990	67	1119	10	2784	10	536
1981	57	4304	57	1231	17	4147	16	842
1982	151	11970	147	2579	17	4756	8	858
1983	146	12544	138	2945	15	3822	14	604
1984	100	8721	100	2431	7	1889	7	385
1985	100	8366	100	2321	29	7644	20	1062
1986	94	7515	94	2222	19	5745	19	888
1987	80	6395	79	1704	33	9477	33	1288
1988	76	6483	76	1576	40	11709	40	1984
1989	66	5547	66	1350	32	8716	32	1561
1990	83	7158	83	1700	40	9901	40	2012
1991	88	7708	88	1865	45	10873	45	1782
1992	77	6549	77	1631	48	10878	48	1906
1993	82	6636	82	1598	51	12158	51	2146
1994	58	4688	54	1064	104	25845	101	1268
1995	40	2879	40	778	36	11598	36	548
1996	55	4600	54	1080	129	26663	129	879
1997	80	6638	80	1581	118	31882	38	1244
1998	80	7076	81	1545	139	26549	139	1720
1999	68	5987	67	1503	84	24954	84	918
2000	155	12219	154	2951	107	20782	107	1436

Table 8. USA sampling of commercial Atlantic cod landings, by market category, for the Georges Bank and South cod stock (NAFO Division 5Z and Subarea 6), 1978 - 2000.

	Number of Samples, by Market Category & Quarter															Annual Sampling Intensity			
	Scrod					Market					Large					No. of Tons Landed/Sample			
Year	Q1	Q2	Q3	Q4	∑	Q1	Q2	Q3	Q4	∑	Q1	Q2	Q3	Q4	∑	Scrd	Mkt	Lge	∑
1978	17	15	6	3	**41**	9	12	13	9	**43**	1	0	1	2	**4**	69	374	1922	302
1979	2	5	14	8	**29**	6	19	11	8	**44**	2	0	4	1	**7**	88	407	1742	408
1980	7	10	13	4	**34**	12	14	5	1	**32**	3	0	0	0	**3**	136	588	5546	580
1981	4	10	11	3	**28**	6	9	10	2	**27**	2	0	0	0	**2**	149	634	6283	594
1982	5	9	32	9	**55**	6	20	27	13	**66**	8	8	9	5	**30**	156	279	410	260
1983	4	12	17	10	**43**	12	19	22	14	**67**	2	15	16	3	**36**	185	291	259	252
1984	6	8	8	7	**29**	8	15	8	11	**42**	18	5	3	3	**29**	138	441	358	329
1985	6	7	16	5	**34**	11	11	12	8	**42**	4	8	7	5	**24**	201	299	310	268
1986	6	7	7	6	**26**	8	10	10	11	**39**	6	5	10	8	**29**	142	215	186	186
1987	7	8	6	8	**29**	6	8	9	10	**33**	6	6	4	2	**18**	240	220	267	238
1988	8	6	7	5	**26**	13	7	9	9	**38**	4	4	3	1	**12**	283	331	532	346
1989	2	7	9	9	**27**	7	8	8	7	**30**	3	4	1	1	**9**	210	450	660	380
1990	8	9	10	4	**31**	10	13	9	8	**40**	4	4	4	0	**12**	295	315	538	340
1991	6	11	7	5	**29**	12	13	8	8	**41**	4	6	3	5	**18**	158	293	423	275
1992	6	7	7	10	**30**	8	10	6	9	**33**	5	5	3	1	**14**	149	215	377	219
1993	5	16	7	6	**34**	10	10	7	9	**36**	6	1	3	2	**12**	126	173	339	178
1994	3	9	8	2	**22**	5	11	7	4	**27**	1	4	3	1	**9**	92	187	290	**167**
1995	2	3	13	2	**20**	2	4	10	2	**18**	0	1	0	1	**2**	83	181	880	**167**
1996	6	2	12	3	**23**	5	6	11	6	**28**	0	2	1	1	**4**	59	143	400	**127**
1997	3	11	3	10	**27**	5	16	9	9	**39**	3	6	0	5	**14**	50	105	148	**94**
1998	3	7	23	5	**38**	10	10	15	3	**38**	1	2	1	0	**3**	44	92	573	**88**
1999	5	3	10	1	21	7	13	10	5	38	2	4	2	0	9	80	118	205	118
2000	22	20	16	27	85	19	14	13	18	64	2	1	2	2	7	18	71	219	49

Table 9. Landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of USA commercial landings of Atlantic cod from the Georges Bank and South stock (NAFO Division 5Z and Subarea 6), 1978-2000.

Year	Age 1	2	3	4	5	6	7	8	9	10+	Total
					USA Commercial Landings in Numbers (000's) at Age						
1978	-	331	5731	1636	625	53	288	35	28	8	8735
1979	34	1618	572	4107	910	403	59	244	-	45	7992
1980	88	3002	4707	286	1888	951	413	76	153	-	11564
1981	25	3060	3613	1960	101	1026	330	72	109	46	10342
1982	325	7855	2466	1682	1258	117	452	116	50	57	14378
1983	81	3542	5557	1244	854	722	85	218	88	62	12453
1984	81	1281	3305	2961	500	393	386	25	153	82	9167
1985	130	4280	1539	985	1388	273	173	165	12	86	9031
1986	137	1091	3290	432	337	412	58	53	38	26	5874
1987	12	4878	804	1380	188	173	153	41	23	18	7670
1988	-	1345	5662	688	1076	175	100	86	21	18	9171
1989	-	1770	2638	3237	207	362	51	20	13	-	8298
1990	-	4603	3273	1265	1465	134	143	28	3	8	10922
1991	41	1032	2731	2040	873	572	52	23	8	3	7375
1992	-	2387	1268	746	936	217	133	9	12	3	5711
1993	-	781	3178	521	269	228	68	74	15	2	5136
1994	0.1	258	1186	1232	181	62	90	24	22	4	3059
1995	-	354	895	629	237	35	24	14	1	1	2190
1996	0.1	183	744	971	190	88	6	0.4	3	-	2185
1997	-	427	511	633	565	72	58	8	6	3	2283
1998	0.1	682	989	327	235	165	26	6	4	3	2437
1999	0.3	256	1690	536	153	69	96	10	1.3	.4	2812
2000	5	781	651	793	213	47	23	16	0.1	0	2531
					USA Commercial Landings in Weight (Tons) at Age						
1978	-	430	14159	6041	2794	276	2168	274	356	81	26579
1979	30	2462	1411	17662	4525	2943	541	2507	-	564	32645
1980	74	4475	11663	1141	10937	6375	3504	657	1227	-	40053
1981	22	4592	8528	6644	524	7532	2773	716	1628	890	33849
1982	249	10960	7032	6465	6856	755	4281	1200	624	911	39333
1983	80	5303	13647	4271	4015	4628	679	2244	975	914	36756
1984	85	2099	8096	10650	2655	2655	3456	246	1739	1234	32915
1985	118	6094	3320	3930	7219	1746	1397	1707	148	1149	26828
1986	131	1586	7498	1475	1892	2964	528	537	507	372	17490
1987	10	6888	1953	5581	1063	1349	1306	392	242	251	19035
1988	-	2098	12981	2288	5677	1157	848	776	226	259	26310
1989	-	2958	5964	11861	1106	2403	439	209	157	-	25097
1990	-	7094	7411	4346	6902	817	1193	297	35	98	28193
1991	47	1615	6840	6943	4362	3526	406	285	96	55	24175
1992	-	3663	3040	2949	4470	1379	1070	93	137	54	16855
1993	-	1192	7081	1865	1417	1581	560	692	166	40	14594
1994	-	378	2491	4407	868	473	726	234	236	79	9893
1995	-	515	1810	2412	1314	267	253	161	9	20	6759
1996	-	275	1823	3303	915	593	64	3	45	-	7020
1997	-	678	1192	2301	2284	441	461	73	69	37	7537
1998	0.1	1011	2263	1173	1152	984	229	55	53	37	6959
1999	0.3	400	3742	1837	784	447	720	106	18	6	8061
2000	6	1343	1605	2934	1086	302	190	149	0.6	0.3	7617

Table 9 continued. Landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of USA commercial landings of Atlantic cod from the Georges Bank and South stock (NAFO Division 5Z and Subarea 6), 1978 - 2000.

Year	Age 1	2	3	4	5	6	7	8	9	10+	Mean
					USA Commercial Landings Mean Weight (kg) at Age						
1978	-	1.298	2.470	3.692	4.473	5.199	7.522	7.924	12.794	10.125	3.043
1979	0.889	1.522	2.464	4.301	4.974	7.309	9.127	10.264	-	12.533	4.085
1980	0.839	1.490	2.478	3.992	5.792	6.703	8.489	8.648	8.046	-	3.464
1981	0.885	1.501	2.360	3.389	5.209	7.339	8.397	9.988	14.884	19.348	3.274
1982	0.767	1.395	2.852	3.845	5.449	6.457	9.473	10.297	12.434	15.982	2.736
1983	0.993	1.497	2.456	3.434	4.703	6.407	7.955	10.280	11.091	14.742	2.952
1984	1.053	1.638	2.450	3.597	5.308	6.751	8.960	9.710	11.361	15.049	3.590
1985	0.914	1.424	2.157	3.989	5.201	6.398	8.075	10.355	12.107	13.360	2.971
1986	0.957	1.454	2.279	3.414	5.608	7.198	9.066	10.135	13.339	14.308	2.978
1987	0.801	1.412	2.429	4.043	5.657	7.811	8.520	9.466	10.621	13.944	2.482
1988	-	1.559	2.293	3.326	5.278	6.629	8.487	9.067	10.606	14.389	2.869
1989	-	1.672	2.260	3.664	5.351	6.632	8.686	10.673	11.622	-	3.025
1990	-	1.541	2.264	3.436	4.712	6.103	8.366	10.482	10.246	12.250	2.581
1991	1.131	1.566	2.504	3.403	4.955	6.161	7.829	12.392	11.991	20.861	3.278
1992	-	1.535	2.397	3.951	4.775	6.359	8.035	10.457	11.107	17.418	2.951
1993	-	1.526	2.228	3.580	5.271	6.936	8.185	9.386	10.520	21.211	2.841
1994	0.900	1.463	2.101	3.577	4.804	7.591	8.089	9.786	10.980	19.055	3.234
1995	-	1.453	2.022	3.837	5.535	7.679	10.701	11.761	10.678	14.953	3.088
1996	-	1.503	2.451	3.400	4.825	6.727	10.497	8.346	13.836	-	3.212
1997	-	1.586	2.335	3.635	4.041	6.156	7.987	8.705	11.898	12.843	3.302
1998	0.534	1.483	2.288	3.585	4.910	5.981	8.799	8.986	13.831	14.461	2.855
1999	1.000	1.566	2.214	3.428	5.122	6.469	7.476	10.835	14.001	14.823	2.867
2000	1.057	1.719	2.464	3.698	5.100	6.449	8.183	9.113	8.571	14.218	3.010
					USA Commercial Landings Mean Length (cm) at Age						
1978	-	50.2	61.5	69.8	73.7	79.3	89.3	91.3	107.1	101.0	64.9
1979	44.7	52.9	61.0	73.9	77.5	88.2	95.3	99.4	-	106.1	70.9
1980	43.9	52.6	61.6	72.4	81.9	86.3	92.9	92.2	91.2	-	66.5
1981	44.6	52.3	60.4	68.5	78.4	88.7	93.1	98.2	112.8	123.2	64.6
1982	42.3	51.4	64.4	70.8	79.9	84.1	96.5	99.2	105.5	114.9	60.7
1983	46.3	52.7	61.5	68.1	75.9	84.5	90.7	99.1	101.5	111.7	63.3
1984	47.2	54.1	61.5	69.8	79.3	86.5	94.8	97.5	102.5	112.0	67.7
1985	45.1	51.8	58.6	72.4	79.0	84.5	91.4	99.4	104.7	107.9	62.5
1986	45.8	52.0	60.1	67.6	81.1	88.2	95.2	98.7	108.2	109.8	63.2
1987	43.3	51.7	61.3	72.7	81.6	90.9	93.2	96.6	100.1	110.1	59.4
1988	-	53.6	60.3	67.6	79.2	85.5	92.7	94.8	100.1	109.6	63.4
1989	-	54.7	60.1	70.0	79.3	85.3	94.2	100.4	103.6	-	64.8
1990	-	53.4	59.8	68.6	76.1	82.7	92.2	99.7	99.3	106.0	61.1
1991	48.4	53.5	62.1	68.0	77.5	82.8	90.0	106.1	105.7	125.8	66.3
1992	-	53.1	61.0	71.7	75.9	83.5	91.1	99.3	101.8	118.2	63.3
1993	-	53.1	59.8	69.4	78.4	87.0	91.7	96.1	99.8	126.0	63.0
1994	45.0	52.4	58.7	69.5	76.4	89.4	91.3	97.4	101.4	122.1	65.7
1995	-	52.4	57.8	71.0	81.0	89.9	100.9	104.3	100.9	113.0	64.6
1996	46.0	53.0	61.6	68.4	76.7	86.4	99.4	92.1	109.8	-	66.4
1997	-	53.8	60.6	69.9	71.9	83.5	91.1	93.7	104.4	107.0	66.5
1998	37.9	52.5	60.3	69.7	77.4	82.8	94.1	94.9	109.8	111.6	60.7
1999	45.0	53.6	59.7	68.9	78.6	84.6	89.2	100.8	108.5	109.8	63.7
2000	47.4	55.2	61.9	70.6	78.4	84.9	92.0	95.6	91.6	108.6	64.8

Table 10. Landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Canadian commercial landings of Atlantic cod from the Georges Bank and South stock (NAFO Division 5Z and Subarea 6), 1978-2000.

Year	Age 1	2	3	4	5	6	7	8	9	10+	Total
						Canadian Commercial Landings in Numbers (000's) at Age					
1978	2	62	2017	667	205	78	57	12	12	7	3119
1979	-	371	328	763	302	55	18	9	4	3	1853
1980	1	775	1121	214	420	125	32	11	14	10	2723
1981	2	145	608	504	134	380	87	51	21	16	1948
1982	6	1283	1358	1105	742	164	221	97	21	26	5023
1983	27	744	2506	1212	201	54	10	17	12	3	4786
1984	-	26	118	375	340	123	72	19	18	39	1130
1985	4	2146	904	383	497	139	45	38	9	11	4176
1986	19	235	1283	365	143	215	29	19	9	3	2320
1987	14	2595	602	741	91	79	117	22	15	6	4282
1988	10	232	2360	324	421	69	61	111	29	29	3646
1989	-	318	284	918	124	179	31	23	37	18	1932
1990	7	339	1769	617	799	95	102	8	14	30	3780
1991	11	493	512	1241	585	516	74	47	15	20	3514
1992	70	1790	902	292	546	187	176	25	21	7	4016
1993	4	252	1068	594	171	244	91	69	17	15	2525
1994	2	140	340	593	213	34	47	22	16	2	1409
1995	0.1	38	162	63	53	10	2	1	1	-	331
1996	0.6	24	159	262	51	35	9	2	1	0.2	545
1997	3	89	128	249	228	60	26	7	4	1	795
1998	0.1	57	198	95	89	73	13	7	3	2	538
1999	1	30	236	170	48	28	23	7	1	3	547
2000	0.1	30	59	231	93	25	15	9	2	1	463
						Canadian Commercial Landings in Weight (Tons) at Age					
1978	1	85	4913	1949	803	483	378	122	113	107	8778
1979	-	509	525	2842	1398	342	169	105	47	42	5978
1980	1	1041	2720	692	2099	809	228	133	177	157	8063
1981	2	197	1426	1772	699	2624	801	497	220	224	8499
1982	4	1853	3156	4217	3849	1074	2019	914	266	418	17824
1983	24	1084	5521	3854	876	335	80	176	147	37	12130
1984	-	38	292	1423	1615	743	622	202	195	620	5763
1985	3	3017	1775	1388	2370	895	368	369	94	160	10443
1986	14	369	3691	1442	800	1543	250	180	89	28	8411
1987	9	4183	1556	3302	557	596	1113	243	189	93	11845
1988	8	300	5942	1265	2406	462	564	1188	334	437	12932
1989	-	417	669	3812	678	1221	231	247	432	276	8011
1990	5	615	5001	2283	4173	631	876	85	187	454	14310
1991	12	866	1425	4278	2593	2885	527	451	127	291	13455
1992	80	2778	2308	1042	2501	1107	1252	241	265	138	11712
1993	3	393	2485	1852	767	1431	635	623	150	180	8519
1994	2	203	817	2266	1023	243	370	196	128	23	5272
1995	0.1	56	405	237	281	60	20	14	12	-	1085
1996	1	37	376	875	268	224	62	18	14	2	1877
1997	3	138	290	813	972	348	213	62	43	16	2898
1998	0.1	85	471	304	380	425	94	62	28	24	1873
1999	1	46	541	600	202	175	154	54	8	39	1819
2000	0.1	43	126	710	392	122	93	64	14	8	1572

Table 10 continued. Landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of Canadian commercial landings of Atlantic cod from the Georges Bank and South stock (NAFO Division 5Z and Subarea 6), 1978 - 2000.

Year	Age 1	2	3	4	5	6	7	8	9	10+	Mean
						Canadian Commercial Landings Mean Weight (kg) at Age					
1978	0.707	1.376	2.436	2.922	3.918	6.187	6.625	10.148	9.429	15.262	2.814
1979	-	1.371	1.601	3.725	4.630	6.222	9.365	11.638	11.699	14.064	3.226
1980	0.567	1.343	2.426	3.235	4.997	6.468	7.119	12.135	12.652	15.721	2.961
1981	0.839	1.362	2.345	3.516	5.216	6.905	9.204	9.747	10.465	13.993	4.363
1982	0.652	1.444	2.324	3.816	5.188	6.550	9.137	9.418	12.667	16.092	3.548
1983	0.904	1.457	2.203	3.180	4.357	6.203	8.042	10.368	12.222	12.270	2.534
1984	-	1.477	2.473	3.794	4.751	6.043	8.633	10.622	10.807	15.897	5.100
1985	0.686	1.406	1.964	3.625	4.768	6.440	8.181	9.718	10.499	14.537	2.501
1986	0.723	1.572	2.877	3.952	5.592	7.179	8.612	9.453	9.934	9.437	3.625
1987	0.661	1.612	2.584	4.456	6.125	7.540	9.510	11.031	12.629	15.444	2.766
1988	0.786	1.294	2.518	3.904	5.716	6.694	9.251	10.700	11.531	15.065	3.547
1989	-	1.310	2.356	4.153	5.471	6.820	7.459	10.757	11.680	15.356	4.141
1990	0.831	1.812	2.827	3.699	5.221	6.657	8.582	11.227	13.080	14.821	3.786
1991	1.051	1.756	2.783	3.447	4.432	5.591	7.116	9.604	8.457	14.550	3.829
1992	1.148	1.552	2.559	3.568	4.581	5.921	7.112	9.626	12.603	19.714	2.916
1993	0.872	1.557	2.327	3.116	4.489	5.858	7.006	9.035	8.974	12.173	3.374
1994	0.906	1.453	2.404	3.822	4.805	7.141	7.869	8.914	7.970	11.637	3.742
1995	0.906	1.472	2.495	3.759	5.298	6.313	10.903	10.181	10.175	-	3.284
1996	1.034	1.538	2.358	3.337	5.237	6.358	6.916	8.455	10.594	12.002	3.443
1997	0.954	1.536	2.264	3.269	4.257	5.855	8.190	8.546	11.825	12.688	3.644
1998	0.626	1.484	2.375	3.195	4.274	5.828	6.991	8.298	10.984	14.840	3.482
1999	0.799	1.554	2.288	3.527	4.162	6.304	6.768	8.003	9.390	13.572	3.327
2000	0.866	1.458	2.128	3.075	4.230	4.923	6.200	7.344	8.254	12.863	3.394
						Canadian Commercial Landings Mean Length (cm) at Age					
1978	39.5	48.9	59.0	63.3	69.6	81.2	82.5	98.3	94.7	112.8	61.8
1979	-	49.3	51.9	69.3	74.8	82.2	95.2	103.2	103.4	110.4	64.1
1980	36.6	48.9	59.5	66.2	76.4	83.6	86.6	104.7	105.7	114.6	61.7
1981	41.8	49.1	59.1	68.1	78.0	86.1	94.8	96.6	97.5	108.9	70.6
1982	38.3	50.1	58.9	70.0	77.8	84.4	94.9	95.2	106.4	115.3	65.5
1983	42.9	50.4	57.9	65.8	73.0	82.9	90.9	99.0	105.1	105.0	59.9
1984	-	50.7	60.4	70.0	75.7	82.3	92.3	100.1	100.8	114.5	75.6
1985	39.0	49.8	55.7	68.7	75.3	83.8	91.1	96.3	99.0	110.8	58.1
1986	39.6	51.7	63.5	71.0	79.6	86.8	92.8	95.9	96.3	96.1	67.2
1987	38.5	52.1	61.0	73.6	82.3	88.4	96.1	101.2	106.3	114.4	60.1
1988	40.8	48.3	60.5	70.4	80.2	84.8	95.2	99.9	102.5	112.2	65.8
1989	-	48.6	59.1	71.9	79.0	85.1	87.7	100.3	103.1	113.3	69.4
1990	41.7	54.3	63.1	69.0	77.6	84.0	92.0	102.0	107.4	112.1	68.2
1991	45.1	53.7	62.6	67.2	73.3	78.8	86.2	96.1	90.6	112.1	68.4
1992	46.2	51.4	60.6	67.7	73.8	80.6	85.4	94.8	105.8	115.1	61.1
1993	42.2	51.4	58.9	64.9	72.9	80.4	85.5	94.1	92.4	104.5	65.0
1994	43.0	50.3	59.6	69.8	75.3	85.9	89.4	93.0	88.6	102.6	67.9
1995	43.0	50.6	60.4	69.5	78.3	83.1	100.9	98.4	97.8	-	65.0
1996	44.9	51.3	59.3	66.6	77.7	83.3	84.7	90.8	99.9	104.6	66.4
1997	43.7	51.3	58.6	66.1	72.4	80.9	91.3	92.5	103.9	105.5	67.4
1998	37.7	50.5	59.4	65.6	72.6	80.9	86.1	91.6	101.2	112.2	66.1
1999	40.7	51.5	58.6	67.9	71.5	82.9	85.4	90.4	95.8	108.9	65.3
2000	42.8	51.2	58.4	65.9	73.4	77.1	83.4	88.5	92.6	108.0	67.3

Table 11. Landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of total commercial landings of Atlantic cod from the Georges Bank and South stock (NAFO Division 5Z and Subarea 6), 1978-2000.

Year	Age 1	2	3	4	5	6	7	8	9	10+	Total	% of Total Landings USA	Canada
Total Commercial Landings in Numbers (000's) at Age													
1978	2	393	7748	2303	830	131	345	47	40	15	11854	73.7	26.3
1979	34	1989	900	4870	1212	458	77	253	4	48	9845	81.2	18.8
1980	89	3777	5828	500	2308	1076	445	87	167	10	14287	80.9	19.1
1981	27	3205	4221	2464	235	1406	417	123	130	62	12290	84.1	15.9
1982	331	9138	3824	2787	2000	281	673	213	71	83	19401	74.1	25.9
1983	108	4286	8063	2456	1055	776	95	235	100	65	17239	72.2	27.8
1984	81	1307	3423	3336	840	516	458	44	171	121	10297	89.0	11.0
1985	134	6426	2443	1368	1885	412	218	203	21	97	13207	68.4	31.6
1986	156	1326	4573	797	480	627	87	72	47	29	8194	71.7	28.3
1987	26	7473	1406	2121	279	252	270	63	38	24	11952	64.2	35.8
1988	10	1577	8022	1012	1497	244	161	197	50	47	12817	71.6	28.4
1989	-	2088	2922	4155	331	541	82	43	50	18	10230	81.1	18.9
1990	7	4942	5042	1882	2264	229	245	36	17	38	14702	74.3	25.7
1991	52	1525	3243	3281	1458	1088	126	70	23	23	10889	67.7	32.3
1992	70	4177	2170	1038	1482	404	309	34	33	10	9727	58.7	41.3
1993	4	1033	4246	1115	440	472	159	143	32	17	7661	67.0	33.0
1994	2	398	1526	1825	394	96	137	46	38	6	4468	68.5	31.5
1995	0.1	392	1058	692	290	44	26	15	2	1	2520	86.9	13.1
1996	0.7	207	903	1234	241	123	15	3	5	0.2	2731	80.0	20.0
1997	3	517	639	881	794	131	84	16	9	4	3078	74.2	25.8
1998	0.2	739	1188	423	324	237	39	14	6	4	2975	81.9	18.1
1999	2	285	1927	706	201	97	119	16	2	3	3359	83.7	16.3
2000	6	811	710	1024	306	72	38	25	2	1	2994	84.5	15.5
Total Commercial Landings in Weight (Tons) at Age													
1978	1	515	18890	7990	3597	757	2549	395	465	198	35357	75.2	24.8
1979	30	2970	1936	20504	5923	3288	711	2611	44	606	38623	84.5	15.5
1980	75	5516	14382	1833	13036	7184	3735	793	1408	154	48116	83.2	16.8
1981	24	4789	9953	8416	1224	10156	3575	1212	1848	1151	42348	79.9	20.1
1982	253	12812	10187	10681	10705	1827	6303	2110	891	1388	57157	68.8	31.2
1983	105	6387	19167	8126	4891	4963	763	2418	1120	946	48886	75.2	24.8
1984	85	2137	8389	12074	4271	3401	4078	447	1938	1858	38678	85.1	14.9
1985	121	9111	5095	5319	9588	2644	1765	2073	246	1309	37271	72.0	28.0
1986	145	1955	11189	2917	2692	4505	776	717	596	409	25901	67.5	32.5
1987	19	11071	3509	8882	1619	1945	2416	633	426	360	30880	61.6	38.4
1988	8	2399	18923	3552	8085	1618	1412	1960	566	719	39242	67.0	33.0
1989	-	3375	6633	15673	1783	3625	669	455	588	298	33098	75.8	24.2
1990	5	7709	12412	6629	11075	1448	2069	382	222	552	42503	66.3	33.7
1991	59	2481	8265	11221	6955	6411	933	736	223	346	37630	64.2	35.8
1992	80	6441	5348	3991	6971	2486	2322	334	402	192	28567	59.0	41.0
1993	3	1585	9566	3717	2184	3012	1195	1315	316	220	23113	63.1	36.9
1994	2	581	3308	6673	1892	716	1095	430	364	103	15165	65.2	34.8
1995	0.1	577	2215	2649	1595	327	273	174	20	20	7851	86.1	13.9
1996	0.6	311	2199	4178	1183	817	127	21	59	2	8898	78.9	21.1
1997	3	816	1483	3114	3256	790	674	135	111	53	10435	72.2	27.8
1998	0.1	1096	2735	1477	1532	1408	323	117	82	61	8832	78.8	21.2
1999	1	446	4283	2437	985	622	874	159	27	45	9880	81.6	18.4
2000	6	1386	1731	3644	1478	424	283	213	14	9	9189	82.9	17.1

Table 11 continued. Landings at age (thousands of fish; metric tons) and mean weight (kg) and mean length (cm) at age of total commercial landings of Atlantic cod from the Georges Bank and South stock (NAFO Division 5Z and Subarea 6), 1978-2000.

	Age										
Year	1	2	3	4	5	6	7	8	9	10+	Mean
					Total Commercial Landings Mean Weight (kg) at Age						
1978	0.707	1.310	2.461	3.469	4.336	5.787	7.374	8.492	11.785	13.200	2.983
1979	0.889	1.494	2.149	4.211	4.888	7.178	9.183	10.313	11.699	12.625	3.923
1980	0.836	1.460	2.468	3.668	5.647	6.676	8.390	9.089	8.432	15.400	3.368
1981	0.882	1.495	2.358	3.415	5.213	7.222	8.565	9.888	14.170	18.565	3.446
1982	0.765	1.402	2.664	3.834	5.352	6.511	9.363	9.897	12.503	16.723	2.946
1983	0.971	1.490	2.377	3.309	4.637	6.393	7.964	10.286	11.227	14.554	2.836
1984	1.053	1.635	2.451	3.619	5.083	6.582	8.909	10.104	11.303	15.356	3.756
1985	0.907	1.418	2.086	3.887	5.087	6.412	8.097	10.236	11.418	13.494	2.822
1986	0.929	1.475	2.447	3.660	5.603	7.191	8.915	9.955	12.687	14.104	3.161
1987	0.726	1.481	2.495	4.187	5.810	7.726	8.949	10.013	11.414	15.000	2.584
1988	0.786	1.520	2.359	3.511	5.401	6.647	8.776	9.987	11.143	15.298	3.062
1989	-	1.617	2.269	3.772	5.396	6.694	8.222	10.718	11.665	17.111	3.235
1990	0.831	1.560	2.462	3.522	4.892	6.333	8.456	10.648	12.580	14.526	2.891
1991	1.114	1.627	2.548	3.420	4.769	5.891	7.410	10.520	9.686	15.373	3.456
1992	1.148	1.542	2.464	3.843	4.704	6.156	7.509	9.846	12.059	19.025	2.937
1993	0.872	1.534	2.253	3.333	4.967	6.379	7.510	9.217	9.699	13.236	3.017
1994	0.906	1.459	2.168	3.657	4.804	7.432	8.013	9.368	9.698	16.659	3.394
1995	0.906	1.471	2.095	3.830	5.492	7.384	10.715	11.617	10.383	14.953	3.087
1996	0.882	1.507	2.435	3.387	4.912	6.622	8.369	8.438	12.883	12.002	3.212
1997	0.954	1.577	2.321	3.532	4.103	6.019	8.050	8.631	11.870	12.795	3.390
1998	0.579	1.483	2.302	3.497	4.735	5.934	8.185	8.610	12.684	14.606	2.969
1999	0.830	1.565	2.223	3.452	4.891	6.422	7.341	9.685	12.153	13.735	2.941
2000	1.055	1.710	2.437	3.558	4.836	5.923	7.406	8.498	8.267	10.594	3.069
1978-2000	0.888	1.514	2.361	3.634	5.028	6.589	8.338	9.747	11.365	14.434	
1996-2000	0.879	1.565	2.346	3.487	4.712	6.191	7.890	8.797	11.570	12.735	
					Total Commercial Landings Mean Length (cm) at Age						
1978	39.5	50.0	60.8	67.9	72.7	80.4	80.2	93.1	103.4	106.5	64.1
1979	44.7	52.2	57.7	73.2	76.8	87.5	95.3	99.5	103.4	106.4	69.6
1980	43.8	51.8	61.2	69.7	80.9	86.0	92.4	93.8	92.4	114.6	65.6
1981	44.4	52.2	60.2	68.4	78.2	88.0	93.5	97.5	110.3	119.5	65.6
1982	42.2	51.2	62.4	70.5	79.1	84.3	96.0	97.4	105.8	115.0	61.9
1983	45.5	52.3	60.4	67.0	75.3	84.4	90.7	99.1	101.9	111.4	62.4
1984	47.2	54.0	61.5	69.8	77.8	85.5	94.4	98.6	102.3	112.8	68.6
1985	44.9	51.1	57.5	71.4	78.0	84.3	91.3	98.8	102.3	108.2	61.1
1986	45.0	51.9	61.1	69.2	80.7	87.7	94.4	98.0	105.9	108.4	64.3
1987	40.7	51.8	61.2	73.0	81.8	90.1	94.5	98.2	102.5	111.2	59.7
1988	40.8	52.8	60.4	68.5	79.5	85.3	93.6	97.7	101.5	111.2	64.1
1989	-	53.8	60.0	70.4	79.2	85.2	91.7	100.3	103.2	113.3	65.7
1990	41.7	53.5	61.0	68.7	76.6	83.2	92.1	100.2	106.0	110.8	62.9
1991	47.7	53.6	62.2	67.7	75.8	80.9	87.8	99.4	95.9	113.9	67.0
1992	46.2	52.4	60.8	70.6	75.1	82.2	87.9	96.0	104.3	116.0	62.4
1993	42.2	52.7	59.6	67.0	76.3	83.6	88.2	95.1	95.9	107.0	63.0
1994	43.1	51.7	58.9	69.6	75.8	88.2	90.7	95.3	95.9	115.8	65.8
1995	43.0	50.6	58.2	70.9	80.5	88.5	100.9	103.8	99.1	113.0	64.6
1996	45.1	52.7	61.2	68.0	76.9	85.5	90.7	91.0	106.9	104.6	66.4
1997	43.7	53.4	60.2	68.8	72.1	82.3	91.2	93.1	104.2	106.5	66.7
1998	37.8	52.4	60.1	68.8	76.0	82.2	91.4	93.1	106.4	111.9	61.7
1999	41.5	53.4	59.6	68.6	76.9	84.1	88.5	96.6	103.4	109.0	64.0
2000	47.3	55.1	61.6	69.6	76.9	82.2	88.6	93.1	92.5	107.9	65.2

Table 12. Summary of USA and Canadian 2000 commercial landings of Atlantic cod from the Georges Bank and South cod stock (NAFO Division 5Z and Subarea 6).

	USA Catch at Age				Canadian Catch at Age				Total 2000 Catch at Age			
Age	Catch in Numbers (000s's)	% of USA Total	Catch in Weight (mt)	% of USA Total	Catch in Numbers (000s's)	% of Can Total	Catch in Weight (mt)	% of Can Total	Catch in Numbers (000s's)	% of Total	Catch in Weight (mt)	% of Total
1	5.4	0.2	6	0.1	0	0.0	0	0.0	6	0.2	6	0.1
2	781	30.9	1343	17.6	30	6.5	43	2.7	811	27.1	1386	15.1
3	651	25.7	1605	21.1	59	12.7	126	8.0	710	23.7	1731	18.8
4	793	31.3	2934	38.5	231	49.7	710	45.2	1024	34.2	3644	39.7
5	213	8.4	1086	14.3	93	20.0	392	24.9	306	10.2	1478	16.1
6	47	1.9	303	4.0	25	5.4	122	7.8	72	2.4	425	4.6
7	23	0.9	190	2.5	15	3.2	93	5.9	38	1.3	283	3.1
8	16	0.6	149	2.0	9	1.9	64	4.1	25	0.8	213	2.3
9	0.1	0.0	1	0.0	2	0.4	14	0.9	2	0.1	15	0.2
10+	0.02	0.0	0	0.0	1	0.2	8	0.5	1	0.0	8	0.1
Total	2529.52	100.0	7617	100.0	465.1	100.0	1572	100.0	2994.62	100.0	9189	100.0
	Mean Weight Per Fish (kg)			3.011	Mean Weight Per Fish (kg)			3.380	Mean Weight Per Fish (kg)			3.069

Table 13. Mean weight at age (kg, January 1) for Georges Bank and South cod stock (NAFO Division 5Z and Subarea 6), 1978-2001. Values derived form landings mean weights at age using the method described by Rivard (1980).

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	0.486	0.694	0.625	0.700	0.548	0.748	0.907	0.711	0.736	0.502	0.548
2	1.023	1.028	1.139	1.118	1.112	1.068	1.260	1.222	1.157	1.173	1.050
3	1.881	1.678	1.920	1.855	1.996	1.826	1.911	1.847	1.863	1.918	1.869
4	2.922	3.219	2.808	2.903	3.007	2.969	2.933	3.087	2.763	3.201	2.960
5	3.370	4.118	4.876	4.373	4.275	4.216	4.101	4.291	4.667	4.611	4.755
6	4.594	5.579	5.712	6.386	5.826	5.849	5.525	5.709	6.048	6.579	6.214
7	6.235	7.290	7.760	7.562	8.223	7.201	7.547	7.300	7.561	8.022	8.234
8	7.235	8.721	9.136	9.108	9.207	9.814	8.970	9.549	8.978	9.448	9.454
9	10.004	9.967	9.325	11.349	11.119	10.541	10.783	10.741	11.396	10.660	10.563
10+	13.200	12.625	15.400	18.565	16.723	14.554	15.356	13.494	14.104	15.000	15.298

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	0.583	0.594	0.947	0.993	0.674	0.711	0.702	0.660	0.765	0.352	0.578	0.934	0.665
2	1.127	1.123	1.163	1.311	1.327	1.128	1.154	1.168	1.179	1.189	0.952	1.191	1.191
3	1.857	1.995	1.994	2.002	1.864	1.824	1.748	1.893	1.870	1.905	1.816	1.953	2.454
4	2.983	2.827	2.902	3.129	2.866	2.870	2.882	2.664	2.933	2.849	2.819	2.812	3.041
5	4.353	4.296	4.098	4.011	4.369	4.001	4.482	4.337	3.728	4.090	4.136	4.086	4.501
6	6.013	5.846	5.368	5.418	5.478	6.076	5.956	6.031	5.437	4.934	5.514	5.382	5.724
7	7.393	7.524	6.850	6.651	6.799	7.149	8.924	7.861	7.301	7.019	6.600	6.896	6.518
8	9.699	9.357	9.432	8.542	8.319	8.388	9.648	9.509	8.499	8.325	8.903	7.898	7.953
9	10.793	11.612	10.156	11.263	9.772	9.454	9.862	12.234	10.008	10.463	10.229	8.948	9.143
10+	17.111	14.526	15.373	19.025	13.236	16.659	14.953	12.002	12.795	14.606	13.735	10.594	10.594

Table 14. General linear model (GLM) analysis of LPUE of Georges Bank cod for interviewed trips landing cod during 1978-1993 as a function of year, area, quarter, tonnage class and depth with no interaction.

General Linear Models Procedure

Dependent Variable: LNCPUEDF

Source	DF	Sum of Squares	Mean Square	F Value	> F
Model	28	31732.79388553	1133.31406734	735.46	0.0001
Error	54356	83760.33125977	1.54095834		
Corrected Total	54384	115493.12514529			

R-Square	C.V.	Root MSE	LNCPUEDF Mean
0.274759	-549.0211	1.24135343	-0.22610303

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	15	12685.54117665	845.70274511	548.82	0.0001
AREA	5	5241.16957276	1048.23391455	680.25	0.0001
QTR	3	4097.78364005	1365.92788002	886.41	0.0001
TC2	3	6023.47684536	2007.82561512	1302.97	0.0001
DEPTH	2	3684.82265071	1842.41132535	1195.63	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	15	15953.77293165	1063.58486211	690.21	0.0001
AREA	5	7615.39757423	1523.07951485	988.40	0.0001
QTR	3	3159.27477519	1053.09159173	683.40	0.0001
TC2	3	6322.64153966	2107.54717989	1367.69	0.0001
DEPTH	2	3684.82265071	1842.41132535	1195.63	0.0001

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate	Retransformed Estimate
INTERCEPT		0.760997649 B	26.75	0.0001	0.02844571	
AREA	522	-0.444577000 B	-29.48	0.0001	0.01507858	0.641168
	523	-0.010785910 B	-0.53	0.5968	0.02038704	0.989478
	524	-0.735978983 B	-41.37	0.0001	0.01778914	0.479112
	525	-0.843403568 B	-36.88	0.0001	0.02286656	0.430356
	526	-1.194326116 B	-60.80	0.0001	0.01964379	0.302966
	521	0.000000000 B	.	.	.	1.000000
QTR	1	-0.057274522 B	-3.86	0.0001	0.01482597	0.944439
	3	-0.621223632 B	-41.41	0.0001	0.01500215	0.537347
	4	-0.417172723 B	-26.54	0.0001	0.01571823	0.658989
	2	0.000000000 B	.	.	.	1.000000
Tonclass	31	-0.793757151 B	-32.66	0.0001	0.02430028	0.452276
	32	-0.540370836 B	-33.92	0.0001	0.01593153	0.582606
	41	0.433927651 B	33.67	0.0001	0.01288832	1.543435
	33	0.000000000 B	.	.	.	1.000000
DEPTHCD	1	0.731465629 B	48.11	0.0001	0.01520442	2.078364
	2	0.373888353 B	24.87	0.0001	0.01503558	1.453539
	3	0.000000000 B	.	.	.	1.000000

Table 15. Georges Bank cod landings (mt), nominal and standardized effort(days fished) and landings per day fished (LPUE), USA only. Standardization based on general linear model (GLM) for 1978-1993.

	USA Landings Used in GLM	Nominal		Standardized		
Year	(mt)	Effort	LPUE	Effort	LPUE	Raised Effort[1]
1978	15776	7980	1.977	5937	2.657	10003
1979	20584	9406	2.188	7720	2.666	12244
1980	25213	10080	2.501	8525	2.958	13543
1981	18339	9089	2.018	8130	2.256	15005
1982	23289	10045	2.319	8833	2.607	15087
1983	22072	11668	1.892	10561	2.090	17587
1984	19669	14641	1.343	12632	1.557	21140
1985	18012	16447	1.095	15045	1.197	22408
1986	11572	12520	0.924	11956	0.968	18072
1987	12731	14945	0.852	13942	0.913	20846
1988	19010	17769	1.070	17099	1.112	23666
1989	15557	15834	0.983	15581	0.998	25136
1990	18358	15882	1.156	15007	1.223	23047
1991	14173	14857	0.954	15085	0.940	25730
1992	8786	13606	0.646	12989	0.676	24919
1993	7749	12958	0.598	12883	0.602	24262
1994	(2126)	5687	0.374	4825	0.441	22456
1995	(2054)	6843	0.300	6362	0.323	20930
1996	(2391)	6563	0.364	5986	0.400	17568
1997	(2725)	5282	0.516	4845	0.562	13399
1998	(2525)	5617	0.450	5389	0.469	14853
1999	(2690)	5476	0.491	4888	0.550	14647
2000	(3112)	6794	0.458	6198	0.502	15169

[1] Derived as total landings/ standardized LPUE.

Table 16. Standardized stratified mean catch per tow in numbers and weight (kg)for Atlantic cod in NEFSC offshore spring and autumn research vessel bottom trawl surveys on Georges Bank (Strata 13-25), 1963 - 2000. [1,2,3]

	Spring		Autumn	
Year	No/Tow	Wt/Tow	No/Tow	Wt/Tow
1963	-	-	4.37	17.8
1964	-	-	2.79	11.4
1965	-	-	4.25	11.8
1966	-	-	4.90	8.1
1967	-	-	10.33	13.6
1968	4.73	12.7	3.31	8.6
1969	4.63	17.8	2.24	8.0
1970	4.34	15.8	5.12	12.6
1971	3.39	14.3	3.19	9.8
1972	9.16	19.3	13.09	22.9
1973	57.81	94.5	12.28	30.9
1974	14.74	36.4	3.49	8.2
1975	6.89	26.1	6.41	14.1
1976	7.06	18.6	10.43	17.7
1977	6.19	15.3	5.44	12.5
1978	12.31	31.2	8.59	23.3
1979	5.00	16.2	5.95	16.5
1980	7.68	24.1	2.91	6.7
1981	10.44	26.1	9.20	20.3
1982	32.96	101.9	3.34	6.1
1983	7.70	23.5	4.14	6.1
1984	4.08	15.3	4.73	10.0
1985	7.03	21.7	2.31	3.1
1986	5.04	16.7	2.99	3.7
1987	3.24	9.9	2.33	4.4
1988	5.87	13.5	3.07	5.6
1989	4.80	10.9	4.84	4.7
1990	4.79	11.7	4.78	11.5
1991	4.31	8.9	0.96	1.4
1992	2.67	7.4	1.72	3.0
1993	2.40	7.0	2.15	2.2
1994	0.95	1.2	1.82	3.3
1995	3.29	8.4	3.62	5.6
1996	2.70	7.5	1.10	2.7
1997	2.32	5.2	0.87	1.9
1998	4.36	11.7	1.87	2.8
1999	2.15	4.7	1.02	3.0
2000	3.57	8.2	1.31	1.4
1995-1999 Average	2.96	7.5	1.70	3.2
1963-2000 Average	7.97	20.5	4.49	9.6

[1] During 1963-1984, BMV oval doors were used in spring and autumn surveys; since 1985, Portuguese polyvalent doors have been used in both surveys. Adjustments have been made to the 1963-1984 catch per tow data to standardize these data to polyvalent door equivalents. Conversion coefficients of 1.56 (numbers) and 1.62 (weight) were usedin this standardization (NEFC 1991).

[2]Spring surveys during 1980-1982, 1989-1991 and 1994 and autumn surveys during 1977-1981,1989-1991,and1993 were accomplished with the *R/V Delaware II*; in all other years, the surveys were accomplished using the *R/V Albatross IV*. Adjustments have been made to the *R/V Delaware II* catch per tow data to standardize these to *R/V Albatross IV* equivalents. Conversion coefficients of 0.79 (numbers) and 0.67 (weight) were used in this standardization (NEFC 1991).

[3]Spring surveys during 1973-1981 were accomplished with a '41 Yankee' trawl; in all other years,spring surveys were accomplished with a '36 Yankee' trawl. No adjustments have been made to the catch per tow data for these gear differences.

Table 17. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), mean biomass (mt), spawning stock biomass (mt), and percent mature of Georges Bank cod, estimated from virtual population analysis (VPA), calibrated using the commercial catch at age ADAPT formulation, 1978-2000.

Stock Numbers (Jan 1) in thousands

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	27711	23512	20109	41393	17470	9615	27390	8672	42751	16376	23448	15689	9218	17866	6632	8433	6300	4331	7612	10325	3179	7291	4896	1710
2	4270	22686	19219	16383	33865	14004	7774	22352	6979	34860	13384	19188	12845	7540	14580	5366	6901	5156	3545	6231	8450	2603	5968	4003
3	25527	3140	16774	12318	10513	19458	7587	5182	12485	4514	21779	9531	13821	6045	4794	8158	3459	5290	3867	2715	4634	6250	1873	4152
4	7933	13889	1756	8460	6266	5148	8635	3115	2032	6084	2423	10573	5159	6753	2015	1961	2837	1451	3374	2349	1645	2719	3373	891
5	2877	4411	6965	986	4697	2608	1992	4051	1312	943	3062	1068	4897	2521	2560	710	597	671	562	1645	1126	964	1587	1835
6	1127	1604	2515	3614	594	2036	1181	871	1611	640	519	1153	575	1961	745	755	184	132	287	242	629	629	607	1023
7	1414	804	899	1085	1687	232	965	500	340	752	296	204	454	264	621	244	191	63	68	124	80	300	427	432
8	67	846	588	334	511	772	104	375	212	200	371	97	93	150	102	229	56	33	28	42	25	30	138	315
9	147	12	463	403	162	226	419	46	124	108	107	126	40	44	60	53	58	4	13	21	20	8	10	91
10+	50	135	25	174	171	133	268	190	69	62	91	41	82	40	16	25	8	2	0	1	12	11	5	12
1 +	71122	71040	69315	85150	75937	54232	56316	45354	67916	64540	65481	57670	47184	43183	32124	25935	20591	17134	19357	23696	19801	20805	18885	14464

Fishing Mortality

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	0	0	0	0	0.02	0.01	0	0.02	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
2	0.11	0.1	0.24	0.24	0.35	0.41	0.21	0.38	0.24	0.27	0.14	0.13	0.55	0.25	0.38	0.24	0.07	0.09	0.07	0.1	0.1	0.13	0.16
3	0.41	0.38	0.48	0.48	0.51	0.61	0.69	0.74	0.52	0.42	0.52	0.41	0.52	0.9	0.69	0.86	0.67	0.25	0.3	0.3	0.33	0.42	0.54
4	0.39	0.49	0.38	0.39	0.68	0.75	0.56	0.66	0.57	0.49	0.62	0.57	0.52	0.77	0.84	0.99	1.24	0.75	0.52	0.54	0.33	0.34	0.41
5	0.38	0.36	0.46	0.31	0.64	0.59	0.63	0.72	0.52	0.4	0.78	0.42	0.72	1.02	1.02	1.15	1.31	0.65	0.64	0.76	0.38	0.26	0.24
6	0.14	0.38	0.64	0.56	0.74	0.55	0.66	0.74	0.56	0.57	0.73	0.73	0.58	0.95	0.91	1.17	0.86	0.46	0.64	0.91	0.54	0.19	0.14
7	0.31	0.11	0.79	0.55	0.58	0.6	0.74	0.66	0.33	0.51	0.92	0.59	0.91	0.75	0.8	1.27	1.57	0.6	0.28	1.38	0.78	0.58	0.1
8	1.49	0.4	0.18	0.52	0.62	0.41	0.63	0.91	0.47	0.43	0.88	0.68	0.56	0.72	0.46	1.18	2.36	0.71	0.12	0.54	0.94	0.89	0.22
9	0.36	0.44	0.51	0.44	0.66	0.67	0.6	0.71	0.54	0.49	0.73	0.58	0.63	0.87	0.95	1.11	1.3	0.71	0.54	0.66	0.4	0.32	0.22
10+	0.36	0.44	0.51	0.44	0.66	0.67	0.6	0.71	0.54	0.49	0.73	0.58	0.63	0.87	0.95	1.11	1.3	0.71	0.54	0.66	0.4	0.32	0.22
mn4-8,u	0.54	0.35	0.49	0.47	0.65	0.58	0.64	0.74	0.49	0.48	0.79	0.60	0.66	0.84	0.81	1.15	1.47	0.63	0.44	0.83	0.59	0.45	0.22
Fwb	0.31	0.29	0.39	0.32	0.47	0.52	0.41	0.53	0.29	0.33	0.42	0.35	0.53	0.56	0.57	0.66	0.55	0.30	0.30	0.31	0.27	0.28	0.24

Table 17 continued. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), mean biomass (mt), spawning stock biomass (mt), and percent mature of Georges Bank cod, estimated from virtual population analysis (VPA), calibrated using the commercial catch at age ADAPT formulation, 1978-2000.

Mean biomass (mt)

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	17756	18930	15201	33078	11990	8411	26099	7070	35926	10766	16700	11504	6940	18010	6861	6663	5173	3556	6085	8926	1668	5484	4679
2	4816	29255	22650	19782	36452	15601	10449	24024	8344	41185	17250	26451	14074	9866	17054	6662	8841	6591	4690	8505	10818	3471	8559
3	47057	5118	29978	21113	20017	31666	12313	7020	21790	8386	36581	16162	24297	9347	7809	11349	5011	8925	7415	4957	8268	10370	3221
4	20817	42243	4894	21839	16000	10999	21920	8106	5192	18430	5809	27816	12975	14785	4809	3823	5495	3590	8152	5875	4457	7258	8991
5	9449	16495	28841	4033	17037	8352	6888	13463	5247	4126	10556	4299	15692	6948	6955	1934	1481	2485	1866	4336	4041	3777	6211
6	5533	8742	11357	18264	2510	9170	5214	3621	8109	3448	2246	5021	2530	6863	2764	2620	840	715	1287	879	2638	3349	3050
7	8154	6341	4785	6532	10957	1273	5563	2718	2353	4828	1564	1165	2323	1262	2948	961	719	467	455	501	416	1533	2728
8	275	6555	4453	2347	3458	5943	717	2321	1538	1486	2266	691	696	1031	735	1145	190	249	204	259	131	176	958
9	1326	107	2801	4217	1355	1693	3264	341	1107	894	774	1020	345	260	428	285	290	30	120	163	193	77	74
10+	553	1376	303	2611	2091	1408	3101	1838	751	735	985	533	880	406	201	203	77	21	4	14	147	130	48
Total	115735	135163	125263	133816	121866	94515	95528	70522	90356	94285	94730	94659	80753	68777	50565	35644	28116	26628	30277	34414	32777	35625	38517

SSB at the start of the spawning season - males and females (mt)

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	912	1104	850	1962	1200	902	3122	773	8515	2226	3480	2477	635	1963	763	660	87	59	97	993	141	530	575
2	1411	7540	6911	5784	16138	6347	4303	11650	5031	25331	8897	13718	6615	4228	9022	3442	2904	2212	1545	3986	5446	1337	3814
3	33839	3730	22412	15924	15649	26066	10500	6878	18777	7103	32838	14540	22023	9033	7442	11476	5186	8150	6400	4297	7431	9422	2973
4	20179	38255	4300	21375	15792	12655	21656	8075	4842	17023	6133	27186	12815	16506	5246	4564	6403	3570	7973	6095	4287	7007	8571
5	8796	16541	30441	3962	17468	9636	7118	14908	5434	3936	12373	4195	18059	8431	8379	2477	1857	2612	2118	5225	4179	3692	6028
6	4892	8127	12487	20325	2961	10514	5653	4252	8583	3704	2763	5934	2953	8688	3351	3291	934	705	1506	1093	2743	3250	3089
7	8094	5563	5914	7240	12174	1464	6221	3163	2355	5363	2023	1326	2842	1542	3495	1300	1018	495	496	695	475	1742	2799
8	366	6672	5047	2693	4108	6842	815	2980	1702	1701	2931	811	769	1214	780	1512	307	271	256	319	175	222	1017
9	1339	111	3841	4111	1557	2059	3957	420	1245	1030	965	1193	408	372	555	414	425	37	142	178	192	77	86
10+	620	1580	355	3000	2562	1729	3731	2282	890	857	1229	637	1067	526	266	279	111	26	5	17	167	144	51
Total	80447	89224	92560	86373	89609	78214	67075	55382	57374	68273	73633	72016	68186	52504	39299	29413	19233	18136	20538	22898	25236	27422	29003

Percent Mature (females)

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	7	7	7	7	13	13	13	13	28	28	28	28	12	12	12	12	2	2	2	13	13	13	13
2	34	34	34	34	47	47	47	47	67	67	67	67	52	52	52	52	39	39	39	57	57	57	57
3	78	78	78	78	84	84	84	84	91	91	91	91	90	90	90	90	95	95	95	92	92	92	92
4	96	96	96	96	97	97	97	97	98	98	98	98	99	99	99	99	100	100	100	100	100	100	100
5-10+	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 18. Yield and SSB per Recruit results for Georges Bank cod from O'Brien and Cadrin (1999).

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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:  7- 4-1998;  Time: 17:28:09.47  Cod Georges Bank - 1998
 Proportion of F before spawning:  .1667
 Proportion of M before spawning:  .1667
 Natural Mortality is Constant at:  .200
 Initial age is:  1; Last age is: 10      Last age is a PLUS group;
 Original age-specific PRs, Mats, and Mean Wts from file: ==> GBYPR10P.DAT
-------------------------------------------------------------
 Age-specific Input data for Yield per Recruit Analysis
-------------------------------------------------------------
  Age | Fish Mort  Nat Mort | Proportion | Average Weights
      |  Pattern    Pattern |   Mature   |  Catch   Stock
-------------------------------------------------------------
   1  |   .0001     1.0000  |    .0400   |   .914    .711
   2  |   .1700     1.0000  |    .4400   |  1.518   1.167
   3  |   .6600     1.0000  |    .9300   |  2.283   1.837
   4  |  1.0000     1.0000  |   1.0000   |  3.583   2.826
   5  |  1.0000     1.0000  |   1.0000   |  4.835   4.182
   6  |  1.0000     1.0000  |   1.0000   |  6.675   5.808
   7  |  1.0000     1.0000  |   1.0000   |  9.044   8.028
   8  |  1.0000     1.0000  |   1.0000   |  9.562   9.218
   9  |  1.0000     1.0000  |   1.0000   | 11.712  10.700
  10+ |  1.0000     1.0000  |   1.0000   | 13.250  13.250
-------------------------------------------------------------
 Summary of Yield per Recruit Analysis for: Cod Georges Bank - 1998
  Slope of the Yield/Recruit Curve at F=0.00: -->   24.7823
    F level at slope=1/10 of the above slope (F0.1): ----->    .175
      Yield/Recruit corresponding to F0.1: ----->    1.6614
    F level to produce Maximum Yield/Recruit (Fmax): ----->    .340
      Yield/Recruit corresponding to Fmax: ----->    1.8051
    F level at 20 % of Max Spawning Potential (F20): ----->    .406
      SSB/Recruit corresponding to F20: -------->    5.0472
-----------------------------------------------------------------------
 Listing of Yield per Recruit Results for:  Cod Georges Bank - 1998
 ---------------------------------------------------------------------------
      FMORT   TOTCTHN  TOTCTHW  TOTSTKN  TOTSTKW  SPNSTKN  SPNSTKW    % MSP
 ---------------------------------------------------------------------------
       .000    .00000   .00000   5.5167  27.3986   3.9184  25.2391    100.00
       .050    .13115   .89059   4.8636  20.3778   3.2642  18.3023     72.52
       .100    .21908  1.34762   4.4265  16.0044   2.8262  13.9970     55.46
       .150    .28229  1.58847   4.1130  13.0878   2.5116  11.1361     44.12
 F0.1  .175    .30759  1.66141   3.9877  11.9857   2.3858  10.0580     39.85
       .200    .33004  1.71408   3.8766  11.0438   2.2743   9.1382     36.21
       .250    .36748  1.77563   3.6918   9.5555   2.0886   7.6881     30.46
       .300    .39770  1.80069   3.5430   8.4381   1.9389   6.6026     26.16
 Fmax  .340    .41785  1.80513   3.4440   7.7381   1.8392   5.9243     23.47
       .350    .42265  1.80475   3.4205   7.5772   1.8155   5.7687     22.86
       .400    .44364  1.79678   3.3176   6.8995   1.7119   5.1139     20.26
 F20%  .406    .44587  1.79535   3.3068   6.8304   1.7009   5.0472     20.00
       .450    .46159  1.78208   3.2299   6.3559   1.6234   4.5898     18.19
       .500    .47715  1.76384   3.1542   5.9126   1.5469   4.1633     16.50
       .550    .49077  1.74397   3.0880   5.5458   1.4800   3.8111     15.10
       .600    .50284  1.72364   3.0296   5.2382   1.4209   3.5163     13.93
       .650    .51360  1.70352   2.9776   4.9774   1.3683   3.2667     12.94
       .700    .52329  1.68402   2.9310   4.7539   1.3210   3.0531     12.10
       .750    .53206  1.66535   2.8889   4.5605   1.2783   2.8684     11.36
       .800    .54006  1.64762   2.8506   4.3918   1.2395   2.7074     10.73
       .850    .54738  1.63085   2.8156   4.2433   1.2040   2.5660     10.17
       .900    .55412  1.61504   2.7835   4.1118   1.1713   2.4408      9.67
       .950    .56036  1.60016   2.7539   3.9945   1.1412   2.3292      9.23
      1.000    .56615  1.58616   2.7265   3.8892   1.1133   2.2291      8.83
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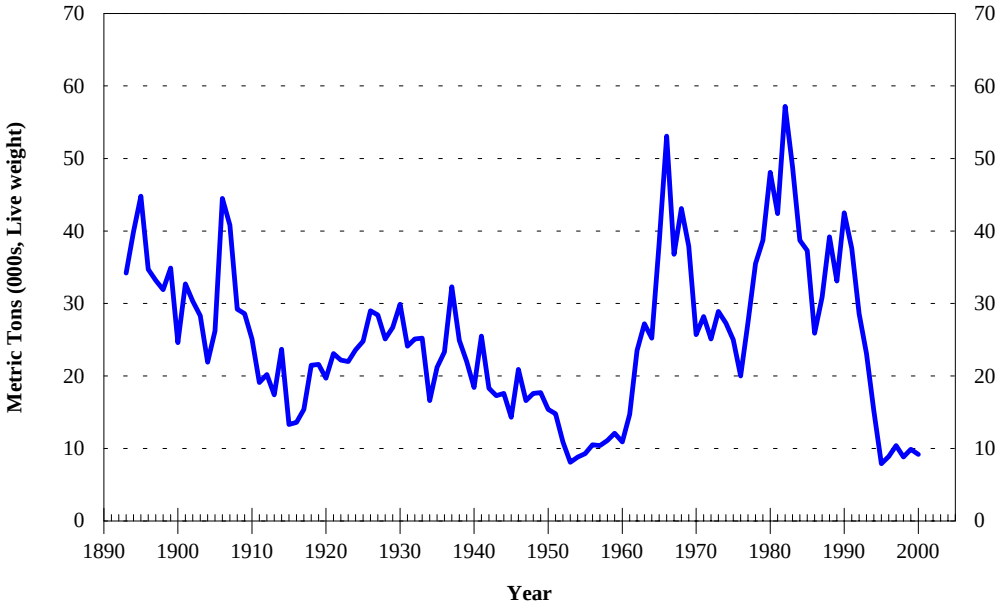


Figure 1a. Total commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6), 1893-2000.

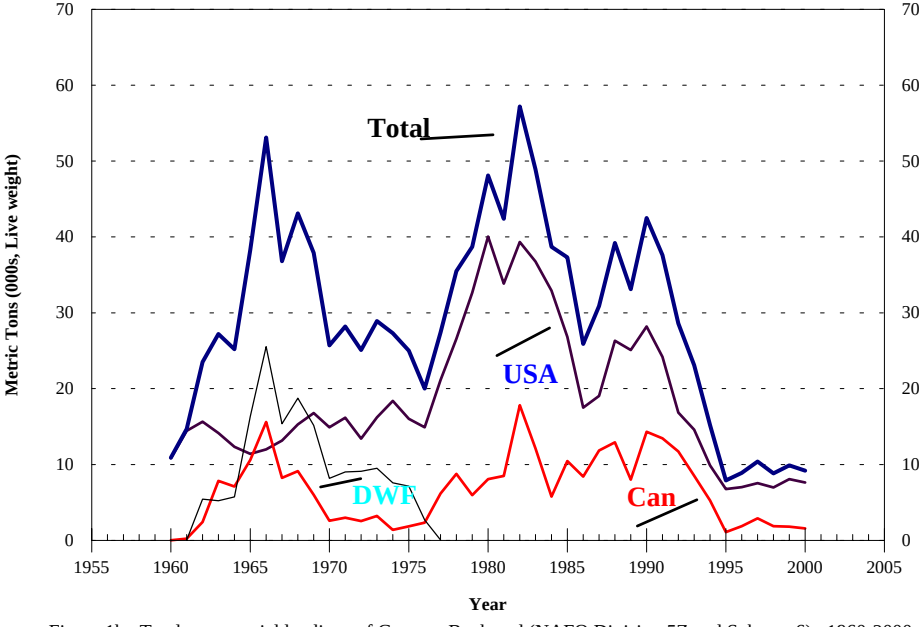


Figure 1b. Total commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6), 1960-2000.

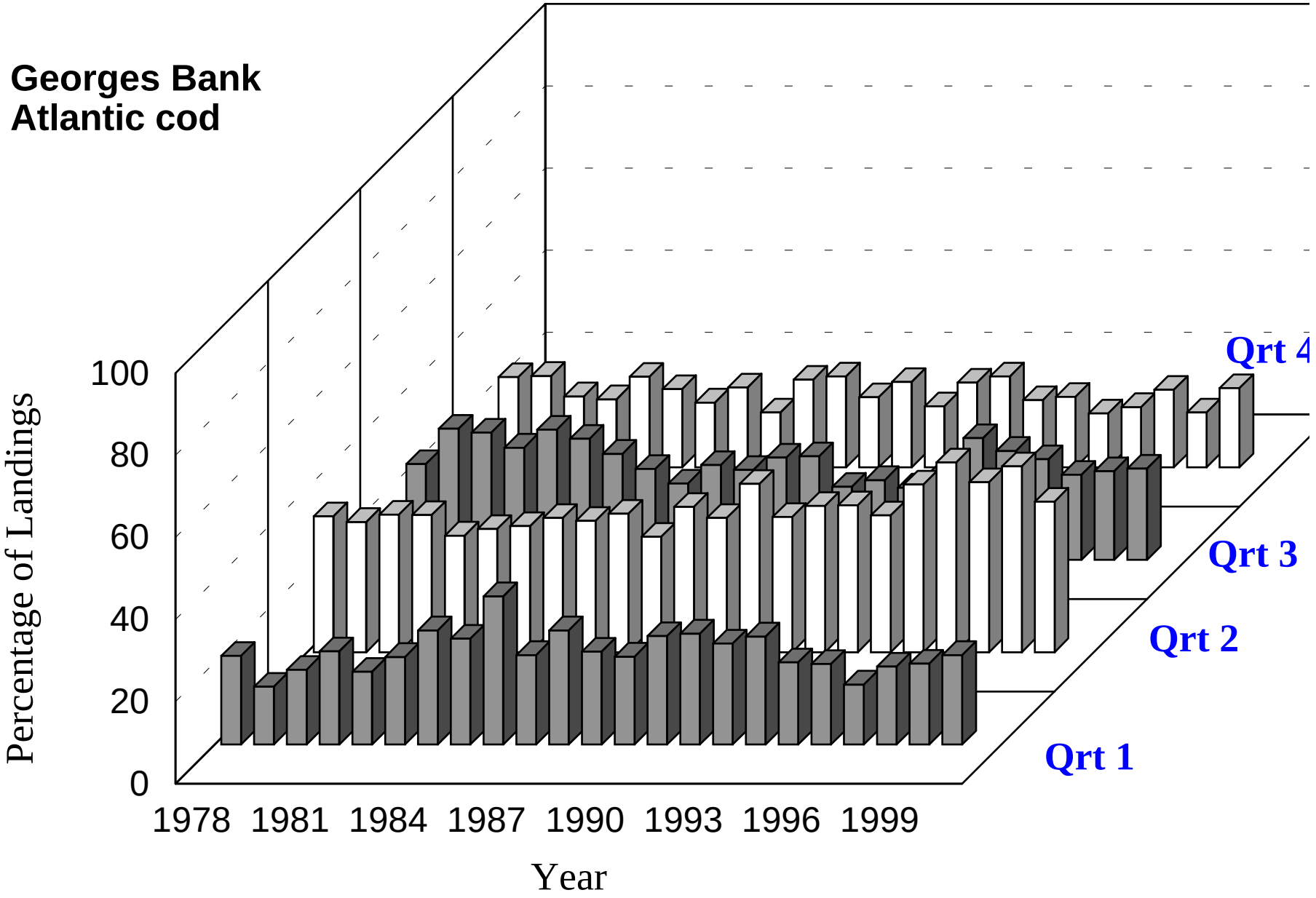


Figure 2. USA commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6) by quarter, 1978-2000.

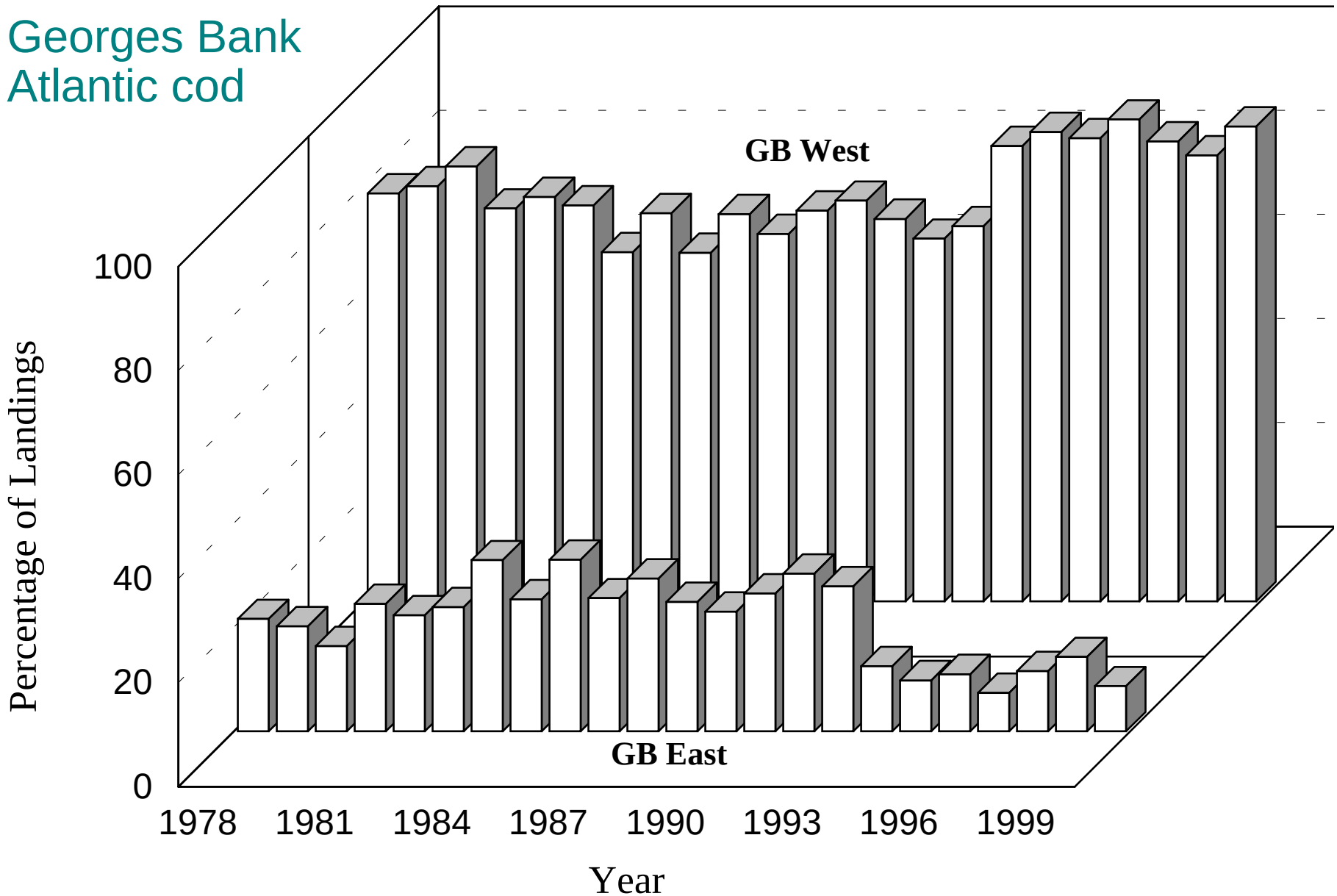


Figure 3. USA commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6) for Eastern Georges Bank (SA 561-562) and Western Georges Bank (SA 521-522,525-526, 537-539, and Subarea 6), 1978-2000.

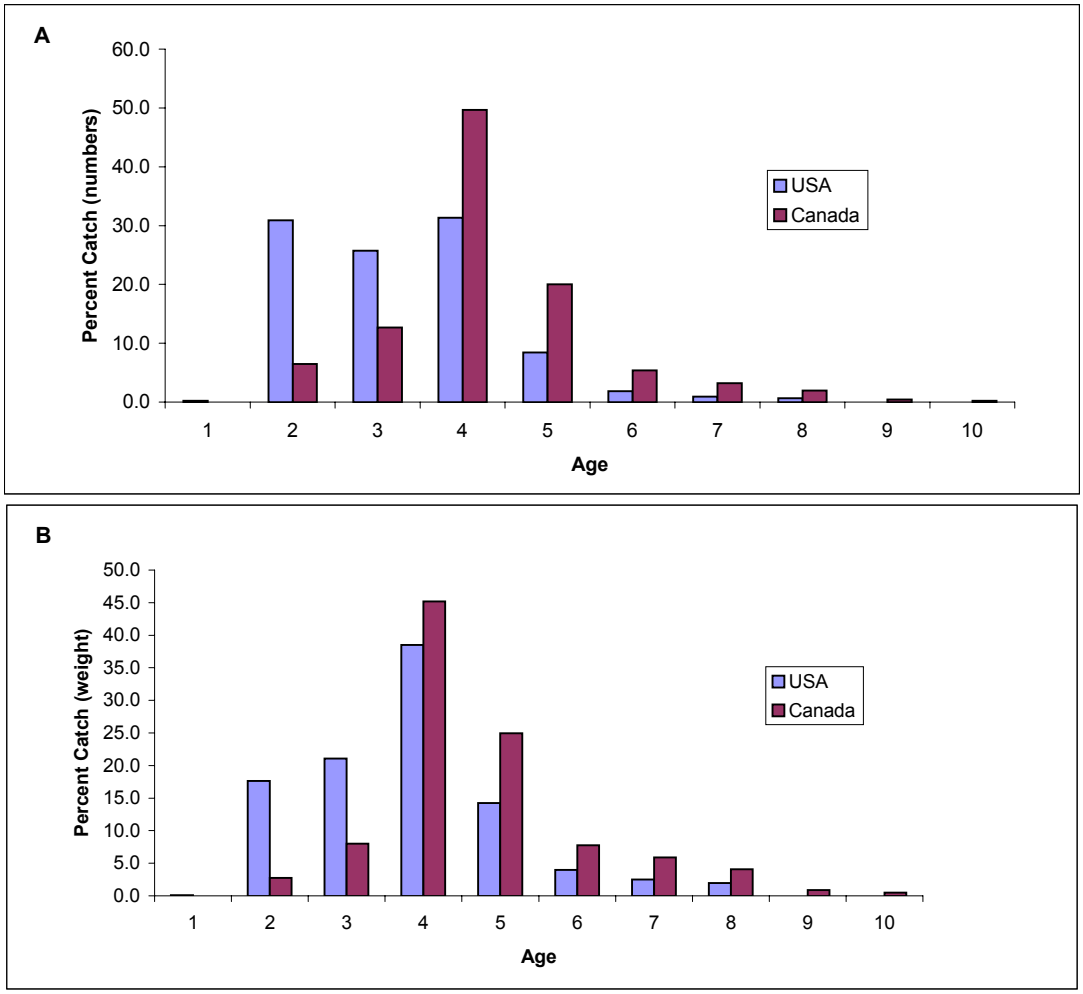


Figure 4. Percentage of Georges Bank cod catch in numbers (A) and weight (B) for USA and Canada for 2000

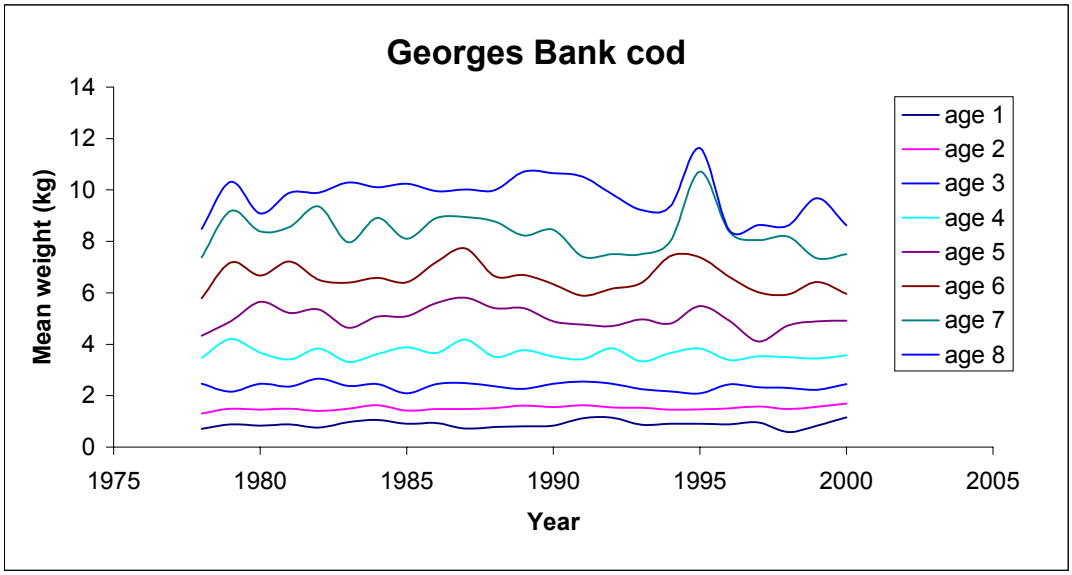


Figure 5. Beginning year mean weight at age for ages 1-8 for Georges Bank cod, 1978-2000.

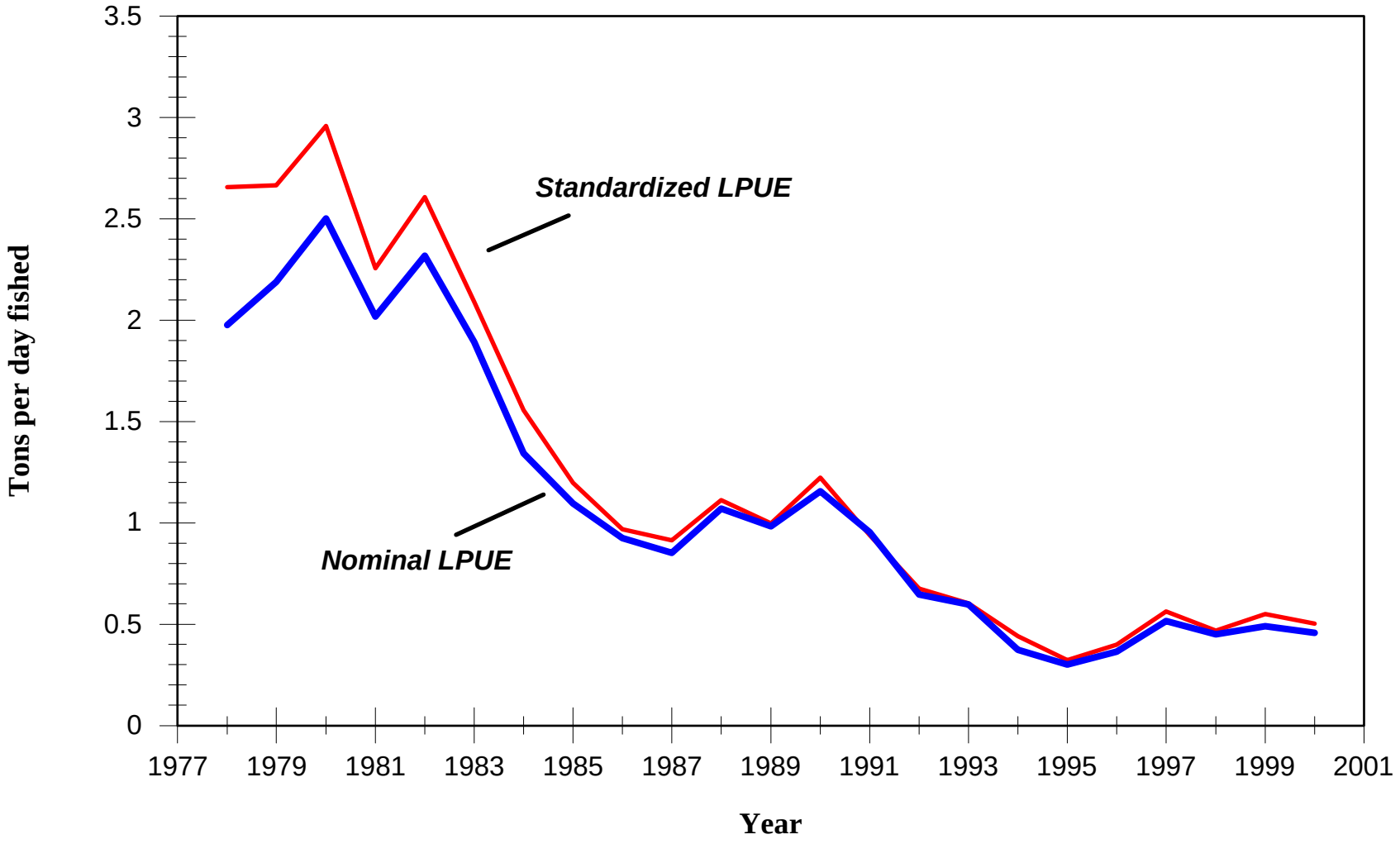


Figure 6. Trends in USA LPUE (landings per day fished) of Georges Bank cod, 1978-2000. Nominal LPUE is based on all otter trawl trips landing cod. Standardized LPUE is derived from a GLM incorporating year, tonnage class, area, quarter, and depth from 1978-1993.

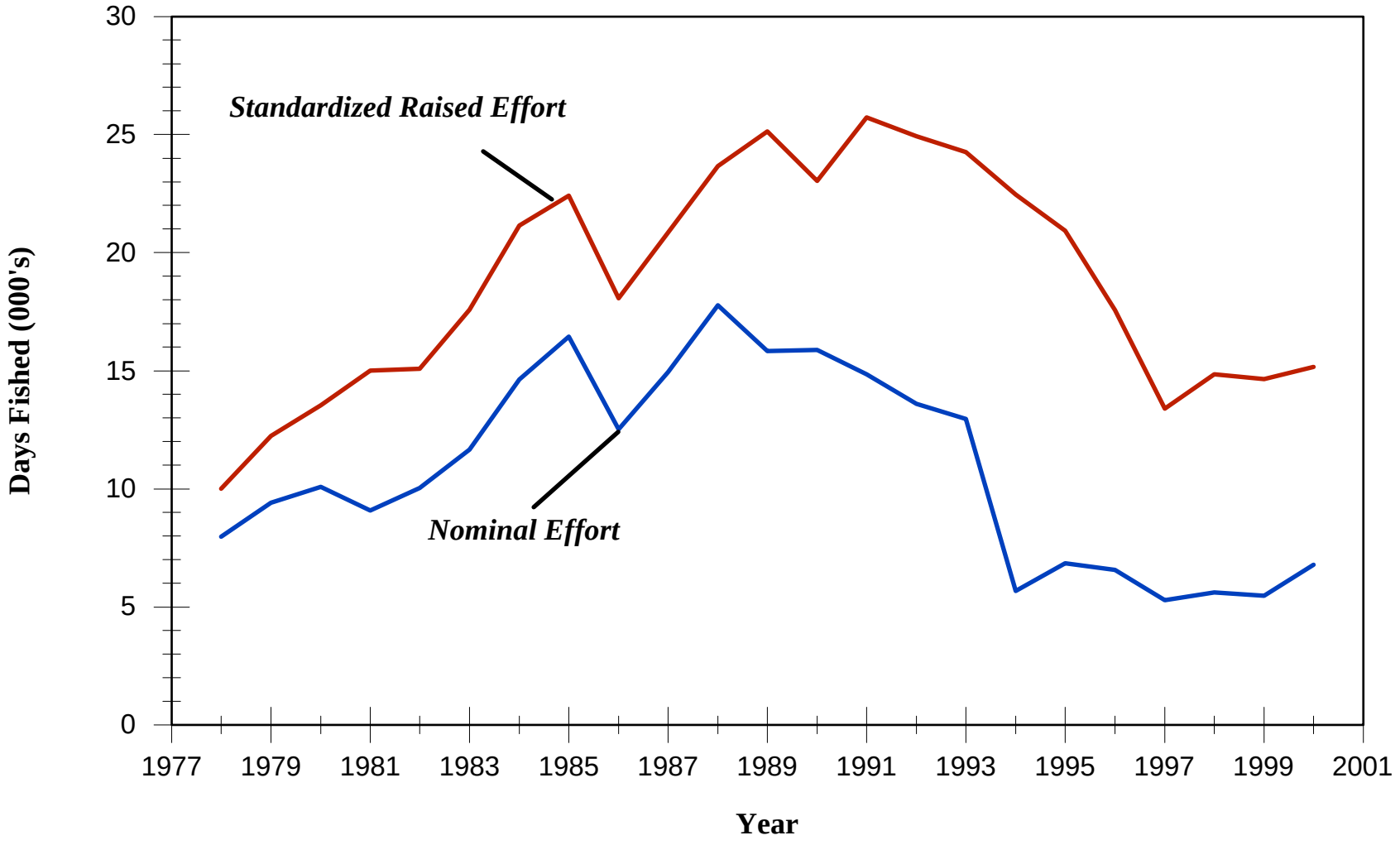


Figure 7. Trends in USA fishing effort (days fished) on Georges Bank, 1978-2000. Nominal effort based on all otter trawl trips landing cod. Standardized-raised effort derived from a GLM incorporating year, tonnage class, area, quarter, and depth.

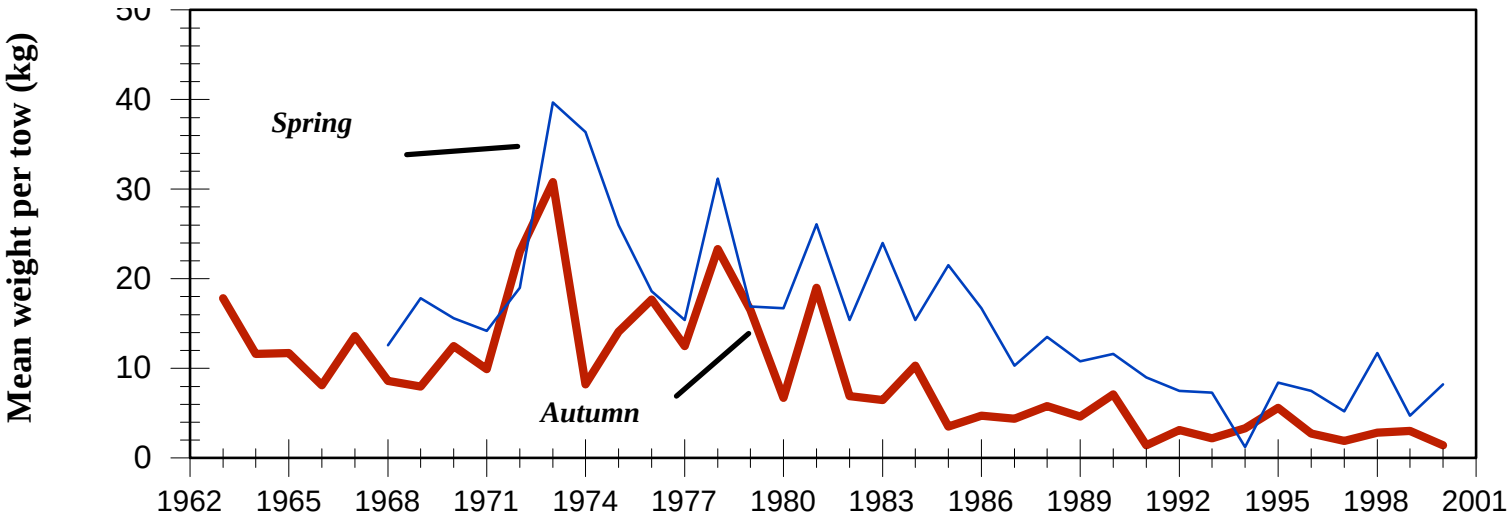


Figure 8. Standardized stratified mean catch per tow(kg) of Atlantic cod in NEFSC spring and autumn research vessel bottom trawl surveys on Georges Bank, 1963-2000.

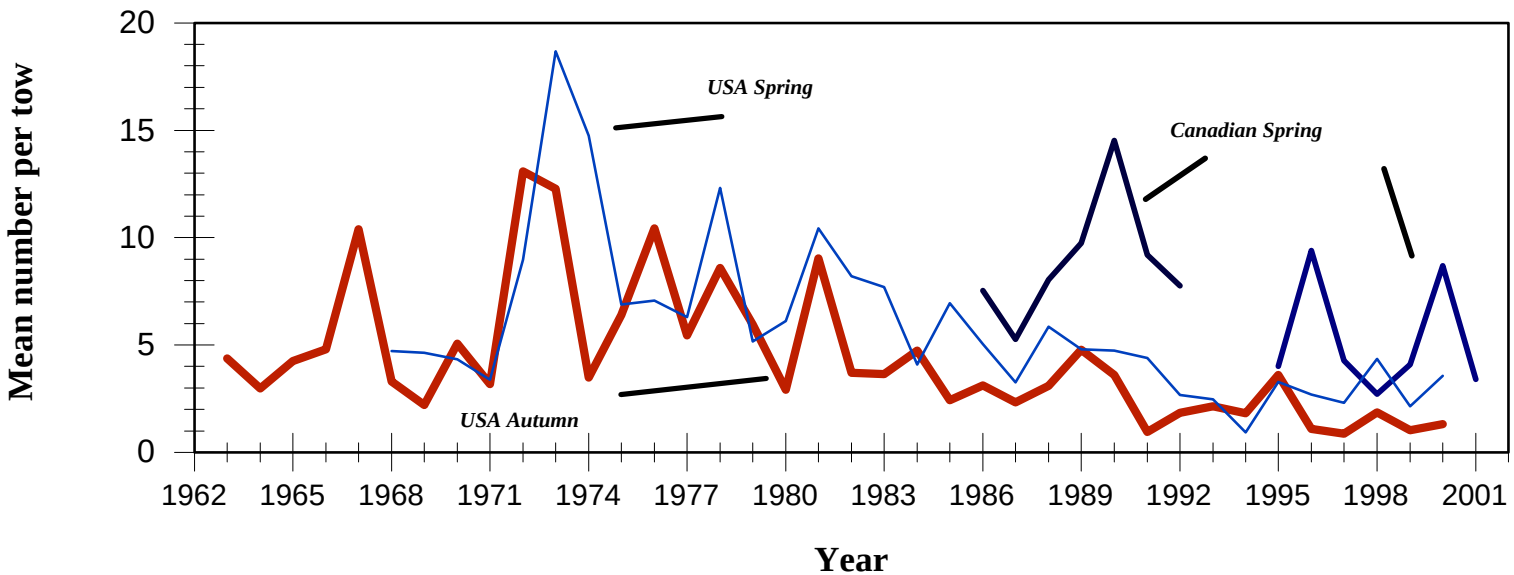


Figure 9. Standardized stratifed mean number per tow of Atlantic cod in NEFSC spring and autumn research vessel bottom trawl surveys, 1963-2000 and Canadian spring research vessel bottom trawl surveys, 1986-1992 and 1994-2001, on Georges Bank.

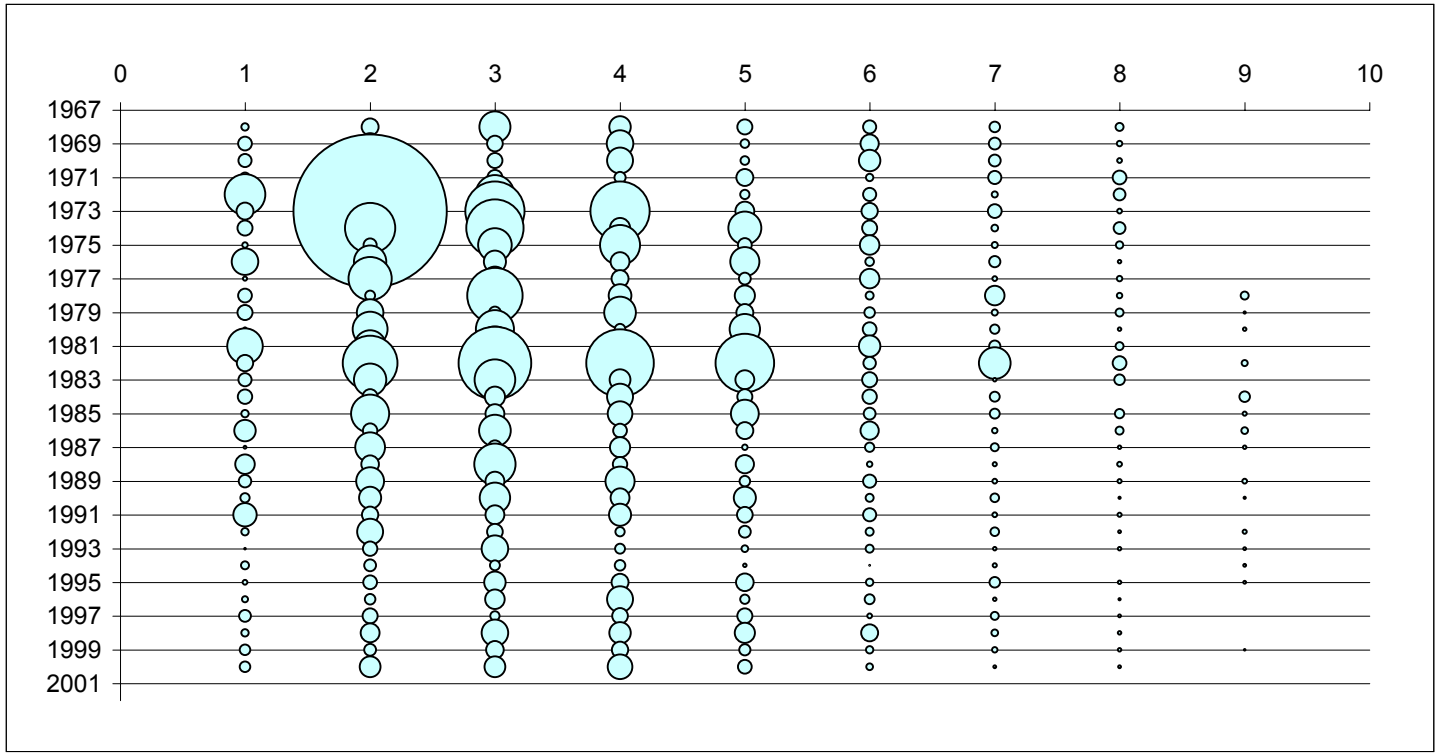


Figure 10. Standardized stratified mean catch per tow at age (numbers) of Atlantic cod in NEFSC offshore spring bottom trawl surveys on Georges Bank, 1968-2000.

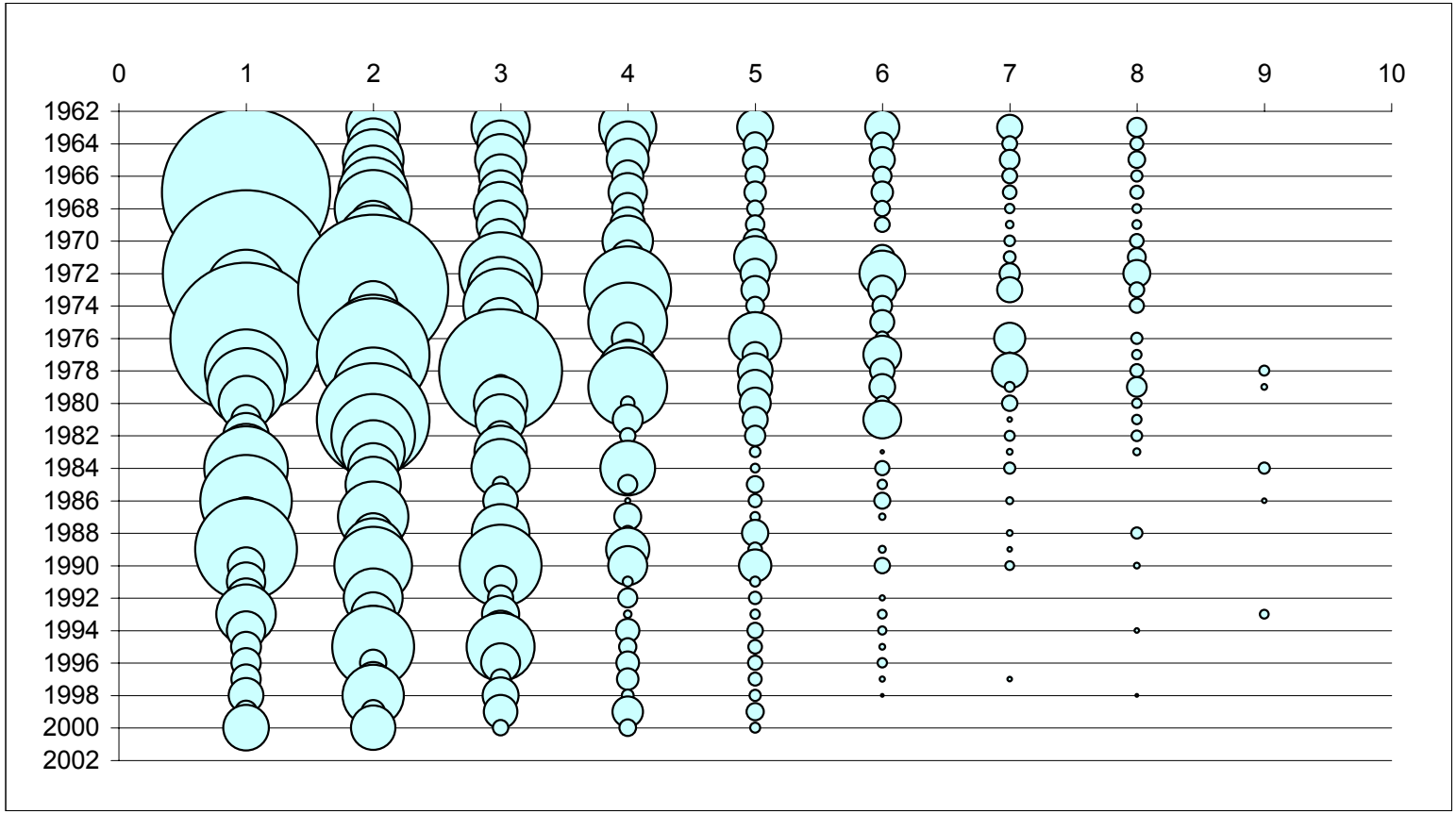


Figure 11. Standardized stratified mean catch per tow at age (numbers) of Atlantic cod in NEFSC offshore autumn bottom trawl surveys on Georges Bank,

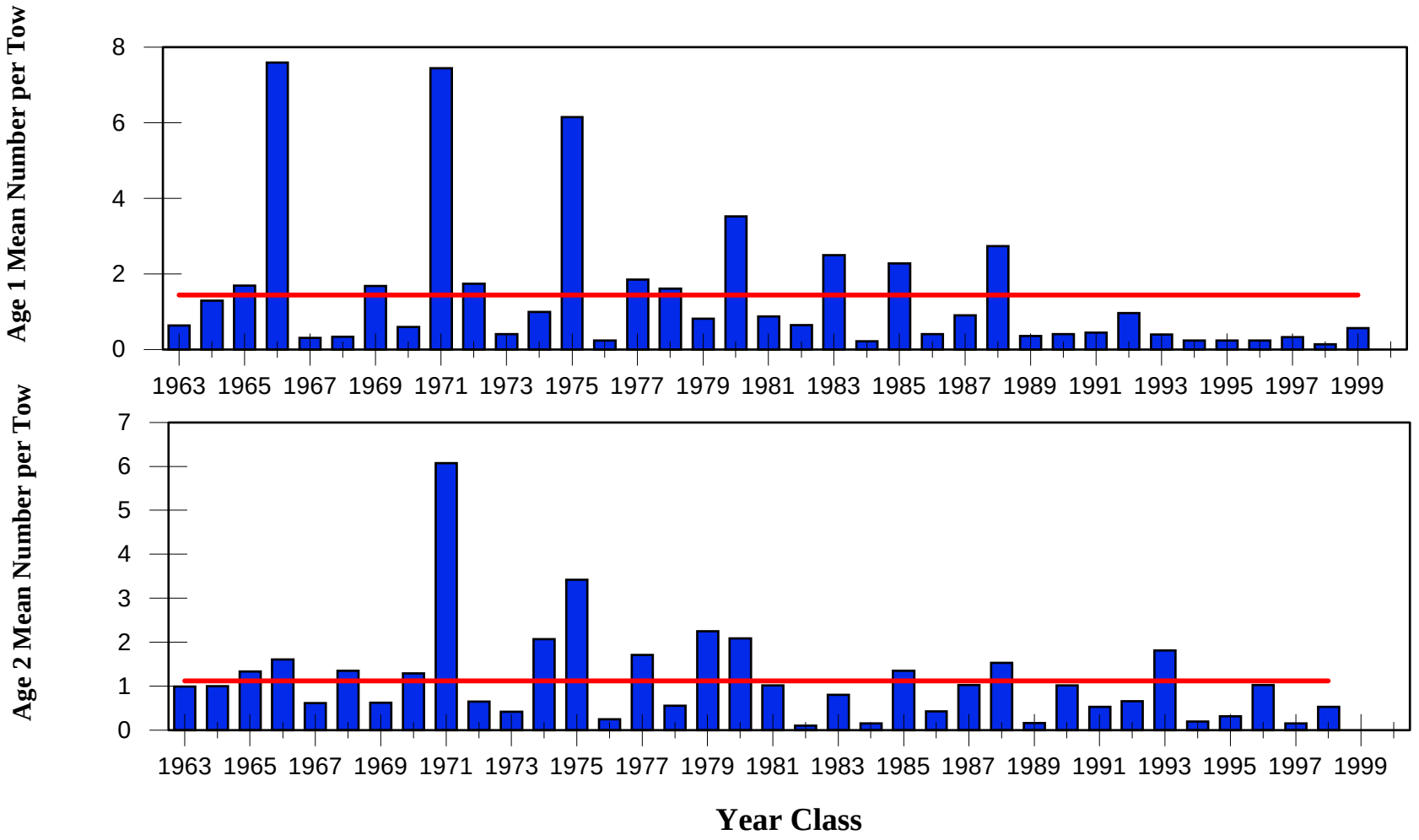


Figure 12. Relative year class strength of age 1 and age 2 Georges Bank cod based on standardized catch (number) per tow indices from NEFSC autumn research vessel bottom trawl surveys, 1963-2000. Horizontal line represents time series average.

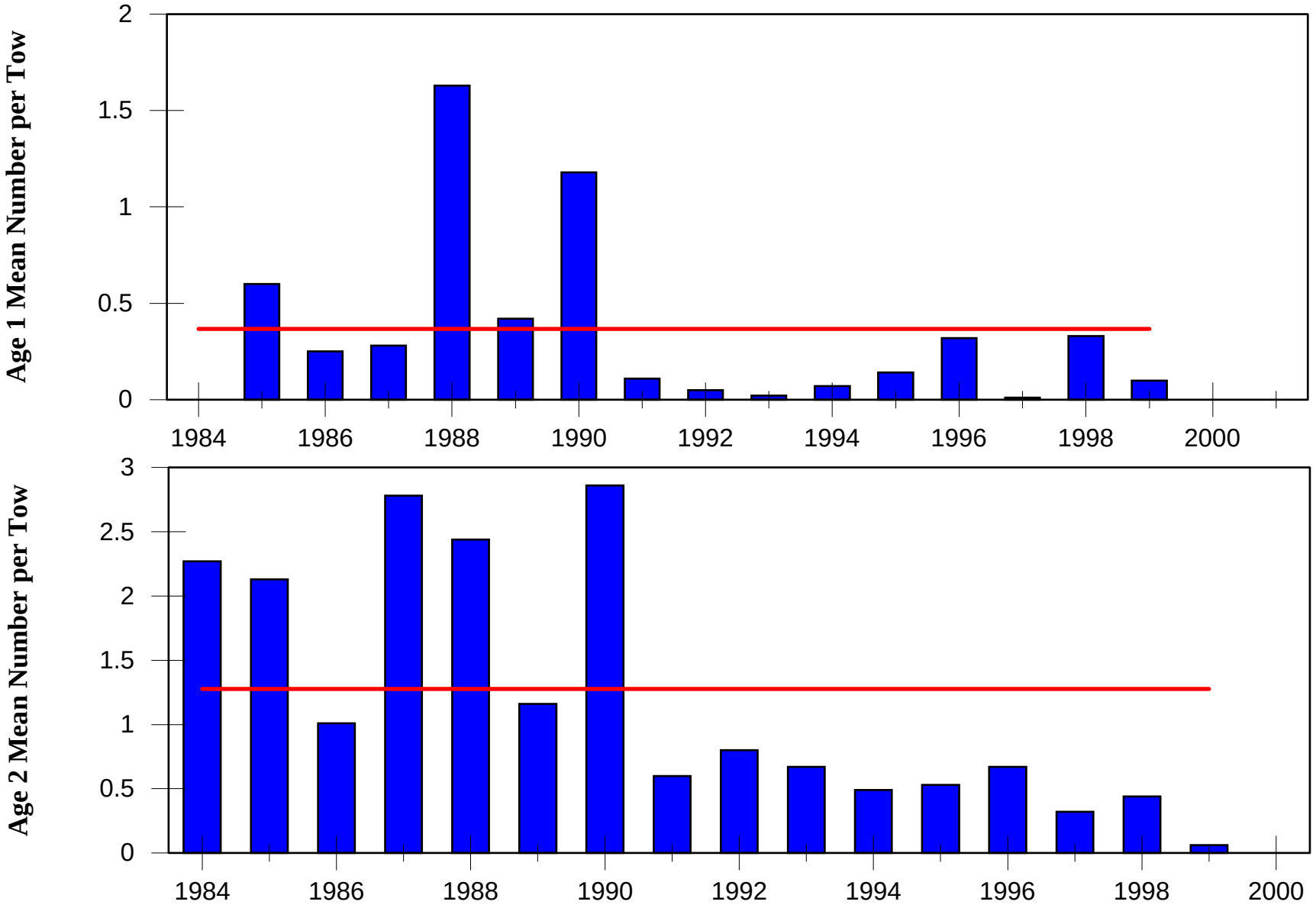
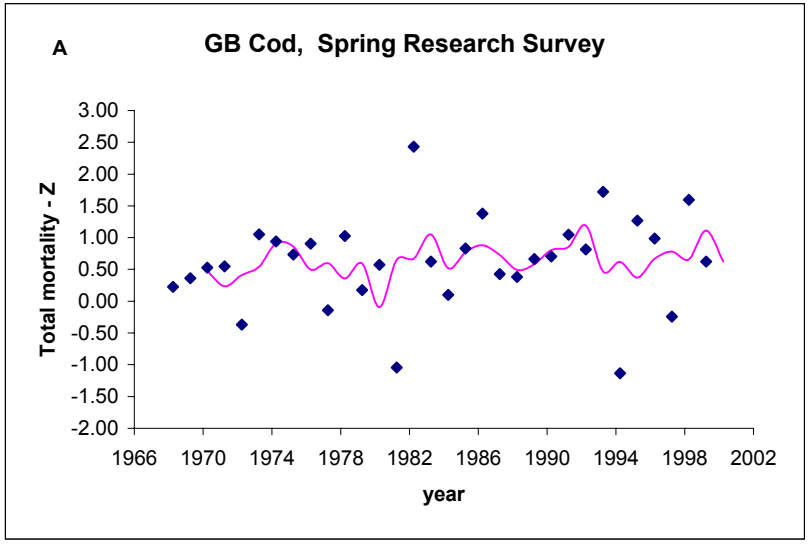
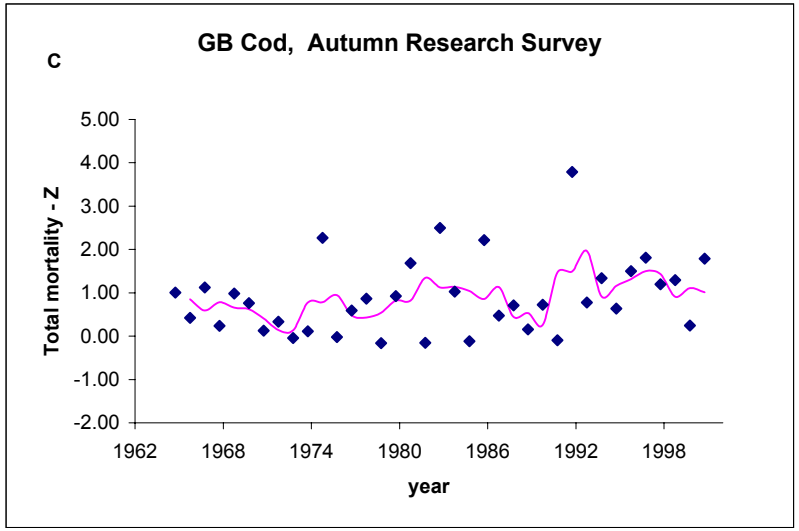


Figure 13. Relative year class strengths of Georges Bank cod age 1 and age 2 based on standardized catch (number) per tow indices from Canadian spring research vessel bottom trawl surveys, 1986-2001. Horizontal line represents time series average.





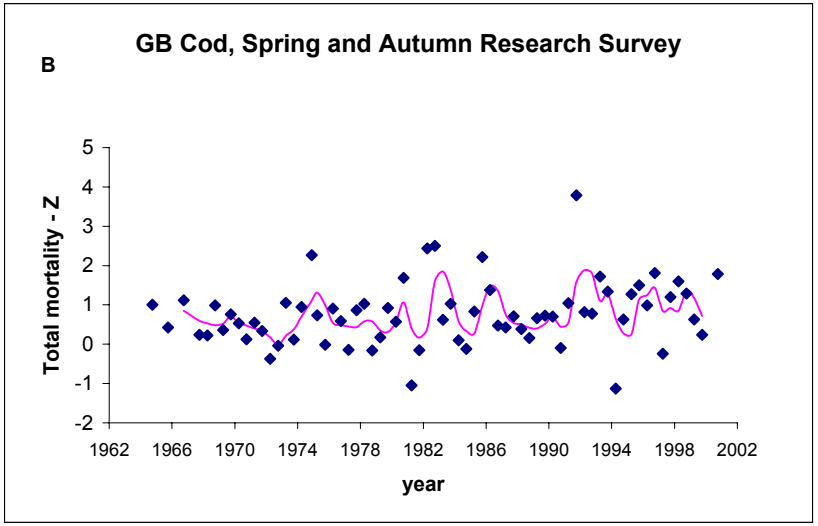


Figure 14. Estimates of instantaneous total mortality (Z) derived from spring (A) and autumn (B) research surveys fit with a 3-year moving average over the time series and sequential spring and autumn estimates (C) fit with a 3-year moving average for George Bank Atlantic cod, 1963-2000.

Figure 15. Scaled observed indices (ln[index/mean]) for ages 1-8 for the USA #41 Yankee (1978-1981), #36 Yankee (1982-1999), and Canadian spring (1986-2001) surveys and ages 1-6 for the USA autumn (1963-2000) survey.

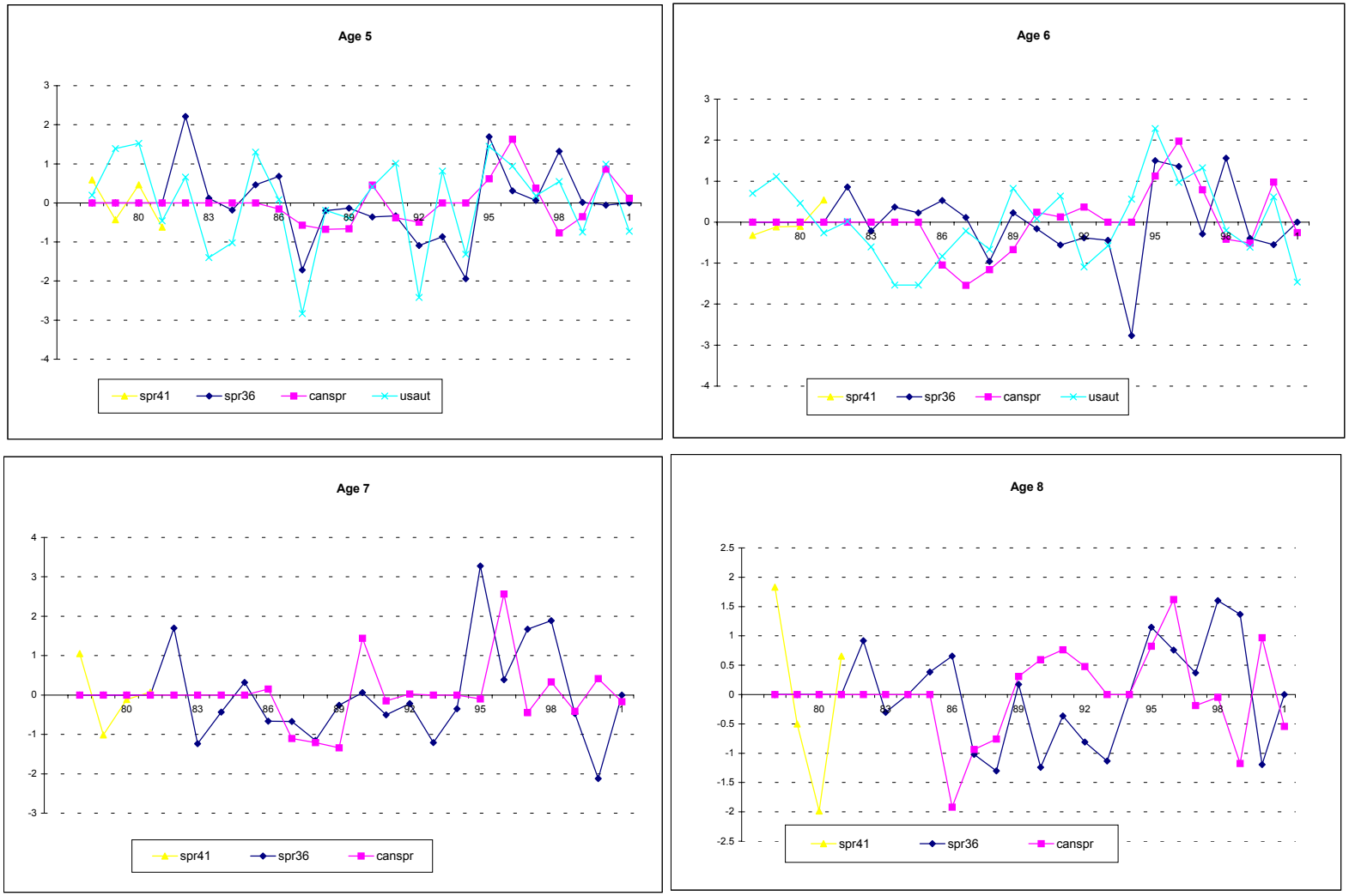


Figure 15 continued. Scaled observed indices (ln[index/mean]) for ages 1-8 for the USA #41 Yankee (1978-1981), #36 Yankee (1982-2000), and Canadian (1986-2001) spring surveys and ages 1-6 for the USA autumn (1963-2000) survey.

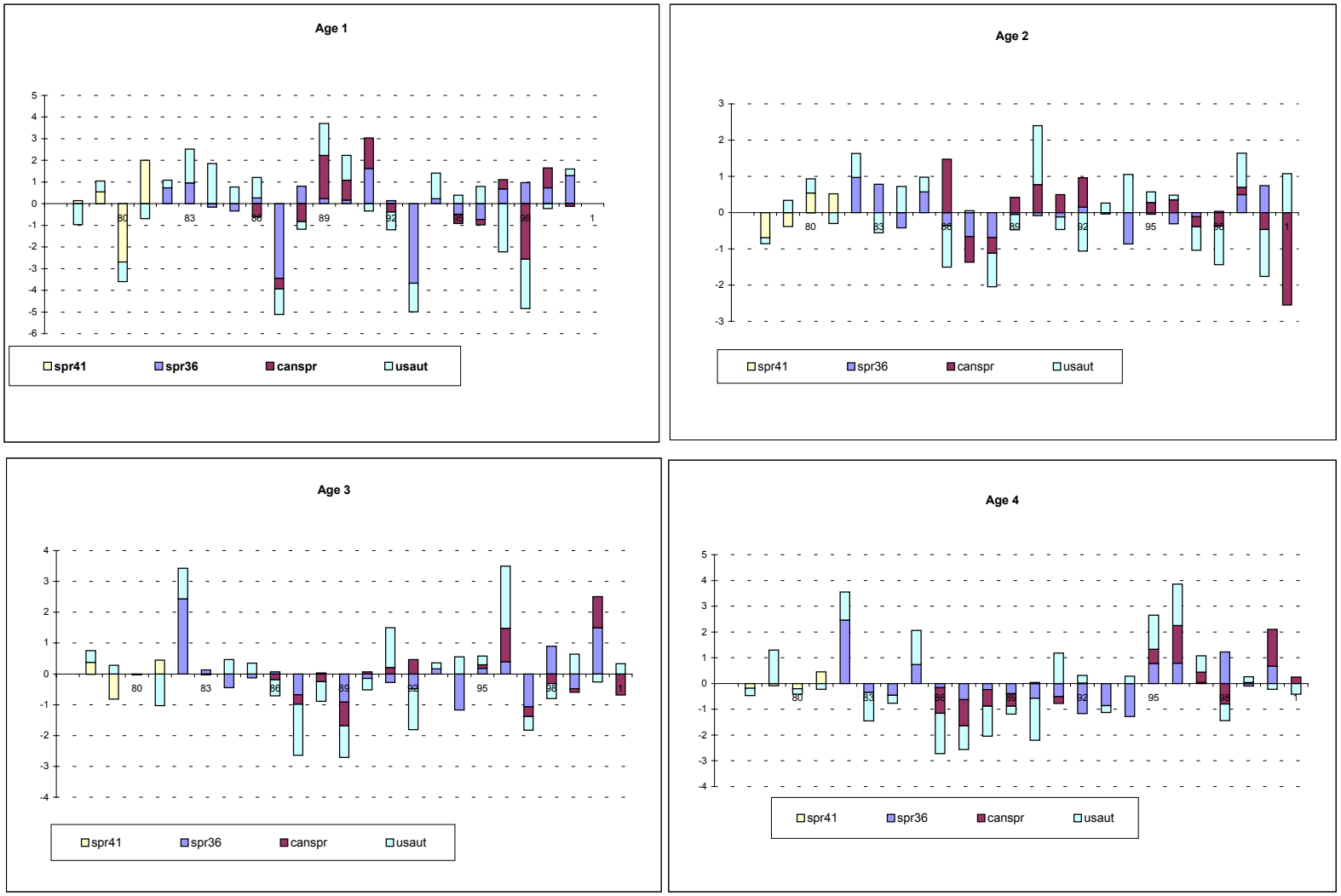


Figure 16. Residual plots (observed-predicted) for ages 1-8 for the USA spring #41 Yankee (1978-1981) and #36 Yankee (1982-2000) and Canadian spring (1986-2001) abundance indices, and ages 1-6 for the USA autumn (1978-2000) research survey indices.

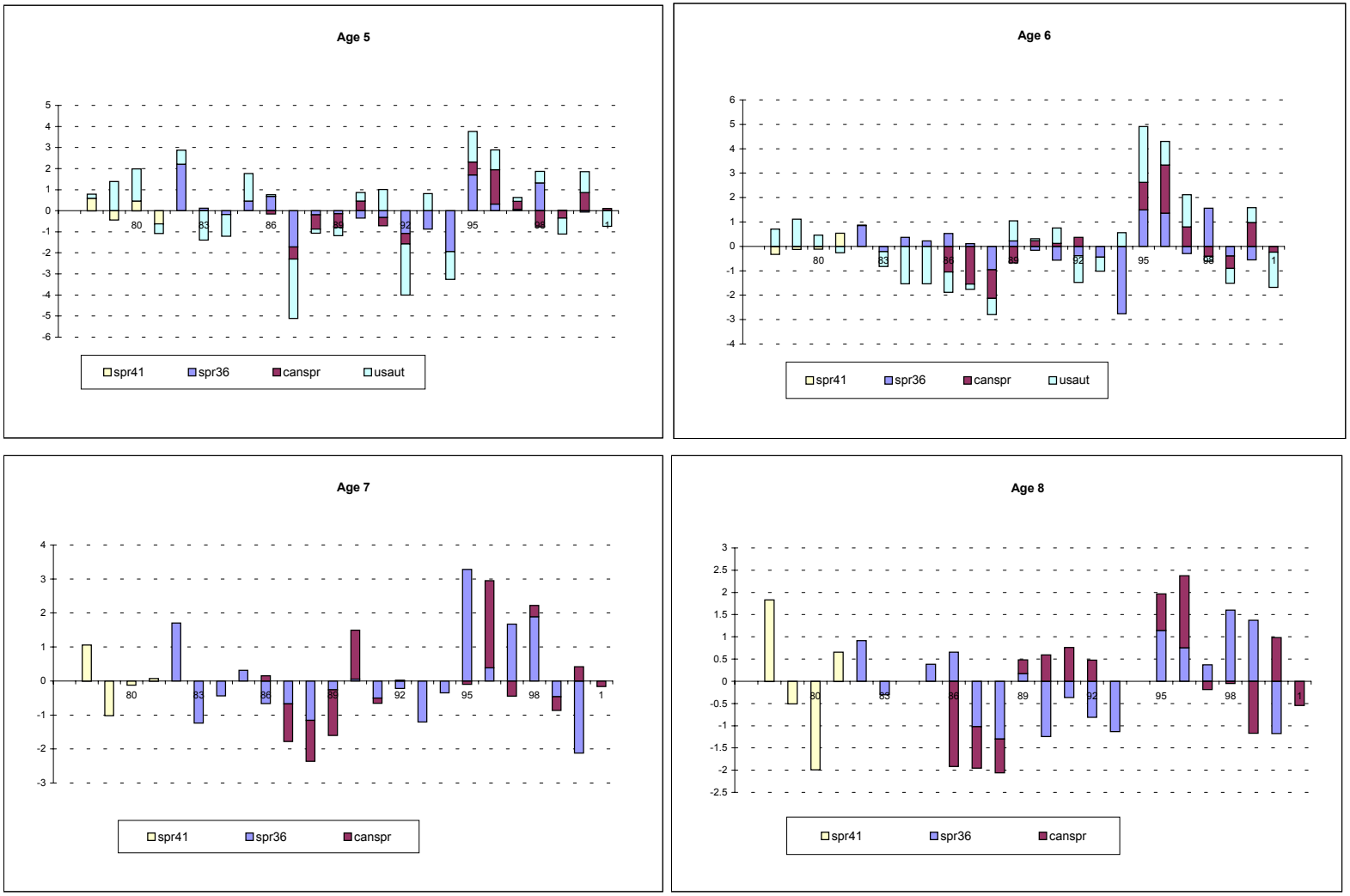


Figure 16 continued. Residual plots (observed-predicted) for ages 1-8 for the USA spring #41 Yankee (1978-1981) and #36 Yankee (1982-2000) and Canadian spring (1986-2001) abundance indices, and ages 1-6 for the USA autumn (1978-2000) research survey indices.

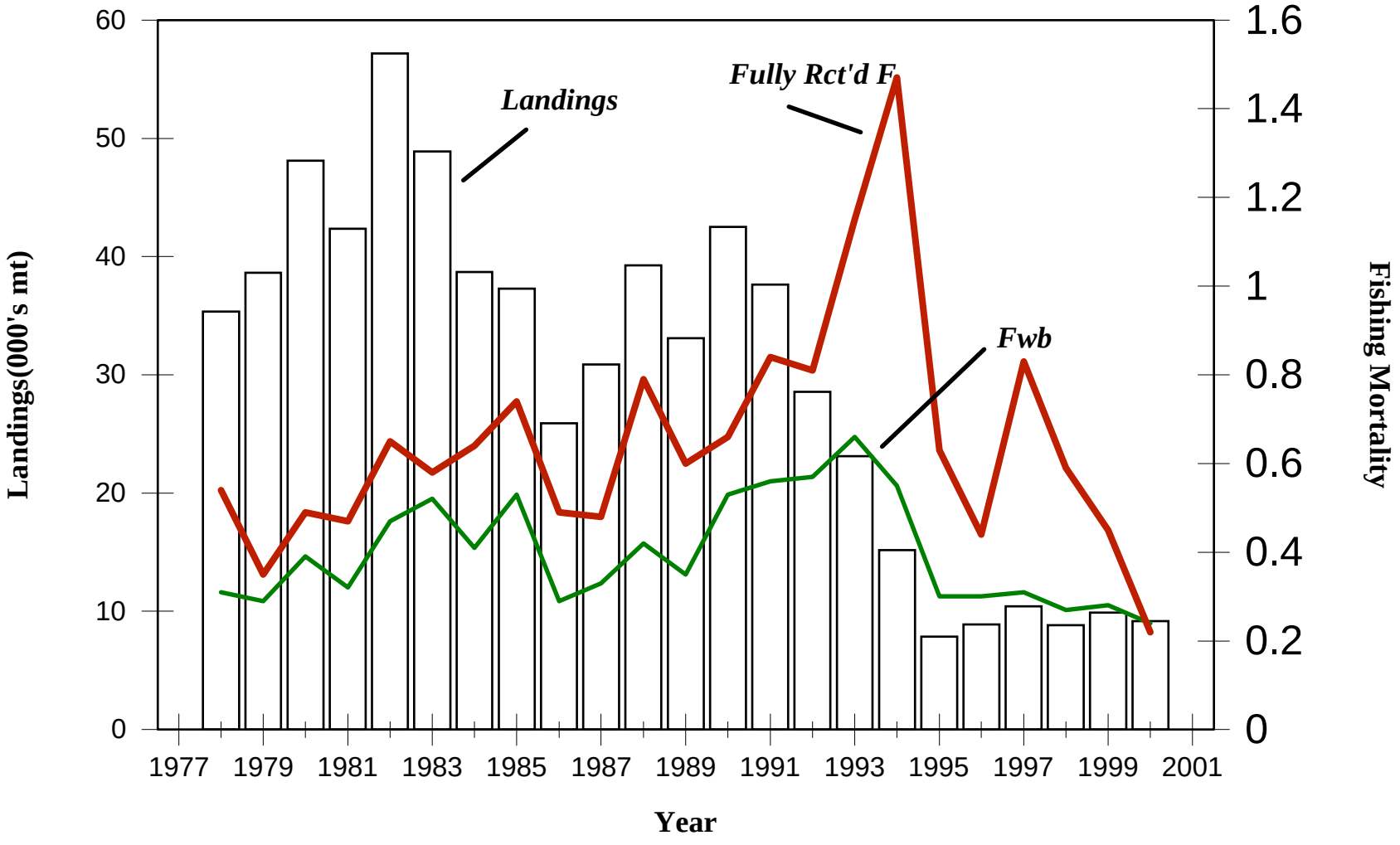


Figure 17a. Trends in total commercial landings and fishing mortality for Georges Bank cod, 1978-2000.

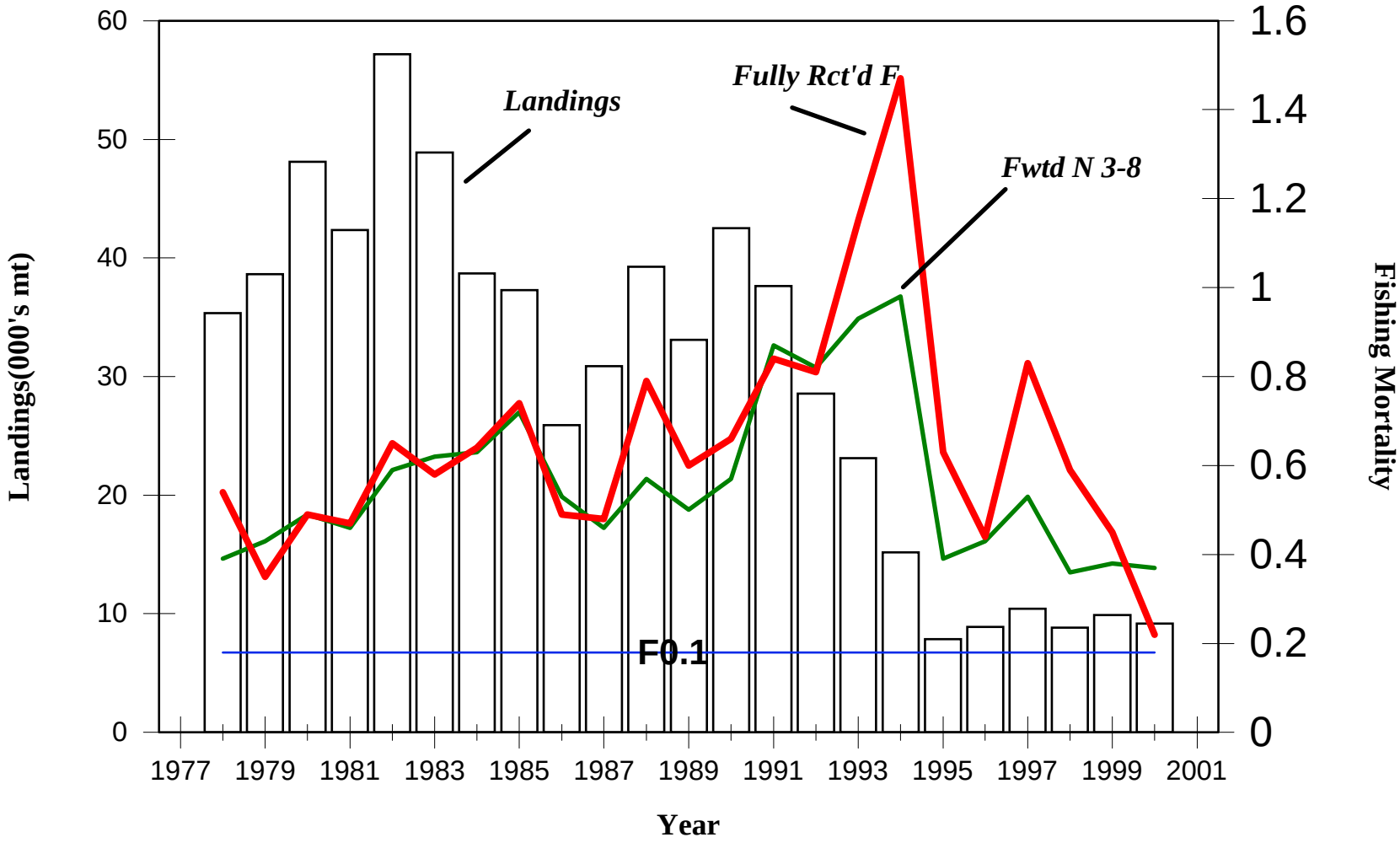


Figure 17b. Trends in total commercial landings and fishing mortality for F unweighted(ages 4-8) and F weighted by stock size F (ages 3-8) for Georges Bank cod, 1978-2000.

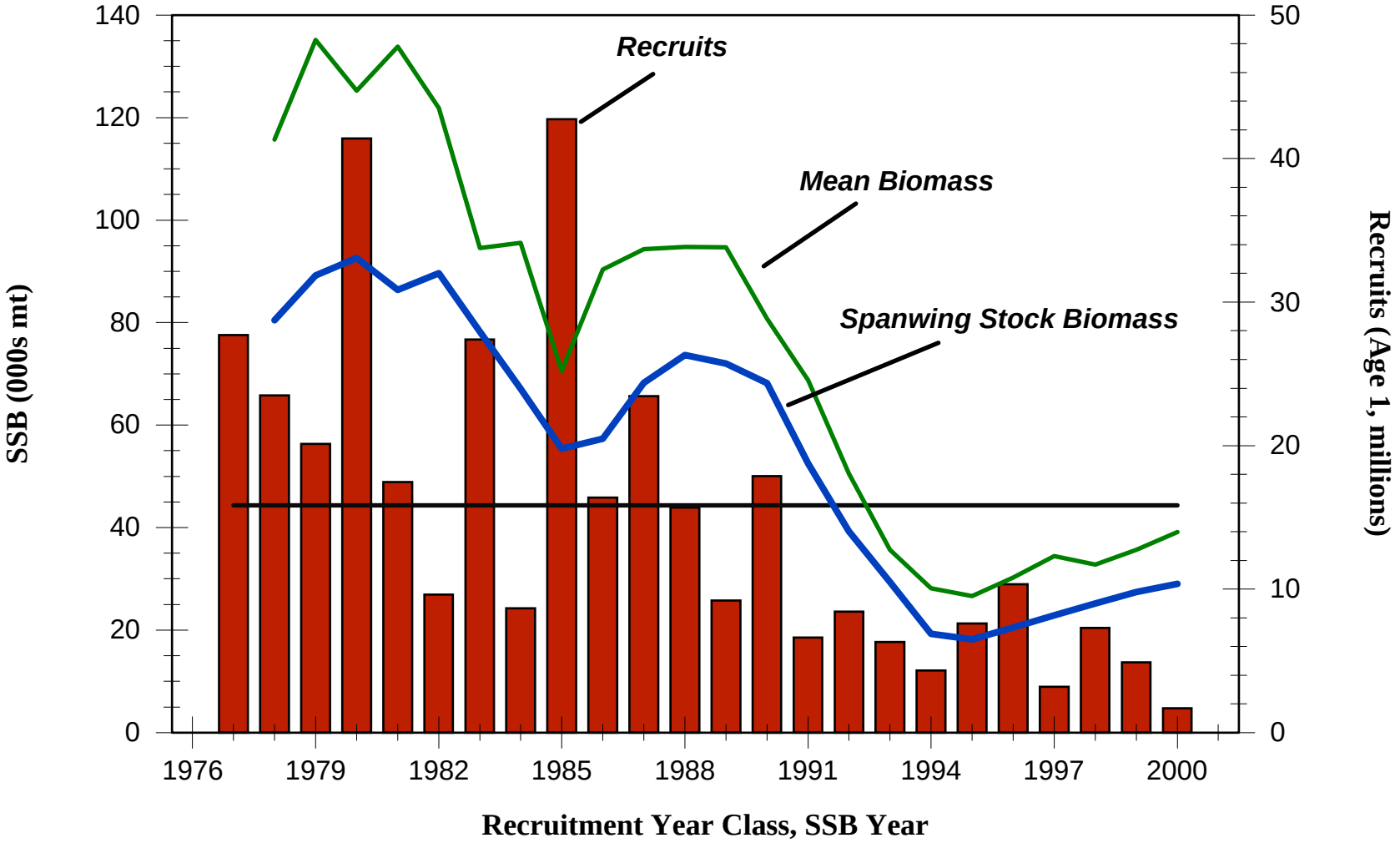


Figure 18. Trends in stock biomass and recruitment for Georges Bank Atlantic cod, 1978-2000. Horizontal line is average recruitment for the time series.

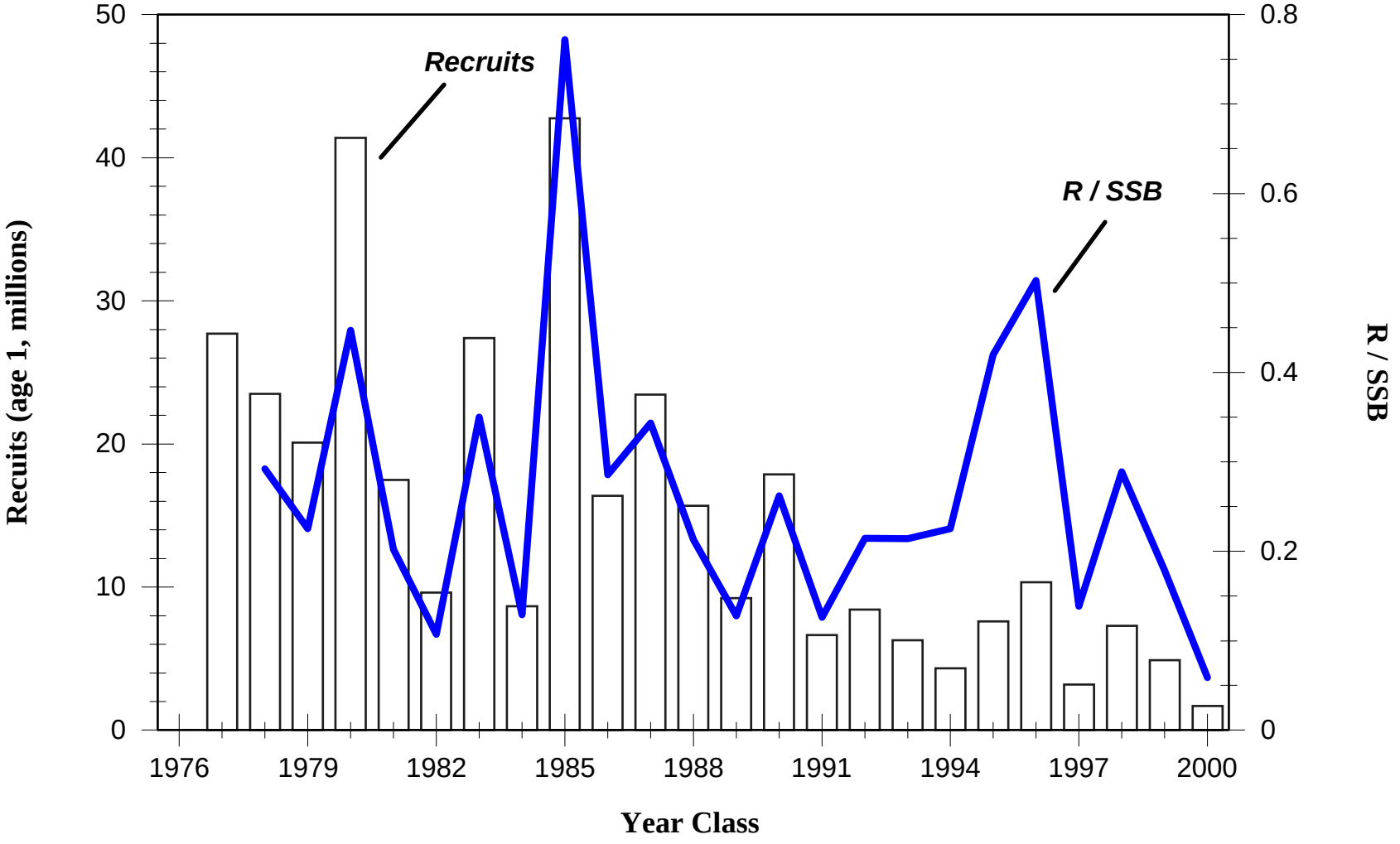


Figure 19. Trends in recruitment and recruitment/ SSB survival ratio for Georges Bank cod, 1978-2000.

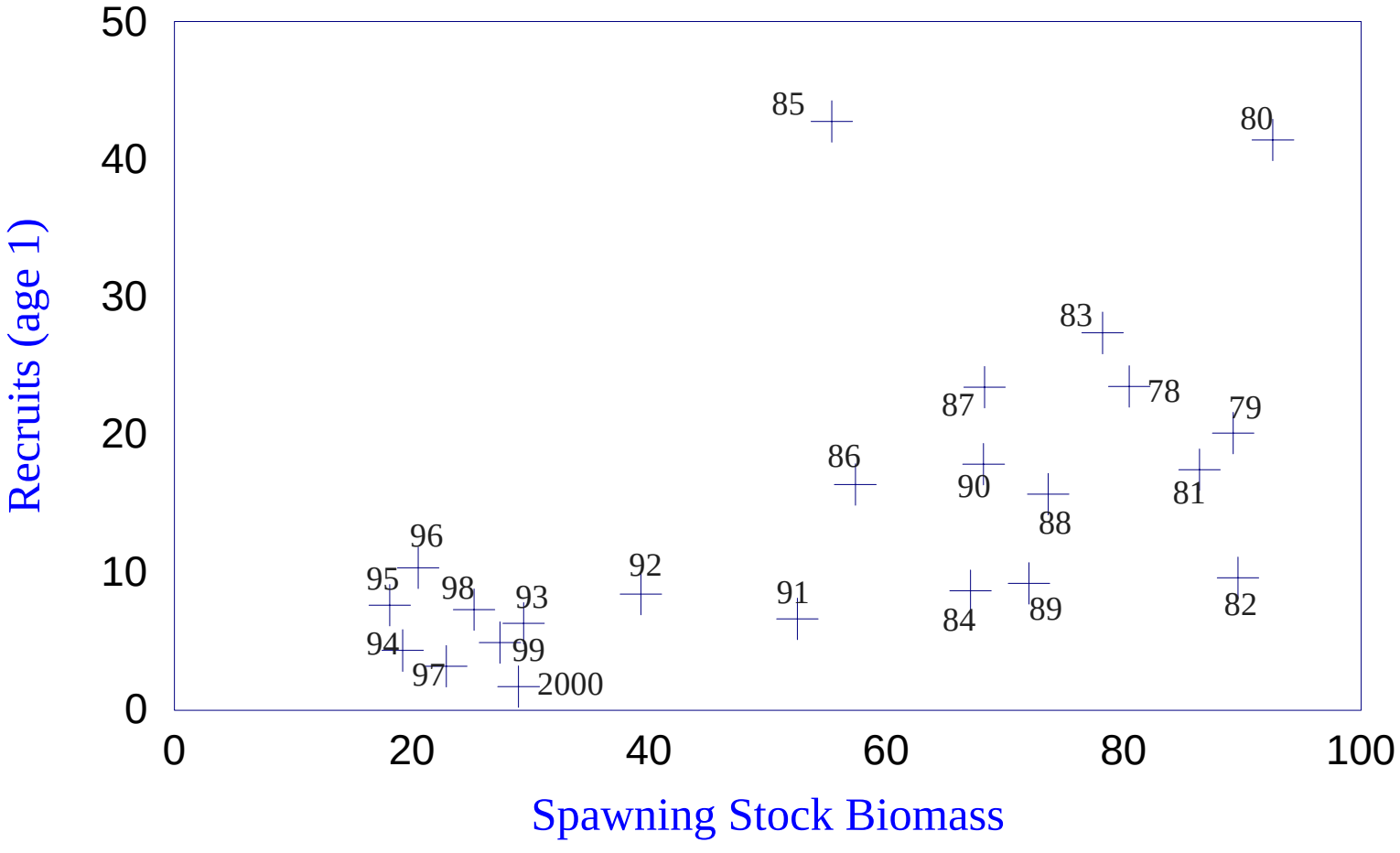


Figure 20. Spawning stock and recruits at age 1 for Georges Bank Atlantic cod, 1978-2000.

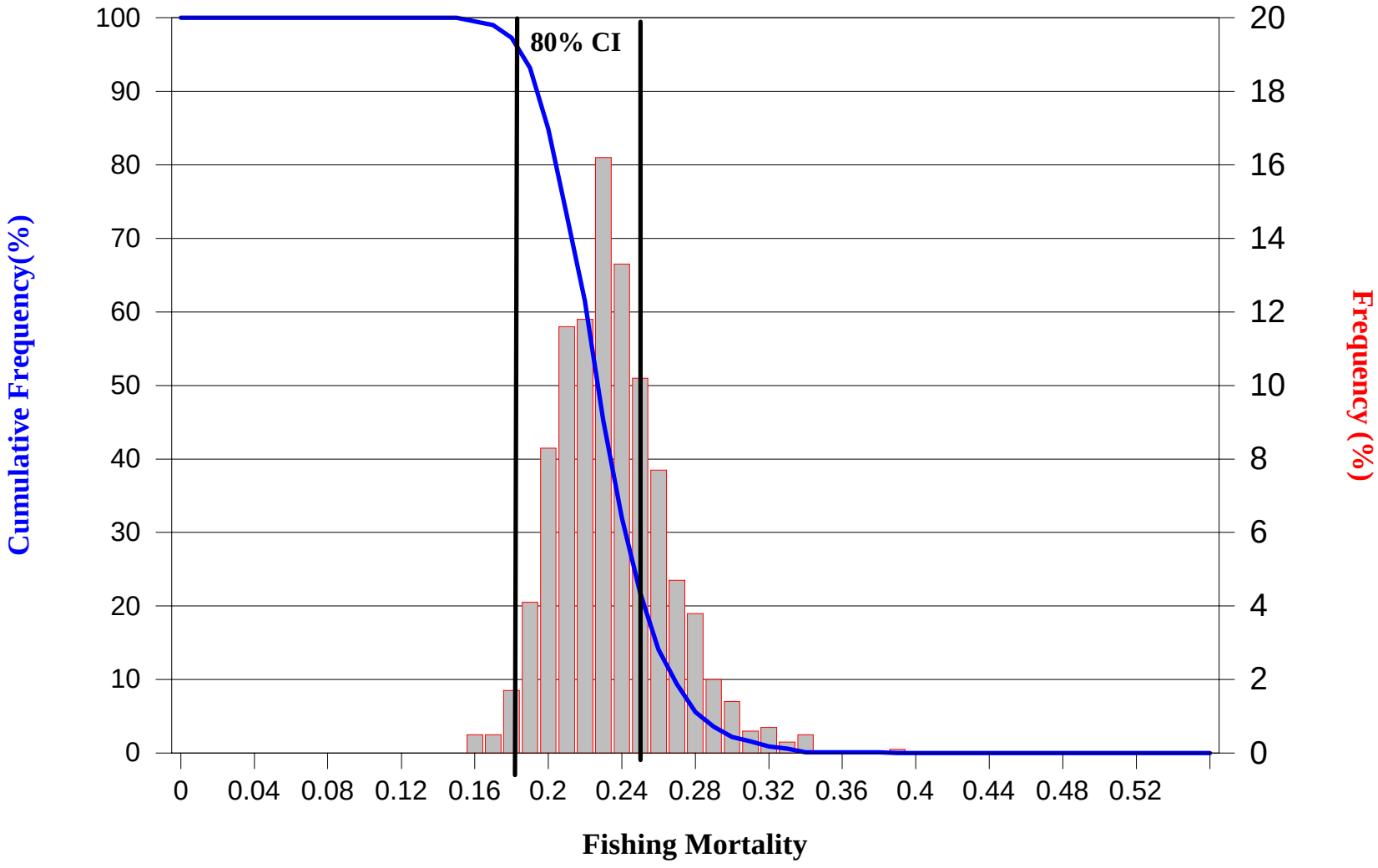


Figure 21. Precision of the estimates of the instantaneous rate of fishing (F) on the fully recruited ages (4+) in 2000 for Georges Bank cod. The bar height indicates the probability of values within that range. The solid line gives the probability that F is greater than any selected value on the X-axis.

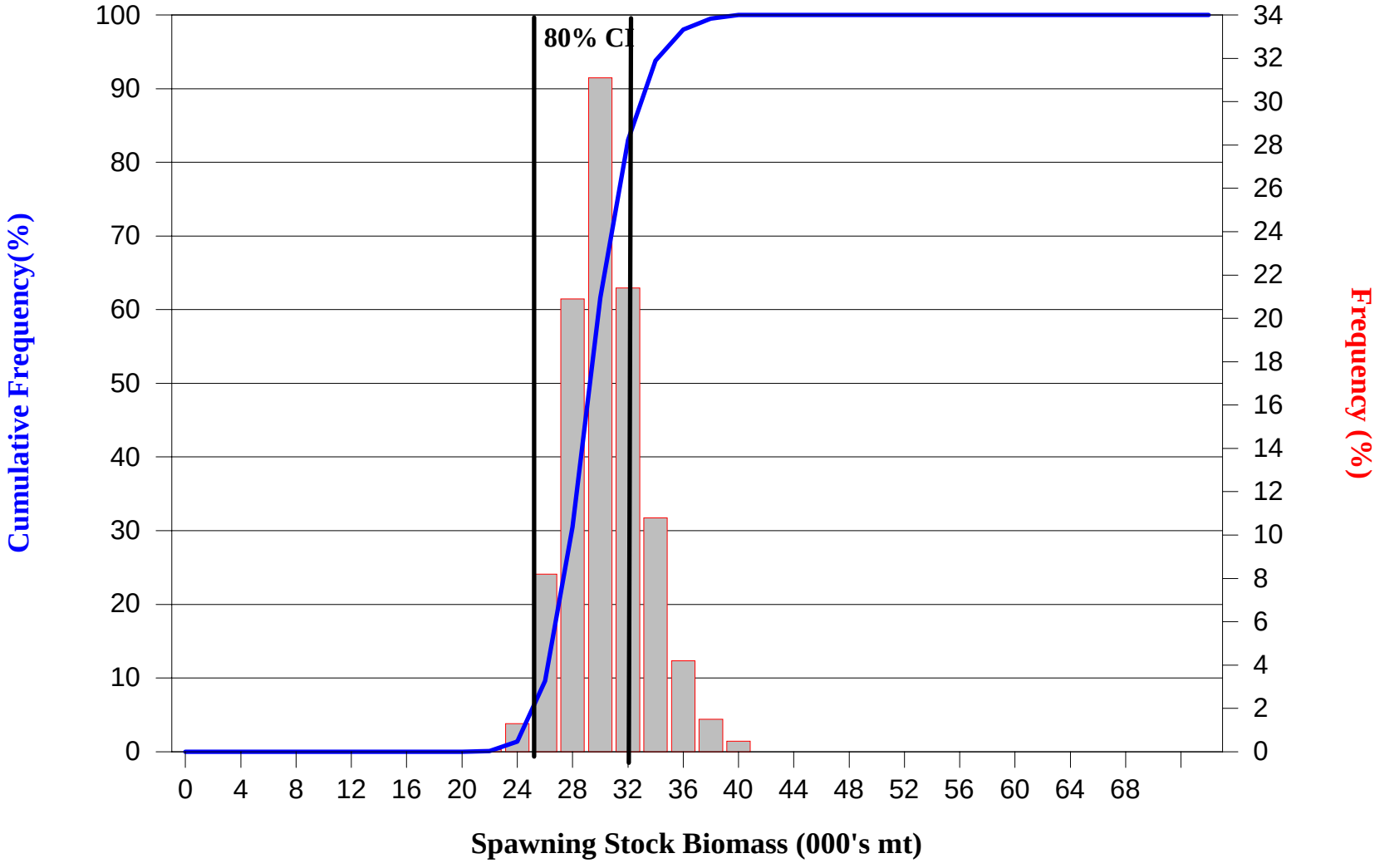


Figure 22. Precision of the estimates of spawning stock biomass (SSB) at the beginning of the spawning season for Georges Bank cod, 2000. The bar height indicates the probability of values within that range. The solid line gives the probability that SSB is less than any selected value on the X-axis.

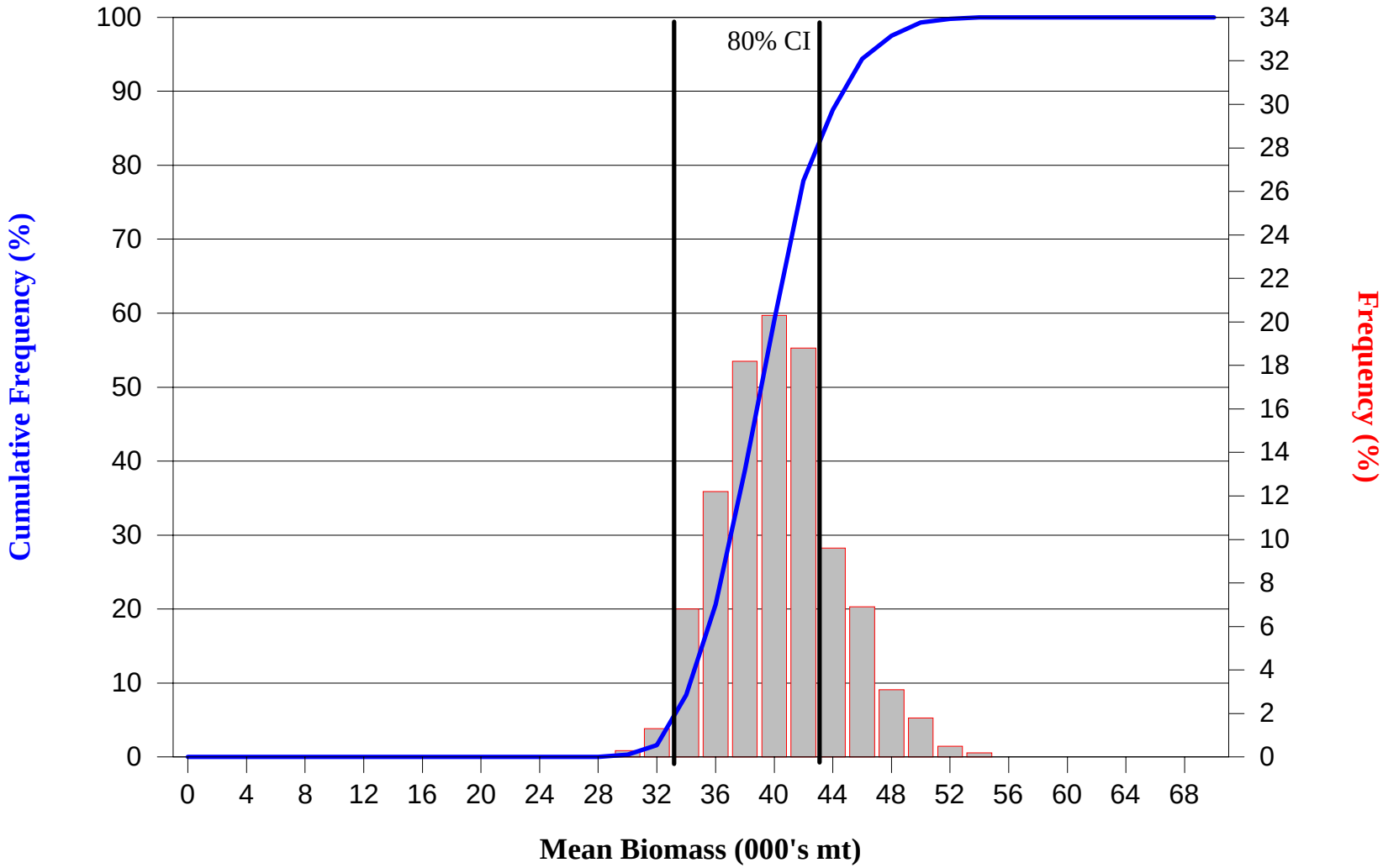


Figure 23. Precision of the estimates of mean stock biomass for Georges Bank cod, 2000. The bar height indicates the probability of values within that range. The solid line gives the probability that mean biomass is less than any selected value on the X-axis.

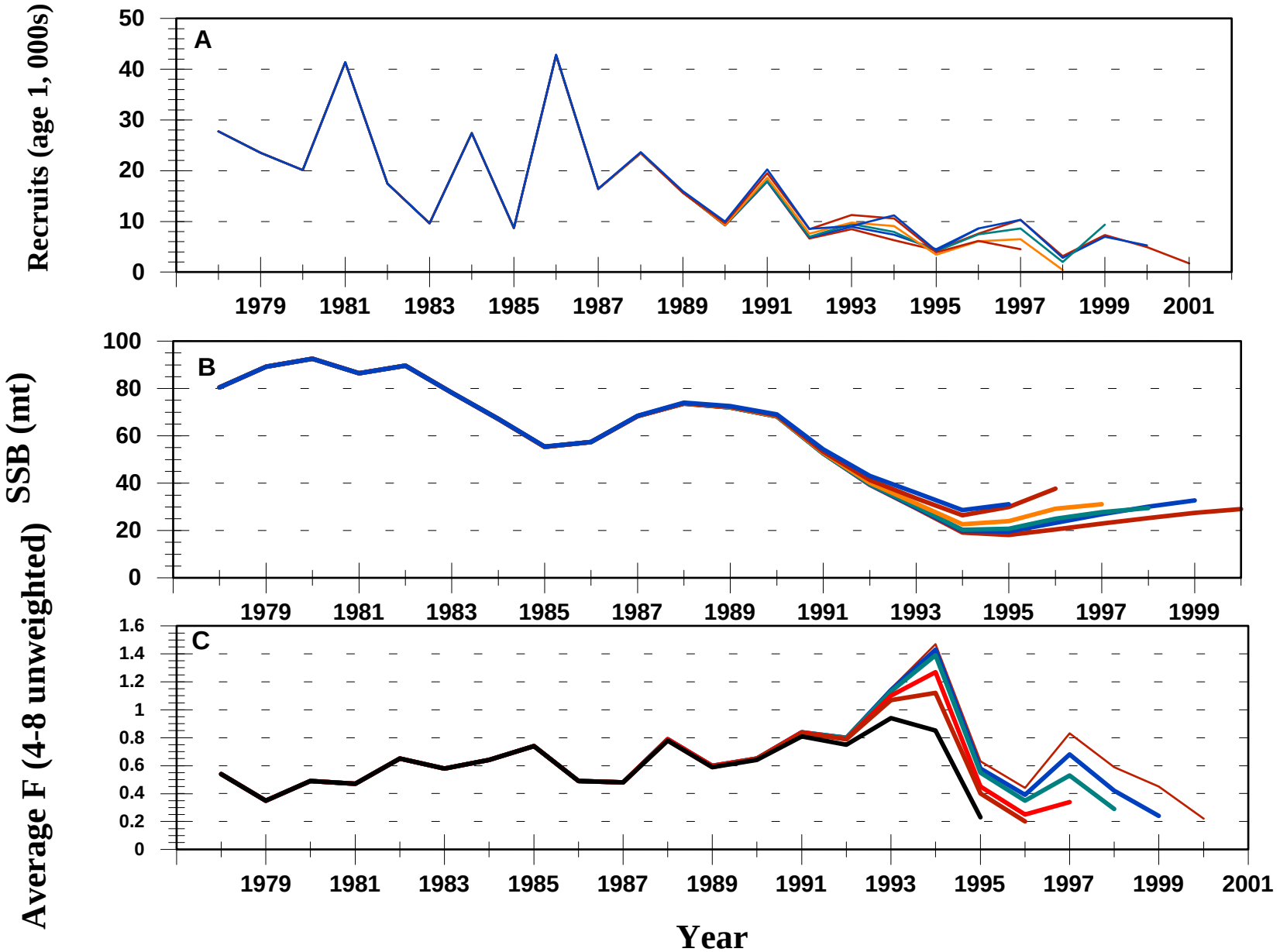


Figure 24. Retrospective analysis of Georges Bank cod recruits at age 1(A), spawning stock biomass (B), and fishing mortality (C), average F, aged 4-8, unweighted) based on the final ADAPT VPA formulation, 2000-1995.

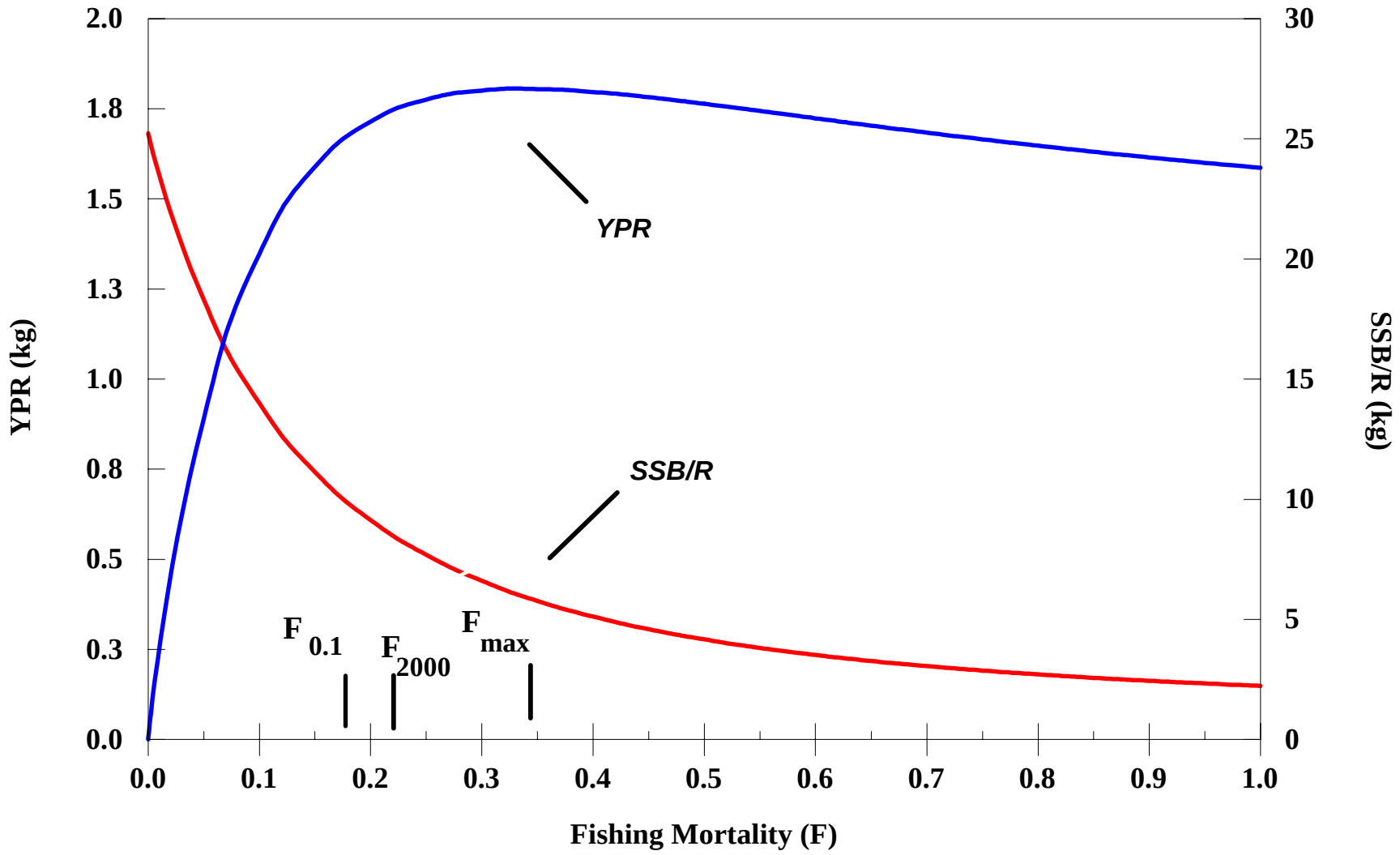


Figure 25. Yield per recruit (YPR) and spawning stock per recruit (SSB/R) for Georges Bank from O'Brien and Cadrin (1999).

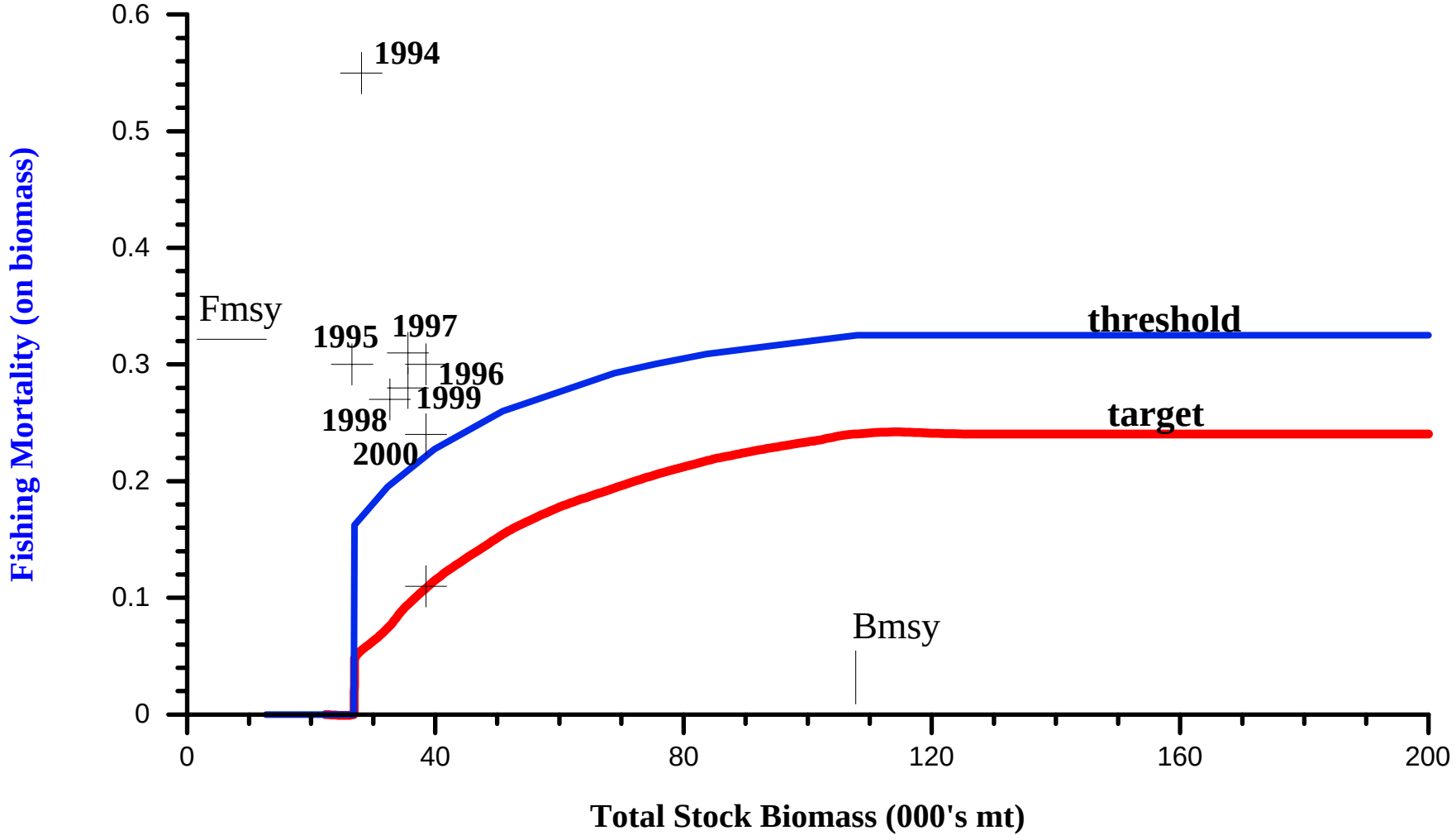


Figure 26. SFA control rule and recent stock status for Geroges Bank Atlantic cod.

APPENDIX 1

Discard / Kept Ratios, Landings, and Discards of Otter Trawls and Gill Nets from the Sea Sampling Database for Georges Bank Cod

Table 1. Observed number of tows and discard ratio derived from the Sea Sampling Database, landings (mt), estimated discards (mt), and catch (mt) of Georges Bank Atlantic cod in the otter trawl and gillnet fisheries in the western part (SA 521-522,525-526,537-539 & Div. 6) and the eastern part(SA 561,562) of Georges Bank, by quarter, 1989-2000.

Table 2. Discard/Kept ratio of Georges Bank cod estimated from vessels with a history of reporting discards on the Vessel Trip Report (VTR) for any species, 1999-2000.

Appendix 1. Table 1a. Observed number of tows and discard ratios derived from the Sea Sampling Database, landings (mt), estimated discards (mt), and catch (mt) of Georges Bank Atlantic cod in the otter trawl fisheries in the western part (SA 521-522,525-526, 537-539 & Div.6) and the eastern part (SA 561, 562) of Georges Bank, by quarter,1989-2000.

OTTER TRAWL

WEST							EAST							West +East		
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Landings	Discard	Catch
1989	1	126	0.029	2686	77.894	2763.89	1989	1	16	0.018	1898	34.164	1932.16			
	2	239	0.054	3987	215.298	4202.3		2	100	0.027	3061	82.647	3143.65			
	3	222	0.073	3386	247.178	3633.18		3	16	0.043	353	15.179	368.179			
	4	151	0.057	2878	164.046	3042.05		4	27	0.03	824	24.72	848.72			
			Annual	12937	704.416	13641.4				Annual	6136	156.71	6292.71	19073	861.126	19934.126
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1990	1	175	0.1	2668	266.8	2934.8	1990	1	63	0.012	2331	27.972	2358.97			
	2	130	0.074	4247	314.278	4561.28		2	20	0.008	3433	27.464	3460.46			
	3	116	0.027	4495	121.365	4616.37		3	14	0.002	457	0.914	457.914			
	4	172	0.02	5206	104.12	5310.12		4	35	0.026	169	4.394	173.394			
			Annual	16616	806.563	17422.6				Annual	6390	60.744	6450.74	23006	867.307	23873.307
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1991	1	187	0.005	3254	16.27	3270.27	1991	1	81	0.016	2040	32.64	2072.64			
	2	173	0.032	4331	138.592	4469.59		2	1	0.027	3745	101.115	3846.12			
	3	167	0.02	2291	45.82	2336.82		3	0	0	143	0	143			
	4	220	0.075	2502	187.65	2689.65		4	0	0	399	0	399			
			Annual	12378	388.332	12766.3				Annual	6327	133.755	6460.76	18705	522.087	19227.087
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1992	1	121	0.012	1692	20.304	1712.3	1992	1	120	0.022	1951	42.922	1993.92			
	2	108	0.009	2120	19.08	2139.08		2	21	0.001	2162	2.162	2164.16			
	3	67	0.053	1340	71.02	1411.02		3	0	0	186	0	186			
	4	90	0.018	2199	39.582	2238.58		4	31	0.061	756	46.116	802.116	2955	85.698	3040.698
			Annual	7351	149.986	7500.99				Annual	5055	91.2	5146.2			
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1993	1	41	0.053	1595	84.535	1679.54	1993	1	18	0.017	1304	22.168	1326.17			
	2	38	0.023	2171	49.933	2220.93		2	203	0.018	1987	35.766	2022.77			
	3	74	0.088	1257	110.616	1367.62		3	0	0	231	0	231			
	4	123	0.03	2242	67.26	2309.26		4	15	0.015	488	7.32	495.32			
			Annual	7265	312.344	7577.34				Annual	4010	65.254	4075.25	11275	377.598	11652.598
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1994	1	172	0.008		0	0	1994	1	114	0.003		0	0		1994 not avalable by qtr	
	2	36	0.043		0	0		2	172	0.005		0	0			
	3	13	0		0	0		3	43	0.003		0	0			
	4	49	0.004		0	0		4	10	0		0	0			
			Annual	5916.63	0	0				Annual	1222.72	0	0	7139.35	0	0

Appendix 1.Table 1a continued. Observed number of tows and discard ratios derived from the Sea Sampling Database, landings (mt), estimated discards (mt), and catch (mt) of Georges Bank Atlantic cod in the otter trawl fisheries in the western part (SA 521-522,525-526, 537-539 & Div.6) and the eastern part (SA 561, 562) of Georges Bank, by quarter,1989-2000.

OTTER TRAWL

WEST							EAST							West +East		
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1995	1	227	0.004	504.29	2.01716	506.307	1995	1	38	0.002	147.29	0.29458	147.585			
	2	217	0.032	1008.17	32.2614	1040.43		2	38	0.001	373.8	0.3738	374.174			
	3	114	0.01	879.81	8.7981	888.608		3	8	0	38.46	0	38.46			
	4	103	0.012	800.6	9.6072	810.207		4	28	0.001	22.47	0.02247	22.4925			
			Annual	3192.87	52.6839	3245.55				Annual	582.02	0.69085	582.711	3774.89	53.3748	3828.26475
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1996	1	99	0.012	635.26	7.62312	642.883	1996	1	30	0.007	147.6	1.0332	148.633			
	2	165	0.001	1330.48	1.33048	1331.81		2	124	0	497.91	0	497.91			
	3	0	0	868.53	0	868.53		3	0	0	35.87	0	35.87			
	4	58	0.009	463.88	4.17492	468.055		4	0	0	73.76	0	73.76			
			Annual	3298.15	13.1285	3311.28				Annual	755.14	1.0332	756.173	4053.29	14.1617	4067.45172
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1997	1	152	0.008	627.06	5.01648	632.076	1997	1	0	0	85.99	0	85.99			
	2	1	0	2058.16	0	2058.16		2	0	0	373.71	0	373.71			
	3	157	0.005	825.99	4.12995	830.12		3	0	0	26.49	0	26.49			
	4	100	0.013	602.12	7.82756	609.948		4	0	0	17.64	0	17.64			
			Annual	4113.33	16.974	4130.3				Annual	503.83	0	503.83	4617.16	16.974	4634.13399
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1998	1	62	0.02	476.17	9.5234	485.693	1998	1	3	0.013	40.72	0.52936	41.2494			
	2	0	0	1408.29	0	1408.29		2	0	0	705.43	0	705.43			
	3	40	0.004	657.07	2.62828	659.698		3	31	0.016	35.45	0.5672	36.0172			
	4	0	0	721.76	0	721.76		4	0	0	12.93	0	12.93			
			Annual	3263.29	12.1517	3275.44				Annual	794.53	1.09656	795.627	4057.82	13.2482	4071.06824
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1999	1	1	0	514.27	0	514.27	1999	1	0	0	249.49	0	249.49			
	2	33	0.002	1679.74	3.35948	1683.1		2	46	0.006	862.95	5.1777	868.128			
	3	57	0.009	755.14	6.79626	761.936		3	12	0	25.48	0	25.48			
	4	106	0.018	664.57	11.9623	676.532		4	0	0	8.3	0	8.3			
			Annual	3613.72	22.118	3635.84				Annual	1146.22	5.1777	1151.4	4759.94	27.2957	4787.2357
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
2000	1	146	0.047	737.99	34.6855	772.676	2000	1	44	0.012	234.52	2.81424	237.334			
	2	143	0.03	1559.36	46.7808	1606.14		2	39	0.02	377.78	7.5556	385.336			
	3	96	0.01	749.37	7.4937	756.864		3	29	0.058	19.67	1.14086	20.8109			
	4		0	1025.78	0	1025.78		4	0	0	22.7	0	22.7			
			Annual	4072.5	88.96	4161.46				Annual	654.67	11.5107	666.181	4727.17	100.471	4827.64073

Appendix 1. Table 1b. Observed number of tows and discard ratios derived from the Sea Sampling Database, landings (mt), estimated discards (mt), and catch (mt) of Georges Bank Atlantic cod in the gillnet fisheries in the western part (SA 521-522,525-526, 537-539 & Div.6) and the eastern part (SA 561, 562) of Georges Bank, by quarter,1989-2000.

GILL NET

WEST							EAST							West +East		
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Landings	Discard	Catch
1989	1	0	0	325	0	325	1989	1	0	0	0	0	0			
	2	3	0.001	997	0.997	997.997		2	0	0	0	0	0			
	3	58	0.011	1901	20.911	1921.91		3	0	0	0	0	0			
	4	36	0.067	304	20.368	324.368		4	0	0	8	0	8			
			Annual	3527	42.276	3569.28				Annual	8	0	8	3535	42.276	3577.28
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1990	1	8	0.017	311	5.287	316.287	1990	1	0	0	0	0	0			
	2	37	0.017	856	14.552	870.552		2	0	0	4	0	4			
	3	15	0.072	1294	93.168	1387.17		3	0	0	0	0	0			
	4	21	0.142	186	26.412	212.412		4	0	0	0	0	0			
			Annual	2647	139.419	2786.42				Annual	4	0	4	2651	139.419	2790.42
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1991	1	4	0.115	186	21.39	207.39	1991	1	0	0	0	0	0			
	2	220	0.011	742	8.162	750.162		2	14	0.001	5	0.005	5.005			
	3	508	0.033	1236	40.788	1276.79		3	0	0	0	0	0			
	4	128	0.102	395	40.29	435.29		4	0	0	0	0	0			
			Annual	2559	110.63	2669.63				Annual	5	0.005	5.005	2564	110.635	2674.64
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1992	1	29	0.033	280	9.24	289.24	1992	1	0	0	2	0	2			
	2	340	0.046	464	21.344	485.344		2	18	0.03	1	0.03	1.03			
	3	257	0.028	1134	31.752	1165.75		3	0	0	1	0	1			
	4	188	0.04	297	11.88	308.88		4	0	0	0	0	0			
			Annual	2175	74.216	2249.22				Annual	4	0.03	4.03	2179	74.246	2253.25
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1993	1	83	0.06	134	8.04	142.04	1993	1	0	0	0	0	0			
	2	140	0.074	561	41.514	602.514		2	5	0.064	0	0	0			
	3	9	0.007	579	4.053	583.053		3	5	0.003	0	0	0			
	4	197	0.056	275	15.4	290.4		4	0	0	0	0	0			
			Annual	1549	69.007	1618.01				Annual	0	0	0	1549	69.007	1618.01
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1994	1	88	0.124		0	0	1994	1	0	0		0	0	*1994 not avalable by qtr*		
	2	0	0		0	0		2	0	0		0	0			
	3	18	0.043		0	0		3	0	0		0	0			
	4	70	0.07		0	0		4	0	0		0	0			
			Annual	1318.19	0	0				Annual	0	0	0	1318.19	0	0

Appendix 1. Table 1b continued. Observed number of tows and discard ratios derived from the Sea Sampling Database, landings (mt), estimated discards (mt), and catch (mt) of Georges Bank Atlantic cod in the gillnet fisheries in the western part (SA 521-522,525-526, 537-539 & Div.6) and the eastern part (SA 561, 562) of Georges Bank, by quarter,1989-2000.

GILL NET

WEST							EAST							West +East		
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1995	1	32	0.193	119.89	23.1388	143.029	1995	1	0	0	3.51	0	3.51			
	2	40	0.028	381.02	10.6686	391.689		2	0	0	1.92	0	1.92			
	3	35	0.029	617.54	17.9087	635.449		3	0	0	0	0	0			
	4	44	0.081	194.9	15.7869	210.687		4	0	0	0	0	0			
			Annual	1313.35	67.5029	1380.85				Annual	5.43	0	5.43	1318.78	67.5029	1386.28
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1996	1	32	0.017	94.64	1.60888	96.2489	1996	1	0	0	0	0	0			
	2	18	0.08	544.07	43.5256	587.596		2	0	0	0	0	0			
	3	6	0.146	631.26	92.164	723.424		3	0	0	0	0	0			
	4	50	0.05	286.98	14.349	301.329		4	0	0	0	0	0			
			Annual	1556.95	151.647	1708.6				Annual	0	0	0	1556.95	151.647	1708.6
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1997	1	28	0.068	59.45	4.0426	63.4926	1997	1	0	0	0	0	0			
	2	23	0.049	775.67	38.0078	813.678		2	0	0	0	0	0			
	3	22	0.02	588.88	11.7776	600.658		3	0	0	0.14	0	0.14			
	4	26	0.093	175.34	16.3066	191.647		4	0	0	1.88	0	1.88			
			Annual	1599.34	70.1347	1669.47				Annual	2.02	0	2.02	1601.36	70.1347	1671.49
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1998	1	57	0.104	110.33	11.4743	121.804	1998	1	0	0	0	0	0			
	2	34	0.111	329.06	36.5257	365.586		2	0	0	10.03	0	10.03			
	3	12	0.08	240.86	19.2688	260.129		3	0	0	0	0	0			
	4	87	0.046	143.24	6.58904	149.829		4	0	0	0.91	0	0.91			
			Annual	823.49	73.8578	897.348				Annual	10.94	0	10.94	834.43	73.8578	908.288
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
1999	1	56	0.043	131.44	#REF!	#REF!	1999	1	0	0	0	0	0			
	2	79	0.037	663.92	#REF!	#REF!		2	0	0	0.03	0	0.03			
	3	40	0.055	471.95	#REF!	#REF!		3	0	0	0	0	0			
	4	27	0.041	184.48	#REF!	#REF!		4	0	0	0.28	0	0.28			
			Annual	1451.79	#REF!	#REF!				Annual	0.31	0	0.31	1452.1	#REF!	#REF!
Year	Quarter	# Tows	D/K	Landings	Discard	Catch	Year	Quarter	# Tows	D/K	Landings	Discard	Catch			
2000	1	24	0.021	179.17	15.7368	765.107	2000	1	0	0	0	0	0			
	2	65	0.022	596.59	22.5672	1048.35		2	0	0	3.6	0	3.6			
	3	54	0.064	629.62	260.64	4333.14		3	0	0	0	0	0			
	4	0	0	225.96	0	0		4	0	0	0	0	0			
			Annual	1631.34	298.944	6146.59				Annual	3.6	0	3.6	1634.94	298.944	6150.19

Appendix 1. Table 2. Discard/Kept ratio of Georges Bank cod estimated from vessels with a history of reporting discards on the Vessel Trip Report (VTR) for any species, 1999-2000.

Otter trawl

Year	Quarter	D/K	Landings	Discard	Catch
1994	1	0.016	0	0	0
	2	0.012	0	0	0
	3	0.020	0	0	0
	4	0.012	0	0	0
		Annual	0	0	0

Year	Quarter	D/K	Landings	Discard	Catch
1995	1	0.019	651.6	12.4	664.0
	2	0.013	1382.0	18.0	1399.9
	3	0.011	918.3	10.1	928.4
	4	0.009	823.1	7.4	830.5
		Annual	3774.9	47.9	3822.7

Year	Quarter	D/K	Landings	Discard	Catch
1996	1	0.004	782.9	3.1	786.0
	2	0.008	1828.4	14.6	1843.0
	3	0.004	904.4	3.6	908.0
	4	0.011	537.6	5.9	543.6
		Annual	4053.3	27.3	4080.6

Year	Quarter	D/K	Landings	Discard	Catch
1997	1	0.017	713.1	12.1	725.2
	2	0.006	2431.9	14.6	2446.5
	3	0.007	852.5	6.0	858.4
	4	0.004	619.8	2.5	622.2
		Annual	4617.2	35.2	4652.3

Year	Quarter	D/K	Landings	Discard	Catch
1998	1	0.004	516.9	2.1	519.0
	2	0.015	2113.7	31.7	2145.4
	3	0.002	692.5	1.4	693.9
	4	0.008	734.7	5.9	740.6
		Annual	4057.8	41.0	4098.9

Year	Quarter	D/K	Landings	Discard	Catch
1999	1	0.003	763.8	2.2	766.0
	2	0.021	2542.7	52.1	2594.8
	3	0.045	780.6	35.0	815.7
	4	0.090	672.9	60.3	733.2
		Annual	4759.9	149.7	4909.6

Year	Quarter	D/K	Landings	Discard	Catch
2000	1	0.026	972.5	25.7	998.2
	2	0.011	1937.1	21.1	1958.3
	3	0.030	769.0	22.8	791.8
	4	0.023	1048.5	24.4	1072.9
		Annual	4727.2	94.0	4821.2

Gill net

Year	Quarter	D/K	Landings	Discard	Catch
1994	1	0.000		0	0
	2	0.002		0	0
	3	0.004		0	0
	4	0.113		0	0
		Annual	0	0	0

Year	Quarter	D/K	Landings	Discard	Catch
1995	1	0.008	123.4	1.0	124.4
	2	0.005	382.9	1.9	384.9
	3	0.007	617.5	4.3	621.9
	4	0.012	194.9	2.3	197.2
		Annual	1318.8	9.6	1328.3

Year	Quarter	D/K	Landings	Discard	Catch
1996	1	0.011	123.4	1.4	124.8
	2	0.003	382.9	1.1	384.1
	3	0.008	617.5	4.9	622.5
	4	0.006	194.9	1.2	196.1
		Annual	1318.8	8.6	1327.4

Year	Quarter	D/K	Landings	Discard	Catch
1997	1	0.005	59.5	0.3	59.7
	2	0.002	775.7	1.6	777.2
	3	0.004	589.0	2.4	591.4
	4	0.003	177.2	0.5	177.8
		Annual	1601.4	4.7	1606.1

Year	Quarter	D/K	Landings	Discard	Catch
1998	1	0.005	110.3	0.6	110.9
	2	0.002	339.1	0.7	339.8
	3	0.005	240.9	1.2	242.1
	4	0.008	144.2	1.2	145.3
		Annual	834.4	3.6	838.0

Year	Quarter	D/K	Landings	Discard	Catch
1999	1	0.004	131.4	0.5	132.0
	2	0.012	664.0	8.0	671.9
	3	0.053	472.0	25.2	497.1
	4	0.039	184.8	7.2	191.9
		Annual	1452.1	40.8	1492.9

Year	Quarter	D/K	Landings	Discard	Catch
2000	1	0.026	179.2	4.7	183.9
	2	0.011	600.2	6.5	606.7
	3	0.030	629.6	18.6	648.3
	4	0.023	226.0	5.3	231.2
		Annual	1634.9	35.2	1670.1

APPENDIX 2

Age-specific bottom trawl survey abundance indices for Georges Bank Cod.

Table 1. Standardized (for vessel and door changes) stratified mean catch per tow at age (numbers) of Atlantic cod in NEFSC offshore spring and autumn bottom trawl surveys on Georges Bank (Strata 13-25), 1963 - 2000.

Table 2. Stratified mean catch per tow at age (numbers) of Atlantic cod in Canadian spring bottom trawl surveys on Eastern Georges Bank, 1986 - 2001.

Appendix 2: Table 1. Standardized (for vessel and door changes) stratified mean catch per tow at age (numbers) of Atlantic cod in NEFSC offshore spring and autumn bottom trawl surveys on Georges Bank (Strata 13-25), 1963 - 2000.

	AGE																
Year	0	1	2	3	4	5	6	7	8	9	10+	0+	1+	2+	3+	4+	5+
SPRING																	
1968	0.513	0.136	1.615	0.825	0.665	0.385	0.246	0.140	0.083	0.056	0.058	4.722	4.209	4.073	2.458	1.633	0.968
1969	0.000	0.123	0.546	1.780	0.888	0.451	0.326	0.215	0.128	0.072	0.112	4.641	4.641	4.518	3.972	2.192	1.304
1970	0.000	0.338	0.804	0.430	1.241	0.162	0.844	0.263	0.058	0.056	0.147	4.342	4.342	4.005	3.201	2.770	1.529
1971	0.000	0.206	0.860	0.438	0.254	0.570	0.114	0.324	0.365	0.128	0.132	3.391	3.391	3.185	2.325	1.888	1.633
1972	0.056	3.000	1.838	2.732	0.445	0.166	0.323	0.084	0.285	0.071	0.158	9.159	9.103	6.104	4.266	1.534	1.089
1973	0.056	0.546	42.258	6.344	6.387	0.657	0.515	0.367	0.058	0.217	0.404	57.808	57.753	57.206	14.949	8.604	2.218
1974	0.000	0.444	4.558	5.971	0.761	1.988	0.442	0.100	0.265	0.064	0.144	14.735	14.735	14.292	9.734	3.763	3.002
1975	0.000	0.064	0.327	2.092	2.941	0.377	0.744	0.084	0.115	0.147	0.000	6.890	6.890	6.826	6.499	4.407	1.466
1976	0.111	1.298	1.955	0.915	0.661	1.607	0.153	0.261	0.029	0.000	0.068	7.058	6.947	5.650	3.695	2.780	2.119
1977	0.000	0.044	3.389	1.084	0.553	0.267	0.717	0.052	0.066	0.000	0.021	6.193	6.193	6.149	2.760	1.676	1.124
1978	3.312	0.372	0.192	5.531	0.972	0.778	0.142	0.712	0.065	0.141	0.096	12.312	9.000	8.628	8.436	2.906	1.934
1979	0.108	0.428	1.298	0.275	1.852	0.547	0.236	0.084	0.139	0.013	0.022	5.000	4.892	4.464	3.166	2.891	1.039
1980	0.105	0.031	2.217	2.690	0.212	1.705	0.374	0.186	0.031	0.030	0.096	7.676	7.571	7.540	5.323	2.634	2.421
1981	0.301	2.302	1.852	2.811	1.685	0.106	0.879	0.258	0.132	0.000	0.113	10.438	10.138	7.835	5.983	3.172	1.487
1982	0.169	0.508	5.435	9.502	8.324	6.208	0.293	1.866	0.369	0.082	0.203	32.958	32.789	32.281	26.846	17.344	9.020
1983	0.081	0.332	1.952	3.017	0.796	0.697	0.443	0.027	0.219	0.000	0.138	7.701	7.620	7.289	5.337	2.320	1.524
1984	0.000	0.402	0.431	0.761	1.238	0.422	0.400	0.209	0.000	0.215	0.000	4.078	4.078	3.676	3.245	2.485	1.246
1985	0.244	0.111	2.653	0.663	1.110	1.412	0.265	0.192	0.180	0.037	0.161	7.029	6.785	6.674	4.021	3.357	2.247
1986	0.092	0.872	0.409	1.844	0.365	0.540	0.618	0.062	0.125	0.101	0.015	5.044	4.952	4.080	3.671	1.827	1.462
1987	0.000	0.020	1.613	0.378	0.763	0.062	0.179	0.136	0.033	0.027	0.025	3.235	3.235	3.215	1.603	1.225	0.461
1988	0.180	0.720	0.609	3.150	0.409	0.644	0.064	0.037	0.049	0.000	0.007	5.868	5.688	4.968	4.359	1.209	0.801
1989	0.000	0.310	1.410	0.666	1.583	0.235	0.351	0.051	0.040	0.055	0.093	4.794	4.794	4.484	3.074	2.407	0.824
1990	0.042	0.173	0.922	1.737	0.674	0.912	0.130	0.143	0.013	0.016	0.027	4.790	4.748	4.574	3.653	1.916	1.242
1991	0.195	1.027	0.528	0.689	0.929	0.479	0.328	0.054	0.041	0.000	0.045	4.313	4.119	3.092	2.564	1.875	0.947
1992	0.000	0.123	1.252	0.468	0.168	0.273	0.142	0.159	0.020	0.037	0.028	2.670	2.670	2.548	1.295	0.827	0.659
1993	0.110	0.009	0.399	1.306	0.205	0.090	0.138	0.029	0.034	0.021	0.055	2.396	2.285	2.277	1.878	0.572	0.367
1994	0.030	0.125	0.272	0.200	0.217	0.033	0.006	0.044	0.000	0.019	0.000	0.945	0.916	0.791	0.519	0.319	0.102
1995	0.482	0.050	0.382	0.854	0.534	0.599	0.107	0.234	0.028	0.022	0.000	3.290	2.808	2.759	2.377	1.523	0.989
1996	0.000	0.073	0.214	0.736	1.247	0.174	0.209	0.028	0.018	0.000	0.000	2.699	2.699	2.626	2.412	1.676	0.429
1997	0.302	0.291	0.437	0.170	0.489	0.422	0.050	0.134	0.020	0.000	0.000	2.315	2.013	1.722	1.285	1.115	0.626
1998	0.018	0.111	0.665	1.298	0.848	0.755	0.533	0.102	0.031	0.000	0.000	4.360	4.342	4.231	3.566	2.268	1.420
1999	0.067	0.212	0.291	0.609	0.510	0.238	0.119	0.064	0.031	0.007	0.000	2.148	2.081	1.869	1.578	0.969	0.459
2000	0.053	0.221	0.807	0.830	1.141	0.370	0.102	0.026	0.020	0.000	0.000	3.569	3.517	3.296	2.489	1.659	0.518
average	0.301	1.506	2.230	1.574	0.991	0.528	0.261	0.149	0.072	0.061	0.072						

Appendix 2: Table 1 continued. Standardized (for vessel and door changes) stratified mean catch per tow at age (numbers) of Atlantic cod in NEFSC offshore spring and autumn bottom trawl surveys on Georges Bank (Strata 13-25), 1963 - 2000.

	AGE																
Year	0	1	2	3	4	5	6	7	8	9	10+	0+	1+	2+	3+	4+	5+
AUTUMN																	
1963	0.019	0.719	0.778	0.920	0.897	0.354	0.326	0.175	0.103	0.014	0.069	4.374	4.355	3.636	2.858	1.938	1.041
1964	0.009	0.640	0.699	0.588	0.538	0.145	0.136	0.062	0.050	0.030	0.083	2.980	2.971	2.331	1.632	1.044	0.506
1965	0.173	1.299	0.998	0.707	0.484	0.167	0.179	0.112	0.081	0.023	0.023	4.246	4.073	2.774	1.776	1.069	0.585
1966	1.025	1.693	1.000	0.515	0.264	0.100	0.095	0.062	0.039	0.002	0.017	4.812	3.787	2.094	1.094	0.579	0.315
1967	0.072	7.596	1.334	0.523	0.406	0.133	0.133	0.055	0.051	0.012	0.070	10.385	10.313	2.717	1.383	0.860	0.454
1968	0.070	0.314	1.611	0.783	0.271	0.073	0.067	0.027	0.023	0.008	0.048	3.295	3.225	2.911	1.300	0.517	0.246
1969	0.000	0.343	0.622	0.626	0.331	0.094	0.061	0.019	0.023	0.022	0.059	2.200	2.200	1.857	1.235	0.609	0.278
1970	0.434	1.699	1.361	0.532	0.696	0.153	0.000	0.033	0.055	0.055	0.098	5.116	4.682	2.983	1.622	1.090	0.394
1971	0.400	0.602	0.617	0.408	0.310	0.478	0.164	0.042	0.090	0.000	0.075	3.186	2.787	2.184	1.567	1.159	0.849
1972	0.948	7.473	1.191	1.841	0.399	0.241	0.568	0.116	0.204	0.021	0.084	13.085	12.137	4.664	3.474	1.633	1.234
1973	0.203	1.748	6.060	1.164	2.039	0.210	0.225	0.175	0.062	0.137	0.253	12.276	12.073	10.325	4.265	3.101	1.062
1974	0.461	0.410	0.667	1.509	0.161	0.089	0.112	0.000	0.059	0.021	0.000	3.489	3.028	2.618	1.952	0.442	0.281
1975	2.377	0.992	0.421	0.628	1.682	0.111	0.156	0.000	0.000	0.000	0.037	6.406	4.028	3.036	2.615	1.987	0.305
1976	0.000	6.144	2.073	0.762	0.275	0.738	0.054	0.269	0.037	0.052	0.021	10.425	10.425	4.281	2.209	1.447	1.172
1977	0.152	0.237	3.434	0.691	0.253	0.173	0.394	0.007	0.027	0.000	0.077	5.444	5.293	5.056	1.622	0.932	0.679
1978	0.395	1.845	0.391	4.058	0.964	0.336	0.165	0.343	0.050	0.030	0.014	8.590	8.195	6.350	5.959	1.901	0.937
1979	0.115	1.625	1.677	0.162	1.687	0.321	0.184	0.031	0.113	0.010	0.025	5.948	5.834	4.209	2.532	2.370	0.683
1980	0.280	0.820	0.564	0.774	0.053	0.265	0.057	0.067	0.027	0.000	0.000	2.905	2.626	1.806	1.242	0.468	0.416
1981	0.261	3.525	2.250	1.559	0.589	0.054	0.579	0.057	0.064	0.018	0.083	9.039	8.778	5.253	3.003	1.444	0.855
1982	0.362	0.577	1.910	0.242	0.068	0.115	0.000	0.031	0.033	0.000	0.000	3.337	2.975	2.398	0.488	0.246	0.179
1983	1.283	0.850	1.089	0.740	0.069	0.033	0.004	0.010	0.015	0.000	0.044	4.136	2.853	2.004	0.914	0.174	0.105
1984	0.179	1.909	0.682	0.929	0.825	0.024	0.059	0.039	0.000	0.039	0.044	4.728	4.549	2.640	1.958	1.030	0.204
1985	1.002	0.181	0.843	0.067	0.106	0.077	0.028	0.000	0.000	0.000	0.003	2.306	1.304	1.122	0.280	0.213	0.108
1986	0.076	2.279	0.129	0.329	0.008	0.049	0.073	0.016	0.000	0.007	0.022	2.987	2.911	0.632	0.503	0.174	0.166
1987	0.204	0.414	1.353	0.108	0.200	0.028	0.012	0.000	0.000	0.000	0.007	2.325	2.122	1.708	0.355	0.247	0.047
1988	0.550	0.875	0.437	0.904	0.060	0.194	0.000	0.011	0.039	0.000	0.000	3.069	2.519	1.645	1.208	0.304	0.244
1989	0.251	2.798	1.046	0.161	0.507	0.055	0.015	0.007	0.000	0.000	0.000	4.841	4.590	1.791	0.745	0.584	0.077
1990	0.157	0.364	1.624	1.814	0.412	0.286	0.069	0.022	0.011	0.000	0.022	4.781	4.624	4.260	2.636	0.822	0.410
1991	0.041	0.408	0.175	0.274	0.031	0.029	0.000	0.000	0.000	0.000	0.000	0.957	0.917	0.509	0.334	0.060	0.029
1992	0.035	0.412	0.949	0.174	0.100	0.044	0.010	0.000	0.000	0.000	0.000	1.724	1.689	1.277	0.328	0.153	0.053
1993	0.178	0.970	0.532	0.383	0.017	0.025	0.022	0.000	0.000	0.022	0.000	2.149	1.970	1.000	0.469	0.086	0.070
1994	0.067	0.406	0.664	0.433	0.153	0.068	0.021	0.000	0.006	0.000	0.000	1.819	1.752	1.347	0.682	0.249	0.095
1995	0.160	0.245	1.811	1.249	0.087	0.054	0.011	0.000	0.000	0.000	0.000	3.616	3.456	3.211	1.400	0.152	0.065
1996	0.022	0.240	0.196	0.414	0.143	0.060	0.027	0.000	0.000	0.000	0.000	1.101	1.079	0.840	0.644	0.229	0.086
1997	0.006	0.236	0.321	0.109	0.129	0.049	0.009	0.007	0.000	0.000	0.000	0.867	0.860	0.624	0.303	0.194	0.065
1998	0.070	0.336	1.026	0.352	0.041	0.035	0.004	0.000	0.004	0.000	0.000	1.867	1.797	1.462	0.435	0.084	0.042
1999	0.070	0.140	0.154	0.310	0.255	0.087	0.000	0.000	0.000	0.000	0.000	1.016	0.946	0.806	0.652	0.342	0.087
2000	0.020	0.571	0.538	0.071	0.079	0.031	0.000	0.000	0.000	0.000	0.000	1.308	1.289	0.718	0.180	0.109	0.031
average	0.287	1.218	0.954	0.569	0.268	0.119	0.068	0.034	0.021	0.022	0.031						

Appendix 2: Table 2. Stratified mean catch per tow at age (numbers) of Atlantic cod in Canadian spring bottom trawl survey on Georges Bank, 1986 - 2001.

	AGE										
Year	1	2	3	4	5	6	7	8	9	10+	0+
SPRING											
1986	0.60	2.27	2.81	0.37	0.65	0.44	0.26	0.04	0.07	0.03	7.54
1987	0.25	2.13	0.93	1.09	0.34	0.12	0.22	0.08	0.03	0.07	5.26
1988	0.28	1.01	4.66	0.58	1.02	0.13	0.08	0.17	0.04	0.07	8.04
1989	1.63	2.78	1.38	2.85	0.36	0.42	0.05	0.10	0.12	0.06	9.75
1990	0.42	2.44	3.78	2.08	3.87	0.42	0.93	0.12	0.12	0.35	14.53
1991	1.18	1.16	1.84	2.15	1.05	1.31	0.16	0.22	0.03	0.09	9.19
1992	0.11	2.86	1.77	0.80	0.98	0.60	0.43	0.12	0.07	0.02	7.76
*1993	0.05	0.60	2.83	1.04	0.62	1.23	0.44	0.42	0.07	0.12	7.42
*1994	0.02	0.80	0.89	1.65	0.60	0.23	0.45	0.11	0.15	0.04	4.94
1995	0.07	0.67	1.50	0.86	0.60	0.19	0.04	0.05	0.02	0.02	4.02
1996	0.14	0.49	2.31	4.02	1.09	0.79	0.33	0.08	0.11	0.03	9.39
1997	0.32	0.53	0.55	1.25	1.23	0.27	0.06	0.03	0.02	0.01	4.27
1998	0.01	0.67	0.95	0.35	0.35	0.28	0.07	0.02	0.00	0.02	2.72
1999	0.33	0.32	1.49	1.09	0.41	0.26	0.15	0.01	0.02	0.01	4.09
2000	0.10	0.44	1.05	3.92	1.71	0.78	0.40	0.24	0.01	0.03	8.68
2001	0.00	0.06	0.64	0.42	1.11	0.52	0.26	0.17	0.16	0.06	3.40
average	0.37	1.20	1.84	1.53	1.00	0.50	0.27	0.12	0.07	0.06	

* indices not included in VPA calibration

APPENDIX 3

Full Listing of ADAPT VPA Calibration Output and Diagnostics for Georges Bank Cod.

```
Fisheries Assessment Toolbox  Georges Bank   Cod - 2001 Assessment, 2000 TY
 Run Number  8   3/29/2001   4:23:31 PM
FACT Version 1.4.7
Georges Bank   Cod - 2001 Assessment, 2000 TY  1978 - 2001
Input Parameters and Options Selected
---------------------------------------
Natural mortality is a matrix below
Oldest age (not in the plus group) is  9
For all years prior to the terminal year ( 23 ), backcalculated
stock sizes for the following ages used to estimate
total mortality (Z) for age  9 : 4 5 6 7 8
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  10 + is then calculated from the following
ratios of F[age 10 +] to F[age 9 ]
          1978               1
          1979               1
          1980               1
          1981               1
          1982               1
          1983               1
          1984               1
          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
Stock size of the  10 + group is then calculated using
the following method:  CATCH EQUATION
 Partial recruitment estimate for  2001
 1             0.0027
 2             0.334
 3             0.8209
 4             1
 5             1
 6             1
 7             1
 8             1
 9             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  1          2.00E+03      1.00E+00      1.00E+06
N  2          9.00E+03      1.00E+00      1.00E+06
N  3          4.00E+03      1.00E+00      1.00E+06
N  4          5.00E+03      1.00E+00      1.00E+06
N  5          2.00E+03      1.00E+00      1.00E+06
N  6          2.00E+03      1.00E+00      1.00E+06
N  7          2.00E+03      1.00E+00      1.00E+06
N  8          1.00E+03      1.00E+00      1.00E+06
q spr_361     1.00E-04      0.00E+00      1.00E+00
q spr_362     1.00E-04      0.00E+00      1.00E+00
q spr_363     1.00E-04      0.00E+00      1.00E+00
q spr_364     1.00E-04      0.00E+00      1.00E+00
q spr_365     1.00E-04      0.00E+00      1.00E+00
q spr_366     1.00E-04      0.00E+00      1.00E+00
q spr_367     1.00E-04      0.00E+00      1.00E+00
q spr_368     1.00E-04      0.00E+00      1.00E+00
q spr_411     1.00E-04      0.00E+00      1.00E+00
q spr_412     1.00E-04      0.00E+00      1.00E+00
q spr_413     1.00E-04      0.00E+00      1.00E+00
q spr_414     1.00E-04      0.00E+00      1.00E+00
q spr_415     1.00E-04      0.00E+00      1.00E+00
q spr_416     1.00E-04      0.00E+00      1.00E+00
q spr_417     1.00E-04      0.00E+00      1.00E+00
q spr_418     1.00E-04      0.00E+00      1.00E+00
q sp_can1     1.00E-04      0.00E+00      1.00E+00
q sp_can2     1.00E-04      0.00E+00      1.00E+00
q sp_can3     1.00E-04      0.00E+00      1.00E+00
q sp_can4     1.00E-04      0.00E+00      1.00E+00
q sp_can5     1.00E-04      0.00E+00      1.00E+00
q sp_can6     1.00E-04      0.00E+00      1.00E+00
q sp_can7     1.00E-04      0.00E+00      1.00E+00
q sp_can8     1.00E-04      0.00E+00      1.00E+00
q us0aut1     1.00E-04      0.00E+00      1.00E+00
q us1aut2     1.00E-04      0.00E+00      1.00E+00
q us2aut3     1.00E-04      0.00E+00      1.00E+00
q us3aut4     1.00E-04      0.00E+00      1.00E+00
q us4aut5     1.00E-04      0.00E+00      1.00E+00
q us5aut6     1.00E-04      0.00E+00      1.00E+00
The following indices of abundance are available
 1            spr_361
 2            spr_362
 3            spr_363
 4            spr_364
 5            spr_365
 6            spr_366
 7            spr_367
 8            spr_368
 9            spr_411
 10           spr_412
 11           spr_413
 12           spr_414
 13           spr_415
 14           spr_416
 15           spr_417
 16           spr_418
 17           sp_can1
 18           sp_can2
 19           sp_can3
 20           sp_can4
 21           sp_can5
```

```
 22           sp_can6
 23           sp_can7
 24           sp_can8
 25           us0aut1
 26           us1aut2
 27           us2aut3
 28           us3aut4
 29           us4aut5
 30           us5aut6
 The Indices that will be used in this run are:
 1            spr_361
 2            spr_362
 3            spr_363
 4            spr_364
 5            spr_365
 6            spr_366
 7            spr_367
 8            spr_368
 9            spr_411
 10           spr_412
 11           spr_413
 12           spr_414
 13           spr_415
 14           spr_416
 15           spr_417
 16           spr_418
 17           sp_can1
 18           sp_can2
 19           sp_can3
 20           sp_can4
 21           sp_can5
 22           sp_can6
 23           sp_can7
 24           sp_can8
 25           us0aut1
 26           us1aut2
 27           us2aut3
 28           us3aut4
 29           us4aut5
 30           us5aut6
Obs Indices (before transformation) by index and year; with Index means

          1978      1979      1980      1981      1982      1983      1984
-----------------------------------------------------------------------------
spr_361  0.00      0.00      0.00      0.00      0.51      0.33      0.40
spr_362  0.00      0.00      0.00      0.00      5.44      1.95      0.43
spr_363  0.00      0.00      0.00      0.00      9.50      3.02      0.76
spr_364  0.00      0.00      0.00      0.00      8.32      0.80      1.24
spr_365  0.00      0.00      0.00      0.00      6.21      0.70      0.42
spr_366  0.00      0.00      0.00      0.00      0.29      0.44      0.40
spr_367  0.00      0.00      0.00      0.00      1.87      0.03      0.21
spr_368  0.00      0.00      0.00      0.00      0.37      0.22      0.00
spr_411  0.37      0.43      0.03      2.30      0.00      0.00      0.00
spr_412  0.19      1.30      2.22      1.85      0.00      0.00      0.00
spr_413  5.53      0.28      2.69      2.81      0.00      0.00      0.00
spr_414  0.97      1.85      0.21      1.68      0.00      0.00      0.00
spr_415  0.78      0.55      1.71      0.11      0.00      0.00      0.00
spr_416  0.14      0.24      0.37      0.88      0.00      0.00      0.00
spr_417  0.71      0.08      0.19      0.26      0.00      0.00      0.00
spr_418  0.07      0.14      0.03      0.13      0.00      0.00      0.00
```

sp_can1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
us0aut1	0.15	0.40	0.11	0.28	0.26	0.36	1.28
us1aut2	0.24	1.85	1.63	0.82	3.53	0.58	0.85
us2aut3	3.43	0.39	1.68	0.56	2.25	1.91	1.09
us3aut4	0.69	4.06	0.16	0.77	1.56	0.24	0.74
us4aut5	0.25	0.96	1.69	0.05	0.59	0.07	0.07
us5aut6	0.17	0.34	0.32	0.26	0.05	0.12	0.03

	1985	1986	1987	1988	1989	1990	1991
spr_361	0.11	0.87	0.02	0.72	0.31	0.17	1.03
spr_362	2.65	0.41	1.61	0.61	1.41	0.92	0.53
spr_363	0.66	1.84	0.38	3.15	0.67	1.74	0.69
spr_364	1.11	0.37	0.76	0.41	1.58	0.67	0.93
spr_365	1.41	0.54	0.06	0.64	0.24	0.91	0.48
spr_366	0.27	0.62	0.18	0.06	0.35	0.13	0.33
spr_367	0.19	0.06	0.14	0.04	0.05	0.14	0.05
spr_368	0.18	0.13	0.03	0.05	0.04	0.01	0.04
spr_411	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_412	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_413	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_414	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_415	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_416	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_417	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_418	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can1	0.00	0.60	0.25	0.28	1.63	0.42	1.18
sp_can2	0.00	2.27	2.13	1.01	2.78	2.44	1.16
sp_can3	0.00	2.81	0.93	4.66	1.38	3.78	1.84
sp_can4	0.00	0.37	1.09	0.58	2.85	2.08	2.15
sp_can5	0.00	0.65	0.34	1.02	0.36	3.87	1.05
sp_can6	0.00	0.44	0.12	0.13	0.42	0.42	1.31
sp_can7	0.00	0.26	0.22	0.08	0.05	0.93	0.16
sp_can8	0.00	0.04	0.08	0.17	0.10	0.12	0.22
us0aut1	0.18	1.00	0.08	0.20	0.55	0.25	0.16
us1aut2	1.91	0.18	2.28	0.41	0.87	2.80	0.36
us2aut3	0.68	0.84	0.13	1.35	0.44	1.05	1.62
us3aut4	0.93	0.07	0.33	0.11	0.90	0.16	1.81
us4aut5	0.83	0.11	0.01	0.20	0.06	0.51	0.41
us5aut6	0.02	0.08	0.05	0.03	0.19	0.05	0.29

	1992	1993	1994	1995	1996	1997	1998
spr_361	0.12	0.01	0.12	0.05	0.07	0.29	0.11
spr_362	1.25	0.40	0.27	0.38	0.21	0.44	0.67
spr_363	0.47	1.31	0.20	0.85	0.74	0.17	1.30
spr_364	0.17	0.21	0.22	0.53	1.25	0.49	0.85
spr_365	0.27	0.09	0.03	0.60	0.17	0.42	0.75
spr_366	0.14	0.14	0.01	0.11	0.21	0.05	0.53
spr_367	0.16	0.03	0.04	0.23	0.03	0.13	0.10
spr_368	0.02	0.03	0.00	0.03	0.02	0.02	0.03
spr_411	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_412	0.00	0.00	0.00	0.00	0.00	0.00	0.00

spr_413	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_414	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_415	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_416	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_417	0.00	0.00	0.00	0.00	0.00	0.00	0.00
spr_418	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sp_can1	0.11	0.00	0.00	0.07	0.14	0.32	0.01
sp_can2	2.86	0.00	0.00	0.67	0.49	0.53	0.67
sp_can3	1.77	0.00	0.00	1.50	2.31	0.55	0.95
sp_can4	0.80	0.00	0.00	0.86	4.02	1.25	0.35
sp_can5	0.98	0.00	0.00	0.60	1.09	1.23	0.35
sp_can6	0.60	0.00	0.00	0.19	0.79	0.27	0.28
sp_can7	0.43	0.00	0.00	0.04	0.33	0.06	0.07
sp_can8	0.12	0.00	0.00	0.05	0.08	0.03	0.02
us0aut1	0.04	0.04	0.18	0.07	0.16	0.02	0.01
us1aut2	0.41	0.41	0.97	0.41	0.24	0.24	0.24
us2aut3	0.18	0.95	0.53	0.66	1.81	0.20	0.32
us3aut4	0.27	0.17	0.38	0.43	1.25	0.41	0.11
us4aut5	0.03	0.10	0.02	0.15	0.09	0.14	0.13
us5aut6	0.03	0.04	0.03	0.07	0.05	0.06	0.05

	1999	2000	2001	Average
spr_361	0.21	0.22	0.00	0.299
spr_362	0.29	0.81	0.00	1.088
spr_363	0.61	0.83	0.00	1.520
spr_364	0.51	1.14	0.00	1.134
spr_365	0.24	0.37	0.00	0.767
spr_366	0.12	0.10	0.00	0.236
spr_367	0.06	0.03	0.00	0.189
spr_368	0.03	0.02	0.00	0.075
spr_411	0.00	0.00	0.00	0.783
spr_412	0.00	0.00	0.00	1.390
spr_413	0.00	0.00	0.00	2.827
spr_414	0.00	0.00	0.00	1.180
spr_415	0.00	0.00	0.00	0.784
spr_416	0.00	0.00	0.00	0.407
spr_417	0.00	0.00	0.00	0.310
spr_418	0.00	0.00	0.00	0.092
sp_can1	0.33	0.10	0.00	0.418
sp_can2	0.32	0.44	0.06	1.274
sp_can3	1.49	1.05	0.64	1.833
sp_can4	1.09	3.92	0.42	1.559
sp_can5	0.41	1.71	1.11	1.055
sp_can6	0.26	0.78	0.52	0.466
sp_can7	0.15	0.40	0.26	0.246
sp_can8	0.01	0.24	0.17	0.104
us0aut1	0.07	0.07	0.02	0.247
us1aut2	0.34	0.14	0.57	0.928
us2aut3	1.03	0.15	0.54	0.991
us3aut4	0.35	0.31	0.07	0.679
us4aut5	0.04	0.25	0.08	0.285
us5aut6	0.04	0.09	0.03	0.104

Catch at age (thousands) -
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	1978	1979	1980	1981	1982	1983	1984

1	02	34	89	27	331	108	81
2	393	1989	3777	3205	9138	4286	1307
3	7748	900	5828	4221	3824	8063	3423
4	2303	4870	500	2464	2787	2456	3336
5	830	1212	2308	235	2000	1055	840
6	131	458	1076	1406	281	776	516
7	345	77	445	417	673	95	458
8	47	253	87	123	213	235	44
9	40	04	167	130	71	100	171
10	15	48	10	62	83	65	121
1+	11854	9845	14287	12290	19401	17239	10297

	1985	1986	1987	1988	1989	1990	1991
1	134	156	26	10	00	07	52
2	6426	1326	7473	1577	2088	4942	1525
3	2443	4573	1406	8022	2922	5042	3243
4	1368	797	2121	1012	4155	1882	3281
5	1885	480	279	1497	331	2264	1458
6	412	627	252	244	541	229	1088
7	218	87	270	161	82	245	126
8	203	72	63	197	43	36	70
9	21	47	38	50	50	17	23
10	97	29	24	47	18	38	23
1+	13207	8194	11952	12817	10230	14702	10889

	1992	1993	1994	1995	1996	1997	1998
1	70	04	02	00	01	03	00
2	4177	1033	398	392	207	517	739
3	2170	4246	1526	1058	903	639	1188
4	1038	1115	1825	692	1234	881	423
5	1482	440	394	290	241	794	324
6	404	472	96	44	123	131	237
7	309	159	137	26	15	84	39
8	34	143	46	15	03	16	14
9	33	32	38	02	05	09	06
10	10	17	06	01	00	01	04
1+	9727	7661	4468	2520	2732	3075	2974

	1999	2000
1	02	06
2	285	811
3	1927	710
4	706	1024
5	201	306
6	97	72
7	119	38
8	16	25
9	02	02
10	03	01
1+	3358	2995

CAA Summary for ages 4 - 10

1978	1979	1980	1981	1982	1983	1984
3711	6922	4593	4837	6108	4782	5486

1985	1986	1987	1988	1989	1990	1991
4204	2139	3047	3208	5220	4711	6069

1992	1993	1994	1995	1996	1997	1998
3310	2378	2542	1070	1621	1916	1047

1999	2000
1144	1468

Weight at age (mid year) in kg -
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	1978	1979	1980	1981	1982	1983	1984
1	0.707	0.889	0.836	0.882	0.765	0.971	1.053
2	1.310	1.494	1.460	1.495	1.402	1.490	1.635
3	2.461	2.149	2.468	2.358	2.664	2.377	2.451
4	3.469	4.211	3.668	3.415	3.834	3.309	3.619
5	4.336	4.888	5.647	5.213	5.352	4.637	5.083
6	5.787	7.178	6.676	7.222	6.511	6.393	6.582
7	7.374	9.183	8.390	8.565	9.363	7.964	8.909
8	8.492	10.313	9.089	9.888	9.897	10.286	10.104
9	11.785	11.699	8.432	14.170	12.503	11.227	11.303
10	13.200	12.625	15.400	18.565	16.723	14.554	15.356

	1985	1986	1987	1988	1989	1990	1991
1	0.907	0.929	0.726	0.786	0.809	0.831	1.114
2	1.418	1.475	1.481	1.520	1.617	1.560	1.627
3	2.086	2.447	2.495	2.359	2.269	2.462	2.548
4	3.887	3.660	4.187	3.511	3.772	3.522	3.420
5	5.087	5.603	5.810	5.401	5.396	4.892	4.769
6	6.412	7.191	7.726	6.647	6.694	6.333	5.891
7	8.097	8.915	8.949	8.776	8.222	8.456	7.410
8	10.236	9.955	10.013	9.987	10.718	10.648	10.520
9	11.418	12.687	11.414	11.143	11.665	12.580	9.686
10	13.494	14.104	15.000	15.298	17.111	14.526	15.373

	1992	1993	1994	1995	1996	1997	1998
1	1.148	0.872	0.906	0.906	0.882	0.954	0.579
2	1.542	1.534	1.459	1.471	1.507	1.577	1.483
3	2.464	2.253	2.168	2.095	2.435	2.321	2.302
4	3.843	3.333	3.657	3.830	3.387	3.532	3.497
5	4.704	4.967	4.804	5.492	4.912	4.103	4.735
6	6.156	6.379	7.432	7.384	6.622	6.019	5.934
7	7.509	7.510	8.013	10.715	8.369	8.050	8.185
8	9.846	9.217	9.368	11.617	8.438	8.631	8.610
9	12.059	9.699	9.698	10.383	12.883	11.870	12.684
10	19.025	13.236	16.659	14.953	12.002	12.795	14.606

	1999	2000

1	0.830	1.055
2	1.565	1.710
3	2.223	2.437
4	3.452	3.558
5	4.891	4.836
6	6.422	5.923
7	7.341	7.406
8	9.685	8.498
9	12.153	8.267
10	13.735	10.594

January 1 Biomass Weights -
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	1978	1979	1980	1981	1982	1983	1984
1	0.486	0.694	0.625	0.700	0.548	0.748	0.907
2	1.023	1.028	1.139	1.118	1.112	1.068	1.260
3	1.881	1.678	1.920	1.855	1.996	1.826	1.911
4	2.922	3.219	2.808	2.903	3.007	2.969	2.933
5	3.370	4.118	4.876	4.373	4.275	4.216	4.101
6	4.594	5.579	5.712	6.386	5.826	5.849	5.525
7	6.235	7.290	7.760	7.562	8.223	7.201	7.547
8	7.235	8.721	9.136	9.108	9.207	9.814	8.970
9	10.004	9.967	9.325	11.349	11.119	10.541	10.783
10	13.200	12.625	15.400	18.565	16.723	14.554	15.356

	1985	1986	1987	1988	1989	1990	1991
1	0.711	0.736	0.502	0.548	0.583	0.594	0.947
2	1.222	1.157	1.173	1.050	1.127	1.123	1.163
3	1.847	1.863	1.918	1.869	1.857	1.995	1.994
4	3.087	2.763	3.201	2.960	2.983	2.827	2.902
5	4.291	4.667	4.611	4.755	4.353	4.296	4.098
6	5.709	6.048	6.579	6.214	6.013	5.846	5.368
7	7.300	7.561	8.022	8.234	7.393	7.524	6.850
8	9.549	8.978	9.448	9.454	9.699	9.357	9.432
9	10.741	11.396	10.660	10.563	10.793	11.612	10.156
10	13.494	14.104	15.000	15.298	17.111	14.526	15.373

	1992	1993	1994	1995	1996	1997	1998
1	0.993	0.674	0.711	0.702	0.660	0.765	0.352
2	1.311	1.327	1.128	1.154	1.168	1.179	1.189
3	2.002	1.864	1.824	1.748	1.893	1.870	1.905
4	3.129	2.866	2.870	2.882	2.664	2.933	2.849
5	4.011	4.369	4.001	4.482	4.337	3.728	4.090
6	5.418	5.478	6.076	5.956	6.031	5.437	4.934
7	6.651	6.799	7.149	8.924	7.861	7.301	7.019
8	8.542	8.319	8.388	9.648	9.509	8.499	8.325
9	11.263	9.772	9.454	9.862	12.234	10.008	10.463
10	19.025	13.236	16.659	14.953	12.002	12.795	14.606

	1999	2000
1	0.578	0.934
2	0.952	1.191

3	1.816	1.953
4	2.819	2.812
5	4.136	4.086
6	5.514	5.382
7	6.600	6.896
8	8.903	7.898
9	10.229	8.948
10	13.735	10.594

SSB Weights - D:\GBcod\assess_2001\vpa\gbcod_2000_new_15_gcaa.9

	1978	1979	1980	1981	1982	1983	1984
1	0.486	0.694	0.625	0.700	0.548	0.748	0.907
2	1.023	1.028	1.139	1.118	1.112	1.068	1.260
3	1.881	1.678	1.920	1.855	1.996	1.826	1.911
4	2.922	3.219	2.808	2.903	3.007	2.969	2.933
5	3.370	4.118	4.876	4.373	4.275	4.216	4.101
6	4.594	5.579	5.712	6.386	5.826	5.849	5.525
7	6.235	7.290	7.760	7.562	8.223	7.201	7.547
8	7.235	8.721	9.136	9.108	9.207	9.814	8.970
9	10.004	9.967	9.325	11.349	11.119	10.541	10.783
10	13.200	12.625	15.400	18.565	16.723	14.554	15.356

	1985	1986	1987	1988	1989	1990	1991
1	0.711	0.736	0.502	0.548	0.583	0.594	0.947
2	1.222	1.157	1.173	1.050	1.127	1.123	1.163
3	1.847	1.863	1.918	1.869	1.857	1.995	1.994
4	3.087	2.763	3.201	2.960	2.983	2.827	2.902
5	4.291	4.667	4.611	4.755	4.353	4.296	4.098
6	5.709	6.048	6.579	6.214	6.013	5.846	5.368
7	7.300	7.561	8.022	8.234	7.393	7.524	6.850
8	9.549	8.978	9.448	9.454	9.699	9.357	9.432
9	10.741	11.396	10.660	10.563	10.793	11.612	10.156
10	13.494	14.104	15.000	15.298	17.111	14.526	15.373

	1992	1993	1994	1995	1996	1997	1998
1	0.993	0.674	0.711	0.702	0.660	0.765	0.352
2	1.311	1.327	1.128	1.154	1.168	1.179	1.189
3	2.002	1.864	1.824	1.748	1.893	1.870	1.905
4	3.129	2.866	2.870	2.882	2.664	2.933	2.849
5	4.011	4.369	4.001	4.482	4.337	3.728	4.090
6	5.418	5.478	6.076	5.956	6.031	5.437	4.934
7	6.651	6.799	7.149	8.924	7.861	7.301	7.019
8	8.542	8.319	8.388	9.648	9.509	8.499	8.325
9	11.263	9.772	9.454	9.862	12.234	10.008	10.463
10	19.025	13.236	16.659	14.953	12.002	12.795	14.606

	1999	2000
1	0.578	0.934
2	0.952	1.191
3	1.816	1.953
4	2.819	2.812
5	4.136	4.086
6	5.514	5.382
7	6.600	6.896

8	8.903	7.898
9	10.229	8.948
10	13.735	10.594

Computed (Rivard)from midyear weights: Jan 1 Weights -
D:\GBcod\assess_2001\vpa\gbcod_2000_new_15_gcaa.9

	1978	1979	1980	1981	1982	1983	1984
1	0.486	0.694	0.625	0.700	0.548	0.748	0.907
2	1.023	1.028	1.139	1.118	1.112	1.068	1.260
3	1.881	1.678	1.920	1.855	1.996	1.826	1.911
4	2.922	3.219	2.808	2.903	3.007	2.969	2.933
5	3.370	4.118	4.876	4.373	4.275	4.216	4.101
6	4.594	5.579	5.712	6.386	5.826	5.849	5.525
7	6.235	7.290	7.760	7.562	8.223	7.201	7.547
8	7.235	8.721	9.136	9.108	9.207	9.814	8.970
9	10.004	9.967	9.325	11.349	11.119	10.541	10.783
10	13.200	12.625	15.400	18.565	16.723	14.554	15.356

	1985	1986	1987	1988	1989	1990	1991
1	0.711	0.736	0.502	0.548	0.583	0.594	0.947
2	1.222	1.157	1.173	1.050	1.127	1.123	1.163
3	1.847	1.863	1.918	1.869	1.857	1.995	1.994
4	3.087	2.763	3.201	2.960	2.983	2.827	2.902
5	4.291	4.667	4.611	4.755	4.353	4.296	4.098
6	5.709	6.048	6.579	6.214	6.013	5.846	5.368
7	7.300	7.561	8.022	8.234	7.393	7.524	6.850
8	9.549	8.978	9.448	9.454	9.699	9.357	9.432
9	10.741	11.396	10.660	10.563	10.793	11.612	10.156
10	13.494	14.104	15.000	15.298	17.111	14.526	15.373

	1992	1993	1994	1995	1996	1997	1998
1	0.993	0.674	0.711	0.702	0.660	0.765	0.352
2	1.311	1.327	1.128	1.154	1.168	1.179	1.189
3	2.002	1.864	1.824	1.748	1.893	1.870	1.905
4	3.129	2.866	2.870	2.882	2.664	2.933	2.849
5	4.011	4.369	4.001	4.482	4.337	3.728	4.090
6	5.418	5.478	6.076	5.956	6.031	5.437	4.934
7	6.651	6.799	7.149	8.924	7.861	7.301	7.019
8	8.542	8.319	8.388	9.648	9.509	8.499	8.325
9	11.263	9.772	9.454	9.862	12.234	10.008	10.463
10	19.025	13.236	16.659	14.953	12.002	12.795	14.606

	1999	2000	2001
1	0.578	0.934	0.665
2	0.952	1.191	1.191
3	1.816	1.953	2.454
4	2.819	2.812	3.041
5	4.136	4.086	4.501
6	5.514	5.382	5.724
7	6.600	6.896	6.518
8	8.903	7.898	7.953
9	10.229	8.948	9.143
10	13.735	10.594	10.594

Percent Mature (females)- D:\GBcod\assess_2001\vpa\gbcod_2000_new_15_gcaa.9

	1978	1979	1980	1981	1982	1983	1984
1	07	07	07	07	13	13	13
2	34	34	34	34	47	47	47
3	78	78	78	78	84	84	84
4	96	96	96	96	97	97	97
5	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100
7	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100
9	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100

	1985	1986	1987	1988	1989	1990	1991
1	13	28	28	28	28	12	12
2	47	67	67	67	67	52	52
3	84	91	91	91	91	90	90
4	97	98	98	98	98	99	99
5	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100
7	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100
9	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100

	1992	1993	1994	1995	1996	1997	1998
1	12	12	02	02	02	13	13
2	52	52	39	39	39	57	57
3	90	90	95	95	95	92	92
4	99	99	100	100	100	100	100
5	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100
7	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100
9	100	100	100	100	100	100	100
10	100	100	100	100	100	100	100

	1999	2000
1	13	13
2	57	57
3	92	92
4	100	100
5	100	100
6	100	100
7	100	100
8	100	100
9	100	100
10	100	100

Natural Mortality D:\GBcod\assess_2001\vpa\gbcod_2000_new_15_gcaa.9

	1978	1979	1980	1981	1982	1983	1984
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
6	.200	.200	.200	.200	.200	.200	.200
7	.200	.200	.200	.200	.200	.200	.200
8	.200	.200	.200	.200	.200	.200	.200
9	.200	.200	.200	.200	.200	.200	.200
10	.000	.000	.000	.000	.000	.000	.000

	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
6	.200	.200	.200	.200	.200	.200	.200
7	.200	.200	.200	.200	.200	.200	.200
8	.200	.200	.200	.200	.200	.200	.200
9	.200	.200	.200	.200	.200	.200	.200
10	.000	.000	.000	.000	.000	.000	.000

	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
6	.200	.200	.200	.200	.200	.200	.200
7	.200	.200	.200	.200	.200	.200	.200
8	.200	.200	.200	.200	.200	.200	.200
9	.200	.200	.200	.200	.200	.200	.200
10	.000	.000	.000	.000	.000	.000	.000

	1999	2000
1	.200	.200
2	.200	.200
3	.200	.200
4	.200	.200
5	.200	.200
6	.200	.200
7	.200	.200
8	.200	.200
9	.200	.000
10	.000	.000

Sex Ratio (Percent Female) -
D:\GBcod\assess_2001\vpa\gbcod_2000_new_15_gcaa.9

	1978	1979	1980	1981	1982	1983	1984
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
6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
7	0.5	0.5	0.5	0.5	0.5	0.5	0.5
8	0.5	0.5	0.5	0.5	0.5	0.5	0.5

9	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	0.5	0.5	0.5	0.5	0.5	0.5	0.5

	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
6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
7	0.5	0.5	0.5	0.5	0.5	0.5	0.5
8	0.5	0.5	0.5	0.5	0.5	0.5	0.5
9	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	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
6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
7	0.5	0.5	0.5	0.5	0.5	0.5	0.5
8	0.5	0.5	0.5	0.5	0.5	0.5	0.5
9	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	0.5	0.5	0.5	0.5	0.5	0.5	0.5

	1999	2000
1	0.5	0.5
2	0.5	0.5
3	0.5	0.5
4	0.5	0.5
5	0.5	0.5
6	0.5	0.5
7	0.5	0.5
8	0.5	0.5
9	0.5	0.5
10	0.5	0.5

```
pF is  0.1667
pM is  0.1667

Residual Sum of Squares from Marquardt Algorithm
Number  1
RSS            1514.57639172604
Lambda        1.00E-02

Number  2
RSS            1298.73889597029
Lambda        1.00E-03

Number  3
RSS            1119.1436575763
Lambda        1.00E-01

Number  4
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```
RSS            979.647508060233
Lambda        1.00E-02

Number  5
RSS            548.944014438341
Lambda        1.00E+00

Number  6
RSS            306.483091644223
Lambda        1.00E-01

Number  7
RSS            239.473790548727
Lambda        1.00E+01

Number  8
RSS            232.88678319881
Lambda        1.00E+00

Number  9
RSS            232.737807590689
Lambda        1.00E-01

Number  10
RSS            232.7373988461
Lambda        1.00E-02

Number  11
RSS            232.737366302349
Lambda        1.00E-03

Number  12
RSS            232.737360083598
Lambda        1.00E-04

RESULTS
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Approximate Statistics Assuming Linearity Near Solution
Sum of Squares:  232.737360083598
Mean Square Residuals: 0.58330

                   PAR. EST. STD. ERR. T-STATISTIC
                                                C.V.
N  1               1.71E+03  1.34E+03  1.27E+00  0.78
N  2               4.00E+03  1.42E+03  2.82E+00  0.35
N  3               4.15E+03  1.31E+03  3.17E+00  0.32
N  4               8.91E+02  3.30E+02  2.70E+00  0.37
N  5               1.84E+03  6.38E+02  2.87E+00  0.35
N  6               1.02E+03  3.25E+02  3.15E+00  0.32
N  7               4.32E+02  1.36E+02  3.18E+00  0.31
N  8               3.15E+02  1.05E+02  2.99E+00  0.33
q spr_361          5.56E-05  9.93E-06  5.60E+00  0.18
q spr_362          7.04E-05  1.25E-05  5.63E+00  0.18
q spr_363          9.27E-05  1.64E-05  5.65E+00  0.18
q spr_364          1.79E-04  3.16E-05  5.64E+00  0.18
q spr_365          3.19E-04  5.66E-05  5.64E+00  0.18
q spr_366          1.09E-03  1.94E-04  5.63E+00  0.18
q spr_367          1.59E-03  2.83E-04  5.64E+00  0.18
q spr_368          4.79E-03  8.97E-04  5.34E+00  0.19
q spr_411          1.54E-05  5.90E-06  2.61E+00  0.38
```

q spr_412	5.47E-05	2.10E-05	2.61E+00	0.38
q spr_413	5.74E-05	2.20E-05	2.61E+00	0.38
q spr_414	1.19E-04	4.58E-05	2.61E+00	0.38
q spr_415	2.20E-04	8.44E-05	2.61E+00	0.38
q spr_416	3.94E-04	1.51E-04	2.61E+00	0.38
q spr_417	7.27E-04	2.79E-04	2.61E+00	0.38
q spr_418	2.62E-03	1.00E-03	2.61E+00	0.38
q sp_can1	5.35E-05	1.16E-05	4.60E+00	0.22
q sp_can2	8.26E-05	1.73E-05	4.78E+00	0.21
q sp_can3	1.42E-04	2.95E-05	4.81E+00	0.21
q sp_can4	2.50E-04	5.22E-05	4.79E+00	0.21
q sp_can5	5.29E-04	1.11E-04	4.78E+00	0.21
q sp_can6	1.31E-03	2.73E-04	4.78E+00	0.21
q sp_can7	2.77E-03	5.80E-04	4.78E+00	0.21
q sp_can8	7.89E-03	1.65E-03	4.78E+00	0.21
q us0aut1	4.61E-05	7.47E-06	6.17E+00	0.16
q us1aut2	6.78E-05	1.07E-05	6.31E+00	0.16
q us2aut3	1.01E-04	1.60E-05	6.33E+00	0.16
q us3aut4	1.60E-04	2.53E-05	6.32E+00	0.16
q us4aut5	2.65E-04	4.20E-05	6.31E+00	0.16
q us5aut6	8.66E-04	1.37E-04	6.31E+00	0.16

Catchability Estimates in Original Units

	Estimate	Std.Err.	C.V.
q spr_361	1.66E-05	2.97E-06	0.18
q spr_362	7.66E-05	1.36E-05	0.18
q spr_363	1.41E-04	2.50E-05	0.18
q spr_364	2.02E-04	3.59E-05	0.18
q spr_365	2.44E-04	4.34E-05	0.18
q spr_366	2.57E-04	4.56E-05	0.18
q spr_367	3.02E-04	5.35E-05	0.18
q spr_368	3.58E-04	6.70E-05	0.19
q spr_411	1.21E-05	4.62E-06	0.38
q spr_412	7.61E-05	2.92E-05	0.38
q spr_413	1.62E-04	6.23E-05	0.38
q spr_414	1.41E-04	5.40E-05	0.38
q spr_415	1.72E-04	6.61E-05	0.38
q spr_416	1.61E-04	6.17E-05	0.38
q spr_417	2.25E-04	8.64E-05	0.38
q spr_418	2.40E-04	9.21E-05	0.38
q sp_can1	2.24E-05	4.86E-06	0.22
q sp_can2	1.05E-04	2.20E-05	0.21
q sp_can3	2.60E-04	5.41E-05	0.21
q sp_can4	3.90E-04	8.14E-05	0.21
q sp_can5	5.58E-04	1.17E-04	0.21
q sp_can6	6.09E-04	1.28E-04	0.21
q sp_can7	6.81E-04	1.43E-04	0.21
q sp_can8	8.18E-04	1.71E-04	0.21
q us0aut1	1.14E-05	1.85E-06	0.16
q us1aut2	6.29E-05	9.97E-06	0.16
q us2aut3	1.01E-04	1.59E-05	0.16
q us3aut4	1.09E-04	1.72E-05	0.16
q us4aut5	7.55E-05	1.20E-05	0.16
q us5aut6	8.98E-05	1.42E-05	0.16

Summary of Residuals
spr_36

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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.508	0.291	0.529	-0.029	1	0.558	0.731	17470
1983	0.332	0.160	0.102	-0.627	1	0.729	0.954	9615
1984	0.402	0.456	0.295	0.420	1	-0.125	-0.164	27390
1985	0.111	0.144	-0.991	-0.730	1	-0.261	-0.342	8672
1986	0.872	0.711	1.069	0.866	1	0.203	0.266	42751
1987	0.020	0.272	-2.721	-0.094	1	-2.627	-3.440	16376
1988	0.720	0.390	0.878	0.265	1	0.613	0.803	23448
1989	0.310	0.261	0.036	-0.137	1	0.173	0.227	15689
1990	0.173	0.153	-0.546	-0.669	1	0.123	0.161	9218
1991	1.027	0.297	1.232	-0.007	1	1.239	1.623	17866
1992	0.123	0.110	-0.892	-0.998	1	0.106	0.139	6632
1993	0.008	0.140	-3.562	-0.758	1	-2.804	-3.671	8433
1994	0.125	0.105	-0.875	-1.049	1	0.174	0.228	6300
1995	0.050	0.072	-1.800	-1.424	1	-0.376	-0.492	4331
1996	0.073	0.127	-1.411	-0.860	1	-0.551	-0.722	7612
1997	0.291	0.172	-0.029	-0.555	1	0.526	0.689	10325
1998	0.111	0.053	-0.989	-1.733	1	0.744	0.974	3179
1999	0.212	0.121	-0.344	-0.903	1	0.560	0.733	7291
2000	0.221	0.081	-0.305	-1.301	1	0.996	1.305	4896
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 1.145

spr_36
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	5.435	2.594	1.608	0.868	1	0.740	0.969	33865
1983	1.952	1.072	0.584	-0.015	1	0.599	0.784	14004
1984	0.431	0.595	-0.926	-0.603	1	-0.323	-0.423	7774
1985	2.653	1.712	0.891	0.453	1	0.438	0.574	22352
1986	0.409	0.534	-0.979	-0.711	1	-0.268	-0.350	6979
1987	1.612	2.670	0.393	0.897	1	-0.504	-0.660	34860
1988	0.609	1.025	-0.581	-0.060	1	-0.521	-0.682	13384
1989	1.410	1.470	0.259	0.300	1	-0.041	-0.054	19188
1990	0.922	0.984	-0.166	-0.101	1	-0.065	-0.086	12845
1991	0.528	0.577	-0.724	-0.634	1	-0.090	-0.118	7540
1992	1.252	1.117	0.140	0.026	1	0.115	0.150	14580
1993	0.399	0.411	-1.004	-0.974	1	-0.030	-0.039	5366
1994	0.272	0.528	-1.385	-0.722	1	-0.663	-0.868	6901
1995	0.382	0.395	-1.048	-1.014	1	-0.034	-0.045	5156
1996	0.214	0.272	-1.627	-1.388	1	-0.239	-0.312	3545
1997	0.437	0.477	-0.912	-0.825	1	-0.088	-0.115	6231
1998	0.665	0.647	-0.492	-0.520	1	0.027	0.036	8450
1999	0.291	0.199	-1.320	-1.698	1	0.378	0.495	2603
2000	0.807	0.457	-0.300	-0.868	1	0.568	0.744	5968
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.158

spr_36
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	9.502	1.482	1.833	-0.025	1	1.858	2.433	10513
1983	3.017	2.743	0.686	0.590	1	0.095	0.125	19458
1984	0.761	1.069	-0.692	-0.352	1	-0.341	-0.446	7587
1985	0.663	0.730	-0.829	-0.733	1	-0.096	-0.126	5182
1986	1.844	1.760	0.193	0.147	1	0.047	0.062	12485
1987	0.378	0.636	-1.390	-0.871	1	-0.520	-0.680	4514
1988	3.150	3.070	0.729	0.703	1	0.026	0.034	21779
1989	0.666	1.343	-0.825	-0.124	1	-0.701	-0.918	9531
1990	1.737	1.948	0.134	0.248	1	-0.115	-0.150	13821
1991	0.689	0.852	-0.792	-0.579	1	-0.213	-0.279	6045
1992	0.468	0.676	-1.178	-0.811	1	-0.367	-0.480	4794
1993	1.306	1.150	-0.152	-0.279	1	0.127	0.167	8158
1994	0.200	0.488	-2.028	-1.137	1	-0.891	-1.167	3459
1995	0.854	0.746	-0.577	-0.712	1	0.136	0.178	5290
1996	0.736	0.545	-0.725	-1.026	1	0.301	0.394	3867
1997	0.170	0.383	-2.189	-1.379	1	-0.810	-1.061	2715
1998	1.298	0.653	-0.158	-0.845	1	0.687	0.899	4634
1999	0.609	0.881	-0.915	-0.545	1	-0.369	-0.483	6250
2000	0.830	0.264	-0.605	-1.751	1	1.145	1.500	1873
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.453

spr_36
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	8.324	1.269	1.993	0.112	1	1.881	2.463	6266
1983	0.796	1.042	-0.354	-0.085	1	-0.269	-0.353	5148
1984	1.238	1.748	0.088	0.433	1	-0.345	-0.452	8635
1985	1.110	0.631	-0.021	-0.587	1	0.566	0.741	3115
1986	0.365	0.411	-1.133	-1.014	1	-0.119	-0.156	2032
1987	0.763	1.232	-0.396	0.083	1	-0.479	-0.627	6084
1988	0.409	0.491	-1.021	-0.838	1	-0.183	-0.239	2423
1989	1.583	2.141	0.333	0.635	1	-0.302	-0.395	10573
1990	0.674	1.045	-0.520	-0.082	1	-0.438	-0.573	5159
1991	0.929	1.367	-0.200	0.187	1	-0.387	-0.506	6753
1992	0.168	0.408	-1.909	-1.023	1	-0.887	-1.161	2015
1993	0.205	0.397	-1.709	-1.050	1	-0.660	-0.864	1961
1994	0.216	0.574	-1.656	-0.680	1	-0.976	-1.278	2837
1995	0.534	0.294	-0.753	-1.351	1	0.597	0.782	1451
1996	1.247	0.683	0.095	-0.507	1	0.602	0.788	3374
1997	0.489	0.476	-0.842	-0.869	1	0.027	0.035	2349
1998	0.848	0.333	-0.291	-1.225	1	0.934	1.223	1645
1999	0.510	0.551	-0.800	-0.723	1	-0.077	-0.101	2719
2000	1.141	0.683	0.006	-0.507	1	0.513	0.672	3373
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.496

spr_36
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	6.208	1.148	2.092	0.404	1	1.688	2.210	4697
1983	0.697	0.638	-0.095	-0.184	1	0.089	0.117	2608
1984	0.422	0.487	-0.596	-0.454	1	-0.142	-0.186	1992
1985	1.412	0.990	0.611	0.256	1	0.355	0.465	4051
1986	0.540	0.321	-0.350	-0.871	1	0.521	0.682	1312
1987	0.062	0.230	-2.513	-1.202	1	-1.311	-1.717	943
1988	0.644	0.749	-0.175	-0.024	1	-0.151	-0.198	3062
1989	0.235	0.261	-1.182	-1.077	1	-0.105	-0.138	1068
1990	0.912	1.197	0.174	0.445	1	-0.272	-0.356	4897
1991	0.479	0.616	-0.471	-0.218	1	-0.252	-0.330	2521
1992	0.273	0.626	-1.033	-0.203	1	-0.830	-1.087	2560
1993	0.090	0.174	-2.148	-1.485	1	-0.663	-0.868	710
1994	0.033	0.146	-3.139	-1.659	1	-1.480	-1.938	597
1995	0.599	0.164	-0.247	-1.542	1	1.295	1.695	671
1996	0.174	0.137	-1.482	-1.719	1	0.238	0.311	562
1997	0.422	0.402	-0.596	-0.645	1	0.049	0.064	1645
1998	0.755	0.275	-0.015	-1.024	1	1.009	1.321	1126
1999	0.238	0.236	-1.169	-1.180	1	0.011	0.014	964
2000	0.370	0.388	-0.728	-0.681	1	-0.047	-0.061	1587
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.634

spr_36
Tuned to: 1-Jan and number
For ages: 6

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.293	0.153	0.217	-0.435	1	0.652	0.854	594
1983	0.443	0.523	0.631	0.796	1	-0.165	-0.216	2036
1984	0.400	0.303	0.530	0.252	1	0.278	0.364	1181
1985	0.265	0.224	0.119	-0.053	1	0.171	0.224	871
1986	0.618	0.414	0.964	0.563	1	0.401	0.525	1611
1987	0.179	0.164	-0.273	-0.361	1	0.088	0.115	640
1988	0.064	0.133	-1.304	-0.570	1	-0.734	-0.961	519
1989	0.351	0.296	0.399	0.227	1	0.171	0.224	1153
1990	0.130	0.148	-0.592	-0.467	1	-0.124	-0.163	575
1991	0.328	0.503	0.331	0.759	1	-0.428	-0.560	1961
1992	0.142	0.191	-0.504	-0.209	1	-0.295	-0.386	745
1993	0.138	0.194	-0.534	-0.195	1	-0.339	-0.443	755
1994	0.006	0.047	-3.722	-1.610	1	-2.112	-2.765	184
1995	0.107	0.034	-0.793	-1.939	1	1.146	1.500	132
1996	0.208	0.074	-0.123	-1.162	1	1.039	1.361	287
1997	0.050	0.062	-1.555	-1.333	1	-0.221	-0.290	242
1998	0.533	0.161	0.815	-0.379	1	1.194	1.563	629
1999	0.119	0.161	-0.681	-0.379	1	-0.302	-0.396	629

2000	0.102	0.156	-0.834	-0.413	1	-0.421	-0.551	607
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.58

spr_36
Tuned to: 1-Jan and number
For ages: 7

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	1.866	0.509	2.289	0.990	1	1.299	1.701	1687
1983	0.027	0.070	-1.939	-0.993	1	-0.947	-1.239	232
1984	0.209	0.291	0.099	0.431	1	-0.332	-0.435	965
1985	0.192	0.151	0.015	-0.227	1	0.241	0.316	500
1986	0.062	0.103	-1.120	-0.611	1	-0.509	-0.667	340
1987	0.136	0.227	-0.333	0.182	1	-0.515	-0.675	752
1988	0.037	0.089	-1.632	-0.750	1	-0.881	-1.154	296
1989	0.050	0.062	-1.320	-1.120	1	-0.200	-0.262	204
1990	0.143	0.137	-0.279	-0.322	1	0.043	0.057	454
1991	0.054	0.080	-1.252	-0.866	1	-0.386	-0.505	264
1992	0.159	0.187	-0.175	-0.010	1	-0.165	-0.216	621
1993	0.029	0.074	-1.865	-0.943	1	-0.922	-1.208	244
1994	0.044	0.058	-1.456	-1.187	1	-0.269	-0.352	191
1995	0.234	0.019	0.211	-2.292	1	2.503	3.277	63
1996	0.028	0.021	-1.921	-2.216	1	0.295	0.386	68
1997	0.134	0.037	-0.345	-1.621	1	1.276	1.671	124
1998	0.102	0.024	-0.621	-2.064	1	1.442	1.888	80
1999	0.064	0.091	-1.090	-0.736	1	-0.354	-0.463	300
2000	0.026	0.129	-2.004	-0.384	1	-1.620	-2.121	427
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 1.015

spr_36
Tuned to: 1-Jan and number
For ages: 8

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.368	0.183	1.597	0.897	1	0.700	0.917	511
1983	0.219	0.276	1.075	1.309	1	-0.234	-0.306	772
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.180	0.134	0.880	0.588	1	0.292	0.382	375
1986	0.125	0.076	0.516	0.016	1	0.500	0.655	212
1987	0.033	0.072	-0.822	-0.042	1	-0.780	-1.021	200
1988	0.049	0.133	-0.417	0.577	1	-0.994	-1.301	371
1989	0.040	0.035	-0.636	-0.768	1	0.132	0.172	97
1990	0.013	0.033	-1.755	-0.805	1	-0.950	-1.244	93
1991	0.041	0.054	-0.609	-0.328	1	-0.281	-0.367	150
1992	0.020	0.036	-1.337	-0.715	1	-0.622	-0.814	102
1993	0.034	0.082	-0.775	0.092	1	-0.866	-1.134	229
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.028	0.012	-0.980	-1.854	1	0.874	1.144	33
1996	0.018	0.010	-1.417	-1.995	1	0.578	0.757	28
1997	0.020	0.015	-1.312	-1.593	1	0.281	0.368	42

1998	0.031	0.009	-0.882	-2.104	1	1.222	1.600	25
1999	0.030	0.011	-0.895	-1.942	1	1.047	1.371	30
2000	0.020	0.049	-1.312	-0.412	1	-0.900	-1.179	138
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.584

spr_41
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.
1978	0.372	0.334	-0.745	-0.853	1	0.107	0.140	27711
1979	0.428	0.283	-0.604	-1.017	1	0.413	0.541	23512
1980	0.031	0.242	-3.223	-1.173	1	-2.050	-2.684	20109
1981	2.302	0.499	1.078	-0.451	1	1.529	2.003	41393
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00
1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 2.46

spr_41
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.
1978	0.192	0.325	-1.980	-1.453	1	-0.527	-0.690	4270
1979	1.298	1.726	-0.068	0.217	1	-0.285	-0.373	22686
1980	2.217	1.462	0.467	0.051	1	0.416	0.545	19219
1981	1.852	1.247	0.287	-0.109	1	0.396	0.519	16383
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00
1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00

1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.252

spr_41
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.
1978	5.531	4.144	0.671	0.383	1	0.289	0.378	25527
1979	0.275	0.510	-2.330	-1.713	1	-0.617	-0.808	3140
1980	2.690	2.723	-0.050	-0.037	1	-0.012	-0.016	16774
1981	2.811	2.000	-0.006	-0.346	1	0.340	0.446	12318
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00
1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.212

spr_41
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.
1978	0.972	1.117	-0.194	-0.055	1	-0.140	-0.183	7933
1979	1.852	1.955	0.450	0.505	1	-0.055	-0.072	13889
1980	0.212	0.247	-1.715	-1.563	1	-0.153	-0.200	1756
1981	1.685	1.191	0.356	0.009	1	0.347	0.454	8460
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00
1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00

1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.061

spr_41
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.
1978	0.778	0.496	-0.008	-0.458	1	0.450	0.590	2877
1979	0.547	0.760	-0.360	-0.031	1	-0.330	-0.431	4411
1980	1.705	1.200	0.777	0.426	1	0.351	0.460	6965
1981	0.106	0.170	-2.002	-1.529	1	-0.472	-0.618	986
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00
1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.241

spr_41
Tuned to: 1-Jan and number
For ages: 6

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.142	0.181	-1.057	-0.811	1	-0.246	-0.322	1127
1979	0.236	0.258	-0.548	-0.458	1	-0.090	-0.118	1604
1980	0.374	0.404	-0.086	-0.008	1	-0.078	-0.102	2515
1981	0.879	0.581	0.769	0.354	1	0.414	0.542	3614
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00

1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.09

spr_41
Tuned to: 1-Jan and number
For ages: 7

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.712	0.318	0.832	0.027	1	0.805	1.054	1414
1979	0.084	0.181	-1.310	-0.538	1	-0.772	-1.011	804
1980	0.186	0.202	-0.513	-0.426	1	-0.088	-0.115	899
1981	0.258	0.244	-0.183	-0.237	1	0.055	0.072	1085
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00
1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00
1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.459

spr_41
Tuned to: 1-Jan and number
For ages: 8

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.065	0.016	-0.343	-1.739	1	1.397	1.829	67
1979	0.139	0.203	0.413	0.795	1	-0.381	-0.500	846
1980	0.031	0.141	-1.085	0.432	1	-1.516	-1.985	588
1981	0.132	0.080	0.365	-0.136	1	0.501	0.656	334
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.000	0.000	0	0	1	0.000	0.000	00
1987	0.000	0.000	0	0	1	0.000	0.000	00
1988	0.000	0.000	0	0	1	0.000	0.000	00
1989	0.000	0.000	0	0	1	0.000	0.000	00

1990	0.000	0.000	0	0	1	0.000	0.000	00
1991	0.000	0.000	0	0	1	0.000	0.000	00
1992	0.000	0.000	0	0	1	0.000	0.000	00
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.000	0.000	0	0	1	0.000	0.000	00
1996	0.000	0.000	0	0	1	0.000	0.000	00
1997	0.000	0.000	0	0	1	0.000	0.000	00
1998	0.000	0.000	0	0	1	0.000	0.000	00
1999	0.000	0.000	0	0	1	0.000	0.000	00
2000	0.000	0.000	0	0	1	0.000	0.000	00
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 1.7

sp_can
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.600	0.957	0.360	0.827	1	-0.467	-0.612	42751
1987	0.250	0.367	-0.515	-0.132	1	-0.383	-0.501	16376
1988	0.280	0.525	-0.402	0.227	1	-0.629	-0.823	23448
1989	1.630	0.351	1.360	-0.175	1	1.535	2.009	15689
1990	0.420	0.206	0.004	-0.707	1	0.710	0.930	9218
1991	1.180	0.400	1.037	-0.045	1	1.082	1.416	17866
1992	0.110	0.148	-1.336	-1.036	1	-0.300	-0.393	6632
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.070	0.097	-1.788	-1.462	1	-0.326	-0.427	4331
1996	0.140	0.170	-1.095	-0.898	1	-0.197	-0.258	7612
1997	0.320	0.231	-0.268	-0.593	1	0.325	0.426	10325
1998	0.010	0.071	-3.734	-1.771	1	-1.963	-2.570	3179
1999	0.330	0.163	-0.237	-0.941	1	0.704	0.922	7291
2000	0.100	0.110	-1.431	-1.339	1	-0.092	-0.120	4896
2001	0.000	0.000	0	0	0	0.000	0.000	00

Partial Variance: 0.809

sp_can
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	2.270	0.735	0.578	-0.550	1	1.128	1.477	6979
1987	2.130	3.669	0.514	1.058	1	-0.544	-0.712	34860

1988	1.010	1.409	-0.232	0.101	1	-0.333	-0.436	13384
1989	2.780	2.020	0.781	0.461	1	0.319	0.418	19188
1990	2.440	1.352	0.650	0.060	1	0.590	0.773	12845
1991	1.160	0.794	-0.093	-0.473	1	0.379	0.497	7540
1992	2.860	1.535	0.809	0.186	1	0.623	0.815	14580
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.670	0.543	-0.642	-0.853	1	0.211	0.276	5156
1996	0.490	0.373	-0.955	-1.227	1	0.272	0.357	3545
1997	0.530	0.656	-0.877	-0.664	1	-0.213	-0.279	6231
1998	0.670	0.889	-0.642	-0.359	1	-0.283	-0.371	8450
1999	0.320	0.274	-1.381	-1.537	1	0.155	0.203	2603
2000	0.440	0.628	-1.063	-0.707	1	-0.356	-0.466	5968
2001	0.060	0.421	-3.055	-1.106	1	-1.949	-2.552	4003

Partial Variance: 0.538

sp_can
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	2.810	3.244	0.427	0.571	1	-0.144	-0.188	12485
1987	0.930	1.173	-0.678	-0.446	1	-0.232	-0.304	4514
1988	4.660	5.659	0.933	1.127	1	-0.194	-0.254	21779
1989	1.380	2.477	-0.284	0.301	1	-0.585	-0.766	9531
1990	3.780	3.591	0.724	0.673	1	0.051	0.067	13821
1991	1.840	1.571	0.004	-0.154	1	0.158	0.207	6045
1992	1.770	1.246	-0.035	-0.386	1	0.351	0.460	4794
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	1.500	1.375	-0.200	-0.288	1	0.087	0.114	5290
1996	2.310	1.005	0.231	-0.601	1	0.832	1.090	3867
1997	0.550	0.706	-1.204	-0.955	1	-0.249	-0.326	2715
1998	0.950	1.204	-0.657	-0.420	1	-0.237	-0.310	4634
1999	1.490	1.624	-0.207	-0.121	1	-0.086	-0.113	6250
2000	1.050	0.487	-0.557	-1.326	1	0.769	1.007	1873
2001	0.640	1.079	-1.052	-0.530	1	-0.522	-0.684	4152

Partial Variance: 0.18

sp_can
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00

1986	0.370	0.793	-1.438	-0.677	1	-0.762	-0.997	2032
1987	1.090	2.373	-0.358	0.420	1	-0.778	-1.019	6084
1988	0.580	0.945	-0.989	-0.501	1	-0.488	-0.639	2423
1989	2.850	4.123	0.603	0.972	1	-0.369	-0.484	10573
1990	2.080	2.012	0.288	0.255	1	0.033	0.043	5159
1991	2.150	2.634	0.321	0.524	1	-0.203	-0.266	6753
1992	0.800	0.786	-0.667	-0.685	1	0.018	0.023	2015
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.860	0.566	-0.595	-1.014	1	0.418	0.548	1451
1996	4.020	1.316	0.947	-0.170	1	1.117	1.462	3374
1997	1.250	0.916	-0.221	-0.532	1	0.311	0.407	2349
1998	0.350	0.642	-1.494	-0.888	1	-0.606	-0.793	1645
1999	1.090	1.060	-0.358	-0.386	1	0.028	0.036	2719
2000	3.920	1.316	0.922	-0.170	1	1.092	1.430	3373
2001	0.420	0.347	-1.312	-1.501	1	0.190	0.248	891

Partial Variance: 0.371

sp_can
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.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.650	0.732	-0.484	-0.366	1	-0.119	-0.155	1312
1987	0.340	0.526	-1.132	-0.696	1	-0.436	-0.571	943
1988	1.020	1.708	-0.034	0.482	1	-0.515	-0.675	3062
1989	0.360	0.596	-1.075	-0.571	1	-0.504	-0.660	1068
1990	3.870	2.731	1.300	0.951	1	0.349	0.456	4897
1991	1.050	1.406	-0.005	0.287	1	-0.292	-0.382	2521
1992	0.980	1.428	-0.074	0.303	1	-0.376	-0.493	2560
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.600	0.374	-0.564	-1.036	1	0.471	0.617	671
1996	1.090	0.313	0.033	-1.214	1	1.246	1.632	562
1997	1.230	0.918	0.153	-0.139	1	0.293	0.383	1645
1998	0.350	0.628	-1.103	-0.519	1	-0.585	-0.766	1126
1999	0.410	0.538	-0.945	-0.674	1	-0.271	-0.355	964
2000	1.710	0.885	0.483	-0.175	1	0.658	0.862	1587
2001	1.110	1.024	0.051	-0.030	1	0.081	0.106	1835

Partial Variance: 0.298

sp_can
Tuned to: 1-Jan and number
For ages: 6

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00

1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.440	0.982	-0.058	0.744	1	-0.803	-1.051	1611
1987	0.120	0.390	-1.358	-0.179	1	-1.179	-1.544	640
1988	0.130	0.316	-1.278	-0.388	1	-0.890	-1.165	519
1989	0.420	0.702	-0.105	0.409	1	-0.514	-0.673	1153
1990	0.420	0.351	-0.105	-0.286	1	0.181	0.237	575
1991	1.310	1.195	1.033	0.940	1	0.092	0.121	1961
1992	0.600	0.454	0.252	-0.027	1	0.279	0.365	745
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.190	0.081	-0.898	-1.757	1	0.859	1.124	132
1996	0.790	0.175	0.527	-0.980	1	1.507	1.973	287
1997	0.270	0.147	-0.547	-1.151	1	0.605	0.792	242
1998	0.280	0.383	-0.510	-0.197	1	-0.314	-0.410	629
1999	0.260	0.383	-0.584	-0.197	1	-0.388	-0.508	629
2000	0.780	0.370	0.514	-0.231	1	0.745	0.976	607
2001	0.520	0.623	0.109	0.290	1	-0.181	-0.237	1023

Partial Variance: 0.583

sp_can
Tuned to: 1-Jan and number
For ages: 7

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00
1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.260	0.232	0.057	-0.058	1	0.115	0.150	340
1987	0.220	0.512	-0.111	0.735	1	-0.845	-1.107	752
1988	0.080	0.202	-1.122	-0.197	1	-0.925	-1.211	296
1989	0.050	0.139	-1.592	-0.568	1	-1.025	-1.342	204
1990	0.930	0.309	1.331	0.231	1	1.100	1.441	454
1991	0.160	0.180	-0.429	-0.313	1	-0.116	-0.152	264
1992	0.430	0.423	0.560	0.543	1	0.017	0.022	621
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.040	0.043	-1.815	-1.739	1	-0.076	-0.100	63
1996	0.330	0.047	0.295	-1.663	1	1.958	2.564	68
1997	0.060	0.084	-1.410	-1.069	1	-0.341	-0.447	124
1998	0.070	0.054	-1.256	-1.511	1	0.255	0.334	80
1999	0.150	0.205	-0.494	-0.183	1	-0.310	-0.406	300
2000	0.400	0.291	0.487	0.169	1	0.318	0.417	427
2001	0.260	0.294	0.057	0.181	1	-0.124	-0.163	432

Partial Variance: 0.635

sp_can
Tuned to: 1-Jan and number
For ages: 8

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.000	0.000	0	0	1	0.000	0.000	00
1979	0.000	0.000	0	0	1	0.000	0.000	00
1980	0.000	0.000	0	0	1	0.000	0.000	00
1981	0.000	0.000	0	0	1	0.000	0.000	00

1982	0.000	0.000	0	0	1	0.000	0.000	00
1983	0.000	0.000	0	0	1	0.000	0.000	00
1984	0.000	0.000	0	0	1	0.000	0.000	00
1985	0.000	0.000	0	0	1	0.000	0.000	00
1986	0.040	0.173	-0.951	0.515	1	-1.466	-1.920	212
1987	0.080	0.163	-0.258	0.456	1	-0.715	-0.936	200
1988	0.170	0.304	0.496	1.076	1	-0.580	-0.759	371
1989	0.100	0.079	-0.035	-0.269	1	0.234	0.307	97
1990	0.120	0.076	0.147	-0.307	1	0.454	0.594	93
1991	0.220	0.123	0.753	0.170	1	0.583	0.763	150
1992	0.120	0.083	0.147	-0.217	1	0.364	0.477	102
1993	0.000	0.000	0	0	1	0.000	0.000	00
1994	0.000	0.000	0	0	1	0.000	0.000	00
1995	0.050	0.027	-0.728	-1.356	1	0.627	0.822	33
1996	0.080	0.023	-0.258	-1.497	1	1.238	1.621	28
1997	0.030	0.035	-1.239	-1.094	1	-0.145	-0.189	42
1998	0.020	0.021	-1.645	-1.605	1	-0.039	-0.051	25
1999	0.010	0.024	-2.338	-1.444	1	-0.894	-1.170	30
2000	0.240	0.113	0.840	0.087	1	0.753	0.986	138
2001	0.170	0.258	0.496	0.912	1	-0.416	-0.545	315

Partial Variance: 0.567

us0aut
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.
1978	0.152	0.316	-0.489	0.246	1	-0.735	-0.962	27711
1979	0.395	0.268	0.469	0.081	1	0.388	0.508	23512
1980	0.114	0.229	-0.770	-0.075	1	-0.695	-0.910	20109
1981	0.280	0.472	0.123	0.647	1	-0.524	-0.686	41393
1982	0.261	0.199	0.054	-0.216	1	0.270	0.353	17470
1983	0.362	0.110	0.381	-0.813	1	1.194	1.564	9615
1984	1.283	0.312	1.647	0.234	1	1.412	1.849	27390
1985	0.179	0.099	-0.322	-0.916	1	0.594	0.777	8672
1986	1.002	0.488	1.399	0.679	1	0.720	0.943	42751
1987	0.076	0.187	-1.178	-0.280	1	-0.898	-1.176	16376
1988	0.204	0.267	-0.194	0.079	1	-0.272	-0.357	23448
1989	0.550	0.179	0.799	-0.323	1	1.122	1.469	15689
1990	0.251	0.105	0.014	-0.855	1	0.869	1.138	9218
1991	0.157	0.204	-0.453	-0.193	1	-0.260	-0.341	17866
1992	0.040	0.076	-1.809	-1.184	1	-0.625	-0.818	6632
1993	0.035	0.096	-1.952	-0.944	1	-1.008	-1.320	8433
1994	0.178	0.072	-0.326	-1.236	1	0.909	1.190	6300
1995	0.067	0.049	-1.309	-1.610	1	0.302	0.395	4331
1996	0.160	0.087	-0.436	-1.046	1	0.611	0.800	7612
1997	0.022	0.118	-2.438	-0.742	1	-1.696	-2.221	10325
1998	0.006	0.036	-3.654	-1.920	1	-1.734	-2.271	3179
1999	0.070	0.083	-1.260	-1.089	1	-0.171	-0.224	7291
2000	0.070	0.056	-1.260	-1.488	1	0.227	0.297	4896
2001	0.020	0.020	-2.540	-2.540	1	0.000	0.000	1710

Partial Variance: 0.767

us1aut
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.
1978	0.237	0.268	-1.365	-1.240	1	-0.126	-0.164	4270
1979	1.845	1.426	0.688	0.430	1	0.257	0.337	22686

1980	1.625	1.209	0.561	0.265	1	0.296	0.388	19219
1981	0.820	1.030	-0.123	0.105	1	-0.228	-0.299	16383
1982	3.525	2.129	1.335	0.831	1	0.504	0.660	33865
1983	0.577	0.881	-0.474	-0.052	1	-0.422	-0.553	14004
1984	0.850	0.489	-0.088	-0.641	1	0.553	0.724	7774
1985	1.909	1.405	0.722	0.416	1	0.306	0.401	22352
1986	0.181	0.439	-1.632	-0.748	1	-0.884	-1.157	6979
1987	2.279	2.192	0.899	0.860	1	0.039	0.051	34860
1988	0.414	0.842	-0.807	-0.097	1	-0.710	-0.930	13384
1989	0.875	1.207	-0.059	0.263	1	-0.322	-0.421	19188
1990	2.798	0.808	1.104	-0.138	1	1.243	1.627	12845
1991	0.364	0.474	-0.936	-0.671	1	-0.265	-0.348	7540
1992	0.408	0.917	-0.822	-0.012	1	-0.811	-1.061	14580
1993	0.412	0.337	-0.811	-1.011	1	0.201	0.263	5366
1994	0.970	0.434	0.045	-0.760	1	0.804	1.053	6901
1995	0.406	0.324	-0.827	-1.051	1	0.224	0.293	5156
1996	0.245	0.223	-1.333	-1.426	1	0.093	0.122	3545
1997	0.240	0.392	-1.352	-0.862	1	-0.491	-0.642	6231
1998	0.236	0.531	-1.368	-0.557	1	-0.811	-1.062	8450
1999	0.336	0.164	-1.017	-1.735	1	0.718	0.940	2603
2000	0.140	0.375	-1.893	-0.905	1	-0.988	-1.294	5968
2001	0.571	0.252	-0.485	-1.304	1	0.819	1.072	4003

Partial Variance: 0.375

us2aut
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.
1978	3.434	2.566	1.242	0.951	1	0.291	0.381	25527
1979	0.391	0.316	-0.930	-1.144	1	0.214	0.281	3140
1980	1.677	1.686	0.526	0.531	1	-0.006	-0.007	16774
1981	0.564	1.238	-0.565	0.222	1	-0.787	-1.031	12318
1982	2.250	1.057	0.820	0.064	1	0.756	0.989	10513
1983	1.910	1.956	0.655	0.680	1	-0.024	-0.032	19458
1984	1.089	0.763	0.094	-0.262	1	0.356	0.466	7587
1985	0.682	0.521	-0.374	-0.643	1	0.269	0.352	5182
1986	0.843	1.255	-0.163	0.236	1	-0.399	-0.522	12485
1987	0.128	0.454	-2.043	-0.781	1	-1.262	-1.652	4514
1988	1.353	2.190	0.311	0.792	1	-0.482	-0.631	21779
1989	0.437	0.958	-0.819	-0.034	1	-0.785	-1.028	9531
1990	1.046	1.389	0.054	0.338	1	-0.284	-0.371	13821
1991	1.624	0.608	0.494	-0.489	1	0.983	1.287	6045
1992	0.175	0.482	-1.733	-0.721	1	-1.012	-1.325	4794
1993	0.949	0.820	-0.044	-0.190	1	0.146	0.191	8158
1994	0.532	0.348	-0.623	-1.048	1	0.424	0.556	3459
1995	0.664	0.532	-0.400	-0.623	1	0.222	0.291	5290
1996	1.811	0.389	0.602	-0.936	1	1.538	2.014	3867
1997	0.196	0.273	-1.622	-1.290	1	-0.332	-0.435	2715
1998	0.321	0.466	-1.128	-0.755	1	-0.373	-0.488	4634
1999	1.026	0.628	0.035	-0.456	1	0.491	0.642	6250
2000	0.154	0.188	-1.861	-1.661	1	-0.200	-0.262	1873
2001	0.538	0.417	-0.612	-0.865	1	0.253	0.332	4152

Partial Variance: 0.414

us3aut
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.

1978	0.691	0.861	0.017	0.237	1	-0.221	-0.289	7933
1979	4.058	1.508	1.787	0.797	1	0.990	1.296	13889
1980	0.162	0.191	-1.433	-1.270	1	-0.163	-0.213	1756
1981	0.774	0.919	0.130	0.302	1	-0.171	-0.225	8460
1982	1.559	0.680	0.831	0.001	1	0.829	1.086	6266
1983	0.242	0.559	-1.033	-0.195	1	-0.838	-1.097	5148
1984	0.740	0.938	0.086	0.322	1	-0.236	-0.310	8635
1985	0.929	0.338	0.313	-0.697	1	1.010	1.323	3115
1986	0.067	0.221	-2.321	-1.124	1	-1.197	-1.567	2032
1987	0.329	0.661	-0.725	-0.028	1	-0.697	-0.913	6084
1988	0.108	0.263	-1.839	-0.948	1	-0.891	-1.166	2423
1989	0.904	1.148	0.285	0.525	1	-0.239	-0.313	10573
1990	0.161	0.560	-1.439	-0.193	1	-1.246	-1.632	5159
1991	1.814	0.733	0.982	0.076	1	0.906	1.186	6753
1992	0.274	0.219	-0.907	-1.133	1	0.226	0.296	2015
1993	0.174	0.213	-1.360	-1.160	1	-0.200	-0.262	1961
1994	0.383	0.308	-0.574	-0.791	1	0.217	0.284	2837
1995	0.433	0.158	-0.450	-1.461	1	1.012	1.325	1451
1996	1.248	0.366	0.608	-0.618	1	1.226	1.605	3374
1997	0.414	0.255	-0.494	-0.980	1	0.485	0.635	2349
1998	0.109	0.179	-1.827	-1.336	1	-0.491	-0.643	1645
1999	0.352	0.295	-0.658	-0.833	1	0.175	0.229	2719
2000	0.310	0.366	-0.786	-0.618	1	-0.168	-0.220	3373
2001	0.070	0.097	-2.266	-1.949	1	-0.317	-0.414	891

Partial Variance: 0.528

us4aut
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.
1978	0.253	0.217	-0.119	-0.270	1	0.151	0.198	2877
1979	0.964	0.333	1.219	0.157	1	1.062	1.390	4411
1980	1.686	0.526	1.779	0.614	1	1.165	1.525	6965
1981	0.052	0.074	-1.691	-1.341	1	-0.350	-0.458	986
1982	0.589	0.355	0.727	0.220	1	0.507	0.663	4697
1983	0.068	0.197	-1.435	-0.368	1	-1.067	-1.397	2608
1984	0.069	0.151	-1.416	-0.638	1	-0.778	-1.019	1992
1985	0.825	0.306	1.064	0.072	1	0.992	1.298	4051
1986	0.106	0.099	-0.993	-1.055	1	0.062	0.081	1312
1987	0.008	0.071	-3.548	-1.386	1	-2.162	-2.830	943
1988	0.200	0.231	-0.352	-0.208	1	-0.144	-0.189	3062
1989	0.060	0.081	-1.557	-1.261	1	-0.297	-0.388	1068
1990	0.507	0.370	0.577	0.262	1	0.315	0.413	4897
1991	0.412	0.190	0.370	-0.402	1	0.773	1.012	2521
1992	0.030	0.193	-2.234	-0.387	1	-1.847	-2.419	2560
1993	0.100	0.054	-1.047	-1.669	1	0.622	0.815	710
1994	0.016	0.045	-2.848	-1.843	1	-1.005	-1.316	597
1995	0.153	0.051	-0.619	-1.725	1	1.107	1.449	671
1996	0.087	0.042	-1.183	-1.903	1	0.720	0.942	562
1997	0.143	0.124	-0.689	-0.829	1	0.140	0.183	1645
1998	0.129	0.085	-0.790	-1.208	1	0.418	0.547	1126
1999	0.041	0.073	-1.936	-1.363	1	-0.572	-0.749	964
2000	0.255	0.120	-0.111	-0.865	1	0.754	0.987	1587
2001	0.079	0.139	-1.285	-0.720	1	-0.565	-0.740	1835

Partial Variance: 0.838

us5aut
Tuned to: 1-Jan and number
For ages: 6

Year	Obs.	Pred.	Ln Scd. Obs.	Ln Scd. Pred.	Wt.	Wt. Res.	Std. Res.	Pred. Stk. Sze.
1978	0.173	0.101	0.512	-0.025	1	0.538	0.704	1127
1979	0.336	0.144	1.174	0.328	1	0.846	1.107	1604
1980	0.321	0.226	1.129	0.778	1	0.351	0.459	2515
1981	0.265	0.324	0.937	1.140	1	-0.203	-0.266	3614
1982	0.054	0.053	-0.653	-0.665	1	0.012	0.016	594
1983	0.115	0.183	0.105	0.567	1	-0.461	-0.604	2036
1984	0.033	0.106	-1.151	0.022	1	-1.173	-1.536	1181
1985	0.024	0.078	-1.455	-0.282	1	-1.173	-1.535	871
1986	0.077	0.145	-0.303	0.333	1	-0.636	-0.832	1611
1987	0.049	0.057	-0.756	-0.590	1	-0.165	-0.217	640
1988	0.028	0.047	-1.309	-0.799	1	-0.510	-0.668	519
1989	0.194	0.103	0.625	-0.002	1	0.627	0.821	1153
1990	0.055	0.052	-0.640	-0.697	1	0.058	0.075	575
1991	0.286	0.176	1.013	0.529	1	0.484	0.634	1961
1992	0.029	0.067	-1.274	-0.439	1	-0.835	-1.094	745
1993	0.044	0.068	-0.864	-0.425	1	-0.439	-0.575	755
1994	0.025	0.016	-1.411	-1.840	1	0.429	0.562	184
1995	0.068	0.012	-0.423	-2.168	1	1.745	2.285	132
1996	0.054	0.026	-0.651	-1.392	1	0.741	0.970	287
1997	0.060	0.022	-0.552	-1.563	1	1.011	1.324	242
1998	0.049	0.056	-0.758	-0.608	1	-0.149	-0.196	629
1999	0.035	0.056	-1.075	-0.608	1	-0.466	-0.611	629
2000	0.087	0.055	-0.174	-0.643	1	0.468	0.613	607
2001	0.031	0.092	-1.221	-0.122	1	-1.099	-1.438	1023

Partial Variance: 0.564

Partial variance (and proportion of total) by index

Index	Partial Variance	Proportion
spr_36 1	1.145	0.064
spr_36 2	0.158	0.009
spr_36 3	0.453	0.025
spr_36 4	0.496	0.028
spr_36 5	0.634	0.035
spr_36 6	0.58	0.032
spr_36 7	1.015	0.056
spr_36 8	0.584	0.032
spr_41 1	2.46	0.137
spr_41 2	0.252	0.014
spr_41 3	0.212	0.012
spr_41 4	0.061	0.003
spr_41 5	0.241	0.013
spr_41 6	0.09	0.005
spr_41 7	0.459	0.026
spr_41 8	1.7	0.094
sp_can 1	0.809	0.045
sp_can 2	0.538	0.03
sp_can 3	0.18	0.01
sp_can 4	0.371	0.021
sp_can 5	0.298	0.017
sp_can 6	0.583	0.032
sp_can 7	0.635	0.035
sp_can 8	0.567	0.031
us0aut 1	0.767	0.043
us1aut 2	0.375	0.021
us2aut 3	0.414	0.023

us3aut 4	0.528	0.029
us4aut 5	0.838	0.047
us5aut 6	0.564	0.031

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

	1978	1979	1980	1981	1982	1983	1984
spr_361	0.000	0.000	0.000	0.000	0.731	0.954	-0.164
spr_362	0.000	0.000	0.000	0.000	0.969	0.784	-0.423
spr_363	0.000	0.000	0.000	0.000	2.433	0.125	-0.446
spr_364	0.000	0.000	0.000	0.000	2.463	-0.353	-0.452
spr_365	0.000	0.000	0.000	0.000	2.210	0.117	-0.186
spr_366	0.000	0.000	0.000	0.000	0.854	-0.216	0.364
spr_367	0.000	0.000	0.000	0.000	1.701	-1.239	-0.435
spr_368	0.000	0.000	0.000	0.000	0.917	-0.306	0.000
spr_411	0.140	0.541	-2.684	2.003	0.000	0.000	0.000
spr_412	-0.690	-0.373	0.545	0.519	0.000	0.000	0.000
spr_413	0.378	-0.808	-0.016	0.446	0.000	0.000	0.000
spr_414	-0.183	-0.072	-0.200	0.454	0.000	0.000	0.000
spr_415	0.590	-0.431	0.460	-0.618	0.000	0.000	0.000
spr_416	-0.322	-0.118	-0.102	0.542	0.000	0.000	0.000
spr_417	1.054	-1.011	-0.115	0.072	0.000	0.000	0.000
spr_418	1.829	-0.500	-1.985	0.656	0.000	0.000	0.000
sp_can1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can7	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can8	0.000	0.000	0.000	0.000	0.000	0.000	0.000
us0aut1	-0.962	0.508	-0.910	-0.686	0.353	1.564	1.849
us1aut2	-0.164	0.337	0.388	-0.299	0.660	-0.553	0.724
us2aut3	0.381	0.281	-0.007	-1.031	0.989	-0.032	0.466
us3aut4	-0.289	1.296	-0.213	-0.225	1.086	-1.097	-0.310
us4aut5	0.198	1.390	1.525	-0.458	0.663	-1.397	-1.019
us5aut6	0.704	1.107	0.459	-0.266	0.016	-0.604	-1.536
Col Avg	0.190	0.153	-0.204	0.079	1.146	-0.161	-0.121

	1985	1986	1987	1988	1989	1990	1991
spr_361	-0.342	0.266	-3.440	0.803	0.227	0.161	1.623
spr_362	0.574	-0.350	-0.660	-0.682	-0.054	-0.086	-0.118
spr_363	-0.126	0.062	-0.680	0.034	-0.918	-0.150	-0.279
spr_364	0.741	-0.156	-0.627	-0.239	-0.395	-0.573	-0.506
spr_365	0.465	0.682	-1.717	-0.198	-0.138	-0.356	-0.330
spr_366	0.224	0.525	0.115	-0.961	0.224	-0.163	-0.560
spr_367	0.316	-0.667	-0.675	-1.154	-0.262	0.057	-0.505
spr_368	0.382	0.655	-1.021	-1.301	0.172	-1.244	-0.367
spr_411	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_412	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_413	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_414	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_415	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_416	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_417	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_418	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can1	0.000	-0.612	-0.501	-0.823	2.009	0.930	1.416
sp_can2	0.000	1.477	-0.712	-0.436	0.418	0.773	0.497

sp_can3	0.000	-0.188	-0.304	-0.254	-0.766	0.067	0.207
sp_can4	0.000	-0.997	-1.019	-0.639	-0.484	0.043	-0.266
sp_can5	0.000	-0.155	-0.571	-0.675	-0.660	0.456	-0.382
sp_can6	0.000	-1.051	-1.544	-1.165	-0.673	0.237	0.121
sp_can7	0.000	0.150	-1.107	-1.211	-1.342	1.441	-0.152
sp_can8	0.000	-1.920	-0.936	-0.759	0.307	0.594	0.763
us0aut1	0.777	0.943	-1.176	-0.357	1.469	1.138	-0.341
us1aut2	0.401	-1.157	0.051	-0.930	-0.421	1.627	-0.348
us2aut3	0.352	-0.522	-1.652	-0.631	-1.028	-0.371	1.287
us3aut4	1.323	-1.567	-0.913	-1.166	-0.313	-1.632	1.186
us4aut5	1.298	0.081	-2.830	-0.189	-0.388	0.413	1.012
us5aut6	-1.535	-0.832	-0.217	-0.668	0.821	0.075	0.634
Col Avg	0.346	-0.242	-1.006	-0.618	-0.100	0.156	0.209

	1992	1993	1994	1995	1996	1997	1998
spr_361	0.139	-3.671	0.228	-0.492	-0.722	0.689	0.974
spr_362	0.150	-0.039	-0.868	-0.045	-0.312	-0.115	0.036
spr_363	-0.480	0.167	-1.167	0.178	0.394	-1.061	0.899
spr_364	-1.161	-0.864	-1.278	0.782	0.788	0.035	1.223
spr_365	-1.087	-0.868	-1.938	1.695	0.311	0.064	1.321
spr_366	-0.386	-0.443	-2.765	1.500	1.361	-0.290	1.563
spr_367	-0.216	-1.208	-0.352	3.277	0.386	1.671	1.888
spr_368	-0.814	-1.134	0.000	1.144	0.757	0.368	1.600
spr_411	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_412	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_413	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_414	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_415	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_416	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_417	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_418	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can1	-0.393	0.000	0.000	-0.427	-0.258	0.426	-2.570
sp_can2	0.815	0.000	0.000	0.276	0.357	-0.279	-0.371
sp_can3	0.460	0.000	0.000	0.114	1.090	-0.326	-0.310
sp_can4	0.023	0.000	0.000	0.548	1.462	0.407	-0.793
sp_can5	-0.493	0.000	0.000	0.617	1.632	0.383	-0.766
sp_can6	0.365	0.000	0.000	1.124	1.973	0.792	-0.410
sp_can7	0.022	0.000	0.000	-0.100	2.564	-0.447	0.334
sp_can8	0.477	0.000	0.000	0.822	1.621	-0.189	-0.051
us0aut1	-0.818	-1.320	1.190	0.395	0.800	-2.221	-2.271
us1aut2	-1.061	0.263	1.053	0.293	0.122	-0.642	-1.062
us2aut3	-1.325	0.191	0.556	0.291	2.014	-0.435	-0.488
us3aut4	0.296	-0.262	0.284	1.325	1.605	0.635	-0.643
us4aut5	-2.419	0.815	-1.316	1.449	0.942	0.183	0.547
us5aut6	-1.094	-0.575	0.562	2.285	0.970	1.324	-0.196
Col Avg	-0.409	-0.639	-0.447	0.775	0.903	0.044	0.021

	1999	2000	2001
spr_361	0.733	1.305	0.000
spr_362	0.495	0.744	0.000
spr_363	-0.483	1.500	0.000
spr_364	-0.101	0.672	0.000
spr_365	0.014	-0.061	0.000
spr_366	-0.396	-0.551	0.000
spr_367	-0.463	-2.121	0.000
spr_368	1.371	-1.179	0.000
spr_411	0.000	0.000	0.000
spr_412	0.000	0.000	0.000

spr_413	0.000	0.000	0.000
spr_414	0.000	0.000	0.000
spr_415	0.000	0.000	0.000
spr_416	0.000	0.000	0.000
spr_417	0.000	0.000	0.000
spr_418	0.000	0.000	0.000
sp_can1	0.922	-0.120	0.000
sp_can2	0.203	-0.466	-2.552
sp_can3	-0.113	1.007	-0.684
sp_can4	0.036	1.430	0.248
sp_can5	-0.355	0.862	0.106
sp_can6	-0.508	0.976	-0.237
sp_can7	-0.406	0.417	-0.163
sp_can8	-1.170	0.986	-0.545
us0aut1	-0.224	0.297	0.000
us1aut2	0.940	-1.294	1.072
us2aut3	0.642	-0.262	0.332
us3aut4	0.229	-0.220	-0.414
us4aut5	-0.749	0.987	-0.740
us5aut6	-0.611	0.613	-1.438
Col Avg	0.000	0.251	-0.386

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

	1978	1979	1980	1981	1982	1983	1984
spr_361	0.000	0.000	0.000	0.000	0.134	0.228	0.007
spr_362	0.000	0.000	0.000	0.000	0.235	0.154	0.045
spr_363	0.000	0.000	0.000	0.000	1.484	0.004	0.050
spr_364	0.000	0.000	0.000	0.000	1.521	0.031	0.051
spr_365	0.000	0.000	0.000	0.000	1.224	0.003	0.009
spr_366	0.000	0.000	0.000	0.000	0.183	0.012	0.033
spr_367	0.000	0.000	0.000	0.000	0.726	0.385	0.047
spr_368	0.000	0.000	0.000	0.000	0.211	0.024	0.000
spr_411	0.005	0.073	1.805	1.005	0.000	0.000	0.000
spr_412	0.119	0.035	0.074	0.067	0.000	0.000	0.000
spr_413	0.036	0.163	0.000	0.050	0.000	0.000	0.000
spr_414	0.008	0.001	0.010	0.052	0.000	0.000	0.000
spr_415	0.087	0.047	0.053	0.096	0.000	0.000	0.000
spr_416	0.026	0.004	0.003	0.074	0.000	0.000	0.000
spr_417	0.278	0.256	0.003	0.001	0.000	0.000	0.000
spr_418	0.838	0.063	0.988	0.108	0.000	0.000	0.000
sp_can1	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can3	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can4	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can6	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can7	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can8	0.000	0.000	0.000	0.000	0.000	0.000	0.000
us0aut1	0.232	0.065	0.207	0.118	0.031	0.613	0.857
us1aut2	0.007	0.028	0.038	0.022	0.109	0.077	0.131
us2aut3	0.036	0.020	0.000	0.266	0.245	0.000	0.055
us3aut4	0.021	0.421	0.011	0.013	0.295	0.302	0.024
us4aut5	0.010	0.484	0.583	0.052	0.110	0.489	0.260
us5aut6	0.124	0.307	0.053	0.018	0.000	0.091	0.591
++	1.828	1.968	3.829	1.942	6.507	2.413	2.160

	1985	1986	1987	1988	1989	1990	1991
spr_361	0.029	0.018	2.965	0.161	0.013	0.006	0.660
spr_362	0.083	0.031	0.109	0.117	0.001	0.002	0.003
spr_363	0.004	0.001	0.116	0.000	0.211	0.006	0.019
spr_364	0.137	0.006	0.098	0.014	0.039	0.082	0.064
spr_365	0.054	0.117	0.739	0.010	0.005	0.032	0.027
spr_366	0.013	0.069	0.003	0.231	0.013	0.007	0.079
spr_367	0.025	0.111	0.114	0.334	0.017	0.001	0.064
spr_368	0.037	0.107	0.261	0.424	0.007	0.388	0.034
spr_411	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_412	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_413	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_414	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_415	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_416	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_417	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_418	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can1	0.000	0.094	0.063	0.170	1.012	0.217	0.503
sp_can2	0.000	0.547	0.127	0.048	0.044	0.150	0.062
sp_can3	0.000	0.009	0.023	0.016	0.147	0.001	0.011
sp_can4	0.000	0.249	0.260	0.102	0.059	0.000	0.018
sp_can5	0.000	0.006	0.082	0.114	0.109	0.052	0.037
sp_can6	0.000	0.277	0.597	0.340	0.114	0.014	0.004
sp_can7	0.000	0.006	0.307	0.368	0.451	0.520	0.006
sp_can8	0.000	0.924	0.219	0.145	0.024	0.089	0.146
us0aut1	0.151	0.223	0.346	0.032	0.541	0.325	0.029
us1aut2	0.040	0.336	0.001	0.217	0.044	0.663	0.030
us2aut3	0.031	0.068	0.684	0.100	0.265	0.035	0.415
us3aut4	0.438	0.615	0.209	0.341	0.025	0.667	0.352
us4aut5	0.423	0.002	2.008	0.009	0.038	0.043	0.256
us5aut6	0.591	0.174	0.012	0.112	0.169	0.001	0.101
++	2.056	3.989	9.344	3.404	3.346	3.301	2.920

	1992	1993	1994	1995	1996	1997	1998
spr_361	0.005	3.378	0.013	0.061	0.130	0.119	0.238
spr_362	0.006	0.000	0.189	0.000	0.024	0.003	0.000
spr_363	0.058	0.007	0.341	0.008	0.039	0.282	0.203
spr_364	0.338	0.187	0.409	0.153	0.156	0.000	0.375
spr_365	0.296	0.189	0.941	0.720	0.024	0.001	0.437
spr_366	0.037	0.049	1.917	0.564	0.464	0.021	0.612
spr_367	0.012	0.366	0.031	2.692	0.037	0.700	0.894
spr_368	0.166	0.322	0.000	0.328	0.144	0.034	0.642
spr_411	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_412	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_413	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_414	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_415	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_416	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_417	0.000	0.000	0.000	0.000	0.000	0.000	0.000
spr_418	0.000	0.000	0.000	0.000	0.000	0.000	0.000
sp_can1	0.039	0.000	0.000	0.046	0.017	0.045	1.655
sp_can2	0.167	0.000	0.000	0.019	0.032	0.020	0.034
sp_can3	0.053	0.000	0.000	0.003	0.298	0.027	0.024
sp_can4	0.000	0.000	0.000	0.075	0.536	0.041	0.158
sp_can5	0.061	0.000	0.000	0.096	0.667	0.037	0.147
sp_can6	0.033	0.000	0.000	0.317	0.976	0.157	0.042

sp_can7	0.000	0.000	0.000	0.003	1.647	0.050	0.028
sp_can8	0.057	0.000	0.000	0.169	0.659	0.009	0.001
us0aut1	0.168	0.437	0.355	0.039	0.160	1.236	1.293
us1aut2	0.282	0.017	0.278	0.022	0.004	0.103	0.282
us2aut3	0.440	0.009	0.077	0.021	1.017	0.047	0.060
us3aut4	0.022	0.017	0.020	0.440	0.646	0.101	0.104
us4aut5	1.466	0.166	0.434	0.526	0.223	0.008	0.075
us5aut6	0.300	0.083	0.079	1.308	0.236	0.439	0.010
++	4.005	5.228	5.085	7.610	8.136	3.482	7.313

	1999	2000	2001	++
spr_361	0.135	0.427	0.000	8.726
spr_362	0.061	0.139	0.000	1.203
spr_363	0.059	0.564	0.000	3.454
spr_364	0.003	0.113	0.000	3.779
spr_365	0.000	0.001	0.000	4.829
spr_366	0.039	0.076	0.000	4.422
spr_367	0.054	1.127	0.000	7.736
spr_368	0.471	0.348	0.000	3.949
spr_411	0.000	0.000	0.000	2.889
spr_412	0.000	0.000	0.000	0.296
spr_413	0.000	0.000	0.000	0.249
spr_414	0.000	0.000	0.000	0.071
spr_415	0.000	0.000	0.000	0.283
spr_416	0.000	0.000	0.000	0.106
spr_417	0.000	0.000	0.000	0.539
spr_418	0.000	0.000	0.000	1.997
sp_can1	0.213	0.004	0.000	4.076
sp_can2	0.010	0.054	1.633	2.946
sp_can3	0.003	0.254	0.117	0.986
sp_can4	0.000	0.512	0.015	2.027
sp_can5	0.032	0.186	0.003	1.628
sp_can6	0.065	0.239	0.014	3.188
sp_can7	0.041	0.044	0.007	3.477
sp_can8	0.343	0.244	0.074	3.102
us0aut1	0.013	0.022	0.000	7.493
us1aut2	0.221	0.419	0.288	3.662
us2aut3	0.103	0.017	0.028	4.040
us3aut4	0.013	0.012	0.043	5.153
us4aut5	0.141	0.244	0.137	8.188
us5aut6	0.093	0.094	0.519	5.504
++	2.114	5.141	2.878	100.000

STOCK NUMBERS (Jan 1) in thousands -
D:\GBcod\assess_2001\vpa\gbcod_2000_new_15_gcaa.9

	1978	1979	1980	1981	1982	1983	1984
1	27711	23512	20109	41393	17470	9615	27390
2	4270	22686	19219	16383	33865	14004	7774
3	25527	3140	16774	12318	10513	19458	7587
4	7933	13889	1756	8460	6266	5148	8635
5	2877	4411	6965	986	4697	2608	1992
6	1127	1604	2515	3614	594	2036	1181

7	1414	804	899	1085	1687	232	965
8	67	846	588	334	511	772	104
9	147	12	463	403	162	226	419
10	50	135	25	174	171	133	268
1+	71122	71040	69315	85150	75937	54232	56316

	1985	1986	1987	1988	1989	1990	1991
1	8672	42751	16376	23448	15689	9218	17866
2	22352	6979	34860	13384	19188	12845	7540
3	5182	12485	4514	21779	9531	13821	6045
4	3115	2032	6084	2423	10573	5159	6753
5	4051	1312	943	3062	1068	4897	2521
6	871	1611	640	519	1153	575	1961
7	500	340	752	296	204	454	264
8	375	212	200	371	97	93	150
9	46	124	108	107	126	40	44
10	190	69	62	91	41	82	40
1+	45354	67916	64540	65481	57670	47184	43183

	1992	1993	1994	1995	1996	1997	1998
1	6632	8433	6300	4331	7612	10325	3179
2	14580	5366	6901	5156	3545	6231	8450
3	4794	8158	3459	5290	3867	2715	4634
4	2015	1961	2837	1451	3374	2349	1645
5	2560	710	597	671	562	1645	1126
6	745	755	184	132	287	242	629
7	621	244	191	63	68	124	80
8	102	229	56	33	28	42	25
9	60	53	58	04	13	21	20
10	16	25	08	02	00	01	12
1+	32124	25935	20591	17134	19357	23696	19801

	1999	2000	2001
1	7291	4896	1710
2	2603	5968	4003
3	6250	1873	4152
4	2719	3373	891
5	964	1587	1835
6	629	607	1023
7	300	427	432
8	30	138	315
9	08	10	91
10	11	05	12
1+	20805	18885	14464

FISHING MORTALITY - D:\GBcod\assess_2001\vpa\gbcod_2000_new_15_gcaa.9

	1978	1979	1980	1981	1982	1983	1984
1	0.00	0.00	0.00	0.00	0.02	0.01	0.00

2	0.11	0.10	0.24	0.24	0.35	0.41	0.21
3	0.41	0.38	0.48	0.48	0.51	0.61	0.69
4	0.39	0.49	0.38	0.39	0.68	0.75	0.56
5	0.38	0.36	0.46	0.31	0.64	0.59	0.63
6	0.14	0.38	0.64	0.56	0.74	0.55	0.66
7	0.31	0.11	0.79	0.55	0.58	0.60	0.74
8	1.49	0.40	0.18	0.52	0.62	0.41	0.63
9	0.36	0.44	0.51	0.44	0.66	0.67	0.60
10	0.36	0.44	0.51	0.44	0.66	0.67	0.60

	1985	1986	1987	1988	1989	1990	1991
1	0.02	0.00	0.00	0.00	0.00	0.00	0.00
2	0.38	0.24	0.27	0.14	0.13	0.55	0.25
3	0.74	0.52	0.42	0.52	0.41	0.52	0.90
4	0.66	0.57	0.49	0.62	0.57	0.52	0.77
5	0.72	0.52	0.40	0.78	0.42	0.72	1.02
6	0.74	0.56	0.57	0.73	0.73	0.58	0.95
7	0.66	0.33	0.51	0.92	0.59	0.91	0.75
8	0.91	0.47	0.43	0.88	0.68	0.56	0.72
9	0.71	0.54	0.49	0.73	0.58	0.63	0.87
10	0.71	0.54	0.49	0.73	0.58	0.63	0.87

	1992	1993	1994	1995	1996	1997	1998
1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2	0.38	0.24	0.07	0.09	0.07	0.10	0.10
3	0.69	0.86	0.67	0.25	0.30	0.30	0.33
4	0.84	0.99	1.24	0.75	0.52	0.54	0.33
5	1.02	1.15	1.31	0.65	0.64	0.76	0.38
6	0.91	1.17	0.86	0.46	0.64	0.91	0.54
7	0.80	1.27	1.57	0.60	0.28	1.38	0.78
8	0.46	1.18	2.36	0.71	0.12	0.54	0.94
9	0.95	1.11	1.30	0.71	0.54	0.66	0.40
10	0.95	1.11	1.30	0.71	0.54	0.66	0.40

	1999	2000
1	0.00	0.00
2	0.13	0.16
3	0.42	0.54
4	0.34	0.41
5	0.26	0.24
6	0.19	0.14
7	0.58	0.10
8	0.89	0.22
9	0.32	0.22
10	0.32	0.22

Average F for 2,8 3,8 4,8 5,8 6,8

	1978	1979	1980	1981	1982	1983	1984
2,8	0.46	0.32	0.45	0.44	0.59	0.56	0.59
3,8	0.52	0.35	0.49	0.47	0.63	0.59	0.65
4,8	0.54	0.35	0.49	0.47	0.65	0.58	0.64
5,8	0.58	0.31	0.52	0.49	0.64	0.54	0.66
6,8	0.65	0.30	0.54	0.55	0.65	0.52	0.68

	1985	1986	1987	1988	1989	1990	1991
2,8	0.69	0.46	0.44	0.66	0.50	0.62	0.77
3,8	0.74	0.49	0.47	0.74	0.57	0.63	0.85
4,8	0.74	0.49	0.48	0.79	0.60	0.65	0.84
5,8	0.76	0.47	0.48	0.83	0.60	0.69	0.86
6,8	0.77	0.45	0.50	0.84	0.66	0.68	0.81

	1992	1993	1994	1995	1996	1997	1998
2,8	0.73	0.98	1.15	0.50	0.37	0.65	0.49
3,8	0.79	1.10	1.33	0.57	0.42	0.74	0.55
4,8	0.81	1.15	1.47	0.63	0.44	0.83	0.59
5,8	0.80	1.19	1.52	0.61	0.42	0.90	0.66
6,8	0.72	1.21	1.60	0.59	0.35	0.94	0.75

	1999	2000
2,8	0.40	0.26
3,8	0.45	0.28
4,8	0.45	0.22
5,8	0.48	0.18
6,8	0.55	0.16

Average F weighted by N for 2,8 3,8 4,8 5,8 6,8

	1978	1979	1980	1981	1982	1983	1984
2,8	0.36	0.27	0.39	0.38	0.45	0.56	0.51
3,8	0.39	0.43	0.49	0.46	0.59	0.62	0.63
4,8	0.36	0.44	0.49	0.44	0.65	0.65	0.59
5,8	0.33	0.34	0.51	0.52	0.63	0.55	0.66
6,8	0.27	0.32	0.61	0.56	0.62	0.52	0.69

	1985	1986	1987	1988	1989	1990	1991
2,8	0.51	0.44	0.32	0.43	0.33	0.56	0.68
3,8	0.72	0.52	0.46	0.57	0.51	0.56	0.87
4,8	0.71	0.54	0.48	0.73	0.57	0.62	0.85
5,8	0.73	0.52	0.48	0.79	0.59	0.71	0.97
6,8	0.75	0.52	0.52	0.83	0.71	0.71	0.91

	1992	1993	1994	1995	1996	1997	1998
2,8	0.57	0.72	0.54	0.27	0.32	0.33	0.23
3,8	0.82	0.93	0.98	0.39	0.42	0.53	0.36
4,8	0.92	1.08	1.27	0.70	0.54	0.66	0.40
5,8	0.95	1.18	1.33	0.62	0.60	0.81	0.46
6,8	0.83	1.19	1.37	0.53	0.54	1.02	0.58

	1999	2000
2,8	0.33	0.28
3,8	0.38	0.37
4,8	0.32	0.31
5,8	0.30	0.20
6,8	0.33	0.14

Average F for weighted by Catch for 2,8 3,8 4,8 5,8 6,8

	1978	1979	1980	1981	1982	1983	1984
2,8	0.39	0.37	0.43	0.41	0.48	0.57	0.58
3,8	0.40	0.44	0.50	0.47	0.60	0.63	0.63
4,8	0.38	0.45	0.52	0.46	0.65	0.66	0.60
5,8	0.38	0.36	0.54	0.53	0.63	0.56	0.66
6,8	0.38	0.36	0.66	0.56	0.63	0.52	0.70

	1985	1986	1987	1988	1989	1990	1991
2,8	0.55	0.48	0.34	0.53	0.44	0.57	0.79
3,8	0.72	0.53	0.47	0.58	0.52	0.57	0.87
4,8	0.71	0.54	0.49	0.74	0.58	0.64	0.86
5,8	0.73	0.52	0.48	0.79	0.61	0.72	0.97
6,8	0.76	0.53	0.53	0.83	0.71	0.74	0.92

	1992	1993	1994	1995	1996	1997	1998
2,8	0.64	0.84	0.96	0.42	0.43	0.51	0.31
3,8	0.83	0.94	1.05	0.48	0.46	0.59	0.37
4,8	0.92	1.09	1.28	0.71	0.54	0.69	0.42
5,8	0.96	1.18	1.37	0.63	0.62	0.83	0.48
6,8	0.85	1.19	1.46	0.55	0.59	1.06	0.59

	1999	2000
2,8	0.37	0.34
3,8	0.39	0.41
4,8	0.34	0.35
5,8	0.35	0.21
6,8	0.44	0.15

Biomass Weighted F

1978	1979	1980	1981	1982	1983	1984
0.31	0.29	0.39	0.32	0.47	0.52	0.41

1985	1986	1987	1988	1989	1990	1991
0.53	0.29	0.33	0.42	0.35	0.53	0.56

1992	1993	1994	1995	1996	1997	1998
0.57	0.66	0.55	0.30	0.30	0.31	0.27

1999	2000
0.28	0.24

BACKCALCULATED PARTIAL RECRUITMENT

	1978	1979	1980	1981	1982	1983	1984
1	0.00	0.00	0.01	0.00	0.03	0.02	0.00
2	0.07	0.21	0.31	0.43	0.48	0.55	0.28
3	0.27	0.78	0.61	0.85	0.70	0.82	0.93
4	0.26	1.00	0.48	0.69	0.92	1.00	0.75
5	0.26	0.74	0.58	0.54	0.86	0.79	0.84

6	0.09	0.77	0.81	1.00	1.00	0.73	0.89
7	0.21	0.23	1.00	0.98	0.79	0.80	1.00
8	1.00	0.82	0.23	0.93	0.83	0.55	0.84
9	0.24	0.90	0.64	0.78	0.90	0.90	0.81
10	0.24	0.90	0.64	0.78	0.90	0.90	0.81

	1985	1986	1987	1988	1989	1990	1991
1	0.02	0.01	0.00	0.00	0.00	0.00	0.00
2	0.42	0.41	0.47	0.15	0.18	0.61	0.25
3	0.81	0.91	0.74	0.57	0.57	0.57	0.88
4	0.73	1.00	0.85	0.67	0.78	0.57	0.76
5	0.79	0.91	0.69	0.85	0.57	0.79	1.00
6	0.81	0.99	1.00	0.80	1.00	0.64	0.93
7	0.72	0.58	0.89	1.00	0.80	1.00	0.74
8	1.00	0.83	0.75	0.96	0.92	0.61	0.71
9	0.78	0.96	0.86	0.79	0.79	0.69	0.85
10	0.78	0.96	0.86	0.79	0.79	0.69	0.85

	1992	1993	1994	1995	1996	1997	1998
1	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2	0.37	0.19	0.03	0.12	0.10	0.07	0.11
3	0.68	0.67	0.28	0.33	0.46	0.22	0.36
4	0.83	0.78	0.53	1.00	0.81	0.39	0.36
5	1.00	0.91	0.55	0.87	1.00	0.55	0.41
6	0.90	0.92	0.37	0.61	1.00	0.66	0.57
7	0.78	1.00	0.66	0.81	0.43	1.00	0.83
8	0.45	0.93	1.00	0.95	0.19	0.39	1.00
9	0.93	0.87	0.55	0.95	0.85	0.48	0.42
10	0.93	0.87	0.55	0.95	0.85	0.48	0.42

	1999	2000
1	0.00	0.00
2	0.14	0.30
3	0.47	1.00
4	0.38	0.75
5	0.29	0.44
6	0.21	0.26
7	0.64	0.19
8	1.00	0.41
9	0.35	0.41
10	0.35	0.41

MEAN BIOMASS (using catch mean weights at age)

	1978	1979	1980	1981	1982	1983	1984
1	17756	18930	15201	33078	11990	8411	26099
2	4816	29255	22650	19782	36452	15601	10449
3	47057	5118	29978	21113	20017	31666	12313
4	20817	42243	4894	21839	16000	10999	21920
5	9449	16495	28841	4033	17037	8352	6888
6	5533	8742	11357	18264	2510	9170	5214
7	8154	6341	4785	6532	10957	1273	5563
8	275	6555	4453	2347	3458	5943	717
9	1326	107	2801	4217	1355	1693	3264
10	553	1376	303	2611	2091	1408	3101

1+	115735	135163	125263	133816	121866	94515	95528

	1985	1986	1987	1988	1989	1990	1991
1	7070	35926	10766	16700	11504	6940	18010
2	24024	8344	41185	17250	26451	14074	9866
3	7020	21790	8386	36581	16162	24297	9347
4	8106	5192	18430	5809	27816	12975	14785
5	13463	5247	4126	10556	4299	15692	6948
6	3621	8109	3448	2246	5021	2530	6863
7	2718	2353	4828	1564	1165	2323	1262
8	2321	1538	1486	2266	691	696	1031
9	341	1107	894	774	1020	345	260
10	1838	751	735	985	533	880	406

1+	70522	90356	94285	94730	94659	80753	68777

	1992	1993	1994	1995	1996	1997	1998
1	6861	6663	5173	3556	6085	8926	1668
2	17054	6662	8841	6591	4690	8505	10818
3	7809	11349	5011	8925	7415	4957	8268
4	4809	3823	5495	3590	8152	5875	4457
5	6955	1934	1481	2485	1866	4336	4041
6	2764	2620	840	715	1287	879	2638
7	2948	961	719	467	455	501	416
8	735	1145	190	249	204	259	131
9	428	285	290	30	120	163	193
10	201	203	77	21	04	14	147

1+	50565	35644	28116	26628	30277	34414	32777

	1999	2000
1	5484	4679
2	3471	8559
3	10370	3221
4	7258	8991
5	3777	6211
6	3349	3050
7	1533	2728
8	176	958
9	77	74
10	130	48

1+	35625	38517	00

Summaries for ages 2,8 3,8 4,8 5,8 6,8

	1978	1979	1980	1981	1982	1983	1984
2,8	96100	114750	106958	93910	106430	83004	63064
3,8	91284	85495	84308	74128	69978	67403	52615
4,8	44227	80377	54330	53016	49961	35737	40303
5,8	23410	38134	49436	31176	33961	24738	18382

6,8	13962	21638	20595	27144	16924	16386	11494

	1985	1986	1987	1988	1989	1990	1991
2,8	61273	52572	81890	76271	81603	72588	50101
3,8	37248	44228	40704	59021	55152	58514	40235
4,8	30229	22438	32319	22440	38990	34217	30889
5,8	22123	17247	13888	16631	11175	21242	16103
6,8	8660	12000	9762	6075	6876	5549	9156

	1992	1993	1994	1995	1996	1997	1998
2,8	43074	28493	22577	23021	24069	25312	30768
3,8	26020	21831	13736	16430	19379	16806	19950
4,8	18211	10481	8724	7505	11964	11849	11681
5,8	13402	6659	3229	3915	3811	5975	7225
6,8	6447	4725	1749	1430	1946	1639	3184

	1999	2000
2,8	29933	33717
3,8	26462	25158
4,8	16093	21937
5,8	8834	12946
6,8	5058	6735

Catch BIOMASS (using catch mean weights)

	1978	1979	1980	1981	1982	1983	1984
1	01	30	75	24	254	105	85
2	517	2982	5546	4819	12909	6441	2148
3	19229	1950	14524	10049	10291	19393	8500
4	8054	20709	1849	8483	10823	8241	12205
5	3628	5970	13154	1233	10835	4948	4321
6	761	3314	7272	10266	1855	5014	3439
7	2562	710	3789	3610	6373	765	4137
8	409	2631	794	1229	2133	2438	450
9	475	47	1422	1859	899	1137	1955
10	198	606	154	1151	1388	946	1858
1+	35834	38948	48578	42723	57759	49429	39099

	1985	1986	1987	1988	1989	1990	1991
1	122	145	19	08	00	06	58
2	9185	1967	11136	2407	3389	7793	2496
3	5167	11305	3539	19120	6687	12541	8400
4	5385	2949	8967	3596	15847	6696	11383
5	9720	2717	1634	8203	1802	11225	7081
6	2679	4558	1969	1644	3671	1467	6521
7	1787	781	2441	1437	682	2106	947
8	2113	724	636	1999	467	388	747
9	243	603	438	565	590	216	226
10	1309	409	360	719	308	552	354
1+	37709	26159	31139	39697	33443	42990	38211

	1992	1993	1994	1995	1996	1997	1998
1	81	04	02	00	01	03	00
2	6493	1594	582	578	313	818	1100
3	5417	9718	3351	2229	2213	1493	2755
4	4051	3783	6821	2688	4223	3145	1490
5	7100	2230	1936	1613	1198	3304	1547
6	2529	3074	725	328	825	802	1421
7	2355	1221	1127	282	126	693	324
8	338	1346	447	177	25	140	123
9	405	317	377	21	65	108	77
10	190	225	100	15	02	09	58
1+	28958	23510	15468	7931	8992	10514	8894

	1999	2000
1	02	06
2	448	1393
3	4321	1749
4	2455	3674
5	989	1488
6	626	428
7	883	282
8	158	214
9	25	17
10	41	11
1+	9946	9262

Summaries for ages 2,8 3,8 4,8 5,8 6,8

	1978	1979	1980	1981	1982	1983	1984
2,8	35160	38264	46927	39689	55219	47241	35200
3,8	34643	35283	41381	34870	42310	40800	33053
4,8	15414	33333	26857	24822	32019	21407	24553
5,8	7360	12624	25009	16339	21196	13166	12348
6,8	3732	6654	11855	15105	10361	8218	8027

	1985	1986	1987	1988	1989	1990	1991
2,8	36035	25002	30322	38405	32545	42216	37573
3,8	26850	23035	19186	35999	29156	34423	35078
4,8	21683	11730	15647	16879	22469	21882	26678
5,8	16298	8780	6680	13283	6622	15186	15295
6,8	6578	6063	5046	5080	4820	3960	8214

	1992	1993	1994	1995	1996	1997	1998
2,8	28283	22965	14989	7894	8923	10394	8758
3,8	21790	21371	14407	7316	8611	9576	7659
4,8	16373	11654	11056	5087	6397	8083	4904
5,8	12322	7871	4236	2399	2175	4938	3414
6,8	5221	5640	2300	786	976	1634	1868

	1999	2000

2,8	9879	9228
3,8	9431	7835
4,8	5111	6087
5,8	2656	2412
6,8	1667	924

Jan 1 BIOMASS (using Jan 1 mean weights)

	1978	1979	1980	1981	1982	1983	1984
1	13468	16318	12568	28975	9574	7192	24843
2	4368	23322	21891	18317	37658	14956	9795
3	48016	5269	32207	22850	20985	35531	14500
4	23180	44708	4932	24560	18841	15283	25327
5	9695	18165	33960	4310	20080	10996	8170
6	5175	8951	14365	23078	3463	11908	6524
7	8818	5860	6978	8208	13868	1673	7281
8	486	7376	5376	3038	4708	7575	935
9	1469	124	4322	4574	1799	2381	4521
10	658	1701	387	3229	2862	1934	4123
1+	115332	131792	136985	141138	133837	109430	106019

	1985	1986	1987	1988	1989	1990	1991
1	6166	31465	8221	12849	9147	5475	16919
2	27314	8074	40891	14053	21625	14425	8770
3	9572	23260	8658	40706	17699	27573	12054
4	9616	5615	19476	7174	31539	14585	19598
5	17385	6125	4347	14561	4651	21036	10332
6	4973	9746	4212	3228	6931	3363	10524
7	3649	2573	6033	2438	1512	3418	1807
8	3585	1904	1889	3511	938	872	1417
9	489	1410	1156	1127	1358	468	444
10	2570	974	930	1388	701	1184	608
1+	85318	91147	95811	101035	96101	92400	82472

	1992	1993	1994	1995	1996	1997	1998
1	6586	5684	4480	3040	5024	7898	1119
2	19114	7121	7784	5951	4141	7347	10048
3	9597	15206	6309	9246	7320	5078	8828
4	6305	5621	8142	4182	8987	6890	4687
5	10270	3104	2388	3009	2437	6134	4606
6	4036	4138	1115	787	1733	1316	3102
7	4128	1661	1368	566	538	905	559
8	871	1902	471	315	270	360	212
9	672	515	546	43	161	205	212
10	311	336	138	29	06	19	178
1+	61889	45286	32740	27168	30616	36152	33550

	1999	2000
1	4214	4573

2	2478	7107
3	11350	3658
4	7665	9486
5	3988	6486
6	3467	3270
7	1982	2945
8	266	1092
9	83	90
10	152	53
1+	35645	38759

Summaries for ages 2,8 3,8 4,8 5,8 6,8

	1978	1979	1980	1981	1982	1983	1984
2,8	99738	113650	119708	104360	119603	97923	72533
3,8	95370	90328	97817	86043	81945	82967	62738
4,8	47354	85059	65610	63193	60960	47436	48238
5,8	24174	40351	60678	38633	42119	32153	22911
6,8	14479	22186	26718	34323	22039	21157	14741

	1985	1986	1987	1988	1989	1990	1991
2,8	76093	57298	85505	85670	84895	85272	64501
3,8	48779	49223	44614	71617	63270	70847	55731
4,8	39207	25963	35956	30912	45571	43274	43678
5,8	29592	20348	16480	23738	14032	28689	24080
6,8	12207	14223	12133	9177	9381	7653	13748

	1992	1993	1994	1995	1996	1997	1998
2,8	54321	38752	27577	24056	25425	28029	32040
3,8	35206	31631	19793	18105	21284	20683	21993
4,8	25609	16425	13483	8859	13964	15605	13165
5,8	19305	10804	5341	4677	4977	8715	8478
6,8	9035	7700	2954	1668	2540	2581	3873

	1999	2000
2,8	31195	34043
3,8	28718	26935
4,8	17368	23278
5,8	9703	13792
6,8	5715	7306

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

	1978	1979	1980	1981	1982	1983	1984
1	912	1104	850	1962	1200	902	3122
2	1411	7540	6911	5784	16138	6347	4303
3	33839	3730	22412	15924	15649	26066	10500
4	20179	38255	4300	21375	15792	12655	21656
5	8796	16541	30441	3962	17468	9636	7118
6	4892	8127	12487	20325	2961	10514	5653
7	8094	5563	5914	7240	12174	1464	6221

8	366	6672	5047	2693	4108	6842	815
9	1339	111	3841	4111	1557	2059	3957
10	620	1580	355	3000	2562	1729	3731
1+	80447	89224	92560	86373	89609	78214	67075

	1985	1986	1987	1988	1989	1990	1991
1	773	8515	2226	3480	2477	635	1963
2	11650	5031	25331	8897	13718	6615	4228
3	6878	18777	7103	32838	14540	22023	9033
4	8075	4842	17023	6133	27186	12815	16506
5	14908	5434	3936	12373	4195	18059	8431
6	4252	8583	3704	2763	5934	2953	8688
7	3163	2355	5363	2023	1326	2842	1542
8	2980	1702	1701	2931	811	769	1214
9	420	1245	1030	965	1193	408	372
10	2282	890	857	1229	637	1067	526
1+	55382	57374	68273	73633	72016	68186	52504

	1992	1993	1994	1995	1996	1997	1998
1	763	660	87	59	97	993	141
2	9022	3442	2904	2212	1545	3986	5446
3	7442	11476	5186	8150	6400	4297	7431
4	5246	4564	6403	3570	7973	6095	4287
5	8379	2477	1857	2612	2118	5225	4179
6	3351	3291	934	705	1506	1093	2743
7	3495	1300	1018	495	496	695	475
8	780	1512	307	271	256	319	175
9	555	414	425	37	142	178	192
10	266	279	111	26	05	17	167
1+	39299	29413	19233	18136	20538	22898	25236

	1999	2000
1	530	575
2	1337	3814
3	9422	2973
4	7007	8571
5	3692	6028
6	3250	3089
7	1742	2799
8	222	1017
9	77	86
10	144	51
1+	27422	29003

APPENDIX 4

Precision Estimates of 2000 Fishing Mortality and Spawning Stock Biomass for Georges Bank Cod.

Appendix 4 Table 1

The number of bootstraps: 1000
Bootstrap Output Variable: N hat

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
N 1	1710	2006	1424	0.83
N 2	4003	4146	1100	0.27
N 3	4152	4251	1010	0.24
N 4	891	915	249	0.28
N 5	1835	1887	483	0.26
N 6	1023	1033	249	0.24
N 7	432	442	102	0.24
N 8	315	321	77	0.25

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	CORRECTED FOR BIAS	NLLS EST CORRECTED ESTIMATE	C.V. FOR LOWER 80%CI	UPPER 80%CI
N 1	296	45	17.32	1413	1.007381	1056	3595
N 2	143	35	3.57	3860	0.284848	2853	5630
N 3	99	32	2.39	4053	0.249147	3077	5585
N 4	24	08	2.70	867	0.287331	619	1213
N 5	52	15	2.82	1784	0.271060	1279	2494
N 6	11	08	1.04	1012	0.245917	766	1423
N 7	10	03	2.23	423	0.240749	312	567
N 8	06	02	1.76	310	0.249982	232	425

Appendix 4 Table 2 Bootstrap Output Variable: Q_unscaled

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
q spr_361	0.0000166	0.0000166	0.0000021	0.13
q spr_362	0.0000766	0.0000777	0.0000103	0.13
q spr_363	0.0001409	0.0001426	0.0000189	0.13
q spr_364	0.0002025	0.0002048	0.0000259	0.13
q spr_365	0.0002444	0.0002498	0.0000327	0.13
q spr_366	0.0002567	0.0002594	0.0000337	0.13
q spr_367	0.0003017	0.0003056	0.0000404	0.13
q spr_368	0.0003579	0.0003617	0.0000514	0.14
q spr_411	0.0000121	0.0000127	0.0000035	0.29
q spr_412	0.0000761	0.0000796	0.0000241	0.32
q spr_413	0.0001623	0.0001672	0.0000483	0.30
q spr_414	0.0001408	0.0001475	0.0000424	0.30
q spr_415	0.0001723	0.0001815	0.0000537	0.31
q spr_416	0.0001607	0.0001677	0.0000487	0.30
q spr_417	0.0002252	0.0002351	0.0000671	0.30
q spr_418	0.0002400	0.0002540	0.0000745	0.31
q sp_can1	0.0000224	0.0000227	0.0000036	0.16
q sp_can2	0.0001053	0.0001068	0.0000162	0.15
q sp_can3	0.0002598	0.0002644	0.0000418	0.16
q sp_can4	0.0003900	0.0003954	0.0000619	0.16
q sp_can5	0.0005577	0.0005603	0.0000852	0.15
q sp_can6	0.0006093	0.0006195	0.0000948	0.16
q sp_can7	0.0006812	0.0006868	0.0001040	0.15
q sp_can8	0.0008176	0.0008303	0.0001268	0.16
q us0aut1	0.0000114	0.0000115	0.0000014	0.12
q us1aut2	0.0000629	0.0000632	0.0000073	0.12
q us2aut3	0.0001005	0.0001014	0.0000114	0.11
q us3aut4	0.0001086	0.0001095	0.0000128	0.12
q us4aut5	0.0000755	0.0000765	0.0000090	0.12
q us5aut6	0.0000898	0.0000909	0.0000105	0.12

	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
q spr_361	-0.00000001	0.000000068	-0.064	0.000016651	0.13	0.0000142	0.0000198
q spr_362	0.00000115	0.000000325	1.503	0.000075433	0.14	0.0000646	0.0000901
q spr_363	0.00000164	0.000000599	1.161	0.000139308	0.14	0.0001168	0.0001644
q spr_364	0.00000229	0.000000819	1.132	0.000200186	0.13	0.0001730	0.0002369
q spr_365	0.00000536	0.000001035	2.192	0.000239067	0.14	0.0002003	0.0002837
q spr_366	0.00000269	0.000001067	1.046	0.000254027	0.13	0.0002144	0.0002993
q spr_367	0.00000395	0.000001278	1.309	0.000297705	0.14	0.0002568	0.0003565
q spr_368	0.00000380	0.000001627	1.063	0.000354065	0.15	0.0002966	0.0004285
q spr_411	0.00000062	0.000000112	5.104	0.000011435	0.31	0.0000087	0.0000172
q spr_412	0.00000356	0.000000761	4.679	0.000072525	0.33	0.0000520	0.0001102
q spr_413	0.00000485	0.000001529	2.990	0.000157485	0.31	0.0001101	0.0002264
q spr_414	0.00000667	0.000001340	4.739	0.000134124	0.32	0.0001003	0.0001962
q spr_415	0.00000924	0.000001699	5.366	0.000163035	0.33	0.0001132	0.0002330
q spr_416	0.00000698	0.000001539	4.343	0.000153699	0.32	0.0001153	0.0002334
q spr_417	0.00000993	0.000002123	4.409	0.000215244	0.31	0.0001601	0.0003229
q spr_418	0.00001397	0.000002355	5.820	0.000226033	0.33	0.0001656	0.0003296
q sp_can1	0.00000026	0.000000115	1.163	0.000022130	0.16	0.0000182	0.0000270
q sp_can2	0.00000150	0.000000513	1.420	0.000103764	0.16	0.0000851	0.0001249
q sp_can3	0.00000457	0.000001322	1.758	0.000255281	0.16	0.0002130	0.0003199
q sp_can4	0.00000543	0.000001957	1.393	0.000384560	0.16	0.0003190	0.0004689
q sp_can5	0.00000254	0.000002695	0.455	0.000555197	0.15	0.0004649	0.0006717
q sp_can6	0.00001016	0.000002997	1.668	0.000599175	0.16	0.0004999	0.0007323
q sp_can7	0.00000556	0.000003290	0.816	0.000675686	0.15	0.0005633	0.0008223
q sp_can8	0.00001268	0.000004009	1.551	0.000804918	0.16	0.0006600	0.0009777
q us0aut1	0.00000006	0.000000043	0.488	0.000011351	0.12	0.0000097	0.0000132
q us1aut2	0.00000036	0.000000230	0.568	0.000062522	0.12	0.0000532	0.0000712
q us2aut3	0.00000082	0.000000361	0.813	0.000099719	0.11	0.0000866	0.0001146
q us3aut4	0.00000091	0.000000404	0.836	0.000107680	0.12	0.0000939	0.0001261
q us4aut5	0.00000094	0.000000285	1.241	0.000074610	0.12	0.0000642	0.0000872
q us5aut6	0.00000116	0.000000333	1.298	0.000088593	0.12	0.0000758	0.0001022

Appendix 4 Table 3

Bootstrap Output Variable: F t

	NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
Age 1	0.0014	0.0014	0.0004	0.28
Age 2	0.1627	0.1670	0.0376	0.23
Age 3	0.5429	0.5566	0.1216	0.22
Age 4	0.4087	0.4187	0.0949	0.23
Age 5	0.2396	0.2484	0.0543	0.23
Age 6	0.1404	0.1441	0.0323	0.23
Age 7	0.1035	0.1075	0.0261	0.25
Age 8	0.2231	0.2297	0.0298	0.13
Age 9	0.2231	0.2297	0.0298	0.13
Age 10	0.2231	0.2297	0.0298	0.13

	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	0.0000460	0.0000120	3.398	0.0013091	0.29	0.0010	0.0019
Age 2	0.0043001	0.0011878	2.642	0.1584469	0.24	0.1234	0.2138
Age 3	0.0136365	0.0038464	2.512	0.5292801	0.23	0.4245	0.7121
Age 4	0.0100070	0.0030012	2.449	0.3986814	0.24	0.3150	0.5439
Age 5	0.0088433	0.0017181	3.691	0.2307508	0.24	0.1770	0.3082
Age 6	0.0037230	0.0010226	2.652	0.1366743	0.24	0.1083	0.1890
Age 7	0.0039346	0.0008252	3.800	0.0996011	0.26	0.0777	0.1380
Age 8	0.0066270	0.0009422	2.971	0.2164269	0.14	0.1838	0.2527
Age 9	0.0066270	0.0009422	2.971	0.2164269	0.14	0.1838	0.2527
Age 10	0.0066270	0.0009422	2.971	0.2164269	0.14	0.1838	0.2527

Appendix 4 Table 4

Bootstrap Output Variable: F full t

NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
0.2231	0.2297	0.0298	0.13

BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V. FOR CORRECTED ESTIMATE	LOWER 80%CI	UPPER 80%CI
0.00663	0.00094	2.97	0.21643	0.14	0.1838	0.2527

Appendix 4 Table 5

Bootstrap Output Variable: Mean Biomass

NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
38516.5716	39285.3264	3952.2211	0.10

BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	CORRECTED FOR BIAS	NLLS EST CORRECTED ESTIMATE	C.V. FOR LOWER 80%CI	UPPER 80%CI
768.7548	124.9802	2.00	37747.8168	0.10	33311.2784	42918.7502

Appendix 4 Table 6

Bootstrap Output Variable: SSB spawn t

NLLS ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP StdError	C.V. FOR NLLS SOLN
29002.5201	29464.3140	2776.8709	0.10

BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	CORRECTED FOR BIAS	NLLS EST CORRECTED ESTIMATE	C.V. FOR LOWER 80%CI	UPPER 80%CI
461.79	87.81	1.59	28540.73	0.10	25378.4864	32076.3722

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